



We've got the **Power.**

HIGH POWER WHITE LIGHT
CONSTANT CURRENT
LED-DRIVERS



DROP IN REPLACEMENT FOR
3-PIN REGULATORS (78 SERIES)
**R-78 SWITCHING
REGULATORS**

100% POWER. NO DERATING.
HIGH EFFICIENCY HIGH TEMP. DC-
DC POWER MODULES



MICROSIZE PCB MOUNT
**SAFETY APPROVED
AC-DC MODULES**

Catalogue

2013

Series	Power (Watts)	Isolation (kVDC)	Input Voltages (VDC)	Output Voltages (VDC)	No. of Outputs	Case	Page No.
RM	0.25	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15	S	SIP4	E-2
RM/E	0.25	1 & 2	3.3, 5, 12	5	S	SIP4	E-4
ROL	0.5	1 & 2	5, 12	5, 12, 15	S	SIP4	E-6
R0.25S	0.25	1 & 3	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SMD	E-8
R0.25D				±3.3, ±5, ±9, ±12, ±15, ±24	D		
R0.25DA				5/5, 12/12	D (isol)		
R0.25S/E	0.25	1 & 2	3.3, 5, 12	5	S	SMD	E-12
RBL/E	0.25	1 & 2	3.3, 5, 12	5	S	SIP7	E-14
R0.5S_D	0.5	1 & 3	3.3, 5, 12, 24	5, 12, 15	S	SMD	E-16
				±5, ±12, ±15	D		
R1S	1	1 & 3	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SMD	E-24
R1D				±3.3, ±5, ±9, ±12, ±15, ±24	D		
R1S/E	1	1 & 2	3.3, 5, 12, 24	±5	S	SIP4	E-28
R1SE	1	1	5	5	S	SMD	E-30
RNM	1	1 & 2	3.3, 5, 12, 15	3.3, 5, 9, 12, 15	S	DIP4	E-32
ROM	1	3	5, 12	5, 12, 15	S	SIP4 Micro	E-35
RO	1	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SIP4	E-37
RO/E	1	1 & 2	3.3, 5, 12, 24	±5	S	SIP4	E-39
ROE	1	1	5	5	S	SIP7	E-41
RBM	1	3	5, 12	5, 12, 15	S	SIP6 Micro	E-43
				±5, ±12, ±15	D		
RB	1	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SIP7	E-46
				±3.3, ±5, ±9, ±12, ±15, ±24	D		
RB/E	1	1 & 2	3.3, 5, 12, 24	±5	S	SIP7	E-49
RBE	1	1	5	5	S	SIP7	E-51
RE	1	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SIP7	E-53
REE	1	1	5	5	S	SIP7	E-55
RK	1	3 & 4	5, 12, 15, 24	5, 9, 12, 15	S	SIP7	E-57
RH				±5, ±9, ±12, ±15	D		
RKE/H	1	3.75	5	5	S	SIP7	E-60
RAM	1	3 & 4	3.3, 5, 12	5	S	SMD	E-62
RAZ	1	1 & 2	3.3, 5, 12	5	S	SMD	E-64
RP	1	5.2	5, 9, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	SIP7	E-66
				±3.3, ±5, ±9, ±12, ±15, ±24	D		
RxxPxx	1	6.4	5, 9, 12, 15, 24	3.3, 5, 9, 12, 15	S	SIP7	E-69
				±3.3, ±5, ±9, ±12, ±15	D		
RxxPxx/R	1	R6.4, R8	5, 9, 12, 15, 24	3.3, 5, 9, 12, 15	S	SIP7	E-73
				±3.3, ±5, ±9, ±12, ±15	D		
R1DA	1	1 & 3	3.3, 5, 12, 15, 24	±3.3, ±5, ±9, ±12, ±15	D	SMD	E-76
RU	1	1 & 2	3.3, 5	5/5	D (isol.)	SIP7	E-79
RUM	1	1 & 2	3.3, 5	5/5	D (isol.)	SIP6	
RN	1.25	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 12, 15, 24	S	DIP8	E-81
RTM	2	2 & 3	5, 12, 24	5	S	SMD	E-83
R2S	2	1 & 3	5, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S & D	SMD	E-85
R2D				±5, ±9, ±12, ±15, ±24	D		
RI	2	1	5, 12, 15, 24	5, 12, 15	S	SIP4	E-89
RD	2	1 & 2	5, 12, 24	±5, ±12, ±15	D	SIP7	E-91
RKZ	2	3 & 4	5, 12	5, 12, 15	S	SIP7	E-93
				±5, ±12, ±15	D		
RxxP2xx	2	5.2	5, 12, 15, 24	3.3, 5, 9, 12, 15	S	SIP7	E-96
				±3.3, ±5, ±9, ±12, ±15	D		
RxxP2xx/R	2	R6.4, R8	5, 12, 15, 24	3.3, 5, 9, 12, 15	S	SIP7	E-100
				±3.3, ±5, ±9, ±12, ±15	D		
RUZ	2	1 & 2	5	5/5	D (isol.)	SIP7	E-104
RJZ	2	3 & 4	3.3, 5, 9, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	DIP14	E-106
RGZ				±3.3, ±5, ±9, ±12, ±15	D		
RV	2	5.2	3.3, 5, 9, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	DIP24 Miniature	E-109
				±3.3, ±5, ±9, ±12, ±15; ±24	D		
RV/R	2	R6.4, R8	3.3, 5, 9, 12, 15, 24	3.3, 5, 9, 12, 15, 24	S	DIP24 Miniature	E-113
				±3.3, ±5, ±9, ±12, ±15; ±24	D		

ECONOLINE - Regulated

RECOM

Series	Power (Watts)	Isolation (kVDC)	Input Voltages (VDC)	Output Voltages (VDC)	No. of Outputs	Case	Page No.
R0.5Z	0.5	1	5, 12, 15, 24	5, 12, 15	S	SMD	E-117
R1Z	1	1 & 2	3.3, 5, 12, 15, 24	3.3, 5, 9, 12	S	SMD	E-119
RY	1	1	5, 9, 12, 15, 24	5, 9, 12, 15, 24 ±5, ±9, ±12, ±15, ±24	S D	SIP7	E-121
RY-SCP_DCP	1	1	5, 9, 12, 15, 24	5, 9, 12, 15, 24 ±5, ±9, ±12, ±15, ±24	S D	SIP7	E-123
RS0-S	1	1, 2 & 3	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	SIP8	E-125
RS0-D				±3.3, ±5, ±9, ±12, ±15	D		
RS0-SZ			4.5-18, 9-36, 18-72	3.3, 5, 9, 12, 15	S		
RS0-DZ				±3.3, ±5, ±9, ±12, ±15	D		
RS-S	2	1, 2 & 3	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	SIP8	E-128
RS-D				±3.3, ±5, ±9, ±12, ±15	D		
RS-SZ			9-36, 18-72	3.3, 5, 9, 12, 15	S		
RS-DZ				±3.3, ±5, ±9, ±12, ±15	D		
RW2	2	1, 2 & 3	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15 ±3.3, ±5, ±9, ±12	S D	DIP16/SMD	E-131
RS3-S	3	1, 2 & 3	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	SIP8	E-133
RS3-D				±3.3, ±5, ±9, ±12, ±15	D		
RS3-SZ			9-27, 20-60	3.3, 5, 9, 12, 15	S		
RS3-DZ				±3.3, ±5, ±9, ±12, ±15	D		
RW-S	3	1	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	DIP24/SMD (Miniature)	E-136
RW-D	3	3	4.5-9, 9-18, 18-36, 36-72	±5, ±9, ±12, ±15	D	DIP24 (Miniature)	E-139
REC3-SR/H1	3	1	5, 12, 24	5, 12, 15, ±5, ±12, ±15	S D	DIP24	E-141
REC3-DR/H1							
REC3-SRW/H*	3	(1.6) 2, 4 & 6	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	DIP24/SMD	E-143
REC3-DRW/H*				±3.3, ±5, ±9, ±12, ±15	D		
REC3-SRWZ/H*			9-36, 18-72	3.3, 5, 9, 12, 15	S		
REC3-DRWZ/H*				±3.3, ±5, ±9, ±12, ±15	D		
REC3.5-SRW/R*	3.5	R8 & R10	4.5-9, 9-18, 18-36, 36-75	5, 9, 12, 15, 24	S	DIP24/SMD	E-147
REC3.5-DRW/R*				±5, ±9, ±12, ±15	D		
REC5-SRW/H*	5	(1.6) 2, 4 & 6	4.5-9, 9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	DIP24/SMD	E-151
REC5-DRW/H*				±5, ±9, ±12, ±15	D		
REC5-SRWZ/H*			9-36, 18-72	3.3, 5, 9, 12, 15	S		
REC5-DRWZ/H*				±5, ±9, ±12, ±15	D		
REC6-SRW/R*	6	R8 & R10	4.5-9, 9-18, 18-36, 36-75	5, 9, 12, 15, 24	S	DIP24/SMD	E-155
REC6-DRW/R*				±5, ±9, ±12, ±15	D		
REC7.5-SRW/H*/A/M	7.5	1, 2 & 3	9-18, 18-36, 36-72	3.3, 5, 9, 12, 15	S	DIP24/SMD	E-159
REC7.5-DRW/H*/A/M				±5, ±9, ±12, ±15	D		
REC8-SRW/H*/A/M	8	2 & 3	4.5-9, 9-18, 18-36, 36-75	3.3, 5, 12, 15	S	DIP24/SMD	E-162
REC8-DRW/H*/A/M				±5, ±12, ±15	D		
REC8-SRWZ/H*/A/M			9-36, 18-75	3.3, 5, 12, 15	S		
REC8-DRWZ/H*/A/M				±5, ±12, ±15	D		
REC10-SRW/H*/A/M	10	2 & 3	9-18, 18-36, 36-75	3.3, 5, 12, 15	S	DIP24/SMD	E-165
REC10-DRW/H*/A/M				±5, ±12, ±15	D		
REC10-SRWZ/H*/A/M			9-36, 18-75	3.3, 5, 12, 15	S		
REC10-DRWZ/H*/A/M				±5, ±12, ±15	D		
REC15-SRW/H*/A/M	15	2 & 3	9-18, 18-36, 36-75	3.4, 5.1, 12, 15	S	2"x 1"	E-168
REC15-DRW/H*/A/M				±5, ±12, ±15	D		

Features

Unregulated Converter

- Single Output Rail
- Industry Standard Pinout
- 1kVDC or 2kVDC Isolation
- High Efficiency for Low Power Applications
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- Custom versions available
- Efficiency to 76%

Description

The RM series DC/DC converter has been designed for isolating or converting DC power rails with very light loads. Efficiencies are typically 10% higher than a comparable 0.5W or 1W converters run at the same low load.

Selection Guide

Part Number SIP 4	(2kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
RM-xx3.3S	(H)	3.3, 5, 12, 15, 24	3.3	76	65-70	1000µF
RM-xx05S	(H)	3.3, 5, 12, 15, 24	5	50	66-72	470µF
RM-xx09S	(H)	3.3, 5, 12, 15, 24	9	28	70-72	470µF
RM-xx12S	(H)	3.3, 5, 12, 15, 24	12	21	70-72	150µF
RM-xx15S	(H)	3.3, 5, 12, 15, 24	15	17	70-76	150µF

xx = Input Voltage (other input and output voltage combinations and output powers available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RM-0505S/P, RM-0505S/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range			±10%
Output Voltage Accuracy			±5%
Line Voltage Regulation			1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output types 5V output type 12V, 15V, 24V output types		20% max. 15% max. 10% max.
Output Ripple and Noise (20MHz limited)			50mVp-p max.
Operating Frequency			50kHz min. / 90kHz typ. / 105kHz max.
Efficiency at Full Load			65% min. / 75% typ.
Minimum Load = 0%			Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second) (rated for 1 minute)		1000VDC 500VAC / 60Hz
Isolation Voltage	H-Suffix H-Suffix	(tested for 1 second) (rated for 1 minute)	2000VDC 1400VAC / 60Hz
Isolation Capacitance			25pF min. / 82pF max.
Isolation Resistance			10 GΩ min.
Short Circuit Protection P-Suffix			1 Second Continuous
Operating Temperature Range (free air convection)			-40°C to +85°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Package Weight	RM types		1.4g
	RL types		1.8g
Packing Quantity			42 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1327 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	302 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

0.25 Watt SIP4 Single Output

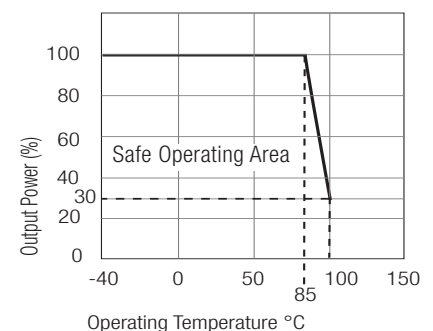


E358085

EN-60950-1 Certified
UL-60950-1 Certified
IEC/EN-60601-1 Certified*
 * (/H suffix)

RM

Derating-Graph (Ambient Temperature)

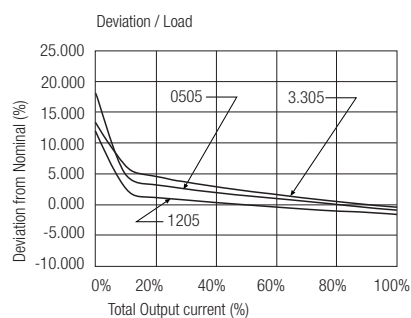
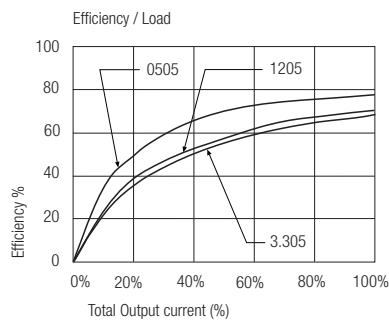


Refer to Application Notes

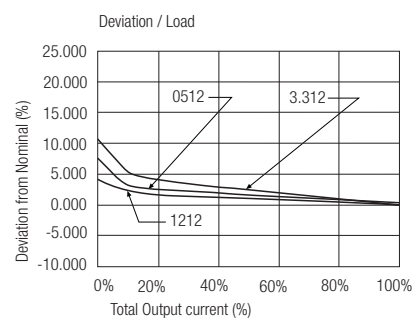
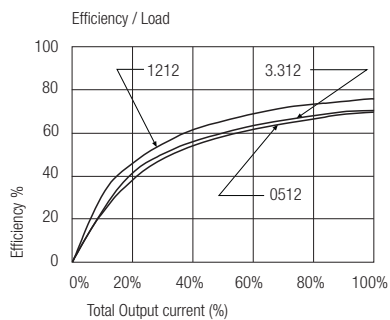
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Typical Characteristics

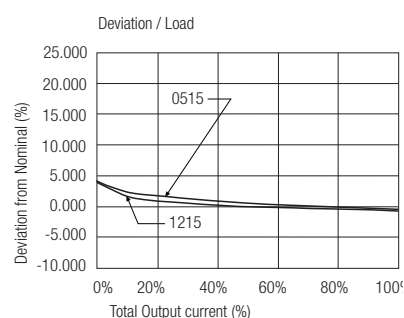
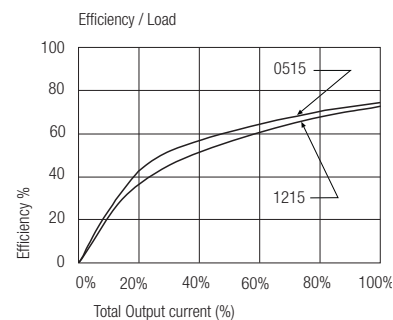
RM-xx05S



RM-xx12S



RM-xx15S



Notes

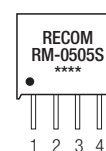
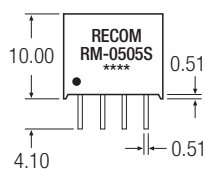
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

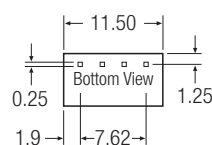
UL General Safety	Report: E358085	UL 60950-1, 2nd Edition
EN General Safety	Report: SPCLVD1109103	EN 60950-1:2006 + A12:2011
EN Medical Safety	Report: MDD1112018 + RM1112018	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Package Style and Pinning (mm)

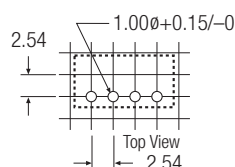
4 PIN SIP Package



3rd angle projection



Recommended Footprint Details



RM Pin Connections

Pin #	Single
1	-Vin
2	+Vin
3	-Vout
4	+Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converter

- 1 : 1 Input Range
- 0.25W SIP4 Package
- Efficiency up to 82%
- 1kVDC and 2kVDC Isolation Option
- Operating Temperature from -40°C to +100°C

Description

The RM/E series DC/DC converter has been designed to offer exceptionally high efficiency, low quiescent current and an extended operating temperature range. Uses include battery powered supplies, high efficiency designs or high temperature applications.

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ^{(1)**}
RM-3.305S/E*	3.3	5	50	80	1000µF
RM-0505S/E*	5	5	50	82	1000µF
RM-1205S/E*	12	5	50	78	1000µF

Other input and output voltage combinations available on request

*add Suffix „H“ for 2 kVDC Isolation, e.g. RM-3.305S/HE

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage full load and after warm-up)

Input Voltage Range	$\pm 10\%$ max.	
Voltage set accuracy	100% Load/nominal V_{in}	-2% typ. / $\pm 5\%$ max.
Line Regulation	Low Line to High Line @ max. Load	1,2% typ.
Load Regulation (10% to 100% Load)	4% typ. / 10% max.	
Ripple & Noise @ 20MHz BW	RM-3.305S/E others	35mVp-p typ. / 60mVp-p max. 35mVp-p typ. / 50mVp-p max.
Efficiency	100% Load	70% min.
Operating Temperature	-40°C to $+100^\circ\text{C}$	
Storage Temperature	-55°C to $+125^\circ\text{C}$	
Isolation Test Voltage (Tested for 1 second)	RM-xx05S/E RM-xx05S/HE	1000VDC 2000VDC
Isolation Capacitance	75PF max.	
Isolation Resistance	Viso = 500V	10 G Ω min.
Humidity	95% max.	
Operating Frequency	V_{in} (nom.)	20kHz min. / 70 kHz max.
Short-Circuit Protection	1 Second	
MTBF	Using MIL-HDBK 217F (+100°C) Using MIL-HDBK 217F (+25°C)	1352 x 10 ³ hours 4494 x 10 ³ hours

Detailed Information see Application Notes chapter „MTBF“

Weight	1.4 g

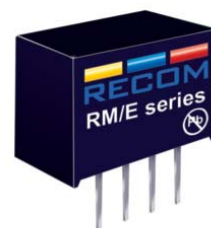
ECONOLINE

DC/DC-Converter

with 3 year Warranty

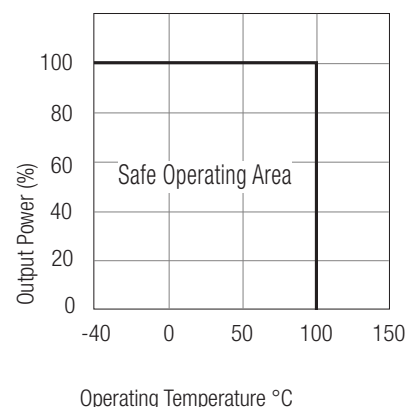
RECOM

0.25 Watt SIP4 Single Output



RM/E

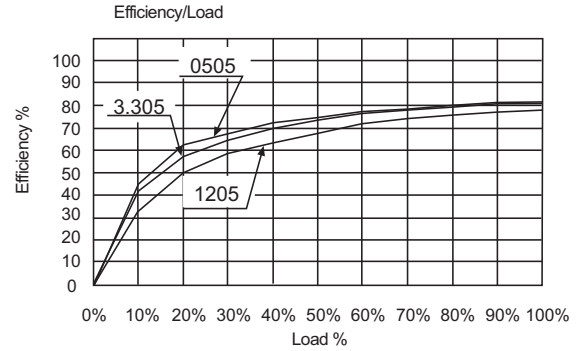
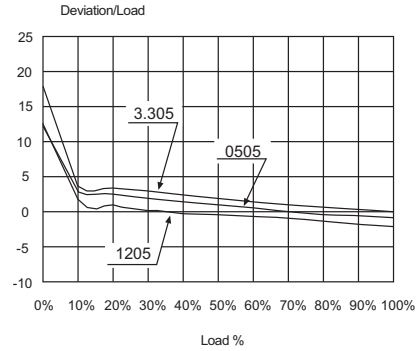
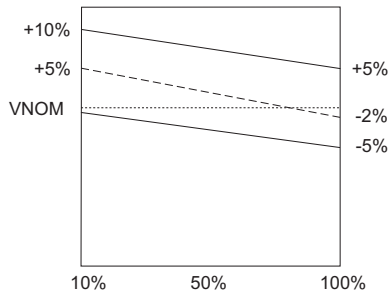
Derating-Graph (Ambient Temperature)



Refer to Application Notes

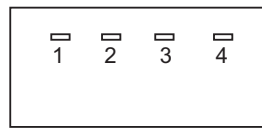
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Typical Characteristics

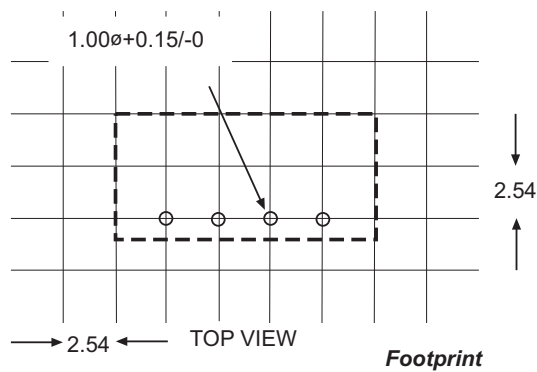
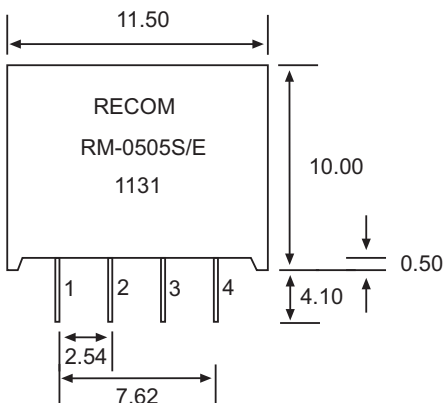


+Vout and -Vout load current (%)

Package Style and Pinning (mm)



3rd angle projection



Pin Connections

Pin #	Function
1	-Vin
2	+Vin
3	-Vout
4	+Vout

UNIT: mm
TOL.: ± 0.25 mm

Features

Unregulated Converter

- Industry Standard Pinout
- 1kVDC or 2kVDC Isolation
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- Custom Solutions Available
- Efficiency to 87%

Description

The ROL DC/DC converters are typically used in general purpose low power isolation and voltage matching applications, and feature a full industrial operating temperature range of -40°C ~ +85°C without derating.

Selection Guide

Part Number SIP 4	(2kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
ROL-xx05S	(H)	5, 12	5	100	78-82	470µF
ROL-xx12S	(H)	5, 12	12	42	80-86	150µF
ROL-xx15S	(H)	5, 12	15	33	80-87	150µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. ROL-0505S/P, ROL-0505S/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range		$\pm 10\%$
Output Voltage Accuracy		$\pm 5\%$
Line Voltage Regulation		1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)		10% max. / 4% typ.
Output Ripple and Noise (20MHz limited)		100mVp-p max.
Operating Frequency		20kHz min. / 54kHz typ.
Efficiency at Full Load		70% min. / 85% typ.
Efficiency at 50% Load		65% min. / 80% typ.
Minimum Load = 0%		Specifications valid for 10% minimum load only.
Isolation Voltage		(tested for 1 second) 1000VDC (rated for 1 minute) 500VAC / 60Hz
Isolation Voltage	H-Suffix	(tested for 1 second) 2000VDC
	H-Suffix	(rated for 1 minute) 1000VAC / 60Hz
Isolation Capacitance		20pF min. / 75pF max.
Isolation Resistance		10 $\text{G}\Omega$ min.
Short Circuit Protection		1 Second
P-Suffix		Continuous
Operating Temperature Range (free air convection)		-40°C to +85°C (see Graph)
Storage Temperature Range		-55°C to +125°C
Relative Humidity		95% RH
Package Weight		1.4g
Packing Quantity		42 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 985 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F 200 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

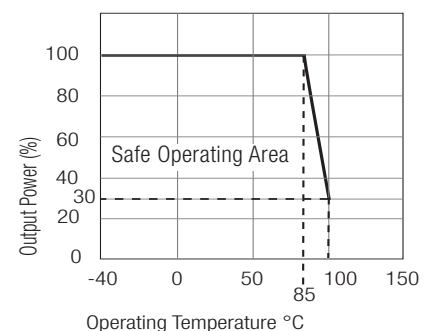
0.5 Watt SIP4 Single Output



EN-60950-1 Certified
UL-60950-1 Certified

ROL

Derating-Graph (Ambient Temperature)

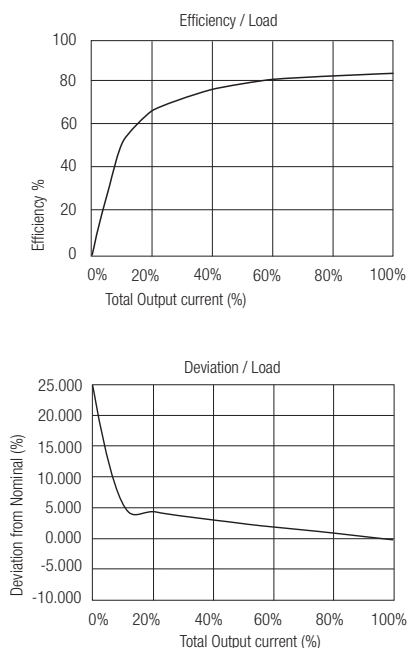


Refer to Application Notes

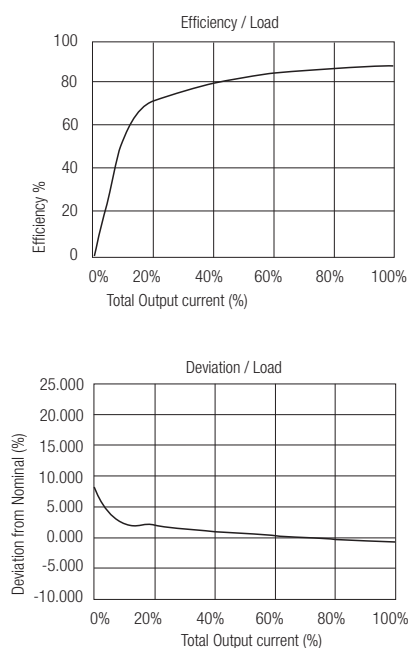
www.recom-electronic.com

Typical Characteristics

ROL-0505S



ROL-0515S



Notes

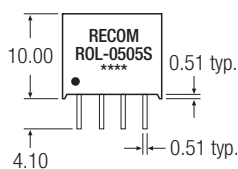
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

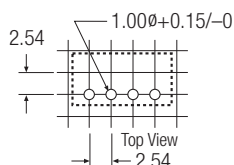
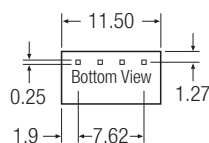
EN General Safety	Report: SPCLVD1109103	EN 60950-1:2006 + A11:2011
UL General Safety	Report: E358085	UL 60950-1, 2nd Edition

Package Style and Pinning (mm)

4 PIN SIP Package



Recommended Footprint Details



ROL Pin Connections

Pin #	Single
1	-Vin
2	+Vin
3	-Vout
4	+Vout
XX.X ± 0.5 mm	
XX.XX ± 0.25 mm	

Features

Unregulated Converters

- Fully RoHS 6/6 Conform
- Full Power at 100°C Ambient Temperature
- 1kVDC or 3kVDC Isolation Options
- Suitable for Fully Automated Assembly (including Vapour Phase Soldering)
- Optional Continuous Short Circuit Protection
- Built-In EN55022 Class A Filter

Selection Guide

Part Number SMD	(3kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Capacitive Load (max.)
R0.25S**-xx3.3	(H)	3.3, 5, 12, 15, 24	3.3	76	1000µF
R0.25S**-xx05	(H)	3.3, 5, 12, 15, 24	5	50	470µF
R0.25S**-xx09	(H)	3.3, 5, 12, 15, 24	9	28	470µF
R0.25S**-xx12	(H)	3.3, 5, 12, 15, 24	12	21	150µF
R0.25S**-xx15	(H)	3.3, 5, 12, 15, 24	15	17	68µF
R0.25S**-xx24	(H)	3.3, 5, 12, 15, 24	24	10.4	68µF
R0.25D**-xx3.3	(H)	3.3, 5, 12, 15, 24	±3.3	±38	470µF
R0.25D**-xx05	(H)	3.3, 5, 12, 15, 24	±5	±25	220µF
R0.25D**-xx09	(H)	3.3, 5, 12, 15, 24	±9	±14	68µF
R0.25D**-xx12	(H)	3.3, 5, 12, 15, 24	±12	±10.4	68µF
R0.25D**-xx15	(H)	3.3, 5, 12, 15, 24	±15	±8.3	68µF
R0.25D**-xx24	(H)	3.3, 5, 12, 15, 24	±24	±5.2	33µF
R0.25DA**-xx0505		3.3, 5, 12, 15, 24	5/5	25/25	220µF/220µF
R0.25DA**-xx1212		3.3, 5, 12, 15, 24	12/12	10/10	68µF/68µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "H" for 3kV Isolation, e.g. R0.25S-0505/H, R0.25D-0505/H, R0.25S12-0505/H, R0.25D12-0505/H

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R0.25S8-0505/P, R0.25S-0505/HP, R0.25D12-0505/HP

* add suffix -R for tape & reel packing e.g. R0.25S-0505-R. For more details see Application Notes.

Case and Pinning Options (note restrictions on /H option)

R0.25S** : ** without marking denotes 5 pins out of 8 fitted (includes /H option)
 ** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)
 ** with marking **12** denotes 10 pins out of 12 fitted (includes /H option)
 R0.25D** : ** without marking denotes 6 pins out of 10 fitted (includes /H option, no DA option)
 R0.25D(A) : ** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)
 R0.25D(A) : ** with marking **12** denotes 10 pins out of 12 fitted (includes /H option - except R0.25DA)

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±5% typ., ±7% max.	
Line Voltage Regulation	(low line to high line at max. load)	2% max.
Load Voltage Regulation (10% to 100% full load)	3.3V output types	15% typ., 20% max.
	5V, 5/5V output types	12% typ., 15% max.
	9V output type	7% typ., 10% max.
	12V, 12/12V, 15V, 24V output types	6% typ., 10% max.
Output Ripple and Noise (20MHz BW limited)	100mVp-p max.	
Operating Frequency	20kHz min. / 50kHz typ. / 90kHz max.	
Efficiency at Full Load	60%-70%	
Minimum Load = 0%	Specifications valid for 10% minimum load only	
Isolation Voltage	(tested for 1 second)	1000VDC
	(rated for 1 minute)	500VAC / 60Hz
	H-Suffix (tested for 1 second)	3000VDC
	(rated for 1 minute)	1500VAC / 60Hz
R0.25DA Output/ Output Isolation Voltage	(tested for 1 second)	1000VDC
Isolation Capacitance	75pF max.	

ECONOLINE
DC/DC-Converter

RECOM

0.25 Watt SMD Single, Dual & Independent Outputs



E358085

UL-60950-1 Certified
EN-60950-1 Certified
EN-60601-1 Certified*
 *(/H suffix)

R0.25S R0.25D(A)

Description

The R0.25S and R0.25D converters are of the enclosed open frame type, i.e. they are not potted.

The converters are typically used in general purpose and industrial low power isolation and voltage matching applications where an SMD converter is required.

The converter series feature an extended ambient temperature operating range of -40°C ~ +100°C without derating and optional continuous short circuit protection.

In addition to single, dual and independent outputs, two isolation options and three different case formats, the converters are also available prepacked as tape and reel for use with automatic insertion machines.

Refer to Application Notes

www.recom-electronic.com

Specifications - continued

Isolation Resistance	$V_{iso}=500V$	10 GΩ min.
Short Circuit Protection		1 Second
P-Suffix		Continuous
Operating Temperature Range (free air convection)		-40°C to +100°C (see Graph)
Storage Temperature Range		-50°C to +125°C
Reflow Temperature	ROHS compliant	245°C (30 sec), Peak 255°C (5 sec) max.
Vapour Phase Process	(for more details see Application Notes)	230°C (90 sec) max.
Relative Humidity		95% RH
Humidity Susceptibility Test		1000 hrs / 90% humidity / +85°C ambient
Package weight		1.0g (R0.25S), 1.2g (R0.25D(A))
Packing Quantity	R0.25S, R0.25S8	40 pcs per Tube
	R0.25S12, R0.25D, R0.25D10	33 pcs per tube
	R0.25D12, R0.25DA	33 pcs per tube
	All Types	500 pcs per Reel

MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	4423 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	2161 x 10 ³ hours

Certifications

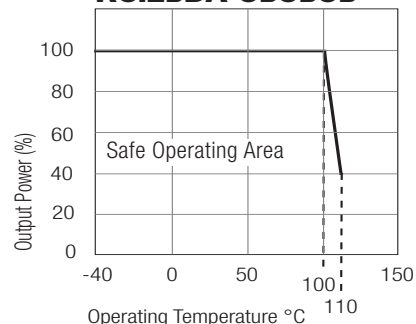
Conducted / Radiated Emissions	EN55022	Level A
CB Test Report	Report: US/14402A/UL	IEC 60950-1:2001 1st Ed.
UL General Safety	Report: E358085	UL 60950-1 2nd Ed.
CUL General Safety		C22.2 No. 60950-1-03
EN Medical Safety	Report: MDD1205098-2 + RM1205098-2	IEC/EN 60601-1 3rd Edition
	Medical Report + ISO14971 Risk Assessment	
EN General Safety	Report: SPCLVD1211033-3	EN60950-1:2006 + A12:2011

Notes

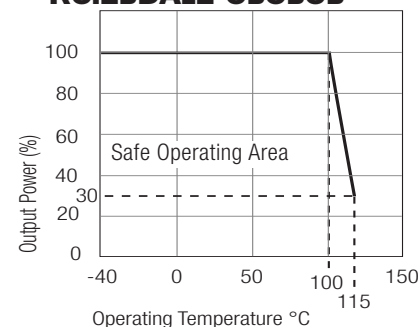
Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Derating-Graph (Ambient Temperature)

R0.25S-0505, R0.25D-0505, R0.25DA-050505



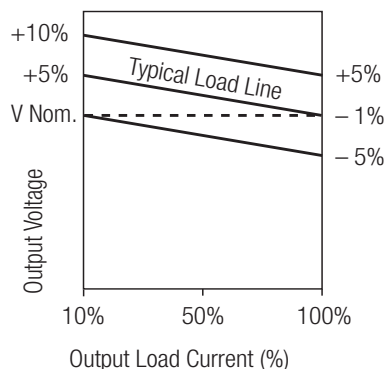
R0.25S12-0505, R0.25D12-0505, R0.25DA12-050505



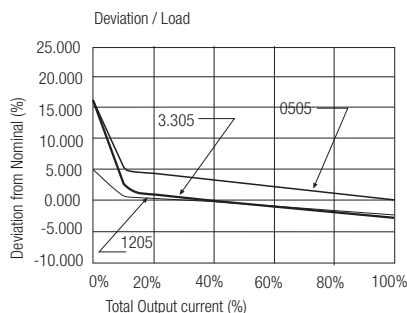
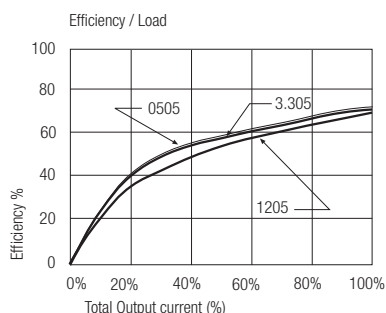
The derating graphs are valid only for the part numbers shown.

Typical Characteristics

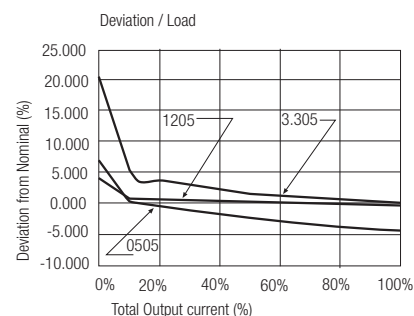
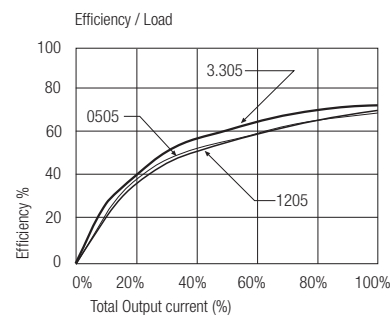
Tolerance Envelope



R0.25S**-xx05



R0.25D**-xx05



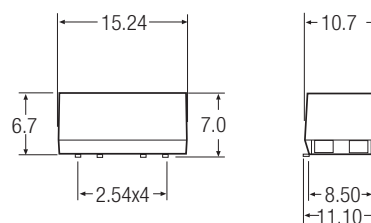
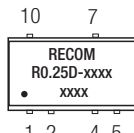
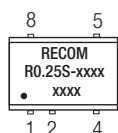
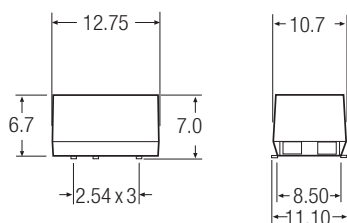
Package Style and Pinning (mm)

5 PIN Single SMD Package

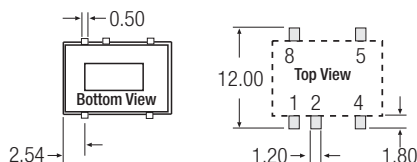
Note: /H option is available in these pin packages

6 PIN Dual SMD Package

3rd angle projection



Recommended Footprint Details



Pin Connections

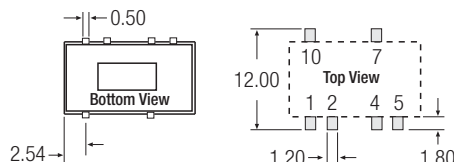
Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Com
5	+Vout	-Vout
7	No Pin	+Vout
8	NC	No Pin
10	No Pin	NC

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Recommended Footprint Details

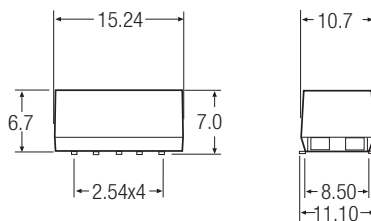
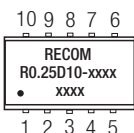
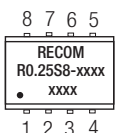
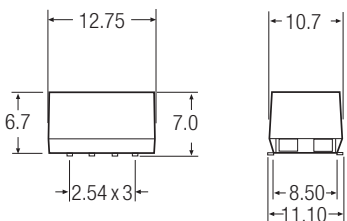


8 PIN Single SMD Package

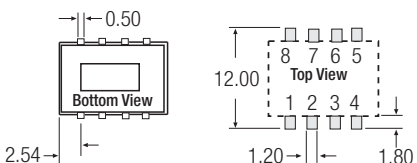
Note: /H option is not available in these pin packages

10 PIN Dual SMD Package

3rd angle projection



Recommended Footprint Details



Pin Connections

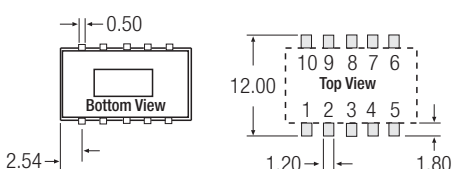
Pin #	Single	Dual	Dual Independent
1	-Vin	-Vin	-Vin
2	+Vin	+Vin	+Vin
3	NC	NC	No Pin
4	-Vout	Com	-Vout1
5	+Vout	-Vout	+Vout1
6	NC	NC	-Vout2
7	NC	+Vout	+Vout2
8	NC	NC	No Pin
9	-	NC	No Pin
10	-	NC	NC

NC = No Connection

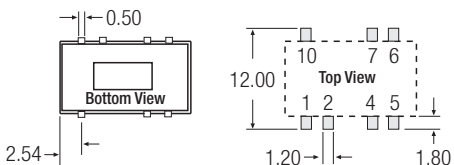
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Recommended Footprint Details (Dual)



Recommended Footprint Details Dual Independent



R0.25S** : ** without marking denotes 5 pins out of 8 fitted (includes /H option)
 ** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)

e.g. R0.25S-0505, R0.25S-0505/H, R0.25S-0505/HP
 e.g. R0.25S8-0505, R0.25S8-0505/P

R0.25D** : ** without marking denotes 6 pins out of 10 fitted (includes /H option)
 ** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)

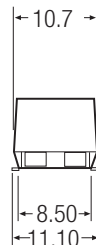
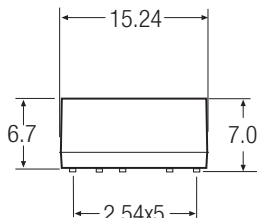
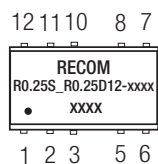
e.g. R0.25D-0505, R0.25D-0505/H, R0.25D-0505/HP
 e.g. R0.25D10-0505, R0.25D10-0505/P

Package Style and Pinning (mm)

12 PIN Single and Dual SMD Package

Note: /H option is available in this pin package

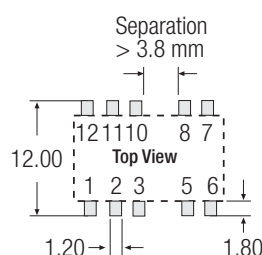
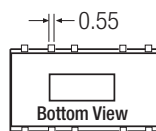
3rd angle projection



R0.25S** : ** with marking **12** denotes 10 pins out of 12 fitted (includes /H option)
e.g. R0.25S12-0505
R0.25S12-0505/H
R0.25S12-0505/HP

R0.25D** : ** with marking **12** denotes 10 pins out of 12 fitted (includes /H option)
e.g. R0.25D12-0505
R0.25D12-0505/H
R0.25D12-0505/HP

Recommended Footprint Details



Pin Connections

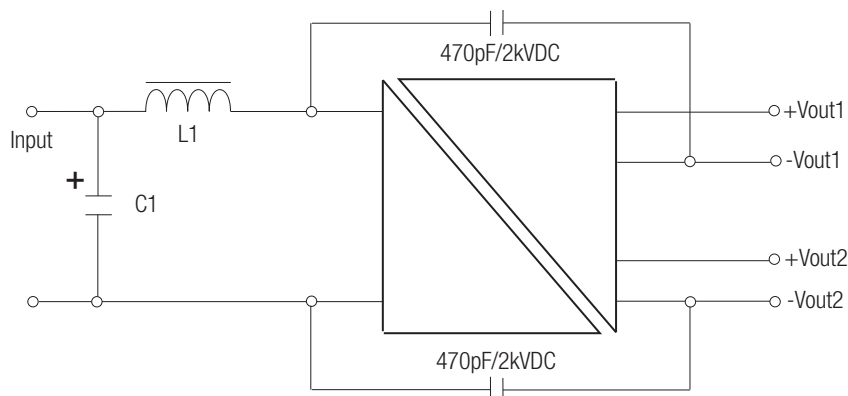
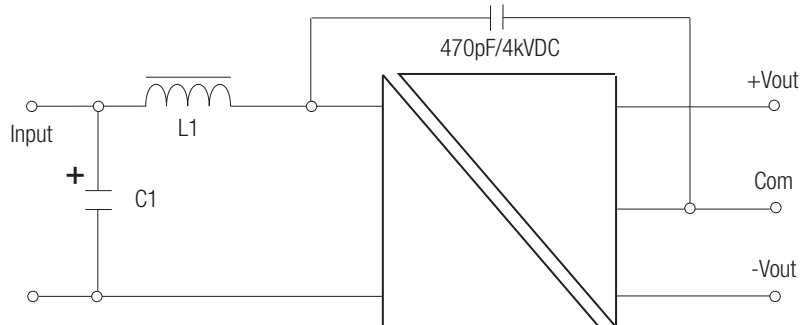
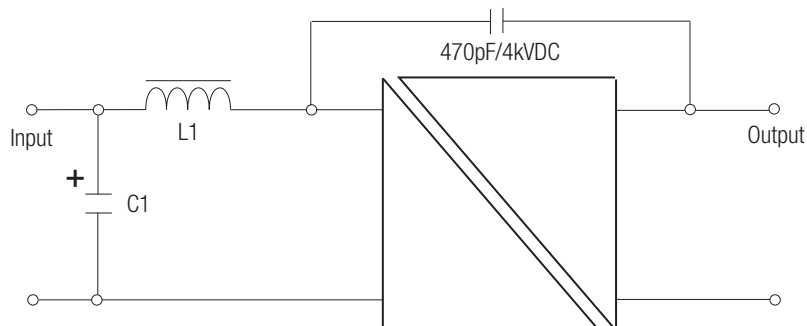
Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	NC	NC
5	-Vout	Com
6	NC	-Vout
7	NC	NC
8	+Vout	+Vout
10	NC	NC
11	NC	NC
12	NC	NC

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

EMC Filtering - Suggestion for EN55022 Class B (Conducted and Emitted)



Standard and /H versions

C1	L1	Vin
2.2µF	3.3µH	3.3V
2.2µF	4.7µH	5V
2.2µF	10µH	9V
1.0µF	22µH	12V
1.0µF	22µH	15V
470nF	47µH	24V

/P and /HP versions

C1	L1	Vin
2.2µF	3.3µH	3.3V
2.2µF	4.7µH	5V
2.2µF	10µH	9V
1.0µF	22µH	12V
1.0µF	22µH	15V
470nF	47µH	24V

C1 = MLCC

L1 = SMD Inductor

Features

Unregulated Converter

- 1 : 1 Input Range
- 0.25W SMD Package
- Efficiency up to 77%
- 1kVDC and 2kVDC Isolation Option
- Operating Temperature from -40°C to +100°C
- EN/UL60950-1 Certified

Description

The R0.25S/E series DC/DC converter has been designed to offer exceptionally high efficiency, low quiescent current and an extended operating temperature range. Uses include battery powered supplies, high efficiency designs or high temperature applications

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ^{(1)**}
R0.25S**-3.305/E*	3.3	5	50	75	1000µF
R0.25S**-0505/E*	5	5	50	77	1000µF
R0.25S**-1205/E*	12	5	50	74	1000µF

Other input and output voltage combinations available on request.

*add Suffix „H“ for 2kVDC Isolation, e.g. R0.25S-3.305/HE

*add Suffix „-R“ for tape & reel packaging, e.g. R0.25S-3.305/E -R

*add Suffix „P“ for Continuous Short Circuit Protection, e.g. R0.25S/PE

**without marking denotes 5 pins out of 8 fitted (includes „H“ option)

with marking 8 denotes 8 pins out of 8 fitted („H“ option not available), e.g R0.25S8-3.305/E

Specifications (measured at T_A = 25°C, nominal input voltage full load and after warm up)

Input Voltage Range	±10% max.	
Voltage set accuracy	100% Load/nominal Vin	-2% typ. / ±5% max.
Line Regulation	Low Line to High Line @ max. Load	1,2% typ.
Load Regulation	(10% to 100% Load)	4% typ. / 10% max.
Ripple & Noise @ 20MHz BW	50mVp-p typ. / 100mVp-p max.	
Efficiency	100% Load	70% min.
Operating Temperature	-40°C to + 100°C	
Storage Temperature	-55°C to +125°C	
Isolation Test Voltage (Tested for 1 second)	R0.25S-xx05/E	1000VDC
	R0.25S-xx05/HE	2000VDC
Isolation Capacitance	75PF max.	
Isolation Resistance	Viso = 500V	10 GΩ min.
Humidity	95% max.	
Operating Frequency	Vin (nom.)	20kHz min. / 70 kHz max.
Short-Circuit Protection	1 Second	
MTBF	Using MIL-HDBK 217F (+100°C)	1352 x 10 ³ hours
	Using MIL-HDBK 217F (+25°C)	4494 x 10 ³ hours
<i>Detailed Information see Application Notes chapter „MTBF“</i>		
Weight	1.0g	
Certification		
UL General Safety	Report: E224736	UL60950-1
EN General Safety		EN60950-1

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

0.25 Watt SMD Isolated Single Output

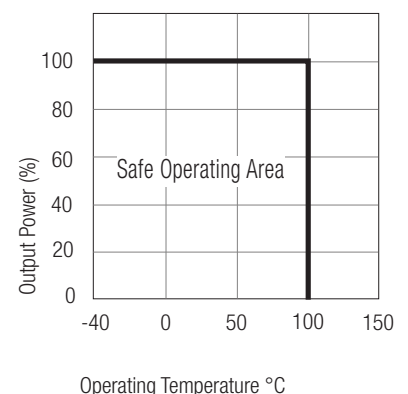


E224736

EN-60950-1 Certified
UL-60950-1 Certified

R0.25S/E

Derating-Graph (Ambient Temperature)



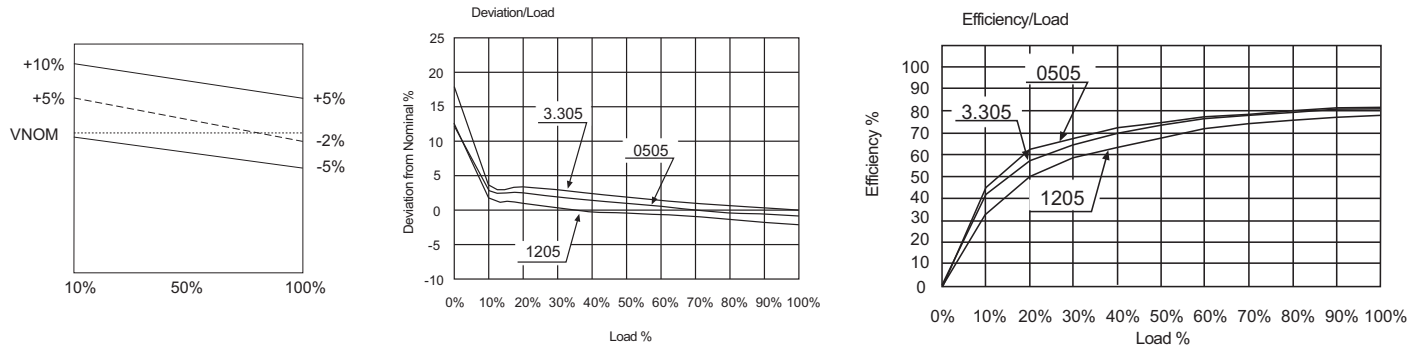
Refer to Application Notes

www.recom-electronic.com

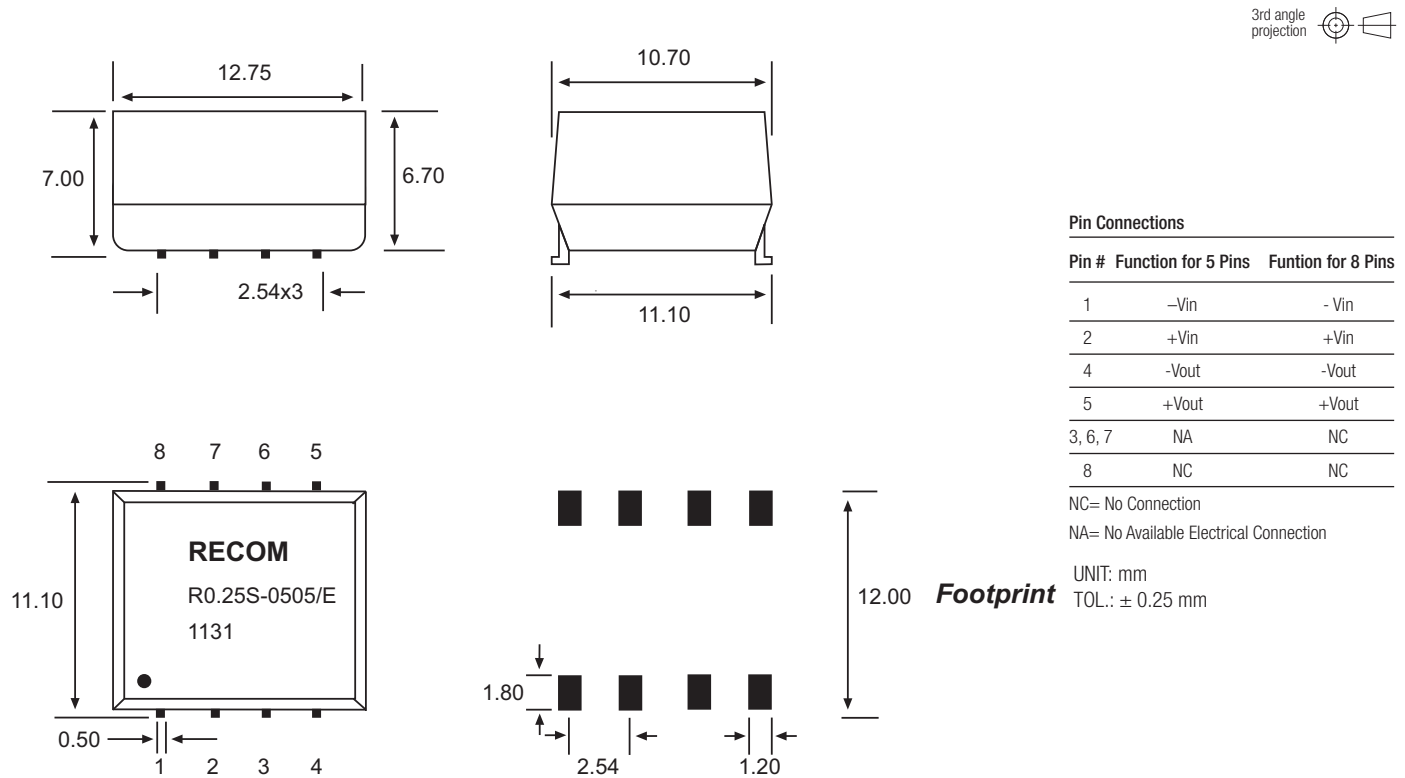
Typical Characteristics

Tolerance Envelope

R0.25S-xx05/E



Package Style and Pinning (mm)



Features

Unregulated Converter

- 1 : 1 Input Range
- 0.25W SIP7 Package
- Efficiency up to 82%
- 1kVDC and 2kVDC Isolation Option
- Operating Temperature from -40°C to +100°C

Description The RBL/E series DC/DC converter has been designed to offer exceptionally high efficiency, low quiescent current and an extended operating temperature range. Uses include battery powered supplies, high efficiency designs or high temperature applications.

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ^{(1)**}
RBL-3.305S/E*	3.3	5	50	80	1000µF
RBL-0505S/E*	5	5	50	82	1000µF
RBL-1205S/E*	12	5	50	78	1000µF

Other input and output voltage combinations available on request

*add Suffix „H“ for 2 kVDC Isolation, e.g. RBL-3.305/EH

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$ max.	
Voltage set accuracy	100% Load/nominal V_{in}	-2% typ. / $\pm 5\%$ max.
Line Regulation	1.2% typ. / 1% of V_{in} typ.	
Load Regulation	4% typ. / 10% max.	
(10% to 100% Load)		
Ripple & Noise @ 20MHz BW	35mVp-p typ. / 50mVp-p max.	
Efficiency	100% Load	70% min.
Operating Temperature	-40°C to $+100^\circ\text{C}$	
Storage Temperature	-55°C to $+125^\circ\text{C}$	
Isolation Test Voltage (Tested for 1 second)	RBL-xx05S/E	1000VDC
	RBL-xx05S/EH	2000VDC
Isolation Capacitance	75pF max.	
Isolation Resistance	10 GΩ min.	
Humidity	95% RH	
Operating Frequency	V_{in} (nom.)	20kHz min. / 70 kHz max.
Short-Circuit Protection	1 Second	
MTBF	Using MIL-HDBK 217F ($+100^\circ\text{C}$)	1352×10^3 hours
	Using MIL-HDBK 217F ($+25^\circ\text{C}$)	4494×10^3 hours
<i>Detailed Information see Application Notes chapter „MTBF“</i>		
Weight	2.2 g	
Packing Quantity	25pcs per tube	

ECONOLINE

DC/DC-Converter

with 3 year Warranty

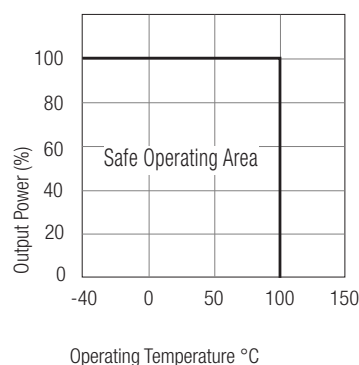
RECOM

0.25 Watt SIP7 Isolated Single Output



RBL/E

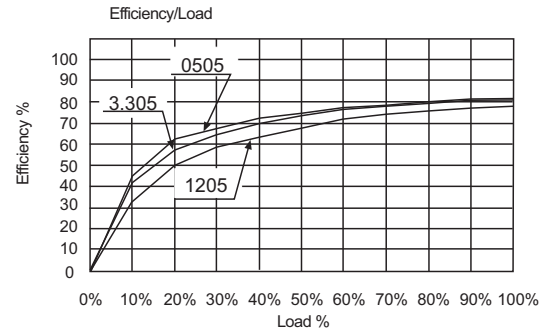
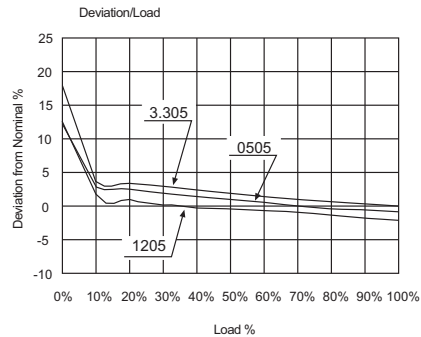
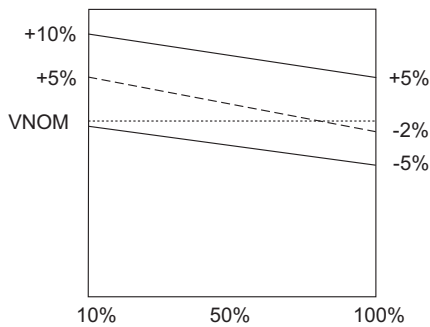
Derating-Graph (Ambient Temperature)



Refer to Application Notes

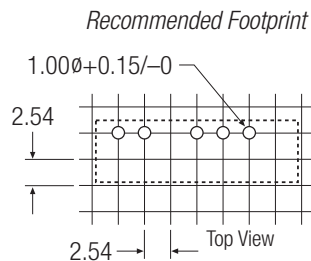
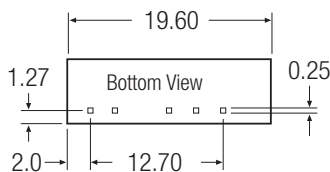
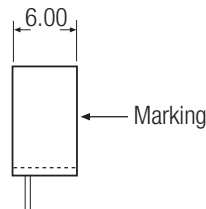
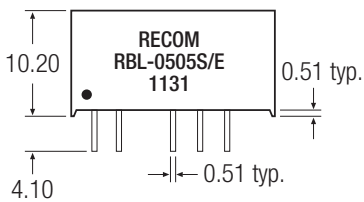
www.recom-electronic.com

Typical Characteristics



Package Style and Pinning (mm)

3rd angle projection



Pin Connections

Pin #	Function
1	+Vin
2	-Vin
4	NC
5	-Vout
6	+Vout

NC= No Connection

UNIT: mm

TOL.: ± 0.25 mm

Features

Unregulated Converter

- 1 : 1 Input Range
- 0.5W SMD Package
- Efficiency up to 80%
- Approved for Medical Applications
- 1kVDC and 3 kVDC Isolation Option
- Operating Temperature from -40°C to +100°C

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ^{(1)**}
R0.5S**-3.305*	3.3	5	100	80	1000μF
R0.5S**-3.312*	3.3	12	42	77	150μF
R0.5S**-3.315*	3.3	15	33	77	150μF
R0.5S**-0505*	5	5	100	72	1000μF
R0.5S**-0512*	5	12	42	77	150μF
R0.5S**-0515*	5	15	33	79	150μF
R0.5S**-1205*	12	5	100	74	1000μF
R0.5S**-1212*	12	12	42	75	150μF
R0.5S**-1215*	12	15	33	75	150μF
R0.5S**-2405*	24	5	100	75	1000μF
R0.5S**-2412*	24	12	42	77	150μF
R0.5S**-2415*	24	15	33	77	150μF
R0.5D**-3.305*	3.3	±5	±50	79	±470μF
R0.5D**-3.312*	3.3	±12	±21	76	±68μF
R0.5D**-3.315*	3.3	±15	±17	77	±68μF
R0.5D**-0505*	5	±5	±50	79	±470μF
R0.5D**-0512*	5	±12	±21	77	±68μF
R0.5D**-0515*	5	±15	±17	79	±68μF
R0.5D**1205*	12	±5	±50	76	±470μF
R0.5D**1212*	12	±12	±21	75	±68μF
R0.5D**1215*	12	±15	±17	75	±68μF
R0.5D**2405*	24	±5	±50	77	±470μF
R0.5D**2412*	24	±12	±21	75	±68μF
R0.5D**2415*	24	±15	±17	75	±68μF

*add Suffix "/H" for 3kVDC Isolation Voltage

*add Suffix "/P" for continuous short circuit protection

*add Suffix "-R" for tape & reel packing

For more details and dimensions of the tapes and reels see Application Notes

R0.5S**:

**without marking denotes 5 pins out of 8 fitted (includes „/H“ option)

**with marking 8 denotes 8 pins out of 8 fitted („/H“ option not available)

**with marking 12 denotes 10 pins out of 12 fitted (includes „/H“ option)

R0.5D**:

**without marking denotes 6 pins out of 10 fitted (includes „/H“ option)

**with marking 10 denotes 10 pins out of 10 fitted („/H“ option not available)

**with marking 12 denotes 10 pins out of 12 fitted (includes „/H“ option)

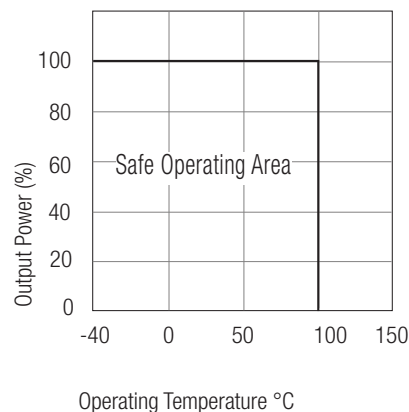
0.5 Watt SMD Isolated Single or Dual Output



UL-60950-1 Certified

R0.5S_D

Derating-Graph (Ambient Temperature)



Refer to Application Notes

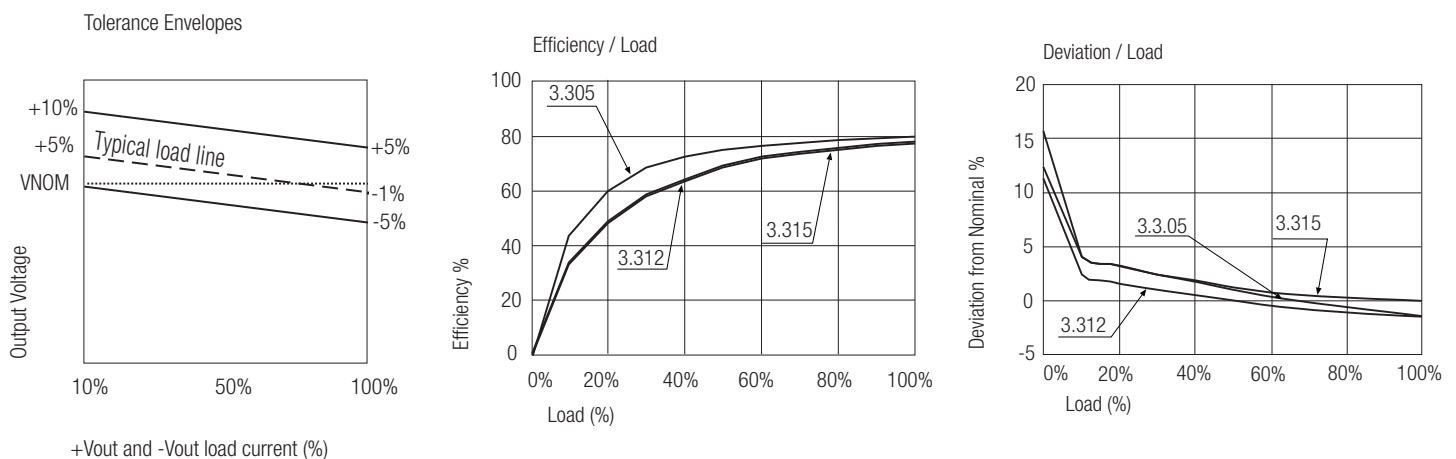
www.recom-electronic.com

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

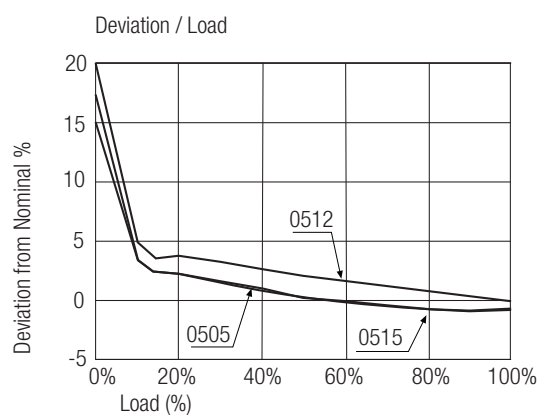
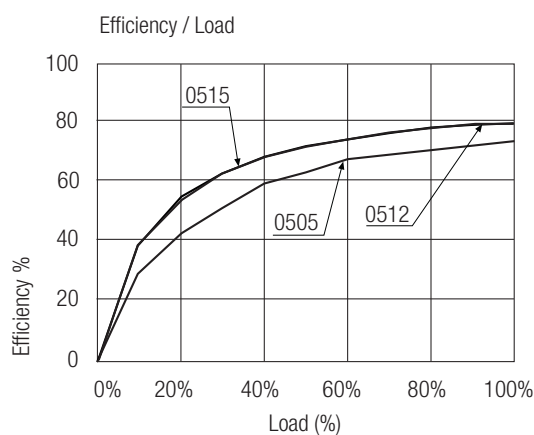
Input Voltage Range	$\pm 10\%$ max.	
Voltage set accuracy	100% Load/nominal V_{in}	-1% typ. / $\pm 5\%$ max.
Line Regulation	Low Line to High Line @ max. Load	1.2% typ.
Load Regulation	5V output	6% typ. / 15% max.
(10% to 100% Load)	12/15V output	5% typ. / 10% max.
Ripple & Noise @ 20MHz BW	50 mVp-p typ. / 100mVp-p max.	
Efficiency at Full Load	70% min.	
Operating Temperature	-40°C to $+100^\circ\text{C}$	
Storage Temperature	-55°C to $+125^\circ\text{C}$	
Isolation Test Voltage (Tested for 1 second)	R0.5S_R0.5D	1000VDC
	R0.5S_R0.5D/H	3000VDC
Isolation Capacitance	75pF max.	
Isolation Resistance	Viso = 500V	10 $\text{G}\Omega$ min.
Humidity	95% max.	
Operating Frequency	V_{in} (nom.)	20kHz min. / 50 kHz typ. / 90 kHz max.
Short-Circuit Protection	1 Second	
MTBF	Using MIL-HDBK 217F ($+100^\circ\text{C}$)	1003×10^3 hours
	Using MIL-HDBK 217F ($+25^\circ\text{C}$)	3962×10^3 hours
<i>Detailed Information see Application Notes chapter „MTBF“</i>		
Weight	Single Types	1.0 g
	Dual Types	1.2 g
Certifications		
UL General Safety	Report: E358085	UL 60950-1 2nd Ed.

Typical Characteristics

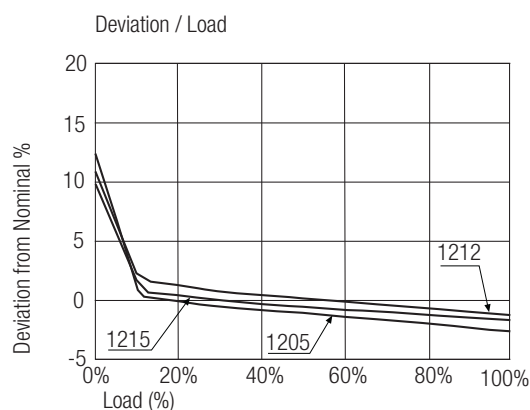
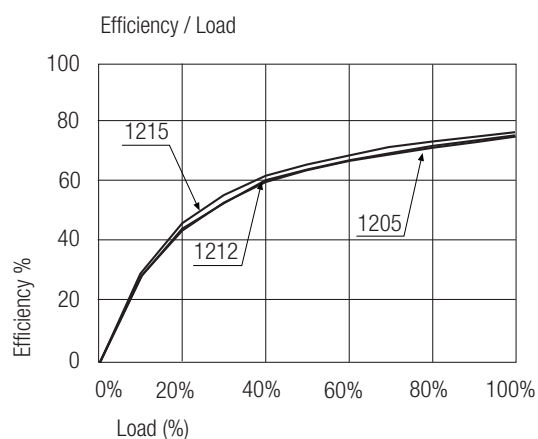
R0.5S-3.3xx



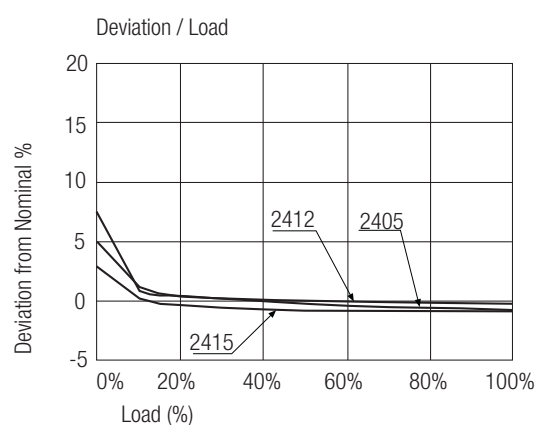
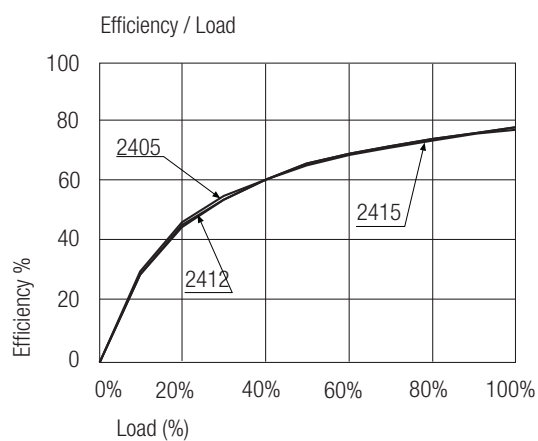
R0.5S-05xx



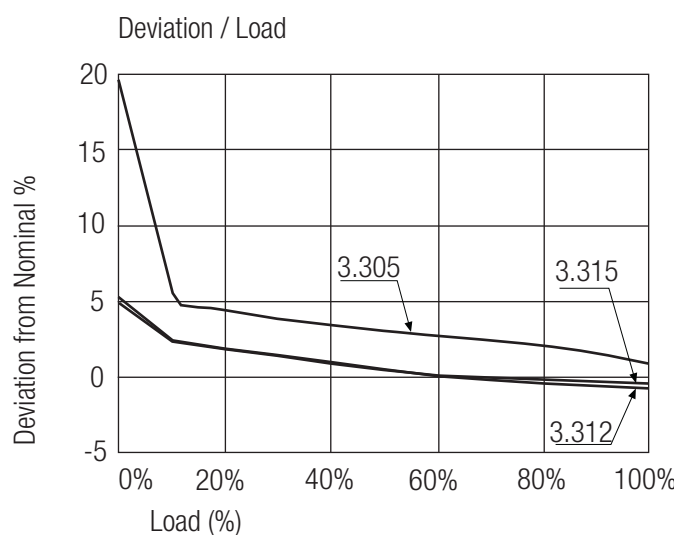
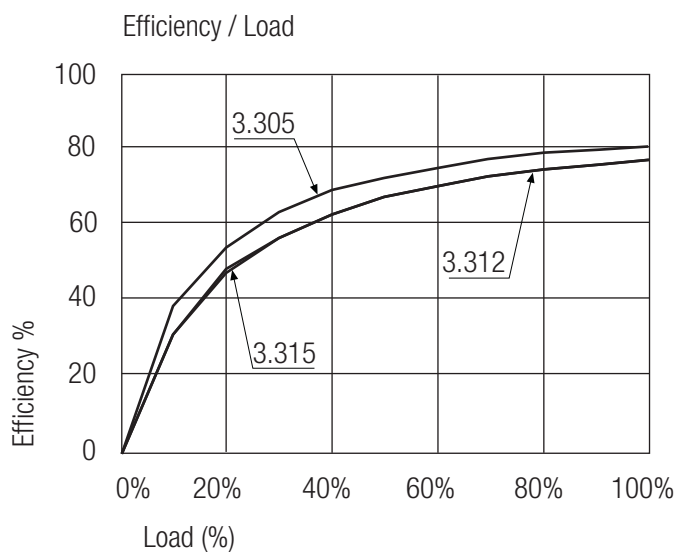
R0.5S-12xx



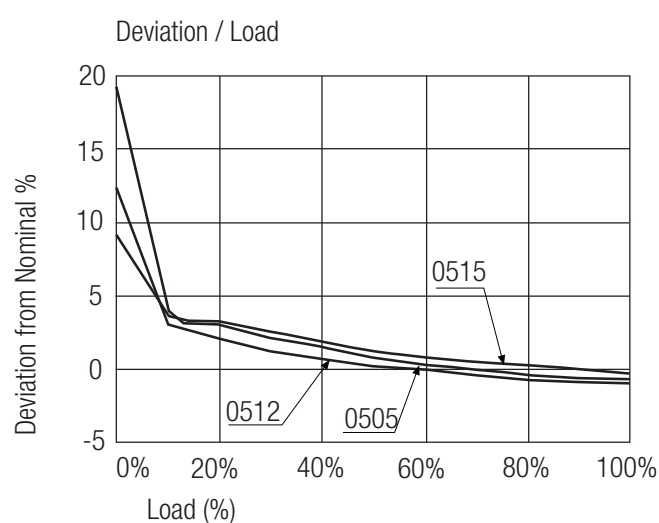
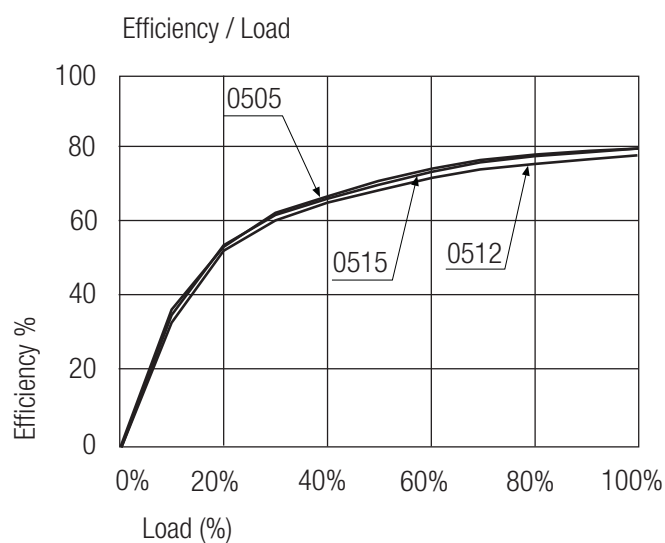
R0.5S-24xx



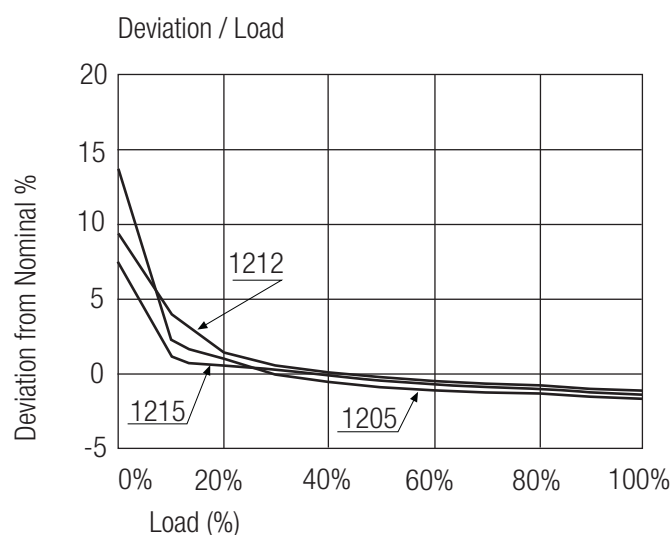
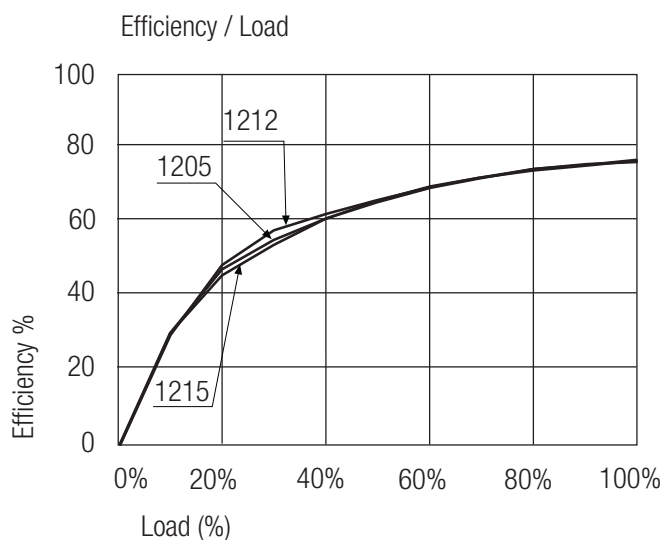
R0.5D-3.3xx



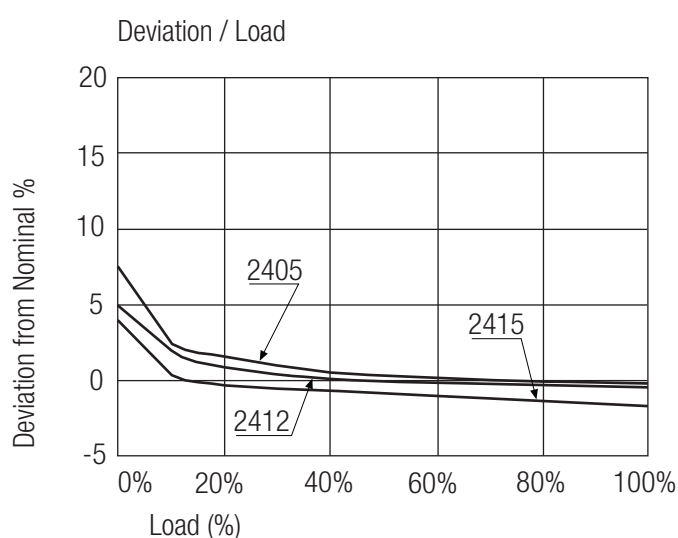
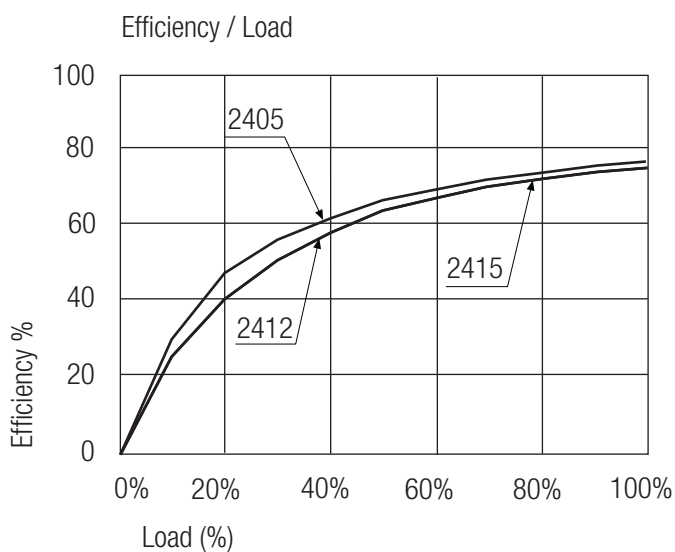
R0.5D-05xx



R0.5D-12xx

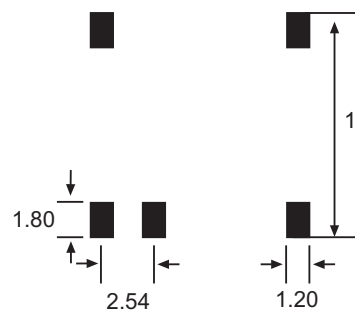
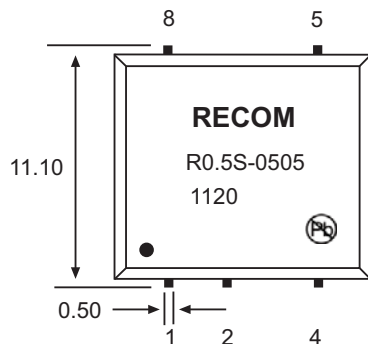
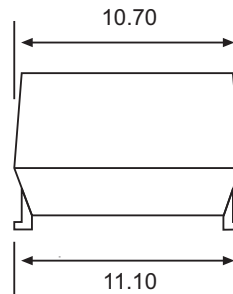
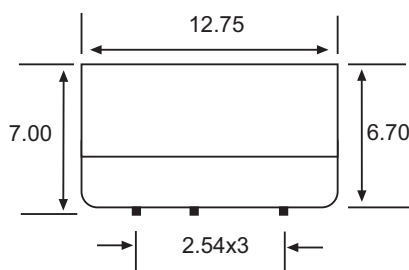


R0.5D-24xx



Package Style and Pinning (mm)

5 PINS Single SMD Package



Footprint

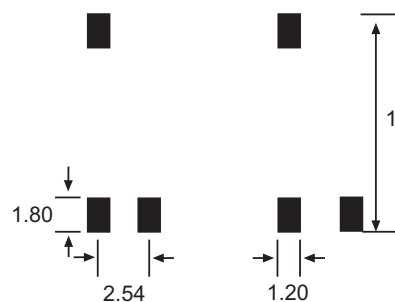
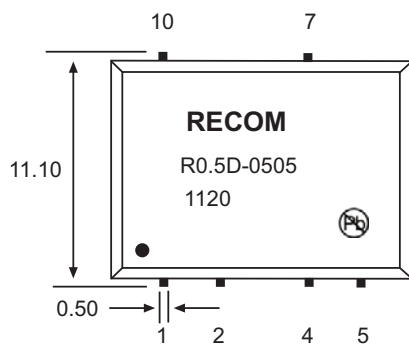
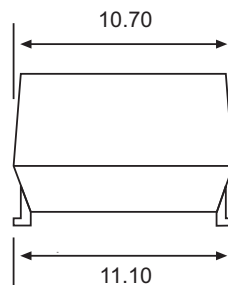
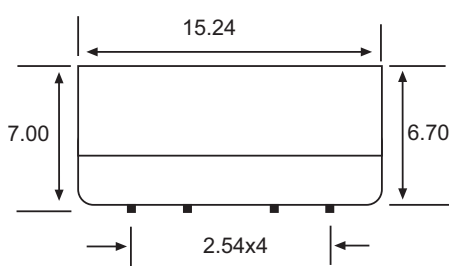
Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Com.
5	+Vout	-Vout
7	No Pin	+Vout
8	NC	No Pin
10	No Pin	NC

NC= No Connection

UNIT: mm
TOL.: ± 0.25 mm

6 PINS Dual SMD Package

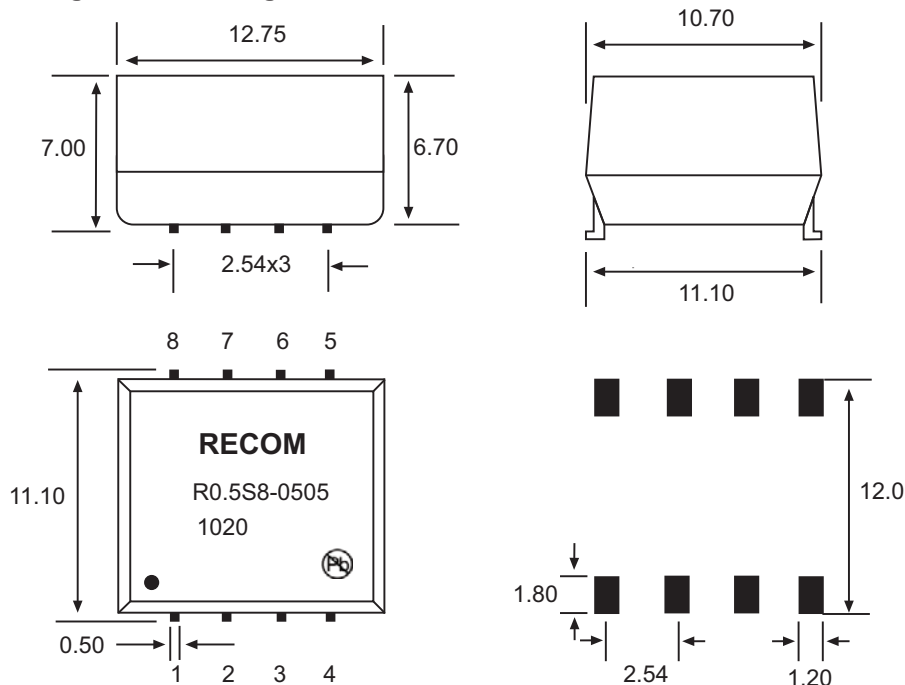


Footprint

Package Style and Pinning (mm)

8 PINS Single SMD Package

3rd angle
projection



Footprint

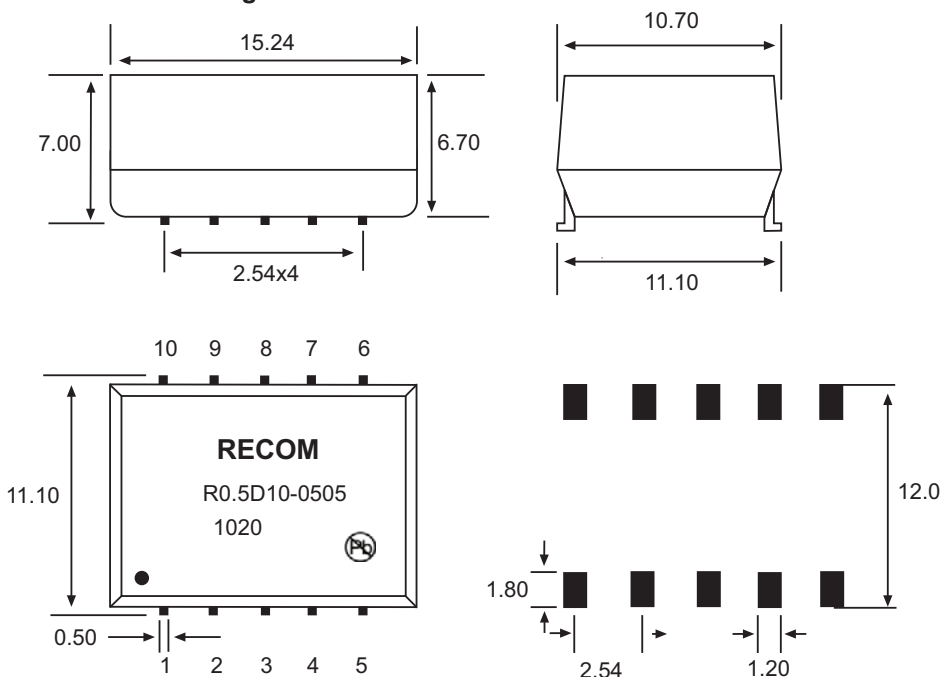
Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Com.
5	+Vout	-Vout
7	NC	+Vout
3, 6, 8	NC	NC
9, 10	No Pin	NC

NC= No Connection

UNIT: mm
TOL.: ± 0.25 mm

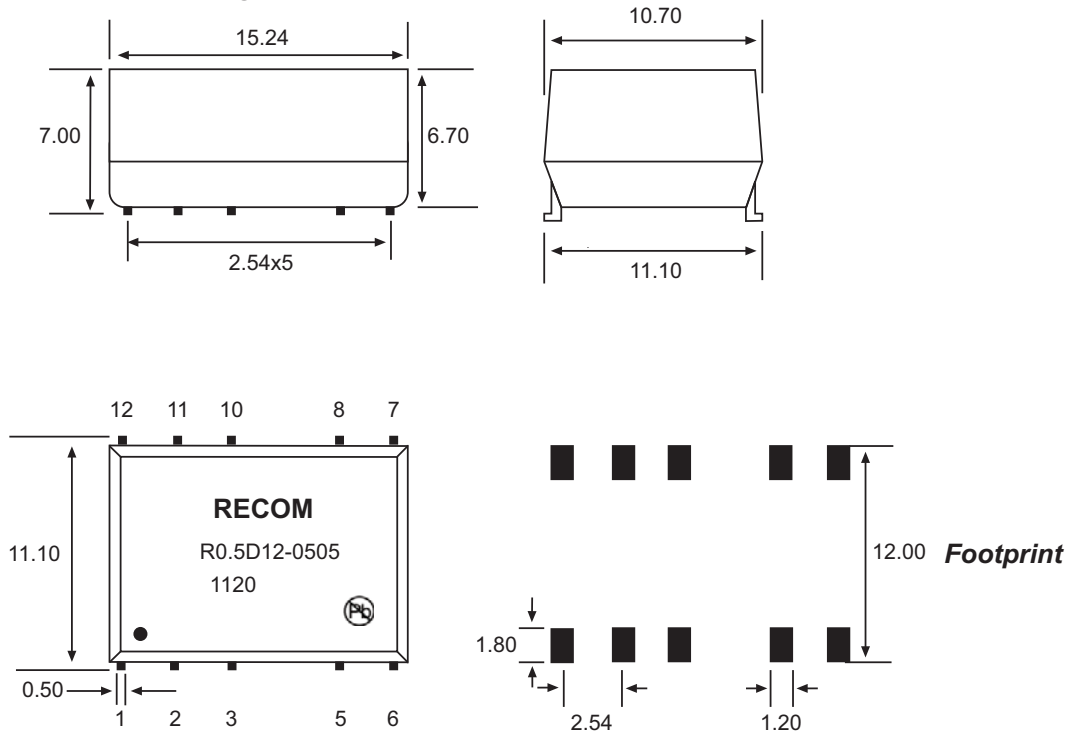
10 PINS Dual SMD Package



Footprint

Package Style and Pinning (mm)

12 PINS Dual SMD Package



Features

Unregulated Converters

- Fully RoHS 6/6 Conform
- Full Power at 100°C Ambient Temperature
- 1kVDC or 3kVDC Isolation Options
- UL /CSA Certified, CB Report
- Suitable for Fully Automated Assembly (including Vapour Phase Soldering)
- Optional Continuous Short Circuit Protection
- Efficiency to 84%
- Built-In EN55022 Class A Filter

Selection Guide

Part Number SMD	(3kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
R1S**-xx3.3	(H)	3.3, 5, 12, 15, 24	3.3	303	75	2200µF
R1S**-xx05	(H)	3.3, 5, 12, 15, 24	5	200	72-78	1000µF
R1S**-xx09	(H)	3.3, 5, 12, 15, 24	9	111	74-78	1000µF
R1S**-xx12	(H)	3.3, 5, 12, 15, 24	12	84	75-80	470µF
R1S**-xx15	(H)	3.3, 5, 12, 15, 24	15	66	75-82	470µF
R1S**-xx24	(H)	3.3, 5, 12, 15, 24	24	42	74-84	220µF
R1D**-xx3.3	(H)	3.3, 5, 12, 15, 24	±3.3	±152	75	±1000µF
R1D**-xx05	(H)	3.3, 5, 12, 15, 24	±5	±100	72-78	±470µF
R1D**-xx09	(H)	3.3, 5, 12, 15, 24	±9	±56	74-78	±470µF
R1D**-xx12	(H)	3.3, 5, 12, 15, 24	±12	±42	75-80	±220µF
R1D**-xx15	(H)	3.3, 5, 12, 15, 24	±15	±33	75-82	±220µF
R1D**-xx24	(H)	3.3, 5, 12, 15, 24	±24	±21	74-84	±100µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "H" for 3kV Isolation, e.g. R1S-0505/H, R1D-0505/H, R1S12-0505/H, R1D12-0505/H

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R1S8-0505/P, R1S-0505/HP, R1D12-0505/HP

* add suffix -R for tape & reel packing e.g. R1S-0505-R. For more details see Application Notes.

Case and Pinning Options (note restrictions on /H option)

R1S** : ** without marking denotes 5 pins out of 8 fitted (includes /H option)
** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)
** with marking **12** denotes 10 pins out of 12 fitted (includes /H option)

R1D** : ** without marking denotes 6 pins out of 10 fitted (includes /H option)
** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)
** with marking **12** denotes 10 pins out of 12 fitted (includes /H option)

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±2% typ., ±5% max.	
Line Voltage Regulation	All Variants	1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output types	15% typ., 20% max.
	5V output type	12% typ., 15% max.
	9V output type	7% typ., 10% max.
	12V, 15V, 24V output types	6% typ., 10% max.
Output Ripple and Noise (20MHz BW limited)	50mVp-p typ., 100mVp-p max.	
Operating Frequency	20kHz min. / 60kHz typ. / 100kHz max.	
Efficiency at Full Load	See Selection Guide	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	

cont.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt SMD Single & Dual Output



UL-60950-1 Certified
EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

R1S_R1D

Description

The R1S and R1D converters are of the enclosed open frame type, i.e. they are not potted.

The converters are typically used in general purpose and industrial low power isolation and voltage matching applications where an SMD converter is required.

The converter series feature an extended ambient temperature operating range of $-40^\circ\text{C} \sim +100^\circ\text{C}$ without derating and optional continuous short circuit protection.

In addition to two isolation options and three different case formats, the converters are also available prepacked as tape and reel for use with automatic insertion machines.

Refer to Application Notes

www.recom-electronic.com

Specifications - continued

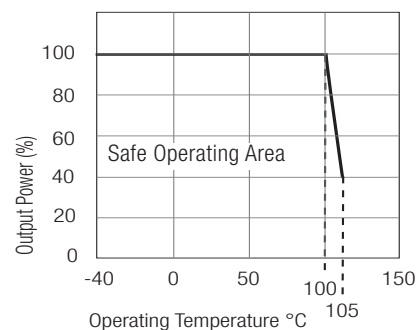
Isolation Voltage		(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz
Isolation Voltage	H-Suffix H-Suffix	(tested for 1 second) (rated for 1 minute)	3000VDC 1500VAC / 60Hz
Isolation Capacitance	R1S, R1S8, R1D, R1D10 R1S12, R1D12	15pF min. / 70pF max. 10pF min. / 75pF max.	
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
P-Suffix			Continuous
Operating Temperature Range (free air convection)			-40°C to +100°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Reflow Temperature	ROHS compliant	245°C (30 sec), Peak 255°C (5 sec) max.	
Vapour Phase Process	(for more details see Application Notes)	230°C (90 sec) max.	
Relative Humidity			95% RH
Humidity Susceptibility Test			1000 hrs / 90% humidity / +85°C ambient
Package weight	R1S R1S8 R1S12, R1D, R1D10, R1D12		1.0g 1.1g 1.2g
Packing Quantity	R1S, R1S8 R1S12, R1D, R1D10, R1D12 All Types	40 pcs per Tube 33 pcs per tube 500 pcs per Reel	
MTBF (+25°C) (+85°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F using MIL-HDBK 217F	4275 x 10 ³ hours 1365 x 10 ³ hours
CERTIFICATIONS			
CB Test Report	Report: US/14402A/UL		IEC 60950-1:2001 1st Ed.
UL General Safety	Report: E358085		UL 60950-1 2nd Ed.
CUL General Safety			C22.2 No. 60950-1-03
EN Medical Safety	Report: MDD1205098-2 + RM1205098-2 Medical Report + ISO14971 Risk Assessment		IEC/EN 60601-1 3rd Edition
EN General Safety	Report: SPCLVD1211033-3		EN60950-1: 2006 + A12:2011
Conducted / Radiated Emissions	EN55022		Level A

Notes

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Derating-Graphs (Ambient Temperature)

R1S-0505, R1D-0505

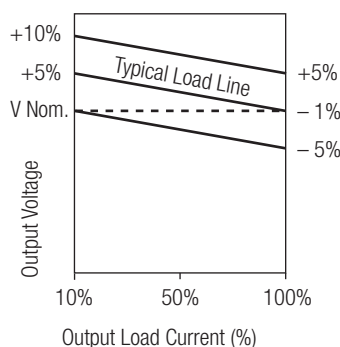


The derating graphs are valid only for the part numbers shown.

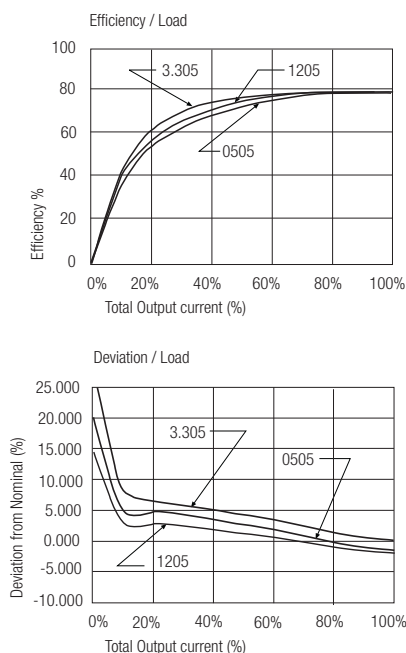
R1S-R1D

Typical Characteristics

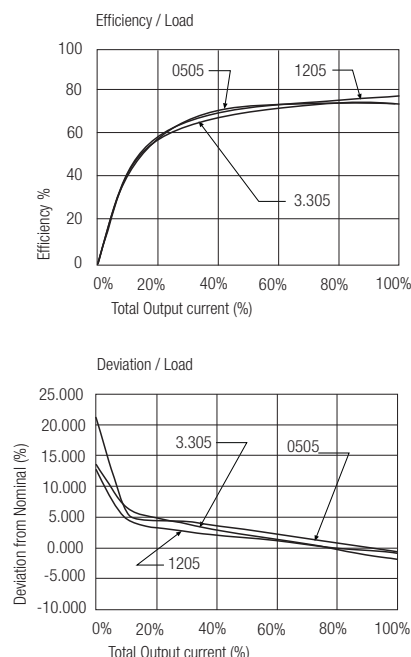
Tolerance Envelope



R1S**-xx05



R1D**-xx05

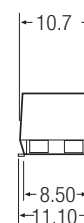
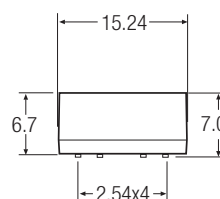
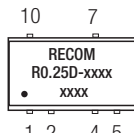
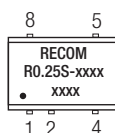
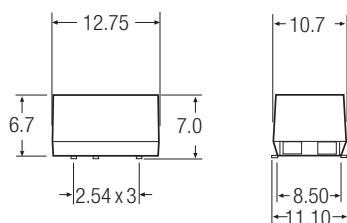


Package Style and Pinning (mm)

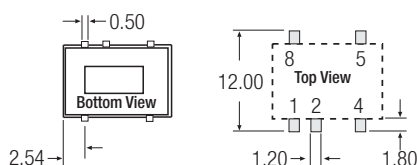
5 PIN Single SMD Package

Note: /H option is available in these pin packages

6 PIN Dual SMD Package



Recommended Footprint Details



Pin Connections

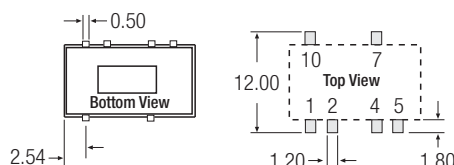
Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Com
5	+Vout	-Vout
7	No Pin	+Vout
8	NC	No Pin
10	No Pin	NC

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

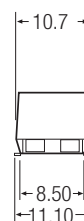
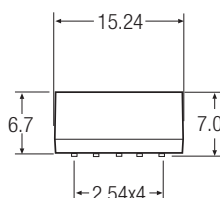
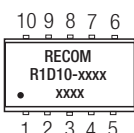
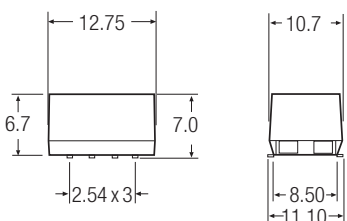
Recommended Footprint Details



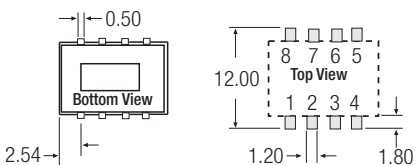
8 PIN Single SMD Package

Note: /H option is not available in these pin packages

10 PIN Dual SMD Package



Recommended Footprint Details



Pin Connections

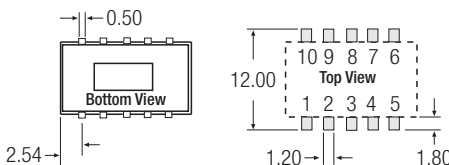
Pin #	Single	Dual	D(isol)
1	-Vin	-Vin	-Vin
2	+Vin	+Vin	+Vin
3	NC	NC	-
4	-Vout	Com	-Vout1
5	+Vout	-Vout	+Vout1
6	NC	NC	-Vout2
7	NC	+Vout	+Vout2
8	NC	NC	-
9	-	NC	-
10	-	NC	NC

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Recommended Footprint Details



R1S** : ** without marking denotes 5 pins out of 8 fitted (includes /H option)
 ** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)

e.g. R1S-0505, R1S-0505/H, R1S-0505/HP
 e.g. R1S8-0505, R1S8-0505/P

R1D** : ** without marking denotes 6 pins out of 10 fitted (includes /H option)
 ** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)

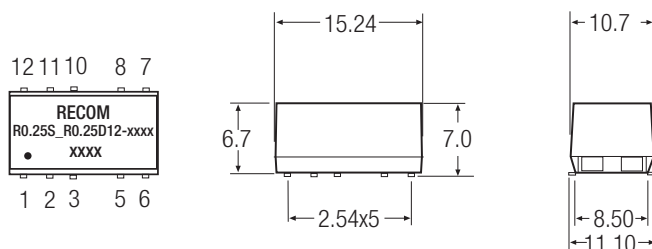
e.g. R1D-0505, R1D-0505/H, R1D-0505/HP
 e.g. R1D10-0505, R1D10-0505/P

Package Style and Pinning (mm)

12 PIN Single and Dual SMD Package

Note: /H option is available in this pin package

3rd angle projection

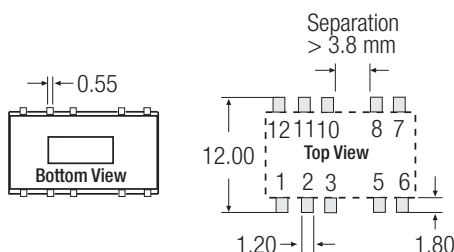


Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	NC	NC
5	-Vout	Com
6	NC	-Vout
7	NC	NC
8	+Vout	+Vout
10	NC	NC
11	NC	NC
12	NC	NC

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Recommended Footprint Details



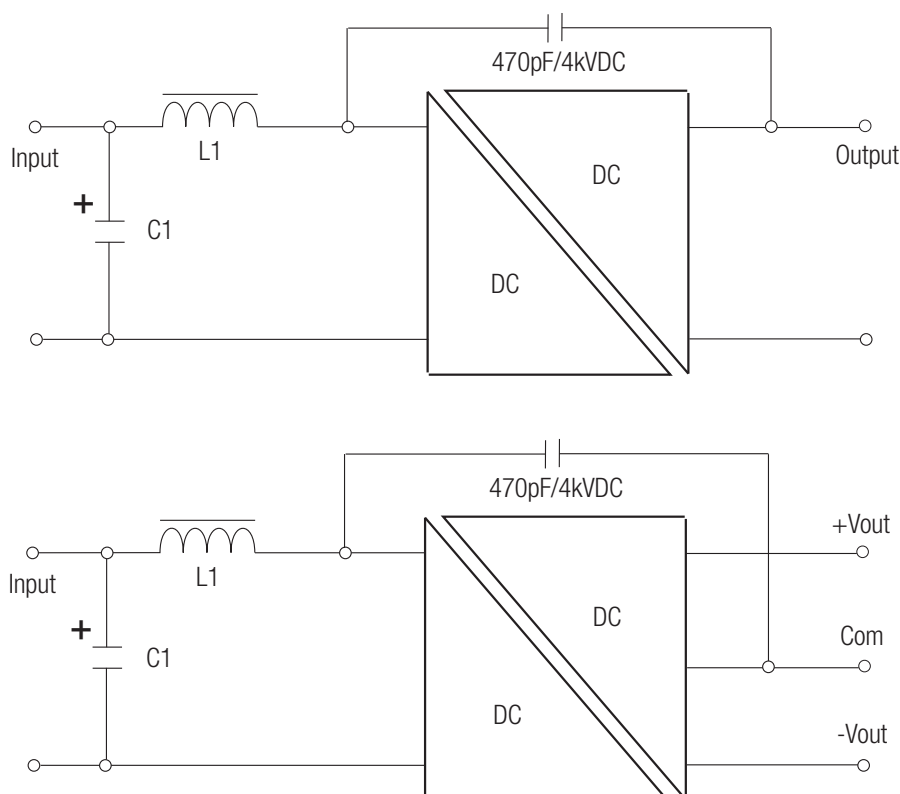
R1S**: ** with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

R1D**: ** with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

e.g. R1S12-0505, R1S12-0505/H, R1S12-0505/HP

e.g. R1D12-0505, R1D12-0505/H, R1D12-0505/HP

EMC Filtering - Suggestion for EN55022 Class B (Conducted and Emitted)



Standard and /H versions

C1	L1	Vin
4.7μF	3.3μH	3.3V
2.2μF	4.7μH	5V
2.2μF	10μH	9V
2.2μF	10μH	12V
2.2μF	22μH	15V
4.7μF	22μH	24V

/P and /HP versions

C1	L1	Vin
4.7μF	10μH	3.3V
10μF	10μH	5V
4.7μF	22μH	9V
4.7μF	22μH	12V
4.7μF	22μH	15V
10μF	47μH	24V

C1 = MLCC

L1 = SMD Inductor

Features

Unregulated Converters

- Efficiency 82% Full Load
- 1:1 Input Range
- 1kVDC and 2kVDC Isolation Option
- EN pending & UL Certified
- -40°C to +100°C Operating Temperature Range
- 1W SMD Package

Description

The R1S/E series is an unregulated DC/DC converter in fully encapsulated SMD package style. This series has been designed to offer exceptionally high efficiency at low loads and an extended operating temperature range. Uses include battery powered supplies, green energy applications and general isolating/converting DC power where board space and high efficiency is a premium.

Selection Guide

Part Number SMD	Isolation Voltage (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)	Capacitive Load (max.)
R1S**-3.305/E*	1	3.3	5	200	81%	2200µF
R1S**-0505/E*	1	5	5	200	81%	2200µF
R1S**-1205/E*	1	12	5	200	82%	2200µF
R1S**-2405/E*	1	24	5	200	80%	2200µF

** without marking denotes 5 pins out of 8 fitted (includes /H option) - e.g. R1S-3.305/EH

** with marking "8" denotes 8 pins out of 8 fitted (/H option not available) - e.g. R1S8-3.305/E

* add Suffix "/H" for 2kVDC Isolation Voltage - e.g. R1S-3.305/EH

* add Suffix "/P" for Continuous Short Protection - e.g. R1S-3.305/EHP, R1S8-3.305/EP

* add Suffix "-R" for tape & reel packing - e.g. R1S-3.305/EHP-R, R1S8-3.305/E-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%		
Output Voltage Accuracy	3.3V, 5V, 12V, 24V	±5% max.	
Line Voltage Regulation (low line to high line at full load)	3.3V, 5V, 12V, 24V	1.2% max.	
Load Voltage Regulation	Load Deviation 10% to 100%	15% max.	
Output Ripple and Noise (20MHz BW)	50mVp-p typ., 100mVp-p max.		
Operating Frequency (Vin=nominal input)	20kHz min. / 90kHz max.		
Efficiency	see Selection Guide		
Minimum Load = 0%	Specifications valid for 10% minimum load only		
Isolation Voltage	R1S-xx05/E	tested for 1 second	1000 VDC
	R1S-xx05/EH	tested for 1 second	2000 VDC
Isolation Capacitance	75pF max.		
Isolation Resistance	(Viso=500V)	10GΩ min.	
Short-Circuit Protection	1 second		
Operating Temperature Range	-40°C to +100°C		
Storage Temperature	-55°C to +125°C		
Reflow Temperature	RoHS compliant	245°C (30 sec.), Peak 255°C (5sec.) max.	
Vapour Phase Process	(for more details see Application Notes)	230°C (90 sec.) max.	
Relative Humidity	95% RH		
Package Weight	(R1S8/xx05/E = 1.1g)	1.0g	
Packing Quantity	40 pcs per Tube		
	500 pcs per Reel		
MTBF (+25°C)	using MIL-HDBK 217F	3459 x 10³ hours	
MTBF (+100°C)	using MIL-HDBK 217F	756 x 10³ hours	

Note: Detailed Information see Application Notes chapter "MTBF"

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

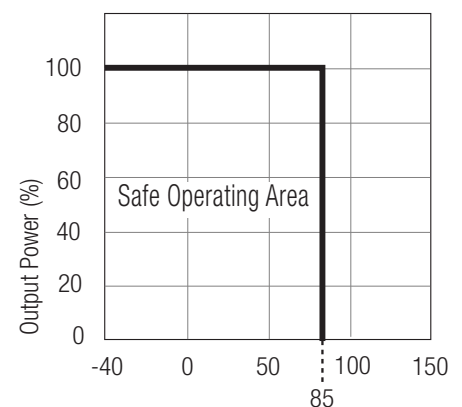
1 Watt SMD Single Output



EN-60950-1 (pending)
UL-60950-1 Certified

R1S/E

Derating-Graph (Ambient Temperature)

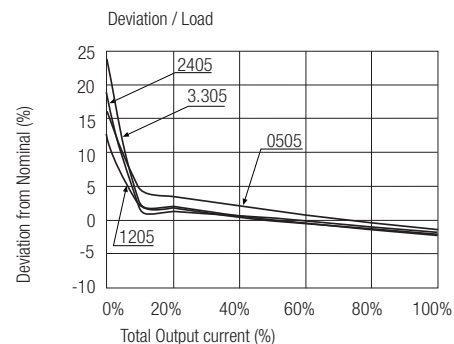
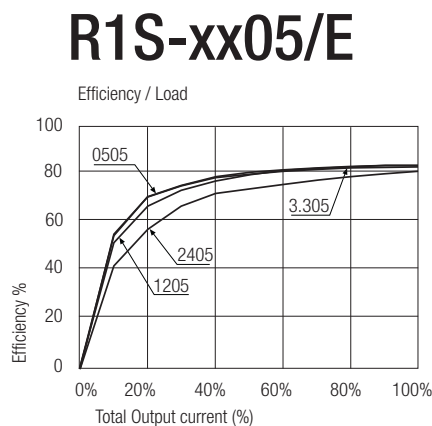
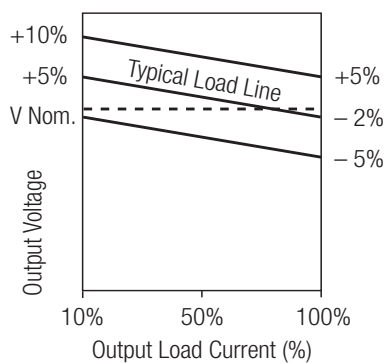


Operating Temperature °C

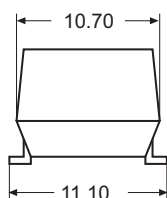
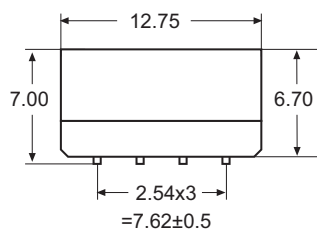
Refer to Application Notes

Typical Characteristics

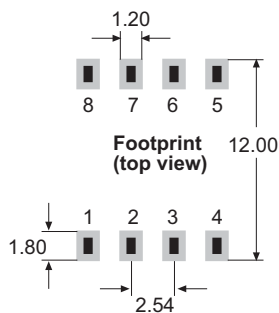
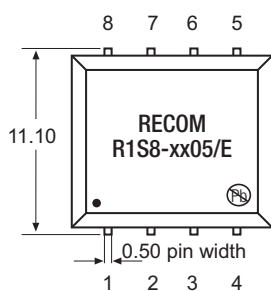
Tolerance Envelope



Package Style and Pinning



8 Pins:

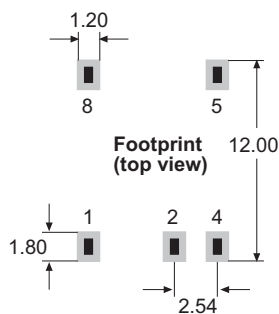
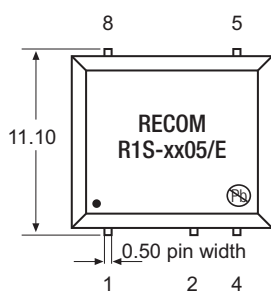


Pin Connections	Function	Function
Pin #	5 Pins	8 Pins
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	-Vout
5	+Vout	+Vout
3,6,7	NA	NC
8	NC	NC

NC = No Internal Connection
NA = No Available Connection

Unit: mm
Tolerance: ± 0.25 mm

5 Pins:



Features

Unregulated Converter

- 1 : 1 Input Range
- SMD Package
- Efficiency up to 75%
- 1kVDC Isolation
- Operating Temperature from -40°C to +85°C

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)
R1SE-0505	5	5	200	75

R1SE*-0505: without marking denotes 5 pins out of 8 fitted

with marking 8 denotes 8 pins out of 8 fitted

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage full load and after warm up)

Input Voltage Range		$\pm 10\%$ max.
Voltage set accuracy	100% Load/nominal Vin	-2% typ. / $\pm 5\%$ max.
Line Regulation	Low Line to High Line @ max. Load	1.2% typ.
Load Regulation	(10% to 100% Load)	10% typ. / 15% max.
Ripple & Noise @ 20MHz BW		68mVp-p typ. / 100mVp-p max.
Efficiency	100% Load	70% min. / 75% max.
Operating Temperature		-40°C to +85°C
Storage Temperature		-55°C to +125°C
Isolation Test Voltage (Tested for 1 second)		1000VDC
Isolation Capacitance		75pF max.
Isolation Resistance	Viso = 500V	10 G Ω min.
Humidity		95% max.
Operating Frequency	Vin (nom.)	20kHz min. / 70 kHz max.
Short-Circuit Protection		1 Second
MTBF	Using MIL-HDBK 217F (+90°C)	172 x 10 ³ hours
	Using MIL-HDBK 217F (+25°C)	1022 x 10 ³ hours

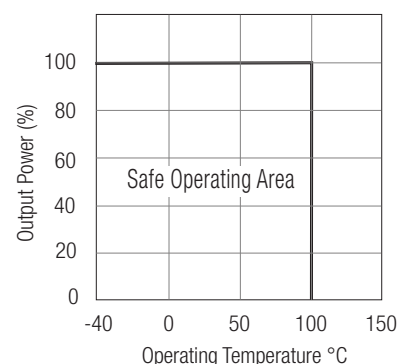
Detailed Information see Application Notes chapter „MTBF“

Weight	1.0g

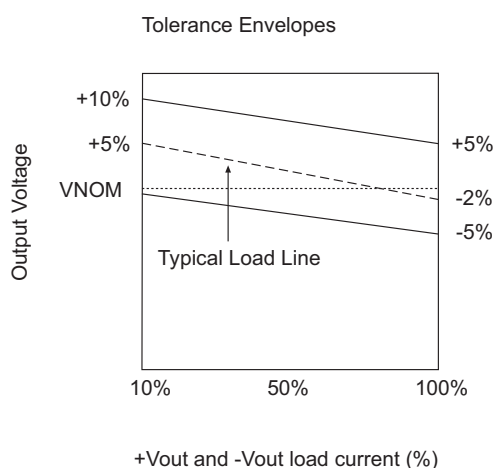


R1SE

Derating-Graph (Ambient Temperature)

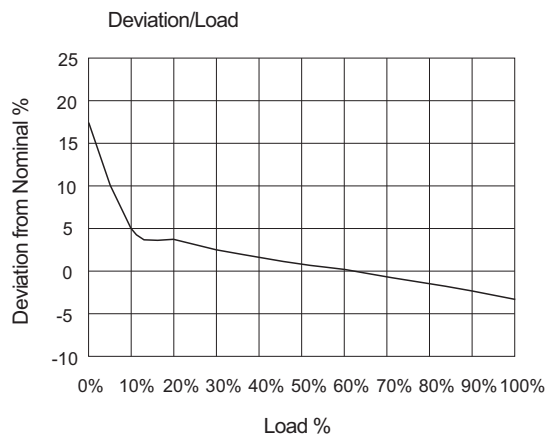
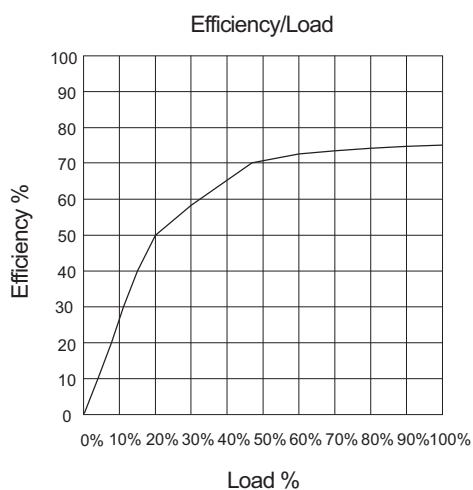


Typical Characteristics

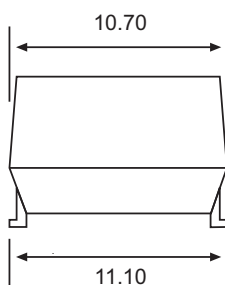
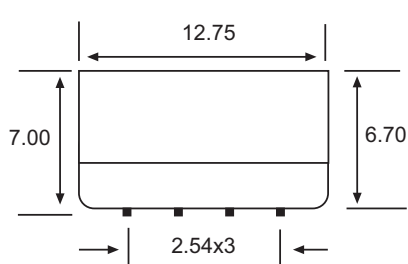


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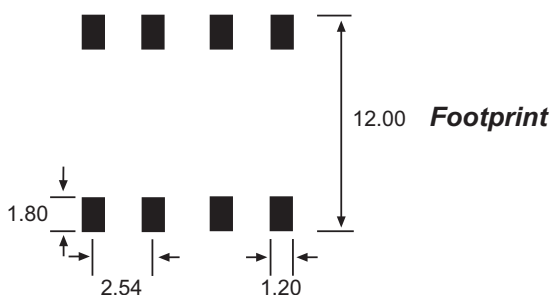
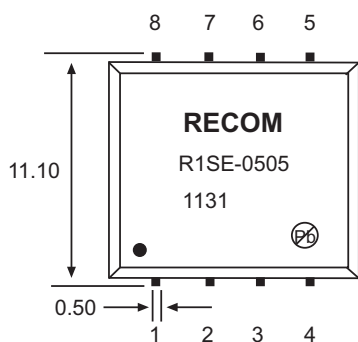
R1SE-0505



Package Style and Pinning (mm)



3rd angle projection



Pin Connections

Pin #	Function for 5 Pins	Function for 8 Pins
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	-Vout
5	+Vout	+Vout
3, 6, 7	NA	NC
8	NC	NC

NC= No Connection

NA= No Available Electrical Connection

UNIT: mm

TOL.: ± 0.25 mm

Features

Unregulated Converters

- Ultra-compact - only 8.3 x 8.3 x 6.8mm
- 1kVDC or 2KVDC Isolation
- No External Components Required
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- UL and EN Certified, CB Report
- Efficiency to 84%

Description

The RNM series DC/DC converters are ultra-compact isolated single output converters for applications where board space is at a premium. Despite their small size, the converters are fully featured with a full industrial operating temperature range of -40°C to +85°C without derating (+100°C with derating), 1kVDC or 2kVDC isolation and optional short circuit protection. The converters are also UL-60950 and EN-60950 certified and have a CB Report.

Selection Guide

Part Number	Input Voltage (2kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
RNM-xx3.3S	(H)	3.3, 5, 12, 15	3.3	303	75	2200µF
RNM-xx05S	(H)	3.3, 5, 12, 15	5	200	70-78	1000µF
RNM-xx09S	(H)	3.3, 5, 12, 15	9	111	70-78	1000µF
RNM-xx12S	(H)	3.3, 5, 12, 15	12	83	76-78	470µF
RNM-xx15S	(H)	3.3, 5, 12, 15	15	66	78-84	470µF

x = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RNM-0505S/P, RNM-0505S/HP

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range			±10%
Output Voltage Accuracy			±5%
Line Voltage Regulation			1.2%/1% of Vin typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output type		20% max.
	5V output type		15% max.
	9V, 12V and 15V output types		10% max.
Output Ripple and Noise (20MHz limited)			100mVp-p max.
Operating Frequency			50kHz min. / 100kHz typ. / 105kHz max.
Efficiency at Full Load			70% min.
Minimum Load = 0%		Specifications valid for 10% minimum load only.	
Isolation Voltage		(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz
Isolation Voltage	H-Suffix	(tested for 1 second)	2000VDC
Rated Working Voltage	H-Suffix	(rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance			20pF min. / 75pF max.
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
P-Suffix			Continuous
Operating Temperature Range (free air convection)			-40°C to +85°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Package Weight			1.1g
Packing Quantity			60 pcs per Tube
MTBF (+25°C)		Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F
(+85°C)			977 x 10 ³ hours
		using MIL-HDBK 217F	189 x 10 ³ hours

Detailed Information see
Application Notes chapter "MTBF"

ECONOLINE

DC/DC-Converter

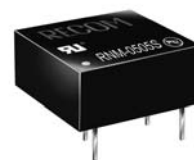
with 3 year Warranty

RECOM

1 Watt

DIP6

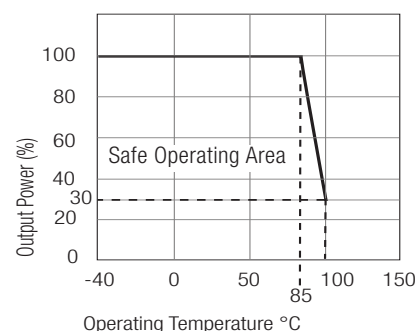
Single Output



UL-60950-1 Certified
EN-60950-1 Certified

RNM

Derating-Graph (Ambient Temperature)



Refer to Application Notes

www.recom-electronic.com

Specifications (cont.)

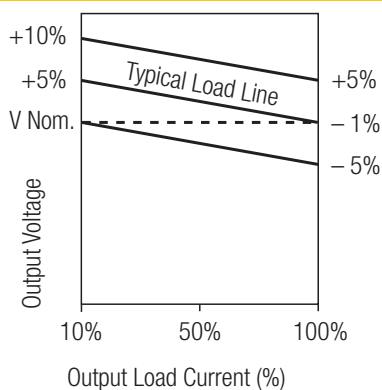
Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

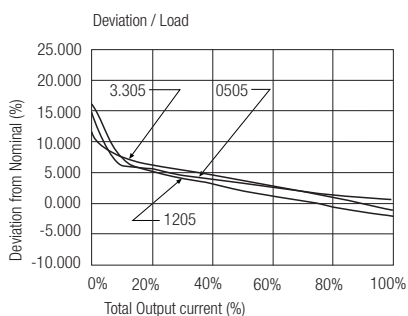
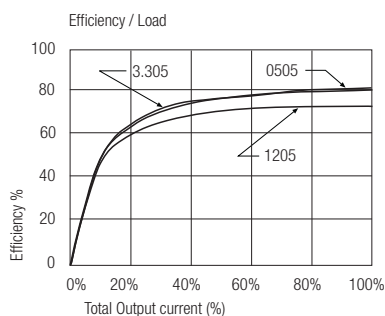
CB Test Report	Report: US/15348/UL	IEC 60950-1:2005 2nd Ed.
UL General Safety	Report: E358085	UL 60950-1 1st Ed.
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006+A12:2011

Tolerance Envelope

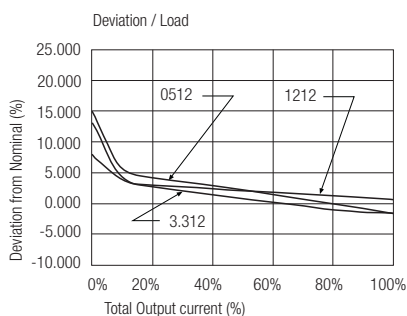
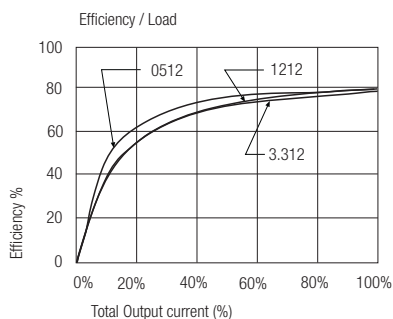


Typical Characteristics

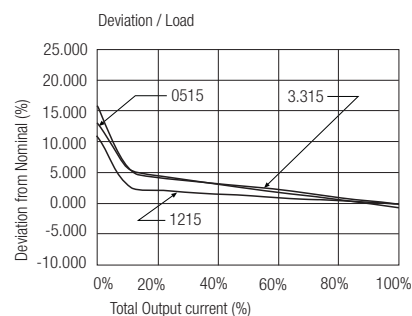
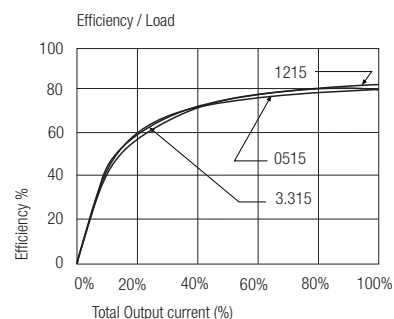
RNM-xx05S



RNM-xx12S



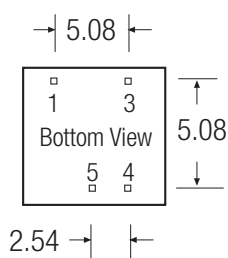
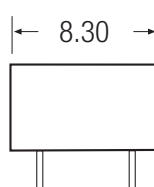
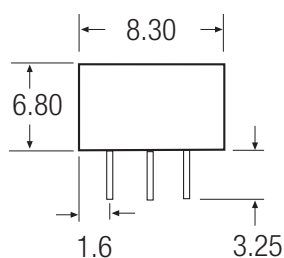
RNM-xx15S



Package Style and Pinning (mm)

4 PIN DIP Package

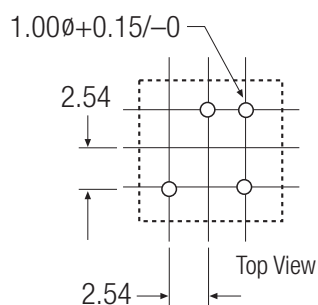
3rd angle projection



RNM Pin Connections

Pin #	Single
1	-Vin
3	+Vin
4	+Vout
5	-Vout

XX.XX ± 0.25 mm



Recommended Footprint Details

Features

Unregulated Converters

- Micro Size SIP4 Package
- 3kVDC Isolation
- Approved for Medical Applications
- Industry Standard Pinout
- Optional Continuous Short Circuit Protected
- UL94V-0 Package Material
- Efficiency to 85 %

Description

The ROM Micro Size DC/DC converter has been designed for isolating or converting DC power rails where board height is at a premium. Although it has a micro-size 7.7mm package, it does not compromise on features and offers a high 3kVDC Isolation, a -40°C to $+85^{\circ}\text{C}$ operating temperature range and optional continuous short circuit protection.

Selection Guide

Part Number SIP4 Micro Size Pack.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
ROM-xx05S	3.3, 5, 12	5	200	70-78	1000 μF
ROM-xx12S	3.3, 5, 12	12	83	78-82	470 μF
ROM-xx15S	3.3, 5, 12	15	66	80-84	470 μF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. ROM-0505S/P

Specifications (measured at $T_A = 25^{\circ}\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$	
Output Voltage Accuracy	$\pm 5\%$	
Line Voltage Regulation	1.2%/1% of V_{in} typ.	
Load Voltage Regulation	5V Output	15% max.
(10% to 100% full load)	12V, 15V Output	10% max.
Output Ripple and Noise (20MHz limited)	100mVp-p max.	
Operating Frequency	50kHz min. / 100kHz typ. / 105kHz max.	
Efficiency at Full Load	70% min. / 80% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Isolation Voltage	(tested for 1 second) (rated for 1 minute)	3000VDC 1500VAC / 60Hz
Isolation Capacitance	20pF min. / 75pF max.	
Isolation Resistance	15 $\text{G}\Omega$ min.	
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range (free air convection)	-40°C to $+85^{\circ}\text{C}$ (see Graph)	
Storage Temperature Range	-55°C to $+125^{\circ}\text{C}$	
Relative Humidity	95% RH	
Package Weight	1g	
Packing Quantity	42 pcs per Tube	
MTBF ($+25^{\circ}\text{C}$)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 977 x 10^3 hours
($+85^{\circ}\text{C}$)		using MIL-HDBK 217F 189 x 10^3 hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt SIP4 Micro Single Output

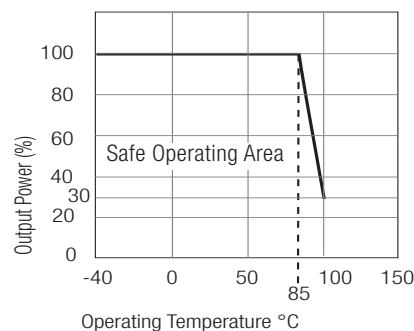


E-358085

EN-60950-1 Certified
UL-60950-1 Certified
EN-60601-1 Certified

ROM

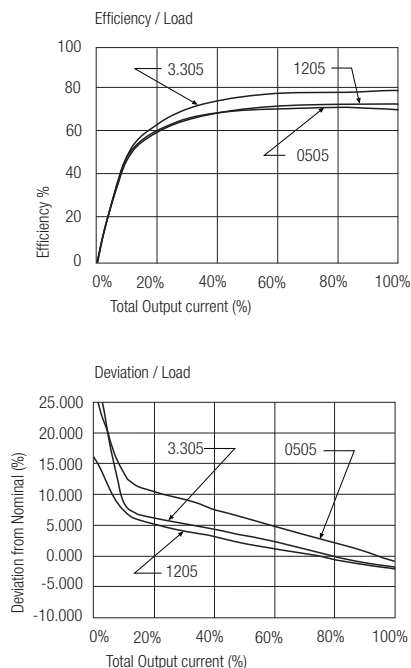
Derating-Graph (Ambient Temperature)



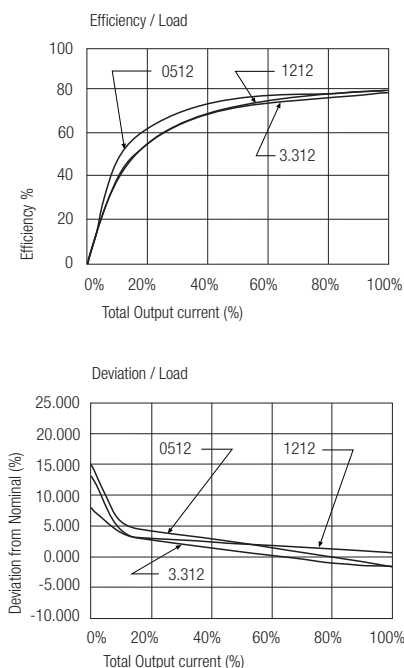
Refer to Application Notes

Typical Characteristics

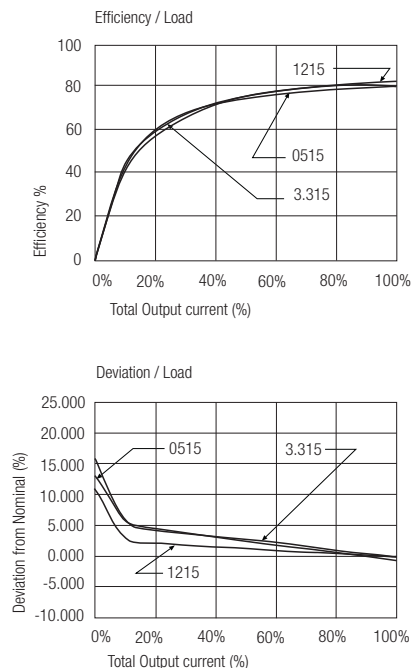
ROM-xx05S



ROM-xx12S



ROM-xx15S



Notes

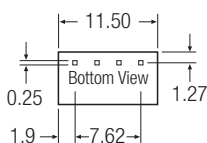
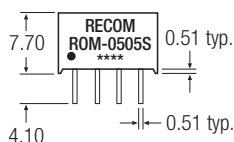
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

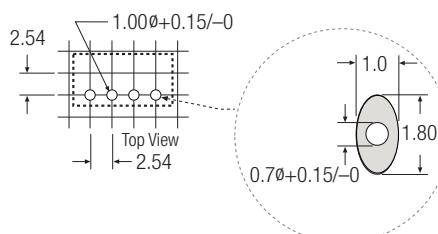
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UL General Safety	Report: E350805	UL 60950-1 2nd Ed.
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011
EN Medical Safety	Report: MDD1205098-4 + RM1205098-4	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Package Style and Pinning (mm)

4 PIN SIP Micro Size Package



Recommended Footprint Details



RO Pin Connections

Pin #	Single
1	-Vin
2	+Vin
3	-Vout
4	+Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converter

- Industry Standard Pinout
- 1kVDC or 2kVDC Isolation
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- Custom Solutions Available
- Efficiency to 85 %

Description

The RO DC/DC converters are typically used in general purpose power isolation and voltage matching applications, and feature a full industrial operating temperature range of -40°C to +85°C without derating.

Selection Guide

Part Number SIP 4	(2kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
RO-xx3.3S	(H)	3.3, 5, 12, 15, 24	3.3	303	75	2200µF
RO-xx05S	(H)	3.3, 5, 12, 15, 24	5	200	78-80	1000µF
RO-xx09S	(H)	3.3, 5, 12, 15, 24	9	111	78-80	1000µF
RO-xx12S	(H)	3.3, 5, 12, 15, 24	12	83	80-84	470µF
RO-xx15S	(H)	3.3, 5, 12, 15, 24	15	66	80-84	470µF
RO-xx24S	(H)	3.3, 5, 12, 15, 24	24	42	78-85	220µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RO-0505S/P, RO-0505S/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range		$\pm 10\%$
Output Voltage Accuracy		$\pm 5\%$
Line Voltage Regulation		1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output type	20% max.
	5V output type	15% max.
	9V, 12V, 15V, 24V output types	10% max.
Output Ripple and Noise (20MHz limited)		100mVp-p max.
Operating Frequency		50kHz min. / 100kHz typ. / 105kHz max.
Efficiency at Full Load		70% min. / 80% typ.
Minimum Load = 0%		Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second)	1000VDC
	(rated for 1 minute)	500VAC / 60Hz
Isolation Voltage	H-Suffix (tested for 1 second)	2000VDC
	H-Suffix (rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance		20pF min. / 75pF max.
Isolation Resistance		10 GΩ min.
Short Circuit Protection		1 Second
P-Suffix		Continuous
Operating Temperature Range (free air convection)		-40°C to +85°C (see Graph)
Storage Temperature Range		-55°C to +125°C
Relative Humidity		95% RH
Package Weight		1.4g
Packing Quantity		42 pcs per Tube
MTBF (+25°C) (+85°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 985 x 10 ³ hours
		using MIL-HDBK 217F 200 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt

SIP4

Single Output



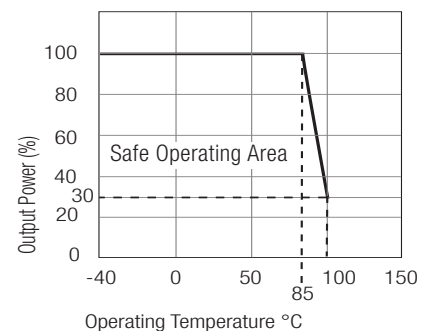
E-358085

EN-60950-1 Certified
UL-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

RO

Derating-Graph

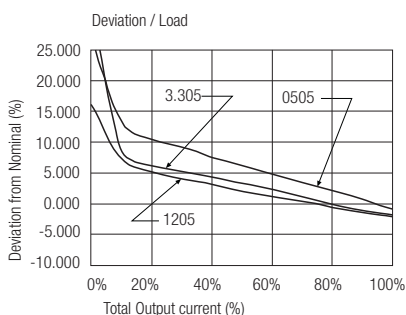
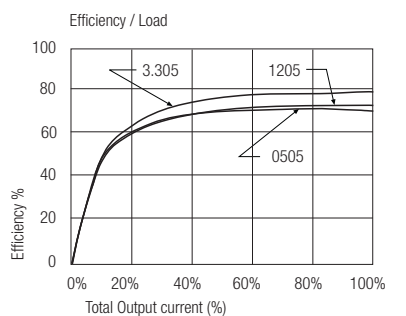
(Ambient Temperature)



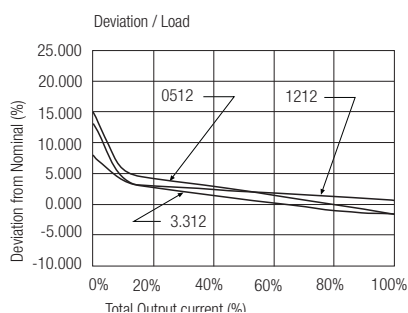
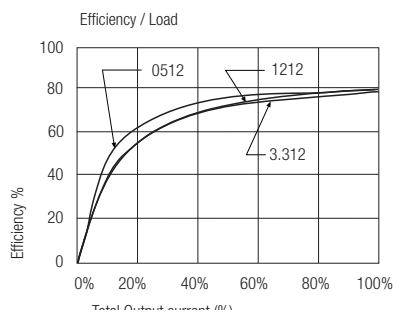
Refer to Application Notes

Typical Characteristics

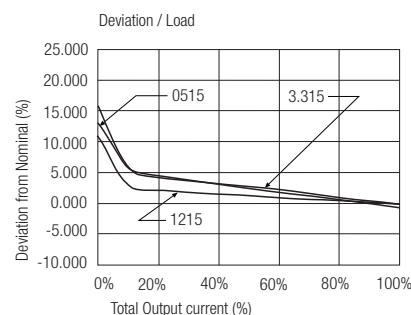
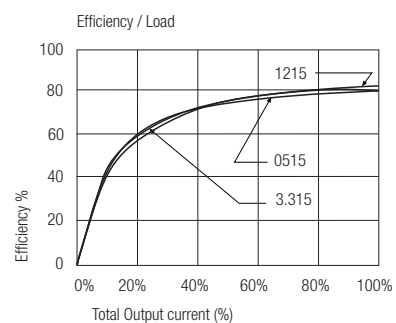
RO-xx05S



RO-xx12S



RO-xx15S



Notes

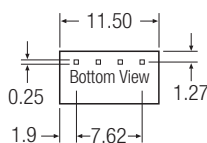
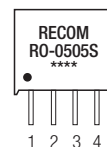
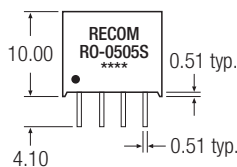
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

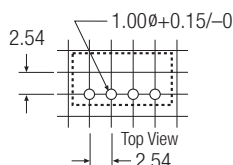
CB Test Report	Report: US/15348/UL	IEC 60950-1:2005 2nd Ed.
UL General Safety	Report: E358085	UL 60950-1 2nd Ed.
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011
EN Medical Safety	Report: MDD1112018 + RM1112018	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Package Style and Pinning (mm)

4 PIN SIP Package



Recommended Footprint Details



RO Pin Connections

Pin #	Single
1	-Vin
2	+Vin
3	-Vout
4	+Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converters

- High Efficiency up to 84%
- Low Deviation (10% ~ 100% Load)
- 1kVDC and 2kVDC Isolation Option
- Safety Certified
- -40°C to +100°C Operating Temperature Range
- 1W SIP4 Package

Description

The RO/E series is an unregulated DC/DC converter in standard SIP4 package style. This series has been designed to offer exceptionally high efficiency at low loads, an extended operating temperature range and low deviation (10% ~ 100% load). Uses include applications with restricted energy budget and industrial applications where a high efficiency level is required.

Selection Guide

Part Number SMD	Isolation Voltage (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)	Capacitive Load (max.)
RO-3.305S/E*	1	3.3	5	200	83%	2200µF
RO-0505S/E*	1	5	5	200	84%	2200µF
RO-1205S/E*	1	12	5	200	84%	2200µF
RO-2405S/E*	1	24	5	200	81%	2200µF

* add Suffix "/H" for 2kVDC Isolation Voltage - e.g. RO-3.305S/EH

* add Suffix "/P" for Continuous Short Protection - e.g. RO-3.305S/EHP, RO-3.305S/EP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range				±10%
Output Voltage Accuracy				±5% max.
Line Voltage Regulation	low line to high line at full load			1.2% max.
Load Voltage Regulation	Load Deviation 10% to 100%			12% typ.
Output Ripple and Noise (20MHz BW)				50mVp-p typ., 100mVp-p max.
Operating Frequency (V_{in} =nominal input)				20kHz min. / 90kHz max.
Efficiency				see Selection Guide
Minimum Load = 0%	Specifications valid for 10% minimum load only			
Isolation Voltage	RO-xx05S/E	tested for 1 second	1000 VDC	
	RO-xx05S/EH	tested for 1 second	2000 VDC	
Isolation Capacitance				75pF max.
Isolation Resistance	(Viso=500V)			10GΩ min.
Short-Circuit Protection				1 second
Operating Temperature Range				-40°C to +100°C
Storage Temperature				-55°C to +125°C
Relative Humidity				95% RH
Package Weight				1.4g
MTBF (+25°C)	using MIL-HDBK 217F	3459 x 10 ³ hours		
MTBF (+100°C)	using MIL-HDBK 217F	756 x 10 ³ hours		

Note: Detailed Information see Application Notes chapter "MTBF"

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt SIP4 Single Output



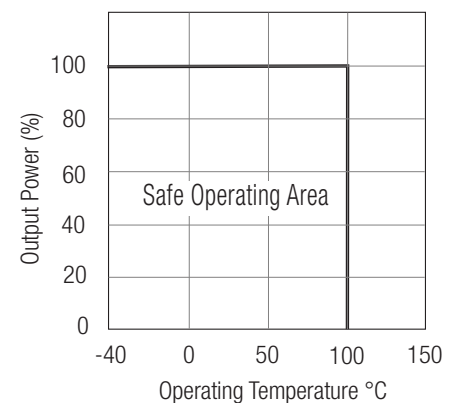
EN-60950-1 (pending)

UL-60950-1 (pending)

RO/E

Derating-Graph

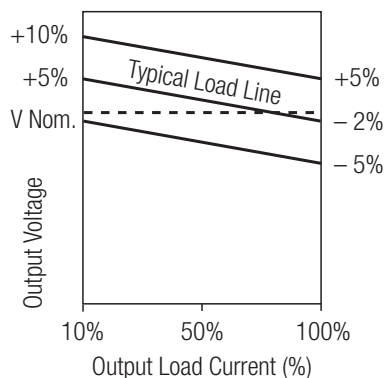
(Ambient Temperature)



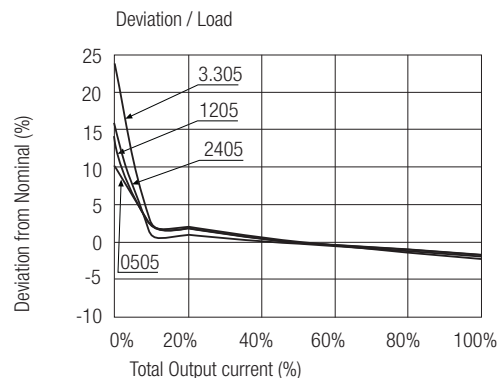
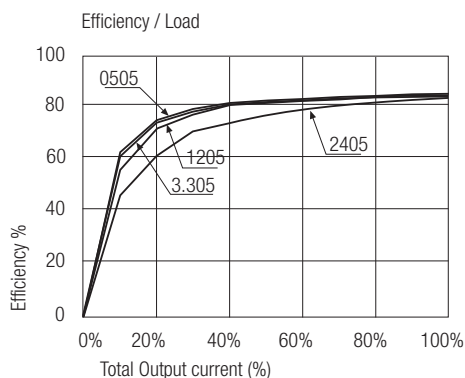
Refer to Application Notes

Typical Characteristics

Tolerance Envelope

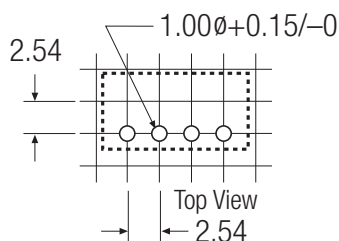
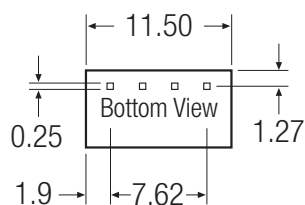
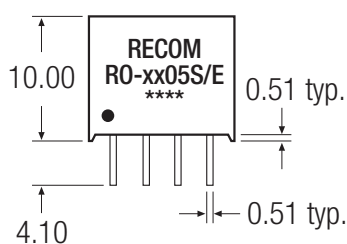


RO-xx05S/E



Package Style and Pinning

3rd angle projection



Pin Connections	Function
Pin #	4 Pins
1	-Vin
2	+Vin
3	-Vout
4	+Vout

Unit: mm
Tolerance: ± 0.25 mm

Features

Unregulated Converters

- 1:1 Input Range
- Low Cost 1W Converter
- Efficiency to 75%
- -40°C to +85°C Operating Temperature Range

ECONOLINE

DC/DC-Converter

RECOM

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)
ROE-0505S	5	5	200	75%

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10% max.		
Output Voltage Accuracy	-2% typ., ±5% max.		
Line Voltage Regulation	(low line to high line at max. load)	1.2% typ.	
	20% to 100% load (5V output)	10% max.	
Output Ripple and Noise (20MHz BW limited)	52mVp-p typ. / 100mVp-p max.		
Operating Frequency (Vin=nominal input)	50kHz min. / 82kHz typ. / 105kHz max.		
Efficiency	75% typ. / 70% min.		
Isolation Test Voltage	1000 VDC min.	(tested for 1 second)	
Isolation Capacitance	75pF max.		
Isolation Resistance	(Viso=500V)	1GΩ min.	
Short-Circuit Protection	1 sec.		
Operating Temperature Range	-40°C to +85°C		
Storage Temperature	-55°C to +125°C		
Relative Humidity	95% RH		
Package Weight	1.4g		
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	2400 x 10³ hours
MTBF (+85°C)		using MIL-HDBK 217F	650 x 10³ hours

1 Watt SIP4 Single Output

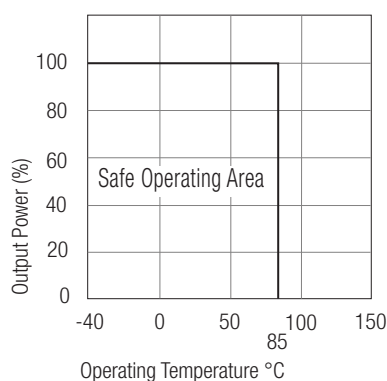


ROE

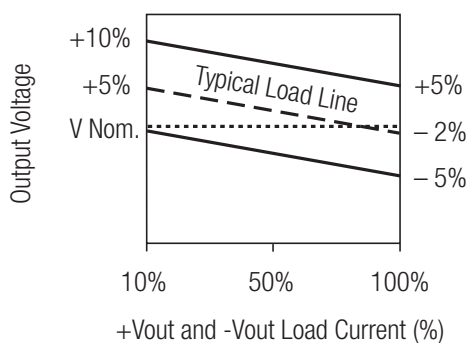
Typical Characteristics

Derating-Graph

(Ambient Temperature)

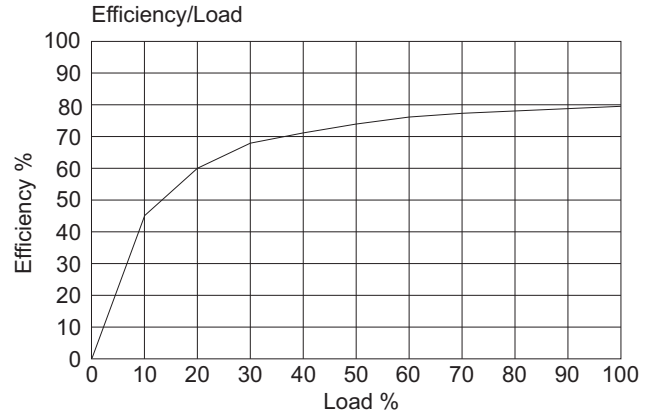
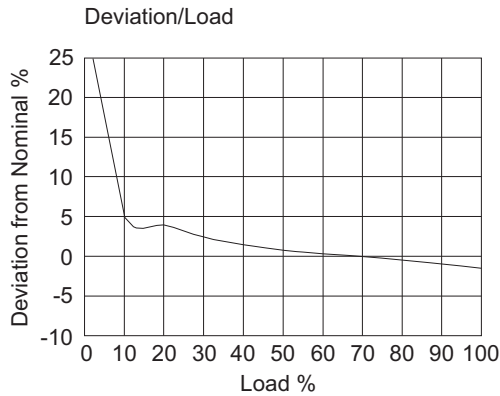


Tolerance Envelope



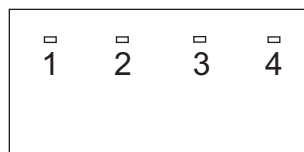
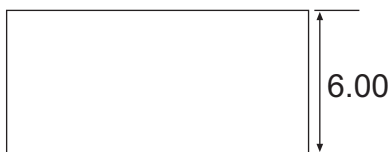
Typical Characteristics

ROE-0505S

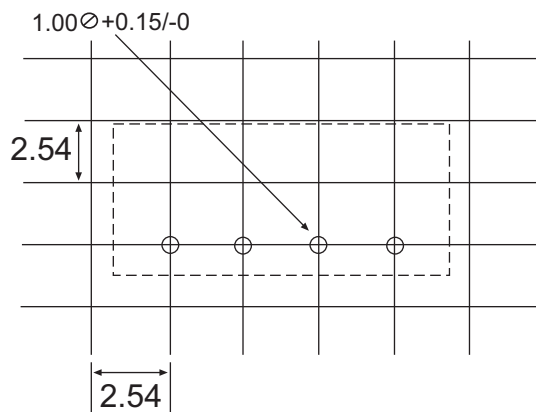
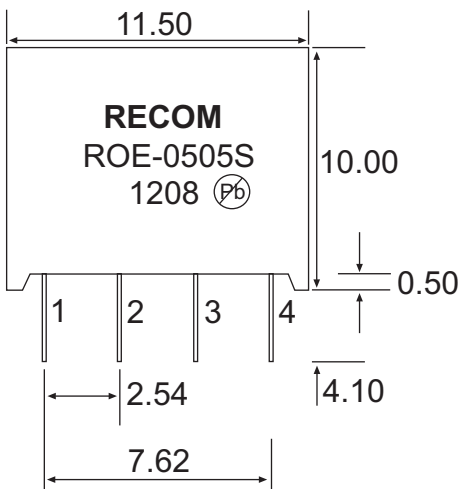


Package Style and Pinning

Single SIP 4PIN Package



BOTTOM VIEW



Pin Connections	
Pin #	Function
1	-Vin
2	+Vin
3	-Vout
4	+Vout
Unit: mm	
Tolerance: ± 0.25 mm	

Features

Unregulated Converters

- Micro Size SIP 6 Package
- Industry Standard Pinout
- Power Sharing on Dual Output Version
- 3kVDC Isolation
- Optional Continuous Short Circuit Protected
- Efficiency to 85 %

Description

The RBM Micro Size DC/DC-Converter complements Recom's industrial range of converters. This range is widely used for pcb distributed power systems and combines small package size, high efficiency, 3kVDC isolation and low output ripple.

The extended operating temperature range covering -40°C to $+85^{\circ}\text{C}$ is a standard feature. The full rated power can be taken from a single pin of this dual output converter, provided this does not exceed 1 Watt.

Selection Guide

Part Number SIP 6 Micro Size	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RBM-xx05S	5, 12	5	200	70-78	1000 μF
RBM-xx12S	5, 12	12	83	78-80	470 μF
RBM-xx15S	5, 12	15	66	80-84	470 μF
RBM-xx05D	5, 12	± 5	± 100	74-78	$\pm 470\mu\text{F}$
RBM-xx12D	5, 12	± 12	± 41	80-82	$\pm 220\mu\text{F}$
RBM-xx15D	5, 12	± 15	± 33	80-84	$\pm 220\mu\text{F}$

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RBM-0505S/P, RBM-0505D/P

Specifications (measured at $T_A = 25^{\circ}\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$		
Output Voltage Accuracy	$\pm 5\%$		
Line Voltage Regulation	1.2%/1% of V_{in} typ.		
Load Voltage Regulation (10% to 100% full load)	5V output type	15% max	
	12, 15V output types	10% max	
Output Ripple and Noise (20MHz limited)	100mVp-p max.		
Operating Frequency	50kHz min. / 100kHz typ. / 105kHz max.		
Efficiency at Full Load	70% min. / 80% typ.		
Minimum Load = 0%	Specifications valid for 10% minimum load only.		
Isolation Voltage	(tested for 1 second)	3000VDC	
	(rated for 1 minute)	1500VAC / 60Hz	
Isolation Capacitance	20pF min. / 65pF max.		
Isolation Resistance	15 G Ω min.		
Short Circuit Protection	1 Second		
P-Suffix	Continuous		
Operating Temperature Range (free air convection)	-40°C to $+85^{\circ}\text{C}$ (see Graph)		
Storage Temperature Range	-55°C to $+125^{\circ}\text{C}$		
Relative Humidity	95% RH		
Package Weight	1.3g		
Packing Quantity	30 pcs per Tube		
MTBF ($+25^{\circ}\text{C}$)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1005 x 10^3 hours
($+85^{\circ}\text{C}$)		using MIL-HDBK 217F	195 x 10^3 hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

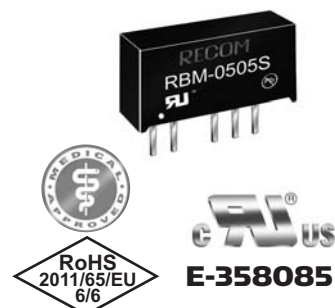
RECOM

1 Watt

SIP 6 Micro

Size, Single &

Dual Output



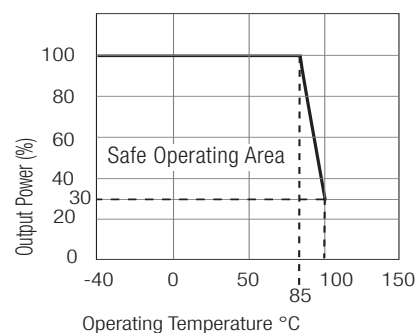
EN-60950-1 Certified

UL-60950-1 Certified

EN-60601-1 Certified

RBM

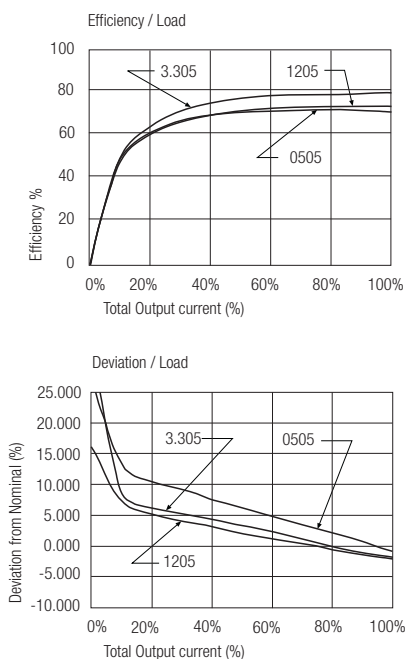
Derating-Graph (Ambient Temperature)



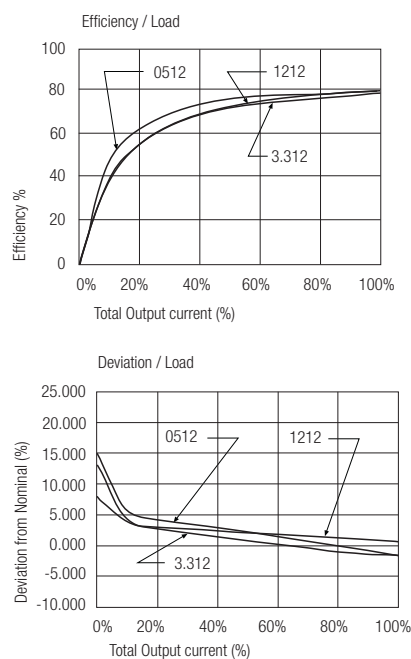
Refer to Application Notes

Typical Characteristics

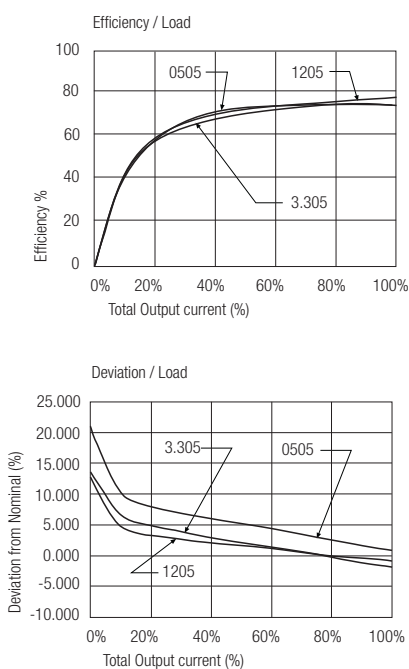
RBM-xx05S



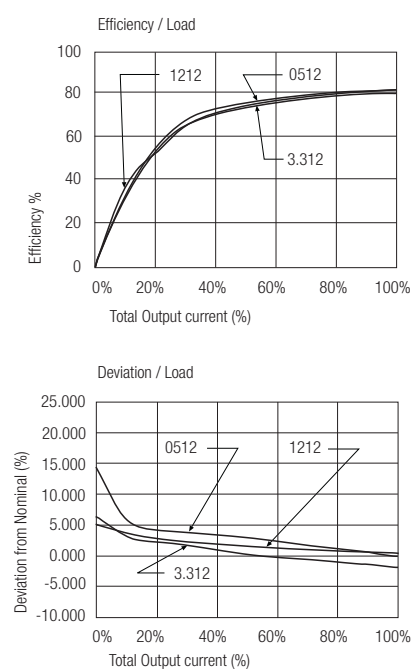
RBM-xx12S



RBM-xx05D

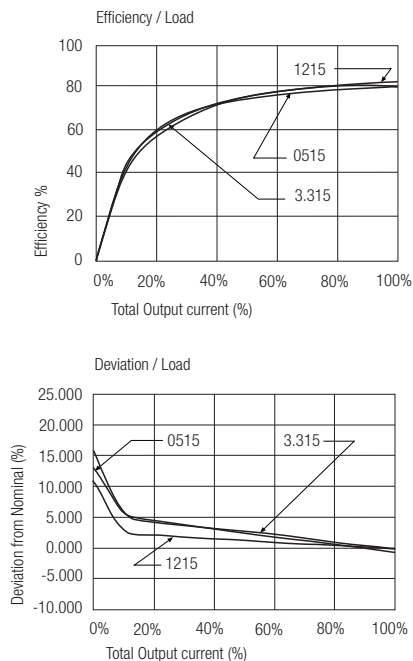


RBM-xx12D

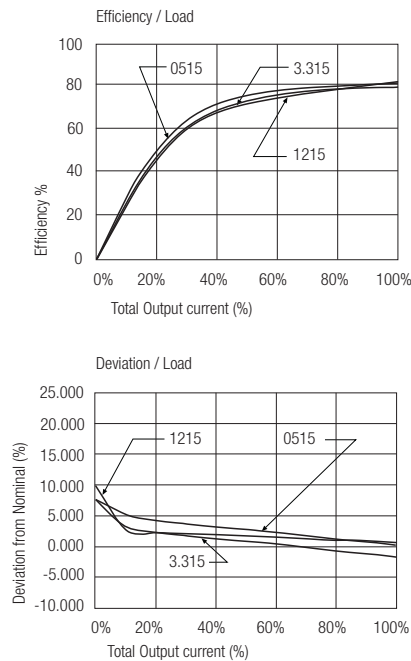


Typical Characteristics

RBM-xx15S



RBM-xx15D



Notes

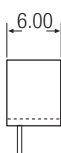
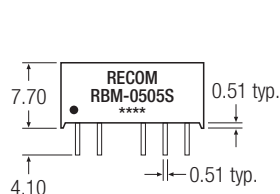
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

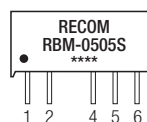
CB Test Report	Report: US/15348/UL	IEC 60950-1:2005 2nd Ed.
UL General Safety	Report: E358085	UL 60950-1 2nd Ed.
EN General Safety	Report: SPCLVD1109103	EN60950-1:2001 + A11:2004
EN Medical Safety	Report: MDD1205098-4 + RM1205098-4	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Package Style and Pinning (mm)

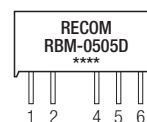
SIP6 Micro Size Package



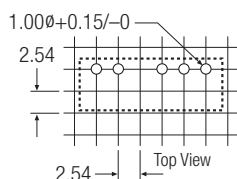
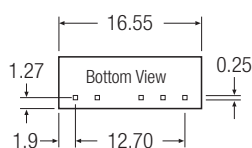
Single Output



Dual Output



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4	NC	-Vout
5	-Vout	Com
6	+Vout	+Vout

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converters

- Low Cost 1W Converter
- Power Sharing on Dual Output Version
- Industry Standard Pinout
- 1kVDC or 2kVDC Isolation Options
- Optional Continuous Short Circuit Protected
- UL94V-0 Package Material
- Efficiency to 85 %

Description

The RB series DC/DC converter has been designed for isolating or converting DC power rails in general purpose applications. Although low cost, it does not compromise on features and offers 1kVDC or 2kVDC isolation, a -40°C to $+85^{\circ}\text{C}$ operating temperature range and optional continuous short circuit protection.

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
SIP 7	(2kV)					
RB-xx3.3S	(H)	3.3, 5, 12, 15, 24	3.3	303	75	2200 μF
RB-xx05S	(H)	3.3, 5, 12, 15, 24	5	200	70-78	1000 μF
RB-xx09S	(H)	3.3, 5, 12, 15, 24	9	111	70-78	1000 μF
RB-xx12S	(H)	3.3, 5, 12, 15, 24	12	84	78-80	470 μF
RB-xx15S	(H)	3.3, 5, 12, 15, 24	15	66	80-84	470 μF
RB-xx24S	(H)	3.3, 5, 12, 15, 24	24	42	74-85	220 μF
RB-xx3.3D	(H)	3.3, 5, 12, 15, 24	± 3.3	± 152	70	$\pm 1000\mu\text{F}$
RB-xx05D	(H)	3.3, 5, 12, 15, 24	± 5	± 100	70-78	$\pm 470\mu\text{F}$
RB-xx09D	(H)	3.3, 5, 12, 15, 24	± 9	± 56	76-79	$\pm 470\mu\text{F}$
RB-xx12D	(H)	3.3, 5, 12, 15, 24	± 12	± 42	78-82	$\pm 220\mu\text{F}$
RB-xx15D	(H)	3.3, 5, 12, 15, 24	± 15	± 33	80-84	$\pm 220\mu\text{F}$
RB-xx24D	(H)	3.3, 5, 12, 15, 24	± 24	± 21	80-84	$\pm 100\mu\text{F}$

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RB-0505S/P, RB-0505S/HP

Specifications (measured at $T_A = 25^{\circ}\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$	
Output Voltage Accuracy	$\pm 5\%$	
Line Voltage Regulation	1.2%/1% of V_{in} typ.	
Load Voltage Regulation (10% to 100% full load)	3.3V output type 5V output type 9V, 12V, 15V, 24V output types	20% max. 15% max. 10% max.
Output Ripple and Noise (20MHz limited)	Single output types Dual output types	100mVp-p max. $\pm 75\text{mVp-p}$ max.
Operating Frequency	50kHz min. / 100kHz typ. / 105kHz max.	
Efficiency at Full Load	70% min. / 80% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Isolation Voltage	(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz
Isolation Voltage	H-Suffix H-Suffix	(tested for 1 second) (rated for 1 minute) 2000VDC 1000VAC / 60Hz
Isolation Capacitance	20pF min. / 75pF max.	
Isolation Resistance	10 G Ω min.	
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range (free air convection)	-40°C to $+85^{\circ}\text{C}$ (see Graph)	
Storage Temperature Range	-55°C to $+125^{\circ}\text{C}$	

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt

SIP7

Single & Dual Output

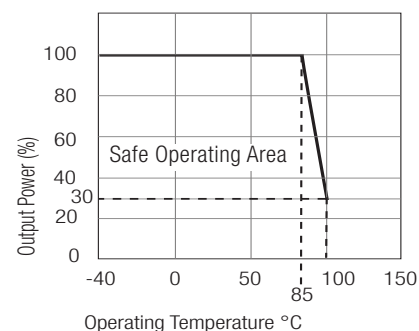


E358085

EN-60950-1 Certified
UL-60950-1 Certified
EN-60601-1 Certified*
 (* /H suffix)

RB

Derating-Graph (Ambient Temperature)



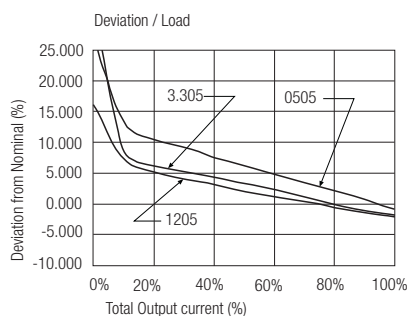
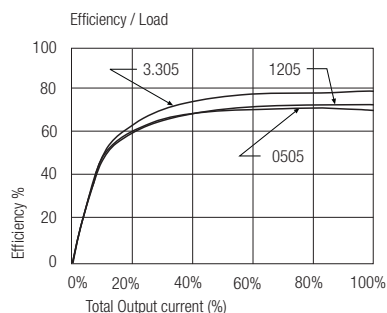
Refer to Application Notes

Specifications - continued

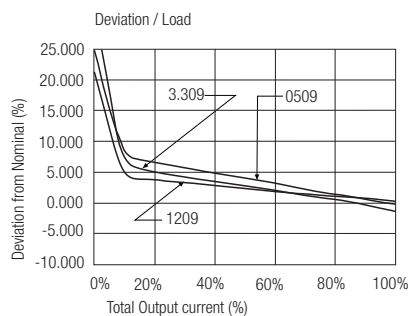
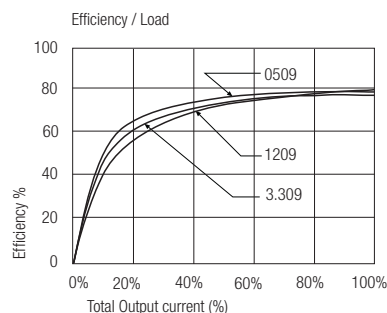
Relative Humidity	95% RH		
Package Weight	2.2g		
Packing Quantity	25 pcs per Tube		
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1012 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	151 x 10 ³ hours

Typical Characteristics - Single Output

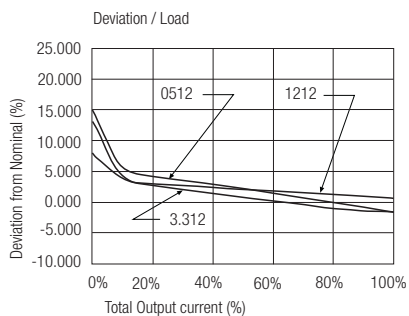
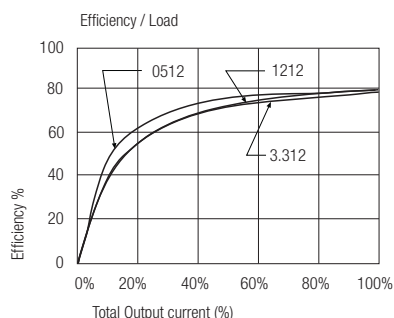
RB-xx05S



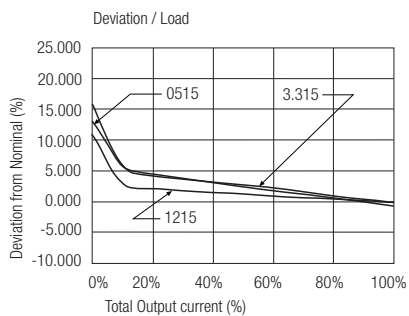
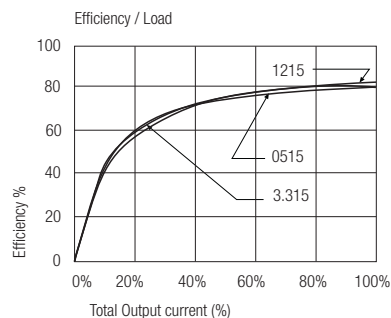
RB-xx09S



RB-xx12S

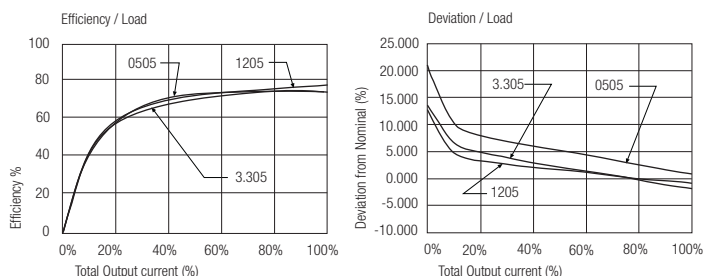


RB-xx15S

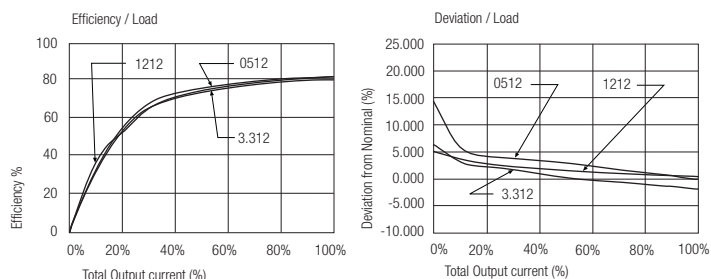


Typical Characteristics - Dual Outputs

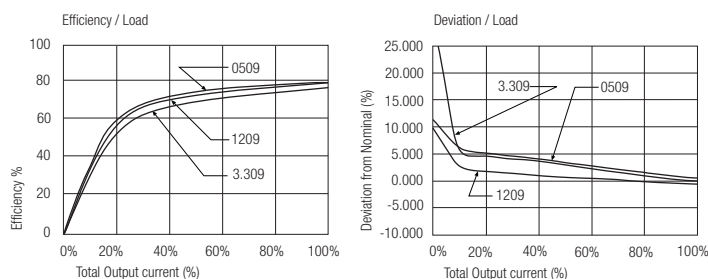
RB-xx05D



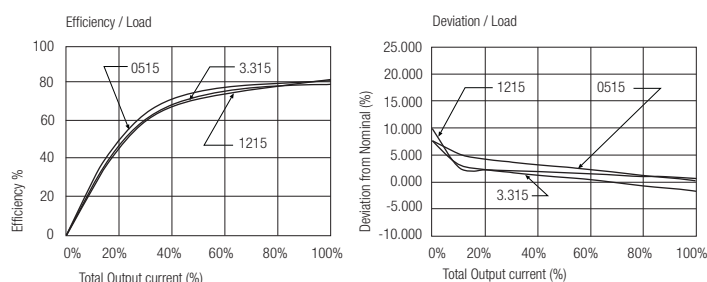
RB-xx12D



RB-xx09D



RB-xx15D



Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

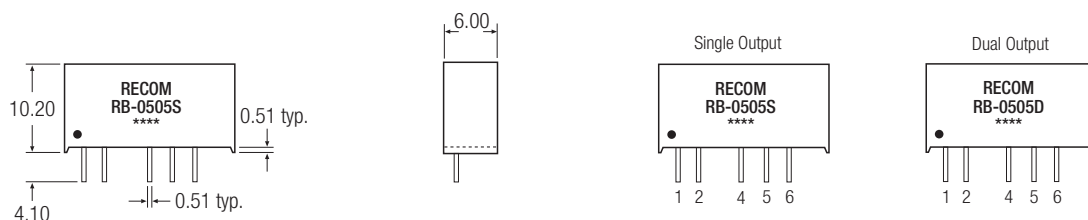
Certifications

CB Test Report	Report: SPCLVD1109103	IEC 60950-1:2005 2nd Ed.
UL General Safety	Report: E358085	UL 60950-1 2nd Ed.
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011
EN Medical Safety	Report: MDD1112018 + RM1112018	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

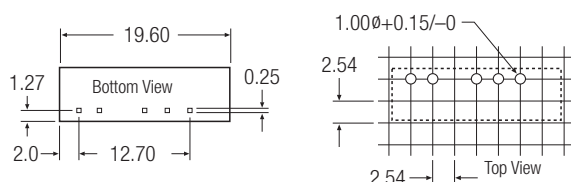
Package Style and Pinning (mm)

SIP7 Package

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4	NC	-Vout
5	-Vout	Com
6	+Vout	+Vout

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converters

- High Efficiency up to 84% Full Load
- Low Deviation (10% ~ 100% Load)
- 1kVDC and 2kVDC Isolation Option
- Safety Certified
- -40°C to +100°C Operating Temperature Range
- 1W SIP7 Package

Description

The RB/E series is an unregulated DC/DC converter in standard SIP7 package style. This series has been designed to offer exceptionally high efficiency at low loads, an extended operating temperature range and low deviation (10% ~ 100%). Uses include applications with restricted energy budget and industrial applications where a high efficiency level is required.

Selection Guide

Part Number SMD	Isolation Voltage (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)	Capacitive Load (max.)
RB-3.305S/E*	1	3.3	5	200	83%	2200µF
RB-0505S/E*	1	5	5	200	84%	2200µF
RB-1205S/E*	1	12	5	200	84%	2200µF
RB-2405S/E*	1	24	5	200	81%	2200µF

* add Suffix "/H" for 2kVDC Isolation Voltage - e.g. RB-3.305S/EH

* add Suffix "/P" for Continuous Short Protection - e.g. RB-3.305S/EHP, RB-3.305S/EP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$		
Output Voltage Accuracy	$\pm 5\%$ max.		
Line Voltage Regulation	low line to high line at full load		1.2% max.
Load Voltage Regulation	Load Deviation 10% to 100%		12% typ.
Output Ripple and Noise (20MHz BW)	50mVp-p typ., 100mVp-p max.		
Operating Frequency (V_{in} =nominal input)	20kHz min. / 90kHz max.		
Efficiency	see Selection Guide		
Minimum Load = 0%	Specifications valid for 10% minimum load only		
Isolation Voltage	RB-xx05S/E	tested for 1 second	1000 VDC
	RB-xx05/EH	tested for 1 second	2000 VDC
Isolation Capacitance	75pF max.		
Isolation Resistance	(Viso=500V)		10GΩ min.
Short-Circuit Protection	1 second		
Operating Temperature Range	-40°C to +100°C		
Storage Temperature	-55°C to +125°C		
Relative Humidity	95% RH		
Package Weight	2.2g		
MTBF (+25°C)	using MIL-HDBK 217F	3459 x 10 ³ hours	
MTBF (+100°C)	using MIL-HDBK 217F	756 x 10 ³ hours	

Note: Detailed information see Application Notes chapter "MTBF"

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

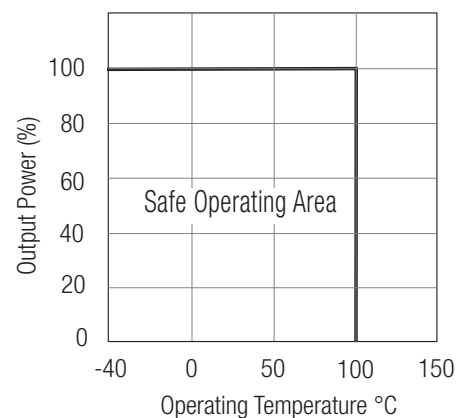
1 Watt SIP7 Single Output



EN-60950-1 Certified
UL-60950-1 Certified

RB/E

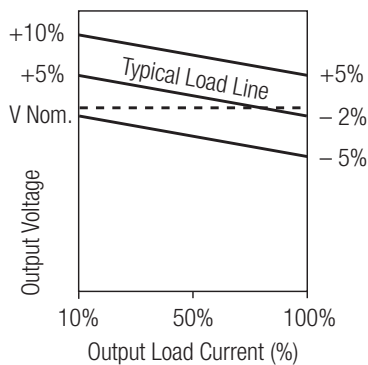
Derating-Graph (Ambient Temperature)



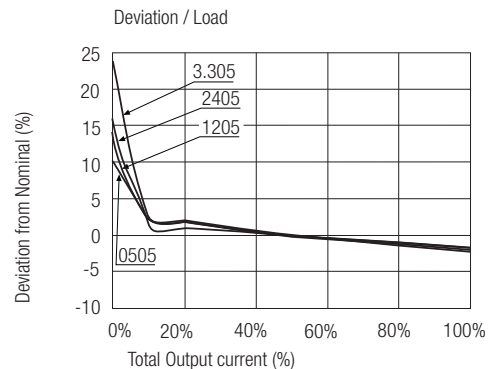
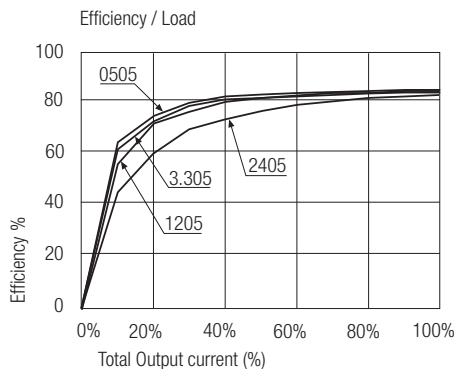
Refer to Application Notes

Typical Characteristics

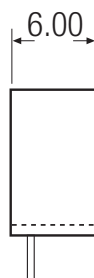
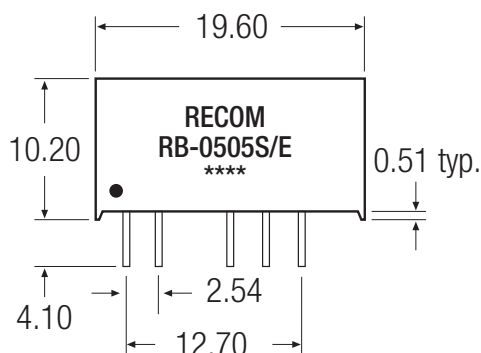
Tolerance Envelope



RB-xx05S/E



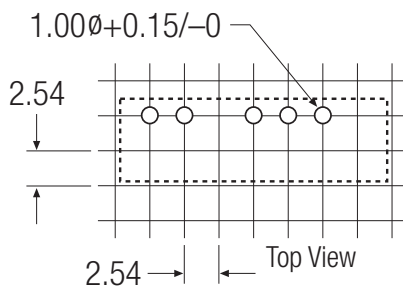
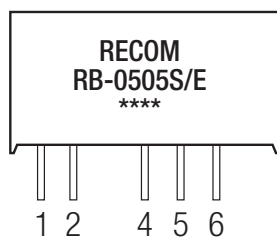
Package Style and Pinning



Pin Connections	Function
Pin #	5 Pins
1	+Vin
2	-Vin
4	NC
5	-Vout
6	+Vout

NC = No Internal Connection

Unit: mm
Tolerance: ± 0.25 mm



Features

Unregulated Converters

- 1:1 Input Range
- Low Cost 1W Converter
- Efficiency to 76%
- -40°C to +85°C Operating Temperature Range

ECONOLINE

DC/DC-Converter

RECOM

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)
RBE-0505S	5	5	200	76%

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10% max.		
Output Voltage Accuracy	-2% typ., ±5% max.		
Line Voltage Regulation	(low line to high line at max. load)	1.2% typ.	
	20% to 100% load (5V output)	10% max.	
Output Ripple and Noise (20MHz BW limited)	52mVp-p typ. / 100mVp-p max.		
Operating Frequency (Vin=nominal input)	50kHz min. / 82kHz typ. / 105kHz max.		
Efficiency	76% typ. / 70% min.		
Isolation Test Voltage	1000 VDC min.(tested for 1 second)		
Isolation Capacitance	75pF max.		
Isolation Resistance	(Viso=500V)	1GΩ min.	
Short-Circuit Protection	1 sec.		
Operating Temperature Range	-40°C to +85°C		
Storage Temperature	-55°C to +125°C		
Relative Humidity	95% RH		
Package Weight	2.2g		
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	2400 x 10 ³ hours
MTBF (+85°C)		using MIL-HDBK 217F	650 x 10 ³ hours

1 Watt SIP7 Single Output

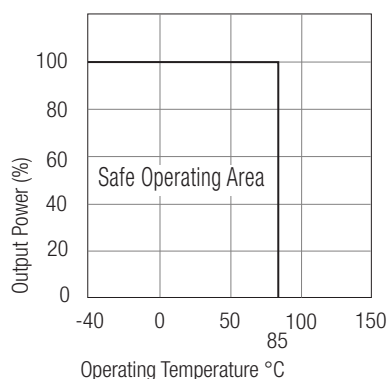


RBE

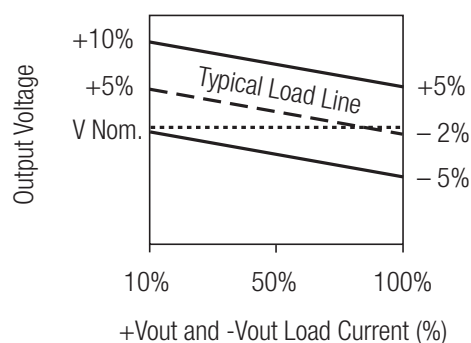
Typical Characteristics

Derating-Graph

(Ambient Temperature)

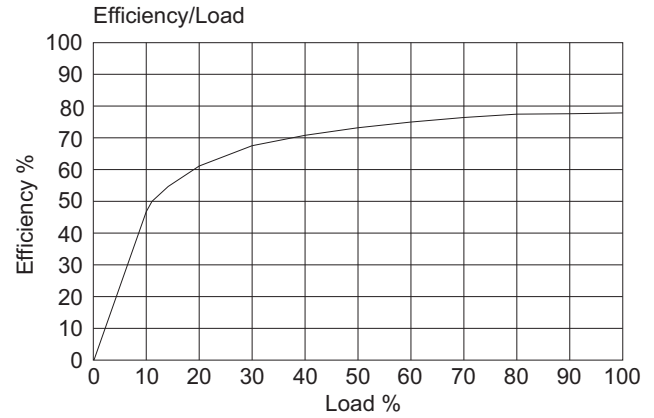
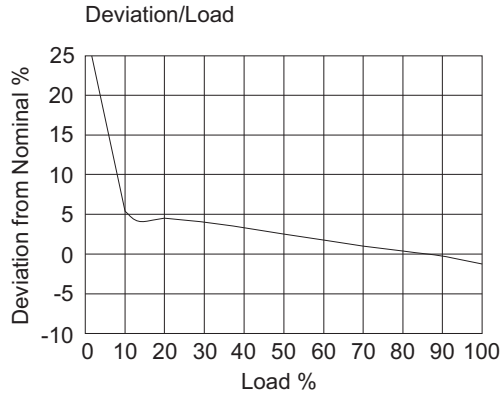


Tolerance Envelope



Typical Characteristics

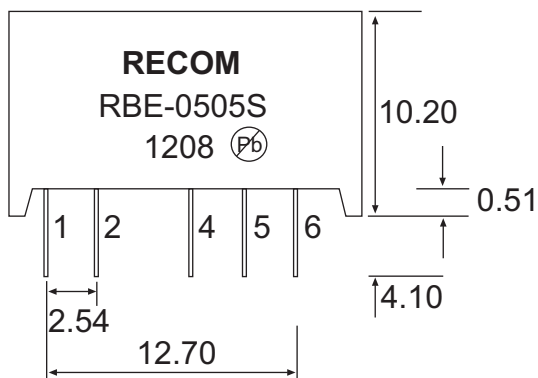
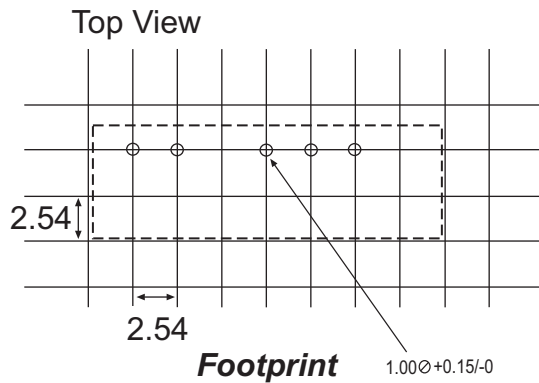
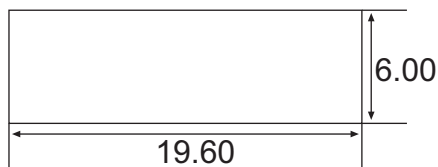
RBE-0505S



Package Style and Pinning

Single SIP 7PIN Package

3rd angle projection



Pin Connections

Pin #	Function
1	+Vin
2	-Vin
4	NC
5	-Vout
6	+Vout

NC = No Connection

Unit: mm

Tolerance: ± 0.25 mm

Features

Unregulated Converter

- Industry Standard Pinout
- 1kVDC or 2kVDC Isolation
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- Custom Solutions Available
- Efficiency to 85 %

Description

The RE DC/DC converters are typically used in general purpose power isolation and voltage matching applications, and feature a full industrial operating temperature range of -40°C ~ +85°C without derating.

Selection Guide

Part Number SIP 7	(2kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RE-xx3.3S	(H)	3.3, 5, 12, 15, 24	3.3	303	75	2200µF
RE-xx05S	(H)	3.3, 5, 12, 15, 24	5	200	78-80	1000µF
RE-xx09S	(H)	3.3, 5, 12, 15, 24	9	111	78-80	1000µF
RE-xx12S	(H)	3.3, 5, 12, 15, 24	12	83	80-84	470µF
RE-xx15S	(H)	3.3, 5, 12, 15, 24	15	66	80-84	470µF
RE-xx24S	(H)	3.3, 5, 12, 15, 24	24	42	78-85	220µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RE-0505S/P, RE-0505S/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range		±10%
Output Voltage Accuracy		±5%
Line Voltage Regulation		1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output type	20% max.
	5V output type	15% max.
	9V, 12V, 15V, 24V output types	10% max.
Output Ripple and Noise (20MHz limited)		100mVp-p max.
Operating Frequency		50kHz min. / 100kHz typ. / 105kHz max.
Efficiency at Full Load		70% min. / 80% typ.
Minimum Load = 0%		Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second)	1000VDC
	(rated for 1 minute)	500VAC / 60Hz
Isolation Voltage	H-Suffix (tested for 1 second)	2000VDC
	H-Suffix (rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance		20pF min. / 75pF max.
Isolation Resistance		10 GΩ min.
Short Circuit Protection		1 Second
P-Suffix		Continuous
Operating Temperature Range (free air convection)		-40°C to +85°C (see Graph)
Storage Temperature Range		-55°C to +125°C
Relative Humidity		95% RH
Package Weight		2.2g
Packing Quantity		25 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 992 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F 145 x 10 ³ hours

ECONOLINE

DC/DC-Converter

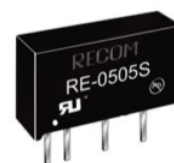
with 3 year Warranty

RECOM

1 Watt

SIP7

Single Output



E-358085

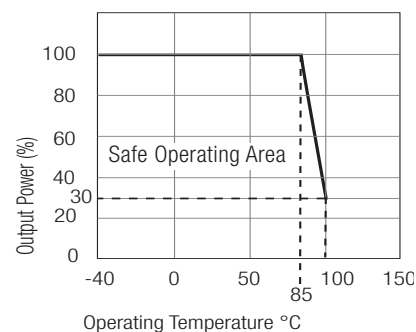
EN-60950-1 Certified

UL-60950-1 Certified

RE

Derating-Graph

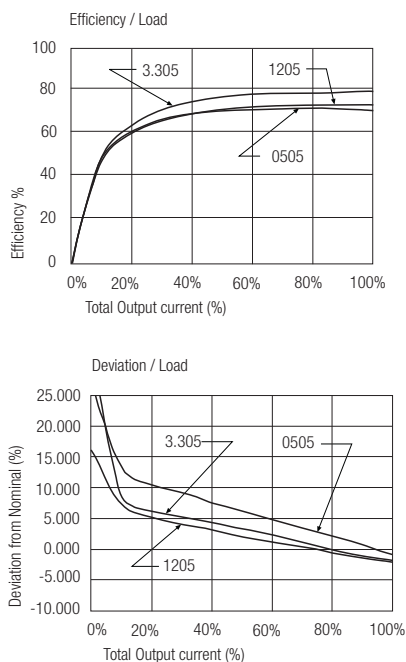
(Ambient Temperature)



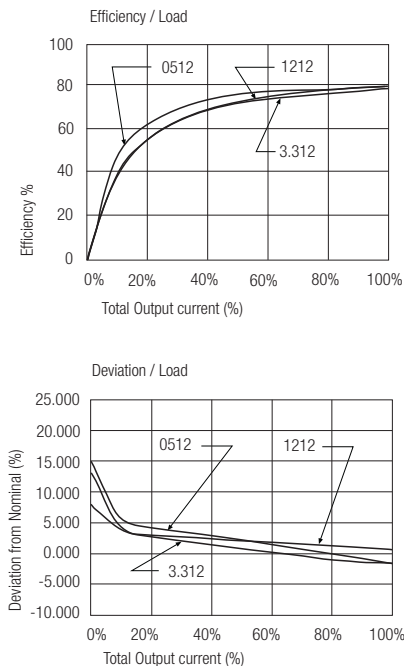
Refer to Application Notes

Typical Characteristics

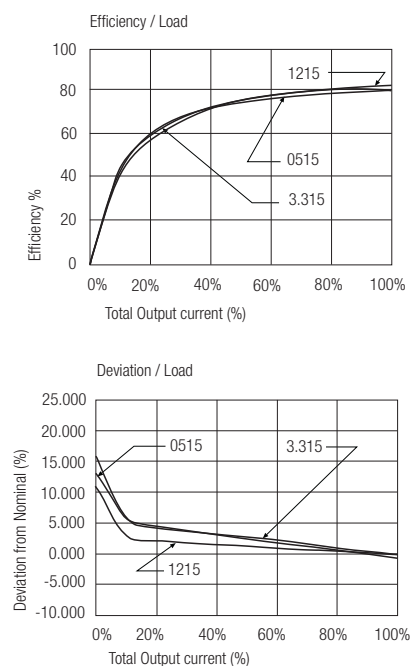
RE-xx05S



RE-xx12S



RE-xx15S



Notes

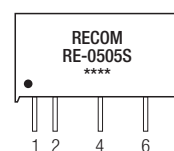
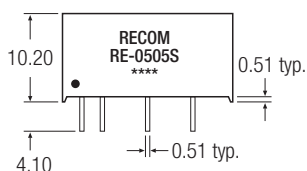
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

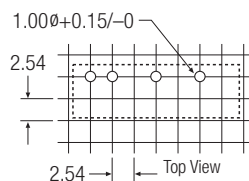
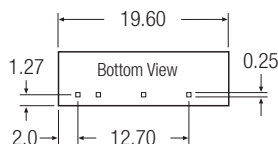
CB Test Report	Report: US/15348/UL	IEC 60950-1:2005 2nd Edition
UL General Safety	Report: E358085	UL 60950-1 2nd Edition
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011

Package Style and Pinning (mm)

7 PIN SIP Package



Recommended Footprint Details



RE Pin Connections

Pin #	Single
1	+Vin
2	-Vin
4	-Vout
6	+Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converters

- 1:1 Input Range
- Low Cost 1W Converter
- Efficiency to 76%
- -40°C to +85°C Operating Temperature Range

ECONOLINE

DC/DC-Converter

RECOM

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)
REE-0505S	5	5	200	76%

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

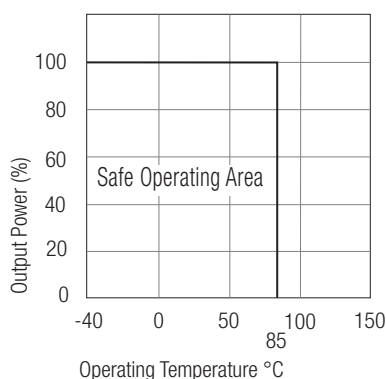
Input Voltage Range	$\pm 10\%$ max.	
Output Voltage Accuracy	-2% typ., $\pm 5\%$ max.	
Line Voltage Regulation	(low line to high line at max. load)	1.2% typ.
	20% to 100% load (5V output)	10% max.
Output Ripple and Noise (20MHz BW limited)	55mVp-p typ. / 100mVp-p max.	
Operating Frequency (V_{in} =nominal input)	50kHz min. / 82kHz typ. / 105kHz max.	
Efficiency	76% typ. / 70% min.	
Isolation Test Voltage	1000 VDC min.	(tested for 1 second)
Isolation Capacitance	75pF max.	
Isolation Resistance	(V_{iso} =500V)	1G Ω min.
Short-Circuit Protection	1 sec.	
Operating Temperature Range	-40°C to +85°C	
Storage Temperature	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	2.2g	
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F
MTBF (+85°C)		using MIL-HDBK 217F
		2400 x 10 ³ hours
		650 x 10 ³ hours



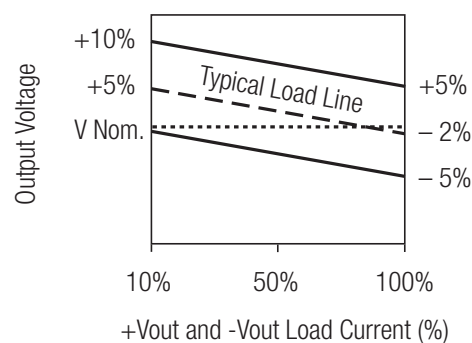
REE

Typical Characteristics

Derating-Graph (Ambient Temperature)

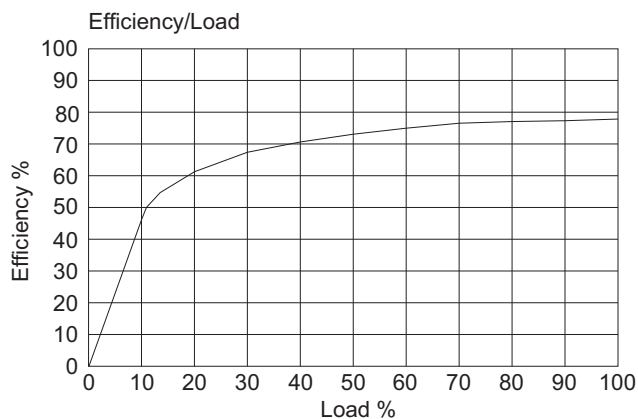
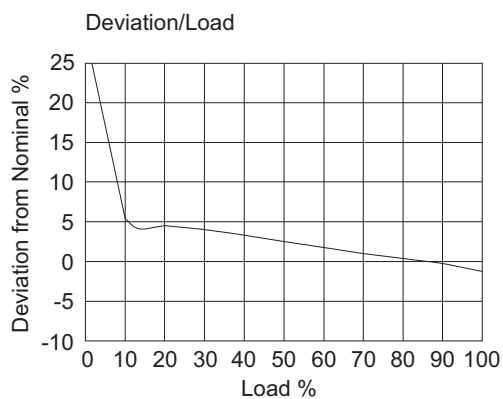


Tolerance Envelope



Typical Characteristics

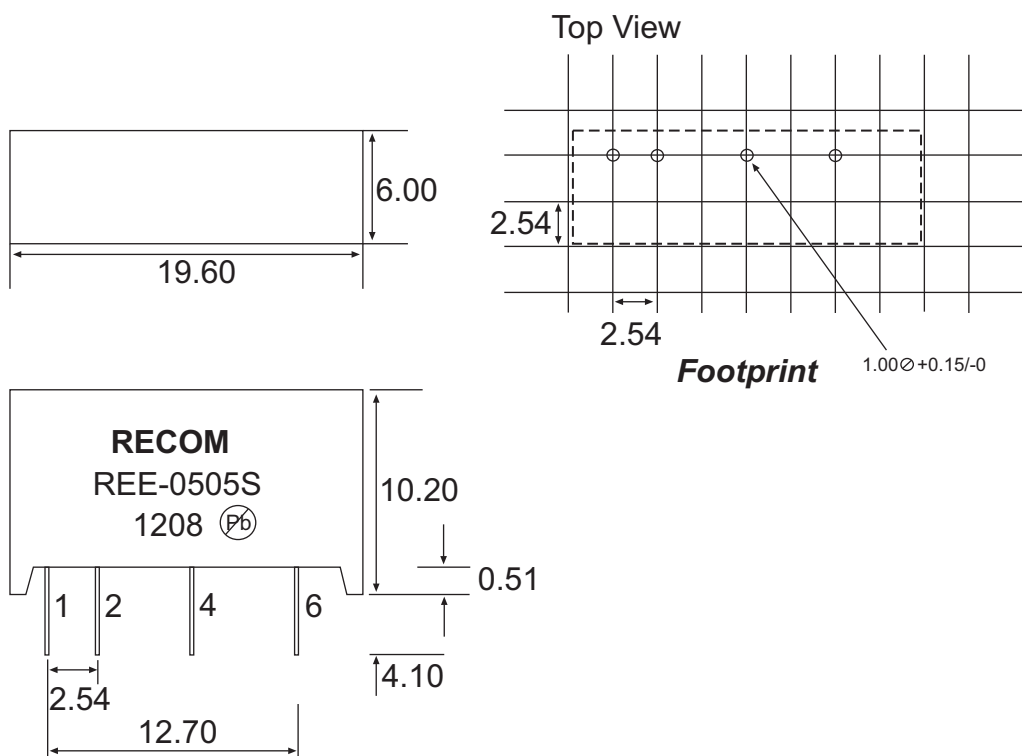
REE-0505S



Package Style and Pinning

Single SIP 7PIN Package

3rd angle projection



Pin Connections

Pin #	Function
1	+Vin
2	-Vin
4	-Vout
6	+Vout

Unit: mm
Tolerance: ± 0.25 mm

Features

Unregulated Converter

- 3kVDC or 4kVDC Isolation
- Optional Continuous Short Circuit Protected
- Custom Solutions Available
- UL94V-0 Package Material
- Efficiency to 84 %
- Suitable for IGBT Applications

Description

The RK and RH Series DC/DC-Converter complements Recom's industrial range of converters with very high isolations of 3kV and 4kVDC. The extended operating temperature range covering -40°C to +90°C is a standard feature. The converters are EN-60601-1 certified, making them suitable for medical as well as IGBT driver applications.

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
SIP 7	(4kV)					
RK-xx05S*	(H)	5, 12, 15, 24	5	200	70-78	1000µF
RK-xx09S*	(H)	5, 12, 15, 24	9	111	70-80	1000µF
RK-xx12S*	(H)	5, 12, 15, 24	12	84	78-82	470µF
RK-xx15S*	(H)	5, 12, 15, 24	15	66	80-82	470µF
RH-xx05D*	(H)	5, 12, 15, 24	±5	±100	74-78	±470µF
RH-xx09D*	(H)	5, 12, 15, 24	±9	±56	76-79	±470µF
RH-xx12D*	(H)	5, 12, 15, 24	±12	±42	78-84	±220µF
RH-xx15D*	(H)	5, 12, 15, 24	±15	±33	80-84	±220µF
RH-xx1509D*	(H)	5, 12, 24	+15/-9	+33/-56	70-81	+220/-470µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RK-0505S/P, RK-0505S/HP

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range		±10%
Output Voltage Accuracy		±5%
Line Voltage Regulation		1.2%/1% of Vin typ.
Load Voltage Regulation	5V output type	15% max.
(10% to 100% full load)	9V, 12V, 15V, 24V output types	10% max.
	RH-xx1509D	10% max.
Output Ripple and Noise (20MHz limited)	Single output types	100mVp-p max.
	Dual output types	±75mVp-p max.
Operating Frequency	RK types	50kHz min. / 100kHz typ. / 105kHz max.
	RH types	57kHz min. / 100kHz typ. / 105kHz max.
	RK-xx1509D	50kHz min. / 88kHz typ.
Efficiency at Full Load		70% min. / 80% typ.
Minimum Load = 0%		Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second)	3000VDC
	(rated for 1 minute)	1500VAC / 60Hz
Isolation Voltage	H-Suffix (tested for 1 second)	4000VDC
	H-Suffix (rated for 1 minute)	2000VAC / 60Hz
Isolation Capacitance	RK types	20pF min. / 75pF max.
	RH types	20pF min. / 65pF max.
Isolation Resistance		15 GΩ min.
Short Circuit Protection		1 Second
P-Suffix		Continuous
Operating Temperature Range (free air convection, without derating)		-40°C to +90°C (see Graph)
Storage Temperature Range		-55°C to +125°C
Relative Humidity		95% RH
Package Weight		2.6g
H-Suffix		2.8g
Packing Quantity		25 pcs per Tube
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	RK types
		992 x 10 ³ hours
		RH types
		1012 x 10 ³ hours
(+85°C)		RK types
		145 x 10 ³ hours
using MIL-HDBK 217F		RH types
		151 x 10 ³ hours

ECONOLINE

DC/DC-Converter

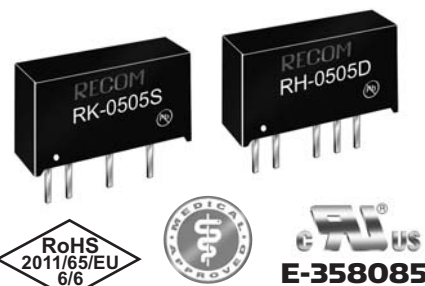
with 3 year Warranty

RECOM

1 Watt

SIP7

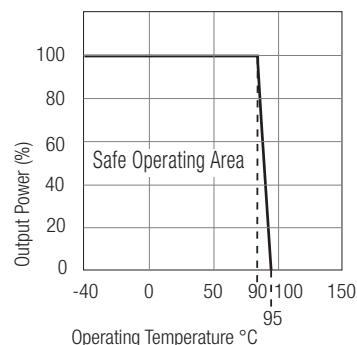
Single & Dual Output



EN-60950-1 Certified
IEC/EN-60601-1 Certified*
UL-60950-1 Certified*
*** ±15/-9 Version excluded**

RK_RH

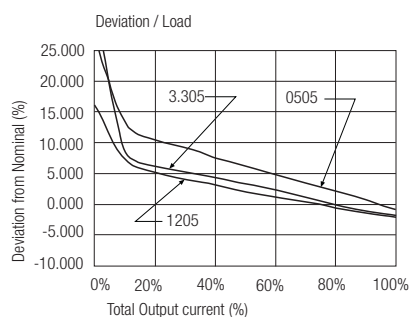
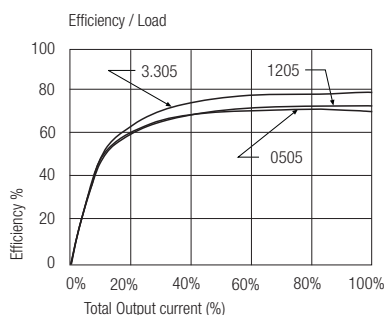
Derating-Graph (Ambient Temperature)



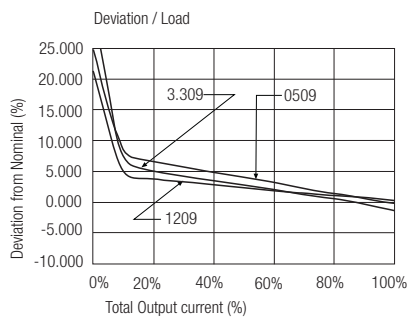
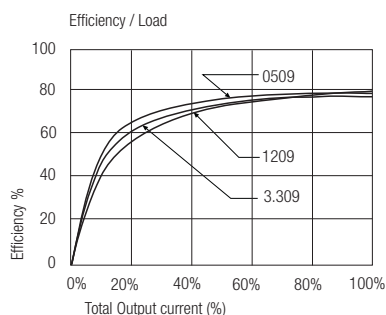
Refer to Application Notes

Typical Characteristics

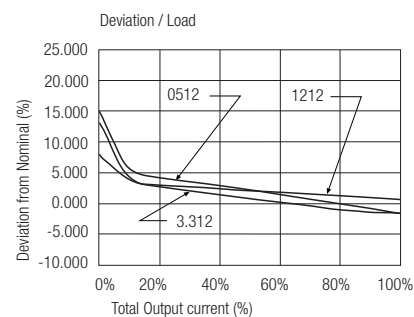
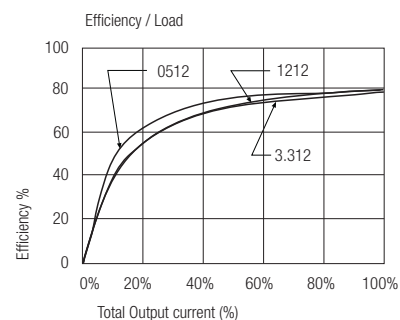
RK-xx05S



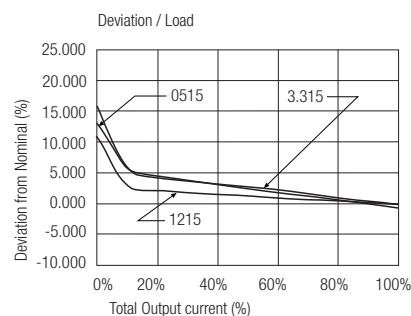
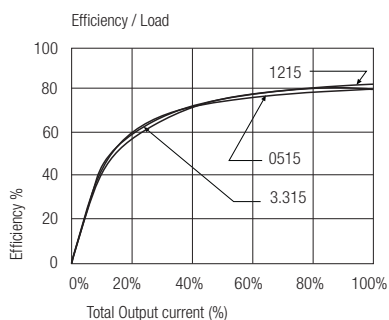
RK-xx09S



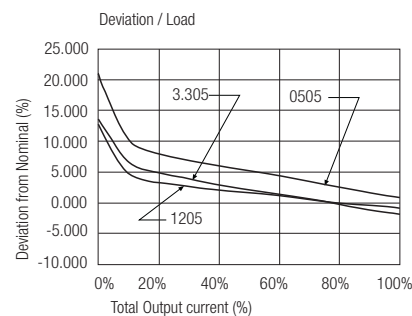
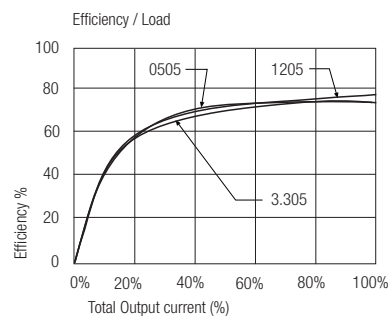
RK-xx12S



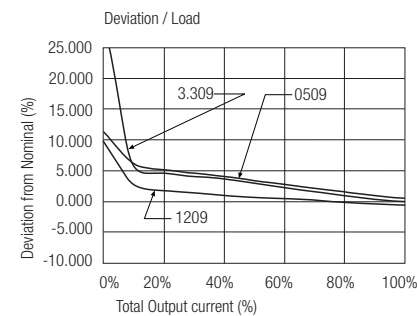
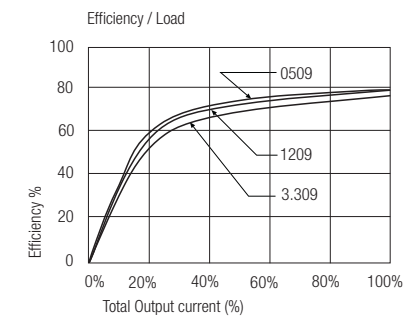
RK-xx15S



RH-xx05D

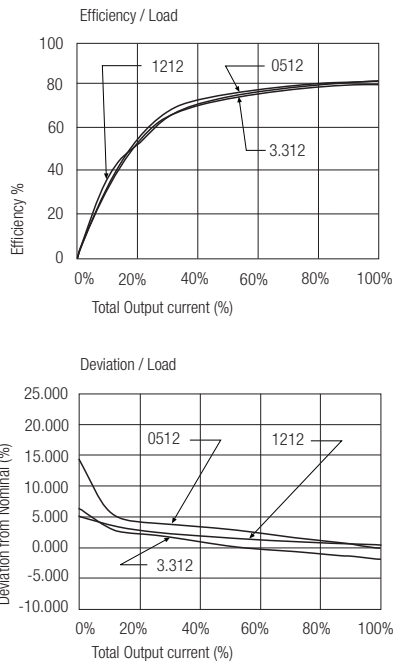


RH-xx09D

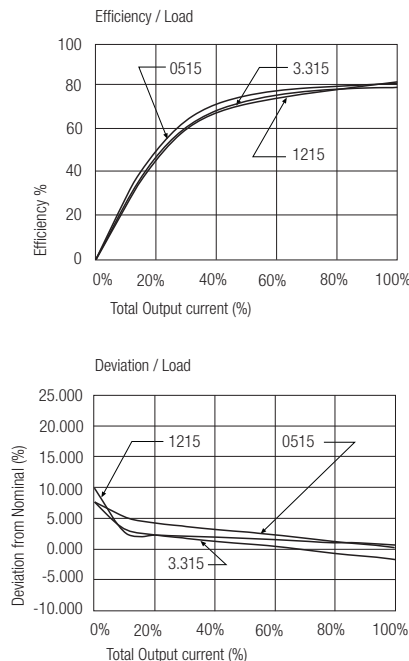


Typical Characteristics

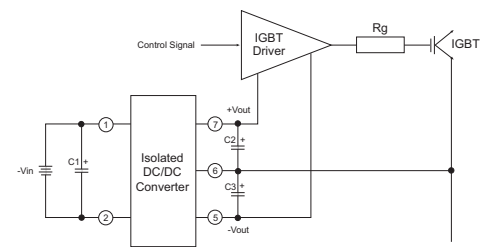
RH-xx12D



RH-xx15D



IGBT Application Circuit



Notes

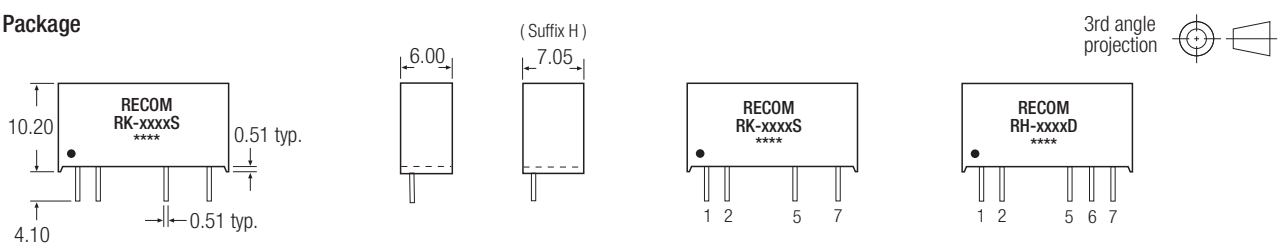
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

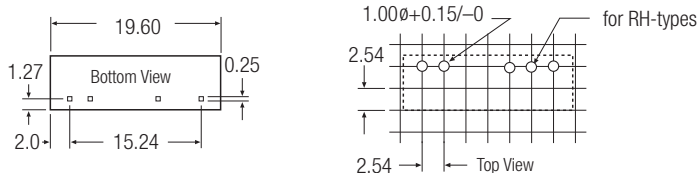
EN General Safety	Report: SPCLVD1109103	EN60950-1: 2006 + A12:2011
EN Medical Safety	Report: SPCMDD1205098-4	IEC/EN 60601-1: 2006, 3rd Edition
UL General Safety	Report: E358085	UL60950-1, 2nd Edition

Package Style and Pinning (mm)

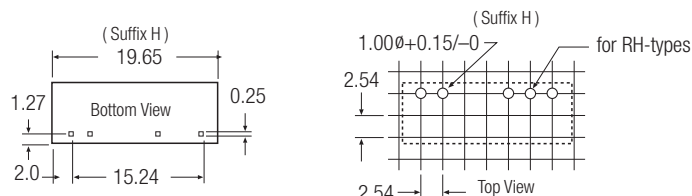
7 PIN SIP Package



Recommended Footprint Details



Recommended Footprint Details



Pin Connections
RK-xxxxS

Pin #	Single
1	+Vin
2	-Vin
5	-Vout
7	+Vout

Pin Connections
RH-xxxxD

Pin #	Dual
1	+Vin
2	-Vin
5	-Vout
6	Com
7	+Vout

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converter

- Low Cost 1W Converter
- 3.75kVDC / 1 sec High Isolation
- Low Output Ripple
- Wide Operating Temperature Range of -40°C to +85°C
- Industry Standard Pinout

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)
RKE-0505S/H	5	5	200	70

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$	
Output Voltage Accuracy	-2% typ. / $\pm 5\%$ max.	
Efficiency (@ Full Load)	65% min. / 70% typ.	
Operating Frequency	50kHz min / 65kHz typ. / 105kHz	
Output Ripple & Noise	55mVp-p typ. / 100mVp-p max.	
Line Voltage Regulation	Low Line to High Line @ max. Load	1.2% typ. of 1% Vin
Load Voltage Regulation	(10% to 100% Load)	12% typ. / 15% max.
Isolation Voltage	3.75kVDC / 1 sec.	
Isolation Capacitance	75pF max.	
Isolation Resistance	Viso=500V	1G Ω min.
Short Circuit Protection	1 sec.	
Operating Temperature Range	-40°C to +85°C	
Storage Temperature Range	-55°C to 125°C	
Humidity	95% max.	
Size	19.60mm x 10.20mm x 7.05mm	
Weight	2.7g	
MTBF (25°C)	using MIL-HDBK 217F	850 x 10 ³ hours
(85°C)	using MIL-HDBK 217F	123 x 10 ³ hours

ECONOLINE
DC/DC-Converter

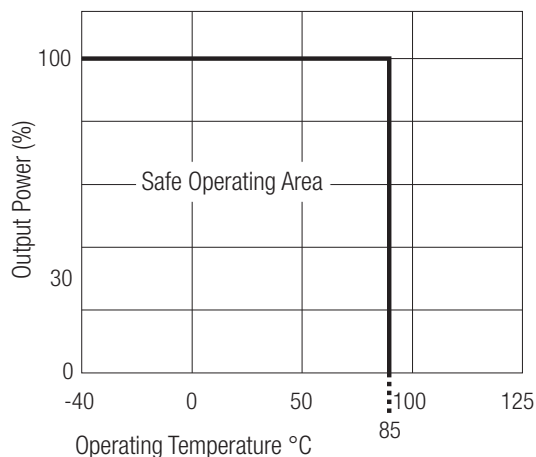
RECOM

1 Watt
SIP7 Single
Output

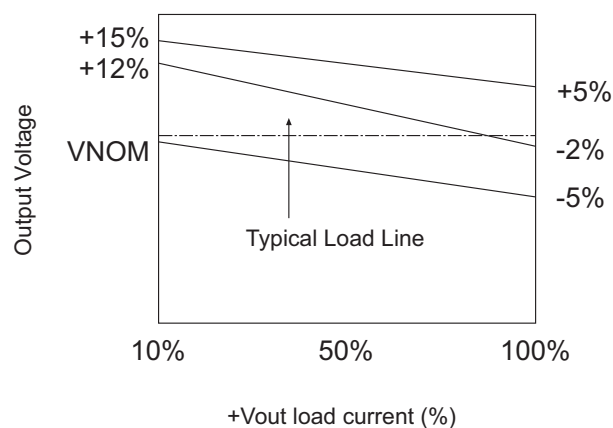


RKE-0505S/H

Derating Graph (Ambient Temperature)



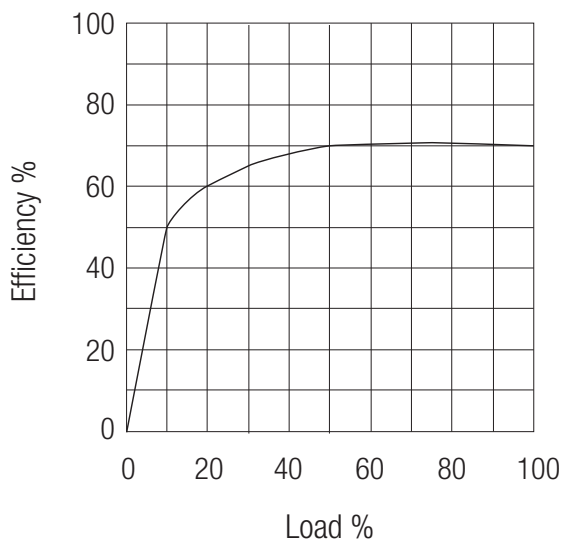
Tolerance Envelopes



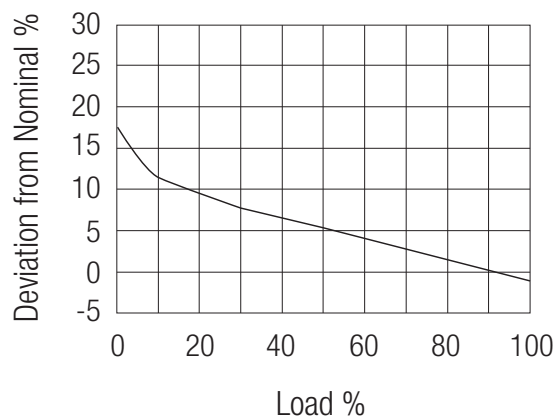
Refer to Application Notes

Typical Characteristics

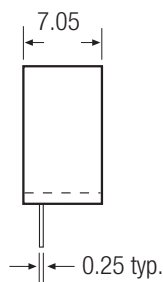
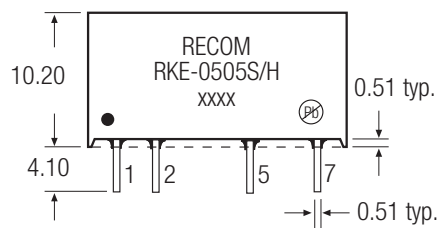
Efficiency vs Load



Deviation vs Load



Package Style and Pinning (mm)



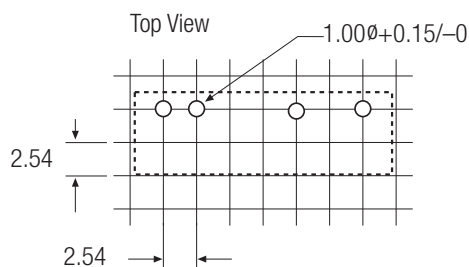
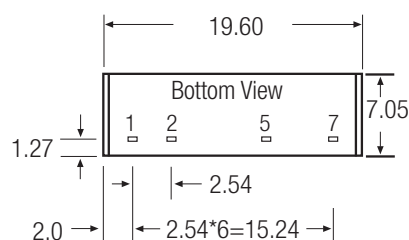
3rd angle projection

Pin Connections RKE-0505S/H

Pin #	Single
1	-Vin
2	+Vin
5	-Vout
7	+Vout

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Recommended Footprint Details



Features

Unregulated Converters

- 1:1 Input Range
- Efficiency up to 80%
- 3kVDC and 4kVDC Isolation Option
- Approved for Medical Applications
- -40°C to +100°C Operating Temperature Range
- Continuous Short Circuit Protection

Selection Guide

Part Number SMD	Isolation Voltage (kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)	Capacitive Load (max.)
RAM-0505S*	3	5	5	200	78%	1000µF
RAM-1205S*	3	12	5	200	80%	1000µF
RAM-2405S*	3	24	5	200	80%	1000µF

* add Suffix "/H" for Isolation 4kVDC/1min. e.g. RAM-0505S/H

* add Suffix "-R" for tape&reel packing e.g. RAM-1205S-R or RAM-2405S/H-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage and rated output current unless otherwise specified)

Input Voltage Range			±10%	
Output Voltage Accuracy			-1% typ., ±5% max.	
Line Voltage Regulation		(low line to high line at max. load)	1.2% typ., 1.5% max.	
Load Voltage Regulation		(10% to 100% full load)	10% typ., 15% max.	
Output Ripple and Noise (20MHz BW limited)			50mVp-p typ., 100mVp-p max.	
Operating Frequency (Vin=nominal input)			20kHz min. / 50kHz typ. / 90kHz max.	
Efficiency			see Selection Guide	
Minimum Load = 0%		Specifications valid for 10% minimum load only		
Isolation Voltage		(tested for 1 minute)	3000 VDC	
		(tested for 1 second)	3750 VDC	
Isolation Voltage	H-Suffix	(tested for 1 minute)	4000 VDC	
	H-Suffix	(tested for 1 second)	5000 VDC	
Isolation Capacitance			4pF typ., 10pF max.	
Isolation Resistance		(Viso=500V)	15GΩ min.	
Short-Circuit Protection			continuous	
Operating Temperature Range			-40°C to +100°C	
Storage Temperature			-55°C to +125°C	
Reflow Temperature	RoHS compliant	245°C (30 sec.), Peak 255°C (5sec.) max.		
Vapour Phase Process	(for more details see Application Notes)		230°C (90 sec.) max.	
Relative Humidity			95% RH	
Package Weight			1.3g	
Packing Quantity		All Types	27 pcs per Tube	
		All Types	500 pcs per Reel	
MTBF (+25°C)		Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	4780 x 10³ hours
MTBF (+85°C)			using MIL-HDBK 217F	1310 x 10³ hours
Certifications				
EN Medical Safety	Report: MDD1112018 + RM1112018		IEC/EN 60601-1 3rd Edition	
	Medical Report + ISO14971 Risk Assessment			
EN General Safety			EN60950-1, 2nd Edition	

Notes

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

ECONOLINE

DC/DC-Converter

RECOM

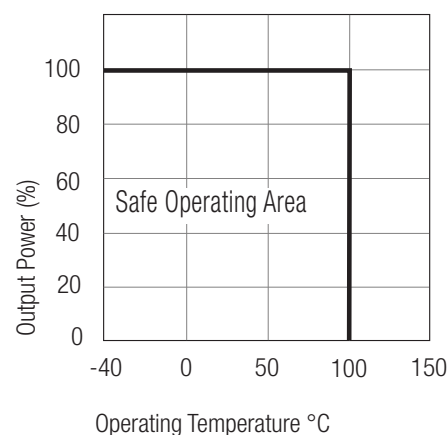
1 Watt SMD Single Output



EN-60601-1 Certified
EN-60950-1 Certified

RAM

Derating-Graph (Ambient Temperature)

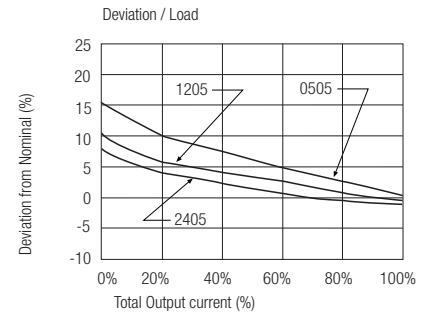
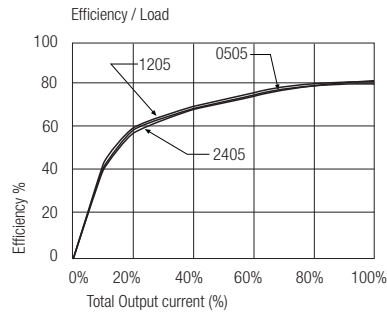
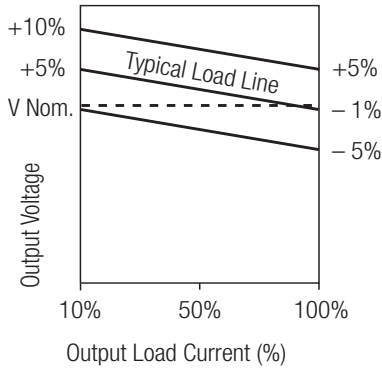


Refer to Application Notes

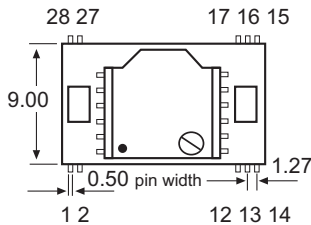
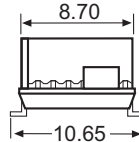
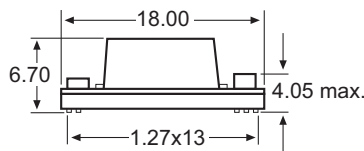
Typical Characteristics

Tolerance Envelope

RAM-xx05S



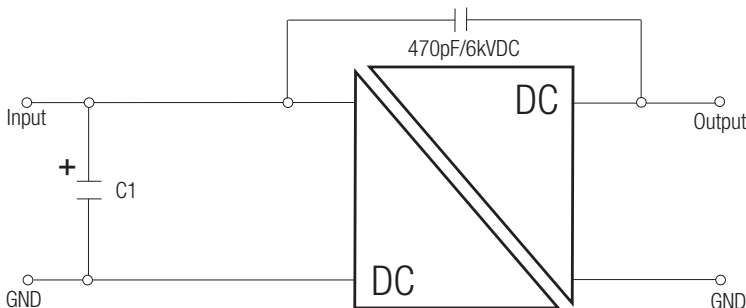
Package Style and Pinning



Pin Connections	
Pin #	Function
1	+Vin
2	-Vin
12	-Vout
13	+Vout
14~17	NC
27,28	NC
NC = No Connection	

Unit: mm
Tolerance: ± 0.25 mm

EMC Filtering - Suggestion for EN55022 Class B



Input Voltage	Inductance/ Capacitance (C1)
5V	10 μ F
12V	4.7 μ F
24V	22 μ F

Features

Regulated Converters

- 1:1 Input Range
- Efficiency up to 69%
- 1kVDC and 2kVDC Isolation Option
- 1W SMD Package
- -40°C to +85°C Operating Temperature Range
- Continuous Short Circuit Protection

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.)	Capacitive Load (max.)
RAZ-0505S*	5	5	200	67%	2200µF
RAZ-1205S*	12	5	200	68%	2200µF
RAZ-2405S*	24	5	200	69%	2200µF

* add Suffix "/H" for 2kVDC/1 min. Isolation - e.g. RAZ-0505S/H

* add Suffix "-R" for tape & reel packing - e.g. RAZ-1205S-R, RAZ-2405S/H-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage and rated output current unless otherwise specified)

Input Voltage Range	$\pm 10\%$ max.	
Output Voltage Accuracy	-1% typ., $\pm 5\%$ max.	
Line Voltage Regulation	(low line to high line at max. load)	1% max.
Load Voltage Regulation	(10% to 100% full load)	1% max.
Output Ripple and Noise (20MHz BW)	50mVp-p typ., 75mVp-p max.	
Operating Frequency (V_{in} =nominal input)	20kHz min. / 35kHz typ. / 60kHz max.	
Efficiency at Full Load	see Selection Guide	
Minimum Load = 0%	Specifications valid for 10% minimum load only	
Isolation Voltage	(tested for 1 minute)	1000 VDC
	(tested for 1 second)	1250 VDC
Isolation Voltage	H-Suffix (tested for 1 minute)	2000 VDC
	H-Suffix (tested for 1 second)	2500 VDC
Isolation Capacitance	6pF typ., 10pF max.	
Isolation Resistance	(Viso=500V)	10GΩ min.
Short-Circuit Protection	continuous	
Operating Temperature Range	-40°C to +85°C	
Storage Temperature	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	1.6g	
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 3914 x 10 ³ hours
MTBF (+85°C)		using MIL-HDBK 217F 855 x 10 ³ hours
Certifications		
EN General Safety	EN60950-1, 2nd Edition	
EN Medical Safety	Report: MDD1112018 + RM1112018	IEC/EN 60601-1 3rd Edition
	Medical Report + ISO14971 Risk Assessment	

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

ECONOLINE

DC/DC-Converter

RECOM

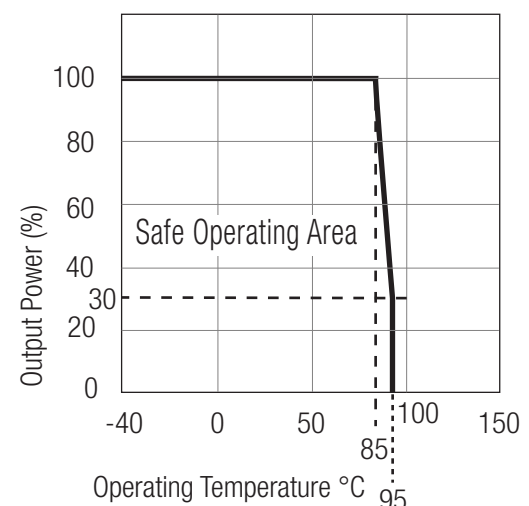
1 Watt SMD Single Output



EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

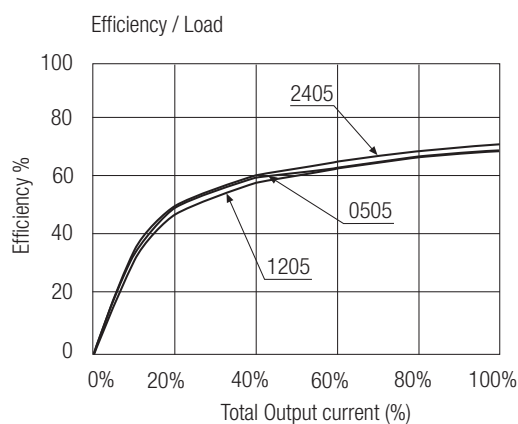
RAZ

Derating-Graph (Ambient Temperature)

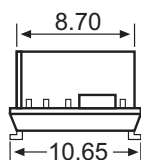
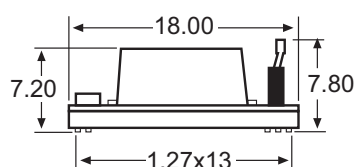


Refer to Application Notes

Typical Characteristics



Package Style and Pinning

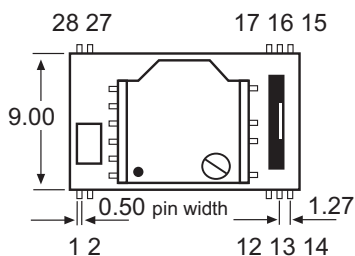


Pin Connections

Pin #	Function
1,2	+Vin
12,15~17,28	NC
13	-Vout
14	+Vout
27	-Vin

NC = No Connection

Unit: mm
Tolerance: ± 0.25 mm



Features

Unregulated Converters

- Pot-Core Transformer - separated windings
- High 5.2kVDC Isolation in compact size
- Optional Continuous Short Circuit Protected
- Pin Compatible with RH and RK Series
- Approved for Medical and IGBT Applications
- UL and EN Certified
- Efficiency to 82 %

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RP-xx3.3S*	5, 9, 12, 15, 24	3.3	303	70	2200µF
RP-xx05S*	5, 9, 12, 15, 24	5	200	70-72	1000µF
RP-xx09S*	5, 9, 12, 15, 24	9	111	75	1000µF
RP-xx12S*	5, 9, 12, 15, 24	12	84	75-78	470µF
RP-xx15S*	5, 9, 12, 15, 24	15	66	80	470µF
RP-xx24S*	5, 9, 12, 15, 24	24	42	80	220µF
RP-xx3.3D*	5, 9, 12, 15, 24	±3.3	±152	70	±1000µF
RP-xx05D*	5, 9, 12, 15, 24	±5	±100	74-76	±470µF
RP-xx09D*	5, 9, 12, 15, 24	±9	±56	75	±470µF
RP-xx12D*	5, 9, 12, 15, 24	±12	±42	79-82	±220µF
RP-xx15D*	5, 9, 12, 15, 24	±15	±33	80-82	±220µF
RP-xx24D*	5, 9, 12, 15, 24	±24	±21	80	±100µF
RP-xx1509D	5, 12, 24	+15/-9	±42	70-85	±220µF

xx = Input Voltage. Other input and output voltage combinations available on request

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RP-0505S/P, RP-0505D/P

* add Suffix "/X2" for single output with alternative pinning e.g. RP-0505S/X2, RP-0505D/P/X2

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±5%	
Line Voltage Regulation	1.2%/1% of Vin typ.	
Load Voltage Regulation	3.3V output types	20% max.
(10% to 100% full load)	5V output type	15% max.
	9V, 12V, 15V, 24V output types, RP-xx1509D	10% max.
Output Ripple and Noise (20MHz limited)	100mVp-p max.	
Operating Frequency	50kHz min. / 100kHz typ. / 120kHz max.	
	RP-xx1509D	50kHz min / 94kHz typ.
Efficiency at Full Load	70% min. / 80% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Isolation Voltage	(tested for 1 second)	5200VDC
	(rated for 1 minute)	2600VAC / 60Hz
Isolation Capacitance	4pF min. / 10pF max.	
Isolation Resistance	20 GΩ min.	
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	2.4g	
Packing Quantity	25 pcs per Tube	
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 928 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F 150 x 10 ³ hours

ECONOLINE

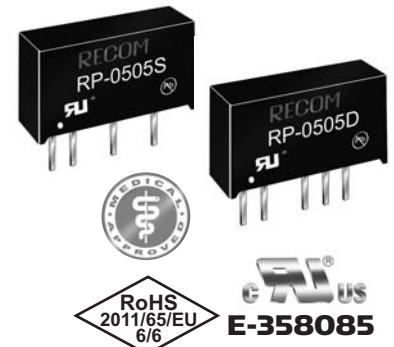
DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt

SIP 7 Single & Dual Output



EN-60950-1 Certified

IEC/EN-60601-1 Certified*

CSA/UL-60950-1 Certified*

*** +15/-9 Version excluded**

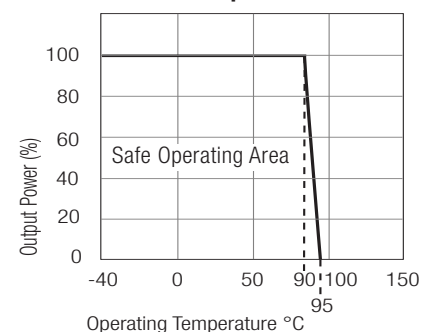
RP

Description

The RP series has very high isolation of 5.2 kVDC in a compact size. The converters are EN-60601-1 certified, making them suitable for medical as well as IGBT driver applications.

The /X2 version has rearranged pins to permit an input output separation of more than 9mm.

Derating-Graph (Ambient Temperature)

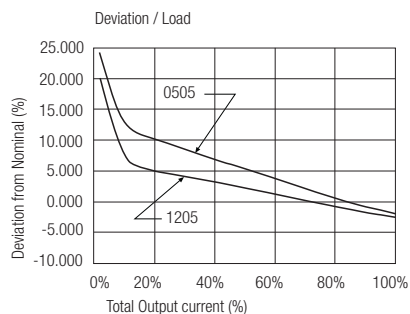
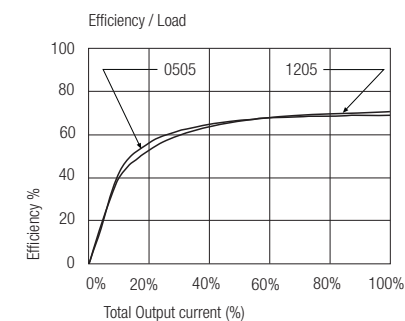


Refer to Application Notes

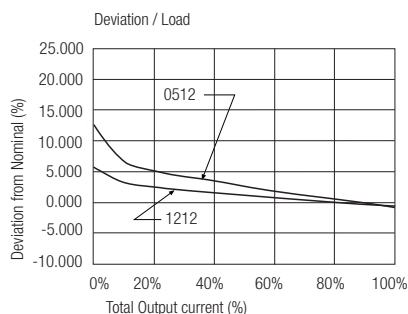
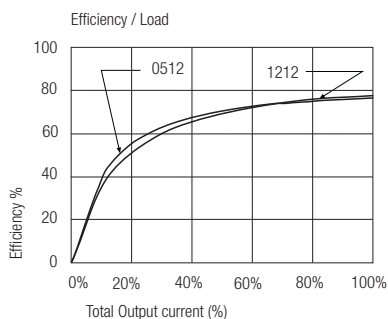
www.recom-electronic.com

Typical Characteristics

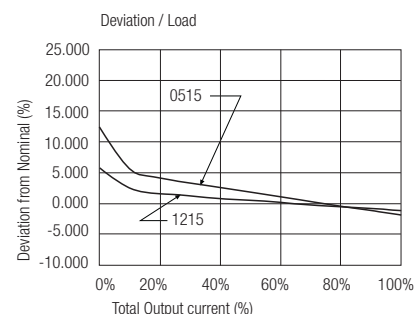
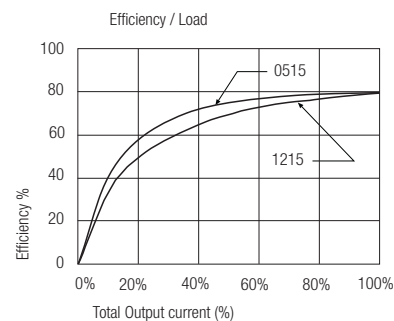
RP-xx05S



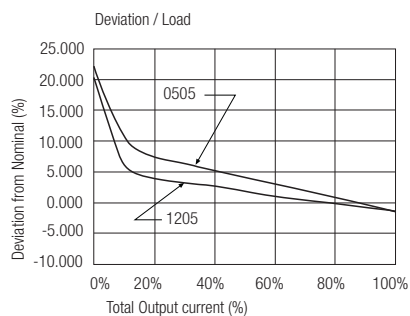
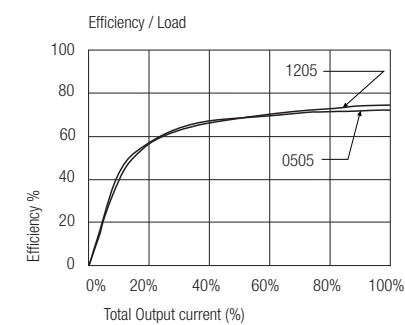
RP-xx12S



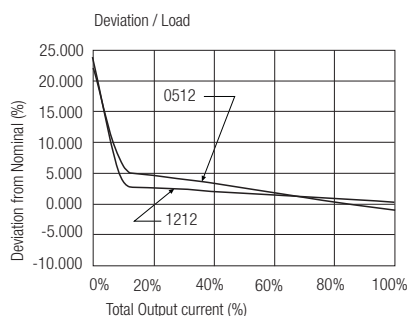
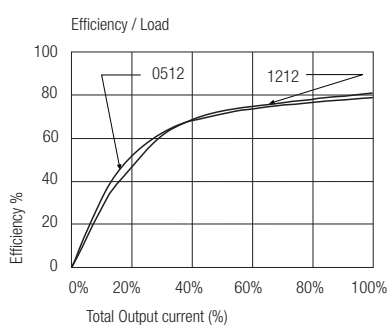
RP-xx15S



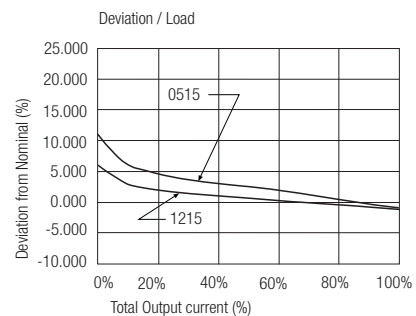
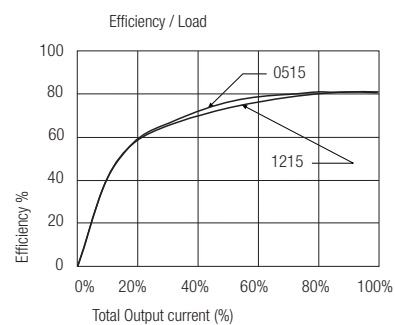
RP-xx05D



RP-xx12D



RP-xx15D

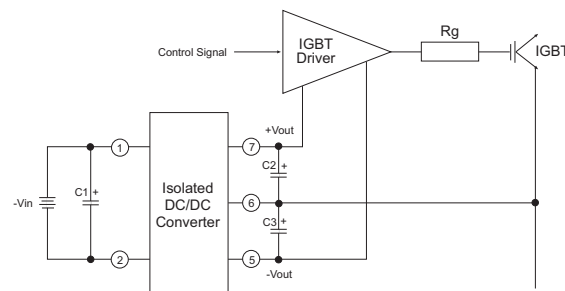


Specifications

Notes			
Note 1	Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.		
Certifications	CSA General Safety	Report: E358085	CSA C22.2 No. 60950-1-03
	UL General Safety	Report: E358085	UL 60950-1 2nd Ed.
	EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011
	EN Medical safety	Report: SPCMDD1205098-4	IEC/EN60601-1:2006, 3rd Edition

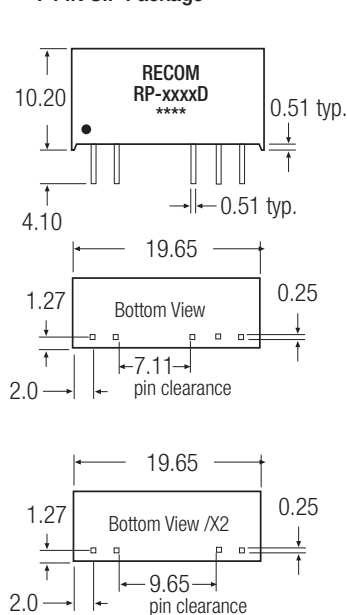
Application

**IGBT Application
Circuit**

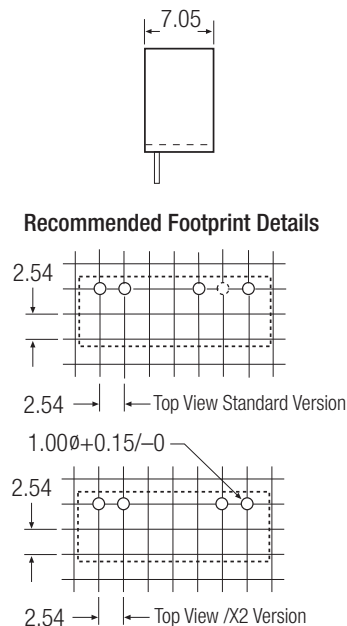


Package Style and Pinning (mm)

7 PIN SIP Package



Recommended Footprint Details



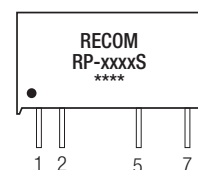
Pin Connections

Pin #	Single	Dual	/X2
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
5	-Vout	-Vout	No Pin
6	No Pin	Com	-Vout
7	+Vout	+Vout	+Vout

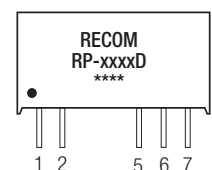
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

3rd angle projection

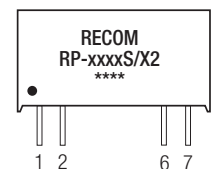
Single Output



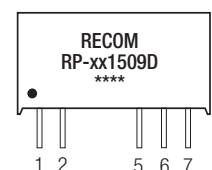
Dual Output



Single Output/X1



Dual Output



Features

Unregulated Converters

- UL/CSA and EN Safety certified
- EN-60601 for Medical Applications
- Isolation 6.4kVDC
- Optional Continuous Short Circuit Protected
- /X2 Option for >9mm Input/Output Clearance
- Suitable for IGBT Applications

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
RxxP3.3S*	5, 9, 12, 15, 24	3.3	303	70	2200µF
RxxP05S*	5, 9, 12, 15, 24	5	200	70-75	1000µF
RxxP09S*	5, 9, 12, 15, 24	9	111	70-75	1000µF
RxxP12S*	5, 9, 12, 15, 24	12	84	70-75	470µF
RxxP15S*	5, 9, 12, 15, 24	15	66	75-80	470µF
RxxP3.3D*	5, 9, 12, 15, 24	±3.3	±151	70	±1000µF
RxxP05D*	5, 9, 12, 15, 24	±5	±100	70-75	±470µF
RxxP09D*	5, 9, 12, 15, 24	±9	±55	70-75	±470µF
RxxP12D*	5, 9, 12, 15, 24	±12	±41	70-75	±220µF
RxxP15D*	5, 9, 12, 15, 24	±15	±33	75-80	±220µF
RxxP1509D*	12, 24	+15/-9	+33/-56	70-80	±220µF
R05P1509D*	5	+15/-9	±42	70-80	+68µF/-220µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R05P05S/P, R05P05D/P

* add Suffix "/X2" for single output with alternative pinout, e.g. R05P05S/X2, R05P05S/P/X2

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3, 5V output types 15% max. other output types, RxxP1509D 10% max.
Output Ripple and Noise (20MHz BW)	200mVp-p max.
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.
	RxxP1509D 20kHz min. / 60kHz typ.
Efficiency at Full Load	65% min. / 75% typ.
Minimum Load = 0%	Specifications valid for 10% minimum load only
Isolation Voltages	(tested for 1 second) 6400VDC (rated for 1 minute) 3200VAC / 60Hz
Isolation Capacitance	4pF min. / 10pF max.
Isolation Resistance	15 GΩ min.
Short Circuit Protection	1 Second
P-Suffix	Continuous
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)
Storage Temperature Range	-55°C to +125°C
Relative Humidity	95% RH
Package Weight	4.3g
Packing Quantity	25 pcs per Tube cont.

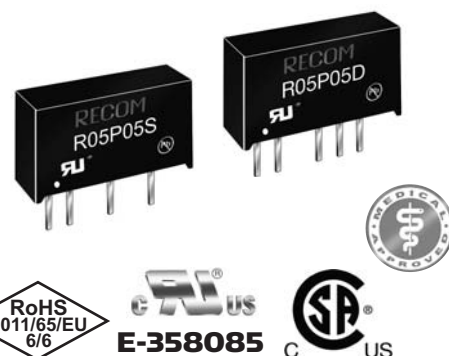
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt SIP 7 Single & Dual Output



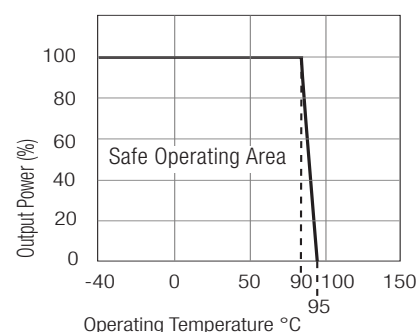
EN-60950-1 Certified
IEC/EN-60601-1 Certified*
CSA/UL-60950-1 Certified*
*** ±15/-9 Version excluded**

RxxPxx

Description

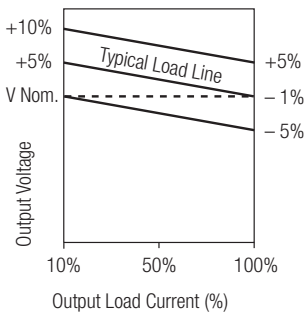
The RxxPxxS_D Series of DC/DC Converters are certified to UL/CSA-60950 as well as EN60950 and EN60601. This makes them ideal for medical and safety applications where approved isolation is required.

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Tolerance Envelope



Specifications (continued)

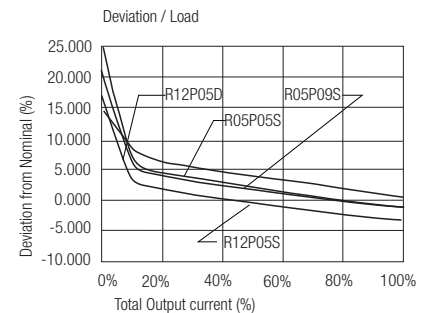
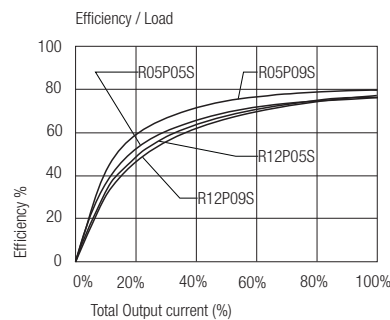
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	2974 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	728 x 10 ³ hours
Certifications	UL/cUL General Safety	Report: E358085	UL 60950-1 2nd Ed.
	EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12: 2011
	EN Medical Safety	Report: SPCMD1205098-4	IEC/EN60601-1:2006, 3rd Edition

Notes

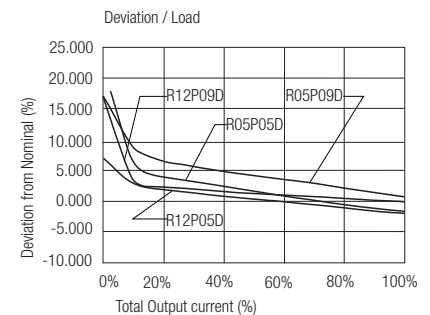
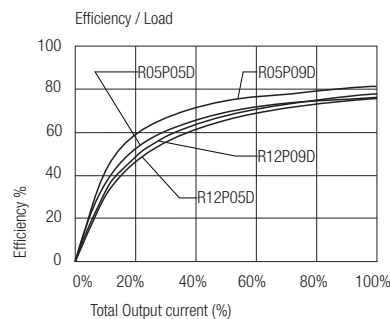
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Characteristics

RxxP05/09S

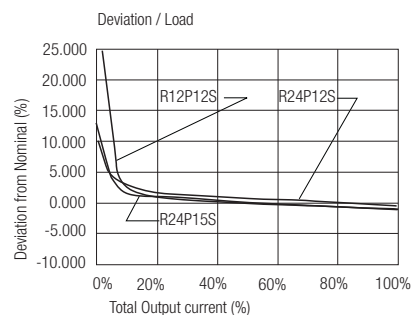
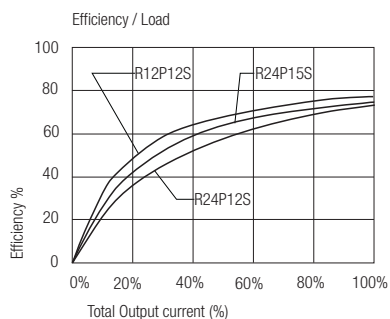


RxxP05/09D

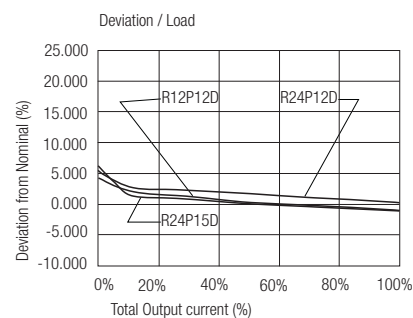
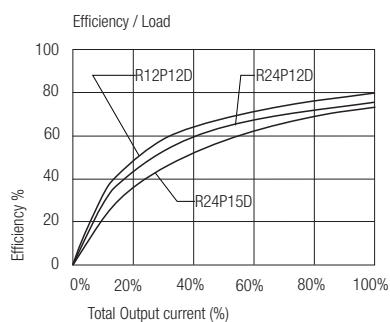


Typical Characteristics

RxxP12/15S

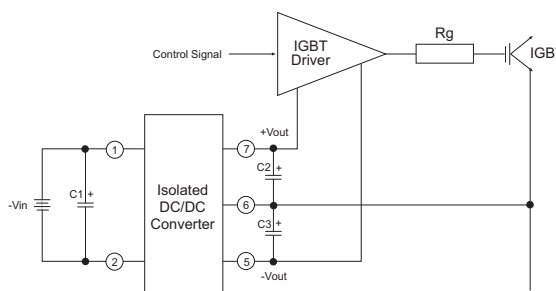


RxxP12/15D



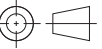
Application

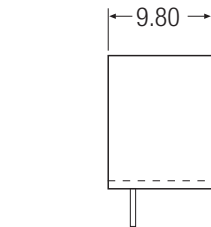
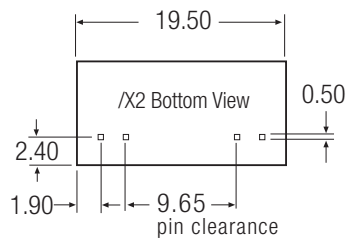
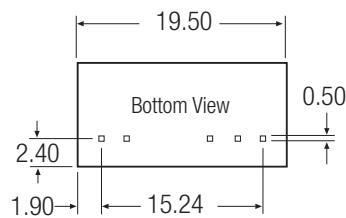
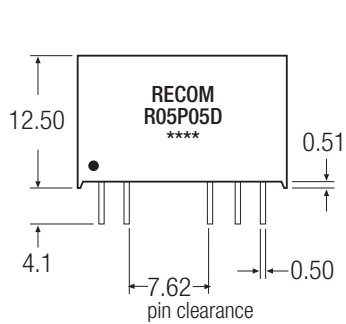
IGBT Application Circuit



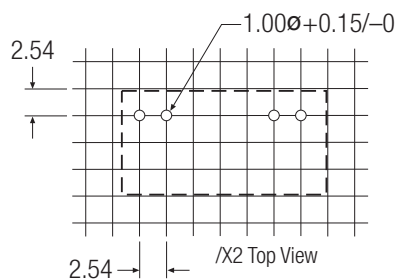
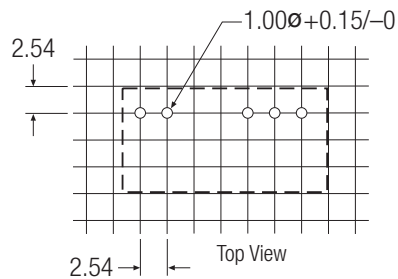
Package Style and Pinning (mm)

7 PIN SIP Package

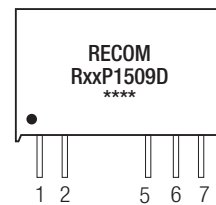
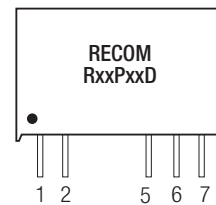
3rd angle projection 



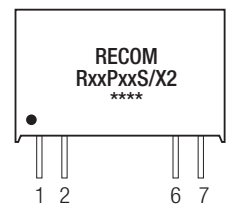
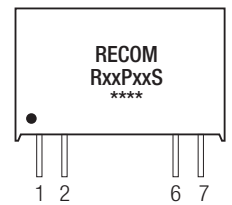
Recommended Footprint Details



Dual Output



Single Output



Pin Connections

Pin #	Single	Dual	/X2
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
5	-Vout	-Vout	No Pin
6	No Pin	Com	-Vout
7	+Vout	+Vout	+Vout

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Features

Unregulated Converters

- UL/CSA and EN Safety certified
- EN-61010 for Test, Measurement and Lab Use
- EN-60601 for Medical Applications
- Reinforced Isolation 6.4kVDC or 8kVDC
- Optional Continuous Short Circuit Protected
- Unique Reinforced Isolation Transformer System
- /X2 Option for >9mm Input/Output Clearance

Selection Guide

Part Number SIP 7	Reinforced Isolation (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
RxxP3.3S	/R6.4 & /R8	5, 9, 12, 15, 24	3.3	303	70~80	2200µF
RxxP05S	/R6.4 & /R8	5, 9, 12, 15, 24	5	200	75-80	1000µF
RxxP09S	/R6.4 & /R8	5, 9, 12, 15, 24	9	111	75-82	1000µF
RxxP12S	/R6.4 & /R8	5, 9, 12, 15, 24	12	84	75-82	470µF
RxxP15S	/R6.4 & /R8	5, 9, 12, 15, 24	15	66	75-83	470µF
RxxP3.3D	/R6.4 & /R8	5, 9, 12, 15, 24	±3.3	±151	72-79	±1000µF
RxxP05D	/R6.4 & /R8	5, 9, 12, 15, 24	±5	±100	75-82	±470µF
RxxP09D	/R6.4 & /R8	5, 9, 12, 15, 24	±9	±55	75-82	±470µF
RxxP12D	/R6.4 & /R8	5, 9, 12, 15, 24	±12	±41	75-82	±220µF
RxxP15D	/R6.4 & /R8	5, 9, 12, 15, 24	±15	±33	75-83	±220µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R05P05S/P, R05P05D/P

* add Suffix "/X2" for single output with alternative pinout, e.g. R05P05S/X2, R05P05S/P/X2

* add Suffix "/R6.4" or "/R8" for Reinforced Isolation, e.g. R05P05D/R6.4, R05P05S/P/X2/R8

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±5%	
Line Voltage Regulation	1.2%/1% of V_{in} typ.	
Load Voltage Regulation (10% to 100% full load)	3.3, 5V output types other output types	15% max. 10% max.
Output Ripple and Noise (20MHz BW)	200mVp-p max.	
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.	
Efficiency at Full Load	65% min. / 75% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Reinforced Isolation /R6.4	(tested for 1 second) (rated for 1 minute)	6400VDC 3200VAC / 60Hz
Reinforced Isolation /R8	(tested for 1 second) (rated for 1 minute)	8000VDC 4000VAC / 60Hz
Isolation Capacitance	4pF min. / 10pF max.	
Isolation Resistance	15 GΩ min.	
Short Circuit Protection P-Suffix	1 Second Continuous	
Operating Temperature Range (free air convection)	-40°C to +85°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	4.3g	
Packing Quantity	25 pcs per Tube cont.	

ECONOLINE

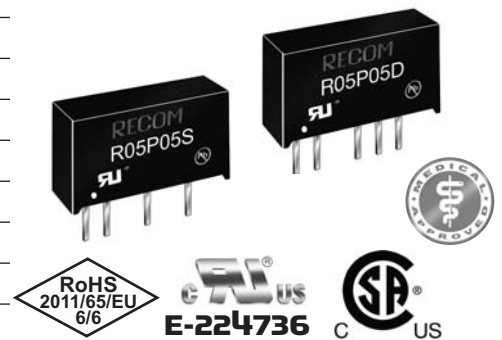
DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt

SIP 7 Single & Dual Output



EN-60950-1 Certified

EN-60601-1 Certified

UL/CSA 60950-1 Certified

U-60601-1 Certified

EN-61010-1 Certified

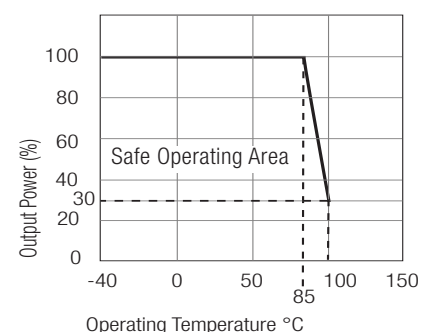
IEC-60601-1 CB Report

RxxPxx/R

Description

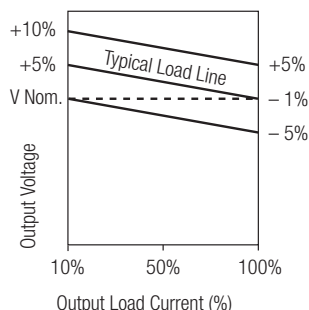
The RxxPxxS_D Series of DC/DC Converters are certified to UL/CSA-60950. This makes them ideal for safety applications where approved or reinforced isolation is required. The reinforced versions are also EN61010-1 certified for Lab Equipment Safety.

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Tolerance Envelope



Specifications (continued)

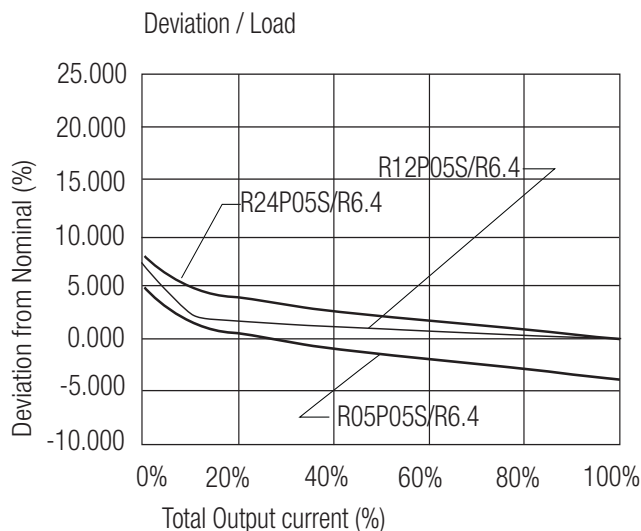
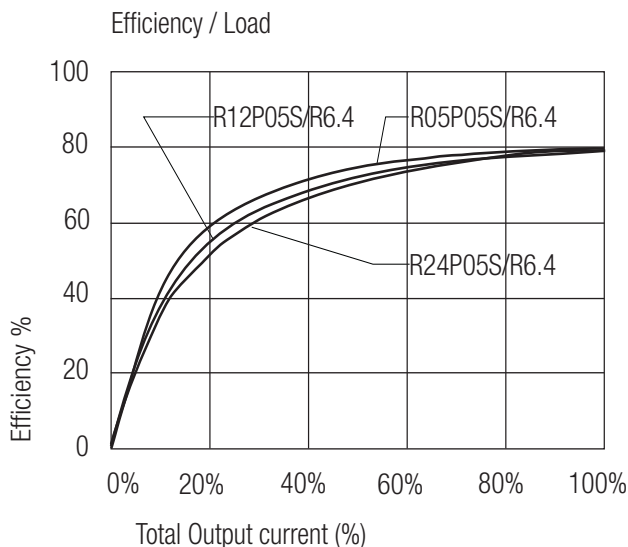
MTBF (+25°C)	} <i>Detailed Information see Application Notes chapter "MTBF"</i>	using MIL-HDBK 217F	2974 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	728 x 10 ³ hours
Reinforced Isolation			
Transformer Clearance	Reinforced Types	5.5 mm min.	
PCB Creepage & Clearance	Reinforced Types	4.8 mm min.	
Certifications			
Measurement, Control and Laboratory Use Safety	Report: T1301251-313		EN 61010-1 : 2010
CSA General Safety			UL 60950-1 1st Ed.
			C22.2 No. 60950-1-03
UL/cUL Medical Safety	Report: E314885-A2-UL		UL60601-1 1st Edition
CSA Medical Safety	Report: 2207629		CAN/CSA-22.2 No 601.1-M90
EN General Safety	Report: PS-R7219C1		EN60950-1:2001 + A11: 2004
CB/EN Medical Safety	Report: CA/11578A1/CSA		IEC/EN 60601-1

Notes

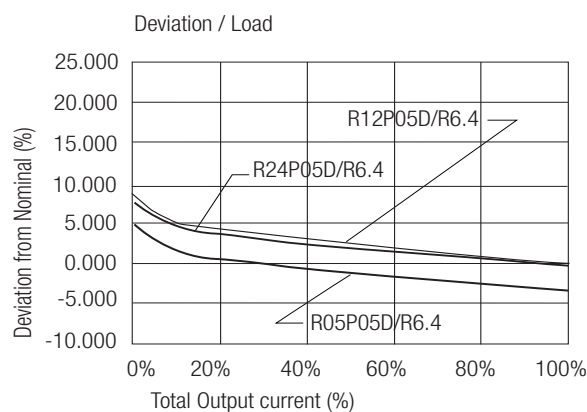
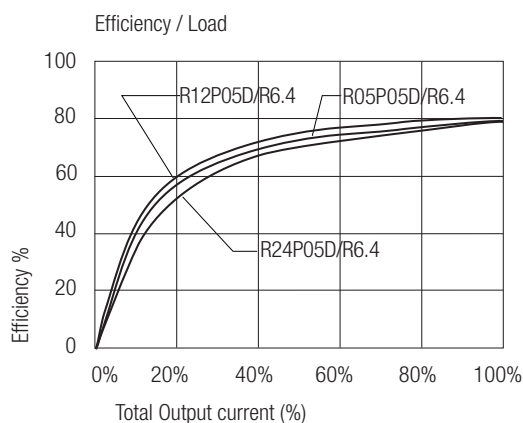
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Characteristics - Reinforced Version

RxxP05S/R6.4 RxxP05S/R8



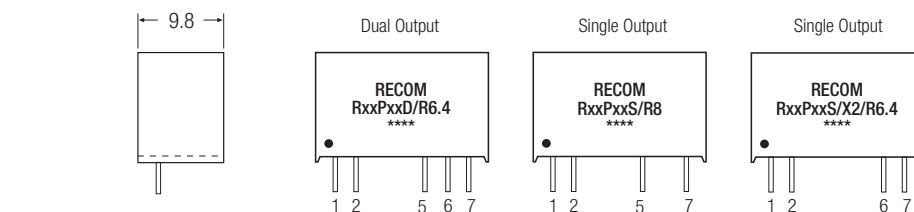
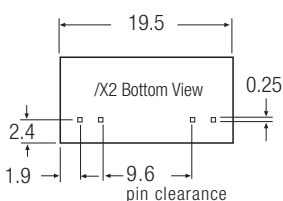
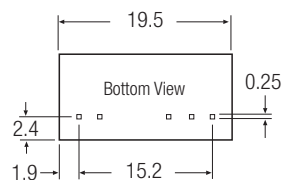
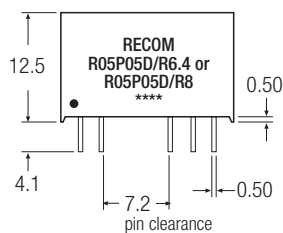
RxxP05D/R6.4 RxxP05D/R8



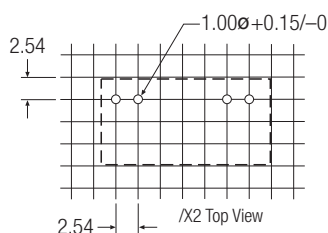
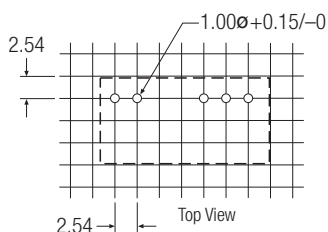
Package Style and Pinning (mm)

7 PIN SIP Package

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual	/X2
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
5	-Vout	-Vout	No Pin
6	No Pin	Com	-Vout
7	+Vout	+Vout	+Vout

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converter

- Fully RoHS 6/6 Conform
- Full Power at 100°C Ambient Temperature
- 1kVDC Isolation
- Suitable for Fully Automated Assembly (including Vapour Phase Soldering)
- Optional Continuous Short Circuit Protection

Selection Guide

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ⁽¹⁾ **
R1DA**xx3.33.3	3.3, 5, 9, 12, 15, 24	3.3/3.3	150/150	75	470µF/470µF
R1DA**xx0505	3.3, 5, 9, 12, 15, 24	5/5	100/100	72-78	470µF/470µF
R1DA**xx0909	3.3, 5, 9, 12, 15, 24	9/9	56/56	74-78	220µF/220µF
R1DA**xx1212	3.3, 5, 9, 12, 15, 24	12/12	42/42	75-80	68µF/68µF
R1DA**xx1515	3.3, 5, 9, 12, 15, 24	15/15	33/33	75-82	68µF/68µF

xx = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e. g. R1DA-050505/P

* add Suffix -R for Tape & Reel Packing e.g. R1DA-050505-R. For more Details see Application Notes.

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	$\pm 10\%$	
Output Voltage Accuracy	-1% typ., $\pm 5\%$ max.	
Line Voltage Regulation (Low Line to High Line @ max. Load)	All Variants	1% typ.
Load Regulation (10% to 100% Load)	3.3V output types	15% typ., 20% max.
	5V output types	12% typ., 15% max.
	9V output types	7% typ., 10% max.
	2V, 15V output types	6% typ., 10% max.
Output Ripple and Noise (20MHz BW limited)	50 mVp-p typ. / 100mVp-p max.	
Operating Frequency	20kHz min. / 50kHz typ. / 90kHz max.	
Efficiency at Full Load	See Selection Guide	
Minimum Load = 0%	Specifications valid for 10% minimum Load only	
Isolation Voltage Input/Output	(tested for 1 second)	1000VDC
Isolation Voltage Output/Output	(rated for 1 minute)	500VAC / 60Hz
Isolation Capacitance	75pF max.	
Isolation Resistance	$V_{iso}=500V$	10 G Ω min.
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range	-40°C to +100°C (see Graph)	
Storage Temperature Range	-50°C to +125°C	
Reflow Temperature	RoHS compliant	245°C (30 sec), Peak 255°C (5 sec) max.
Vapour Phase Process	(for more details see Application Notes) 230°C (90 sec) max.	
Relative Humidity	95% RH	
Humidity Susceptibility Test	1000 hrs / 90% humidity / +85°C ambient	
Package Weight	1.2g	
Packing Quantity	33 pcs per tube / 500 pcs per reel	
MTBF	Using MIL-HDBK 217F (+25°C)	1045 x 10 ³ hours
	Using MIL-HDBK 217F (+85°C)	183 x 10 ³ hours

Detailed Information see Application Notes chapter „MTBF“

ECONOLINE
DC/DC-Converter

RECOM

1 Watt SMD Dual Independent Outputs



EN-60950-1-Certified
UL-60950-1-Certified

R1DA

Description

The R1DA converters are of the enclosed open frame type, i.e. they are not potted.

The converters are typically used in general purpose and industrial low power isolation and voltage matching applications where an SMD converter is required.

The converter series feature an extended ambient temperature operating range of -40°C - +100°C without derating and optional continuous short circuit protection.

In addition to single, dual and independent outputs, two isolation options and three different case formats, the converters are also available pre-packed as tape and reel for use with automatic insertion machines.

Refer to Application Notes

www.recom-international.com

Specifications - continued

Certifications

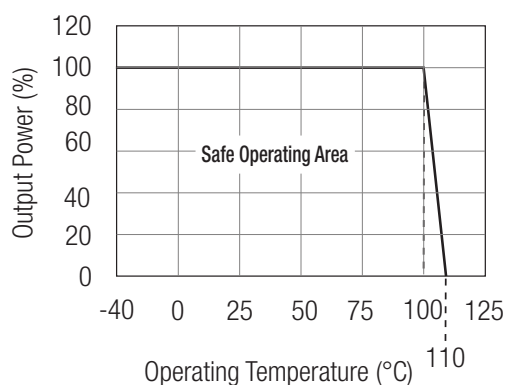
EN General Safety	Report: 10010807-2009	EN-60950-1, 2nd Edition
Conducted Emissions		EN55022 Class B with Filter
Radiated Emissions		EN55022 Class B with Filter
UL General Safety	Report: E358085	UL60950-1, 2nd Edition

Notes

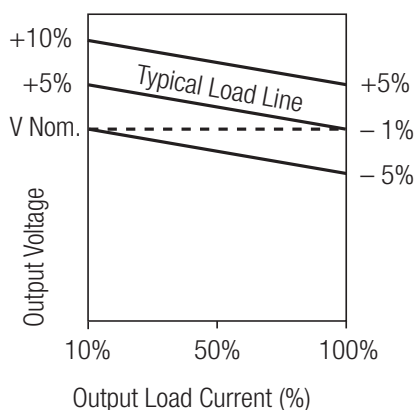
Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Derating-Graph (Ambient Temperature)

R1DA-0505

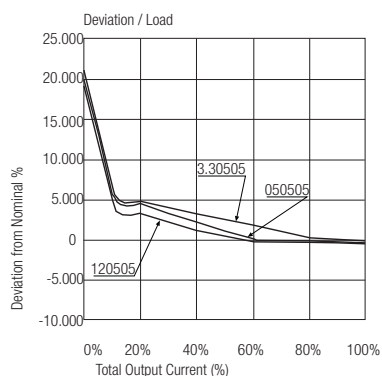
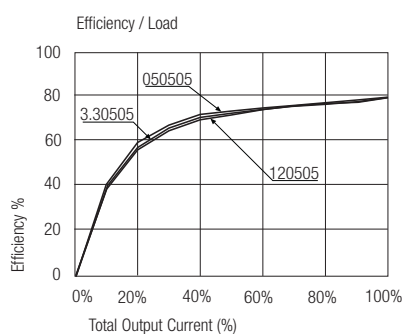


Tolerance Envelope

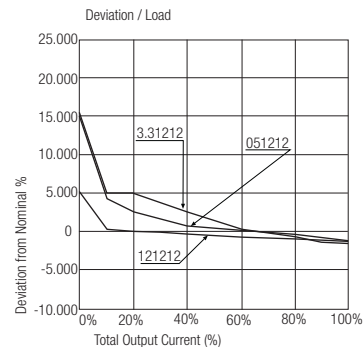
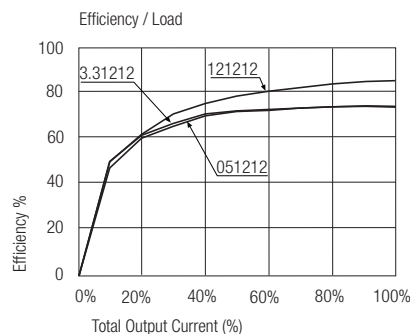


Typical Characteristics

R1DA-xx0505

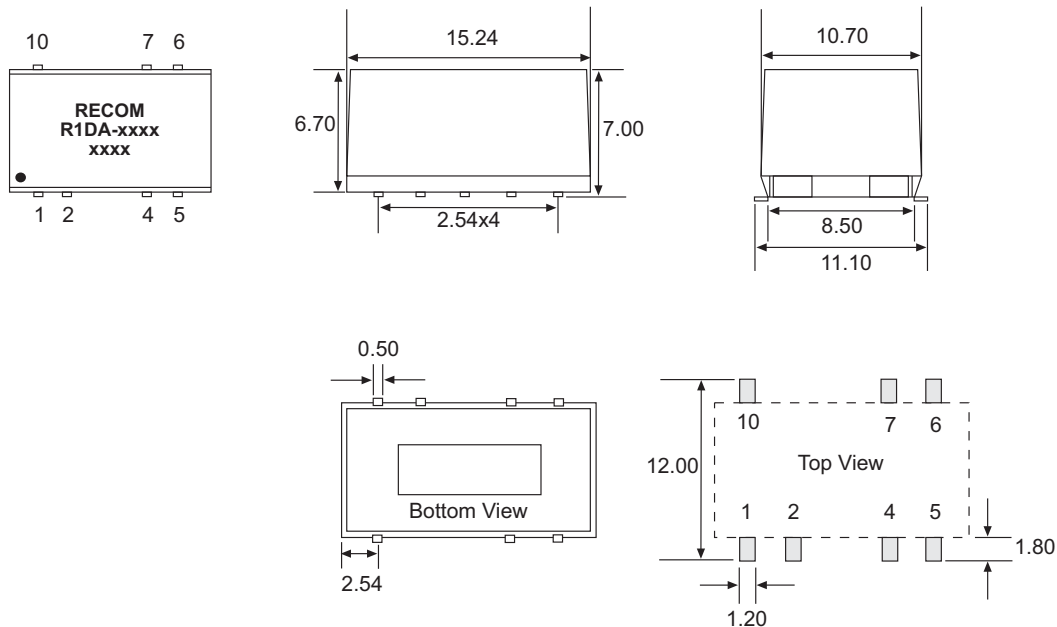


R1DA-xx1212



Package Style and Pinning (mm)

2 PIN Dual SMD Package

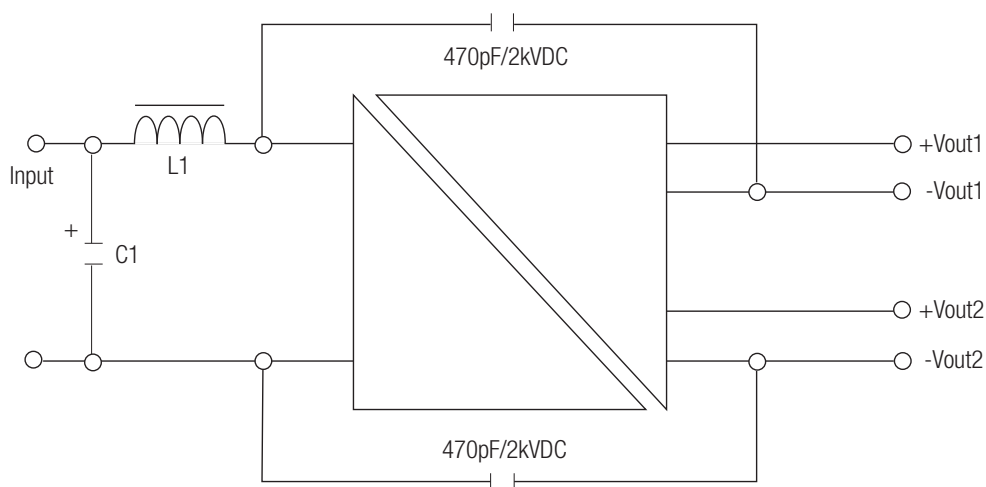


Pin Connections

Pin #	Function
1	-Vin
2	+Vin
4	-Vout1
5	+Vout1
6	-Vout2
7	+Vout2
10	NC

NC= No Connection

EMC Filtering - Suggestion for EN55022 Class B (Conducted and Emited)



Standard

C1	L1	Vin
2.2µF	4.7µH	3.3V
2.2µF	4.7µH	5V
2.2µF	10µH	9V
2.2µF	10µH	12V
2.2µF	10µH	15V
2.2µF	22µH	24V

/P versions

C1	L1	Vin
4.7µF	10µH	3.3V
4.7µF	10µH	5V
4.7µF	10µH	9V
4.7µF	10µH	12V
4.7µF	22µH	15V

C1 = MLCC

L1 = SMD Inductor

Features

Unregulated Converters

- Twin Independent Outputs
- Output/Output Isolation 1kVDC
- Power Sharing on Outputs
- Input/Output Isolation 1kVDC
- Standard and Miniature Versions
- Optional Continuous Short Circuit Protected
- Custom Solutions Available
- Efficiency to 76%

Description

The RU DC/DC converter offers two independent isolated outputs. Typical applications include multiple channel circuits where inter-channel isolation is also required. The RUM offers similar specifications in a miniature case for applications where space is at a premium. Both converters offer 1kVDC input/output isolation and 1kVDC output/output isolation. The /H versions offer 2kVDC isolation between input and outputs.

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (V1VDC)	Output Voltage (V2VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ⁽¹⁾
SIP 7	2kV						
RU-3.30505	(H)	3.3	5	5	100/100	76	470µF/470µF
RU-050505	(H)	5	5	5	100/100	72	470µF/470µF
RUM-3.30505	(H)	3.3	5	5	100/100	78	470µF/470µF
RUM-050505	(H)	5	5	5	100/100	72	470µF/470µF

Other input and output voltage combinations available on request

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RU-050505/P, RUM-050505/P, RU-3.30505/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range		±10%		
Output Voltage Accuracy		±5%		
Line Voltage Regulation		1.2%/1% of Vin typ.		
Load Voltage Regulation (10%~100% Load)		15% max 10% typ.		
Output Ripple and Noise (20MHz limited)	RU	75mVp-p max.		
Full Load	RUM	100mVp-p max.		
Operating Frequency		20kHz min. / 70kHz typ. / 105kHz max.		
Efficiency at Full Load		RU 70% min. RUM 70% min.		
Minimum Load = 0%		Specifications valid for 10% minimum load only.		
Isolation Voltage	(tested for 1 second)	1000VDC		
Input/Output and Output/Output	(rated for 1 minute)	500VAC / 60Hz		
Isolation Voltage	H-suffix (tested for 1 second)	2000VDC		
Input/Output	H-suffix (rated for 1 minute)	1000VAC / 60Hz		
Output/Output	H-suffix (rated for 1 minute)	500VAC / 60Hz		
Isolation Capacitance		20pF min. / 94pF max.		
Isolation Resistance		10 GΩ min.		
Short Circuit Protection		1 Second		
P-Suffix		Continuous		
Operating Temperature Range (free air convection)		-40°C to +85°C (see Graph)		
Storage Temperature Range		-55°C to +125°C		
Relative Humidity		95% RH		
Package Weight		2.7g		
Packing Quantity		RU 25 pcs per Tube RUM 30 pcs per Tube		
MTBF (+25°C)		Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1012 x 10³ hours
(+85°C)			using MIL-HDBK 217F	151 x 10³ hours
Certifications				
EN60950-1		Report: SPCLVD1109103	EN60950-1: 2006+A12:2011	

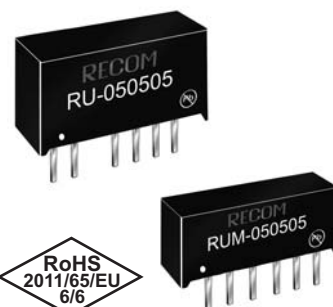
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

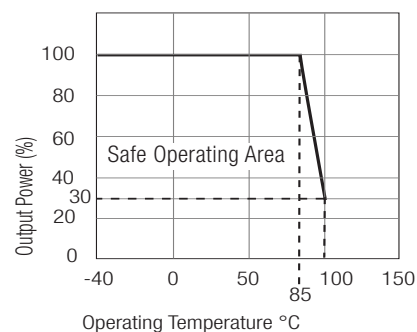
1 Watt SIP7 Isolated Dual Output



EN-60950-1 Certified

RU/RUM

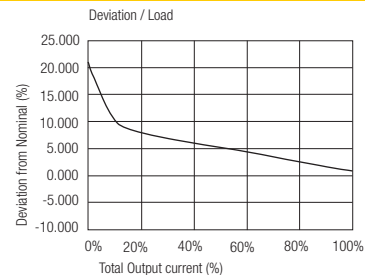
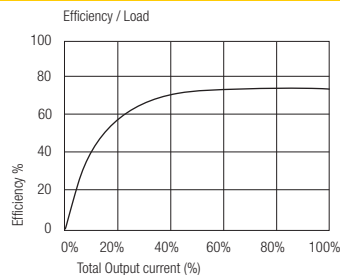
Derating-Graph (Ambient Temperature)



Refer to Application Notes

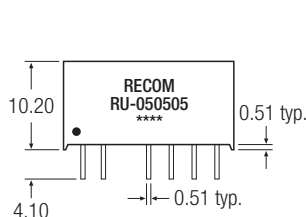
Typical Characteristics

RU-050505
RUM-050505

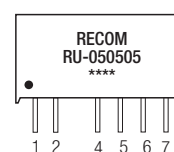


RU Package Style and Pinning (mm)

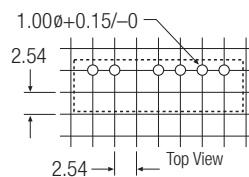
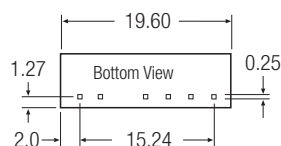
SIP7 Package



3rd angle projection



Recommended Footprint Details



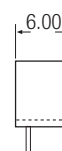
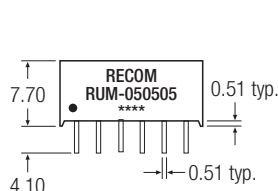
Pin Connections

Pin #	Single
1	+Vin
2	-Vin
4	+Vout 1
5	-Vout 1
6	+Vout 2
7	-Vout 2

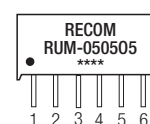
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

RUM Package Style and Pinning (mm)

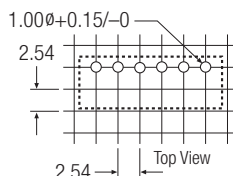
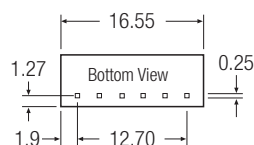
SIP6 Package



3rd angle projection



Recommended Footprint Details



Pin Connections

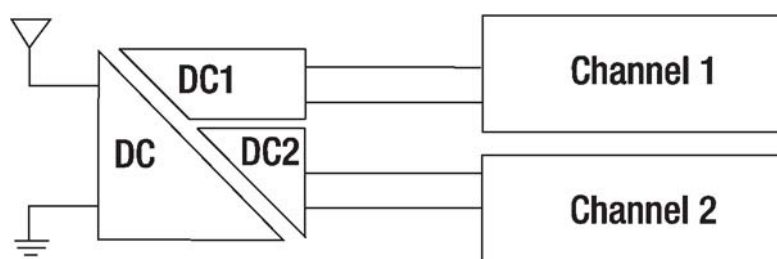
Pin #	Single
1	+Vin
2	-Vin
3	-Vout 1
4	+Vout 1
5	-Vout 2
6	+Vout 2

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Application



Features

Unregulated Converters

- Custom Solutions Available
- 1kVDC & 2kVDC Isolation
- No Extern. Components Required
- UL94V-0 Package Material
- No Heatsink Required
- Efficiency to 85%

Description

The RN series of compact 1.25W single output converters are especially useful when more than 1W of power is required, but there are space restrictions than make a 2W converter unsuitable. The converter series feature an industrial ambient temperature operating range of -40°C ~ +85°C without derating and up to 100°C ambient temperature with derating. Options include 1kVDC or 2kVDC isolation and continuous short circuit protection (P).

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load ⁽¹⁾
DIP6	(2kV)					
RN-xx3.3S	(H)	3.3, 5, 9, 12, 15, 24	3.3	378	70	2200µF
RN-xx05S	(H)	3.3, 5, 9, 12, 15, 24	5	250	70-72	1000µF
RN-xx07S	(H)	3.3, 5, 9, 12, 15, 24	7	180	72-75	1000µF
RN-xx09S	(H)	3.3, 5, 9, 12, 15, 24	9	140	75-80	1000µF
RN-xx12S	(H)	3.3, 5, 9, 12, 15, 24	12	104	79-82	470µF
RN-xx15S	(H)	3.3, 5, 9, 12, 15, 24	15	84	80-84	470µF
RN-xx24S	(H)	3.3, 5, 9, 12, 15, 24	24	52	80-85	220µF

x = Input Voltage (other input and output voltage combinations available on request)

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RN-0505S/P, RN-0505S/HP

Specifications (Core Operating Area)

Input Voltage Range			±10%
Output Voltage Accuracy			±5%
Line Voltage Regulation			1.2% typ. / 1.4% max.
Load Voltage Regulation (10% to 100% full load)	3.3V output types		20% max.
	5V output type		15% max.
	9V, 12V, 15V, 24V output types		10% max.
Output Ripple and Noise (20MHz limited)			75mVp-p max.
Operating Frequency			50kHz min. / 100kHz typ. / 105kHz max.
Efficiency at Full Load			70% min. / 75% typ.
Minimum Load = 0%			Specifications valid for 10% minimum load only.
Isolation Voltage		(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz
Isolation Voltage	H-Suffix	(tested for 1 second)	2000VDC
	H-Suffix	(rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance			30pF min. / 95pF max.
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
Operating Temperature Range (free air convection)			-40°C to +85°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Package Weight			1.9g
Packing Quantity			39 pcs per Tube
MTBF (+25°C) (+85°C)	} Detailed information page 266	using MIL-HDBK 217F	955 x 10 ³ hours
		using MIL-HDBK 217F	132 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1.25 Watt

DIP8

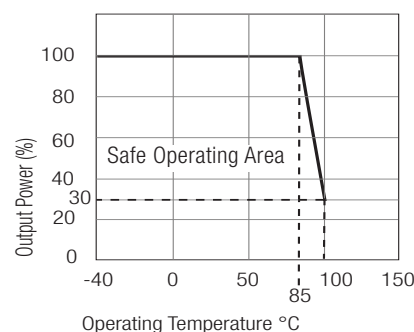
Single Output



EN-60950-1 Certified

RN

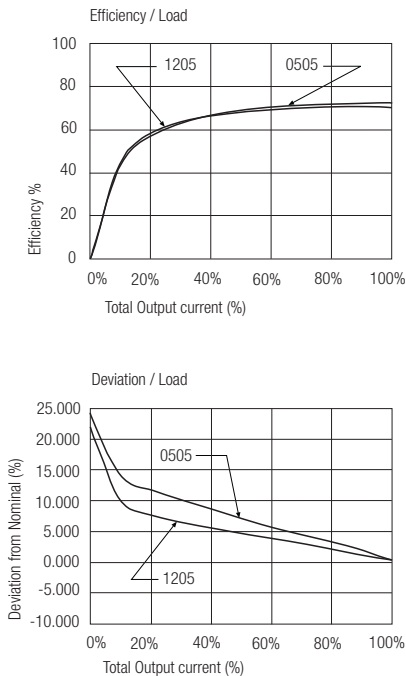
Derating-Graph (Ambient Temperature)



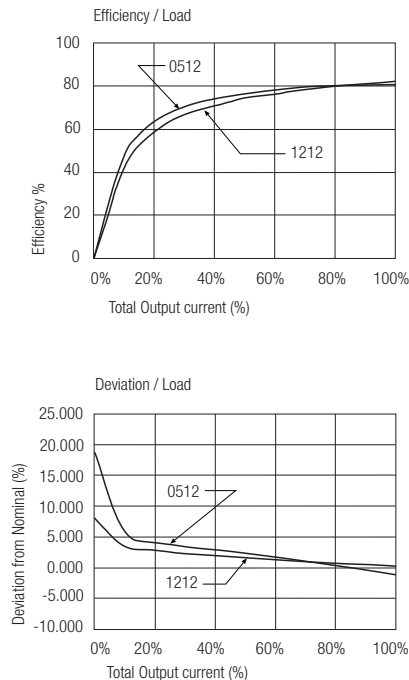
Refer to Application Notes

Typical Characteristics

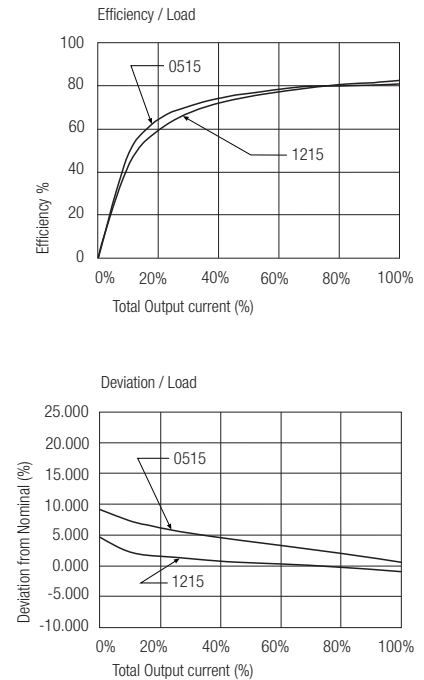
RN-xx05S



RN-xx12S



RN-xx15S



Notes

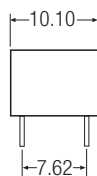
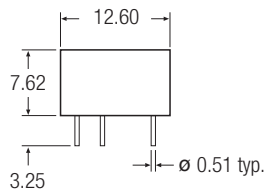
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

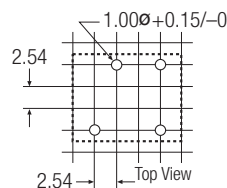
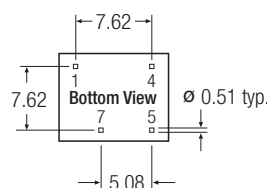
EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011

Package Style and Pinning (mm)

DIP8 Package



Recommended Footprint Details



Pin Connections

Pin #	Single
1	-Vin
4	+Vin
5	+Vout
7	-Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converters

- 1:1 Input Range
- Efficiency up to 84%
- 2kVDC and 3kVDC Isolation Option
- Approved for Medical Applications
- -40°C to +90°C Operating Temperature Range
- 2W SMD Package

Selection Guide

Part Number SMD	Isolation Voltage (kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (max.)	Capacitive Load (max.)
RTM-0505S*	2	5	5	400	79%	2200µF
RTM-1205S*	2	12	5	400	83%	2200µF
RTM-2405S*	2	24	5	400	84%	2200µF

* add Suffix "/H" for 3kVDC/1sec. Isolation e.g. RTM-0505S/H

* add Suffix "-R" for tape&reel packing e.g. RTM-1205S-R or RTM-2405S/H-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage and rated output current unless otherwise specified)

Input Voltage Range	$\pm 10\%$ max.	
Output Voltage Accuracy	-1% typ., $\pm 5\%$ max.	
Line Voltage Regulation	(low line to high line at max. load)	1.2% typ.
Load Voltage Regulation	(10% to 100% full load)	10% typ., 15% max.
Output Ripple and Noise (20MHz BW limited)	50mVp-p typ., 100mVp-p max.	
Operating Frequency (V_{in} =nominal input)	20kHz min. / 40kHz typ. / 80kHz max.	
Efficiency at Full Load	see Selection Guide	
Minimum Load = 0%	Specifications valid for 10% minimum load only	
Isolation Voltage	RTM-xx05S (tested for 1 second)	2000 VDC
	RTM-xx05S/H (tested for 1 second)	3000 VDC
Isolation Capacitance	30pF typ., 50pF max.	
Isolation Resistance	(Viso=500V)	15GΩ min.
Short-Circuit Protection	1 second	
Operating Temperature Range	with Derating	-40°C to +90°C
Storage Temperature	-55°C to +125°C	
Reflow Temperature	RoHS compliant	245°C (30 sec.), Peak 255°C (5sec.) max.
Vapour Phase Process	(for more details see Application Notes)	230°C (90 sec.) max.
Relative Humidity	95% RH	
Package Weight	1.4g	
Packing Quantity	All Types	27 pcs per Tube
	All Types	500 pcs per Reel
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 3907 x 10 ³ hours
MTBF (+85°C)		using MIL-HDBK 217F 313 x 10 ³ hours

Certifications

EN Medical Safety Report: MDD1112018 + RM1112018 IEC/EN 60601-1 3rd Edition
Medical Report + ISO14971 Risk Assessment

EN General Safety EN60950-1, 2nd Edition

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

ECONOLINE

DC/DC-Converter

RECOM

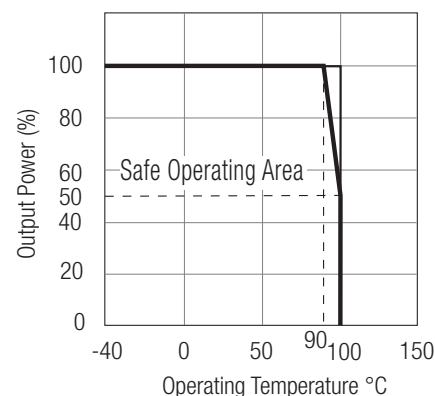
2 Watt SMD Single Output



EN-60601-1 Certified
EN-60950-1 Certified

RTM

Derating-Graph (Ambient Temperature)

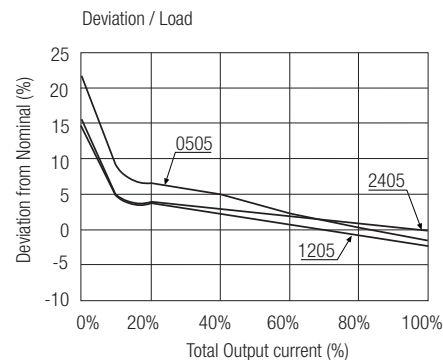
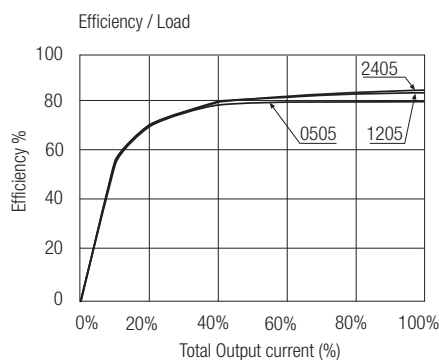
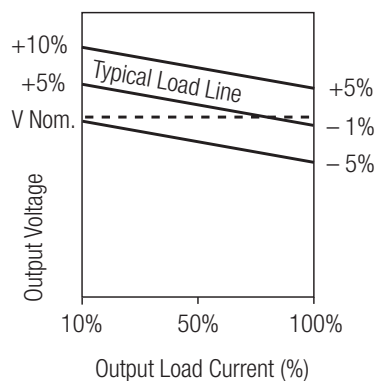


Refer to Application Notes

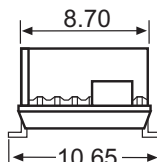
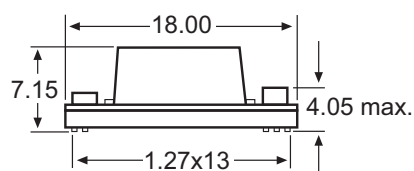
Typical Characteristics

Tolerance Envelope

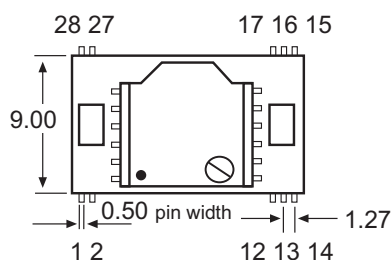
RTM-xx05S



Package Style and Pinning



3rd angle projection



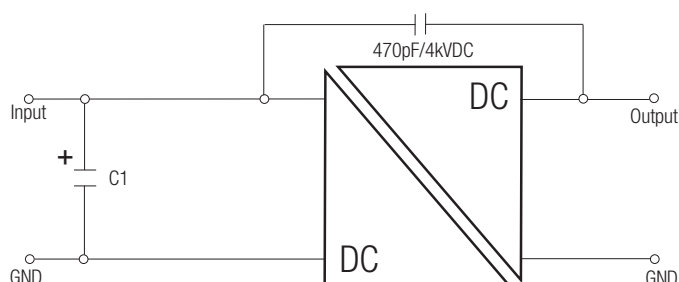
Pin Connections

Pin #	Function
1	+Vin
2	-Vin
12	-Vout
13	+Vout
14~17	NC
27,28	NC

NC = No Connection

Unit: mm
Tolerance: ± 0.25 mm

EMC Filtering - Suggestion for EN55022 Class B



Input Voltage	Inductance/ Capacitance (C1)
5V	4.7µF
12V	2.2µF
24V	47µF

Features

Unregulated Converters

- Fully RoHS 6/6 Conform
- Full Power at 85°C Ambient Temperature
- 1kVDC and 3kVDC Isolation Options
- /H Version Certified for Medical Applications
- UL/EN/CSA Certified, CB Report
- Suitable for Fully Automated Assembly (including Vapour Phase Soldering)
- Optional Continuous Short Circuit Protection
- Efficiency to 85%
- Built-In EN55022 Class A Filter

Description

The R2S and R2D converters are of the enclosed open frame type, meaning that they are unpotted. The converters are typically used in general purpose and industrial low power isolation and voltage matching applications where an SMD converter is required. The converter series feature an extended ambient temperature operating range of -40°C ~ +85°C without derating and optional continuous short circuit protection. In addition to two isolation options and three different case formats, the converters are also available prepacked as tape and reel for use with automatic insertion machines.

Selection Guide

Part Number SMD	(3kV)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
R2S**-xx3.3	(H)	5, 12, 15, 24	3.3	606	70-75	3300µF
R2S**-xx05	(H)	5, 12, 15, 24	5	400	76-84	1200µF
R2S**-xx09	(H)	5, 12, 15, 24	9	222	76-84	1200µF
R2S**-xx12	(H)	5, 12, 15, 24	12	167	76-85	680µF
R2S**-xx15	(H)	5, 12, 15, 24	15	133	76-85	680µF
R2S**-xx24	(H)	5, 12, 15, 24	24	83	76-85	220µF
R2D**-xx05	(H)	5, 12, 15, 24	±5	±200	75-80	±470µF
R2D**-xx09	(H)	5, 12, 15, 24	±9	±111	75-80	±470µF
R2D**-xx12	(H)	5, 12, 15, 24	±12	±83	75-83	±330µF
R2D**-xx15	(H)	5, 12, 15, 24	±15	±66	75-85	±330µF
R2D**-xx24	(H)	5, 12, 15, 24	±24	±42	75-85	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R2S-0505/P, R2D-0505/HP

* add suffix -R for tape&reel packing e.g. R2S-0505-R. For more details see Tapes Section.

Case and Pinning Options (note restrictions on /H option)

- R2S** : ** without marking denotes 5 pins out of 8 fitted (/H option available)
 ** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)
 ** with marking **12** denotes 10 pins out of 12 fitted (/H option available)
R2D** : ** without marking denotes 6 pins out of 10 fitted (/H option available)
 ** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)
 ** with marking **12** denotes with 10 pins out of 12 fitted (/H option available)

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of Vin max.
Load Voltage Regulation (10% to 100% full load)	3.3V output types 20% max. 5V output type 15% max. 9V, 12V, 15V, 24V output types 10% max.
Output Ripple and Noise (20MHz limited)	150mVp-p max.
Operating Frequency	20kHz min. / 40kHz typ. / 85kHz max.
Efficiency at Full Load	70% min. / 80% typ.
Minimum Load = 0%	Specifications valid for 10% minimum load only.

cont.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

SMD Single & Dual Output



E358085

UL-60950-1 Certified
EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

R2S-R2D

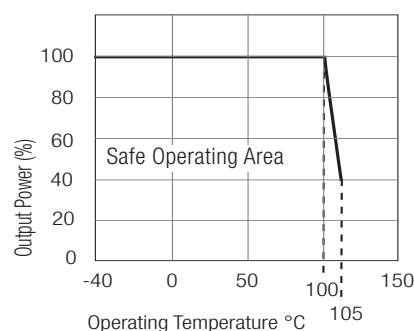
Refer to Application Notes

Specifications - Continued

Isolation Voltage	(tested for 1 second)	1000VDC	
	(rated for 1 minute)	500VAC / 60Hz	
Isolation Voltage	(rated for 1 second)	3000VDC	
	(rated for 1 minute)	1500VAC / 60Hz	
Isolation Capacitance		115pF max.	
Isolation Resistance	(Viso 500V)	10 GΩ min.	
Short Circuit Protection		1 Second	
P-Suffix		Continuous	
Operating Temperature Range (free air convection)		-40°C to +100°C (see Graph)	
Storage Temperature Range		-55°C to +125°C	
Reflow Temperature	ROHS compliant	245°C (30 sec), peak 255°C (5 sec) max.	
Vapour Phase Process	(for more details see Application Notes)	230°C (90 sec) max.	
Relative Humidity		95% RH	
Package Weight	R2S, R2S8	1.4g	
	R2D, R2D10	1.5g	
	R2S12, R2D12	1.6g	
Packing Quantity	R2S, R2S8	39 pcs per Tube	
	R2S12, R2D, R2D10, R2D12	33 pcs per tube	
	All Types	250 pcs per Reel	
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	886 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	128 x 10 ³ hours
Certifications			
CB Test Report	Report: US/14402/UL		
UL General Safety	Report: E308085	UL 60950-1 2nd Ed.	
CUL General Safety		C22.2 No. 60950-1-03	
EN Medical Safety	Report: MDD1205098-2 + RM1205098-2	IEC/EN 60601-1 3rd Ed.	
	Medical Report + ISO14971 Risk Assessment		
EN General Safety	Report: SPCLVD 1211033-3	EN60950-1: 2006 + A12:2011	
Conducted / Radiated Emissions	EN55022		Level A

Derating-Graph (Ambient Temperature)

R2S-0505, R2D-0505



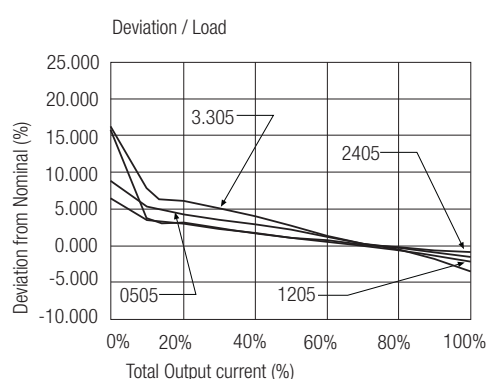
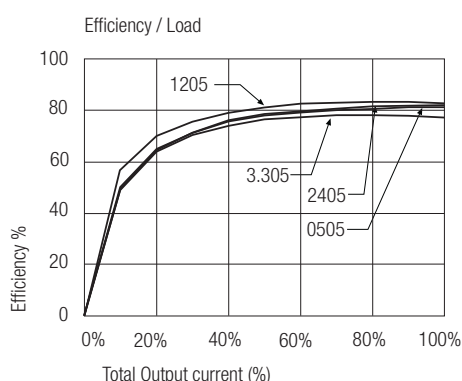
The derating graph is valid only for the shown part numbers.

Notes

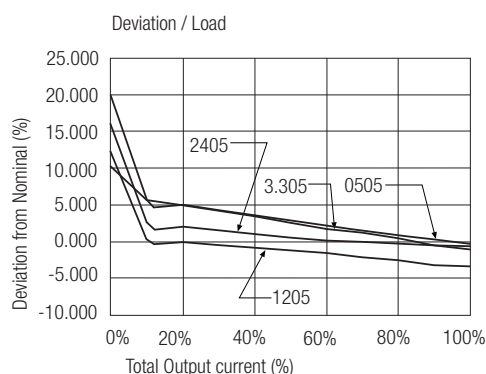
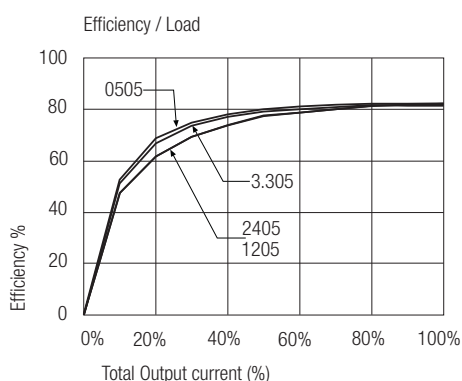
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Characteristics

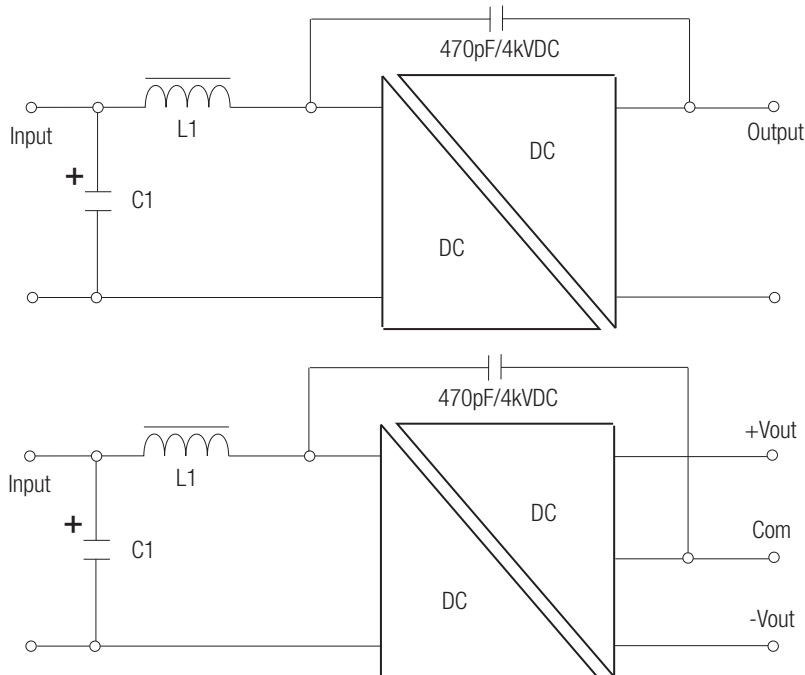
R2S-xx05



R2D-xx05



EMC Filtering - Suggestion for EN55022 Class B (Conducted and Emitted)



Standard and /H versions

C1	L1	Vin
4.7µF	3.3µH	3.3V
2.2µF	4.7µH	5V
2.2µF	10µH	9V
2.2µF	10µH	12V
2.2µF	22µH	15V
4.7µF	22µH	24V

/P and /HP versions

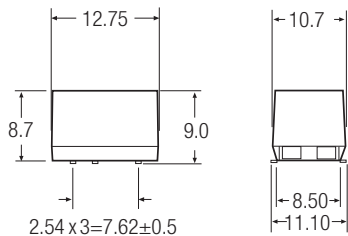
C1	L1	Vin
10µF	4.7µH	3.3V
10µF	10µH	5V
4.7µF	22µH	9V
4.7µF	22µH	12V
4.7µF	22µH	15V
10µF	47µH	24V

C1 = MLCC

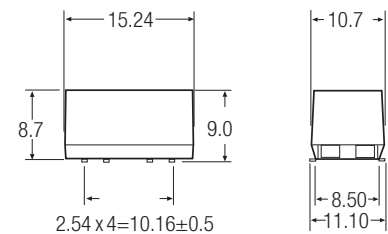
L1 = SMD Inductor

Package Style and Pinning (mm)

8 PIN Single SMD Package

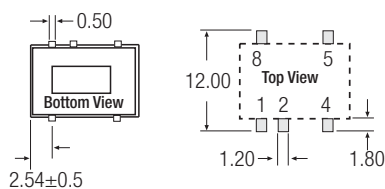


10 PIN Dual SMD Package



3rd angle projection

Recommended Footprint Details

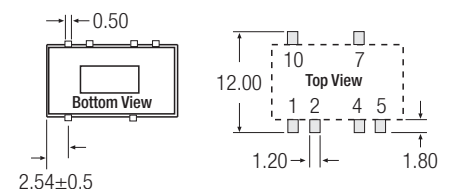


Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Com
5	+Vout	-Vout
7	No Pin	+Vout
8	NC	No Pin
10	No Pin	NC

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Recommended Footprint Details



R2S** : ** without marking denotes 5 pins out of 8 fitted (includes /H option)
** with marking **8** denotes 8 pins out of 8 fitted (/H option not available)

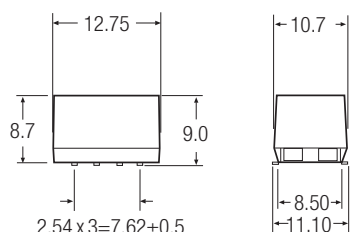
R2D** : ** without marking denotes 6 pins out of 10 fitted (includes /H option)
** with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)

e.g. R2S-0505, R2S-0505/H, R2S-0505/HP
e.g. R2S8-0505, R2S8-0505/P

e.g. R2D-0505, R2D-0505/H, R2D-0505/HP
e.g. R2D10-0505, R2D10-0505/P

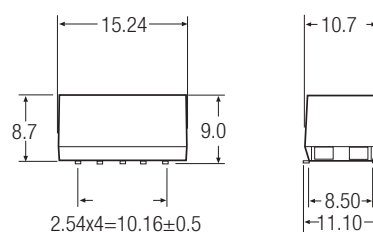
Package Style and Pinning (mm)

Full 8 PIN Single SMD Package

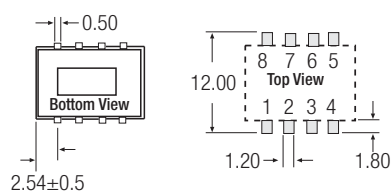


Note: /H option is not available in these pin packages

Full 10 PIN Dual SMD Package



Recommended Footprint Details



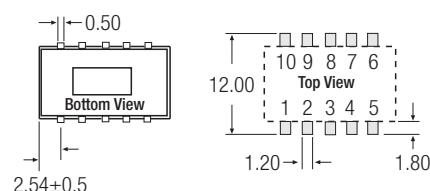
Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	NC	NC
4	-Vout	Com
5	+Vout	-Vout
6	NC	NC
7	NC	+Vout
8	NC	NC
9	-	NC
10	-	NC

NC = No Connection

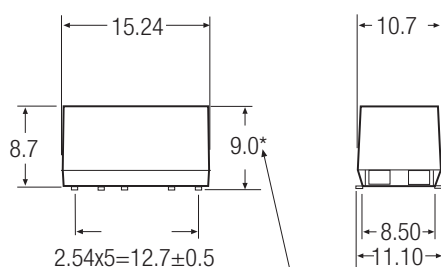
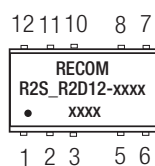
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Recommended Footprint Details

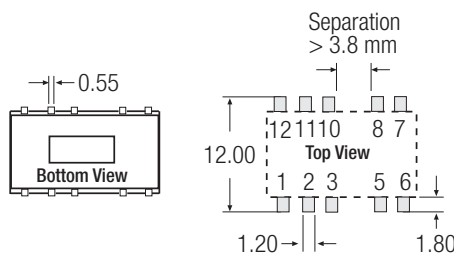


12 PIN Single and Dual SMD Package

Note: /H option is available in this pin package



*R2S12-05xx/HP = 9.4mm



Recommended Footprint Details

Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	NC	NC
5	-Vout	Com
6	NC	-Vout
7	NC	NC
8	+Vout	+Vout
10	NC	NC
11	NC	NC
12	NC	NC

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm



R2S**: ** with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

R2D**: ** with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

e.g. R2S12-0505, R2S12-0505/H, R2S12-0505/HP

e.g. R2D12-0505, R2D12-0505/H, R2D12-0505/HP

Features

Unregulated Converters

- Custom Solutions Available
- 1kVDC Isolation
- No External Components Required
- Optional Continuous Short Circuit Protected
- UL94V-0 Package Material
- No Heatsink Required
- Efficiency to 85%

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

Description

The RI series has been specifically designed for applications where board space is at a premium since these 2 Watt converters have only a slightly larger foot print than the RO series 1 Watt converters.

With efficiencies up to 87%, the full output power is available over the operating temperature range -40°C to +85°C and the converters can be used in ambient temperatures of up to 100°C with derating. The wide selection of input voltage and output voltage options plus an I/O-Isolation of 1kVDC as standard makes these converters suitable for many industrial applications.

Selection Guide

Part Number SIP4	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ¹⁾
RI-xx05S	5, 12, 15, 24	5	400	78-83	1200µF
RI-xx12S	5, 12, 15, 24	12	167	80-85	680µF
RI-xx15S	5, 12, 15, 24	15	133	80-85	680µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RI-0505S/P

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

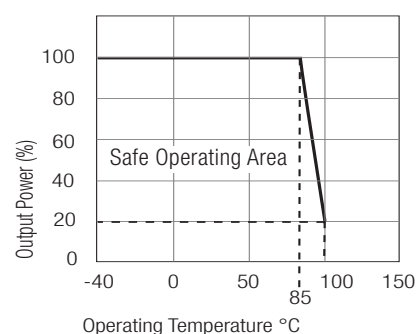
Input Voltage Range	±10%		
Output Voltage Accuracy	±5%		
Line Voltage Regulation	1.2%/1% of Vin typ.		
Load Voltage Regulation	5V Output types	15% max.	
(10% to 100% full load)	All others	10% max.	
Output Ripple and Noise (20MHz limited)	200mVp-p max.		
Operating Frequency	35kHz min. / 50kHz typ. / 85kHz max.		
Efficiency at Full Load	70% min. / 80% typ.		
Minimum Load = 0%	Specifications valid for 10% minimum load only.		
Isolation Voltage	(tested for 1 second)	1000VDC	
	((rated for 1 minute)	500VAC / 60Hz	
Isolation Capacitance	30pF min. / 85pF max.		
Isolation Resistance	10 GΩ min.		
Short Circuit Protection	1 Second		
P-Suffix	Continuous		
Operating Temperature Range (free air convection)	-40°C to +85°C (see Graph)		
Storage Temperature Range	-55°C to +125°C		
Relative Humidity	95% RH		
Package Weight	1.4g		
Packing Quantity	42 pcs per Tube		
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	845 x 10³ hours
(+85°C)		using MIL-HDBK 217F	160 x 10³ hours



EN-60950-1 Certified

RI

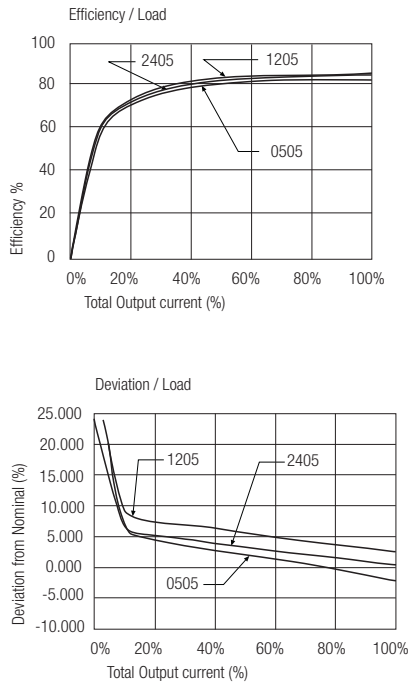
Derating-Graph (Ambient Temperature)



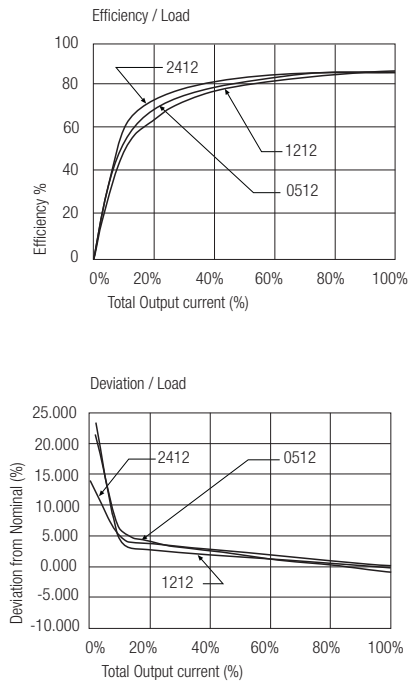
Refer to Application Notes

Typical Characteristics

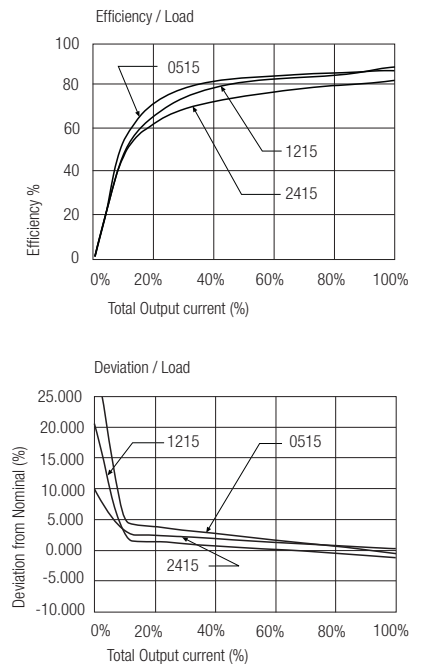
RI-xx05S



RI-xx12S



RI-xx15S



Notes

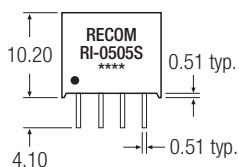
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

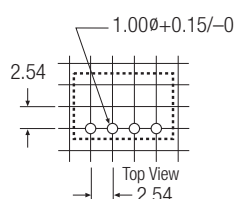
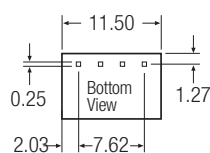
EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011

Package Style and Pinning (mm)

4 PIN SIP Package



Recommended Footprint Details



Pin Connections

Pin #	Dual
1	-Vin
2	+Vin
3	-Vout
4	+Vout
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

Features

Unregulated Converters

- Low Cost 2W Dual Output Converter
- Industry Standard SIP7 and DIP14 Packages
- Power Sharing on Outputs
- Optional Continuous Short Circuit Protected
- 1kVDC and 2kVDC Isolation Options
- UL94V-0 Package Material
- Efficiency to 86 %

Description

The RD series have been specifically designed for applications where dual power rails need to be created from a single rail supply and a low cost solution is required.

With efficiencies up to 85%, the full output power is available over the operating temperature range -40°C to +85°C and the converters can be used in ambient temperatures of up to 100°C with derating.

The wide selection of industry standard input voltage and output voltage options plus an I/O-Isolation of 1kVDC or 2kVDC makes these converters suitable for many industrial applications.

Selection Guide

Part Number	2kV	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RD-xx05D	(H)	5, 12, 24	±5	±200	75-82	±470µF
RD-xx12D	(H)	5, 12, 24	±12	±84	80-84	±330µF
RD-xx15D	(H)	5, 12, 24	±15	±66	82-86	±330µF
RD-xx24D	(H)	5, 12, 24	±24	±42	82-86	±100µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RD-0505D/P, RD-0505D/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range			±10%
Output Voltage Accuracy			±5%
Line Voltage Regulation			1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output types		20% max.
	5V output type		15% max.
	9V, 12V, 15V, 24V output types		10% max.
Output Ripple and Noise (20MHz limited)			150mVp-p max.
Operating Frequency			34kHz min. / 50kHz typ. / 85kHz max.
Efficiency at Full Load			70% min. / 80% typ.
Minimum Load = 0%			Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second)		1000VDC
	(rated for 1 minute)		500VAC / 60Hz
Isolation Voltage	H-Suffix	(tested for 1 second)	2000VDC
	H-Suffix	(rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance			40pF min. / 115pF max.
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
P-Suffix			Continuous
Operating Temperature Range (free air convection)			-40°C to +85°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Package Weight			2.8g
Packing Quantity			25 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	988 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	135 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

SIP7

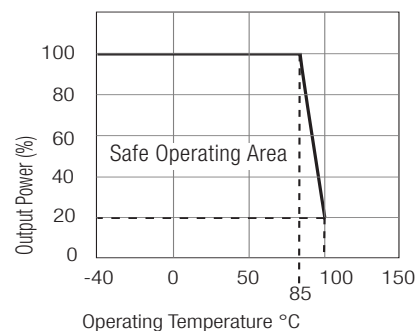
Dual Output



EN-60950-1 Certified

RD

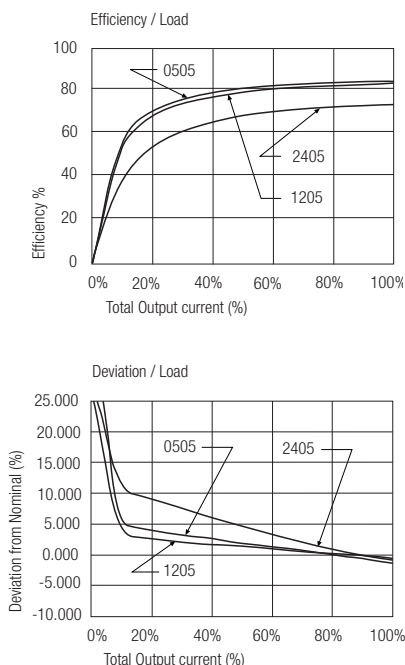
Derating-Graph (Ambient Temperature)



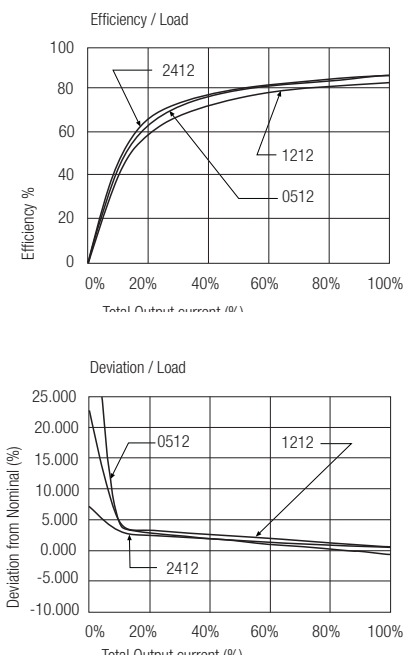
Refer to Application Notes

Typical Characteristics

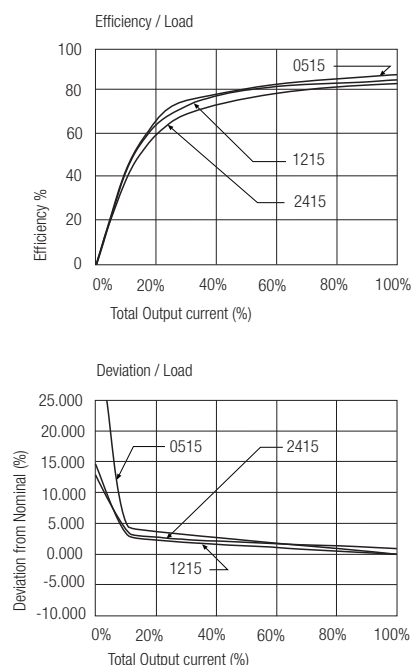
RD-xx05D



RD-xx12D



RD-xx15D



Notes

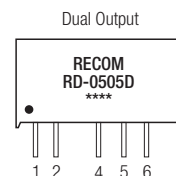
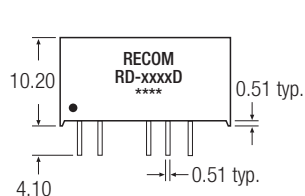
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Certifications

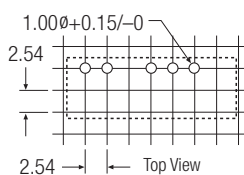
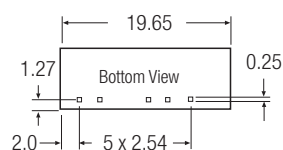
EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011

Package Style and Pinning (mm)

7 PIN SIP Package



Recommended Footprint Details



Pin Connections

Pin #	RD
1	+Vin
2	-Vin
4	-Vout
5	Com
6	+Vout

XX.X $\pm$ 0.5 mm
XX.XX $\pm$ 0.25 mm

Features

Unregulated Converters

- High Isolation 2W Converter
- Approved for Medical Applications
- Custom Solutions Available
- 3kVDC and 4kVDC Isolation Options
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Efficiency to 84 %
- Suitable for IGBT Applications

Description

The RKZ Series of 2W DC/DC Converters are certified to EN 60950-1 and to the medical standard EN-60601-1. This makes them suitable for high end industrial applications such as IGBT driver circuitry as well as standard medical applications. The RUZ converters are pin-compatible with the RK and RH converter series, offering a simple way to upgrade a 1W high isolation supply to 2W.

Selection Guide

Part Number	4kV	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RKZ-xx05S*	(H)	5, 12	5	400	82-84	1200µF
RKZ-xx12S*	(H)	5, 12	12	168	82-84	680µF
RKZ-xx15S*	(H)	5, 12	15	132	82-84	680µF
RKZ-xx05D*	(H)	5, 12	±5	±200	70-82	±470µF
RKZ-xx12D*	(H)	5, 12	±12	±84	82-84	±220µF
RKZ-xx15D*	(H)	5, 12	±15	±66	82-84	±220µF
RKZ-xx1509D*	(H)	5, 12, 24	+15/-9	+67/-111	70-81	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RKZ-0515D/P,

e.g. RKZ-0515D/HP has 4kV Isolation and is Short Circuit Protected.

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±5%	
Line Voltage Regulation	1.2%/1% of Vin typ.	
Load Voltage Regulation	5V type	15% max.
(10% to 100% load)	Other types, RKZ-xx1509D	10% max.
Output Ripple and Noise (20MHz limited)	150mVp-p max.	
Operating Frequency	35kHz min. / 50kHz typ. / 85kHz max.	
	RKZ-xx1509D	20kHz min. / 51kHz typ.
Efficiency at Full Load	70% min. / 80% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Isolation Voltage	(tested for 1 second)	3000VDC
	(rated for 1 minute)	1500VAC / 60Hz
Isolation Voltage	H-Suffix (tested for 1 second)	4000VDC
	H-Suffix (rated for 1 minute)	2000VAC / 60Hz
Isolation Capacitance	30pF min. / 110pF max.	
Isolation Resistance	15 GΩ min.	
Short Circuit Protection	1 sec	
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	2.8g	
Packing Quantity	25 pcs per Tube	
MTBF (+25°C)	Detailed Information see	using MIL-HDBK 217F 988 x 10 ³ hours
(+85°C)	Application Notes chapter "MTBF"	using MIL-HDBK 217F 135 x 10 ³ hours

ECONOLINE

DC/DC-Converter

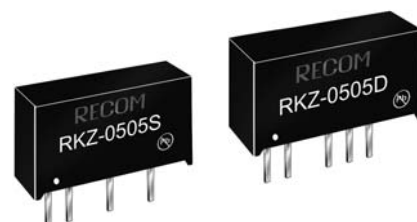
with 3 year Warranty

RECOM

2 Watt

SIP7

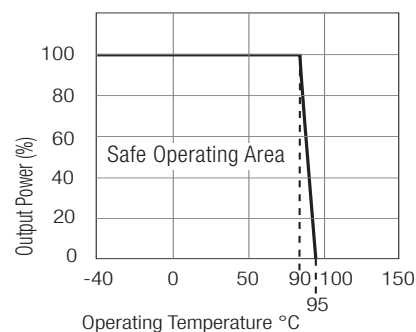
Single & Dual Output



EN-60950-1 Certified
IEC/EN-60601-1 Certified*
 * +15/-9 Version excluded

RKZ

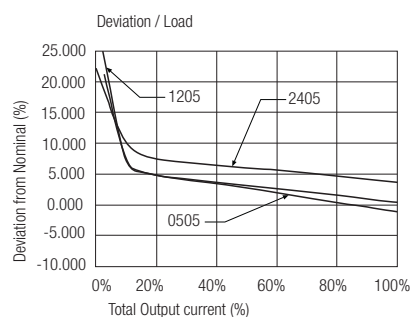
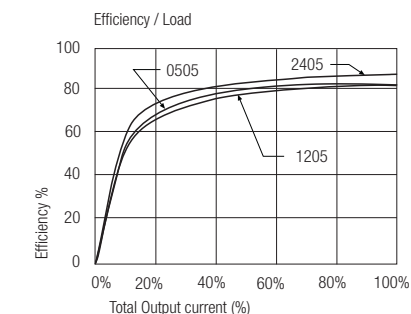
Derating-Graph (Ambient Temperature)



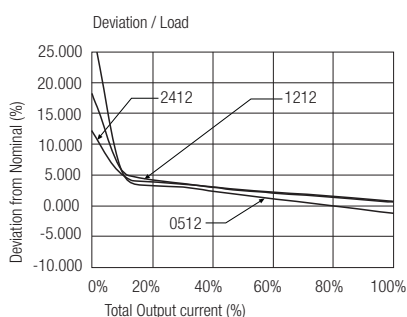
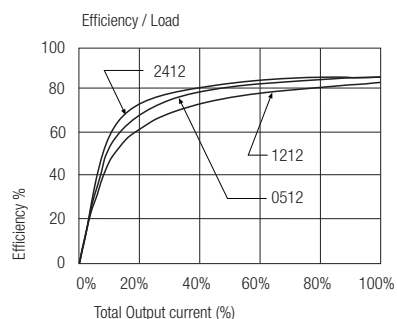
Refer to Application Notes

Typical Characteristics

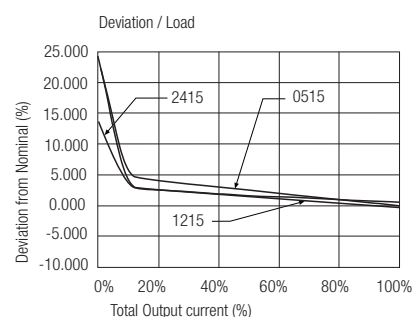
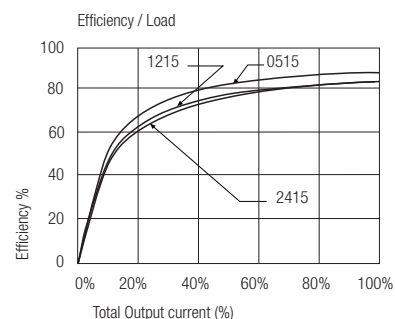
RKZ-xx05S



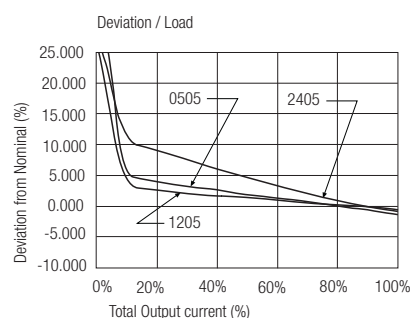
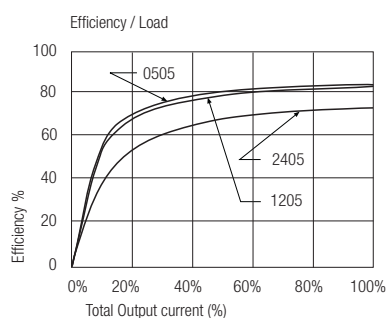
RKZ-xx12S



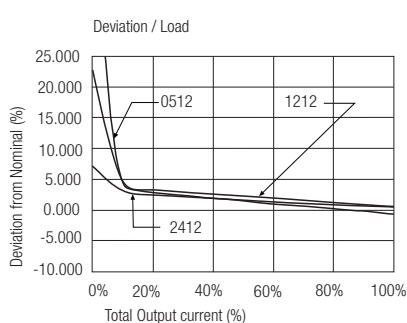
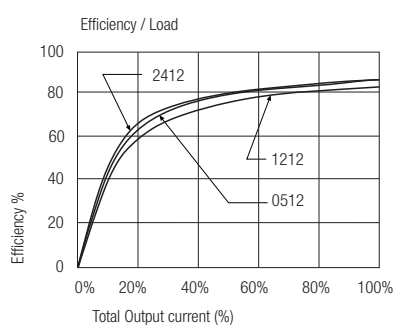
RKZ-xx15S



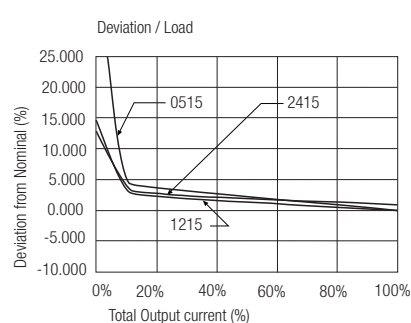
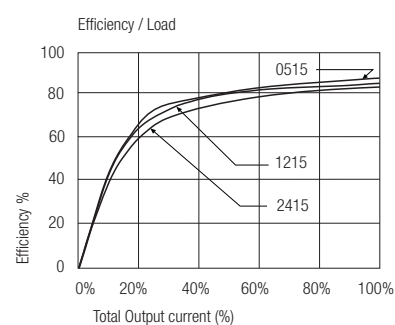
RKZ-xx05D



RKZ-xx12D



RKZ-xx15D

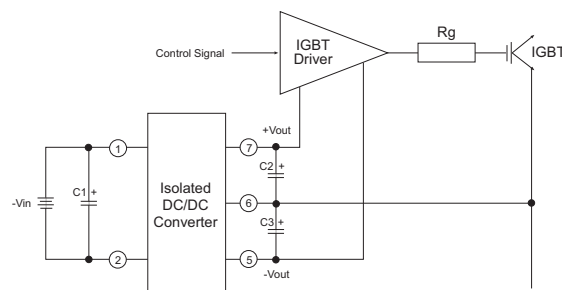


Typical Characteristics

Notes		
Note 1	Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.	
Certifications		
EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12:2011
EN Medical safety	Report: SPCMDD1205098-4	IEC/EN 60601-1:2006, 3rd Edition

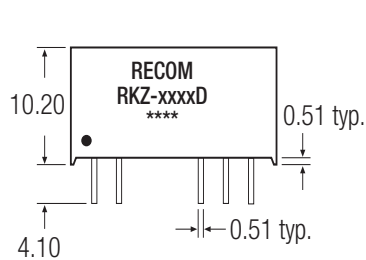
Application

IGBT Application Circuit

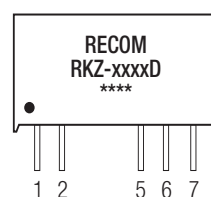


Package Style and Pinning (mm)

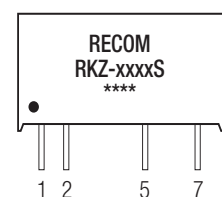
7 PIN SIP Package



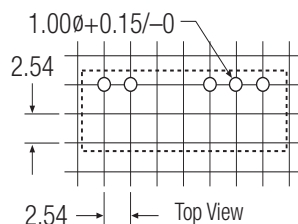
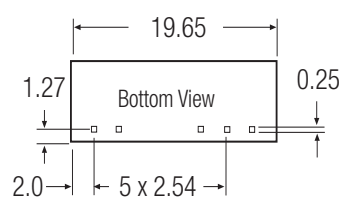
Dual Output



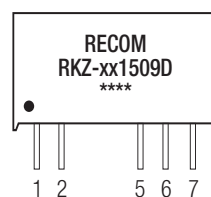
Single Output



Recommended Footprint Details



+15/-9 Output



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
5	-Vout	-Vout
6	No Pin	Com
7	+Vout	+Vout

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Features

Unregulated Converters

- UL/CSA and EN Safety certified
- EN-60601 for Medical Applications
- Isolation 6.4kVDC
- Optional Continuous Short Circuit Protected
- Unique Transformer System (Patent Pending)
- Compact SIP7 Package
- /X2 Version with >9mm Input/Output Clearance
- Suitable for IGBT Applications
- Very Low Isolation Capacitance

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
RxxP23.3S*	5, 12, 15, 24	3.3	600	70	3300µF
RxxP205S*	5, 12, 15, 24	5	400	70-75	1200µF
RxxP209S*	5, 12, 15, 24	9	222	70-75	1200µF
RxxP212S*	5, 12, 15, 24	12	167	70-75	680µF
RxxP215S*	5, 12, 15, 24	15	132	75-80	680µF
RxxP23.3D*	5, 12, 15, 24	±3.3	±300	70	±1500µF
RxxP205D*	5, 12, 15, 24	±5	±200	70-75	±470µF
RxxP209D*	5, 12, 15, 24	±9	±111	70-75	±470µF
RxxP212D*	5, 12, 15, 24	±12	±85	70-75	±330µF
RxxP215D*	5, 12, 15, 24	±15	±66	75-80	±330µF
RxxP21509D*	5, 12, 24	+15/-9	+67/-111	70-82	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R05P205S/P, R05P205D/P

* add Suffix "/X2" for single output with alternative pinout, e.g. R05P205S/X2, R05P205S/P/X2

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of V_{in} typ.
Load Voltage Regulation	3.3, 5V output types 15% max.
(10% to 100% full load)	other output types, RxxP21509D 10% max.
Output Ripple and Noise (20MHz BW)	200mVp-p max.
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.
	RxxP21509D 20kHz min. / 50kHz typ.
Efficiency at Full Load	65% min. / 80% max.
Minimum Load = 0%	Specifications valid for 10% minimum load only.
Isolation Voltage	(tested for 1 second) 6400VDC
	(rated for 1 minute) 3200VAC / 60Hz
Isolation Capacitance	1.5pF min / 10pF max.
Isolation Resistance	15 GΩ min.
Short Circuit Protection	1 Second
P-Suffix	Continuous
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)
Storage Temperature Range	-55°C to +125°C
Relative Humidity	95% RH
	cont.

ECONOLINE

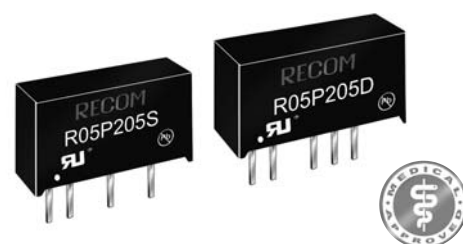
DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

SIP 7 Single & Dual Output



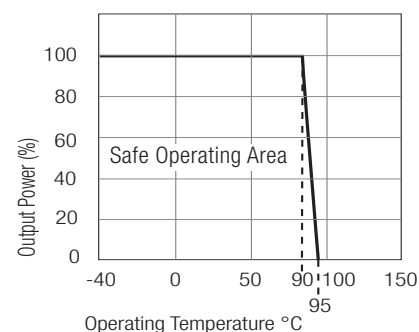
EN-60950-1 Certified
IEC/EN-60601-1 Certified*
UL/CSA 60950-1 Certified*
*** +15/-9 Version excluded**

RxxP2xx

Description

The RxxP2xxS_D Series of DC/DC Converters are certified to UL/CSA-60950 and UL/CSA 60601 as well as EN-60950 and EN60601. This makes them ideal for medical and safety applications where approved isolation is required. The /X2 version has an input/output clearance of more than 9mm.

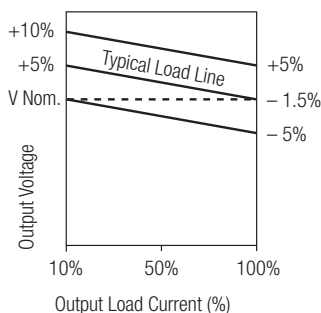
Derating-Graph (Ambient Temperature)



Refer to Application Notes

www.recom-electronic.com

Tolerance Envelope



Specifications (continued)

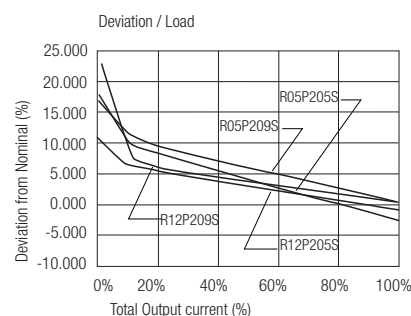
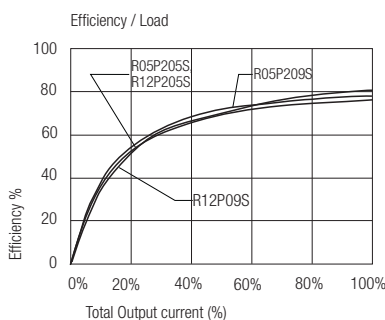
Package Weight					4.3g
Packing Quantity					25 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	Single/Dual	using MIL-HDBK 217F	2113/2434 x 10 ³ hours	
. (+85°C)		Single/Dual	using MIL-HDBK 217F	299/334 x 10 ³ hours	
Certifications	UL/cUL General Safety	Report: E358085	UL 60950-1 2nd Ed.		
	EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12: 2011		
	EN Medical Safety	Report: SPCMD1205098-4	IEC/EN60601-1:2006, 3rd Edition		

Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

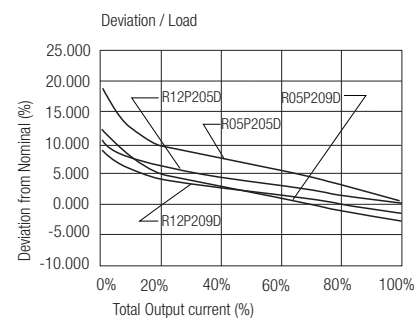
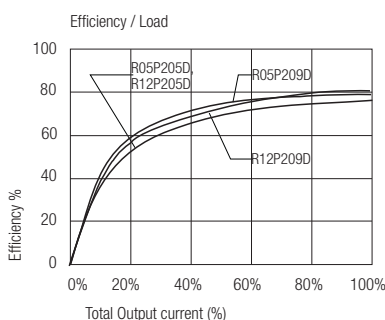
Typical Characteristics

RxxP20509S



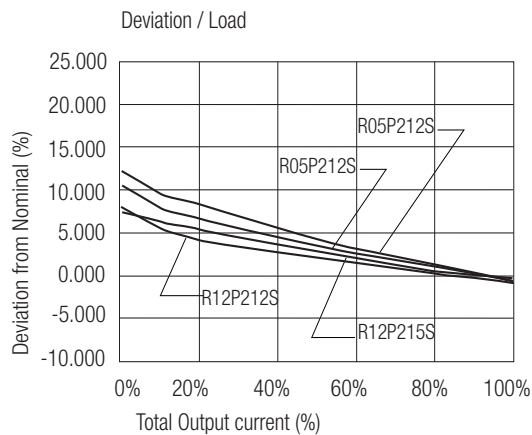
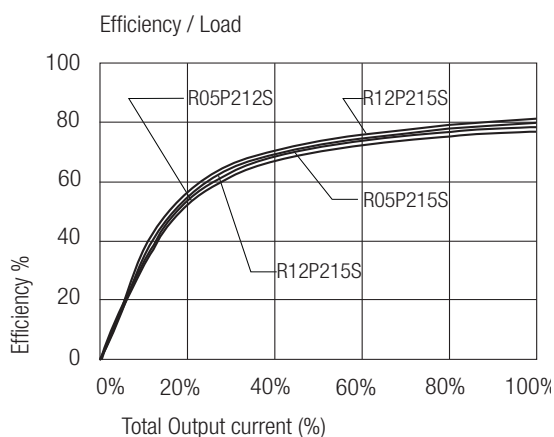
RxxP2xx

RxxP20509D

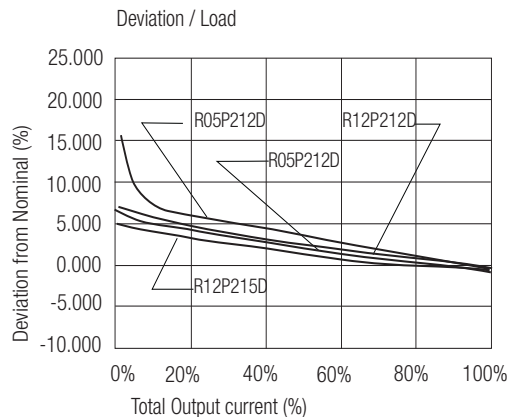
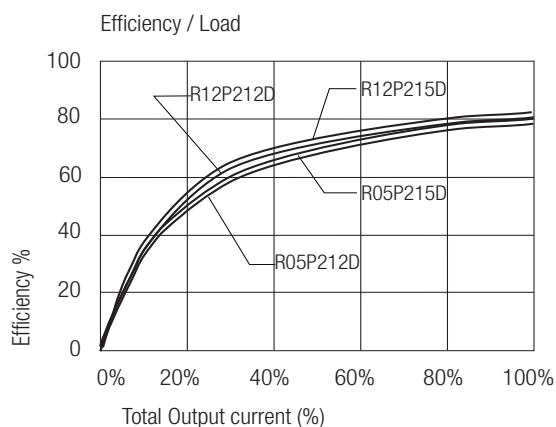


Typical Characteristics

RxxP21215S



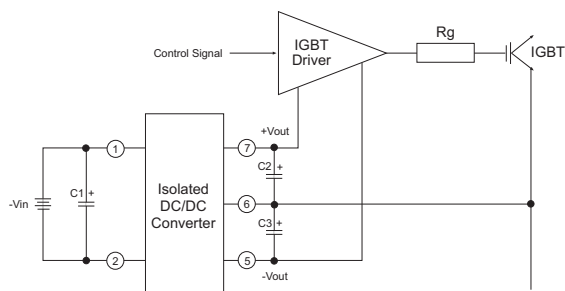
RxxP21215D



RxxP2xx

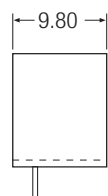
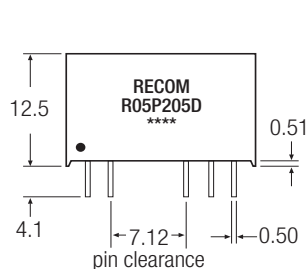
Application

IGBT Application Circuit

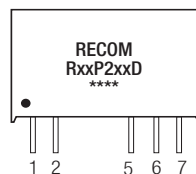


Package Style and Pinning (mm)

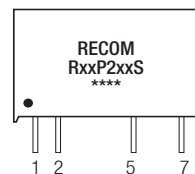
7 PIN SIP Package



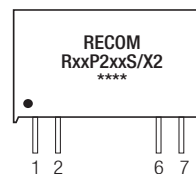
Dual Output



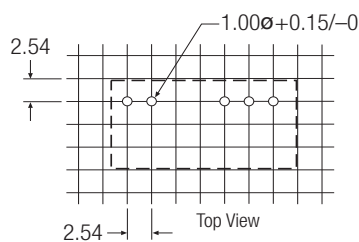
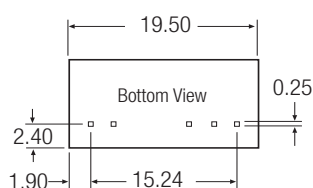
Single Output



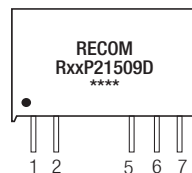
/X2 Single Output



Recommended Footprint Details



+15/-9 Output

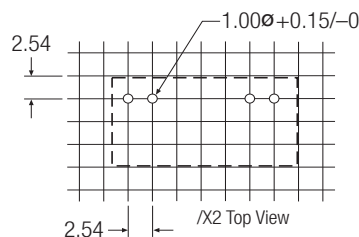
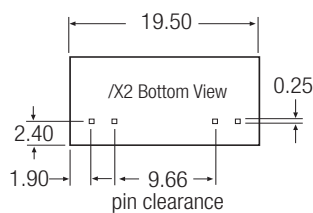


Pin Connections

Pin #	Single	Dual	/X2
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
5	-Vout	-Vout	No Pin
6	No Pin	Com	-Vout
7	+Vout	+Vout	+Vout

XX.X $\pm$ 0.5 mm

XX.XX $\pm$ 0.25 mm



Features

Unregulated Converters

- UL/CSA and EN Safety certified
- EN-61010 for Test, Measurement and Lab Use
- EN-60601 for Medical Applications
- Reinforced Isolation 6.4kVDC or 8kVDC
- Optional Continuous Short Circuit Protected
- Compact SIP7 Package
- Efficiency to 88%
- Very Low Isolation Capacitance
- /X2 Version with >9mm Input/Output Clearance

Selection Guide

Part Number SIP 7	Reinforced Isolation (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
RxxP23.3S	/R6.4 & /R8	5, 12, 15, 24	3.3	600	72-78	3300µF
RxxP205S	/R6.4 & /R8	5, 12, 15, 24	5	400	79-84	1200µF
RxxP209S	/R6.4 & /R8	5, 12, 15, 24	9	222	80-87	1200µF
RxxP212S	/R6.4 & /R8	5, 12, 15, 24	12	167	80-87	680µF
RxxP215S	/R6.4 & /R8	5, 12, 15, 24	15	132	80-88	680µF
RxxP23.3D	/R6.4 & /R8	5, 12, 15, 24	±3.3	±300	73-80	±1500µF
RxxP205D	/R6.4 & /R8	5, 12, 15, 24	±5	±200	79-85	±470µF
RxxP209D	/R6.4 & /R8	5, 12, 15, 24	±9	±111	80-87	±470µF
RxxP212D	/R6.4 & /R8	5, 12, 15, 24	±12	±85	80-87	±330µF
RxxP215D	/R6.4 & /R8	5, 12, 15, 24	±15	±66	80-88	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R05P205S/P, R05P205D/P

* add Suffix "/X2" for single output with alternative pinout, e.g. R05P205S/X2, R05P205S/P/X2

* add Suffix "/R6.4" or "/R8" for Reinforced Isolation, e.g. R05P205D/R6.4, R05P205S/P/X2/R8

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3, 5V output types 15% max. other output types 10% max.
Output Ripple and Noise (20MHz BW)	200mVp-p max.
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.
Efficiency at Full Load	65% min. / 80% max.
Minimum Load = 0%	Specifications valid for 10% minimum load only.
/R6.4	(tested for 1 second) 6400VDC (rated for 1 minute) 3200VAC / 60Hz
/R8	(tested for 1 second) 8000VDC (rated for 1 minute) 4000VAC / 60Hz
Isolation Capacitance	1.5pF min. / 10pF max.
Isolation Resistance	15 GΩ min.
Short Circuit Protection	1 Second
P-Suffix	Continuous
Operating Temperature Range (free air convection)	-40°C to +85°C (see Graph)
Storage Temperature Range	-55°C to +125°C
Relative Humidity	95% RH

cont.

ECONOLINE

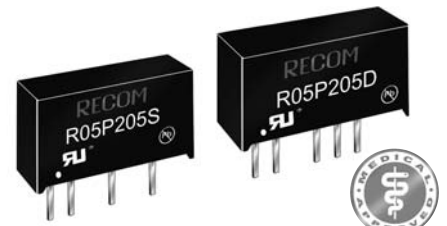
DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

SIP 7 Single & Dual Output



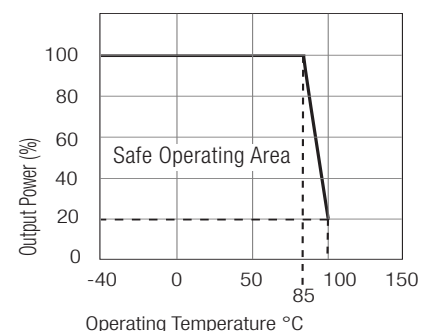
EN-60950-1 Certified
EN-60601-1 Certified
UL/CSA 60950-1 Certified
UL-60601 Certified
EN-61010-1 Certified
IEC-60601-1 CB Report

RxxP2xx/R

Description

The RxxP2xxS_D Series of DC/DC Converters are certified to UL/CSA-60950 and UL/CSA 60601. This makes them ideal for medical and safety applications where approved or reinforced isolation is required. The reinforced versions are also EN61010-1 certified for Lab Equipment. The /X2 version has an input/output clearance of more than 9mm.

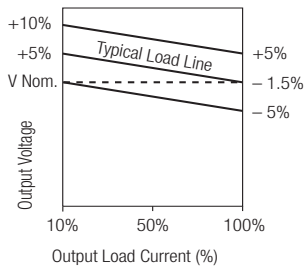
Derating-Graph (Ambient Temperature)



Refer to Application Notes

www.recom-electronic.com

Tolerance Envelope



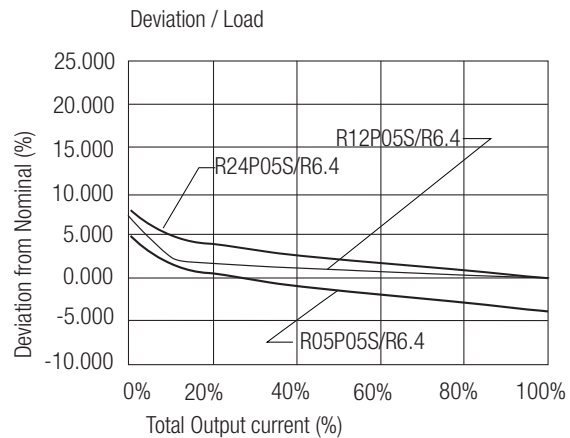
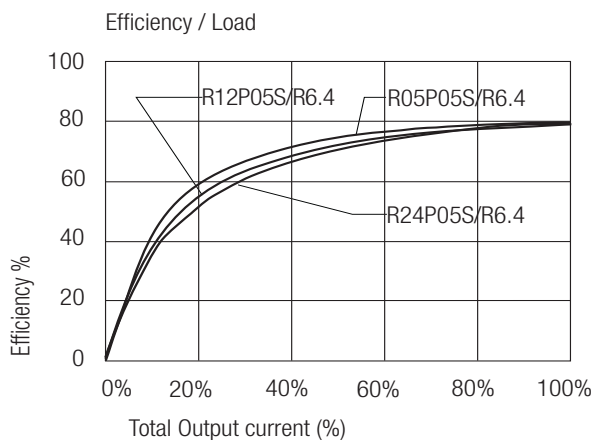
Specifications (continued)

Package Weight		4.3g
Packing Quantity		25 pcs per Tube
MTBF (+25°C)		1154 x 10 ³ hours
. (+85°C)		168 x 10 ³ hours
Reinforced Isolation		Reinforced
Transformer Creepage	/R6.4 Types	5.5 mm min.
Transformer Clearance	/R6.4 Types	5.5 mm min.
PCB Creepage & Clearance	/R6.4 Types	4.8 mm min.
Certifications		
Measurement, Control and Laboratory Use Safety	Report: T1301251-313	EN 61010-1 : 2010
CSA General Safety		UL 60950-1 1st Ed.
		C22.2 No. 60950-1-03
UL/cUL Medical Safety	Report: E314885-A2-UL	UL60601-1 1st Edition
CSA Medical Safety	Report: 2207629	CAN/CSA-22.2 No 601.1-M90
EN General Safety	Report: PS-R7219C1	EN60950-1:2001 + A11: 2004
CB/EN Medical Safety	Report: CA/11578A1/CSA	IEC/EN 60601-1

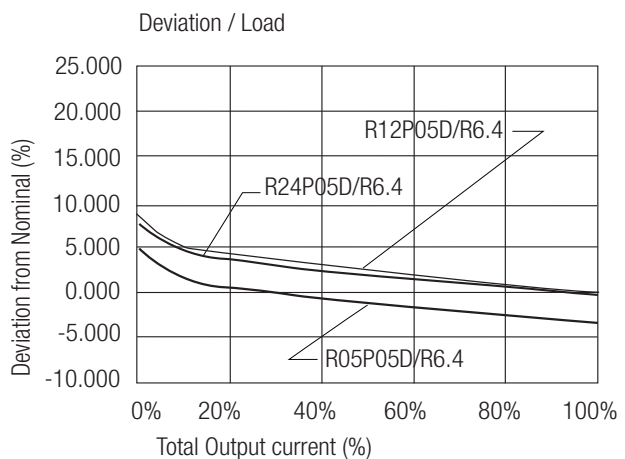
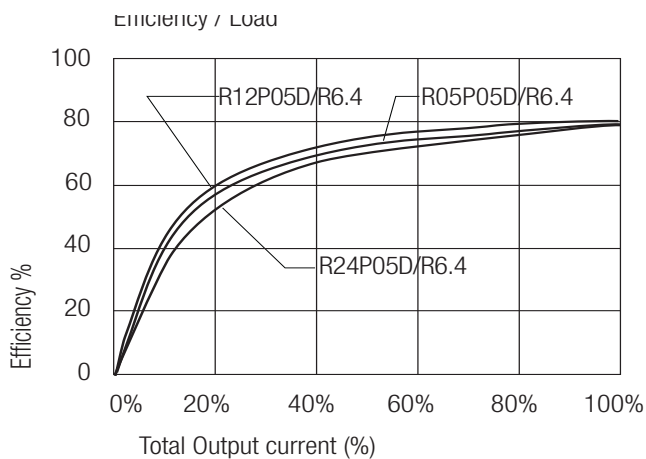
Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

RxxP205S/R6.4 RxxP205S/R8



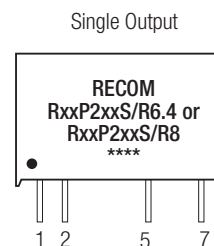
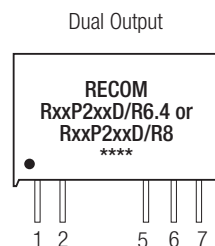
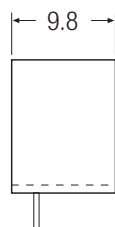
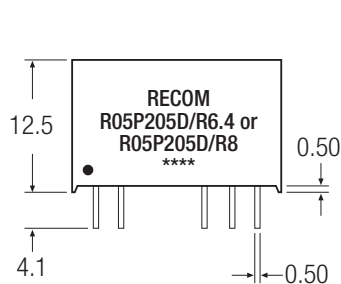
RxxP205D/R6.4 RxxP205D/R8



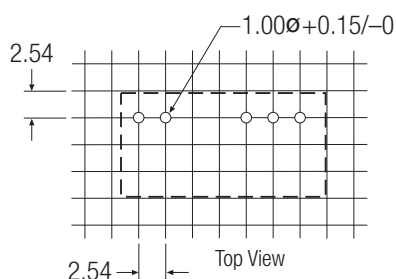
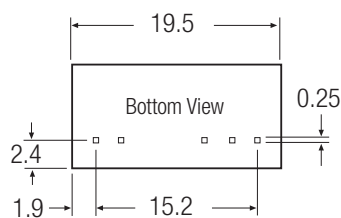
Package Style and Pinning (mm)

7 PIN SIP Package

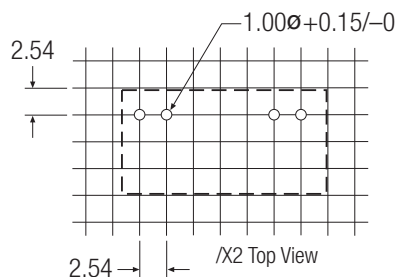
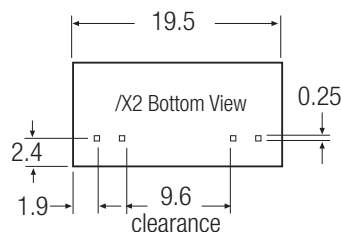
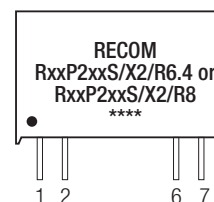
3rd angle projection



Recommended Footprint Details



/X2 Single Output



Pin Connections

Pin #	Single	Dual	/X2
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
5	-Vout	-Vout	No Pin
6	No Pin	Com	-Vout
7	+Vout	+Vout	+Vout

XX.X $\pm$ 0.5 mm
XX.XX $\pm$ 0.25 mm

Features

Unregulated Converters

- Dual Output from a Single Input Rail
- Input/Output Isolation 1kVDC or 2kVDC
- Output/Output Isolation 1kVDC
- Power Sharing on Outputs
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- No External Components Required
- Efficiency to 85 %

Description

The RUZ DC/DC converter offers two independent isolated outputs. Typical applications include multiple channel circuits where inter-channel isolation is also required.

The /H option offers 2kVDC isolation between input and outputs. The /P option is with continuous short circuit protection on either or both outputs.

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (V1VDC)	Output Voltage (V2VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
SIP 7	2kV						
RUZ-050505	(H)	5	5	5	200/200	70	470µF/470µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RUZ-050505/P, RUZ-050505/H/P

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range			±10%
Output Voltage Accuracy			±5%
Line Voltage Regulation			1.2%/1% of V_{in} typ.
Load Voltage Regulation ((10% to 100% full load)			15% max.
Output Ripple and Noise (20MHz limited)			150mVp-p max.
Operating Frequency			20kHz min. / 50kHz typ. / 85kHz max.
Efficiency at Full Load			70% min. / 80% typ.
Minimum Load = 0%	Specifications valid for 10% minimum load only.		
Isolation Voltage		(tested for 1 second)	1000VDC
Input/Output and Output/Output		(rated for 1 minute)	3200VAC / 60Hz
Isolation Voltage	H-suffix	(tested for 1 second)	2000VDC
Input/Output	H-suffix	(rated for 1 minute)	1000VAC / 60Hz
Output/Output		(tested for 1 second)	1000VDC
Isolation Capacitance			40pF min. / 120pF max.
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
P-Suffix			Continuous
Operating Temperature Range (free air convection)			-40°C to +85°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Package Weight			2.8g
Packing Quantity			25 pcs per Tube
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	988 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	135 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

SIP7

Isolated

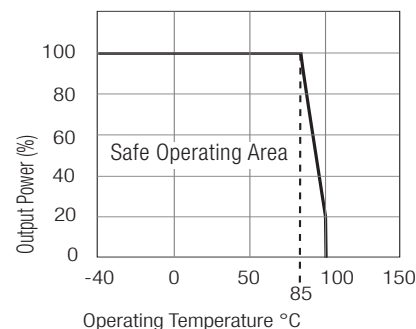
Dual Output



EN-60950-1 Certified

RUZ

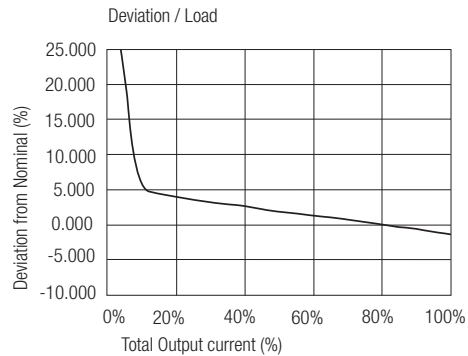
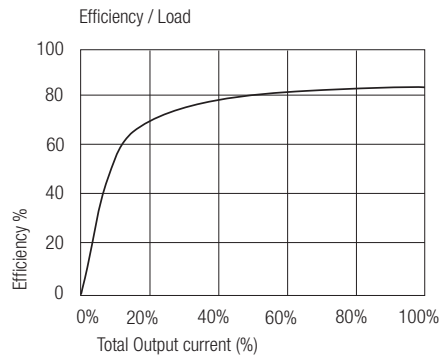
Derating-Graph (Ambient Temperature)



Refer to Application Notes

www.recom-electronic.com

Typical Characteristics



Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

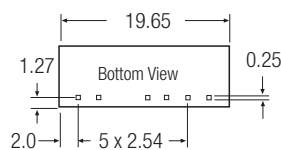
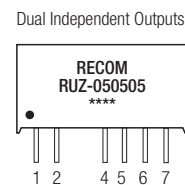
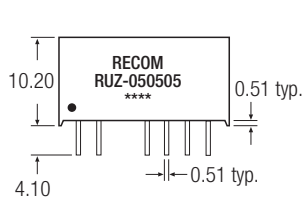
Certifications

EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011

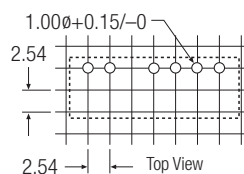
Package Style and Pinning (mm)

7 PIN SIP Package

3rd angle projection



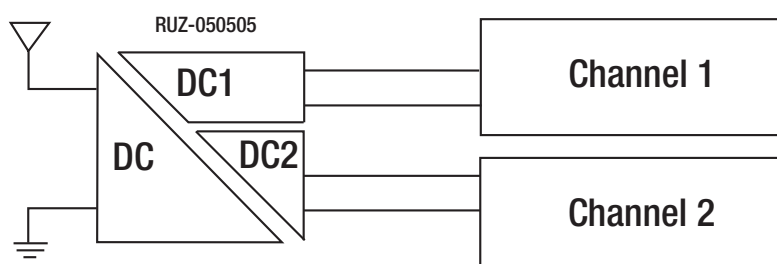
Recommended Footprint Details



Pin Connections

Pin #	Single
1	+Vin
2	-Vin
4	+Vout 1
5	-Vout 1
6	+Vout 2
7	-Vout 2
XX.X ± 0.5 mm	
XX.XX ± 0.25 mm	

Typical Application



Features

Unregulated Converters

- 2W Single and Dual Outputs in DIP 14
- 3kVDC or 4kVDC Isolation
- Optional Continuous Short Circuit Protected
- Custom Solutions Available
- UL94V-0 Package Material
- Efficiency up to 85%
- Suitable for IGBT Applications

Description

The RJZ and RGZ series converters are available in DIP14 packages, so can be used for applications where component height is restricted.

The wide selection of input voltage and output voltage options plus an I/O-Isolation of 3kVDC or 4kVDC as standard makes these converters suitable for many industrial, medical and IGBT applications.

Selection Guide

Part Number		Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
DIP 14	4kV					
RJZ-xx3.3S*	(H)	3.3,5,9,12,15,24	3.3	606	70-75	3300µF
RJZ-xx05S*	(H)	3.3,5,9,12,15,24	5	400	78-85	1200µF
RJZ-xx09S*	(H)	3.3,5,9,12,15,24	9	222	78-84	1200µF
RJZ-xx12S*	(H)	3.3,5,9,12,15,24	12	166	80-85	680µF
RJZ-xx15S*	(H)	3.3,5,9,12,15,24	15	133	82-85	680µF
RJZ-xx24S*	(H)	3.3,5,9,12,15,24	24	83	80-85	220µF
RGZ-xx3.3D*	(H)	3.3,5,9,12,15,24	±3.3	±303	75	±1500µF
RGZ-xx05D*	(H)	3.3,5,9,12,15,24	±5	±200	75-82	±470µF
RGZ-xx09D*	(H)	3.3,5,9,12,15,24	±9	±111	75-80	±470µF
RGZ-xx12D*	(H)	3.3,5,9,12,15,24	±12	±84	78-82	±220µF
RGZ-xx15D*	(H)	3.3,5,9,12,15,24	±15	±66	80-84	±220µF
RGZ-xx24D*	(H)	3.3,5,9,12,15,24	±24	±42	82-84	±100µF
RGZ-xx1509D*	(H)	5, 12, 24	+15/-9	+67/-111	70-81	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RGZ-0524D/P, RJZ-0505S/HP

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V Types ±20% max. 5V Types ±15% max. All other Types, RGZ-xx1509D ±10% max.
Output Ripple and Noise (20MHz limited)	±150mVp-p max.
Temperature Coefficient	0.02%/°C max.
Operating Frequency	20kHz min. / 50kHz typ. / 90kHz max. RGZ-xx1509D 20kHz min. / 45kHz typ.
Efficiency at Full Load	70% min. / 80% typ.
Minimum Load = 0%	Specifications valid for 10% minimum load only.
Isolation Voltage (tested for 1 second)	3000VDC
(rated for 1 minute)	1500VAC / 60Hz
Isolation Voltage H-Suffix (tested for 1 second)	4000VDC min.
H-Suffix (rated for 1 minute)	2000VAC / 60Hz
Isolation Capacitance	120pF max.
Isolation Resistance	15GΩ min.
Short Circuit Protection P-Suffix	1 Second Continuous
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)

cont.

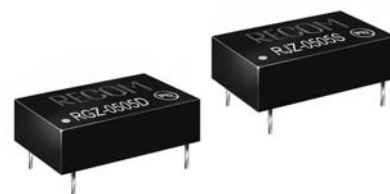
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

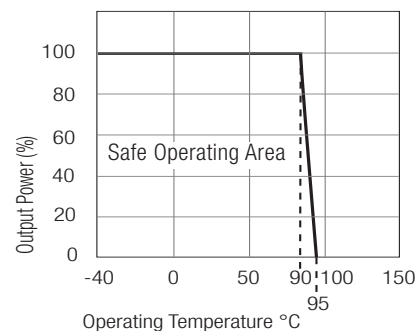
2 Watt DIP14 Single & Dual Output



EN-60950-1 Certified
IEC/EN-60601-1 Certified*
*** +15/-9 Version excluded**

RJZ_RGZ

Derating-Graph (Ambient Temperature)



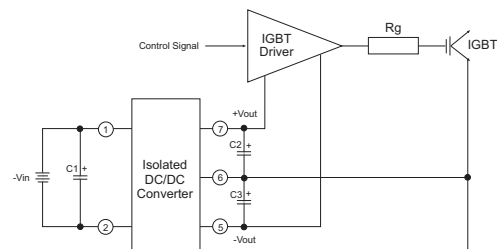
Refer to Application Notes

www.recom-electronic.com

Specifications - continued

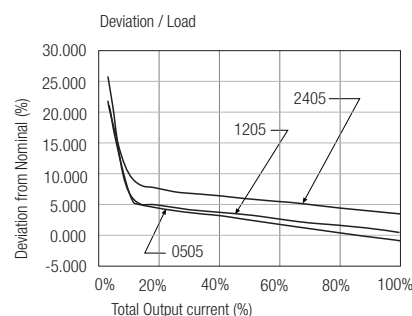
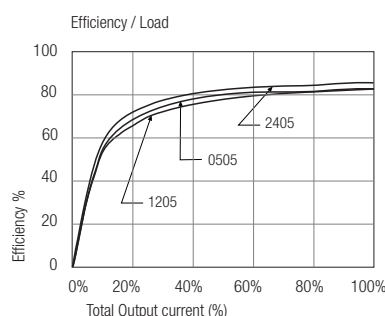
Storage Temperature Range	-55°C to +125°C		
Relative Humidity	95% RH		
Package Weight	2.8g		
Packing Quantity	24 pcs per Tube		
MTBF (+25°C)	using MIL-HDBK 217F	RJZ types	893 x 10 ³ hours
}	Detailed Information see Application Notes chapter "MTBF"	RGZ types	810 x 10 ³ hours
(+85°C)	using MIL-HDBK 217F	RJZ types	208 x 10 ³ hours
		RGZ types	151 x 10 ³ hours

IGBT Application Circuit

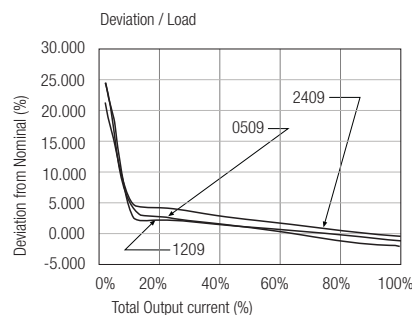
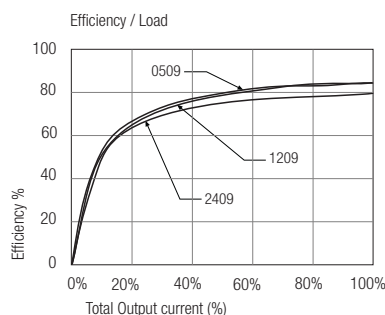


Typical Characteristics

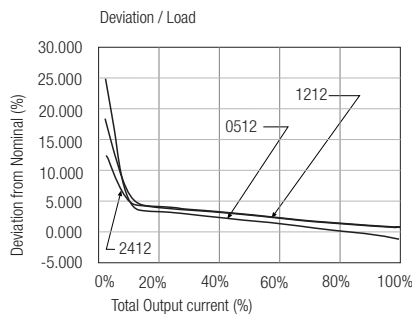
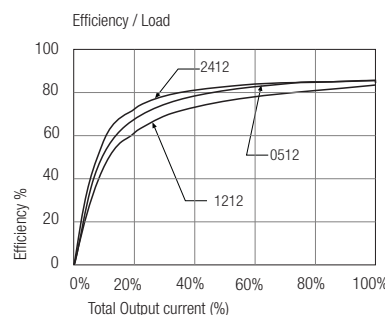
RJZ-xx05S



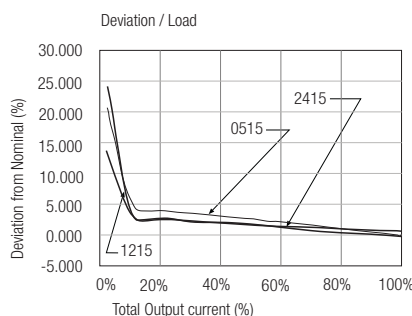
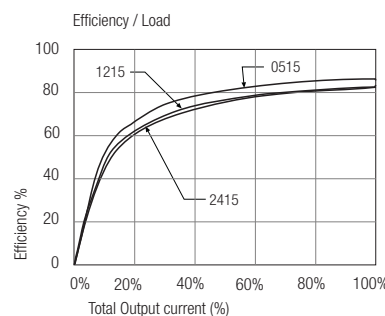
RJZ-xx09S



RJZ-xx12S

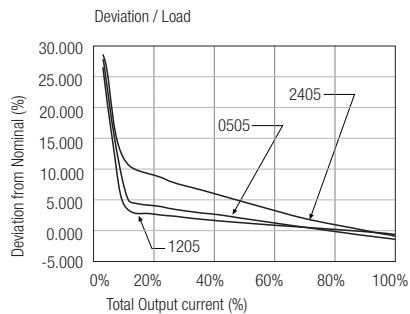
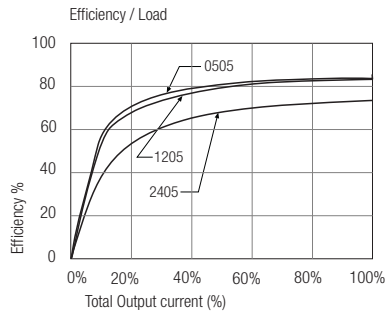


RJZ-xx15S

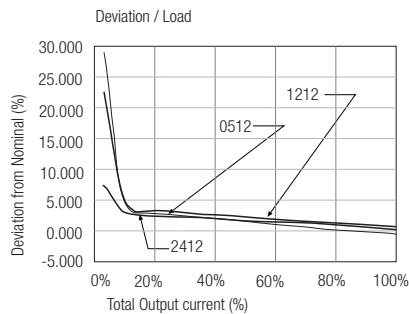
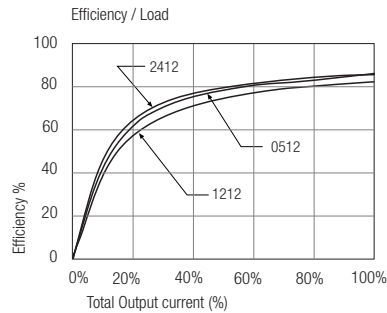


Typical Characteristics

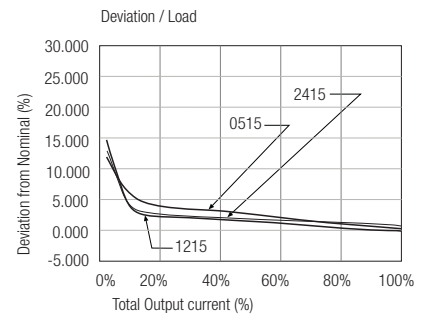
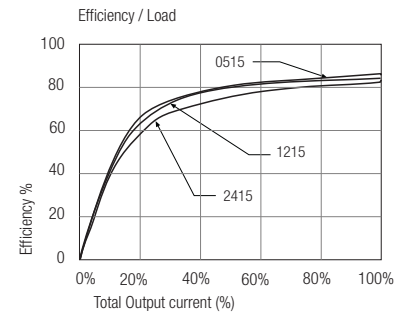
RGZ-xx05D



RGZ-xx12D



RGZ-xx15D



Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

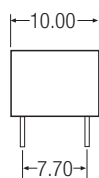
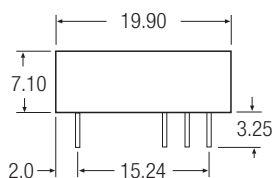
Certifications

EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011
EN Medical Safety Report: SPCMD120598-4 IEC/EN 60601-1:2006, 3rd Edition

RJZ_RGZ

Package Style and Pinning (mm)

14 PIN DIP Package



Single Output



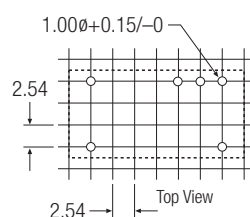
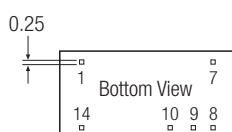
Dual Output



+15/-9 Output



Recommended Footprint Details



Pin Connections

Pin #	RJZ	RGZ
1	-Vin	-Vin
7	NC	NC
8	+Vout	+Vout
9	No Pin	Com
10	-Vout	-Vout
14	+Vin	+Vin

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converters

- UL/CSA and EN-60950-1 Safety certified
- EN-60601 for Medical Applications
- 6kVDC Isolation
- Optional Continuous Short Circuit Protection
- Efficiency up to 82%
- Space Saving „Skinny DIP“ Package
- Very Low Isolation Capacitance
- Suitable for IGBT Applications

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
SIP 7					
RV-xx3.3S*	3.3, 5, 12, 15, 24	3.3	600	70	3300µF
RV-xx05S*	3.3, 5, 12, 15, 24	5	400	70-75	1200µF
RV-xx09S*	3.3, 5, 12, 15, 24	9	222	70-75	1200µF
RV-xx12S*	3.3, 5, 12, 15, 24	12	167	70-75	680µF
RV-xx15S*	3.3, 5, 12, 15, 24	15	132	75-80	680µF
RV-xx24S*	3.3, 5, 12, 15, 24	24	83	75-80	220µF
RV-xx3.3D*	3.3, 5, 12, 15, 24	±3.3	±300	70	±1500µF
RV-xx05D*	3.3, 5, 12, 15, 24	±5	±200	70-75	±470µF
RV-xx09D*	3.3, 5, 12, 15, 24	±9	±111	70-75	±470µF
RV-xx12D*	3.3, 5, 12, 15, 24	±12	±85	70-75	±220µF
RV-xx15D*	3.3, 5, 12, 15, 24	±15	±66	75-80	±220µF
RV-xx24D*	3.3, 5, 12, 15, 24	±24	±42	75-80	±100µF
RV-xx1509D	5, 12, 24	+15/-9	+67/-111	70-82	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RV-0505S/P, RV-0505D/P

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±5%	
Line Voltage Regulation	1.2%/1% of V_{in} typ.	
Load Voltage Regulation	3.3V output types	20% max.
(10% to 100% full load)	5V output type	15% max.
	9V, 12V, 15V, 24V output types, RV-xx1509D	10% max.
Output Ripple and Noise (20MHz limited)	200mVp-p max.	
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.	
	RV-xx1509D	20kHz min. / 47kHz typ.
Efficiency at Full Load	70% min. / 75% typ.	
Minimum Load = 0%	Specifications valid for 10% minimum load only.	
Isolation Voltage	(tested for 1 second)	6000VDC
	(rated for 1 minute)	3000VAC / 60Hz
Isolation Capacitance	2pF min. / 12pF max.	
Isolation Resistance	15 GΩ min.	
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range (free air convection, without derating)	-40°C to +90°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	9g	
Packing Quantity	15 pcs per Tube	
	cont.	

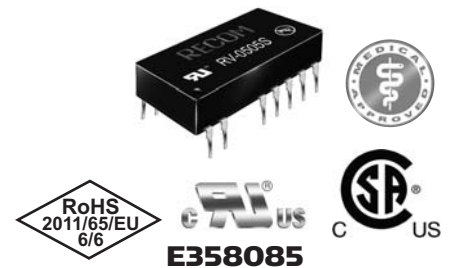
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt DIP24 Miniature Single & Dual Output



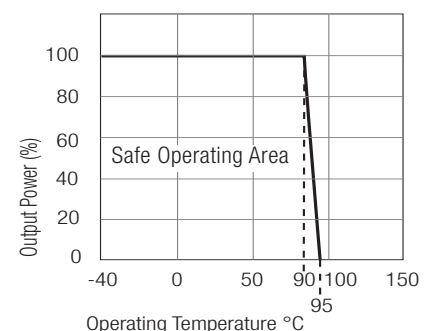
EN-60950-1 Certified
IEC/EN-60601-1 Certified*
UL/CSA 60950-1 Certified*
*** +15/-9 Version excluded**

RV

Description

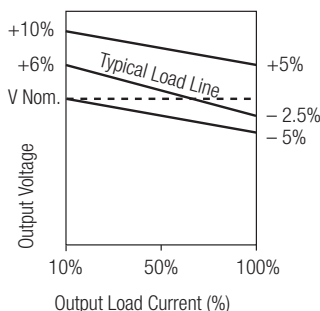
Very high isolation in a small size are the main features of this miniature DIP24 converter, ideal for highly sophisticated industrial, test and measurement and medical designs where board space is at a premium.

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Tolerance Envelope



Specifications (continued)

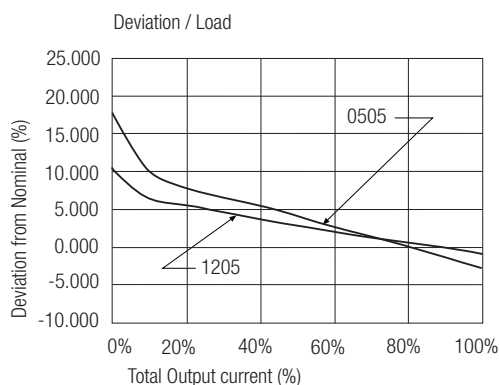
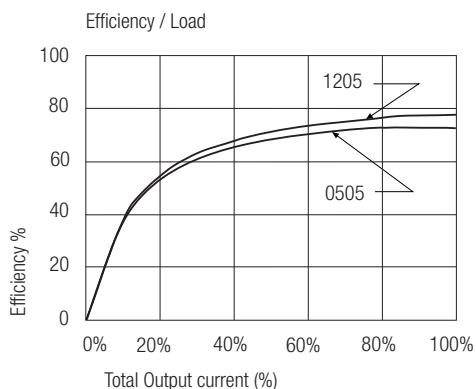
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1154 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	168 x 10 ³ hours
Certifications	UL/cUL General Safety	Report: E358085	UL 60950-1 2nd Ed.
	EN General Safety	Report: SPCLVD1109103	EN60950-1:2006 + A12: 2011
	EN Medical Safety	Report: SPCMDD1205098-4	IEC/EN60601-1:2006, 3rd Edition

Notes

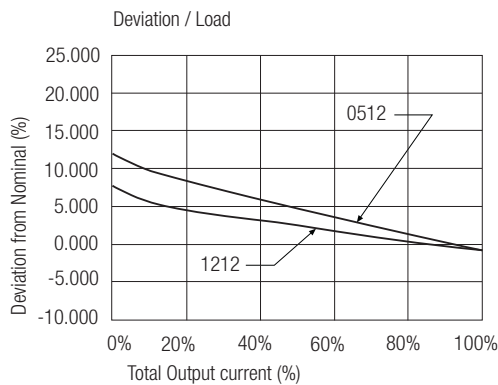
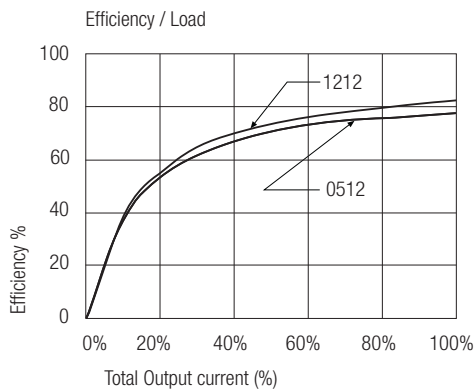
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Characteristics

RV-xx05S

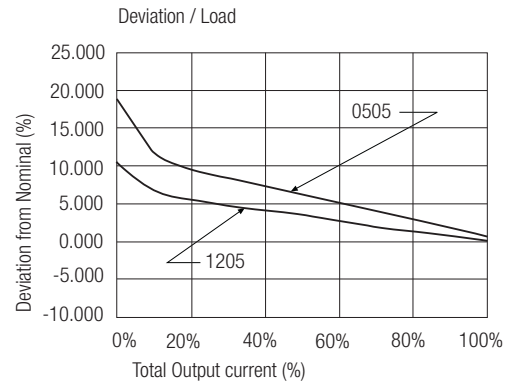
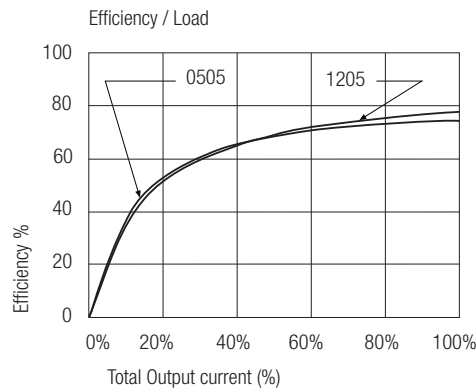


RV-xx12S

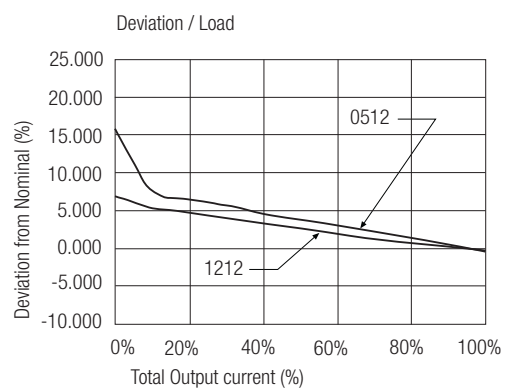
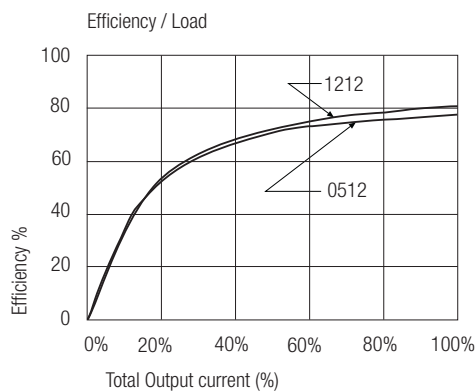


Typical Characteristics

RV-xx05D

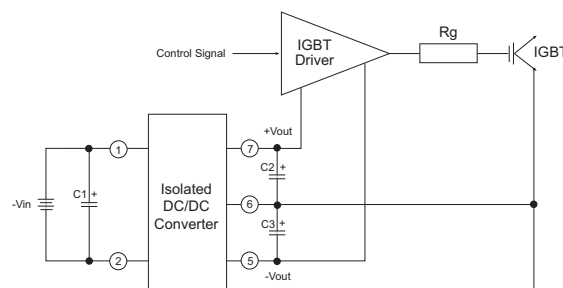


RV-xx12D



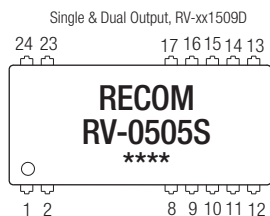
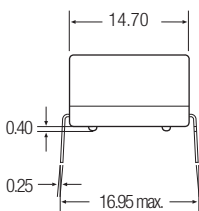
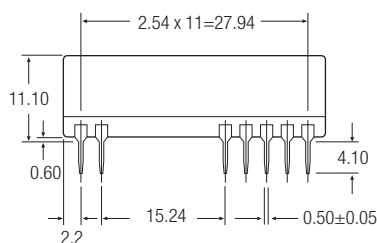
Applications

IGBT Application Circuit

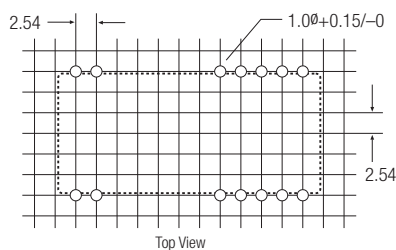
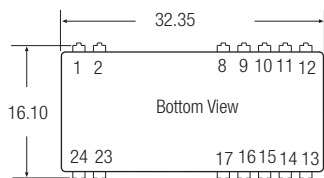


Package Style and Pinning (mm)

24 PIN DIP Miniature Package Style



Recommended Footprint Details



Pin Connections

Pin #	Single
1	+Vin
2	-Vin
8, 9, 11, 14	NC
10, 15	-Vout
12 & 13	+Vout
16, 17, 23, 24	NC

NC = No Connection

Pin Connections

Pin #	Dual
1	+Vin
2	-Vin
8, 17	-Vout
9, 11, 14, 16, 23, 24	NC
10 & 15	Com
12, 13	+Vout

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Unregulated Converters

- UL/CSA and EN-60950-1 Safety certified
- EN-61010 for Test, Measurement and Lab Use
- UL/CSA and EN-60601 for Medical Applications
- 6.4kVDC or 8kV Reinforced Isolation
- Optional Continuous Short Circuit Protection
- Efficiency to 88%
- Space Saving „Skinny DIP“ Package
- Very Low Isolation Capacitance

Selection Guide

Part Number SIP 7	Reinforced Isolation (kVDC)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency Std (%)	Max Capacitive Load ⁽¹⁾
RV-xx3.3S	/R6.4 & /R8	3.3, 5, 12, 15, 24	3.3	600	70-78	3300µF
RV-xx05S	/R6.4 & /R8	3.3, 5, 12, 15, 24	5	400	76-80	1200µF
RV-xx09S	/R6.4 & /R8	3.3, 5, 12, 15, 24	9	222	78-85	1200µF
RV-xx12S	/R6.4 & /R8	3.3, 5, 12, 15, 24	12	167	78-85	680µF
RV-xx15S	/R6.4 & /R8	3.3, 5, 12, 15, 24	15	132	78-88	680µF
RV-xx3.3D	/R6.4 & /R8	3.3, 5, 12, 15, 24	±3.3	±300	70-78	±1500µF
RV-xx05D	/R6.4 & /R8	3.3, 5, 12, 15, 24	±5	±200	75-82	±470µF
RV-xx09D	/R6.4 & /R8	3.3, 5, 12, 15, 24	±9	±111	76-84	±470µF
RV-xx12D	/R6.4 & /R8	3.3, 5, 12, 15, 24	±12	±85	78-86	±220µF
RV-xx15D	/R6.4 & /R8	3.3, 5, 12, 15, 24	±15	±66	78-86	±220µF

xx = Input Voltage. Other input and output voltage combinations available on request.

No suffix is 6kVDC functional isolation

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RV-0505S/P, RV-0505D/P

* add Suffix "/R6.4" or "/R8" for Reinforced Isolation, e.g. RV-0505S/R6.4, RV-0505D/P/R8

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%
Output Voltage Accuracy	±5%
Line Voltage Regulation	1.2%/1% of V_{in} typ.
Load Voltage Regulation (10% to 100% full load)	3.3V output types 20% max. 5V output type 15% max. 9V, 12V, 15V, 24V output types 10% max.
Output Ripple and Noise (20MHz limited)	200mVp-p max.
Operating Frequency	20kHz min. / 50kHz typ. / 85kHz max.
Efficiency at Full Load	70% min. / 75% typ.
Minimum Load = 0%	Specifications valid for 10% minimum load only.
/R6.4	(tested for 1 second) 6400VDC (rated for 1 minute) 3200VAC / 60Hz
/R8	(tested for 1 second) 8000VDC (rated for 1 minute) 4000VAC / 60Hz
Isolation Capacitance	2pF min. / 12pF max.
Isolation Resistance	15 GΩ min.
Short Circuit Protection P-Suffix	1 Second Continuous
Operating Temperature Range (free air convection)	-40°C to +85°C (see Graph)
Storage Temperature Range	-55°C to +125°C
Relative Humidity	95% RH
Package Weight	9g
Packing Quantity	15 pcs per Tube cont.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt DIP24 Miniature Single & Dual Output



E-224736



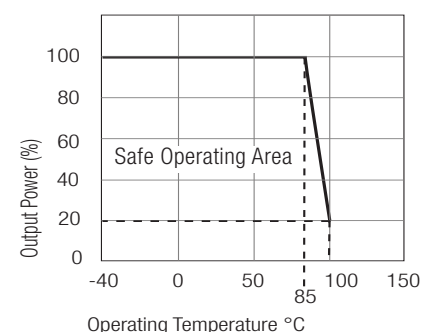
EN-60950-1 Certified
EN-60601-1 Certified
UL/CSA 60950-1 Certified
UL-60601-1 Certified
EN-61010-1 Certified
IEC-60601-1 CB Report

RV/R

Description

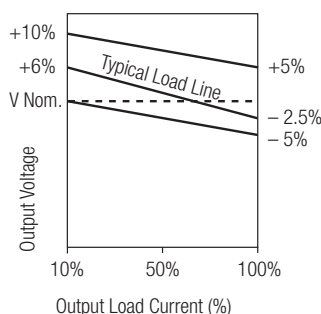
Very high isolation in a small size are the main features of this miniature DIP24 converter, ideal for highly sophisticated industrial, test and measurement and medical designs where board space is at a premium.

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Tolerance Envelope



Specifications (continued)

MTBF (+25°C) } <i>Detailed Information see</i>		using MIL-HDBK 217F	1154 x 10 ³ hours
(+85°C) } <i>Application Notes chapter "MTBF"</i>		using MIL-HDBK 217F	168 x 10 ³ hours
Reinforced Isolation	Transformer Creepage	/R6.4 Types	5.5 mm min.
	Transformer Clearance	/R6.4 Types	5.5 mm min.
	PCB Creepage & Clearance	/R6.4 Types	4.8 mm min.
Certifications			
Measurement, Control and Laboratory Use Safety		Report: T1301251-313	EN 61010-1 : 2010
CSA General Safety			UL 60950-1 1st Ed.
			C22.2 No. 60950-1-03
UL/cUL Medical Safety		Report: E314885-A2-UL	UL60601-1 1st Edition
CSA Medical Safety		Report: 2207629	CAN/CSA-22.2 No 601.1-M90
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EN Medical Safety		Report: CA/11578A1/CSA	IEC/EN 60601-1

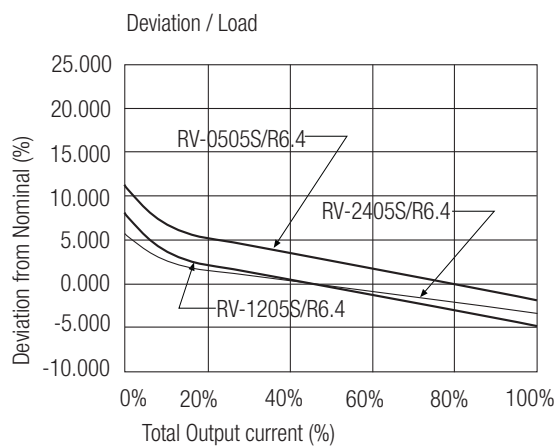
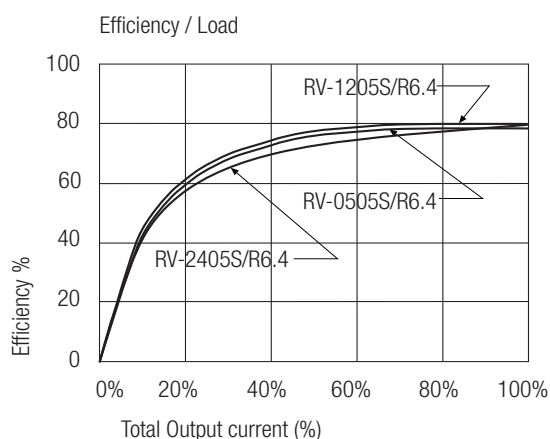
Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

Typical Characteristics

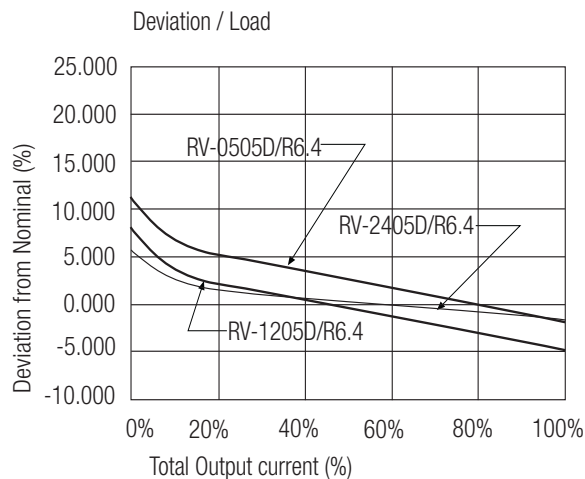
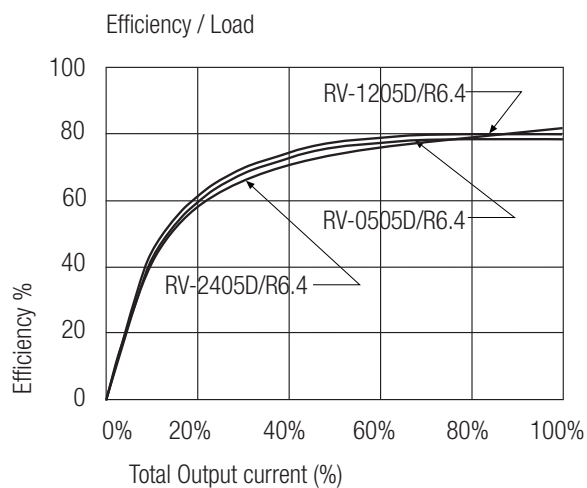
RV-xx05S/R6.4

RV-xx05S/R8



RV-xx05D/R6.4

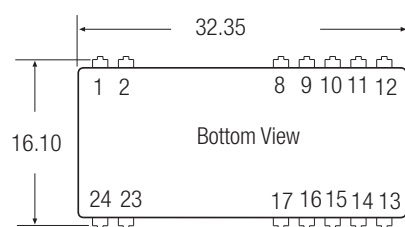
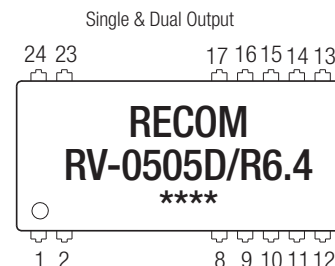
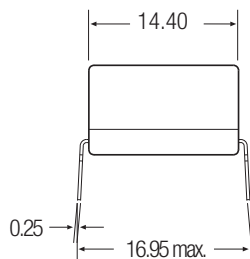
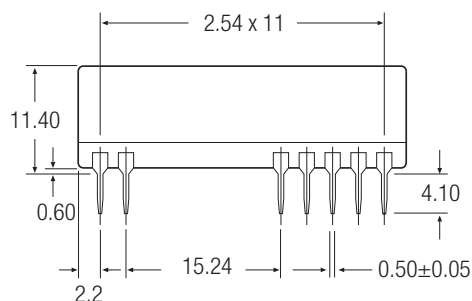
RV-xx05D/R8



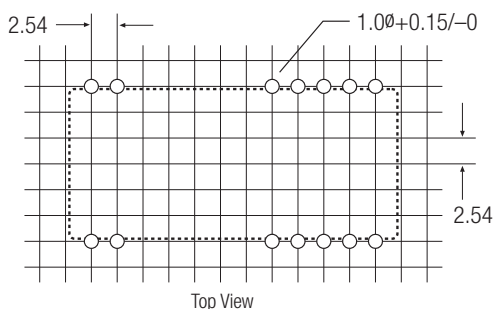
Package Style and Pinning (mm)

24 PIN DIP Miniature Package Style

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	Single
1	+Vin
2	-Vin
8, 9, 11, 14	NC
10, 15	-Vout
12 & 13	+Vout
16, 17, 23, 24	NC

NC = No Connection
 XXX ± 0.5 mm
 XX.XX ± 0.25 mm

Pin Connections

Pin #	Dual
1	+Vin
2	-Vin
8, 17	-Vout
9, 11, 14, 16, 23, 24	NC
10 & 15	Com
12, 13	+Vout

NC = No Connection

Features

Regulated Converter

- 1kVDC or 2kVDC Isolation
- SMD Package Styles
- Single Regulated Output (Internal Linear Regulator)
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Fully Encapsulated
- Efficiency to 62 %
- Built-In EN55022 Class A Filter

Description

The R0.5Z series DC/DC converter has been designed for isolating or converting DC power rails where board space is at a premium. Although no larger than a standard unregulated SMD converter, the R0.5Z series also incorporates an internal linear regulator to deliver a stable output voltage which makes it ideal for powering logic level or supply voltage sensitive circuitry.

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Part Number SMD	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
R0.5Z-xx05*	5, 12, 15, 24	5	100	50	1000 μF
R0.5Z-xx12*	5, 12, 15, 24	12	42	60	220 μF
R0.5Z-xx15*	5, 12, 15, 24	15	33	62	220 μF

xx = Input Voltage

* add Suffix "P" for Continuous Short Circuit Protection, e.g. R0.5Z-0505/P

* add Suffix „H“ for 2kVDC Isolation Voltage, e.g. R0.5Z-0505/H

* add suffix -R for tape & reel packing e.g. R0.5Z-0505-R, R0.5Z.0505/P-R

For more details and dimensions of the tapes and reels see Application Notes

Specifications (Core Operating Area)

Input Voltage Range	$\pm 5\%$	
Output Voltage Accuracy	$\pm 5\%$	
Line Voltage Regulation	1% max.	
Load Voltage Regulation (10% to 100% full load)	1% max.	
Output Ripple and Noise (20MHz limited)	100mVp-p max.	
Operating Frequency	20kHz min. / 50kHz typ. / 90kHz max.	
Efficiency at Full Load	50% min. / 60% typ.	
Minimum Load	0%	
No Load Power Consumption	127mW min. / 155mW typ. / 320mW max.	
Isolation Voltage	(rated for 1 minute)	500VAC / 60Hz 1000VDC 2000VDC
	Suffix „H“	
Isolation Capacitance	25pF min. / 75pF max.	
Isolation Resistance	10 G Ω min.	
Short Circuit Protection P-Suffix	1 Second Continuous	
Operating Temperature Range (natural convection)	-40°C to +85°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Reflow Temperature	ROHS compliant	245°C (30 sec) max.
Vapour Phase Process		230°C (90 sec) max.
	(for more details see Application Notes)	
Relative Humidity	95% RH	
Package Weight	1.2g	
Packing Quantity	33 pcs per tube 500 pcs per Reel	
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 3947 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F 841 x 10 ³ hours
Conducted / Radiated Emissions	EN55022	Level A

continued on next page

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

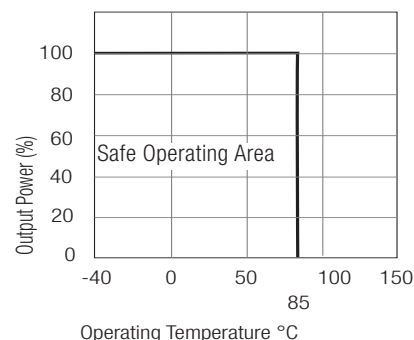
0.5 Watt SMD Isolated Single Output



EN-60950-1 Certified
EN-60601-1 Certified*
UL-60950-1 Certified
(* / H suffix)

R0.5Z

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Specifications

Certifications

EN General Safety

EN Medical Safety

UL General Safety

Report-No.: SPCLVD1211033-3

Report: MDD1205098-2 + RM1205098-2

Medical Report + ISO14971 Risk Assessment

Report-No.: E358085

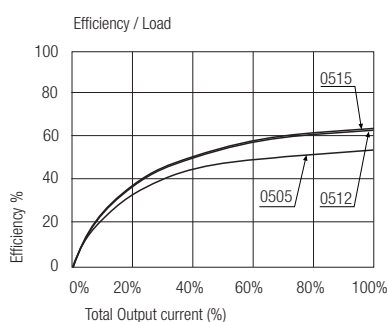
EN60950-1:2006 + A12:2011

IEC/EN 60601-1 3rd Edition

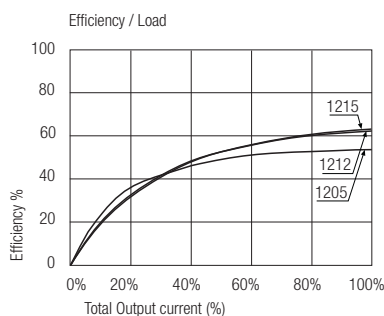
UL60950-1, 2nd Edition

Typical Characteristics

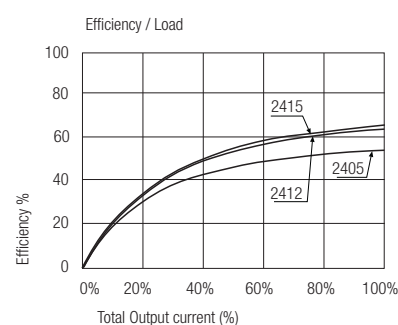
R0.5Z-xx05



R0.5Z-xx12



R0.5Z-xx15



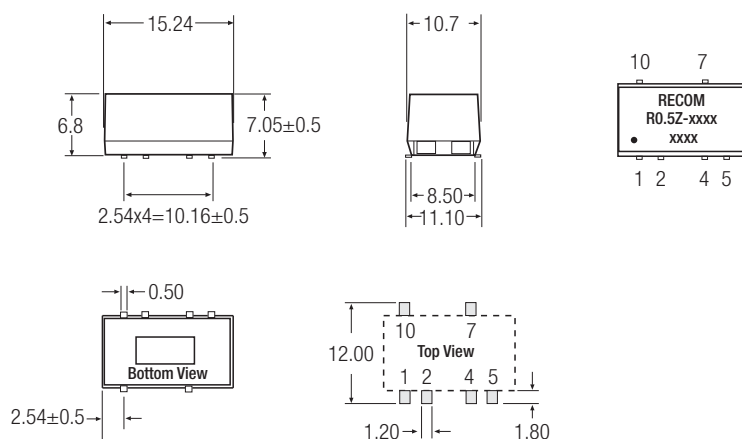
Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Package Style and Pinning (mm)

10 PIN Single SMD Package

3rd angle projection



Recommended Footprint Details

Pin Connections

Pin #	Function
1	-Vin
2	+Vin
4	-Vout
5	-Vout
7	+Vout
10	NC

NC= No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Regulated Converters

- 1kVDC & 2kVDC Isolation
- UL94V-0 Package Material
- RoHS 6/6
- Toroidal Magnetics
- Optional Continuous Short Circuit Protected
- Built-In EN55022 Class A Filter

Selection Guide

Part Number SMD	2kVDC	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Max Capacitive Load ⁽¹⁾
R1Z-xx3.3*	(/H)	3.3, 5, 12, 15, 24	3.3	303	2200µF
R1Z-xx05*	(/H)	3.3, 5, 12, 15, 24	5	200	1200µF
R1Z-xx09*	(/H)	3.3, 5, 12, 15, 24	9	111	680µF
R1Z-xx12*	(/H)	3.3, 5, 12, 15, 24	12	84	680µF
R1Z-xx15*	(/H)	3.3, 5, 12, 15, 24	15	66	470µF

xx= Input Voltage (other input and output voltage combinations available on request)

*add suffix -R for tape & reel packing e.g. R1Z-0505-R

*add suffix /P for continuous short circuit protection, e.g. R1Z-0505/P-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range			$\pm 5\%$
Output Voltage Accuracy			$\pm 2\%$
Line Voltage Regulation			1% max.
Load Voltage Regulation			1% max.
Output Ripple and Noise (at 20MHz BW)			100mVp-p max.
Operating Frequency			20kHz min. / 40kHz typ. / 80kHz max.
Efficiency at Full Load			50% min. / 60% typ.
Minimum Load			0%
No Load Power Consumption			134mW min. / 217mW typ. / 350mW max.
Isolation Voltage		(tested for 1 second)	1000VDC
		(rated for 1 minute)	500VAC / 60Hz
Isolation Voltage	H-Suffix	(tested for 1 second)	2000VDC
	H-Suffix	(rated for 1 minute)	1000VAC / 60Hz
Isolation Capacitance			70pF typ.
Isolation Resistance			10 GΩ min.
Short Circuit Protection			1 Second
P-Suffix			Continuous
Operating Temperature Range (natural convection)			-40°C to +70°C (see Graph)
Storage Temperature Range			-55°C to +125°C
Reflow Temperature	ROHS compliant		245°C (30 sec) max.
Vapour Phase Process			230°C (90 sec) max.
(for more details see Application Notes)			
Relative Humidity			95% RH
Package Weight			1.6g
Packing Quantity			33 pcs per tube 250 pcs per Reel
MTBF	R1Z (+25°C)	using MIL-HDBK 217F	2203 x 10 ³ hours
	(+70°C)	using MIL-HDBK 217F	391 x 10 ³ hours
	R1Z/P (+25°C)	using MIL-HDBK 217F	2387 x 10 ³ hours
	(+70°C)	using MIL-HDBK 217F	641 x 10 ³ hours
For detailed information see Application Notes chapter "MTBF"			
Conducted / Radiated Emissions	EN55022		Level A
EN General Safety	Report: SPCLVD1211033-3	EN60950-1:2006 + A12:2011	
EN Medical Safety	Report: MDD1205098-4 + RM1205098-4	IEC/EN 60601-1 3rd Edition	
		Medical Report + ISO14971 Risk Assessment	
UL General Safety	Report: E358085	UL60950-1, 2nd Edition	

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt SMD Miniature Isolated Single Output



E358085



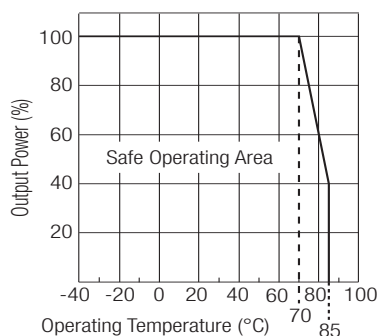
EN-60950-1 Certified
EN-60601-1 Certified*
UL-60950-1 Certified
(* /H suffix)

R1Z

Description

The R1Z series DC/DC converter has been designed for isolating or converting DC power rails where an SMD format with regulated output is required, although it is no larger than a standard unregulated SMD converter.

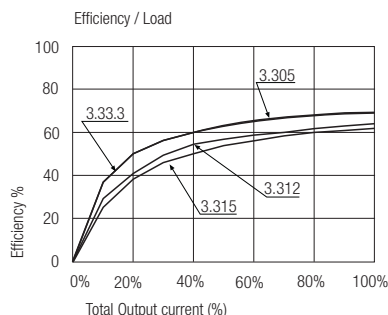
Derating-Graph (Ambient Temperature)



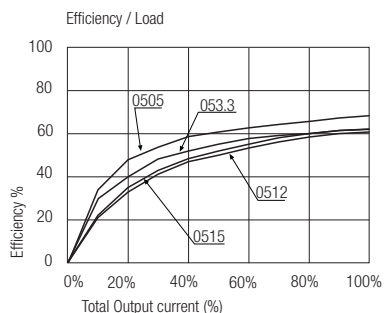
Refer to Application Notes

Typical Characteristics

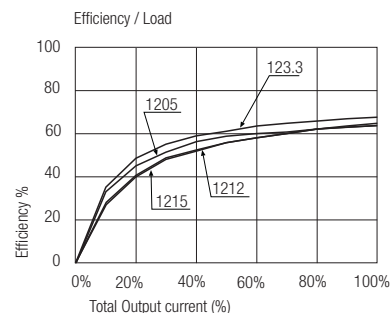
R1Z-3.3xx/P



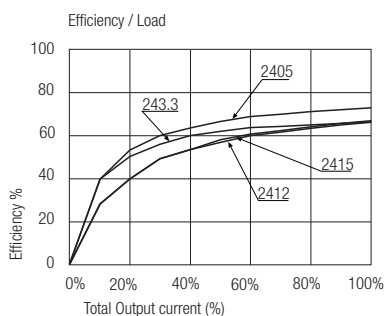
R1Z-05xx/P



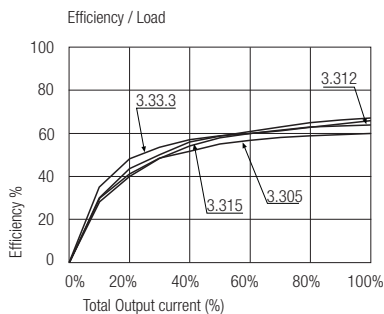
R1Z-12xx/P



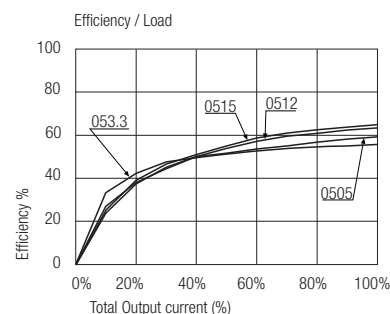
R1Z-24xx/P



R1Z-3.3xx



R1Z-05xx



Notes

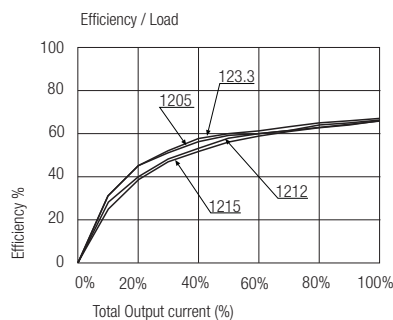
Note 1

Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Package Style and Pinning (mm)

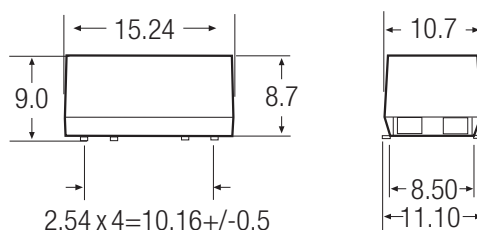


R1Z-12xx

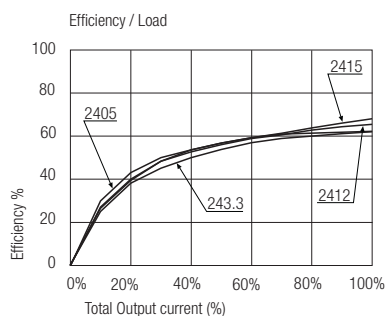


Ordering Example: R1Z-0505 (5V Input, 5V Output, not short circuit protected)
R1Z-0505/HP (5V Input, 5V Output, 2kVDC Isolation and short circuit protection)

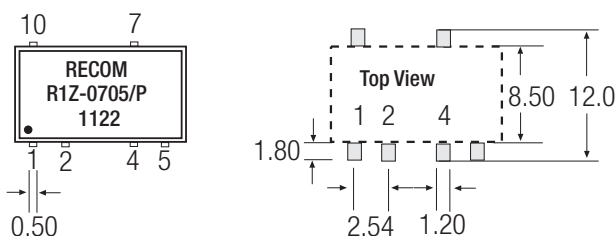
10 PIN Single SMD Package



R1Z-24xx



Recommended Footprint Details



Pin Connections

Pin #	Function
1	-Vin
2	+Vin
4	-Vout
5	-Vout
7	+Vout
10	NC

NC= No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Features

Regulated Converters

- On/Off Pin
- 1kVDC Isolation
- UL94V-0 Package Material
- Optional Continuous Short Circuit Protected
- Internal linear regulator
- Efficiency to 70 %
- Adjustable Output Voltage

Description

The RY series DC/DC converter is a low cost general purpose isolated converter with a built-in linear regulator to give a regulated, load-independent output. It is available with single or dual outputs. A useful feature is the CTRL pin on the single output version which allows the converter to be adjusted or controlled by an external enable signal.

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RY-xx05S	5, 9, 12, 15, 24	5	200	58-60	1200µF
RY-xx09S	5, 9, 12, 15, 24	9	111	56-62	1200µF
RY-xx12S	5, 9, 12, 15, 24	12	84	60-66	680µF
RY-xx15S	5, 9, 12, 15, 24	15	66	60-66	680µF
RY-xx24S	5, 9, 12, 15, 24	24	42	60-68	220µF
RY-xx05D	5, 9, 12, 15, 24	±5	±100	50-58	±470µF
RY-xx09D	5, 9, 12, 15, 24	±9	±55	52-60	±470µF
RY-xx12D	5, 9, 12, 15, 24	±12	±42	58-68	±330µF
RY-xx15D	5, 9, 12, 15, 24	±15	±33	62-68	±330µF
RY-xx24D	5, 9, 12, 15, 24	±24	±21	64-70	±100µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add Suffix "P" for Continuous Short Circuit Protection, e.g. RY-0505S/P, RY-0505D/P

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±5%	
Output Voltage Accuracy	±5%	
Line Voltage Regulation	±1% max.	
Load Voltage Regulation (10% to 100% full load)	±1% max.	
Minimum Load	0%	
Output Ripple and Noise (20MHz limited)	100mVp-p max.	
Operating Frequency	30kHz min. / 50kHz typ. / 88kHz max.	
Efficiency at Full Load	54% min. / 60% typ.	
Isolation Voltage	(tested for 1 second) (rated for 1 minute)	1000VDC 1500VAC / 60Hz
Isolation Capacitance	Single output types Dual output types	30pF min. / 150pF max. 40pF min. / 72pF max.
Isolation Resistance	10 GΩ min.	
Short Circuit Protection	1 Second	
P-Suffix	Continuous	
Operating Temperature Range (free air convection)	-40°C to +70°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Package Weight	RY Single & Dual output types	2.8g
Packing Quantity	25 pcs per Tube	
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 924 x 10 ³ hours
(+70°C)		using MIL-HDBK 217F 135 x 10 ³ hours

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

1 Watt

SIP7

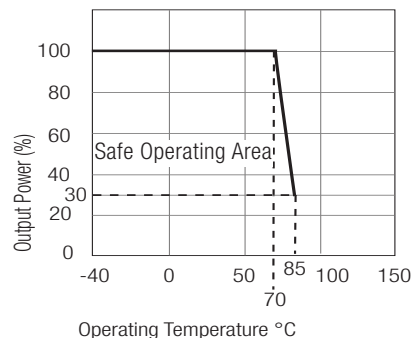
Single & Dual
Output



EN-60950-1 Certified

RY

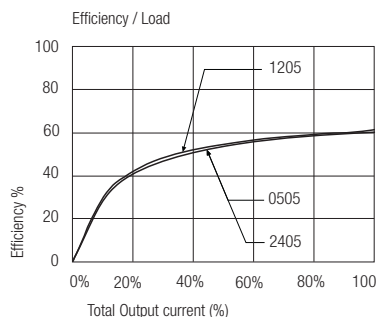
Derating-Graph (Ambient Temperature)



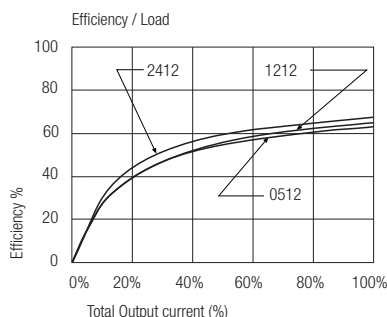
Refer to Application Notes

Typical Characteristics

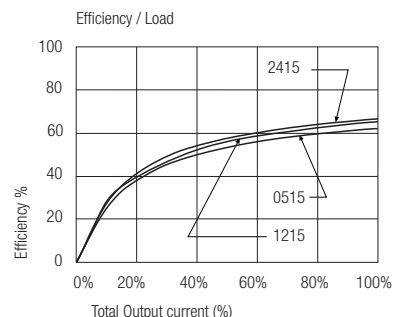
RY-xx05S



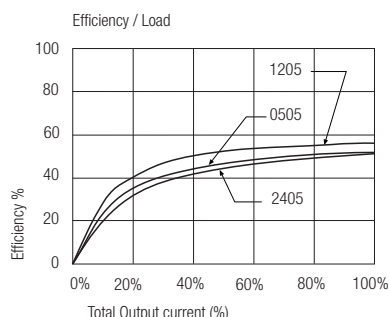
RY-xx12S



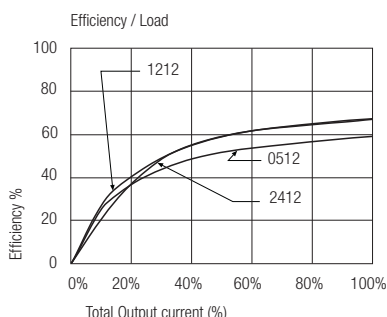
RY-xx15S



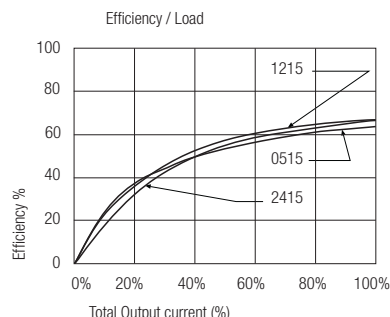
RY-xx05D



RY-xx12D



RY-xx15D



Notes

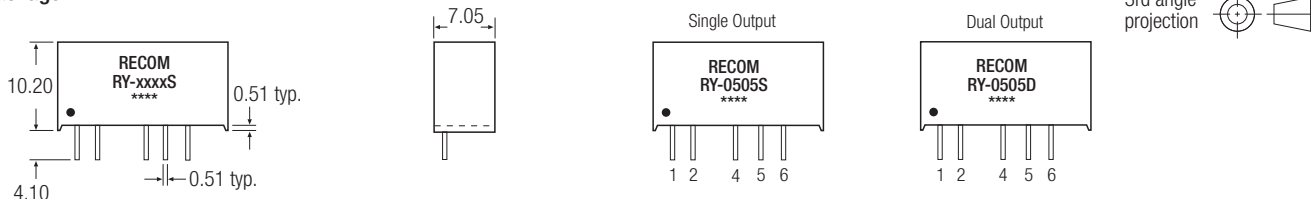
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

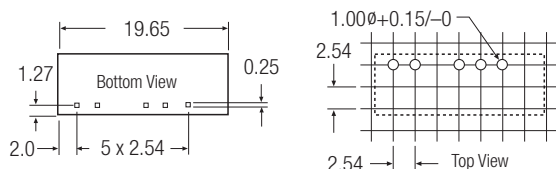
EN General Safety Report: SPCLVD1109103 EN60950-1:2006 + A12:2011

Package Style and Pinning (mm)

SIP7 Package



Recommended Footprint Details



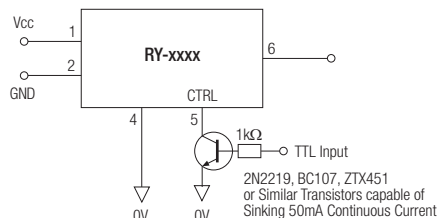
RX Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4	-Vout	-Vout
5	CTRL	Com
6	+Vout	+Vout

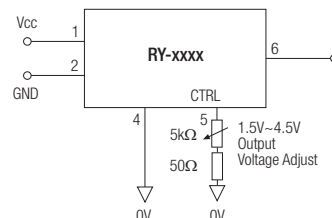
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Typical On/Off Control and Adjustable Output Applications

On/Off Control



Adjustable Output



Features

Regulated Converters

- Internal linear regulator
- 1kVDC Isolation
- UL94V-O Package Material
- Continuous Short Circuit Protected
- Current Foldback
- Efficiency to 63%
- +/- 10% Input Voltage Range

Description

The RY-SCP and -DCP series DC/DC converter are low cost general purpose isolated converters with a built-in linear regulator to give a regulated, load-independent output. It is available with single or dual outputs. The converters are both short circuit and overload protected.

Selection Guide

Part Number SIP 7	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RY-xx05SCP	5, 12, 24	5	200	57-62	1200µF
RY-xx12SCP	5, 12, 24	12	84	59-63	680µF
RY-xx15SCP	5, 12, 24	15	66	62-63	680µF
RY-xx05DCP	5, 12, 24	±5	±100	57-62	±470µF
RY-xx12DCP	5, 12, 24	±12	±42	59-63	±330µF
RY-xx15DCP	5, 12, 24	±15	±33	62-63	±330µF

xx = Input Voltage. Other input and output voltage combinations available on request.

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	±10%	
Output Voltage Accuracy	±2%	
Line Voltage Regulation	±0.5% max.	
Load Voltage Regulation (10% to 100% full load)	±0.5% max.	
Minimum Load	0%	
Output Ripple and Noise (20MHz limited)	50mVp-p max.	
Operating Frequency	100kHz max.	
Efficiency at Full Load	see table above	
Isolation Voltage	(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz
Isolation Capacitance	Single output types	20pF max.
Isolation Resistance	10 GΩ min.	
Short Circuit Protection	Single & Dual output types	Current Foldback Continuous
Operating Temperature Range (free air convection)	-40°C to +70°C (see Graph)	
Storage Temperature Range	-55°C to +125°C	
Temperature Coefficient	0.03%/°C	
Relative Humidity	95% RH	
Package Weight	Single & Dual output types	2.9g
Packing Quantity	25 pcs per Tube	
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 1023 x 10 ³ hours
(+70°C)		using MIL-HDBK 217F 170 x 10 ³ hours

ECONOLINE

DC/DC-Converter

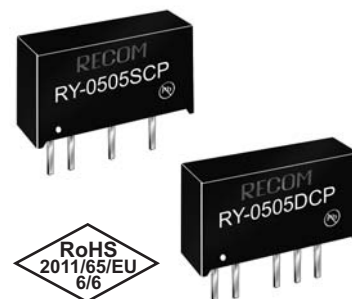
with 3 year Warranty

RECOM

1 Watt

SIP7

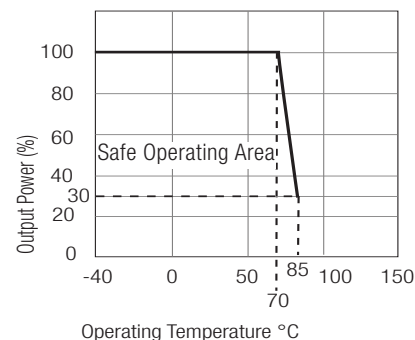
Single & Dual Output



EN-60950-1 Certified

RY-S_DCP

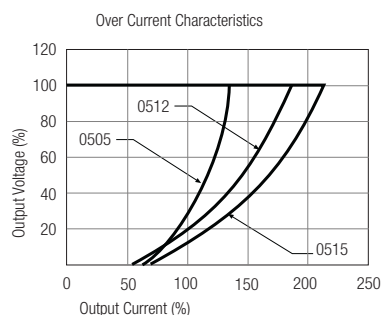
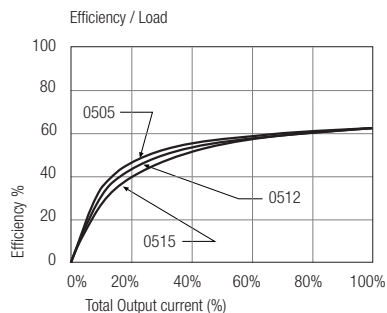
Derating-Graph (Ambient Temperature)



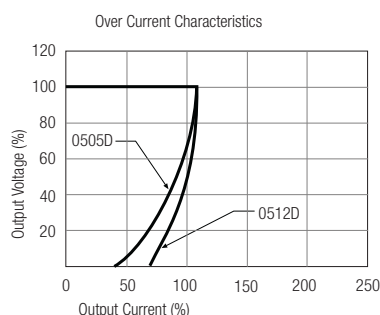
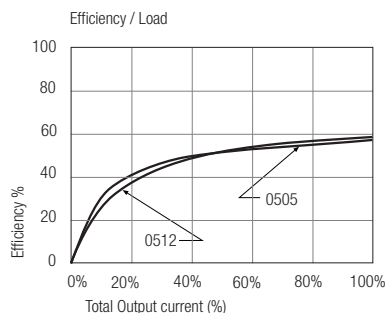
Refer to Application Notes

Typical Characteristics

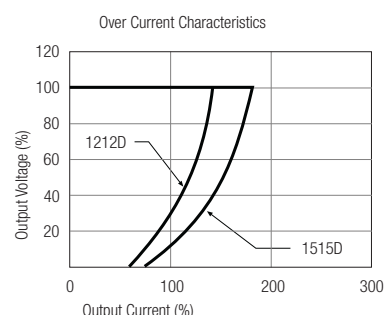
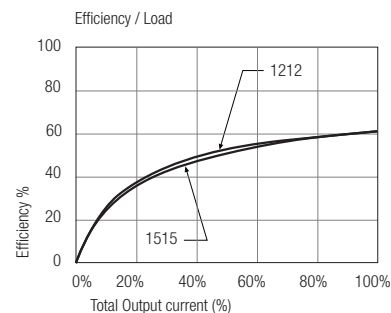
RY-xx05SCP



RY-xx05DCP



RY-1212DCP RY-1515DCP



Notes

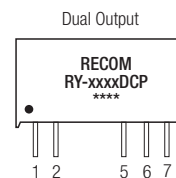
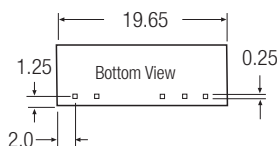
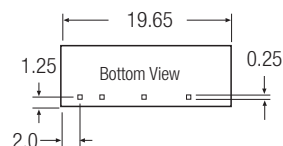
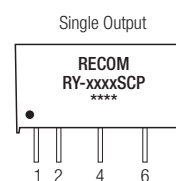
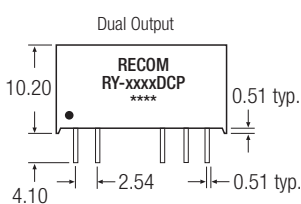
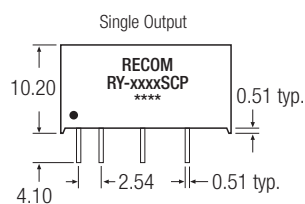
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

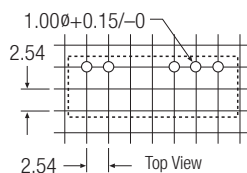
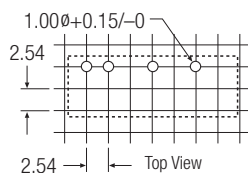
EN General Safety Report: PS-R7219C1 EN60950-1:2001 + A11:2004

Package Style and Pinning (mm)

7 PIN SIP Package



Recommended Footprint Details



XX.X ± 0.5 mm
XX.XX ± 0.25 mm

RY-S/DCP Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4	-Vout	No Pin
5	No Pin	-Vout
6	+Vout	Com
7	No Pin	+Vout

Features

Regulated Converters

- 2:1 and 4:1 Wide Input Voltage Ranges
- 1kVDC, 2kVD or 3kVDC Isolation
- UL94V-O Package Material
- Certified for Medical Applications
- Continuous Short Circuit Protection
- Low Noise
- No External Capacitor needed
- Efficiency to 83 %

Description

High-power-density, an industrial temperature range of -40°C to +85°C and extra features like On-Off-control are just some of the characteristics of this converter, ideal for highly sophisticated industrial-designs. The RSO series is available with isolation of 2kV or 3kV by choosing option "/H2" or "/H3" in which case it is also ideal for medical applications which additionally require EN-60601-1 certification. The standard version offers 2:1 input voltage range, while the "Z" version features 4:1 input voltage range, which includes an input voltage range covering both 5V and 12V supplies.

Selection Guide

Part Number	Input Voltage Range (VDC)	Rated Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load ⁽¹⁾
SIP8					
RSO-xx3.3S*	4.5-9**, 9-18 18-36, 36-72	3.3	300	68-72 70	3300µF
RSO-xx05S*	4.5-9**, 9-18 18-36, 36-72	5	200	73-75 75-78	1200µF
RSO-xx09S*	4.5-9**, 9-18 18-36, 36-72	9	111	74-78 78-81	680µF
RSO-xx12S*	4.5-9**, 9-18 18-36, 36-72	12	83	75-80 80-83	680µF
RSO-xx15S*	4.5-9**, 9-18 18-36, 36-72	15	67	75-80 80-83	680µF
RSO-xx3.3D*	4.5-9**, 9-18 18-36, 36-72	±3.3	±150	68-72 70	±1500µF
RSO-xx05D*	4.5-9**, 9-18 18-36, 36-72	±5	±100	73-75 75-76	±470µF
RSO-xx09D*	4.5-9**, 9-18 18-36, 36-72	±9	±56	74-78 78	±470µF
RSO-xx12D*	4.5-9**, 9-18 18-36, 36-72	±12	±42	75-79 79-80	±330µF
RSO-xx15D*	4.5-9**, 9-18 18-36, 36-72	±15	±34	75-79 79-80	±330µF
RSO-xx3.3SZ*	9-36 18-72	3.3	300	68-70 70	3300µF
RSO-xx05SZ*	4.5-18**, 9-36 18-72	5	200	73-78 75	1200µF
RSO-xx09SZ*	4.5-18**, 9-36 18-72	9	111	75-81 78	680µF
RSO-xx12SZ*	4.5-18**, 9-36 18-72	12	83	77-83 80	680µF
RSO-xx15SZ*	4.5-18**, 9-36 18-72	15	67	78-83 80	680µF
RSO-xx3.3DZ*	9-36 18-72	±3.3	±150	70-74 70	±1500µF
RSO-xx05DZ*	4.5-18**, 9-36 18-72	±5	±100	73-77 75	±470µF
RSO-xx09DZ*	4.5-18**, 9-36 18-72	±9	±56	74-78 78	±470µF
RSO-xx12DZ*	4.5-18**, 9-36 18-72	±12	±42	75-80 80	±330µF
RSO-xx15DZ*	4.5-18**, 9-36 18-72	±15	±34	75-80 80	±330µF

No suffix is standard isolation (1kVDC) e.g., RSO-0505S

*add suffix /H2 or /H3 for 2kVDC or 3kVDC isolation, e.g., RSO-0505S/H2, RSO-0505DZ/H3

** derate to 75% if Vin<5V, 12V 4:1 input also requires an external 10µF input capacitor.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

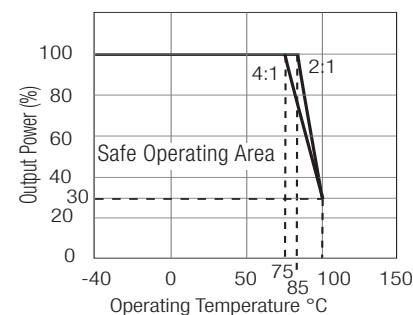
1 Watt SIP8 Isolated Single & Dual Output



EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

RSO

Derating-Graph (Ambient Temperature)



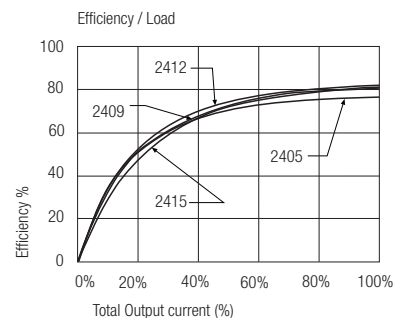
2:1 Input (RSO-S/D)	4:1 Input (RSO-SZ/DZ)
xx = 4.5-9Vin = 05	xx = 4.5-18Vin = 12
xx = 9-18Vin = 12	xx = 9-36Vin = 24
xx = 18-36Vin = 24	xx = 18-72Vin = 48
xx = 36-72Vin = 48	

Refer to Application Notes

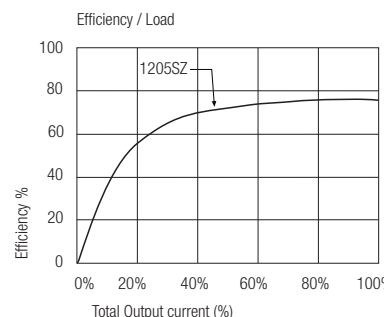
Specifications (Core Operating Area) measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up time unless otherwise specified

Input Voltage Range		2:1 and 4:1		
Output Voltage Accuracy		±2% typ.		
Line Voltage Regulation	2:1	±0.2% max.		
	4:1	±0.5% max.		
Load Voltage Regulation (10% to 100% full load)	2:1	±0.4% max.		
	4:1	±0.5% typ.		
Minimum Load		0%		
Output Ripple and Noise (20MHz limited)		50mVp-p max.		
Operating Frequency	2:1	200kHz min. / 500kHz max.		
	4:1	100kHz min. / 800kHz max.		
Efficiency at Full Load		See Selection Guide		
Quiescent Current	RSO-05xxS_D, SZ_DZ		40mA typ.	
Nominal input Voltage	RSO-12xxS_D		32mA typ.	
(Standard, /H2 and /H3)	RSO-24xxS_D, SZ_DZ		25mA typ.	
	RSO-48xxS_D, SZ_DZ		15mA typ.	
CTRL Pin drive current /see Notes)		3mA typ, 6mA max.		
Quiescent Input Current when Converter is OFF		10mA max.		
Isolation Voltage	Standard	(tested for 1 second)	1000VDC	
		(rated for 1 minute)	500VAC / 60Hz	
	/H2 Version	(tested for 1 second)	2000VDC	
		(rated for 1 minute)	1000VAC / 60Hz	
/H3 Version	(tested for 1 second)	3000VDC		
	(rated for 1 minute)	1500VAC / 60Hz		
Isolation Capacitance	Standard	2:1 Single	10pF min. / 40pF typ. / 60pF max.	
Isolation Capacitance	/H2 and /H3	2:1 Single	5pF min. / 30pF typ. / 60pF max.	
Isolation Capacitance	Standard	2:1 Dual	120pF min. / 170pF typ. / 250pF max.	
Isolation Capacitance	/H2 and /H3	2:1 Dual	5pF min. / 30pF typ. / 60pF max.	
Isolation Capacitance	Standard	4:1 Single/Dual	200pF max.	
Isolation Capacitance	/H2 and /H3	4:1 Single/Dual	30pF max.	
Isolation Resistance		>1GΩ min.		
Short Circuit Protection		Continuous		
Operating Temperature Range (free air convection)		-40°C to +85°C (see Graph)		
Storage Temperature Range		-55°C to +125°C		
Relative Humidity		95% RH		
Package Weight		4.7g		
Packing Quantity		22 pcs per Tube		
MTBF (+25°C) (+85°C)		} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1685 x 10³ hours
			using MIL-HDBK 217F	254 x 10³ hours

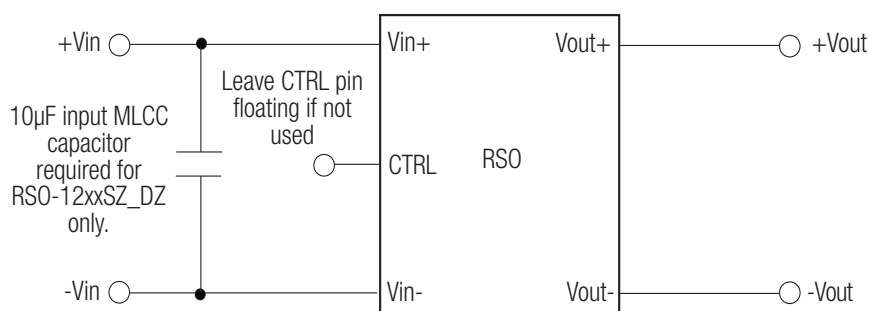
RSO-24xxS



RSO-1205SZ

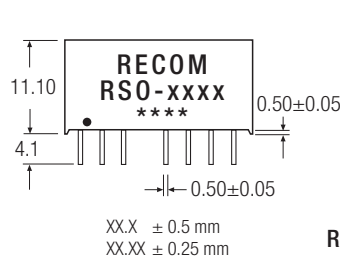


Typical Application

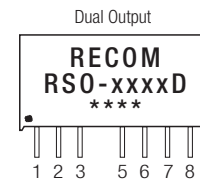
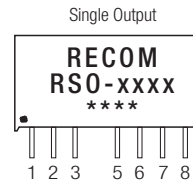
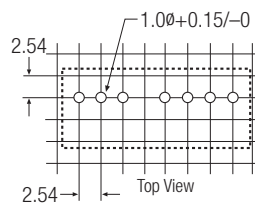
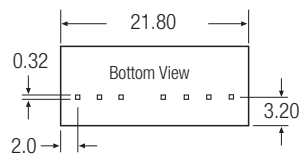


Package Style and Pinning (mm)

8 PIN SIP Package



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	CTRL	CTRL
5	NC	NC
6	+Vout	+Vout
7	-Vout	Com
8	NC*	-Vout

NC = No Connection

NC* = NC, but no external Connection allowed.

Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + A11:2009+A1:2010+A12:2011
EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

CTRL Examples

Pin 8 (NC*) This pin is used internally and must have no external connection.

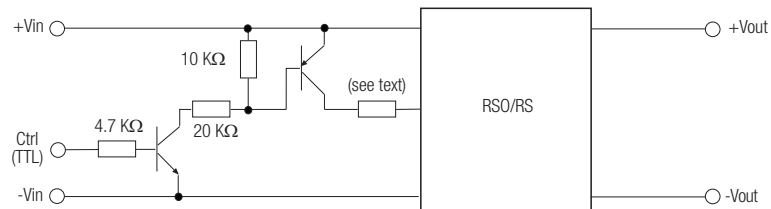
Pin 5 (NC) Not connected internally.

Pin 3 (CTRL)

This pin provides an Off function which puts the converter into a low power mode. When the pin is 'high' the converter is OFF and when the pin is high 'Z' the converter is ON. There is no allowed low state for this pin.

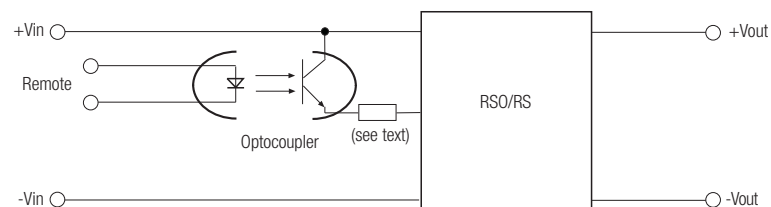
TTL Remote CTRL Circuit

Control Pin Input Current: 10mA
Control Pin (CTRL) Input Current, control voltage applied via 1K resistor, output voltage must reduce to 0V: typ. 3mA max. 6mA



Voltage to be applied via a limiting resistor with a recommended value of 1K for RSO-05xx; 3.3K for RSO-12xx; 4.7K for RSO-24xx and 10K for RSO-48xx.

Isolated Remote CTRL Circuit



Features

Regulated Converters

- 2:1 and 4:1 Wide Input Voltage Ranges
- 1kVDC, 2kVDC & 3kVDC Isolation
- UL94V-0 Package Material
- Continuous Short Circuit Protection
- Low Noise
- No External Capacitor needed
- Efficiency to 83 %

Description

High power-density, an industrial temperature range of -40°C to +85°C and extra features like Remote-On-Off-control are just some of the characteristics of this converter, ideal for highly sophisticated industrial designs. The RS series is available with isolation of 2kV or 3kV by choosing option "/H2" or "/H3" in which case it is also ideal for medical applications which additionally require EN-60601-1 certification.

Selection Guide 5V, 12V, 24V and 48V Input Types

Part Number	Input Voltage Range (VDC)	Rated Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency typ. (%)	Max Capacitive Load
SIP8					
RS-xx3.3S (H2/H3)	4.5-9, 9-18 18-36, 36-72	3.3	500	68-69 70-73	4700µF
RS-xx05S (H2/H3)	4.5-9, 9-18 18-36, 36-72	5	400	73-75 78	1000µF
RS-xx09S (H2/H3)	4.5-9, 9-18 18-36, 36-72	9	222	74-78 81	1000µF
RS-xx12S (H2/H3)	4.5-9, 9-18 18-36, 36-72	12	166	75-80 83	1000µF
RS-xx15S (H2/H3)	4.5-9, 9-18 18-36, 36-72	15	134	75-80 83	1000µF
RS-xx3.3D (H2/H3)	4.5-9, 9-18 18-36, 36-72	±3.3	±250	68-69 70-73	±2200µF
RS-xx05D (H2/H3)	4.5-9, 9-18 18-36, 36-72	±5	±200	73-75 78	±680µF
RS-xx09D (H2/H3)	4.5-9, 9-18 18-36, 36-72	±9	±111	74-78 81	±680µF
RS-xx12D (H2/H3)	4.5-9, 9-18 18-36, 36-72	±12	±83	75-80 83	±680µF
RS-xx15D (H2/H3)	4.5-9, 9-18 18-36, 36-72	±15	±67	75-80 83	±680µF
RS-xx3.3SZ (H2/H3)	9-36 18-72	3.3	500	75 75	4700µF
RS-xx05SZ (H2/H3)	9-36 18-72	5	400	80 80	1000µF
RS-xx09SZ (H2/H3)	9-36 18-72	9	222	80 80	1000µF
RS-xx12SZ (H2/H3)	9-36 18-72	12	166	83 83	1000µF
RS-xx15SZ (H2/H3)	9-36 18-72	15	134	84 84	1000µF
RS-xx3.3DZ (H2/H3)	9-36 18-72	±3.3	±250	73 73	±2200µF
RS-xx05DZ (H2/H3)	9-36 18-72	±5	±200	77 77	±680µF
RS-xx09DZ (H2/H3)	9-36 18-72	±9	±111	80 80	±680µF
RS-xx12DZ (H2/H3)	9-36 18-72	±12	±83	81 81	±680µF
RS-xx15DZ (H2/H3)	9-36 18-72	±15	±67	83 83	±680µF

No suffix is standard isolation (1kVDC) e.g., RS-0505S

*add suffix /H2 or /H3 for 2kVDC or 3kVDC isolation, e.g., RS-0505S/H2, RS-0505DZ/H3

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt SIP8 Isolated Single & Dual Output



EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

RS

2:1 Input
(RS-S/D)

xx = 4.5-9Vin = 05

xx = 9-18Vin = 12

xx = 18-36Vin = 24

xx = 36-72Vin = 48

4:1 Input
(RS-SZ/DZ)

xx = 9-36Vin = 24

xx = 18-72Vin = 48

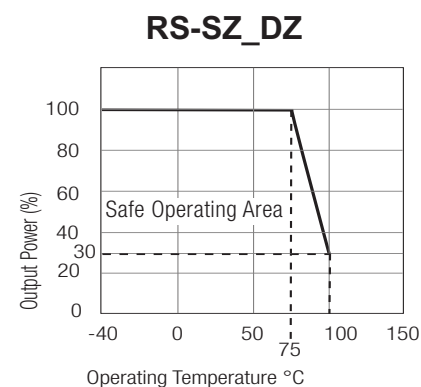
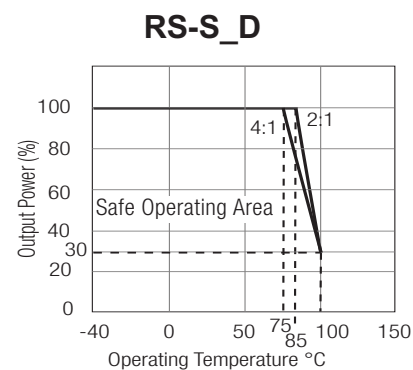
Refer to Application Notes

www.recom-electronic.com

Electrical Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up time unless otherwise specified)

Input Voltage Range		2:1 and 4:1	
Output Accuracy		±2% typ.	
Line Voltage Regulation		±0.5% max.	
Load Voltage Regulation	20%-100% Load		±0.5% max.
Minimum Load		0%	
Output Ripple and Noise (20MHz limited)		50mVp-p max.	
Switching Frequency	Full Load	100kHz min. / 300kHz max.	
Efficiency at Full Load		See Selection Guide	
Quiescent Current	RS-05xxS_D	40mA typ.	
Nominal input Voltage (Standard, /H2 and /H3)	RS-12xxS_D	32mA typ.	
	RS-24xxS_D, SZ_DZ	25mA typ.	
	RS-48xxS_D, SZ_DZ	15mA typ.	
Isolation Voltage	Standard	(tested for 1 second)	1000VDC
		(rated for 1 minute)	500VAC / 60Hz
	/H2 Version	(tested for 1 second)	2000VDC
		(rated for 1 minute)	1000VAC / 60Hz
	/H3 Version	(tested for 1 second)	3000VDC
		(rated for 1 minute)	1500VAC / 60Hz
Isolation Capacitance	Standard	2:1 Single	10pF min. / 40pF typ. / 60pF max.
Isolation Capacitance	/H2 and /H3	2:1 Single	5pF min. / 30pF typ. / 60pF max.
Isolation Capacitance	Standard	2:1 Dual	120pF min. / 170pF typ. / 250pF max.
Isolation Capacitance	/H2 and /H3	2:1 Dual	5pF min. / 30pF typ. / 60pF max.
Isolation Capacitance	Standard	4:1 Single/Dual	200pF max.
Isolation Capacitance	/H2 and /H3	4:1 Single/Dual	30pF max
Isolation Resistance		1GΩ min.	
Short Circuit Protection		Continuous	
Operating Temperature Range (No Derating)	2:1	−40°C to +85°C	
	4:1	−40°C to +75°C	
Storage Temperature Range		−55°C to +125°C	
Relative Humidity		95% RH	
Package Weight		4.7g	
Packing Quantity		22 pcs per Tube	
MTBF (+25°C) (+85°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1398 x 10³ hours
		using MIL-HDBK 217F	210 x 10³ hours

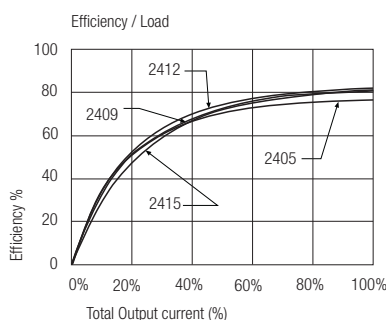
Derating-Graph (Ambient Temperature)



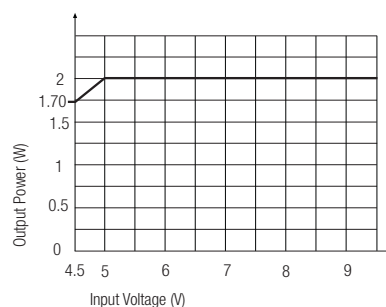
RS

Typical Characteristics

RS-24xx

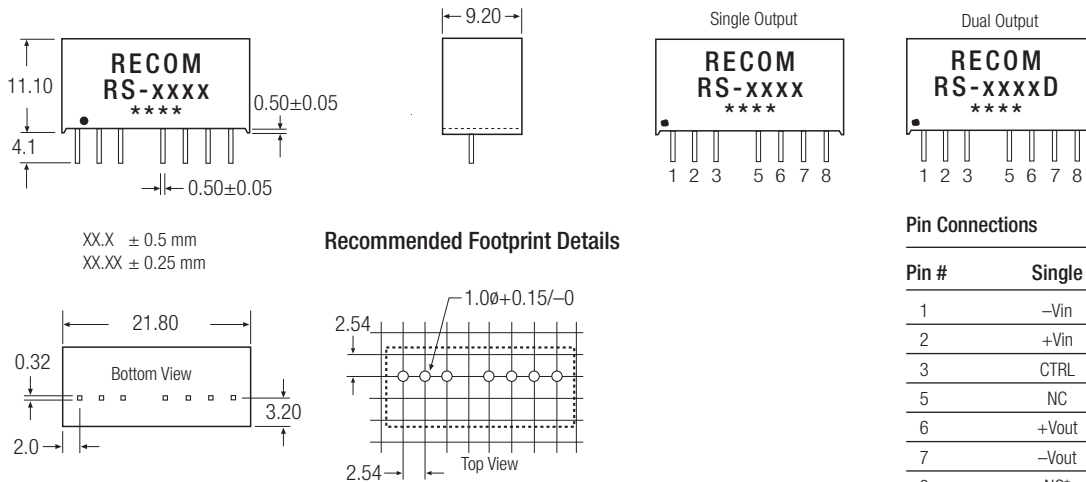


RS-05xx types



Package Style and Pinning (mm)

8 PIN SIP Package



Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	CTRL	CTRL
5	NC	NC
6	+Vout	+Vout
7	-Vout	Com
8	NC*	-Vout

NC = No Connection

NC* = NC, but no external Connection allowed.

Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + A11:2009+A1:2010+A12:2011
EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Pin 8 (NC*) This pin is used internally and must have no external connection.

Pin 5 (NC) Not connected internally.

Pin 3 (CTRL)

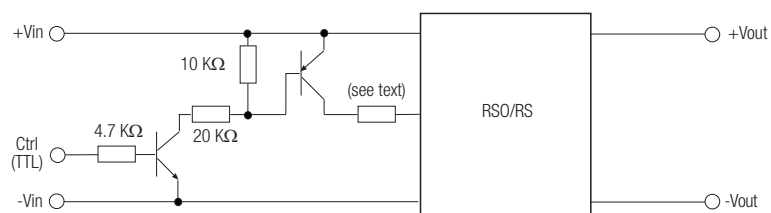
This pin provides an Off function which puts the converter into a low power mode. When the pin is 'high' the converter is OFF and when the pin is high 'Z' the converter is ON. There is no allowed low state for this pin.

Application Examples

TTL Remote CTRL Circuit

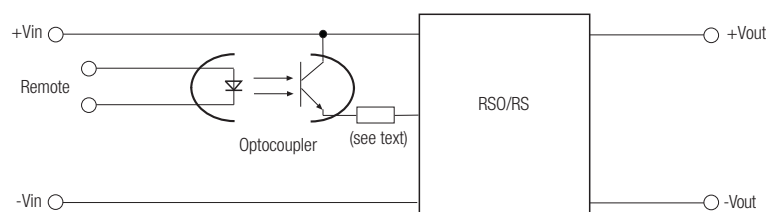
Control Pin Input Current: 10mA

Control Pin (CTRL) Input Current, control voltage applied via 1K resistor, output voltage must reduce to 0V: typ. 3mA max. 6mA



Voltage to be applied via a limiting resistor with a recommended value of 1K for RS-05xx; 3.3K for RS-12xx; 4.7K for RS-24xx and 10K for RS-48xx.

Isolated Remote CTRL Circuit



Features

Regulated Converters

- 2:1 Wide Range Voltage Input
- 1kVDC, 2kVDC and 3kVDC Isolation
- Approved for Medical Applications
- Continuous Short Circuit Protection
- Low Ripple and Noise
- DIP16, mini DIP16 and SMD Cases Styles
- Efficiency to 83 %

Description

High power-density, 2:1 input voltage range and a wide temperature range of -40°C to +85°C are just some of the characteristics of this versatile DIP16 converter, ideal for highly sophisticated industrial and medical designs where a regulated converter is required but space is at a premium. Three different case styles and isolation options are available.

Selection Guide

Part Number	Input Voltage Range (VDC)	Rated Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency typ./nom Vin (%)	Max Capacitive Load ⁽¹⁾
DIP16 (Mini & SMD)					
RW2-053.3S (H2/H3)	4.5 - 9	3.3	500	68	4700µF
RW2-0505S (H2/H3)	4.5 - 9	5	400	73	1000µF
RW2-0512S (H2/H3)	4.5 - 9	12	166	75	1000µF
RW2-0515S (H2/H3)	4.5 - 9	15	134	75	1000µF
RW2-123.3S (H2/H3)	9 - 18	3.3	500	69	4700µF
RW2-1205S (H2/H3)	9 - 18	5	400	75	1000µF
RW2-1212S (H2/H3)	9 - 18	12	166	80	1000µF
RW2-1215S (H2/H3)	9 - 18	15	134	80	1000µF
RW2-243.3S (H2/H3)	18 - 36	3.3	500	70	4700µF
RW2-2405S (H2/H3)	18 - 36	5	400	78	1000µF
RW2-2412S (H2/H3)	18 - 36	12	166	83	1000µF
RW2-2415S (H2/H3)	18 - 36	15	134	83	1000µF
RW2-483.3S (H2/H3)	36 - 72	3.3	500	73	4700µF
RW2-4805S (H2/H3)	36 - 72	5	400	76	1000µF
RW2-4812S (H2/H3)	36 - 72	12	166	81	1000µF
RW2-4815S (H2/H3)	36 - 72	15	134	81	1000µF
RW2-0505D (H2/H3)	4.5 - 9	±5	±200	73	±680µF
RW2-0509D (H2/H3)	4.5 - 9	±9	±111	74	±680µF
RW2-0512D (H2/H3)	4.5 - 9	±12	±83	75	±680µF
RW2-0515D (H2/H3)	4.5 - 9	±15	±67	75	±680µF
RW2-1205D (H2/H3)	9 - 18	±5	±200	75	±680µF
RW2-1209D (H2/H3)	9 - 18	±9	±111	78	±680µF
RW2-1212D (H2/H3)	9 - 18	±12	±83	80	±680µF
RW2-1215D (H2/H3)	9 - 18	±15	±67	80	±680µF
RW2-2405D (H2/H3)	18 - 36	±5	±200	78	±680µF
RW2-2409D (H2/H3)	18 - 36	±9	±111	81	±680µF
RW2-2412D (H2/H3)	18 - 36	±12	±83	83	±680µF
RW2-2415D (H2/H3)	18 - 36	±15	±67	83	±680µF
RW2-4805D (H2/H3)	36 - 72	±5	±200	78	±680µF
RW2-4809D (H2/H3)	36 - 72	±9	±111	81	±680µF
RW2-4812D (H2/H3)	36 - 72	±12	±83	83	±680µF
RW2-4815D (H2/H3)	36 - 72	±15	±67	83	±680µF

Standard Isolation is 1kVDC. Add suffix "/H2" for 2kVDC Isolation, "/H3" for 3kVDC Isolation. Add no suffix for standard case style, "/SMD" for SMD package or "/B" for smaller case size e.g. RW2-0505S/H3, RW2-0505D/H2/SMD or RW2-0505S/B

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

2 Watt

DIP16, Mini

DIP16 & SMD

Single & Dual Output

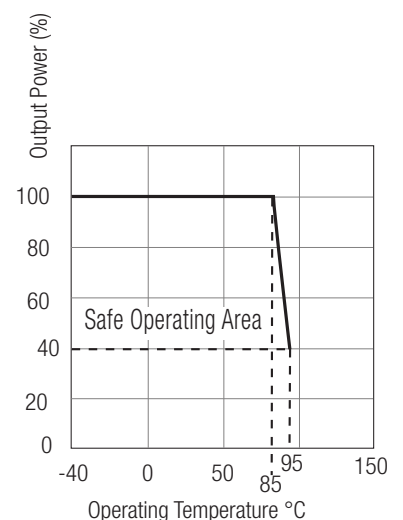


EN-60950-1 Certified
(All Suffixes)

EN-60601-1 Certified*
(* /H suffix)

RW2

Derating-Graph (Ambient Temperature)

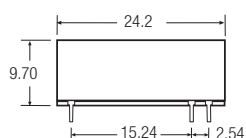


Refer to Application Notes

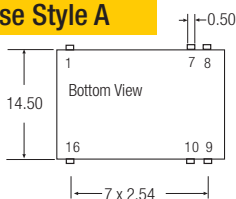
Electrical Specifications (measured at $T_A = 25^\circ\text{C}$, at nominal input voltage and rated output current unless otherwise specified)

Input Voltage Range			2:1
Output Accuracy			±2% typ.
Line Voltage Regulation			±0.5% max.
Load Voltage Regulation	(20% to 100% full load)	±0.5% typ.	
Minimum Load			0%
Output Ripple and Noise (20MHz limited)			50mVp-p max.
Switching Frequency (at full Load)			100kHz min. / 700kHz max.
Efficiency at Full Load			70% min. / 80% typ.
Isolation Voltage	(tested for 1 second)	1000VDC	
	(rated for 1 minute)	500VAC / 60Hz	
/H2	(tested for 1 second)	2000VDC	
	(rated for 1 minute)	1000VAC / 60Hz	
/H3	(tested for 1 second)	3000VDC	
	(rated for 1 minute)	1500VAC / 60Hz	
Isolation Capacitance			30pF max.
Isolation Resistance			1GΩ min.
Short Circuit Protection			Continuous
Operating Temperature Range			−40°C to +85°C (see Graph)
Storage Temperature Range			−55°C to +125°C
Case Temperature			100°C max.
Relative Humidity			95% RH
Package Weight			6.4g
Packing Quantity	Case Style A, SMD	20 pcs per tube	
	Case Style B	22 pcs per Tube	
MTBF (+25°C)	} For Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	4366 x10³ hours
(+85°C)		using MIL-HDBK 217F	658 x10³ hours

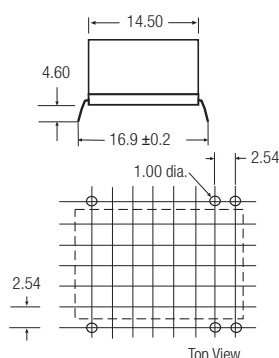
Package Style and Pinning (mm)



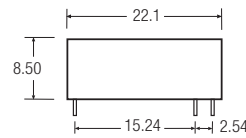
Case Style A



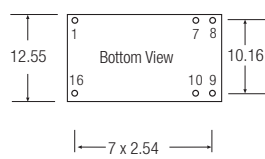
16 Pin DIP Package



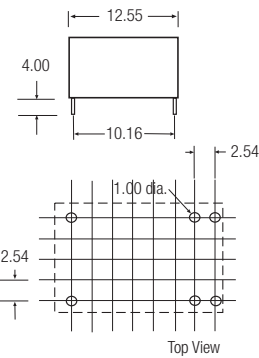
Recommended Footprint Details



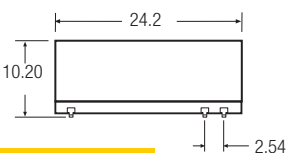
Case Style B



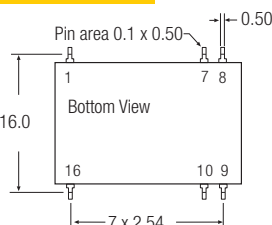
16 Pin Mini-DIP Package



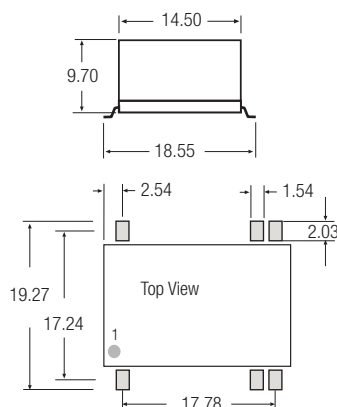
Recommended Footprint Details



SMD Case Style



16 Pin SMD Package



Recommended Pad Details

Pin Connections (All Case Styles)

Pin #	Single	Dual
1	-Vin	-Vin
7	NC	NC
8	NC	Com
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

XX.X ± 0.5 mm
XX.XX ± 0.35 mm



Certifications

EN General Safety Report: SPCLVD1212007 EN60950-1:2006 + A11:2009

EN Medical Safety Report: MDD1205098-3 + RM1205098-3

IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Features

Regulated Converters

- 2:1 and 3:1 Wide Input Voltage Ranges
- 1kVDC, 2kVDC and 3kVDC Isolation
- UL94V-0 Package Material
- Continuous Short Circuit Protection
- Low Ripple and Noise
- Remote On/Off Control
- Efficiency to 83 %

Description

Very high power density, 2:1 or 3:1 input voltage range and a wide operating temperature range -40°C~+71°C and extra features such as On/Off control are just some of the characteristics of this converter which is ideal for highly sophisticated industrial designs. The RS3 is available with 2kV or 3kV isolation options (1kVDC is standard)

Selection Guide

Part Number		Input Voltage Range (VDC)	Rated Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency typ. (%)	Max Capacitive Load ⁽¹⁾
SIP8						
RS3-xx3.3S	(H2/H3)	4.5-9, 9-18 18-36, 36-72	3.3	600	73-75 77-78	4700µF
RS3-xx05S	(H2/H3)	4.5-9, 9-18 18-36, 36-72	5	600	76-79 80-81	4700µF
RS3-xx09S	(H2/H3)	4.5-9, 9-18 18-36, 36-72	9	333	77-80 81-82	3300µF
RS3-xx12S	(H2/H3)	4.5-9, 9-18 18-36, 36-72	12	250	80-81 83	2200µF
RS3-xx15S	(H2/H3)	4.5-9, 9-18 18-36, 36-72	15	200	80-81 83	2200µF
RS3-xx3.3D	(H2/H3)	4.5-9, 9-18 18-36, 36-72	±3.3	±300	73-75 75	±2200µF
RS3-xx05D	(H2/H3)	4.5-9, 9-18 18-36, 36-72	±5	±300	76-80 80-81	±2200µF
RS3-xx09D	(H2/H3)	4.5-9, 9-18 18-36, 36-72	±9	±167	77-81 81	±2200µF
RS3-xx12D	(H2/H3)	4.5-9, 9-18 18-36, 36-72	±12	±125	78-83 83	±1000µF
RS3-xx15D	(H2/H3)	4.5-9, 9-18 18-36, 36-72	±15	±100	79-83 83	±1000µF
RS3-xx3.3SZ	(H2/H3)	9-27 20-60	3.3	600	73 74	4700µF
RS3-xx05SZ	(H2/H3)	9-27 20-60	5	600	76-79 78	4700µF
RS3-xx09SZ	(H2/H3)	9-27 20-60	9	333	77 79	3300µF
RS3-xx12SZ	(H2/H3)	9-27 20-60	12	250	80 80	2200µF
RS3-xx15SZ	(H2/H3)	9-27 20-60	15	200	80 80	2200µF
RS3-xx3.3DZ	(H2/H3)	9-27 20-60	±3.3	±300	73 74	±2200µF
RS3-xx05DZ	(H2/H3)	9-27 20-60	±5	±300	77 78	±2200µF
RS3-xx09DZ	(H2/H3)	9-27 20-60	±9	±167	79 79	±2200µF
RS3-xx12DZ	(H2/H3)	9-27 20-60	±12	±125	80 80	±1000µF
RS3-xx15DZ	(H2/H3)	9-27 20-60	±15	±100	80 80	±1000µF

No suffix is standard isolation (1kVDC) e.g., RS3-0505S

*add suffix /H2 or /H3 for 2kVDC or 3kVDC isolation, e.g., RS3-0505S/H2, R3S-0505DZ/H3

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

3 Watt SIP8 Isolated Single & Dual Output



EN-60950-1 Certified
EN-60601-1 Certified*
(* /H suffix)

RS3

2:1 Input
(RS3-S/D)

xx = 4.5-9Vin = 05
xx = 9-18Vin = 12
xx = 18-36Vin = 24
xx = 36-72Vin = 48

3:1 Input
(RS3-SZ/DZ)

xx = 9-27Vin = 24
xx = 20-60Vin = 48

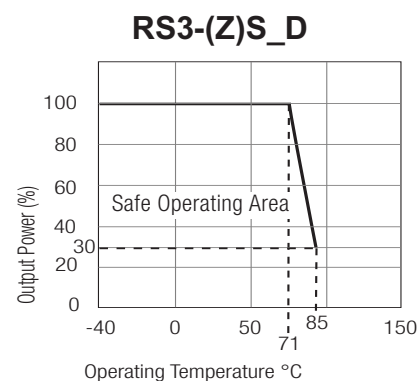
Refer to Application Notes

Electrical Specifications (measured at $T_A = 25^\circ\text{C}$, at nominal input voltage and rated output current unless otherwise specified)

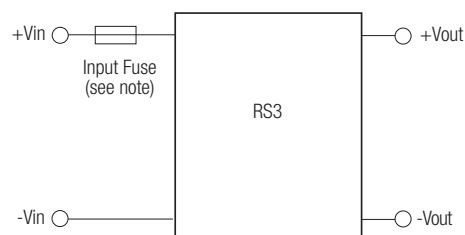
Input Voltage Range		2:1 and 3:1		
Output Accuracy		Nominal Vin and full load	±2% typ.	
Line Voltage Regulation		LL to HL, full load	±0.5% max.	
Load Voltage Regulation		20% to 100% full load	±0.5% typ.	
Minimum Load		5V input	10%	
		all others	0%	
Output Ripple and Noise		20MHz limited	50mVp-p max.	
Switching Frequency		20% to 100% full load	200kHz typ.	
Efficiency at Full Load		see Selection Guide		
Quiescent Current		RS3-05xxS_D	35mA typ.	
Nominal input Voltage (Standard, /H2 and /H3)		RS3-12xxS_D	25mA typ.	
		RS3-24xxS_D, SZ_DZ	20mA typ.	
		RS3-48xxS_D, SZ_DZ	10mA typ.	
Isolation Voltage	Standard	(tested for 1 second)	1000VDC	
		(rated for 1 minute)	500VAC / 60Hz	
	/H2 Version	(tested for 1 second)	2000VDC	
		(rated for 1 minute)	1000VAC / 60Hz	
/H3 Version	(tested for 1 second)	3000VDC		
	(rated for 1 minute)	1500VAC / 60Hz		
Isolation Capacitance (2:1 and 3:1) (tested at 100kHz)		H1	200pF max.	
		H2/H3	30pF max.	
Isolation Resistance		1GΩ min.		
Short Circuit Protection (see note)		Continuous		
Operating Temperature Range		−40°C to +71°C		
Storage Temperature Range		−55°C to +125°C		
Relative Humidity		95% RH		
Package Weight		4.7g		
Packing Quantity		22 pcs per Tube		
MTBF (+25°C) (+71°C)		Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	3303 x10³ hours
			using MIL-HDBK 217F	745 x10³ hours

Note: To protect the converter under all fault conditions, an input fuse is required. Quick-blow fuses should be rated at 2x-3x the normal input current, time-delay fuses at 1.5x the normal input current.

Derating-Graph (Ambient Temperature)

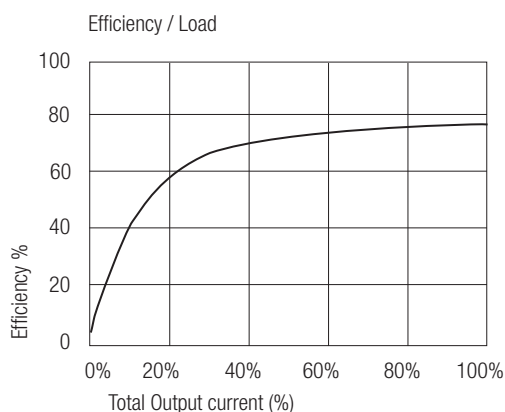


Typical Application

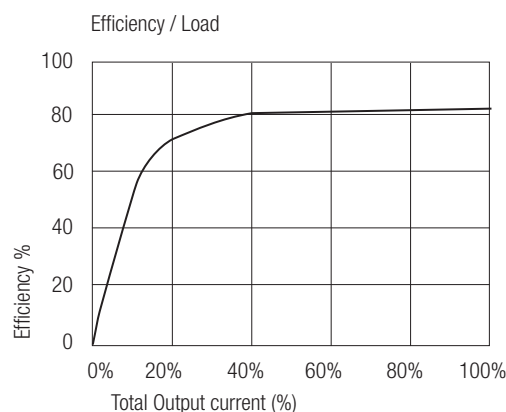


Typical Characteristics

RS3-0505S

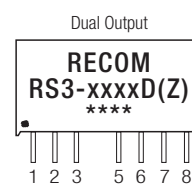
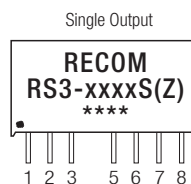
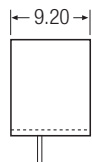
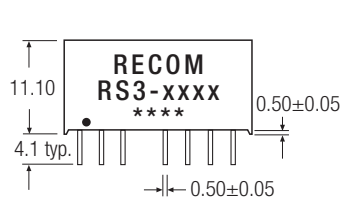


RS3-4805D

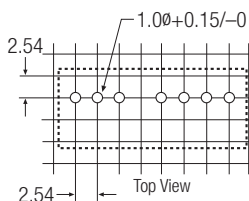
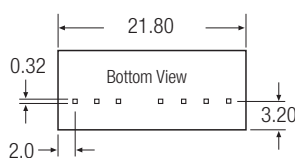


Package Style and Pinning (mm)

3rd angle projection



Recommended Footprint Details



XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Pin Connections

Pin #	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	CTRL	CTRL
5	NC	NC
6	+Vout	+Vout
7	-Vout	Com
8	NC	-Vout

NC = No Connection

Notes

Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + A11:2009+A1:2010+A12:2011
EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Pin 8 (NC*) This pin is used internally and must have no external connection.

Pin 5 (NC) Not connected internally.

Pin 3 (CTRL)

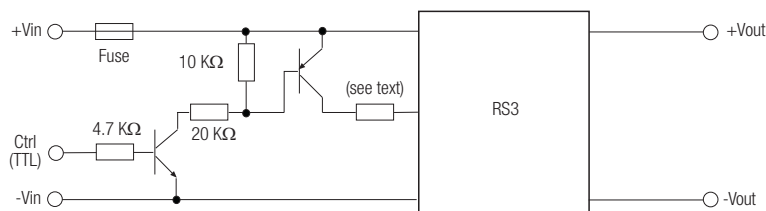
This pin provides an Off function which puts the converter into a low power mode. When the pin is 'high' the converter is OFF and when the pin is high 'Z' the converter is ON. There is no allowed low state for this pin.

Application Examples

TTL Remote CTRL Circuit

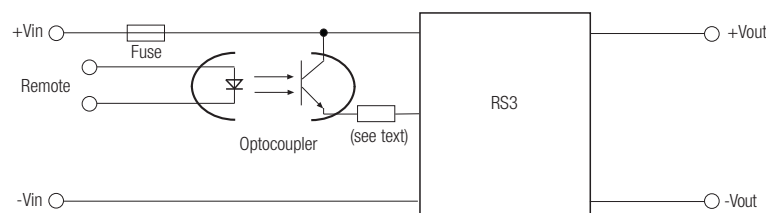
Control Pin Input Current: 10mA

Control Pin (CTRL) Input Current, control voltage applied via 1K resistor, output voltage must reduce to 0V: typ. 3mA max. 6mA



Voltage to be applied via a limiting resistor with a recommended value of 1K for RS3-05xx; 3.3K for RS3-12xx; 4.7K for RS3-24xx and 10K for RS3-48xx.

Isolated Remote CTRL Circuit



Features

Regulated Converters

- DIP24 Low Profile Miniature Package
- 1kVDC Isolation
- Feedback Regulated Output
- 2:1 Wide Range Voltage Input
- Continuous Short Circuit Protection
- Less than 7mm Height
- SMD Pinning Option
- Efficiency to 87 %

Description

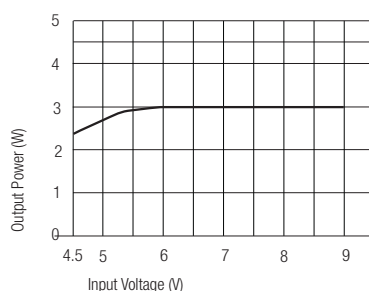
The RW-S series with 2:1 input voltage ranges and max. height of 7,0 mm has been designed for the industrial automation markets. They are aimed at applications where pcb-space is at a premium so SMD pinning is also available. The converters supply the full 3 watts without additional heat-sinks over the temperature range -40°C to +80°C.

Selection Guide

Part Number DIP24 Miniature	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
RW-053.3S	4.5 – 9	3.3	650	68	4700µF
RW-0505S	4.5 – 9	5	600	69	4700µF
RW-0509S	4.5 – 9	9	333	70	3300µF
RW-0512S	4.5 – 9	12	250	72	2200µF
RW-0515S	4.5 – 9	15	200	73	2200µF
RW-123.3S	9 – 18	3.3	650	70	4700µF
RW-1205S	9 – 18	5	600	73	4700µF
RW-1209S	9 – 18	9	333	78	3300µF
RW-1212S	9 – 18	12	250	79	2200µF
RW-1215S	9 – 18	15	200	79	2200µF
RW-243.3S	18 – 36	3.3	650	75	4700µF
RW-2405S	18 – 36	5	600	78	4700µF
RW-2409S	18 – 36	9	333	82	3300µF
RW-2412S	18 – 36	12	250	84	2200µF
RW-2415S	18 – 36	15	200	85	2200µF
RW-483.3S	36 – 72	3.3	650	73	4700µF
RW-4805S	36 – 72	5	600	78	4700µF
RW-4809S	36 – 72	9	333	82	3300µF
RW-4812S	36 – 72	12	250	84	2200µF
RW-4815S	36 – 72	15	200	85	2200µF

* add suffix "/SMD" for SMD package, e.g. RW-2405S/SMD

RW-05xx types



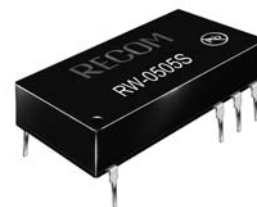
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

3 Watt DIP24/SMD Low Profile Package Single Output



EN-60950-1 Certified

RW-S

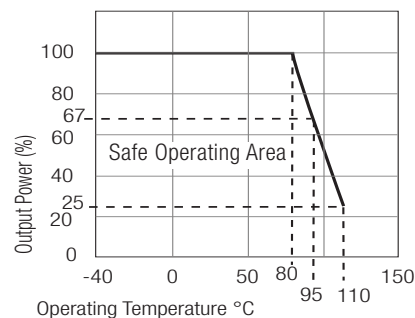
Refer to Application Notes

www.recom-electronic.com

Specifications (Core Operating Area)

Input Voltage Range		2:1	
Output Voltage Accuracy		±2% max.	
Line Voltage Regulation		±0.2% typ.	
Load Voltage Regulation (10% to 100% full load)		±0.5% max.	
Minimum Load		0%	
Output Ripple and Noise (20MHz limited)		70mVp-p max.	
Operating Frequency		85kHz min. / 100kHz typ.	
Efficiency at Full Load		See Selection Guide	
No Load Power Consumption		250mW max.	
Isolation Voltage	(tested for 1 second) (rated for 1 minute)	1000VDC 500VAC / 60Hz	
Isolation Capacitance		40pF min. / 60pF max.	
Isolation Resistance		1 GΩ min.	
Short Circuit Protection		Continuous	
Operating Temperature Range (free air convection)		-40°C to +80°C (see Graph)	
Storage Temperature Range		-55°C to +125°C	
Relative Humidity		95% RH	
Package Weight	DIP24	7g	
	SMD	7.7g	
Packing Quantity		15 pcs per Tube	
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1034 x 10 ³ hours
(+80°C)		using MIL-HDBK 217F	186 x 10 ³ hours

Derating-Graph (Ambient Temperature)



Notes

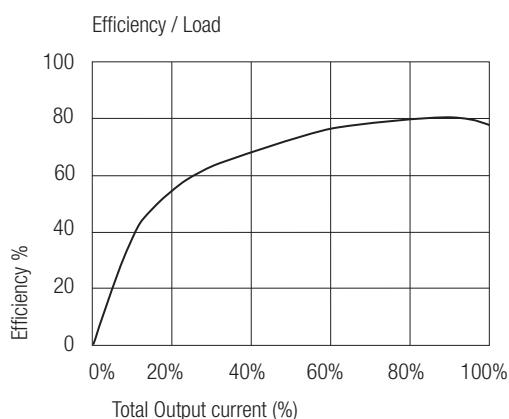
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

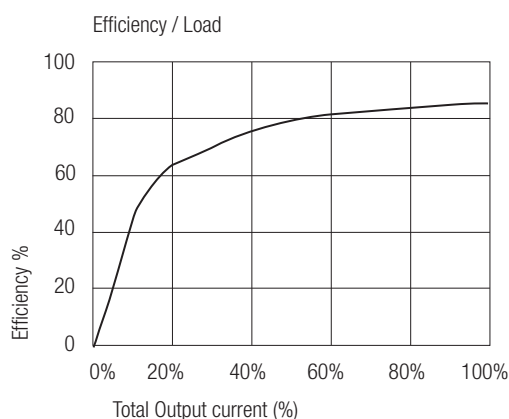
EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + A11:2009+A1:2010+A12:2011
EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment

Typical Performance

RW-1205S



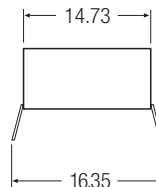
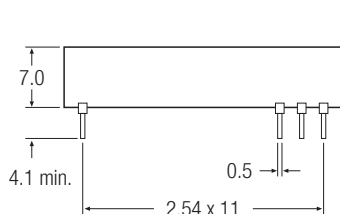
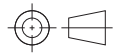
RW-2412S



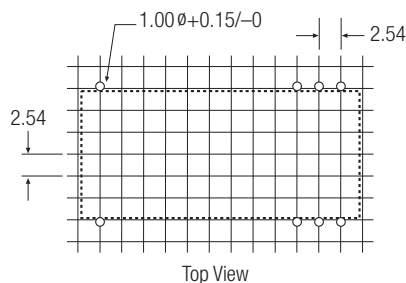
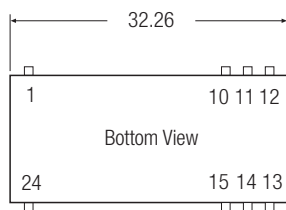
Package Style and Pinning (mm)

24 PIN DIP Miniature Package Style

3rd angle projection



Recommended Footprint Details

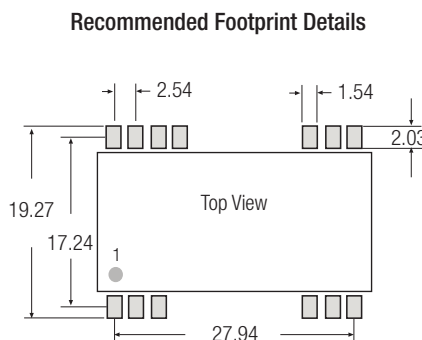
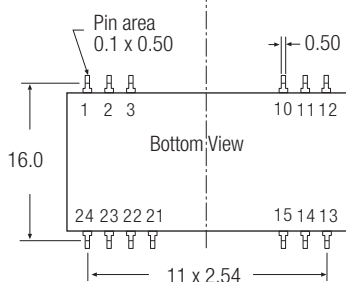
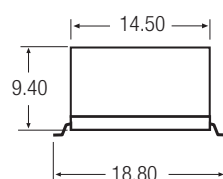
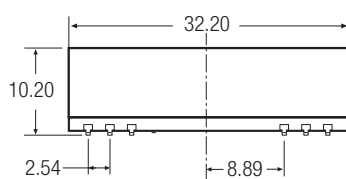


Pin Connections

Pin #	Single
1 & 24	+Vin
10 & 15	-Vout
11 & 14	+Vout
12 & 13	-Vin

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

24 PIN SMD Miniature Package Style



Pin Connections

Pin #	Single
1 & 24	+Vin
10 & 15	-Vout
11 & 14	+Vout
12 & 13	-Vin
others	NC

NC = No Connection
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Regulated Converters

- DIP24 Low Profile Package
- Dual Outputs from a Single Supply
- 2:1 Wide Range Voltage Input
- 3kVDC Isolation
- UL94V-0 Package Material
- Continuous Short Circuit Protection
- Low profile 7mm Height
- Approved for Medical Applications
- Efficiency to 85 %

Description

The RW_D series with 2:1 input voltage ranges and maximum height of 7,0 mm has been designed for industrial automation and medical markets where a dual output rail needs to be generated from a single rail source. The converters supply the full 3 Watts without additional heat-sinks over the temperature range -40°C to +85°C.

Selection Guide

Part Number DIP24 Miniature	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency %	Max Capacitive Load ⁽¹⁾
RW-0505D	4.5 – 9	±5	±300	71	±2200µF
RW-0509D	4.5 – 9	±9	±167	73	±1000µF
RW-0512D	4.5 – 9	±12	±125	74	±1000µF
RW-0515D	4.5 – 9	±15	±100	75	±1000µF
RW-1205D	9 – 18	±5	±300	76	±2200µF
RW-1209D	9 – 18	±9	±167	80	±1000µF
RW-1212D	9 – 18	±12	±125	83	±1000µF
RW-1215D	9 – 18	±15	±100	83	±1000µF
RW-2405D	18 – 36	±5	±300	78	±2200µF
RW-2409D	18 – 36	±9	±167	81	±1000µF
RW-2412D	18 – 36	±12	±125	85	±1000µF
RW-2415D	18 – 36	±15	±100	85	±1000µF
RW-4805D	36 – 72	±5	±300	78	±2200µF
RW-4809D	36 – 72	±9	±167	82	±1000µF
RW-4812D	36 – 72	±12	±125	84	±1000µF
RW-4815D	36 – 72	±15	±100	84	±1000µF

Specifications (Core Operating Area)

Input Voltage Range	2:1
Output Voltage Accuracy	±1% typ. / ±2% max.
Line Voltage Regulation	0.1% typ. / 0.2% max.
Load Voltage Regulation (10% to 100% full load)	0.2% typ. / 0.5% max.
Minimum Load	0%
Output Ripple and Noise (20MHz limited)	50mVp-p max.
Operating Frequency	100kHz min. / 150kHz typ.
Efficiency at Full Load	See above
No Load Power Consumption	250mW max.
Isolation Voltage	(tested for 1 second) 3000VDC (rated for 1 minute) 1500VAC / 60Hz
Isolation Capacitance	20pF min. / 40pF typ. / 60pF max.
Isolation Resistance	1 GΩ min.
Short Circuit Protection	Continuous
Operating Temperature Range (free air convection)	-40°C to +85°C (see Graph)

continued on next page

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

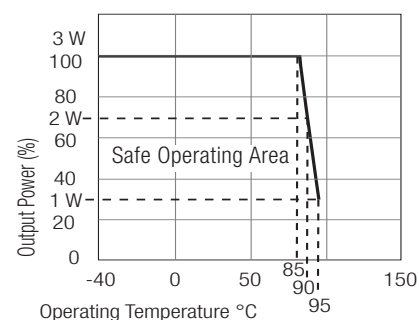
3 Watt DIP24 Low Profile Regulated Dual Output



EN-60950-1 Certified
EN-60601-1 Certified

RW-D

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Specifications (Core Operating Area)

Storage Temperature Range	-55°C to +125°C		
Case Material	Non-Conductive Black Plastic		
Potting Material	Epoxy (UL94V-0)		
Relative Humidity	95% RH		
Package Weight	7.7g		
Packing Quantity	15pcs per Tube		
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1636 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F	303 x 10 ³ hours

Notes

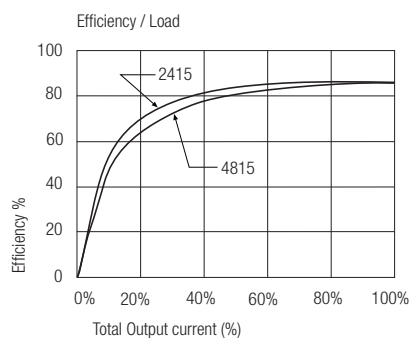
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Certifications

EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + A11:2009+A1:2010+A12:2011	
EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	IEC/EN 60601-1 3rd Edition	Medical Report + ISO14971 Risk Assessment

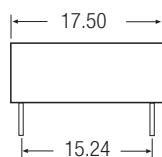
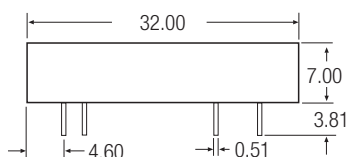
Typical Performance

RW-xx15D



Package Style and Pinning (mm)

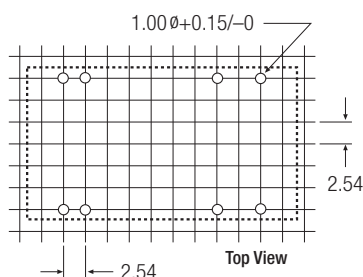
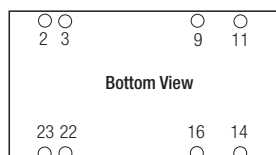
24 PIN DIP Miniature Package Style



3rd angle projection



Recommended Footprint Details



Pin Connections

Pin	Dual
2 & 3	-Vin
9 & 16	Com
11	-Vout
14	+Vout
22 & 23	+Vin
NC = No Connection	
XX.X ± 0.5 mm	
XX.XX ± 0.25 mm	

Features

Regulated Converters

- Low Cost 3W converter in DIP24 Package
- 1kVDC Isolation
- Regulated Output
- Continuous Short Circuit Protection
- Internal SMD design
- 3 Pinout Options, 3 Case Styles.
- Efficiency to 75 %

Description

The REC3-SR/DR series is a low cost converter containing a built in linear regulator to give a regulated, load independent constant voltage output. The converter is designed to run from a regulated supply and is typically used to provide an isolated output or to generate dual rails from a single rail supply. The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number DIP24 (SMD)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Max Capacitive Load ⁽¹⁾
REC3-xx05SR/H1	5, 12, 24	5	600	4700µF
REC3-xx12SR/H1	5, 12, 24	12	250	2200µF
REC3-xx15SR/H1	5, 12, 24	15	200	2200µF
REC3-xx05DR/H1	5, 12, 24	±5	±300	±2200µF
REC3-xx12DR/H1	5, 12, 24	±12	±125	±1000µF
REC3-xx15DR/H1	5, 12, 24	±15	±100	±1000µF

xx = Input Voltage. Other input and output voltage combinations available on request.

* add suffix "/SMD" for SMD package, e.g. REC3-0505SR/H1/SMD

* add suffix "/M" for Metal Case, e.g. REC3-0505SR/H1/M

* add suffix "-R" for Tape and Reel packaging, e.g. REC3-0505SR/H1/SMD-R

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	5V	4.5V - 5.75V
	12V	10.2V - 31.8V
	24V	20.4V - 27.6V
Output Voltage Accuracy		±3% typ.
Line Voltage Regulation		±0.5% max
Load Voltage Regulation (10% to 100% full load)		±1% max.
Minimum Load		0%
Output Ripple and Noise (at 20MHz BW)		100mVp-p max.
Operating Frequency		75kHz min.
Efficiency at Full Load		65% min.
No Load Power Consumption		300mW max.
Isolation Voltage	(tested for 1 second)	1000VDC
	(rated for 1 minute)	500VAC / 60Hz
Isolation Capacitance		30pF typ.
Isolation Resistance		1 GΩ min.
Short Circuit Protection		Continuous
Operating Temperature Range (free air convection)		-40°C to +80°C (see Graph)
Storage Temperature Range		-55°C to +125°C
Relative Humidity		95% RH
Thermal Impedance	Natural convection	20°C/W for plastic case
		12°C/W for metal case
Package Weight		12g
Packing Quantity		15 pcs per Tube
		100 pcs per Reel
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F
		950 x 10 ³ hours
(+80°C)		using MIL-HDBK 217F
		145 x 10 ³ hours

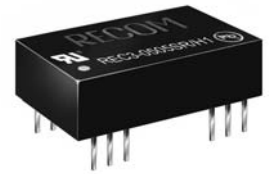
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

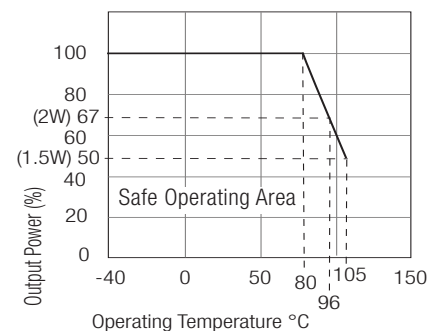
3 Watt DIP24 & SMD Single & Dual Output



EN-60950-1 Certified

REC3-S_DR

Derating-Graph (Ambient Temperature)



Refer to Application Notes

Specifications (continued)

Certifications

EN General Safety

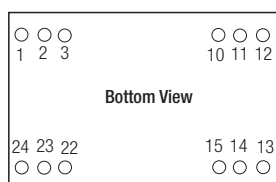
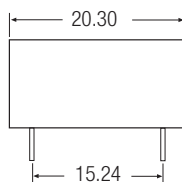
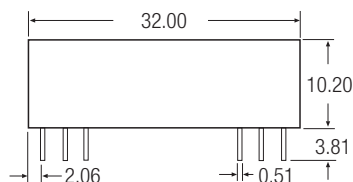
Report: SPCLVD1212007 EN60950-1:2006 + A11:2009+A1:2010+A12:2011

Notes

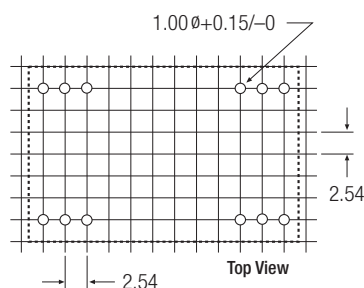
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Package Style and Pinning (mm)

24 PIN DIP Package



Recommended Footprint Details



Pin Connections

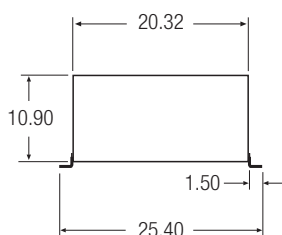
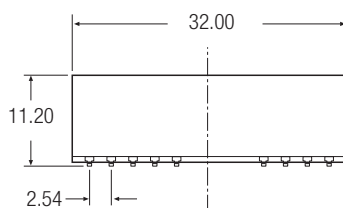
Pin #	Single	Dual
1	+Vin	+Vin
2	No Pin	-Vout
3	No Pin	Com
10	-Vout	Com
11	+Vout	+Vout
12	-Vin	-Vin
13	-Vin	-Vin
14	+Vout	+Vout
15	-Vout	Com
22	No Pin	Com
23	No Pin	-Vout
24	+Vin	+Vin

NC = No Connection

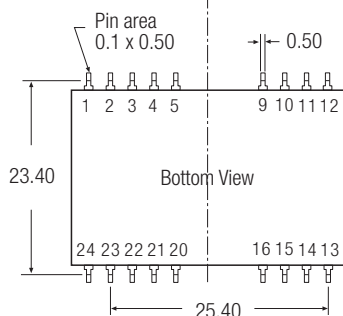
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

3rd angle projection

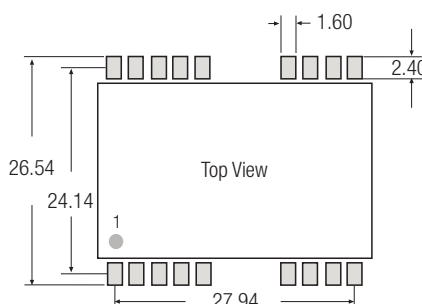
24 PIN DIP SMD Package



XX.X ± 0.5 mm
XX.XX ± 0.25 mm



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	NC	-Vout
3	NC	Com
4	NC	NC
5	NC	NC
9	NC	NC
10	-Vout	Com
11	+Vout	+Vout
12	-Vin	-Vin
13	-Vin	-Vin
14	+Vout	+Vout
15	-Vout	Com
16	NC	NC
20	NC	NC
21	NC	NC
22	NC	Com
23	NC	-Vout
24	+Vin	+Vin

SMD pin connections follow standard package pinning.

All unused pins are NC (No Connection).

Features

Regulated Converters

- 2kV, 4kVDC & 6kVDC Isolation
- Industry Standard 3W DIP24 Package
- Feedback Regulated Output
- Continuous Short Circuit Protection
- Wide Input 2:1 & 4:1
- Medical Approvals (4kV/6kV Versions)
- EN and UL Certificates
- 3 Pinout Options, 3 Case Styles
- Control Pin Option
- Efficiency to 86%

Description

Besides the standard isolation of 2kVDC, this series offers options of 4kVDC (= "/H4") or 6kVDC (= "/H6") making it suitable for medical applications and other sophisticated industrial applications. Packaging can be either DIP-24 plastic or 5-side-shielded DIP24 metal case (= option "/M") as well as SMD pinning (= option "/SMD"). For all the above variants, 2 industry-standard pinouts (= option "/A" or "/C") are available, and B pinning is available with 1.6kVDC isolation. Remote on/off control is possible with the /CTRL option (A pinning only). The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number DIP24 (SMD)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
REC3-xx3.3SRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	3.3	900	66-76	4700µF
REC3-xx05SRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	5	600	71-79	4700µF
REC3-xx09SRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	9	330	74-83	3300µF
REC3-xx12SRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	12	250	75-85	2200µF
REC3-xx15SRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	15	200	75-86	2200µF
REC3-xx05DRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	±5	±300	74-83	±2200µF
REC3-xx12DRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	±12	±125	75-85	±1000µF
REC3-xx15DRW/H*	4.5 - 9, 9 - 18, 18 - 36, 36 - 72	±15	±100	75-86	±1000µF
REC3-xx3.3SRWZ/H*	9 - 36, 18 - 72	3.3	900	77-79	4700µF
REC3-xx05SRWZ/H*	9 - 36, 18 - 72	5	600	78-80	4700µF
REC3-xx09SRWZ/H*	9 - 36, 18 - 72	9	330	80-83	3300µF
REC3-xx12SRWZ/H*	9 - 36, 18 - 72	12	250	83-85	2200µF
REC3-xx15SRWZ/H*	9 - 36, 18 - 72	15	200	83-85	2200µF
REC3-xx05DRWZ/H*	9 - 36, 18 - 72	±5	±300	77-80	±2200µF
REC3-xx12DRWZ/H*	9 - 36, 18 - 72	±12	±125	83-85	±1000µF
REC3-xx15DRWZ/H*	9 - 36, 18 - 72	±15	±100	83-85	±1000µF

H* = H2, H4 or H6 for A or C pinning options with 2kVDC, 4kVDC or 6kVDC isolation.

H* = H for B pinning option with 1.6kVDC isolation only.

2:1 Input

(REC3-S/DRWH4/H6)
xx = 4.5-9Vin = 05
xx = 9-18Vin = 12
xx = 18-36Vin = 24
xx = 36-72Vin = 48

4:1 Input

(REC3-S/DRWZ(H4/H6))
xx = 9-36Vin = 24
xx = 18-72Vin = 48

- * add suffix "/A", "/B" or "/C" for pinning options, see next page and Isolation Restrictions.
- * add suffix "/M" for metal case.
- * add suffix "/SMD" for SMD package.
- * add suffix "/CTRL" for control pin option (A Pinning only)
- * add suffix -R for Tape and Reel packaging

Ordering Examples:

REC3-0512DRW/H2/A/CTRL= 2:1 input, 5V Vin, ±12V Vout, 2kVDC, pinout "A", plastic case, control pin
REC3-4812SRWZ/H4/A/M = 4:1 input, 48V Vin, 12V Vout, 4kVDC, pinout "A", metal case, no control pin
REC3-2412DRWZ/H/B = 4:1 input, 24V Vin, ±12V Vout, 1.6kVDC, pinout "B", plastic case, no control pin
REC3-0505SRW/H6/C/SMD-R = 2:1 input, 5V Vin, 5V Vout, 6kVDC, SMD pinout "C", plastic case, no control pin, Tape and Reel packaging.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

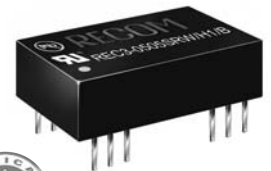
RECOM

3 Watt

DIP24 & SMD

Single & Dual

Output



E-358085

EN-60950-1 Certified

UL-60950-1 Certified

EN-60601-1 Certified

REC3-S_DRW

Isolation Restrictions

'B' Pinning is restricted to 1.6kV isolation due to the closeness of the input and output pins.

If the options "/M" for metal case and "/SMD" for SMD pinout are combined, the maximum allowed isolation voltage is 2kVDC because of the shorter distances between pins and the metal case.

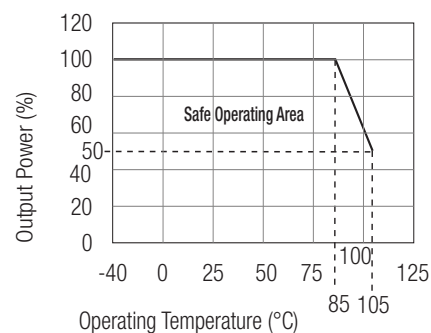
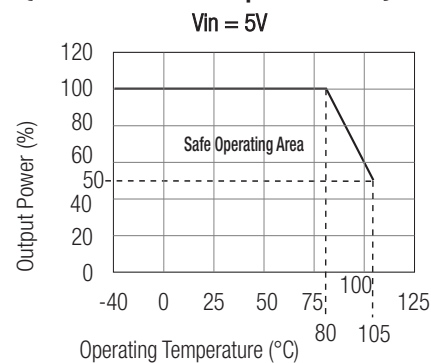
DIP-24 through-hole case and SMD-plastic case are not affected and offer the full isolation barriers of 2kV through to 6kVDC.

Refer to Application Notes

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	2:1 & 4:1	
Output Voltage Accuracy	$\pm 2\%$ max.	
Line Regulation (HL-LL)	$\pm 0.4\%$ max.	
Load Regulation (for output load current change from 20% to 100%)	$\pm 0.6\%$ max.	
Minimum Load	0%	
Output Ripple and Noise (0,1 μ F capacitor on output, 20MHz BW)	50mVp-p max.	
Switching Frequency at Full Load	2:1 Input types	90kHz min. / 150kHz max.
and nominal Input Voltage	4:1 Input types	120kHz min. / 180kHz max.
Input Filter	Pi Network	
Efficiency at Full Load	see above	
No Load Power Consumption	300mW max.	
Isolation Voltage	H2 types	(tested for 1 second) (rated for 1 minute) 2000VDC 1000VAC / 60Hz
Isolation Voltage	H4 types	(tested for 1 second) (rated for 1 minute) 4000VDC 2000VAC / 60Hz
Isolation Voltage	H6 types	(tested for 1 second) (rated for 1 minute) 6000VDC 3000VAC / 60Hz
Isolation Capacitance	2:1 Input types	20pF min. / 60pF max.
	4:1 Input types	40pF min. / 80pF max.
Isolation Resistance	1 G Ω min.	
Short Circuit Protection (Max temp. = 60°C during short circuit conditions)	Continuous, Auto Restart	
Operating Temperature Range (free air convection)	5V input types	-40°C to +80°C (see Graph)
	others	-40°C to +85°C (see Graph)
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	95% RH	
Case Material	Non-Conductive Plastic or Metal	
Thermal Impedance	Natural convection	20°C/W for plastic case 12°C/W for metal case
Package Weight	13g	
Packing Quantity	15 pcs per Tube 100 pcs per Reel	
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 1043 x 10 ³ hours
(+85°C)		using MIL-HDBK 217F 186 x 10 ³ hours
Certifications	UL General Safety Report: E358085 UL 60950-1 1st Ed. C22.2 No. 60950-1-03 EN General Safety Report: SPCLVD1212007 EN60950-1:2006 + A1:2010+A12:2011 EN Medical Safety Report: MDD1205098-3 + RM1205098-3 IEC/EN 60601-1 3rd Ed. Medical Report + ISO14971 Risk Assessment	

Derating-Graph (Ambient Temperature)

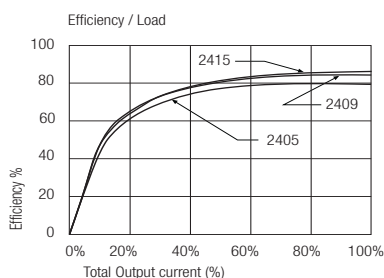


Notes

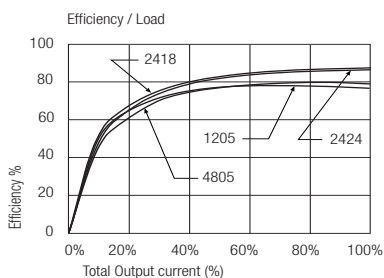
Note 1 Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter

Typical Characteristics

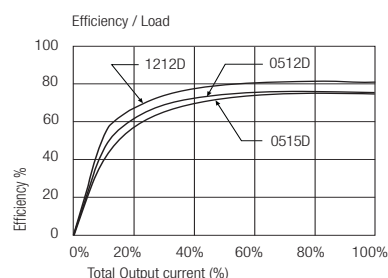
Single 2:1 Input



Single 2:1 Input

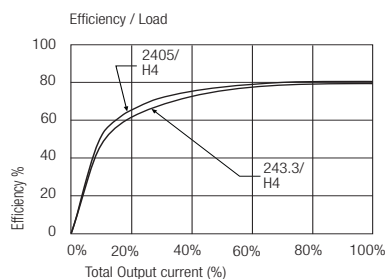


Dual 2:1 Input

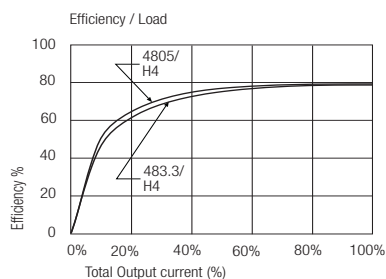


Typical Characteristics - Continued

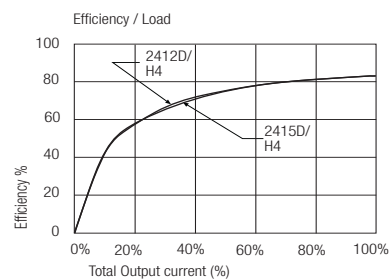
Single 4:1 Input



Single 4:1 Input



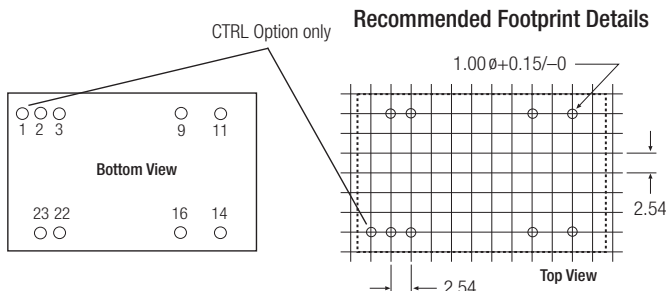
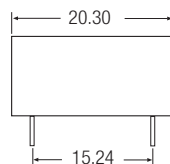
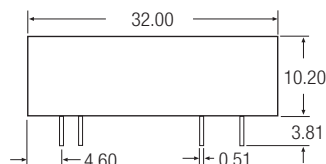
Dual 4:1 Input



Package Style and Pinning (mm) DIP 24 , Wide Input 2:1 & 4:1

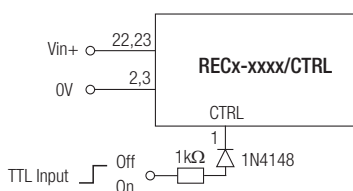
"A" Pinning

/H2, /H4 & /H6



CTRL Option

ON = Open or $0V < V_{ctrl} < 1.2V$
OFF = $2.2V < V_{ctrl} < 12V$



3rd angle projection

Pin Connections

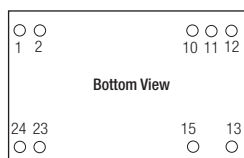
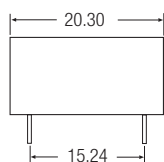
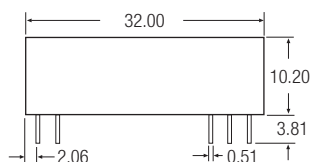
Pin #	Single	Dual
1 (option)	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

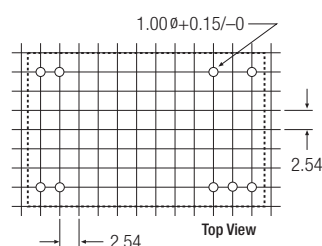
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

"C" Pinning

/H2, /H4 & /H6



Recommended Footprint Details



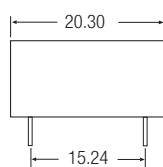
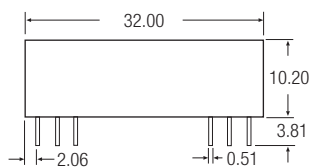
Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	+Vin	+Vin
10	NC	Com
11	NC	Com
12	-Vout	NC
13	+Vout	-Vout
15	NC	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

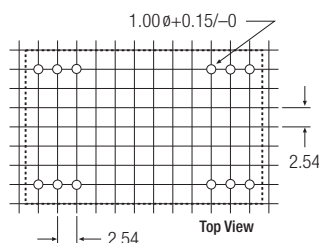
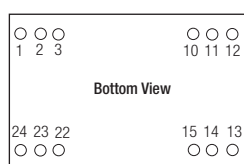
NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

"B" Pinning /H (1.6kV Only)



Recommended Footprint Details



Pin Connections

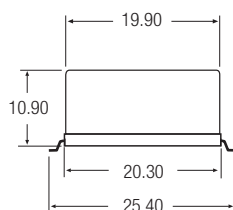
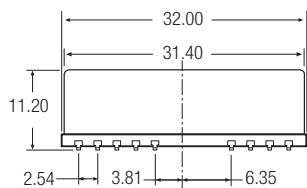
Pin #	Single	Dual
1	+Vin	+Vin
2	No Pin	-Vout
3	No Pin	Com
10	-Vout	Com
11	+Vout	+Vout
12	-Vin	-Vin
13	-Vin	-Vin
14	+Vout	+Vout
15	-Vout	Com
22	No Pin	Com
23	No Pin	-Vout
24	+Vin	+Vin

NC = No Connection

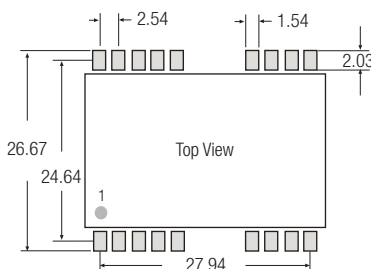
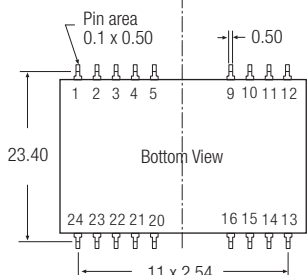
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

SMD Pinning



Recommended Footprint Details



SMD pin connections follow standard package A (/A/SMD), B (/B/SMD) or C (/C/SMD) pinning.

All unused pins are NC (No Connection). See Below for detailed pinout lists

for all packages incl.SMD case the length of plastic case is 31,8 mm, length of metal case 32.0 mm

/A/SMD Pinning

Pin #	Single	Dual
1 (Option)	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
4	NC	NC
5	NC	NC
9	NC	Com
10	NC	NC
11	NC	-Vout
12	NC	NC
13	NC	NC
14	+Vout	+Vout
15	NC	NC
16	-Vout	Com
20	NC	NC
21	NC	NC
22	+Vin	+Vin
23	+Vin	+Vin
24	NC	NC

/B/SMD Pinning

Pin #	Single	Dual
1	+Vin	+Vin
2	NC	-Vout
3	NC	Com
4	NC	NC
5	NC	NC
9	NC	NC
10	-Vout	Com
11	+Vout	+Vout
12	-Vin	-Vin
13	-Vin	-Vin
14	+Vout	+Vout
15	-Vout	Com
16	NC	NC
20	NC	NC
21	NC	NC
22	NC	Com
23	NC	-Vout
24	+Vin	+Vin

/C/SMD Pinning

Pin #	Single	Dual
1	+Vin	+Vin
2	+Vin	+Vin
3	NC	NC
4	NC	NC
5	NC	NC
9	NC	NC
10	NC	Com
11	NC	Com
12	-Vout	NC
13	+Vout	-Vout
14	NC	NC
15	NC	+Vout
16	NC	NC
20	NC	NC
21	NC	NC
22	NC	NC
23	-Vin	-Vin
24	-Vin	-Vin

Features

Regulated Converters

- 8kVDC & 10kVDC Reinforced Isolation
- Industry Standard DIP24 Package
- 3.5W Regulated Output
- Continuous Short Circuit Protection
- Wide Input 2:1
- Medical Approved
- EN, CSA and CB Certificates
- 2 Pinout Options
- Control Pin Option
- Efficiency to 86%

Description

The REC3.5 series uses a reinforced isolation transformer to offer exceptionally high isolation of 8kVDC (4kVAC/1 minute) or 10kVDC (5kVAC/1 minute) making it suitable for HT monitoring circuits, mains power meters, IGBT isolated power supplies and other sophisticated industrial and medical applications. The isolation capacitance of only 20pF makes them also suitable for low leakage applications. The isolation transformer is recognised by CSA as reinforced isolated with a minimum internal clearance of 2.4mm and a minimum internal creepage clearance of 4.6mm. The REC3.5 is available in two industry-standard pinouts (= "/A" or "/C"). Remote on/off control is possible with the /CTRL option (A pinning only) and an optional undervoltage lockout function is also available (= "/X1"). The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number DIP24	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ^(*)
REC3.5-xx05SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	5	700	80, 81, 82 77	4700µF
REC3.5-xx09SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	9	388	81, 82, 83 80	3300µF
REC3.5-xx12SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	12	290	82, 83, 84 82	2200µF
REC3.5-xx15SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	15	233	84, 85, 86 83	2200µF
REC3.5-xx24SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	24	145	83, 84, 85 82	1000µF
REC3.5-xx05DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±5	±350	80, 81, 82 77	±2200µF
REC3.5-xx09DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±9	±194	81, 82, 83 80	±1600µF
REC3.5-xx12DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±12	±145	81, 82, 83 82	±1000µF
REC3.5-xx15DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±15	±117	82, 83, 84 80	±1000µF

R* = R8 or R10 for 8kVDC or 10kVDC isolation.

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

* add suffix "/A" or "/C" for pinning options, see next page for details.

* add suffix "/CTRL" for control pin option (A Pinning only)

* add suffix "/X1" for Undervoltage Lockout

2:1 Input

(REC3.5-S_DRW/R8(R10))

xx = 4.5-9Vin = 05

xx = 9-18Vin = 12

xx = 18-36Vin = 24

xx = 36-75Vin = 48

Ordering Examples:

REC3.5-0512DRW/R8/A/CTRL = 5V Vin, ±12V Vout, 8kVDC isolation, pinout "A", control pin

REC3.5-4805SRW/R10/A = 48V Vin, 5V Vout, 10kVDC isolation, pinout "A"

REC3.5-1212DRW/R8/C/X1 = 12V Vin, ±12V Vout, 8kVDC isolation, pinout "C", UVL

REC3.5-0505SRW/R10/A/CTRL/X1 = 5V Vin, 5V Vout, 10kVDC isolation, pinout "A", control pin, UVL

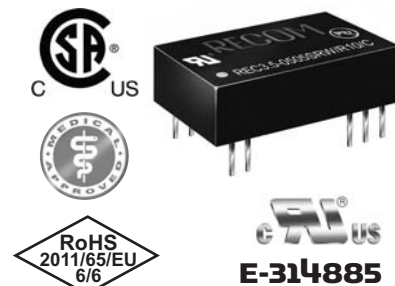
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

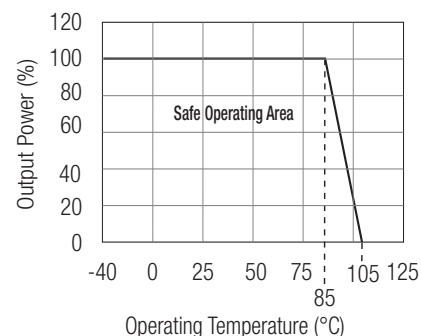
3.5 Watt DIP24 Reinforced Single & Dual Output



C22.2-No. 60950 Certified
C22.2-601.1 Certified
UL-60601.1 Certified

REC3.5/R

Derating-Graph (Ambient Temperature)

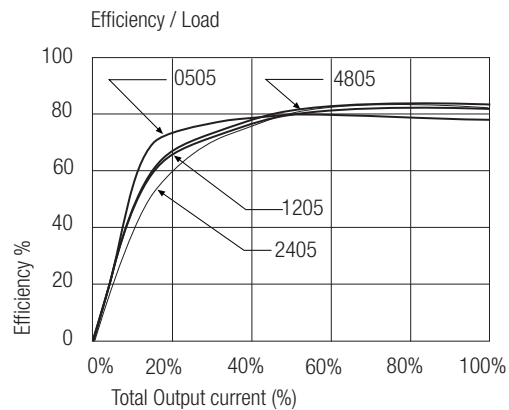


Refer to Application Notes

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

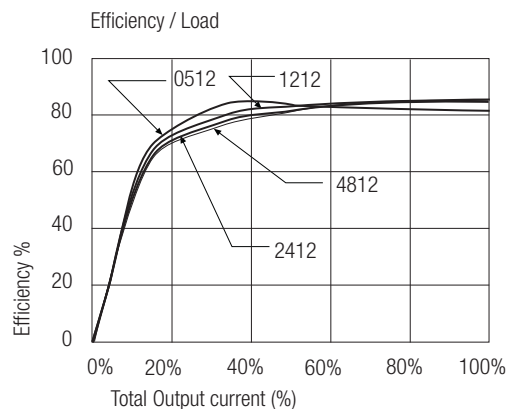
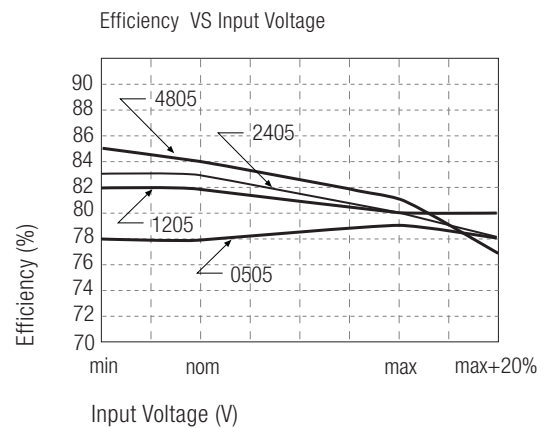
Input Voltage Range			2:1
Output Voltage Accuracy			±2% max.
Line Regulation	(HL-LL)		±0.3% max.
Load Regulation	(for output load current change from 20% to 100%)		±0.6% max.
Input Surge	(1 minute)	5V types	16V max.
		12V types	25V max.
		24V types	50V max.
		48V types	100V max.
Undervoltage Lockout	(X1 Versions)	5V types	3.5V typ. (±20%)
		12V types	7V typ. (±20%)
		24V types	15V typ. (±10%)
		48V types	32V typ. (±10%)
Output Ripple and Noise	(0,1µF capacitor on output, 20MHz BW limited)		150mVp-p max.
Transient Response	(25% step change)		1ms typ.
Switching Frequency	(Full load and nominal input voltage)		150kHz min. / 500kHz max.
Input Filter			Pi Network
Capacitors	All types		MLCC capacitors only
Mimimum Load	(Operation under no load will not damage the converter, but it may not meet all specifications)		10% Full Load
No Load Power Consumption			400mW max.
Isolation Voltage	R8 types	(tested for 1 second)	8000VDC
		(rated for 1 minute)	4000VAC / 60Hz
Isolation Voltage	R10 types	(tested for 1 second)	10000VDC.
		(rated for 1 minute)	5000VAC / 60Hz
Isolation Capacitance			20pF typ.
Isolation Resistance			10 GΩ min.
Short Circuit Protection		(Max operating temp. = 60°C during short circuit conditions)	Continuous, Auto Restart
Operating Temperature Range		(free air convection)	-40°C to +85°C (see Graph)
Case Temperature			105°C max.
Storage Temperature Range			-55°C to +125°C
Relative Humidity			95% RH
Case Material			Non-Conductive Plastic
Potting Material			Silicone
Thermal Impedance		Natural convection	20°C/W
Package Weight			14g
Packing Quantity			15 pcs per Tube
MTBF (+25°C) (+75°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1206 x 10³ hours
		using MIL-HDBK 217F	392x 10³ hours
EMC (with 470µF//0.1µF capacitors across input)	Conducted Emissions	EN55022	Class A
	Radiated Emissions	EN55022	Class A
Reinforced Isolation	Transformer Creepage	/R8 and /R10 Types	4.6 mm min.
	Transformer Clearance	/R8 and /R10 Types	2.4 mm min.
	PCB Creepage & Clearance	/R8 and /R10 Types	6.0 mm min.
	Optocoupler Creepage	/R8 and /R10 Types	6.0 mm min.
External Creepage and Clearance	Plastic Case	Input <> Output pins	14.2 mm min.
Certifications	CB/EN Medical Safety		Report: MDD1207051 + RM1207051 IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment
	CSA	Medical Safety	Report: 2202478 C22.2 601-1 2nd Ed.
	UL	Medical Safety	E314885 UL 60601-1
		General Safety	Report: 2219431 C22.2 No. 60950-1-03
	UL 60950-1 1st Ed.		Recognised as Reinforced Isolation Supplement to Report: 2219431

Efficiency vs Load

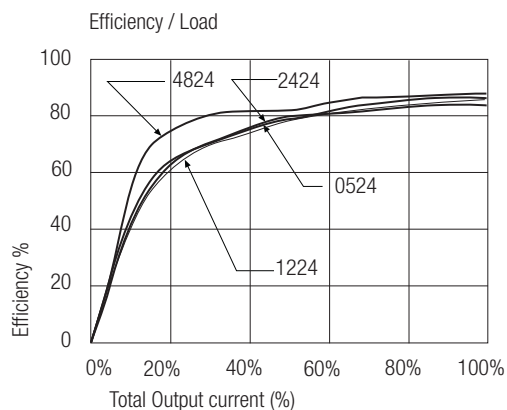
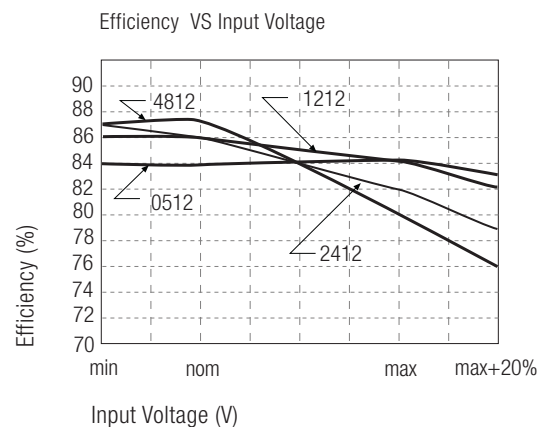


REC3.5-xx05SRW/R*
REC3.5-xx05DRW/R*

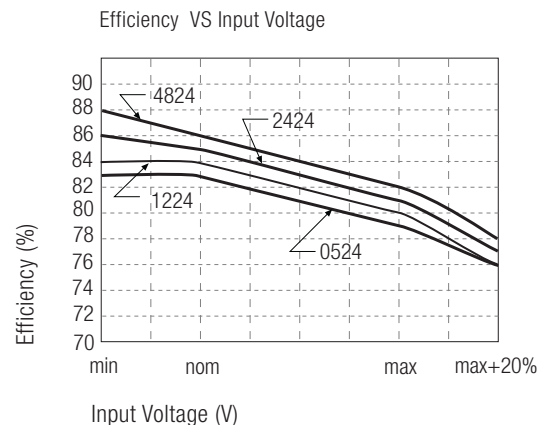
Efficiency vs Vin



REC3.5-xx12SRW/R*

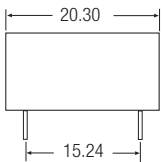
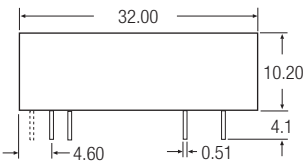


REC3.5-xx24SRW/R*
REC3.5-xx12DRW/R*

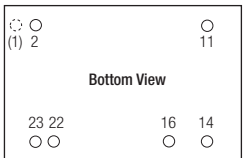




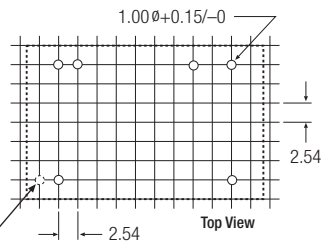
"A" Pinning
/R8 & /R10



Recommended Footprint Details



CRTL Version only



Pin Connections

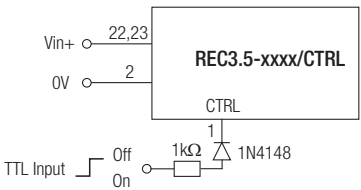
Pin #	Single	Dual
1 (option)	CTRL	CTRL
2	-Vin	-Vin
11	NC	-Vin
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

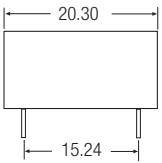
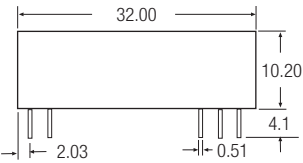
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

CTRL Option

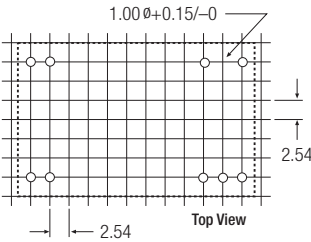
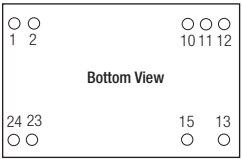
ON = Open or $0V < V_{ctrl} < 1.2V$
OFF = $2.2V < V_{ctrl} < 12V$



"C" Pinning
/R8 & /R10



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	+Vin	+Vin
10	NC	Com
11	NC	Com
12	-Vout	NC
13	+Vout	-Vout
15	NC	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Regulated Converters

- High 4kVDC & 6kVDC Isolation
- 5W DIP24 Industry Standard Package
- Feedback Regulated Output
- Continuous Short Circuit Protection
- Wide Inputs 2:1 & 4:1
- Approved for Medical Applications
- UL and EN Safety Approvals
- 2 Pinout Options, 3 Case Styles
- Efficiency to 86 %

Description

This series offers standard isolation of 2kVDC with 4kVDC or 6kVDC options making it ideal for both industrial, medical and other sophisticated high end applications. Packaging can be either DIP-24 non-conductive plastic or 5-side-shielded DIP24 metal case (= option "/M") as well as DIP24-SMD case (= option "/SMD"). For all the above variants, 2 industry-standard pinouts (= option "/A" or "/C") are available. "B" pinning is also available with "/H" isolation of 1.6kVDC. Remote on/off control is possible with the /CTRL option ("A" pinning only). The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number DIP24 (SMD)	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
REC5-xx3.3SRW/H*	9 - 18, 18 - 36, 36 - 72	3.3	1000	75-77	6800µF
REC5-xx05SRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	5	1000	79-81 72	6800µF
REC5-xx09SRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	9	556	82-83 73	6800µF
REC5-xx12SRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	12	420	84-85 74	6800µF
REC5-xx15SRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	15	340	85-86 75	6800µF
REC5-xx05DRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	±5	±500	79-81 72	±2200µF
REC5-xx09DRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	±9	±278	82-84 74	±2200µF
REC5-xx12DRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	±12	±210	84-85 75	±2200µF
REC5-xx15DRW/H*	9 - 18, 18 - 36, 36 - 72 4.5 - 9V	±15	±170	85-86 75	±2200µF
REC5-xx3.3SRWZ/H*	9 - 36**, 18 - 72	3.3	1000	75-76	6800µF
REC5-xx05SRWZ/H*	9 - 36**, 18 - 72	5	1000	81-82	6800µF
REC5-xx09SRWZ/H*	9 - 36, 18 - 72	9	556	82-83	6800µF
REC5-xx12SRWZ/H*	9 - 36, 18 - 72	12	420	83-84	6800µF
REC5-xx15SRWZ/H*	9 - 36, 18 - 72	15	340	84-85	6800µF
REC5-xx05DRWZ/H*	9 - 36**, 18 - 72	±5	±500	81-82	±2200µF
REC5-xx09DRWZ/H*	9 - 36, 18 - 72	±9	±278	82-84	±2200µF
REC5-xx12DRWZ/H*	9 - 36, 18 - 72	±12	±210	82-83	±2200µF
REC5-xx15DRWZ/H*	9 - 36, 18 - 72	±15	±170	84-85	±2200µF

H* = H2, H4 or H6 for A or C pinning options with 2kVDC, 4kVDC or 6kVDC isolation.

H* = H for B pinning option with 1.6kVDC isolation only. ** Derate to 900mA (±450mA) max. at Vin=9V

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

* add suffix "/A", "/B" or "/C" for pinning options, see next page and Isolation Restrictions.

* add suffix "/M" for metal case.

* add suffix "/SMD" for SMD package.

* add suffix "/CTRL" for control pin option (A Pinning only)

* add suffix -R for Tape and Reel packaging

2:1 Input (REC5-S/DRW)	4:1 Input (REC5-S/DRWZ)
xx = 4.5-9Vin = 05	xx = 9-36Vin = 24
xx = 9-18Vin = 12	xx = 18-72Vin = 48
xx = 18-36Vin = 24	
xx = 36-72Vin = 48	

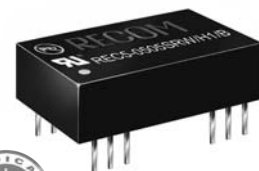
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

5 Watt DIP24 & SMD Single & Dual Output



REC5
E358085

EN-60950-1 Certified

UL-60950-1 Certified

EN-60601-1 Certified

REC 5

Isolation Restrictions

'B' Pinning is restricted to 1.6kV isolation due to the closeness of the input and output pins.

If the options "/M" for metal case and "/SMD" for SMD pinout are combined, the maximum allowed isolation voltage is 2kVDC because of the shorter distances between pins and the metal case.

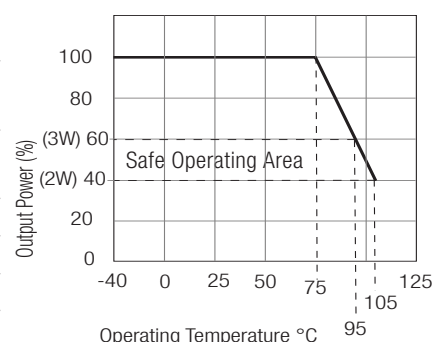
DIP-24 through-hole case and SMD-plastic case are not affected and offer the full isolation barriers of 2kV through to 6kVDC.

Refer to Application Notes

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range			2:1 & 4:1
Output Voltage Accuracy			±2% max.
Line Regulation (HL-LL)			±0.3% max.
Load Regulation (for output load current change from 20% to 100%)			±0.6% max.
Minimum Load			0%
Output Ripple and Noise (0,1µF capacitor on output, 20MHz BW)			50mVp-p max.
Operating Frequency at Full Load (at nominal input voltage)	2:1 input		120kHz typ.
	4:1 input		200kHz typ.
Input Filter			Pi Network
Efficiency at Full Load			see above
No Load Power Consumption			300mW max.
Isolation Voltage	H2 types	(tested for 1 second) (rated for 1 minute)	2000VDC 1000VAC / 60Hz
Isolation Voltage	H4 types	(tested for 1 second) (rated for 1 minute)	4000VDC 2000VAC / 60Hz
Isolation Voltage	H6 types	(tested for 1 second) (rated for 1 minute)	6000VDC 3000VAC / 60Hz
Isolation Capacitance			60pF typ.
Isolation Resistance			1 GΩ min.
Short Circuit Protection (Max temp. = 50°C during short circuit conditions)		Continuous, Auto Restart	
Operating Temperature (free air convection)		-40°C to +75°C (see Graph)	
Storage Temperature Range		-55°C to +125°C	
Relative Humidity		95% RH	
Case Material		Non-Conductive Plastic or Metal	
Thermal Impedance	Natural convection	20°C/W for plastic case 12°C/W for metal case	
Package Weight			13g
Packing Quantity			15 pcs per Tube 100 pcs per Reel
MTBF (+25°C) (+75°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	850 x 10³hours
		using MIL-HDBK 217F	206 x 10³hours
Certifications	UL General Safety	Report: E358085	UL 60950-1 1st Ed. C22.2 No. 60950-1-03
	EN General Safety	Report: SPCLVD1212007	EN60950-1:2006 + 9+A1:2010+A12:2011
	EN Medical Safety	Report: MDD1205098-3 + RM1205098-3	
	IEC/EN 60601-1 3rd Edition, Medical Report + ISO14971 Risk Assessment		

Derating-Graph (Ambient Temperature)



Ordering Examples:

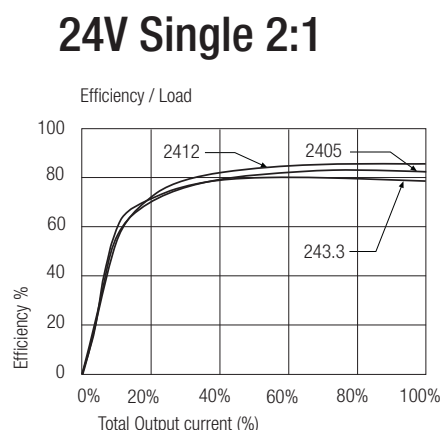
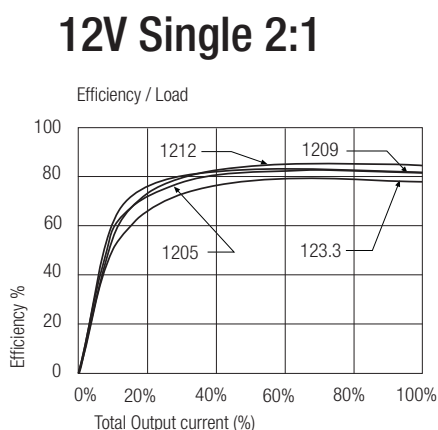
REC5-0512DRW/H2/A/CTRL = 2:1 input, 5V Vin, $\pm 12\text{V}$ Vout, 2kVDC, pinout "A", plastic case, control pin

REC5-4812SRWZ/H4/A/M = 4:1 input, 48V Vin, 12V Vout, 4kVDC, pinout "A", metal case, no control pin

REC5-1212DRWZ/H/B = 4:1 input, 12V Vin, $\pm 12\text{V}$ Vout, 1.6kVDC, pinout "B", plastic case, no control pin

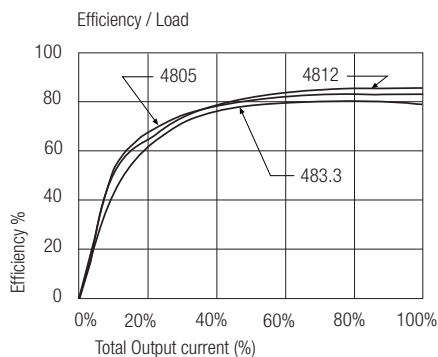
REC5-0505SRW/H6/C/SMD = 2:1 input, 5V Vin, 5V Vout, 6kVDC, SMD pinout "C", plastic case, no control pin

Typical Characteristics

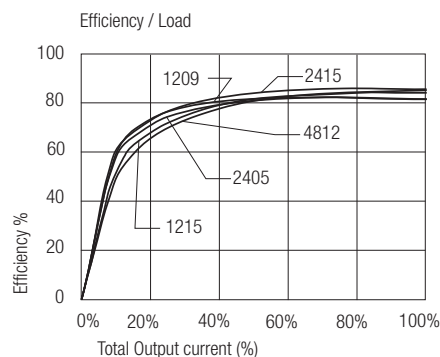


Typical Characteristics

48V Single 2:1



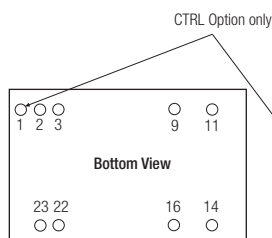
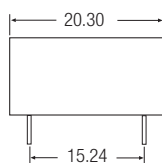
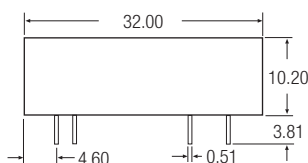
Dual 4:1



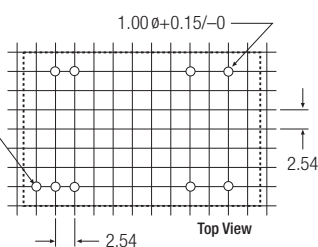
Package Style and Pinning (mm) DIP 24 , Wide Input 2:1 & 4:1

"A" Pinning

/H2, /H4 & /H6



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1 (option)	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

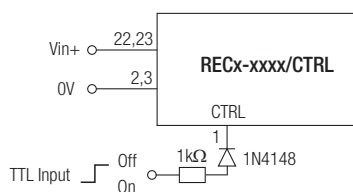
NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

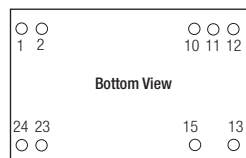
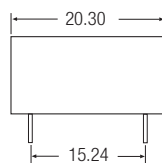
CTRL Option

ON = Open or $0V < V_{ctrl} < 1.2V$
OFF = $2.2V < V_{ctrl} < 12V$

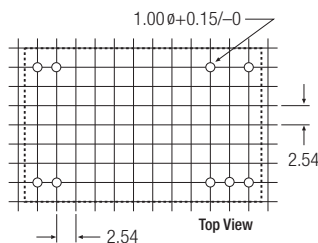


"C" Pinning

/H2, /H4 & /H6



Recommended Footprint Details



Pin Connections

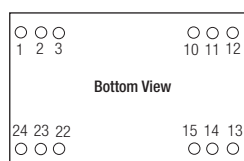
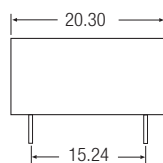
Pin #	Single	Dual
1	+Vin	+Vin
2	+Vin	+Vin
10	NC	Com
11	NC	Com
12	-Vout	NC
13	+Vout	-Vout
15	NC	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

NC = No Connection

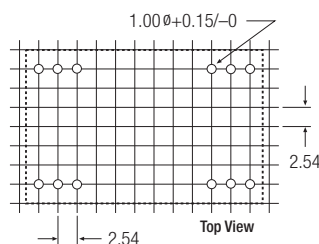
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

"B" Pinning /H (1.6kV Only)



Recommended Footprint Details



Pin Connections

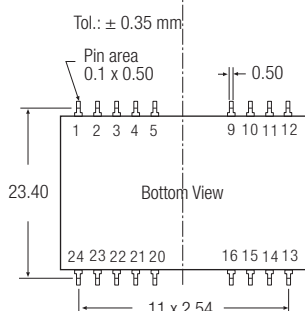
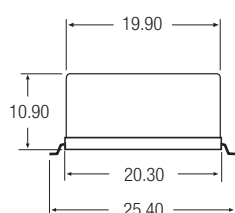
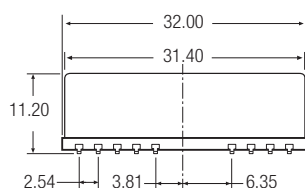
Pin #	Single	Dual
1	+Vin	+Vin
2	No Pin	-Vout
3	No Pin	Com
10	-Vout	Com
11	+Vout	+Vout
12	-Vin	-Vin
13	-Vin	-Vin
14	+Vout	+Vout
15	-Vout	Com
22	No Pin	Com
23	No Pin	-Vout
24	+Vin	+Vin

NC = No Connection

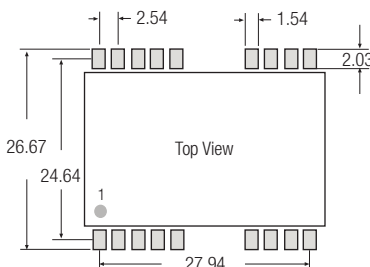
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

SMD Pinning



Recommended Footprint Details



SMD pin connections follow standard package A (/A/SMD), B (/B/SMD) or C (/C/SMD) pinning.

All unused pins are NC (No Connection). See Below for detailed pinout lists

for all packages incl.SMD case the length of plastic case is 31,8 mm, length of metal case 32.0 mm

/A/SMD Pinning

Pin #	Single	Dual	Pin #	Single	Dual
1 (Option)	CTRL	CTRL	13	NC	NC
2	-Vin	-Vin	14	+Vout	+Vout
3	-Vin	-Vin	15	NC	NC
4	NC	NC	16	-Vout	Com
5	NC	NC	20	NC	NC
9	NC	Com	21	NC	NC
10	NC	NC	22	+Vin	+Vin
11	NC	-Vout	23	+Vin	+Vin
12	NC	NC	24	NC	NC

/B/SMD Pinning

Pin #	Single	Dual	Pin #	Single	Dual
1	+Vin	+Vin	13	-Vin	-Vin
2	NC	-Vout	14	+Vout	+Vout
3	NC	Com	15	-Vout	Com
4	NC	NC	16	NC	NC
5	NC	NC	20	NC	NC
9	NC	NC	21	NC	NC
10	-Vout	Com	22	NC	Com
11	+Vout	+Vout	23	NC	-Vout
12	-Vin	-Vin	24	+Vin	+Vin

/C/SMD Pinning

Pin #	Single	Dual	Pin #	Single	Dual
1	+Vin	+Vin	13	+Vout	-Vout
2	+Vin	+Vin	14	NC	NC
3	NC	NC	15	NC	+Vout
4	NC	NC	16	NC	NC
5	NC	NC	20	NC	NC
9	NC	NC	21	NC	NC
10	NC	Com	22	NC	NC
11	NC	Com	23	-Vin	-Vin
12	-Vout	NC	24	-Vin	-Vin

Features

Regulated Converters

- 8kVDC & 10kVDC Reinforced Isolation
- Industry Standard DIP24 Package
- 6W Regulated Output
- Continuous Short Circuit Protection
- Wide Input 2:1
- Medical Approved
- EN, CSA and CB Certificates
- 2 Pinout Options
- Control Pin Option
- Efficiency to 86%

Description

The REC6 series uses a reinforced isolation transformer to offer exceptionally high isolation of 8kVDC (4kVAC/1 minute) or 10kVDC (5kVAC/1 minute) making it suitable for HT monitoring circuits, mains power meters, IGBT isolated power supplies and other sophisticated industrial and medical applications. The isolation capacitance of only 20pF makes them also suitable for low leakage applications. The isolation transformer is recognised by CSA as reinforced isolated with a minimum internal clearance of 2.4mm and a minimum internal creepage clearance of 4.6mm. The REC6 is available in two industry-standard pinouts (= "/A" or "/C"). Remote on/off control is possible with the /CTRL option (A pinning only) and an optional undervoltage lockout function is also available (= "/X1"). The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number DIP24	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
REC6-xx05SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	5	1000	80, 81, 82 77	6800µF
REC6-xx09SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	9	667 555	81, 82, 83 80	6800µF
REC6-xx12SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	12	500 417	82, 83, 84 82	6800µF
REC6-xx15SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	15	400 333	84, 85, 86 83	6800µF
REC6-xx24SRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	24	250 208	83, 84, 85 82	4700µF
REC6-xx05DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±5	±500	80, 81, 82 77	±2200µF
REC6-xx09DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±9	±335 ±278	81, 82, 83 80	±2200µF
REC6-xx12DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±12	±250 ±208	81, 82, 83 82	±2200µF
REC6-xx15DRW/R*	9 - 18, 18 - 36, 36 - 75 4.5 - 9	±15	±200 ±167	82, 83, 84 80	±2200µF

R* = R8 or R10 for 8kVDC or 10kVDC isolation.

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

* add suffix "/A" or "/C" for pinning options, see next page for details.

* add suffix "/CTRL" for control pin option (A Pinning only)

* add suffix "/X1" for Undervoltage Lockout

2:1 Input

(REC6-S_DRW/R8(R10))

xx = 4.5-9Vin = 05

xx = 9-18Vin = 12

xx = 18-36Vin = 24

xx = 36-75Vin = 48

Ordering Examples:

REC6-0512DRW/R8/A/CTRL = 5V Vin, ±12V Vout, 8kVDC isolation, pinout "A", control pin

REC6-4805SRW/R10/A = 48V Vin, 5V Vout, 10kVDC isolation, pinout "A"

REC6-1212DRW/R8/C/X1 = 12V Vin, ±12V Vout, 8kVDC isolation, pinout "C", UVL

REC6-0505SRW/R10/A/CTRL/X1 = 5V Vin, 5V Vout, 10kVDC isolation, pinout "A", control pin, UVL

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

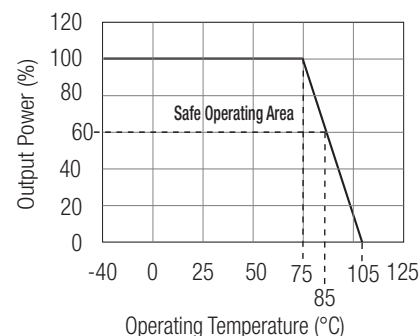
6 Watt DIP24 Reinforced Single & Dual Output



C22.2-No. 60950 Certified
C22.2-601.1 Certified
UL-60601.1 Certified

REC6/R

Derating-Graph (Ambient Temperature)



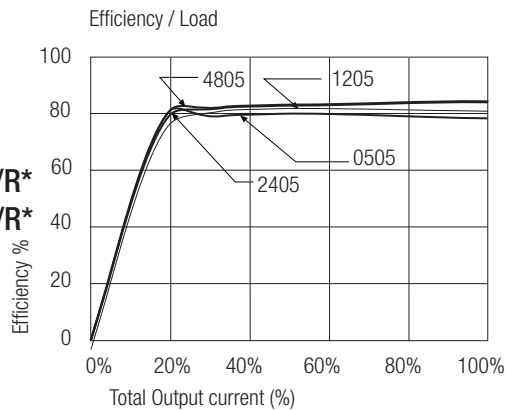
Refer to Application Notes

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

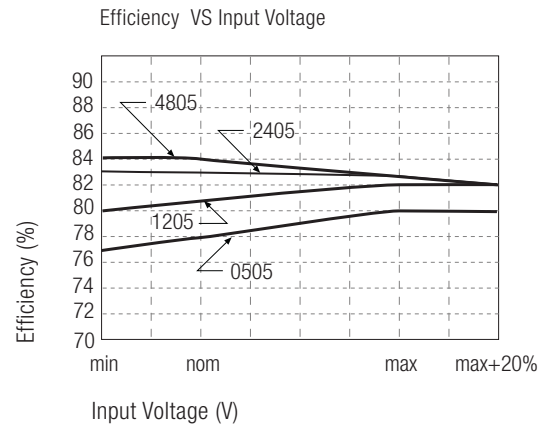
Input Voltage Range			2:1
Output Voltage Accuracy			$\pm 2\%$ max.
Line Regulation	(HL-LL)		$\pm 0.3\%$ max.
Load Regulation	(for output load current change from 20% to 100%)		$\pm 0.6\%$ max.
Input Surge	(1 minute)	5V types	16V max.
		12V types	25V max.
		24V types	50V max.
		48V types	100V max.
Undervoltage Lockout	(X1 Versions)	5V types	3.5V typ. ($\pm 20\%$)
		12V types	7V typ. ($\pm 20\%$)
		24V types	15V typ. ($\pm 10\%$)
		48V types	32V typ. ($\pm 10\%$)
Output Ripple and Noise	(0,1 μF capacitor on output, 20MHz BW limited)		200mVp-p max.
Transient Response	(25% step change)		1ms typ.
Switching Frequency	(Full load and nominal input voltage)		100kHz min. / 350kHz max.
Input Filter			Pi Network
Capacitors	All types		MLCC capacitors only
Minimum Load	(Operation under no load will not damage the converter, but it may not meet all specifications)		10% Full Load
No Load Power Consumption			400mW max.
Isolation Voltage	R8 types	(tested for 1 second)	8000VDC
		(rated for 1 minute)	4000VAC / 60Hz
Isolation Voltage	R10 types	(tested for 1 second)	10000VDC
		(rated for 1 minute)	5000VAC / 60Hz
Isolation Capacitance			20pF typ.
Isolation Resistance			10 G Ω min.
Short Circuit Protection	(Max operating temp. = 50°C during short circuit conditions)		Continuous, Auto Restart
Operating Temperature Range	(free air convection)		-40°C to $+75^\circ\text{C}$ (see Graph)
Case Temperature			105°C max.
Storage Temperature Range			-55°C to $+125^\circ\text{C}$
Relative Humidity			95% RH
Case Material			Non-Conductive Plastic
Potting Material			Silicone
Thermal Impedance	Natural convection		$20^\circ\text{C}/\text{W}$
Package Weight			14g
Packing Quantity			15 pcs per Tube
MTBF ($+25^\circ\text{C}$) ($+75^\circ\text{C}$)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	953 x10 ³ hours
		using MIL-HDBK 217F	234 x10 ³ hours
EMC (with 470 μF /0.1 μF capacitors across input)	Conducted Emissions	EN55022	Class A
	Radiated Emissions	EN55022	Class A
Reinforced Isolation	Transformer Creepage	/R8 and /R10 Types	4.6 mm min.
	Transformer Clearance	/R8 and /R10 Types	2.4 mm min.
	PCB Creepage & Clearance	/R8 and /R10 Types	6.0 mm min.
	Optocoupler Creepage	/R8 and /R10 Types	6.0 mm min.
External Creepage and Clearance	Plastic Case	Input <> Output pins	14.2 mm min.
Certifications	EN Medical Safety	Report: MDD1207051 + RM1207051	IEC/EN 60601-1 3rd Edition Medical Report + ISO14971 Risk Assessment
	CSA	Medical Safety	Report: 2202478
	UL	Medical Safety	E314885
		General Safety	Report: 2219431
	UL 60950-1 1st Ed.	Recognised as Reinforced Isolation	Supplement to Report: 2219431

Efficiency vs Load

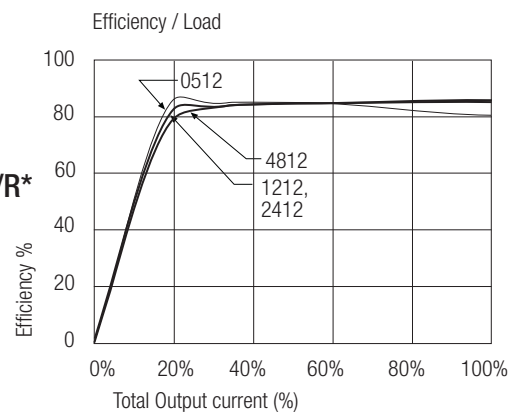
REC6-xx05SRW/R*
REC6-xx05DRW/R*



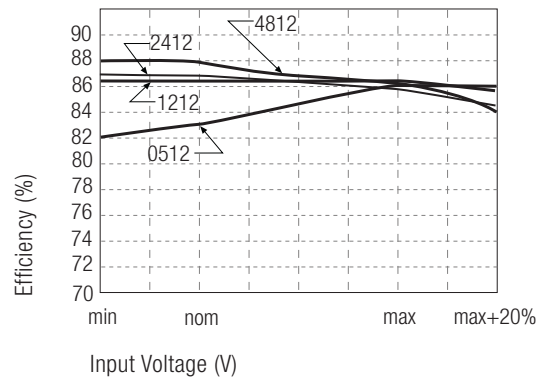
Efficiency vs Vin



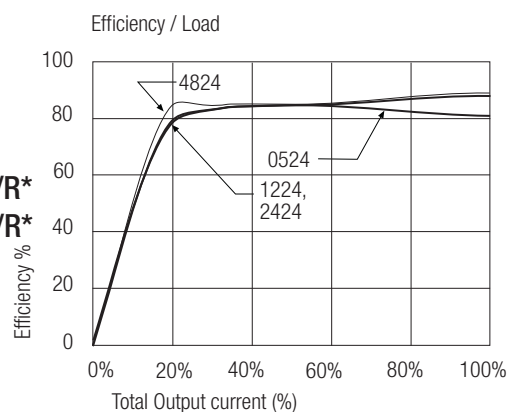
REC6-xx12SRW/R*



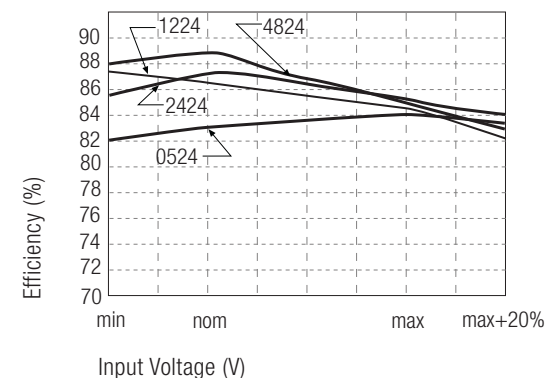
Efficiency VS Input Voltage



REC6-xx24SRW/R*
REC6-xx12DRW/R*

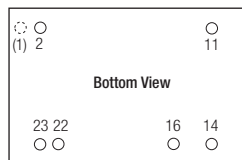
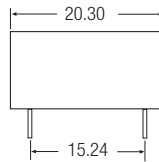
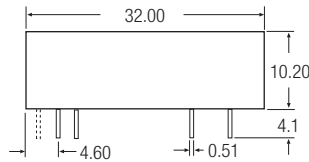


Efficiency VS Input Voltage



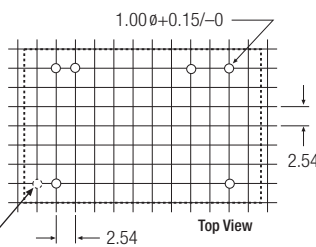


"A" Pinning /R8 & /R10



CTRL Version only

Recommended Footprint Details



Pin Connections

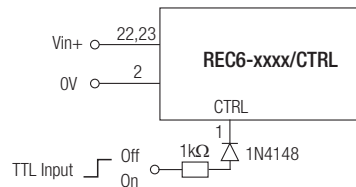
Pin #	Single	Dual
1 (option)	CTRL	CTRL
2	-Vin	-Vin
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

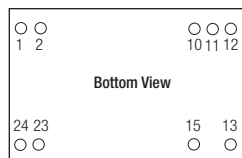
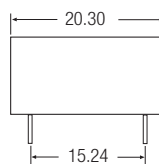
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

CTRL Option

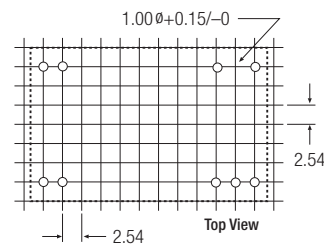
ON = Open or $0V < V_{ctrl} < 1.2V$
OFF = $2.2V < V_{ctrl} < 12V$



"C" Pinning /R8 & /R10



Recommended Footprint Details



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	+Vin	+Vin
10	NC	Com
11	NC	Com
12	-Vout	NC
13	+Vout	-Vout
15	NC	+Vout
23	-Vin	-Vin
24	-Vin	-Vin

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Regulated Converters

- 7.5W DIP24 Package
- 1KVDC, 2KVDC and 3kVDC Isolation Options
- Approved for Medical Applications (/H)
- UL and EN Safety Approvals
- Continuous Short Circuit Protection (power limiting)
- 5 Side Shielded Metal Case
- Full SMD design
- 2 Case Style Options
- Remote Pin Option
- Efficiency to 86 %

Description

The REC7.5-xxxSRW/DRW-series offer single and dual regulated outputs in a DIP24 package with 1kV, 2kV or 3kV options and are suitable for higher power industrial or medical applications. Remote on/off control is possible with the /CTRL option and SMD pinning is offered with the /SMD option. The converters can deliver 140% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load ⁽¹⁾
REC7.5-xx3.3SRW/H*/A/M	9-18, 18-36, 36-72	3.3	1800	78	6800µF
REC7.5-xx05SRW/H*/A/M	9-18, 18-36, 36-72	5	1500	79-82	6800µF
REC7.5-xx09SRW/H*/A/M	9-18, 18-36, 36-72	9	833	81-84	6800µF
REC7.5-xx12SRW/H*/A/M	9-18, 18-36, 36-72	12	625	82-85	6800µF
REC7.5-xx15SRW/H*/A/M	9-18, 18-36, 36-72	15	500	83-86	6800µF
REC7.5-xx05DRW/H*/A/M	9-18, 18-36, 36-72	±5	±750	79-82	±2200µF
REC7.5-xx09DRW/H*/A/M	9-18, 18-36, 36-72	±9	±417	81-84	±2200µF
REC7.5-xx12DRW/H*/A/M	9-18, 18-36, 36-72	±12	±312	82-85	±2200µF
REC7.5-xx15DRW/H*/A/M	9-18, 18-36, 36-72	±15	±250	83-86	±2200µF

Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

* add suffix /H1 for 1kVDC Isolation, /H2 for 2kVDC isolation or /H3 for 3kVDC Isolation (not available in H3/A/M/SMD combination)

* add suffix "/SMD" for SMD package, e.g. REC7.5-2405DRW/H1/A/M/SMD

* add suffix "/CTRL" for Remote Pin option

no plastic case is available for REC7.5

2:1

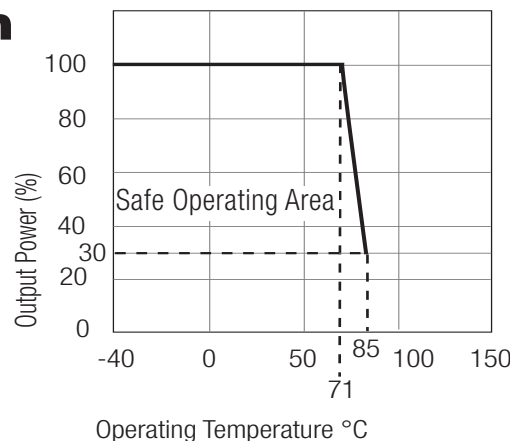
xx = 9-18Vin = 12V,

xx = 18-36Vin = 24,

xx = 36-72Vin = 48

Derating

Derating-Graph (Ambient Temperature)



ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

7.5 Watt DIP24 & SMD Single & Dual Output



E-224736

EN-60950-1 Certified

EN-60601-1 Certified

(* /H suffix)

UL-60950-1 Certified

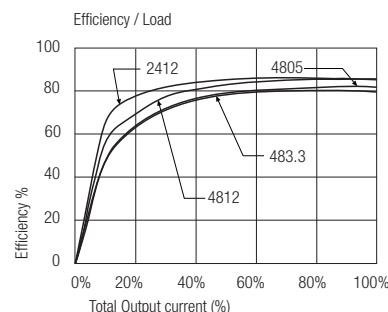
REC 7.5

Refer to Application Notes

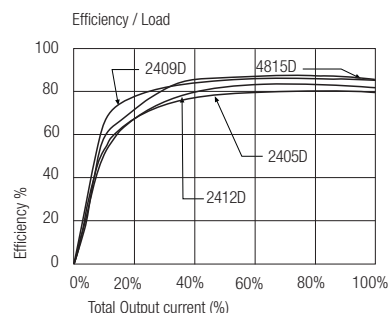
Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range		2:1	
Output Voltage Accuracy		±2% max.	
Line Voltage Regulation		0.4% max.	
Load Voltage Regulation (25% to 100% full load)		0.8% max.	
Minimum Load		0%	
Output Ripple and Noise (at 20MHz BW)	3.3V output type	100mVp-p max.	
	5, 9, 12 and 15V output types	50mVp-p max.	
Operating Frequency (Full Load)		150kHz min. / 240kHz max.	
Input Filter		PI Network	
Efficiency at Full Load		see Selection Guide	
No Load Power Consumption		300mW max.	
Isolation Voltage	/H1 Version	(tested for 1 second)	1000VDC
		(rated for 1 minute)	500VAC / 60Hz
	/H2 Version	(tested for 1 second)	2000VDC
		(rated for 1 minute)	1000VAC / 60Hz
	/H3 Version	(tested for 1 second)	3000VDC
		(rated for 1 minute)	1500VAC / 60Hz
Isolation Capacitance		50pFtyp.	
Isolation Resistance		1 GΩ min.	
Short Circuit Protection (Max temp. = 50°C during short circuit conditions)		Continuous, Auto Restart	
Operating Temperature Range (free air convection)		-40°C to +71°C (see Graph)	
Storage Temperature Range		-55°C to +125°C	
Relative Humidity		95% RH	
Case Material		Nickel Plated Metal with Non-Conductive Base	
Thermal Impedance		Natural convection 12°C/W	
Package Weight		16g	
Packing Quantity		15 pcs per Tube	
MTBF (+25°C)	} Detailed Information see	using MIL-HDBK 217F	800 x 10³hours
		using MIL-HDBK 217F	>200 x 10³hours
(+71°C)	} Application Notes chapter "MTBF"		
Certifications	UL General Safety Report: E248550		UL 60950-1 1st Ed.
			C22.2 No. 60950-1-03
	EN General Safety Report: SPCLVD1212007		EN60950-1:2006 +A12:2011
	EN Medical Safety Report: MDD1205098-3 + RM1205098-3		
IEC/EN 60601-1 3rd Edition; Medical Report + ISO14971 Risk Assessment			

Single

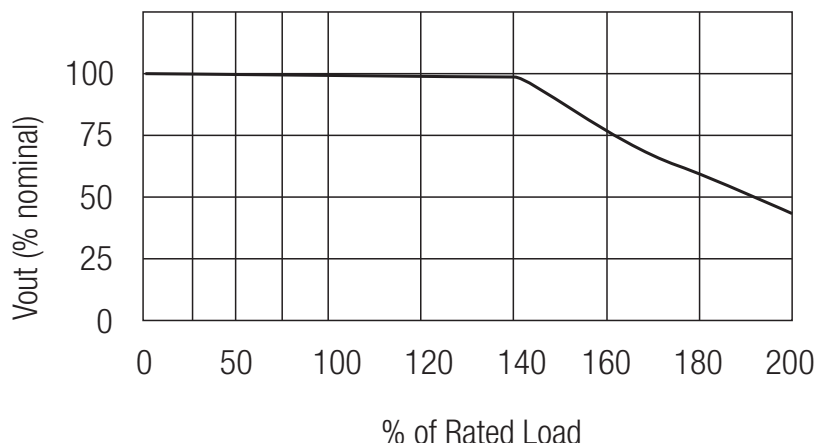


Dual



Typical Characteristics

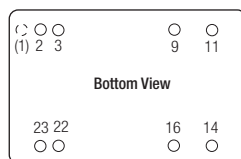
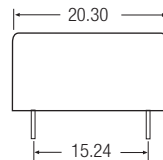
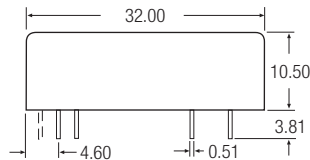
Overload Response



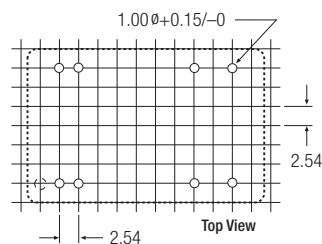
Package Style and Pinning (mm)



24 PIN DIP Package



Recommended Footprint Details



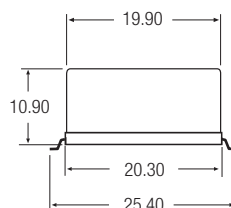
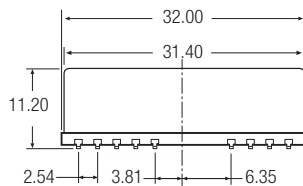
Pin Connections DIP24

Pin #	Single	Dual
1	CTRL/No Pin	CTRL/No Pin
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

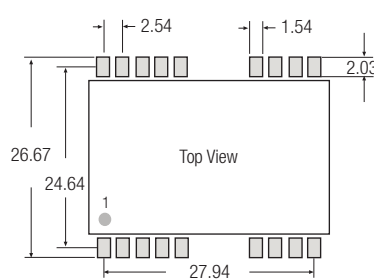
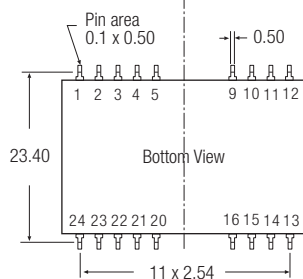
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

24 PIN SMD Package

/H3/A/M/SMD combination is not allowed



Recommended Footprint Details



Pin Connections DIP24 SMD

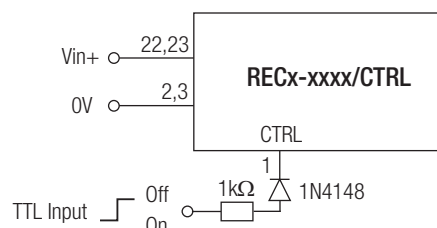
Pin #	Single	Dual
1	CTRL/NC	CTRL/NC
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
1,4,5,10,12	NC	NC
13,15,20,21,24	NC	NC

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

CTRL Option

ON = Open or $0V < V_{ctrl} < 1.2V$
OFF = $2.2V < V_{ctrl} < 12V$



Features

Regulated Converters

- 8W DIP24 Package
- 2KVDC and 3kVDC Isolation Options
- 2:1 and 4:1 Versions
- Continuous Short Circuit Protection (power limiting)
- Synchronous Rectification on 3.3, 5V outputs
- Full SMD internal design
- Through Hole or SMD Pinning Options
- Remote Control Pin
- Efficiency to 87%

Description

The REC8-xxxxSRW/DRW-series offer single and dual regulated outputs in a DIP24 package with 2kV or 3kV isolation options and are suitable for higher power industrial or medical applications. Remote on/off control is standard and SMD pinning is offered with the /SMD option. The converters can deliver 150% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Cap. Load
REC8-xx3.3SRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	3.3	1600	83-85	2200µF
REC8-xx05SRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	5	1600	85-87	2200µF
REC8-xx12SRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	12	666	84-86	470µF
REC8-xx15SRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	15	533	84-86	220µF
REC8-xx05DRW/H*/A/M	9-18, 18-36, 36-75	±5	±800	84	±1000µF
REC8-xx12DRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	±12	±333	84-86	±220µF
REC8-xx15DRW/H*/A/M	4.5-9, 9-18, 18-36, 36-75	±15	±267	84-86	±100µF
REC8-xx3.3SRWZ/H*/A/M	9-36, 18-75	3.3	1600	84	2200µF
REC8-xx05SRWZ/H*/A/M	9-36, 18-75	5	1600	86	2200µF
REC8-xx12SRWZ/H*/A/M	9-36, 18-75	12	666	85	470µF
REC8-xx15SRWZ/H*/A/M	9-36, 18-75	15	533	85	220µF
REC8-xx05DRWZ/H*/A/M	9-36, 18-75	±5	±800	83	±1000µF
REC8-xx12DRWZ/H*/A/M	9-36, 18-75	±12	±333	85	±220µF
REC8-xx15DRWZ/H*/A/M	9-36, 18-75	±15	±267	85	±100µF

* Standard is /H2 for 2kVDC isolation, use /H3 for 3kVDC Isolation (not SMD)

* add suffix "/SMD" for SMD package, e.g. REC8-2405SRW/H2/A/M/SMD

2:1

xx = 4.5-9Vin = 05,
xx = 9-18Vin = 12,
xx = 18-36Vin = 24,
xx = 36-75Vin = 48

4:1

xx = 9-36Vin = 24,
xx = 18-75Vin = 48

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	2:1 & 4:1
Input Filter	PI Network
Output Voltage Accuracy	±1.5% max.
Line Voltage Regulation (V _L to V _H at full load)	±0.5% max.
Load Voltage Regulation (25% to 100% full load)	Single ±0.5% max. Dual ±1.2% max.
Cross Regulation (100%: 25% to 100% full load)	±5% max.
Output Ripple and Noise (with 100n output capacitor and 20MHz BW)	50mVp-p max.
Start-up time	300ms typ.
Operating Frequency (Full Load)	330kHz typ.
Efficiency at Full Load	see Selection Guide
Minimum Load	0% cont.

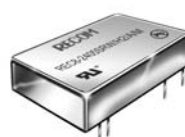
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

8 Watt DIP24 & SMD Single & Dual Output



EN-60950-1 Certified
UL-60950-1 Certified
EN-60601-1 Certified

REC8

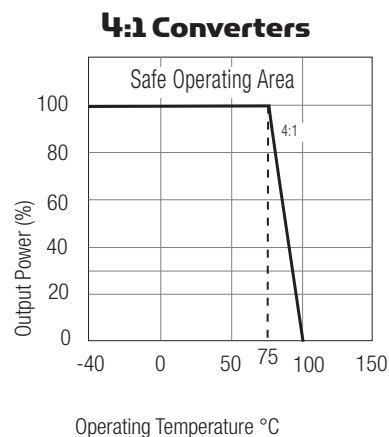
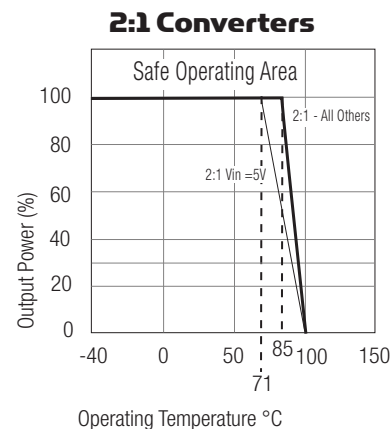
Refer to Application Notes

www.recom-electronic.com

Specifications cont. (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

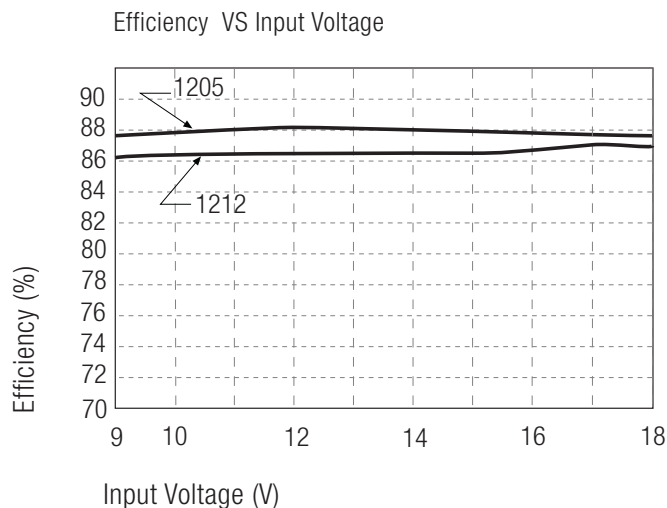
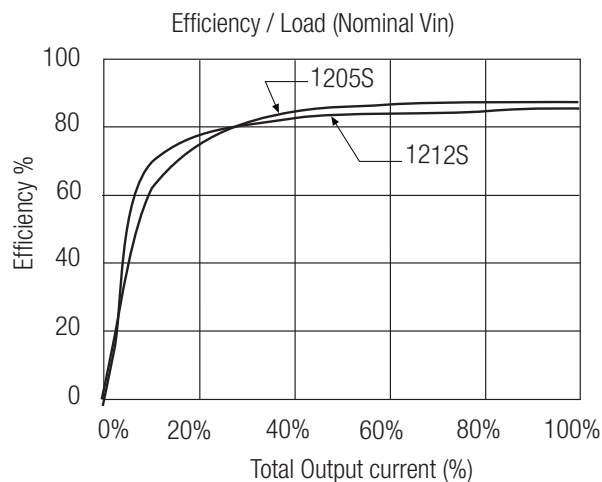
Input Surge Voltage (100ms max.)		5V Input	15VDC
		12V Input	36VDC
		24V Input	50VDC
		48V Input	100VDC
Isolation Voltage	/H2 and SMD	(tested for 1 second)	2000VDC
		(rated for 1 minute)	1000VAC / 60Hz
	/H3 Version	(tested for 1 second)	3000VDC
		(rated for 1 minute)	1500VAC / 60Hz
Isolation Capacitance			1200pF typ.
Isolation Resistance			1 GΩ min.
Overload Protection			150% typ.
Short Circuit Protection			Continuous, Auto Restart
Operating Temperature Range (free air convection)	4:1	-40°C to +71°C (see Graph)	
	2:1 - Vin=5V	-40°C to +71°C (see Graph)	
	2:1 - All Others	-40°C to +85°C (see Graph)	
Remote On/Off	DC/DC ON	Open or 3.5V<Vr<12V	
	DC/DC OFF	Short or 0V<Vr<1.2V	
Storage Temperature Range			-55°C to +105°C
Temperature Coefficient			±0.05% max.
Relative Humidity			95% RH max.
Case Material			Nickel Plated Metal with Non-Conductive Base
Thermal Impedance			Natural convection 12°C/W
Maximum Case Temperature			100°C
Vibration			10-55Hz, 2G, 30mins along X,Y & Z
Package Weight			18g
Packing Quantity			15 pcs per Tube
MTBF (+25°C) (+71°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	1200 x 10³hours
		using MIL-HDBK 217F	>300 x 10³hours

Derating-Graph (Ambient Temperature)



Typical Characteristics

REC8-1205SRW/H2/A/M (/SMD) REC8-1212SRW/H2/A/M (/SMD)



Note: Refer to Application Notes for EMC Class B Filter suggestion

Specifications (cont.)

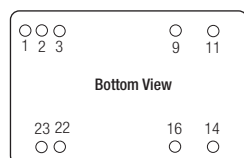
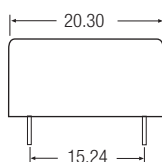
Certifications

EN General Safety	Report: SPCLVD1211033-2	EN60950-1:2006
UL General Safety	Report: E224736	UL 60950-1 1st Ed.
		C22.2 No. 60950-1-03
EN Medical Safety	Report: MDD12060585 + RM1206085	
	IEC/EN 60601-1 3rd Edition; Medical Report + ISO14971 Risk Assessment	

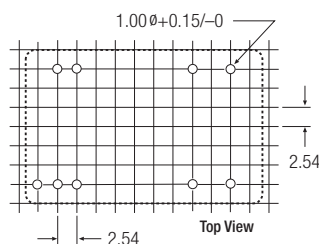
Package Style and Pinning (mm)

24 PIN DIP Package - Available with /H2 and /H3 Options

3rd angle projection



Recommended Footprint Details



Pin Connections DIP24

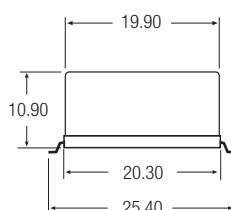
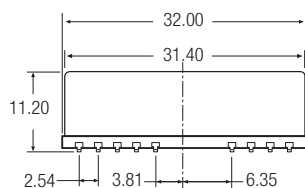
Pin #	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

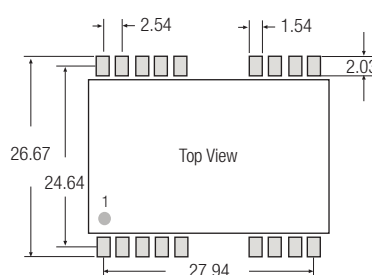
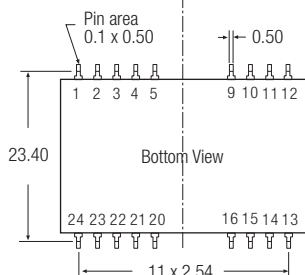
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

24 PIN SMD Package - available with /H2 option only.



Recommended Footprint Details



Pin Connections DIP24 SMD

Pin #	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
4,5,10,12	NC	
13,15,20,21,24	NC	

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Features

Regulated Converters

- 10W DIP24 Package
- 2kVDC and 3kVDC Isolation Options
- 2:1 and 4:1 Versions
- Continuous Short Circuit Protection (power limiting)
- Synchronous Rectification on 3.3, 5V outputs
- Full SMD internal design
- Through Hole or SMD Pinning Options
- Remote Control Pin
- Efficiency to 87%

Description

The REC10-xxxxSRW/DRW-series offer single and dual regulated outputs in a DIP24 package with 2kV or 3kV isolation options and are suitable for higher power industrial or medical applications. Remote on/off control is standard and SMD pinning is offered with the /SMD option. The converters can deliver 150% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Cap. Load
REC10-xx3.3SRW/A/M/H*	9-18, 18-36, 36-75	3.3	2000	84-85	2200µF
REC10-xx05SRW/A/M/H*	9-18, 18-36, 36-75	5	2000	86-87	2200µF
REC10-xx12SRW/A/M/H*	9-18, 18-36, 36-75	12	833	85-86	470µF
REC10-xx15SRW/A/M/H*	9-18, 18-36, 36-75	15	667	85-86	220µF
REC10-xx05DRW/A/M/H*	9-18, 18-36, 36-75	±5	±1000	84	±1000µF
REC10-xx12DRW/A/M/H*	9-18, 18-36, 36-75	±12	±416	86	±220µF
REC10-xx15DRW/A/M/H*	9-18, 18-36, 36-75	±15	±333	86	±100µF
REC10-xx3.3SRWZ/A/M/H*	9-36, 18-75	3.3	2000	84	2200µF
REC10-xx05SRWZ/A/M/H*	9-36, 18-75	5	2000	86	2200µF
REC10-xx12SRWZ/A/M/H*	9-36, 18-75	12	833	85	470µF
REC10-xx15SRWZ/A/M/H*	9-36, 18-75	15	667	85	220µF
REC10-xx05DRWZ/A/M/H*	9-36, 18-75	±5	±1000	83	±1000µF
REC10-xx12DRWZ/A/M/H*	9-36, 18-75	±12	±416	85	±220µF
REC10-xx15DRWZ/A/M/H*	9-36, 18-75	±15	±333	85	±100µF

* Standard is /H2 for 2kVDC isolation, use /H3 for 3kVDC Isolation (not SMD)

* add suffix "/SMD" for SMD package, e.g. REC10-2405SRW/H2/A/M/SMD

2:1

xx = 9-18Vin = 12,
xx = 18-36Vin = 24,
xx = 36-75Vin = 48

4:1

xx = 9-36Vin = 24,
xx = 18-75Vin = 48

Specifications (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Input Voltage Range	2:1 & 4:1
Input Filter	PI Network
Output Voltage Accuracy	±1.5% max.
Line Voltage Regulation (V_L to V_H at full load)	±0.5% max.
Load Voltage Regulation (25% to 100% full load)	Single ±0.5% max. Dual ±1.2% max.
Cross Regulation (100%: 25% to 100% full load)	±5% max.
Output Ripple and Noise (with 100n output capacitor and 20MHz BW)	100mVp-p max.
Start-up time	300ms typ.
Operating Frequency (Full Load)	400kHz typ.
Efficiency at Full Load	see Selection Guide
Minimum Load	0%
	cont.

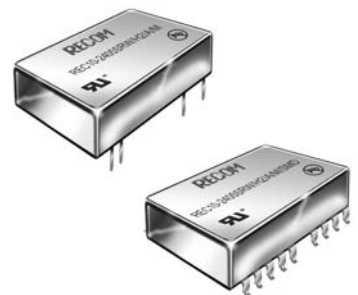
ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

10 Watt DIP24 & SMD Single & Dual Output



E-224736

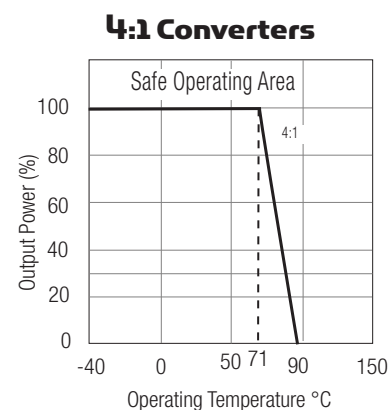
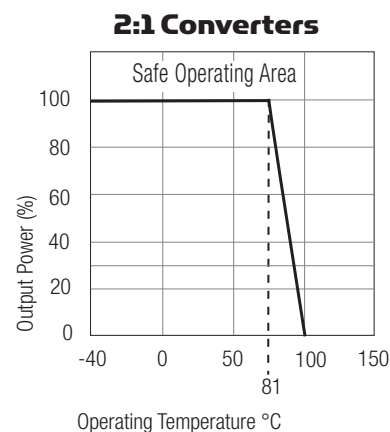
EN-60950-1 Certified
UL-60950-1 Certified

REC10

Specifications cont. (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

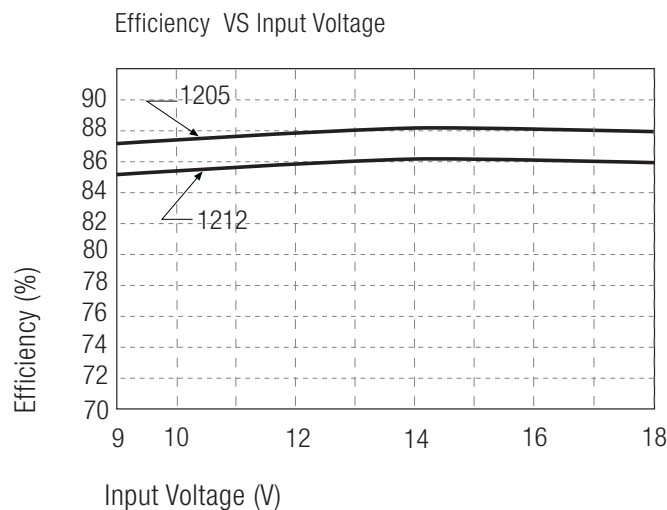
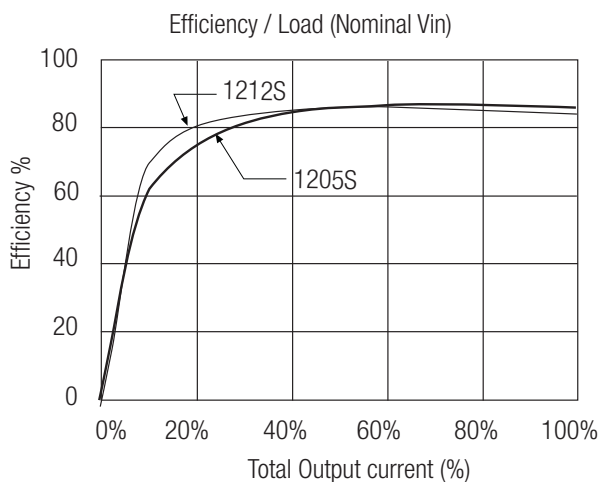
Input Surge Voltage (100ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Isolation Voltage	/H2 and SMD	(tested for 1 second) 2000VDC
		(rated for 1 minute) 1000VAC / 60Hz
	/H3 Version	(tested for 1 second) 3000VDC
		(rated for 1 minute) 1500VAC / 60Hz
Isolation Capacitance		1200pF typ.
Isolation Resistance		1 G Ω min.
Overload Protection		150% typ.
Short Circuit Protection		Continuous, Auto Restart
Operating Temperature Range	4:1	-40°C to +65°C (see Graph)
(free air convection)	2:1	-40°C to +75°C (see Graph)
Remote On/Off	DC/DC ON	Open or $3.5\text{V} < V_r < 12\text{V}$
	DC/DC OFF	Short or $0\text{V} < V_r < 1.2\text{V}$
Storage Temperature Range		-55°C to +105°C
Temperature Coefficient		$\pm 0.05\%$ max.
Relative Humidity		95% RH
Case Material		Nickel Plated Metal with Non-Conductive Base
Thermal Impedance	Natural convection	15°C/W
Maximum Case Temperature		100°C
Vibration		10-55Hz, 2G, 30mins along X,Y & Z
Package Weight		18g
Packing Quantity		15 pcs per Tube
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F 1000 x 10 ³ hours
(+71°C)		using MIL-HDBK 217F >250 x 10 ³ hours

Derating-Graph (Ambient Temperature)



Typical Characteristics

REC10-1205SRW/H2/A/M (/SMD) REC10-1212SRW/H2/A/M (/SMD)



Note: Refer to Application Notes for EMC Class B Filter suggestion

Specifications (cont.)

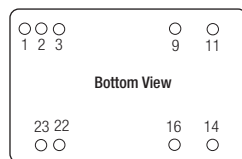
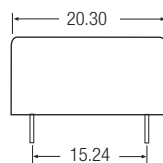
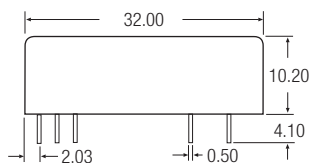
Certifications

EN General Safety	Report: SPCLVD1211033-2	EN60950-1:2006
UL General Safety	Report: E224736	UL 60950-1 1st Ed.
		C22.2 No. 60950-1-03

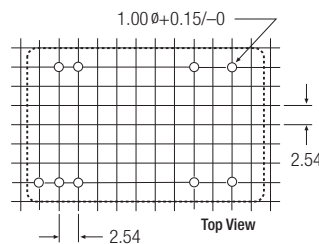
Package Style and Pinning (mm)

24 PIN DIP Package - Available with /H2 and /H3 Options

3rd angle projection



Recommended Footprint Details



Pin Connections DIP24

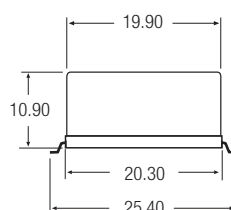
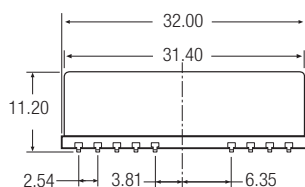
Pin #	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

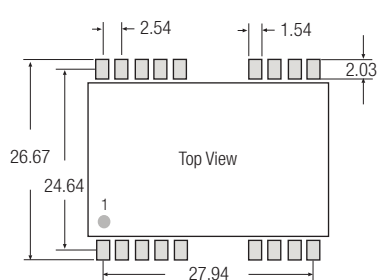
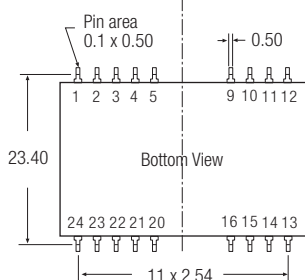
XX.X ± 0.5 mm

XX.XX ± 0.25 mm

24 PIN SMD Package- Only available with /H2 Option



Recommended Footprint Details



Pin Connections DIP24 SMD

Pin #	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
4,5,10,12		NC
13,15,20,21,24		NC

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

Features

Regulated Converters

- 10W in 2" x 1" Package
- 2kVDC and 3kVDC Isolation Options
- 2:1 or 4:1 Input Voltage Range
- Continuous Short Circuit Protection (power limiting)
- Synchronous Rectification on all Del outputs
- Full SMD internal design
- Remote Control Pin
- Efficiency to 87%

Description

The REC10-xxxxS_D/M -series offer single and dual regulated outputs in a 2"x1" package with 2kVDC or 3kVDC isolation options and are suitable for higher power industrial applications. Remote on/off control is standard. The converters can deliver 150% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents.

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.) (%)	Max. Cap. Load
REC10-xx3.3S/H*/M	9-18, 18-36, 36-75	3.3	2000	83-84	2200µF
REC10-xx5.0S/H*/M	9-18, 18-36, 36-75	5.0	2000	86-87	2200µF
REC10-xx12S/H*/M	9-18, 18-36, 36-75	12	833	85-86	2200µF
REC10-xx15S/H*/M	9-18, 18-36, 36-75	15	667	85-86	2200µF
REC10-xx05D/H*/M	9-18, 18-36, 36-75	±5	±1000	82-83	±1000µF
REC10-xx12D/H*/M	9-18, 18-36, 36-75	±12	±416	85-86	±1000µF
REC10-xx15D/H*/M	9-18, 18-36, 36-75	±15	±333	85-86	±1000µF
REC10-xx3.3SZ/H*/M	9-36, 18-75	3.3	2000	82	2200µF
REC10-xx5.0SZ/H*/M	9-36, 18-75	5.0	2000	86	2200µF
REC10-xx12SZ/H*/M	9-36, 18-75	12	833	85	2200µF
REC10-xx15SZ/H*/M	9-36, 18-75	15	667	86	2200µF
REC10-xx05DZ/H*/M	9-36, 18-75	±5	±1000	82	±1000µF
REC10-xx12DZ/H*/M	9-36, 18-75	±12	±416	85	±1000µF
REC10-xx15DZ/H*/M	9-36, 18-75	±15	±333	86	±1000µF

* Standard is /H2 for 2kVDC isolation,
use /H3 for 3kVDC Isolation

2:1

xx = 9-18Vin = 12,
xx = 18-36Vin = 24,
xx = 36-75Vin = 48

4:1

xx = 9-36Vin = 24,
xx = 18-75Vin = 48

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	2:1 or 4:1	
Input Filter	PI Network	
Output Voltage Accuracy (the Output 3.3V is ±1.2% max.)	±1.0% max.	
Line Voltage Regulation	±0.3% max.	
Load Voltage Regulation	Single	±0.5% max.
(25% to 100% full load)	Dual	±1.2% max.
Cross Regulation (100%: 25% to 100% full load)	±5% max.	
Output Ripple and Noise (with 100n output capacitor and 20MHz BW)	100mVp-p max.	
Start-up time (Nom. Vin at 100% Load)	25ms typ.	
Operating Frequency (Full Load)	300kHz typ.	
Efficiency (Nom. Vin at 100% Load)	see Selection Guide	
Minimum Load	0%	
Input Surge Voltage (100ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC

cont.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

10 Watt 2" x 1" Single & Dual Output



E-224736

EN-60950-1 Certified
UL-60950-1 Certified

REC10/M

Refer to Application Notes

www.recom-electronic.com

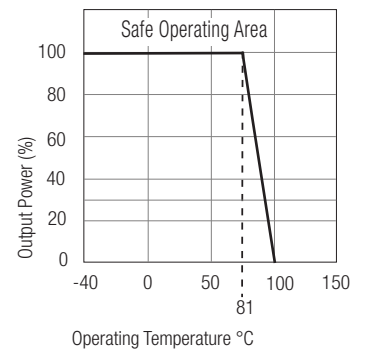
Specifications cont. (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Isolation Voltage	/H2 Version	(tested for 1 second)	2000VDC
	/H3 Version	(rated for 1 minute)	1000VAC / 60Hz
Under Voltage Lockout (2:1)		(tested for 1 second)	3000VDC
		(rated for 1 minute)	1500VAC / 60Hz
Under Voltage Lockout (4:1)	12V Input	DC-DC on 8.3VDC, DC-DC off 7.9VDC	
	24V Input	DC-DC on 17.4VDC, DC-DC off 16.7VDC	
	48V Input	DC-DC on 35.7VDC, DC-DC off 34.3VDC	
Under Voltage Lockout (4:1)	24V Input	DC-DC on 8.3VDC, DC-DC off 7.9VDC	
	48V Input	DC-DC on 17.4VDC, DC-DC off 16.7VDC	
Isolation Capacitance			1200pF typ.
Isolation Resistance			1 GΩ min.
Overload Protection			150% typ.
Short Circuit Protection			Continuous, Auto Restart
Operating Temperature Range (free air convection)	4:1	-40°C to +71°C (see Graph)	
	2:1	-40°C to +81°C (see Graph)	
Storage Temperature Range			-55°C to +105°C
Remote On/Off	DC/DC ON	Open or 3.5V<Vr<12V	
	DC/DC OFF	Short or 0V<Vr<1.2V	
Temperature Coefficient			±0.05% max.
Relative Humidity			95% RH
Case Material			Nickel Plated Metal with Non-Conductive Base
Thermal Impedance			Natural convection 20°C/W
Maximum Case Temperature			100°C
Vibration			10-55Hz, 2G, 30mins along X,Y & Z
Package Weight			27g
Packing Quantity			10 pcs per Tube
MTBF (+25°C) (+71°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	>1000 x 10³hours
		using MIL-HDBK 217F	>250 x 10³hours
Certifications			
EN General Safety	Report: SPCLVD1211033-2	EN60950-1:2006	
UL General Safety	Report: E224736	UL 60950-1 1st Ed.	
C22.2 No. 60950-1-03			

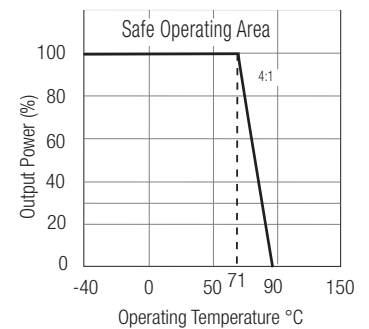
Note: Refer to Application Notes for EMC Class B Filter suggestion

Derating-Graph (Ambient Temperature)

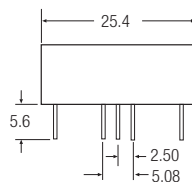
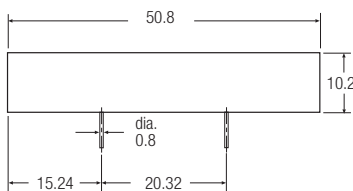
2:1 Converters



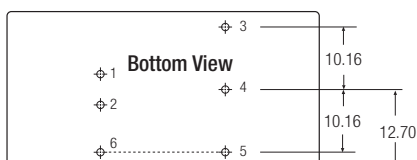
4:1 Converters



Package Style and Pinning (mm)



2" x 1" Package



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6	CTRL	CTRL

XX.X ± 0.5 mm
XX.XX ± 0.35 mm

Features

Regulated Converters

- 15W in 2" x 1" Package
- 2kVDC and 3kVDC Isolation Options
- 2:1 or 4:1 Input Voltage Range
- Continuous Short Circuit Protection (power limiting)
- Synchronous Rectification on 3.4V & 5.1V outputs
- Full SMD internal design
- Remote Control Pin
- Efficiency to 87%

Description

The REC15-xxxxS_D/M -series offer single and dual regulated outputs in a 2"x1" package with 2kVDC or 3kVDC isolation options and are suitable for higher power industrial applications. Remote on/off control is standard. The converters can deliver 150% rated power for short periods of time to cope with applications with large capacitive loads or high start up currents. The outputs with 3A load current have raised output voltages to compensate for track losses as standard.

Selection Guide

Part Number	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.) (%)	Max. Cap. Load
REC15-xx3.4S/H*/M	9-18, 18-36, 36-75	3.4	3000	84-85	3300µF
REC15-xx5.1S/H*/M	9-18, 18-36, 36-75	5.1	3000	86-87	3300µF
REC15-xx12S/H*/M	9-18, 18-36, 36-75	12	1250	85-86	3300µF
REC15-xx15S/H*/M	9-18, 18-36, 36-75	15	1000	85-86	3300µF
REC15-xx05D/H*/M	9-18, 18-36, 36-75	±5	±1500	82-83	±1500µF
REC15-xx12D/H*/M	9-18, 18-36, 36-75	±12	±625	85-86	±1000µF
REC15-xx15D/H*/M	9-18, 18-36, 36-75	±15	±500	85-86	±1000µF
REC15-xx3.4SZ/H*/M	9-36, 18-75	3.4	3000	84-85	3300µF
REC15-xx5.1SZ/H*/M	9-36, 18-75	5.1	3000	87	3300µF
REC15-xx12SZ/H*/M	9-36, 18-75	12	1250	86	3300µF
REC15-xx15SZ/H*/M	9-36, 18-75	15	1000	86	3300µF
REC15-xx05DZ/H*/M	9-36, 18-75	±5	±1500	83	±1500µF
REC15-xx12DZ/H*/M	9-36, 18-75	±12	±625	86	±1000µF
REC15-xx15DZ/H*/M	9-36, 18-75	±15	±500	86	±1000µF

* Standard is /H2 for 2kVDC isolation,
use /H3 for 3kVDC Isolation

2:1	4:1
xx = 9-18Vin = 12,	xx = 9-36Vin = 24,
xx = 18-36Vin = 24,	xx = 18-75Vin = 48
xx = 36-75Vin = 48	

Specifications (measured at T_A = 25°C, nominal input voltage, full load and after warm-up)

Input Voltage Range	2:1 or 4:1
Input Filter	PI Network
Output Voltage Accuracy (the Output 3.4V is ±1.2% max.)	±1.0% max.
Line Voltage Regulation	±0.3% max.
Load Voltage Regulation	±0.5% max.
(25% to 100% full load)	±1.2% max.
Cross Regulation (100%: 25% to 100% full load)	±5% max.
Output Ripple and Noise (with 100n output capacitor and 20MHz BW)	100mVp-p max.
Start-up time (Nom. Vin at 100% Load)	25ms typ.
Operating Frequency (Full Load)	300kHz typ.
Efficiency (Nom. Vin at 100% Load)	see Selection Guide
Minimum Load	0%
Input Surge Voltage (100ms max.)	12V Input 36VDC
	24V Input 50VDC
	48V Input 100VDC

cont.

ECONOLINE

DC/DC-Converter

with 3 year Warranty

RECOM

15 Watt 2" x 1" Single & Dual Output



E-224736

EN-60950-1 Certified
UL-60950-1 Certified

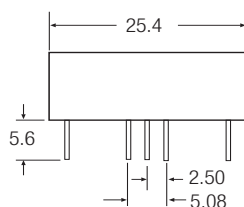
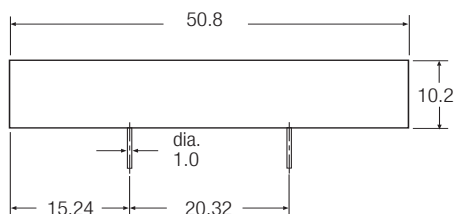
REC15/M

Specifications cont. (measured at $T_A = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

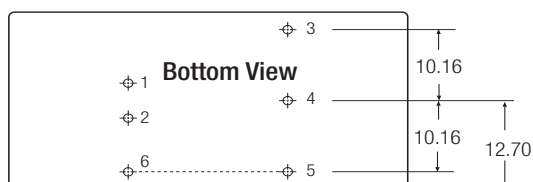
Isolation Voltage	/H2 Version	(tested for 1 second) (rated for 1 minute)	2000VDC 1000VAC / 60Hz
	/H3 Version	(tested for 1 second) (rated for 1 minute)	3000VDC 1500VAC / 60Hz
Under Voltage Lockout (2:1)	12V Input	DC-DC on 8.3VDC, DC-DC off 7.9VDC	
	24V Input	DC-DC on 17.4VDC, DC-DC off 16.7VDC	
	48V Input	DC-DC on 35.7VDC, DC-DC off 34.3VDC	
Under Voltage Lockout (4:1)	24V Input	DC-DC on 8.3VDC, DC-DC off 7.9VDC	
	48V Input	DC-DC on 17.4VDC, DC-DC off 16.7VDC	
Isolation Capacitance			1200pF typ.
Isolation Resistance			1 GΩ min.
Overload Protection			150% typ.
Short Circuit Protection			Continuous, Auto Restart
Operating Temperature Range (free air convection)	4:1	-40°C to +65°C (see Graph)	
	2:1	-40°C to +71°C (see Graph)	
Storage Temperature Range			-55°C to +105°C
Remote On/Off	DC/DC ON	Open or 3.5V<Vr<12V	
	DC/DC OFF	Short or 0V<Vr<1.2V	
Temperature Coefficient			±0.05% max.
Relative Humidity			95% RH
Case Material			Nickel Plated Metal with Non-Conductive Base
Thermal Impedance			Natural convection 20°C/W
Maximum Case Temperature			100°C
Vibration			10-55Hz, 2G, 30mins along X,Y & Z
Package Weight			27g
Packing Quantity			10 pcs per Tube
MTBF (+25°C) (+71°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	>700 x 10³hours
		using MIL-HDBK 217F	>150 x 10³hours
Certifications			
EN General Safety	Report: SPCLVD 1206084-1	EN60950-1:2006 + A12:2011	
UL General Safety	Report: E224736	UL 60950-1 1st Ed.	
		C22.2 No. 60950-1-03	

Note: Refer to Application Notes for EMC Class B Filter suggestion

Package Style and Pinning (mm)



3rd angle projection



Pin Connections

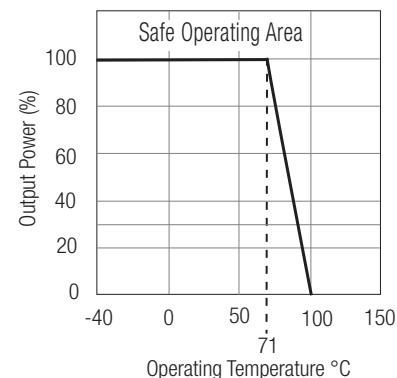
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6	CTRL	CTRL

XX.X ± 0.5 mm

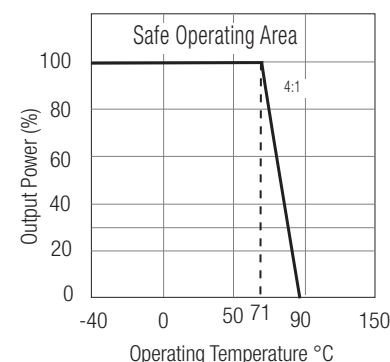
XX.XX ± 0.35 mm

Derating-Graph (Ambient Temperature)

2:1 Converters



4:1 Converters



INNOLINE - CONTENTS

Switching and High Voltage Regulators



Step Down Switching Regulators

Series	Output Current	Input Voltages (VDC)		Output Voltages (VDC)	No. of Outputs	Case	Page No.
		min.(1)	max.				
R-78xx-0.5	500mA	4.75	34	1.5, 1.8, 2.5, 3.3, 5, 6.5, 9, 12, 15	S	SIP3	I-2
R-78AAxx-0.5SMD	500mA	4.75	34	1.5, 1.8, 2.5, 3.3, 5, 6.5, 9, 12, 15	S	SMD OF	I-7
R-78xx-1.0	1A	4.75	18	1.8, 2.5, 3.3, 5	S	SIP3	I-12
R-78AAxx-1.0SMD	1A	4.75	18	1.5, 1.8, 2.5, 3.3, 5	S	SMD OF	I-15
R-78Cxx-1.0	1A	8	42	5, 9, 12, 15	S	SIP3	I-19
R-78Bxx-1.0	1A	4.75	34	1.5, 1.8, 2.5, 3.3, 5, 6.5, 9, 12, 15	S	SIP3	I-21
R-78Bxx-1.5	1.5A	4.75	18	1.5, 1.8, 2.5, 3.3, 5, 6.5	S	SIP3	I-25
R-78HBxx-0.5	500mA	9	72	3.3, 5, 6.5, 9, 12, 15	S	SIP3	I-29
R-78HB24-0.3	300mA	36	72	24			
ROF-78E3.3-0.5SMD	500mA	5	36	3.3	S	SMD	I-33
ROF-78E5.0-0.5SMD	500mA	9	36	5.0			
R-78E	500mA	7	28	5	S	SIP3	I-37
R-5xxxP/DA	2, 3, 4, 5A	4.75	18	1.2, 1.8, 2.5, 3.3, 5	S	SIP12	I-38
R-6xxxP/D	1.1A, 2A	9	32	1.8, 2.5, 3.3, 5, 9, 12, 18	S	SIP12	I-44
R-7xxxP/D	2, 3, 4A	4.5	28	3.3, 5, 6.5, 9, 12, 15	S	SIP12	I-48

High Voltage Regulators

Series	Output Current	Input Voltages (VDC)		Output Voltages (VDC)	No. of Outputs	Case	Page No.
		min.(1)	max.				
Rxx-B	25mA/50mA	5, 12, 15, 24		40..120, 55..135, 95..210	S	DIP24	I-52

Features

- Efficiency up to 97%, Non isolated, no need for heatsinks
- Pin-out compatible with LM78XX Linears
- Very low profile (L*W*H=11.5*7.5*10.2)
- Wide input range (4.75V ~ 32V)
- Short circuit protection, Thermal shutdown
- Non standard outputs available as specials
- Low ripple and noise
- UL94V-0 package material
- EMC, Safety Certified
- See InnoLine Application Notes for use as an inverter (alternative to LM79xx Linear)

Description

The R-78xx-Series high efficiency switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 97% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs. Low ripple and noise figures and short circuit, overload and over-temperature protection round off the specifications of this versatile converter series. This R-78xx-0.5 is fully certified to EN 55022 (Emissions), and EN55024 (Immunity) EMC Standards and for EN-60950-1 Safety.

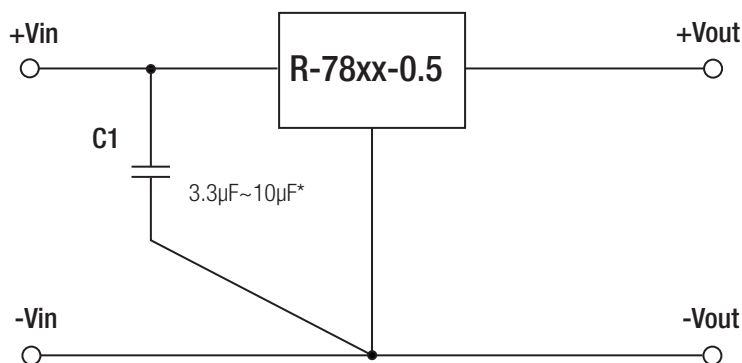
Selection Guide

Part Number SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency	
				Min. Vin (%)	Max. Vin (%)
R-781.5-0.5	4.75 – 30 ⁽¹⁾	1.5	0.5	73	63
R-781.8-0.5	4.75 – 32	1.8	0.5	82	71
R-782.5-0.5	4.75 – 32	2.5	0.5	87	77
R-783.3-0.5	4.75 ⁽²⁾ – 32	3.3	0.5	91	81
R-785.0-0.5	6.5 – 32	5.0	0.5	94	86
R-786.5-0.5	8.0 – 32	6.5	0.5	95	88
R-789.0-0.5	11 – 32	9.0	0.5	96	92
R-7812-0.5	15 – 32	12	0.5	97	94
R-7815-0.5	18 – 32	15	0.5	97	95

Note 1: 1.5V Output can be unstable with Vin > 30VDC

Note 2: Refer to Dynamic Load Stability

Standard Application Circuit



* Input capacitor required if Vin > 26VDC (3.3µF) or if the supply is a battery or other low impedance source (4.7µF ~ 10µF)
Capacitor should be electrolytic or MLCC with 1R resistor in series

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

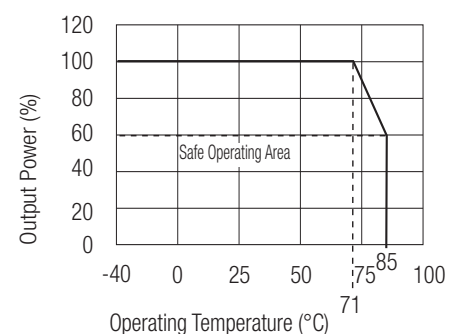
0.5 AMP
SIP3
Single Output



EN-55022 Certified
EN-55024 Certified
EN-60950-1 Certified

R-78-0.5

Derating-Graph (Ambient Temperature)

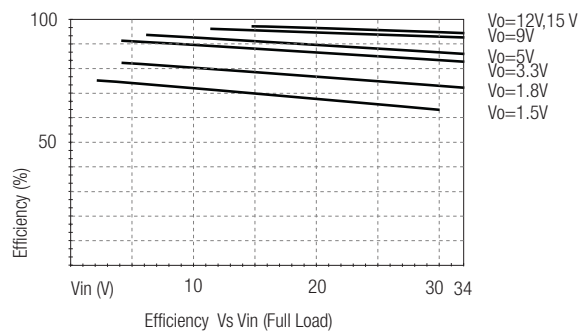


Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

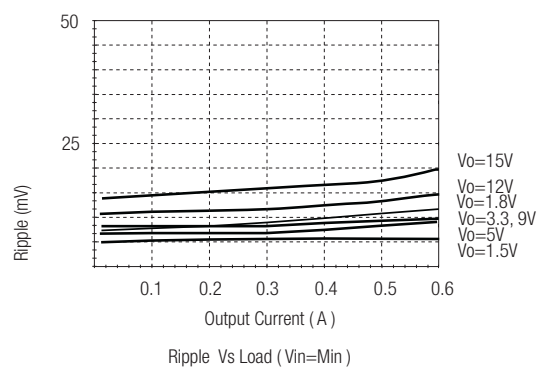
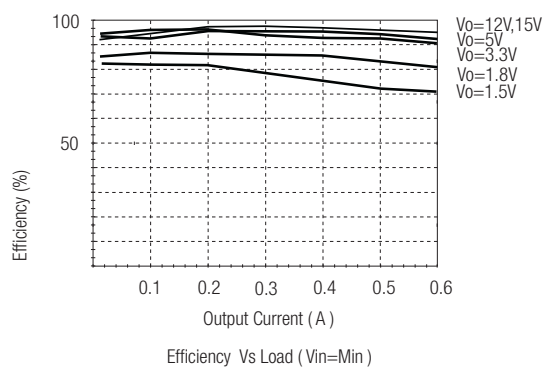
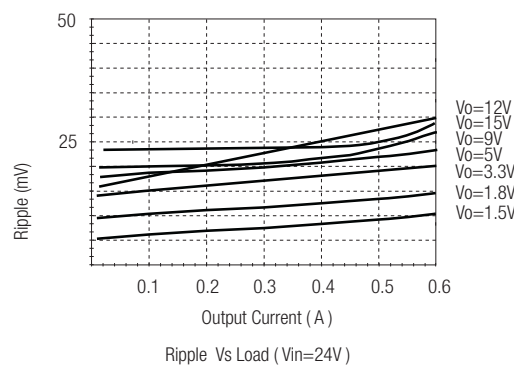
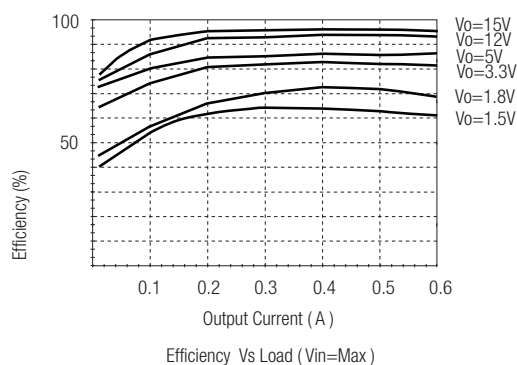
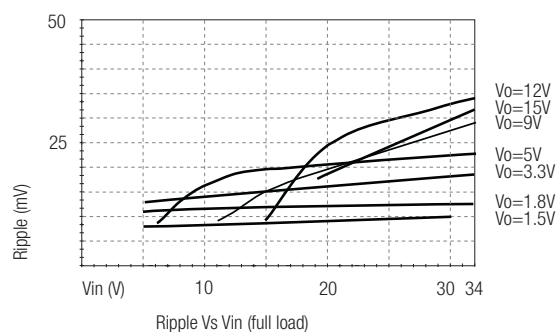
Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	1.5V	4.75	30V	34V abs. max.
	1.8V to 15.5V	4.75	32V	34V abs. max.
Output Voltage Range (for customized parts)	All Series	1.25		15.5V
Output Current (see note)	All Series	0*		500mA
Output Current Limit	All Series			2000mA
Short Circuit Input Current (Vin = 24V)	All Series			60mA
Internal Power Dissipation				0.4W
Short Circuit Protection			Continuous, automatic recovery	
Output Voltage Accuracy (At 100% Load)	All Series		±2	±3%
Line Voltage Regulation (Vin = min. to max. at full load)	1.5V to 6.5V		0.2	0.4%
	9V to 15.5V		0.1	0.2%
Load Regulation (10 to 100% full load)	1.5V to 6.5V		0.4	0.6%
	9V to 15.5V		0.25	0.4%
Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 6mA is recommended				
Dynamic Load Stability	100% <-> 50% load		±75mV	
	100% <-> 10% load			±100mV
Note: The R-783.3-0.5 requires Vin>5.5V to meet the Dynamic Load Stability Specification.				
Ripple & Noise (without Output Capacitor)	1.5V to 6.5V		20mVp-p	30mVp-p
	9V to 15.5V		30mVp-p	40mVp-p
Ripple & Noise (with Output Capacitor=100µF)	1.5V to 6.5V		15mVp-p	20mVp-p
	9V to 15.5V		25mVp-p	35mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			220µF
	with <1 second start up time + diode protection circuit			6800µF
Switching Frequency		280	330	380kHz
Quiescent Current	Vin = min. to max. at 0% load		5	7mA
Operating Temperature Range		-40°C		+85°C
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				70°C / W
Thermal Shutdown	Internal IC junction			+160°C
Case Material			Non-Conductive Black Plastic	
Potting Material			Epoxy (UL94V-0)	
Conducted Emissions (with filter)	EN55022			Class B
Radiated Emissions (with filter)	EN55022			Class B
ESD	EN61000-4-2			Class A
Radiated Immunity	EN61000-4-3			Class A
Fast Transient	EN61000-4-4			Class A
Conducted Immunity	EN61000-4-6			Class A
Magnetic Field Immunity	EN61000-4-8			Class A
Package Weight			1.9g	
Packing Quantity				42pcs per Tube
MTBF (+25°C) (+71°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F		21098 x 10³ hours
		using MIL-HDBK 217F		4212 x 10³ hours
Certifications				
EN General Safety	Report: SPCLVD 1301026-1		EN 60950-1:2006 + A12:2011	
EMC	Report: 5A111502E		EN55022, EN61000, EN55024	

Characteristics

Efficiency



Ripple

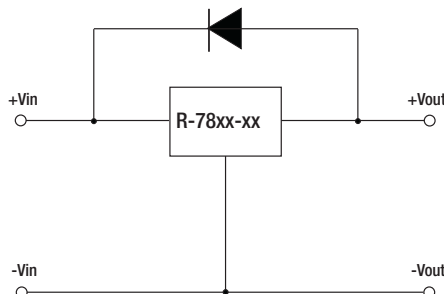


Optional Diode Protection Circuit

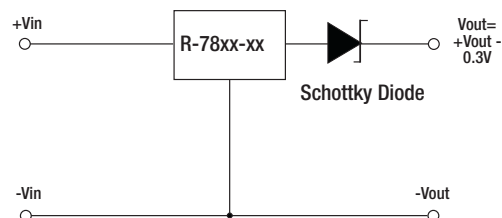
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

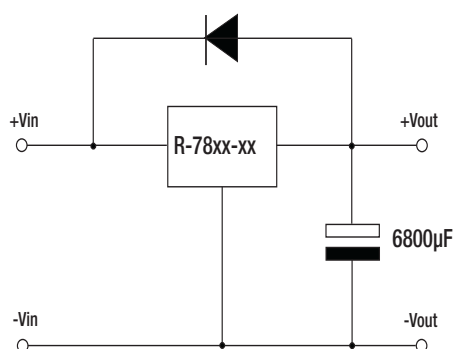
The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



Optional Protection 2:

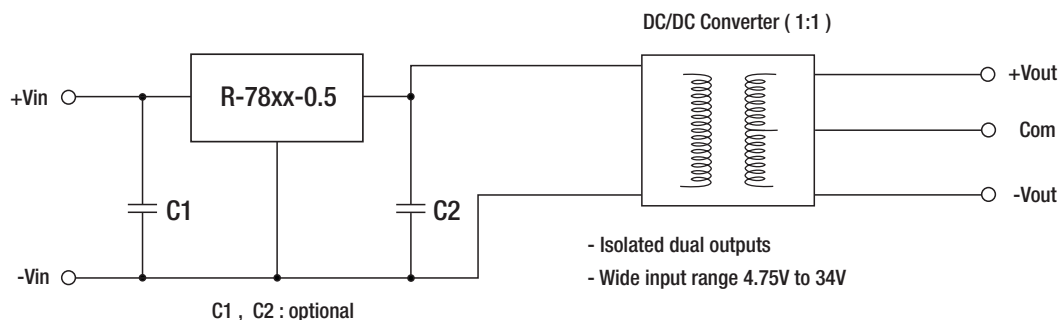


Application example:
Driving a high capacitive load



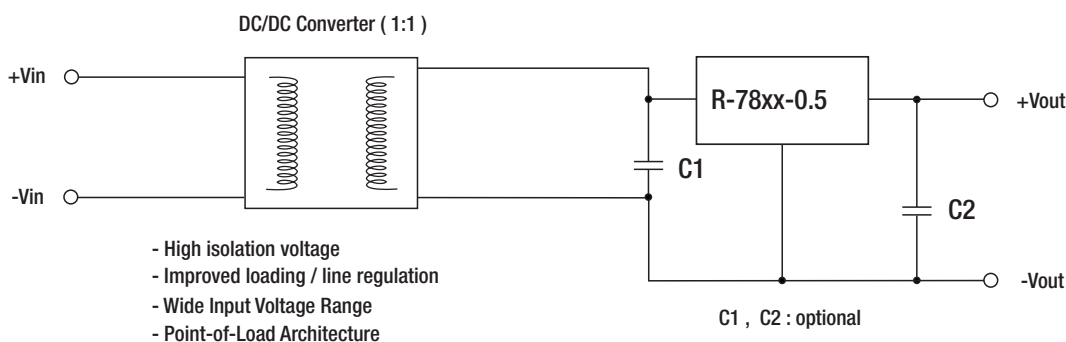
Application Examples

High efficiency, isolated, dual unregulated outputs



R-78-0.5

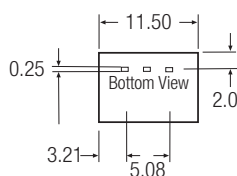
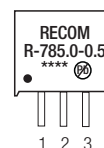
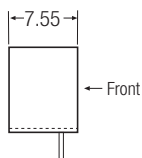
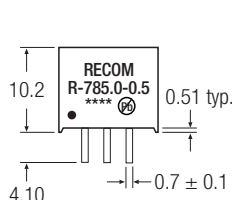
Isolated (up to 6KV), wide Input range regulated output



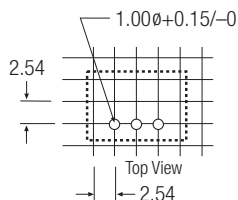
Package Style and Pinning (mm)

SIP3 PIN Package

3rd angle
projection



Recommended Footprint Details



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout

xx.x ±0.5mm
xx.xx ±0.25mm

Features

- Replacement for R-78Axx-0.5SMD series
- RoHS 6/6 Conform (100% Lead Free)
- Efficiency up to 97%, Non isolated, no need for heatsinks
- High Reflow Temperature SMD Package
- Adjustable Output Voltage
- Wide input range.(4.75V ~ 32V)
- Short circuit protection, Thermal shutdown
- Remote On/Off Control
- UL94V-0 Package Material
- Very Low Shutdown Current
- See Innoline Application Notes for use as an inverter (alternative to LM79xx Linear)

Description

The R-78AAxx-0.5SMD series are manufactured without lead and meet the requirements for RoHS 6/6 as well as the increased reflow soldering temperatures associated with vapour phase soldering, making these high efficiency switching regulators ideally suited to modern pick-and-place mass production. The efficiency of up to 97% means that very little energy is wasted as heat. The additional features of remote on/off control and adjustable output voltages will find many uses in the battery-powered, industrial, medical and automotive markets.

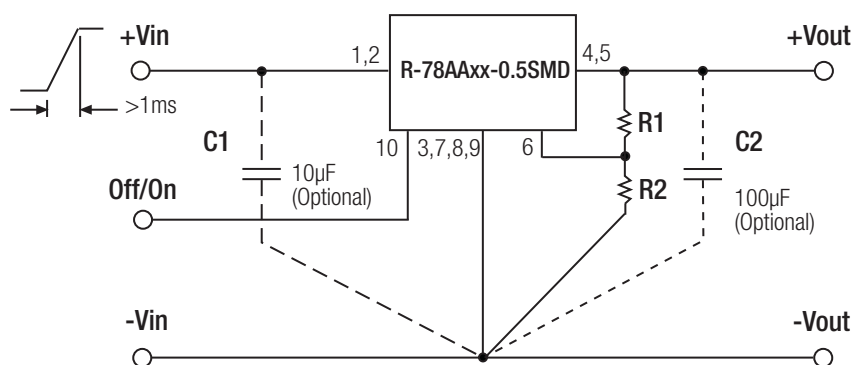
Selection Guide

Part Number SMD	Input Range (V)	Output Voltage (V)	Adjust Range (V)	Output Current (A)	Efficiency Min. Vin (%)	Max. Vin (%)
R-78AA1.5-0.5SMD	4.75 – 30	1.5	fixed	0.5	73	63
R-78AA1.8-0.5SMD	4.75 – 32	1.8	1.5~3.0	0.5	82	71
R-78AA2.5-0.5SMD	4.75 – 32	2.5	1.5~3.0	0.5	87	77
R-78AA3.3-0.5SMD	4.75 – 32	3.3	3.0~5.5	0.5	91	81
R-78AA5.0-0.5SMD	6.5 – 32	5.0	3.0~8.0	0.5	94	86
R-78AA6.5-0.5SMD	8.0 – 32	6.5	3.3~11.0	0.5	95	88
R-78AA9.0-0.5SMD	11 – 32	9.0	4.5~12.6	0.5	96	92
R-78AA12-0.5SMD	15 – 32	12	4.5~12.6	0.5	97	94
R-78AA15-0.5SMD	18 – 32	15	fixed	0.5	97	95

Note 1: 1.5V Output can be unstable with $V_{in} > 30VDC$

* add suffix -R for tape&reel packing e.g. R-78AA5.0-0.5-R. For more details see Application Notes.

Standard Application Circuit



To protect the converter from high inrush currents, use soft start V_{in} and $C1=10\mu F$
Output capacitor $C2$ recommended if load is very dynamic

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

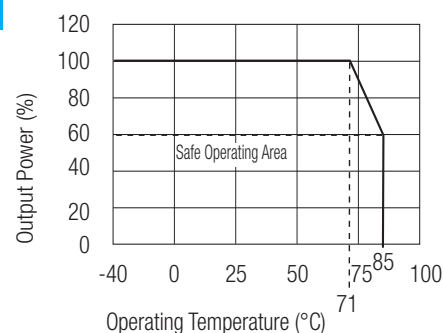
0.5 AMP
SMD
Single Output



EN-60950-1 Certified

R-78AA-0.5

Derating-Graph
(Ambient Temperature)

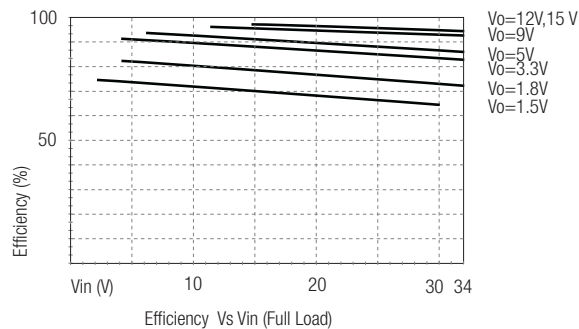


Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

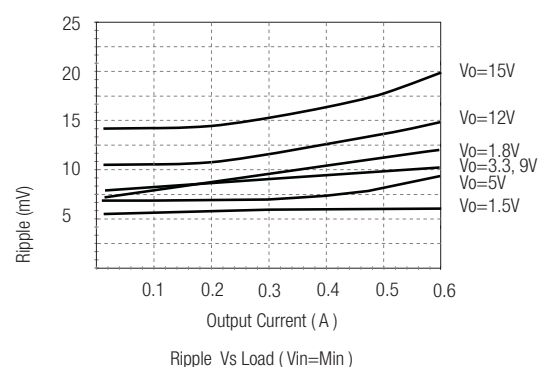
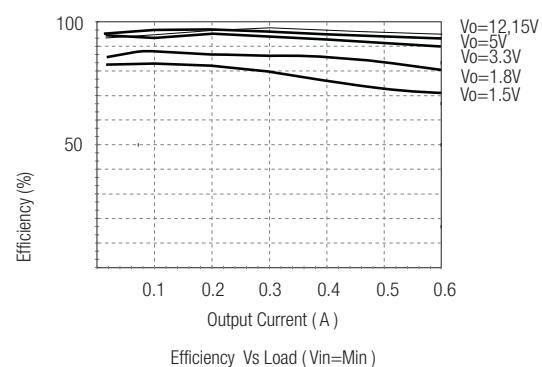
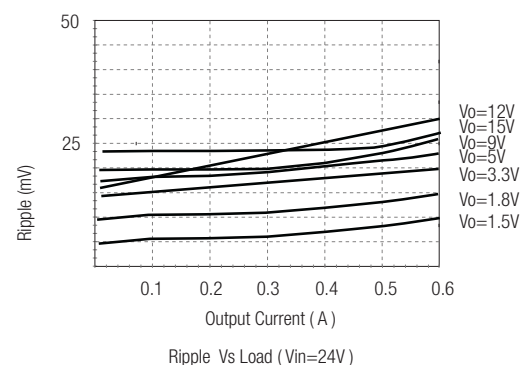
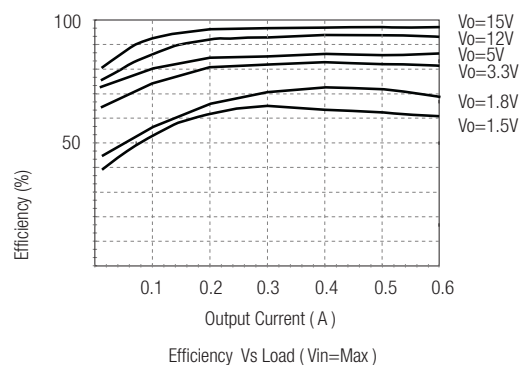
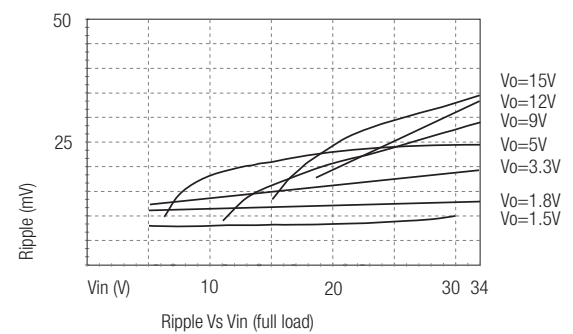
Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	See Table	4.75V	32V	34V abs. max.
Output Voltage Range	See Table	1.5V		15V
Output Current (see Note)	All Series	0mA*		500mA
Output Current Limit	All Series			2000mA
Short Circuit Input Current	V _{in} = 24V		60mA	100mA
Internal Power Dissipation				0.4W
Short Circuit Protection			Continuous, automatic recovery	
Output Voltage Accuracy	100% Load		±2%	±3%
Adjustable Voltage Range	See Table 1			±50%
Line Voltage Regulation (V _{in} = min. to max. at full load)	1.5V to 6.5V		0.2%	0.4%
	9V to 15V		0.1%	0.2%
Load Regulation (10 to 100% full load)	1.5V to 6.5V		0.7%	1.0%
	9V to 15V		0.25%	0.4%
Dynamic Load Stability with 100µF Output capacitor	100% <-> 50% load		±75V	±100mV
	100% <-> 10% load		±100mV	
Ripple & Noise (without Output Capacitor)	1.5V to 6.5V		20mVp-p	30mVp-p
	9V to 15.5V		30mVp-p	40mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			220µF
	with <1 second start up time + diode protection circuit			6800µF
Switching Frequency		280kHz	330kHz	380kHz
Quiescent Current	V _{in} = min. to max. at 0% load		5mA	7mA
ON/OFF Remote Control Pin Drive Current	ON: Open or 1.6V<V _r <5V		I _r =1.8µA typ	
	OFF: GND or 0<V _r <1.6V			
Converter Input Current (valid for V _r < 1.6V)			20µA	30µA
Remote On/Off Threshold Voltage (V _r rising)		2.4V	2.6V	2.8V
Remote On/Off Voltage Hysteresis			250mV	
Operating Temperature Range (with derating)		-40°C		+85°C
Switch On/Off Time	(using Remote On/Off Control)			50ms
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				70°C / W
Thermal Shutdown	Internal IC junction			+160°C
Case Material			Non-Conductive Black Plastic	
Potting Material			Epoxy (UL94V-0)	
EMC	Conducted Emissions (with filter)	EN55022		Class B
	Radiated Emissions (with filter)	EN55022		Class B
	ESD	EN61000-4-2		Class A
	Radiated Immunity	EN61000-4-3		Class A
	Fast Transient	EN61000-4-4		Class A
	Conducted Immunity	EN61000-4-6		Class A
	Magnetic Field Immunity	EN61000-4-8		Class A
Safety Certification	Report: SPCLVD 1301026-1		EN 60950-1:2006 + A12:2011	
Package Weight				2.7g
Packing Quantity				33pcs per Tube
				250pcs per Reel
MTBF (+25°C) (+71°C)	<i>Detailed Information see Application Notes chapter "MTBF"</i>	using MIL-HDBK 217F	21098~29253 x 10 ³ hours	
			4214-7365 x 10 ³ hours	

*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 6mA is recommended

Efficiency

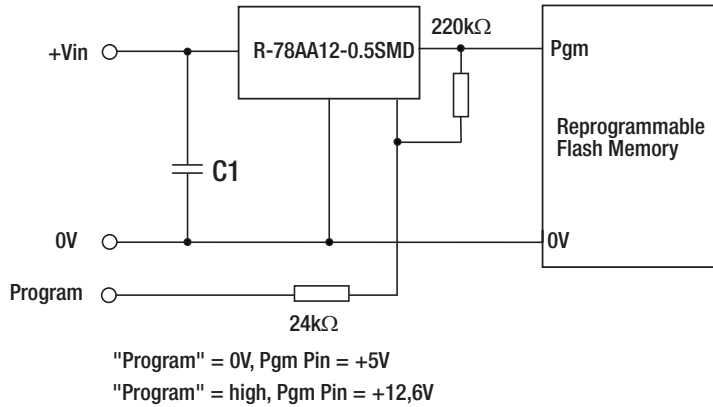


Ripple

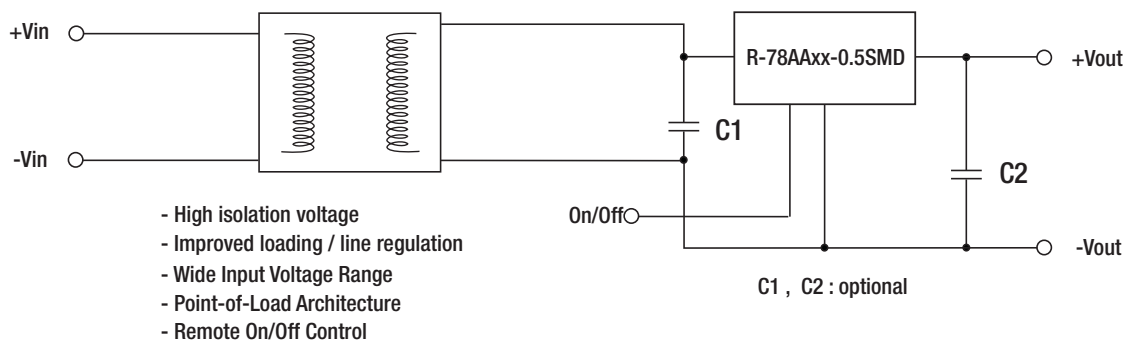


Application Examples

Flash Memory Program Voltage Switcher



DC/DC Converter (1:1)

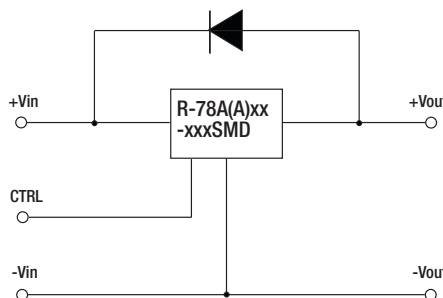


Optional Protection Circuit

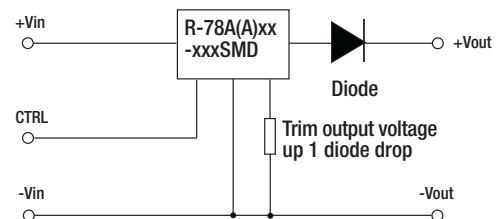
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



Optional Protection 2:



Application example:
Driving a high capacitive load

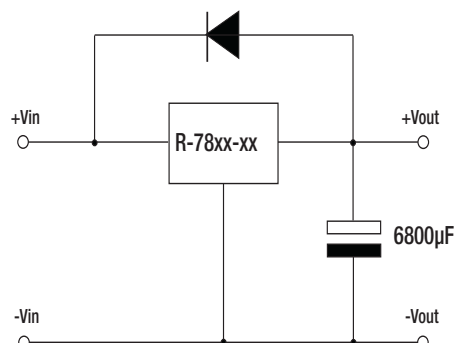


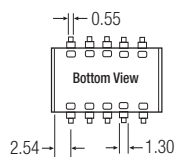
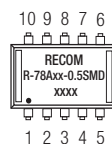
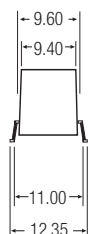
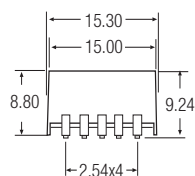
Table 1: Adjustment Resistor Values

0.5Adc	R-78AA1.8		R-78AA2.5		R-78AA3.3		R-78AA5.0		R-78AA6.5		R-78AA9.0		R-78AA12	
	-0.5SMD		-0.5SMD		-0.5SMD		-0.5SMD		-0.5SMD		-0.5SMD		-0.5SMD	
Vout (nom.)	1.8Vdc		2.5Vdc		3.3Vdc		5.0Vdc		6.5Vdc		9.0Vdc		12.0Vdc	
Vout (adj.)	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
1.5 (V)	3K Ω		200 Ω											
1.8 (V)			12K Ω											
2.5 (V)		11.8K Ω												
3.0 (V)		4.64K Ω		44.2K Ω	88.4K Ω		17K Ω							
3.3 (V)							27K Ω		6.7K Ω					
3.6 (V)						60.4K Ω	42K Ω		14K Ω					
3.9 (V)						28K Ω	58K Ω		23K Ω					
4.5 (V)						11.3K Ω	180K Ω		49K Ω		26K Ω		17K Ω	
4.9 (V)						7.15K Ω	850K Ω		77K Ω		36K Ω		24K Ω	
5.0 (V)						6.34K Ω			86K Ω		39K Ω		26K Ω	
5.1 (V)						5.9K Ω		231K Ω	97K Ω		42K Ω		28K Ω	
5.5 (V)						3.9K Ω		56.2K Ω	160K Ω		56K Ω		36K Ω	
6.5 (V)								14K Ω			112K Ω		63K Ω	
8.0 (V)								2.32K Ω		24.6K Ω	400K Ω		125K Ω	
9.0 (V)										10.7K Ω			200K Ω	
10 (V)										4.75K Ω		54.9K Ω	345K Ω	
11 (V)										1.65K Ω		16.5K Ω	740K Ω	
12 (V)												3.6K Ω		
12.6 (V)												0 Ω		180K Ω

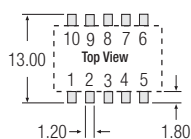
R-78AA-0.5

Package Style and Pinning (mm)

SMD 10Pin Package



Recommended Footprint Details



Pin Connections

Pin #	
1,2	+Vin
3,7,8,9	GND
4,5	+Vout
6	V adj
10	Remote On/Off
xx.x	$\pm 0.5\text{mm}$
xx.xx	$\pm 0.25\text{mm}$

Features

- Efficiency up to 94%, no need for heatsinks!
- Pin-out compatible with LM78XX Linear Regs.
- Low profile (L*W*H=11.5*7.5*10.2mm)
- Wide input range (4.75V ~ 18V)
- Short circuit protection, thermal shutdown
- Non standard outputs available as specials
- Low ripple and noise

Selection Guide

Part Number SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency Min. Vin (%)	Max. Vin (%)
R-781.8-1.0	4.75 – 18	1.8	1.0	82	76
R-782.5-1.0	4.75 – 18	2.5	1.0	87	81
R-783.3-1.0	4.75 – 18	3.3	1.0	90	84
R-785.0-1.0	6.5 – 18	5.0	1.0	94	89

Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	All Series	4.75V		18V
Output Voltage Range	All Series	1.5V		5.5V
Output Current	All Series	0mA*		1000mA
Output Current Limit	All Series			3000mA
Short Circuit Input Current (Vin =12V)	All Series			100mA
Internal Power Dissipation				0.4W
Short Circuit Protection		Continuous, automatic recovery		
Output Voltage Accuracy (At 100% Load)	All Series		±2%	±3%
Line Regulation (100% Load, Vin max.)	All Series		0.2%	0.4%
Load Regulation (10 to 100% full load)	All Series		0.4%	0.6%
Dynamic Load Stability	100% <-> 50% load		±85mV	±100mV
Ripple & Noise (20Mhz BW)	All Series		20mVp-p	30mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			470µF
	with <1 second start up time + diode protection circuit			6800µF
Switching Frequency		280kHz	350kHz	430kHz
Quiescent Current	Vin = min. to max. at 0% load		5mA	7mA
Operating Temperature Range			-40°C to +85°C	
Operating Case Temperature (with derating)				+100°C
Storage Temperature Range			-55°C to +125°C	
Case Thermal Impedance				70°C/W
Thermal Shutdown	Internal IC junction			+160°C
Case Material		Non-Conductive Black Plastic		
Potting Material		Epoxy (UL94V-0)		
Conducted Emissions (with filter)	EN55022			Class B
Radiated Emissions (with filter)	EN55022			Class B
ESD	EN61000-4-2			Class A
Radiated Immunity	EN61000-4-3			Class A
Fast Transient	EN61000-4-4			Class A
Conducted Immunity	EN61000-4-6			Class A
Magnetic Field Immunity	EN61000-4-8			Class A
Certifications				
General Safety	Report: SPCLVD 1301026-1	EN 60950-1:2006 + A12:2011		
EMC	Report: 5A111502E	EN 55022, EN55024, EN61000		
Package Weight				1.9g
Packing Quantity				42 pcs per Tube
MTBF (+25°C)	Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F	13338 x 10 ³ hours.	
(+71°C)		using MIL-HDBK 217F	3880 x 10 ³ hours.	

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

1.0 AMP SIP3 Single Output



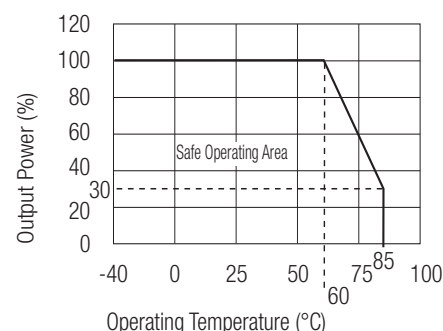
EN-55022 Certified
EN-55024 Certified
EN-60950-1 Certified

R-78-1.0

Description

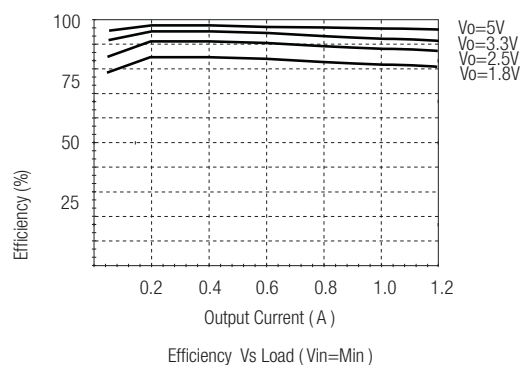
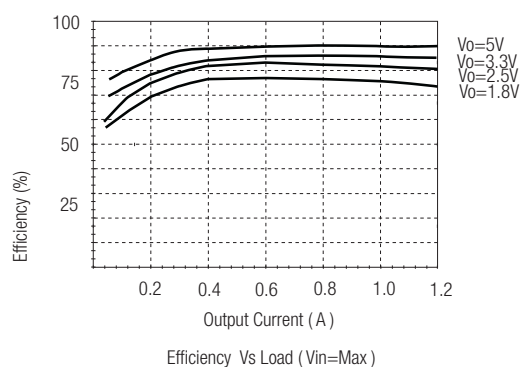
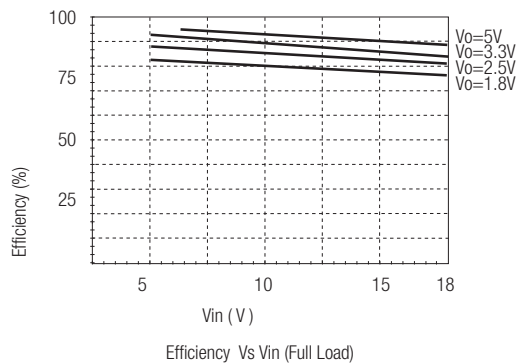
The R-78xx-1.0 series switching regulators are ideally suited to replace 1 Amp 78xx linear regulators and are pin compatible. Efficiencies of up to 97% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs.

Derating-Graph (Ambient Temperature)

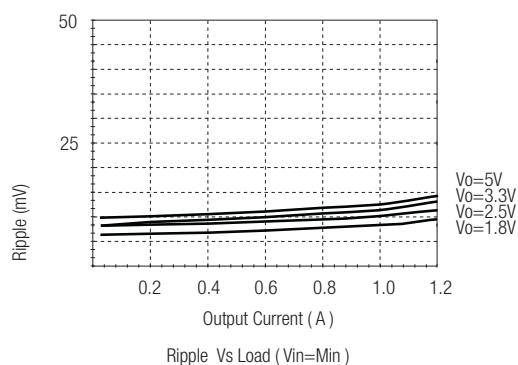
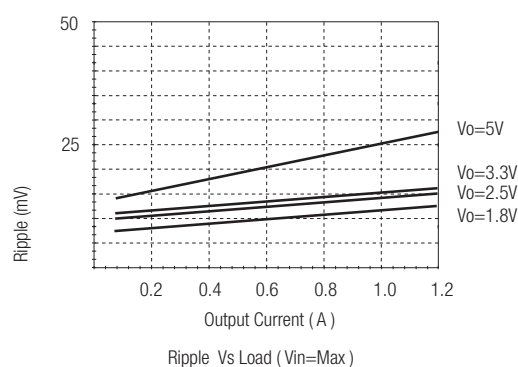
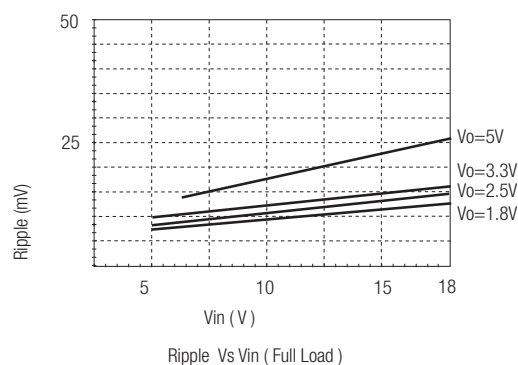


Characteristics

Efficiency



Ripple



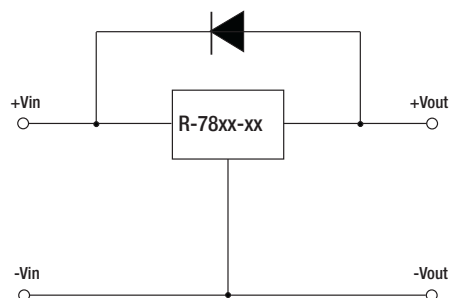
*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

Optional Protection Circuit

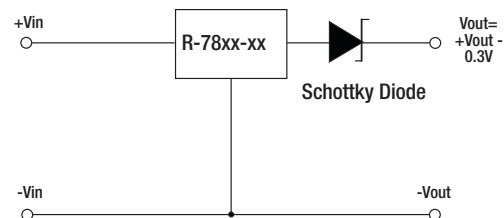
Optional Protection 1:

Add a blocking diode to V_{out} if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).

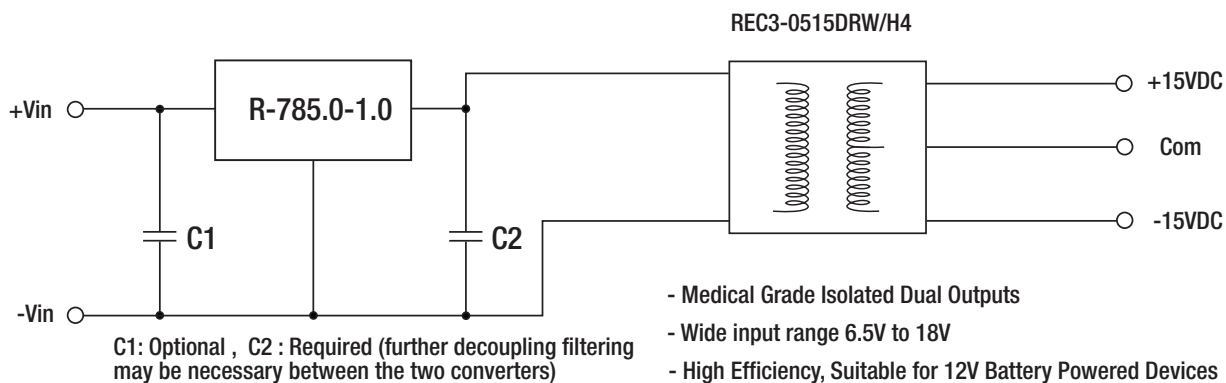


Optional Protection 2:

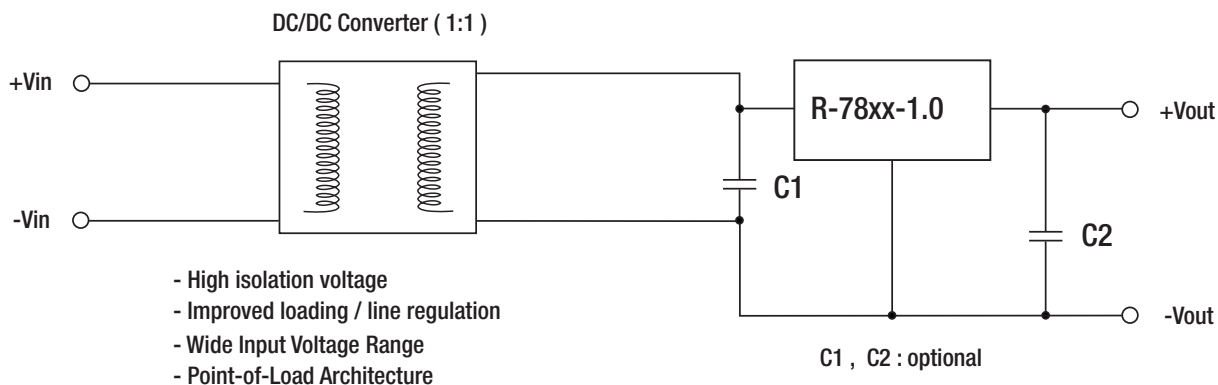


Application Examples

High efficiency, isolated, dual regulated outputs



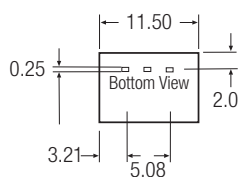
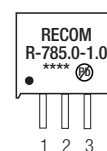
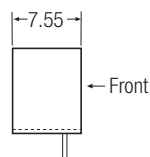
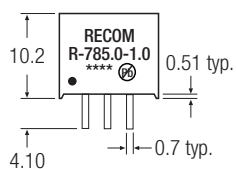
Isolated (up to 6KV), wide Input range regulated output



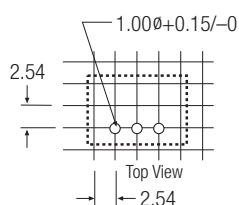
Package Style and Pinning (mm)

SIP3 PIN Package

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout

xx.x ±0.5mm
xx.xx ±0.25mm

Features

- Replacement for R-78Axx-1.0SMD series
- RoHS 6/6 Conform (100% Lead Free)
- High Reflow Temperature SMD Package
- Adjustable Output Voltage
- Short circuit protection, Thermal shutdown
- Remote On/Off Control
- Very Low Shutdown Current

Description

The R-78Axx-1.0SMD series are manufactured without lead and meet the requirements for RoHS 6/6 as well as the increased reflow soldering temperatures associated with vapour phase soldering, making these high efficiency switching regulators ideally suited to modern pick-and-place mass production. The efficiency of up to 94% means that very little energy is wasted as heat. The additional features of remote on/off control and adjustable output voltages will find many uses in the battery-powered, industrial, medical and automotive markets.

Selection Guide

Part Number SMD	Input Range (V)	Output Voltage (V)	Adjust Range (V)	Output Current (A)	Efficiency Min. Vin (%)	Max. Vin (%)
R-78AA1.5-1.0SMD	4.75 – 18	1.5	fixed	1.0	77	73
R-78AA1.8-1.0SMD	4.75 – 18	1.8	1.5~3.0	1.0	82	76
R-78AA2.5-1.0SMD	4.75 – 18	2.5	1.5~3.0	1.0	87	81
R-78AA3.3-1.0SMD	4.75 – 18	3.3	3.0~5.5	1.0	90	84
R-78AA5.0-1.0SMD	6.5 – 18	5.0	3.0~5.5	1.0	94	89

Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	See Table	4.75V		18.0V
Output Voltage Range	See Table	1.5V		5.5V
Output Current	All Series	0mA*		1000mA
Output Current Limit	All Series			5500mA
Short Circuit Input Current	Vin = 12V			120mA
Internal Power Dissipation				0.4W
Short Circuit Protection		Continuous, automatic recovery		
Output Voltage Accuracy	100% Load		±2%	±3%
Adjustable Voltage Range	See Table 1			±50%
Line Voltage Regulation (Vin = min to max at full load)			0.2%	0.4%
Load Regulation (10% to 100% full load)			0.7%	1.0%
Dynamic Load Stability	100%<->50% load, 25mA/μs		±85mV	±100mV
Ripple & Noise (20MHz BW)			20mVp-p	30mVp-p
Temperature Coefficient	-40°C~+85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			470μF
	with <1 second start up time + diode protection circuit			6800μF
Switching Frequency		335kHz	385kHz	435kHz
Quiescent Current	Vin = min. to max. at 0% load		5mA	7mA
ON/OFF Remote Control Pin Drive Current	ON: Open or 1.6V<Vr<5V OFF: GND or 0<Vr<1.6V		Ir=1.8μA typ	
Converter Input Current (valid for Vr < 1.6V)			20μA	35μA
Remote On/Off Threshold Voltage (Vr rising)		2.4V	2.6V	2.8V
Remote On/Off Voltage Hysteresis			250mV	
Operating Temperature Range		-40°C		+85°C
Switch On/Off Time	(using Remote On/Off Control)			50ms
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				70°C / W
Thermal Shutdown	Internal IC junction			+160°C
Case Material		Non-Conductive Black Plastic		
Potting Material		Epoxy (UL94V-0)		

cont.

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DC/DC-Converter
with 3 year Warranty

RECOM

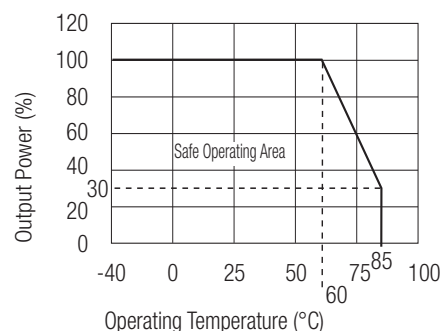
1.0 AMP
SMD
Single Output



EN-60950-1 Certified

R-78AA-1.0

Derating-Graph (Ambient Temperature)



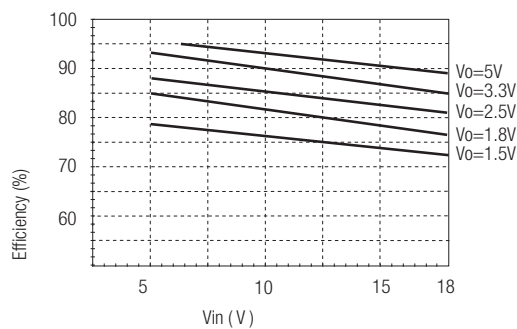
Standard Application Circuit

EMC	Conducted Emissions (with filter)	EN55022	Class B
	Radiated Emissions (with filter)	EN55022	Class B
	ESD	EN61000-4-2	Class A
	Radiated Immunity	EN61000-4-3	Class A
	Fast Transient	EN61000-4-4	Class A
	Conducted Immunity	EN61000-4-6	Class A
	Magnetic Field Immunity	EN61000-4-8	Class A
Safety Certification	Report: SPCLVD 1301026-1	EN-60950-1:2006 + A12:2011	
Package Weight		1.7g	
Packing Quantity		33 pcs per Tube 250 pcs per Reel	
MTBF (+25°C)		Detailed Information see Application Notes chapter "MTBF"	13338~21070 x 10 ³ hours
(+71°C)			
		using MIL-HDBK 217F	3880~6769 x 10 ³ hours

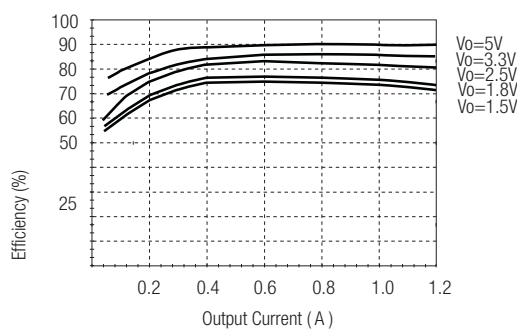
*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

Characteristics

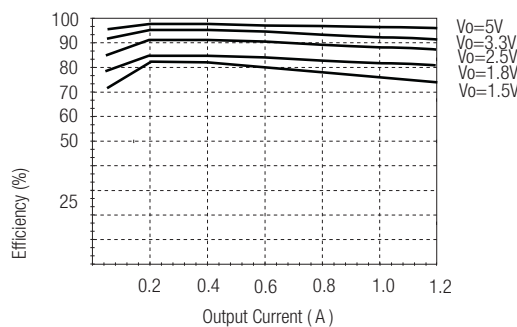
Efficiency



Efficiency Vs Vin (Full Load)

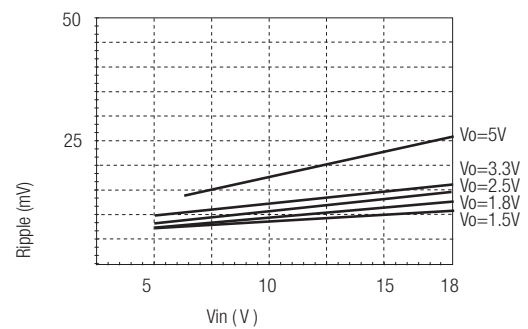


Efficiency Vs Load (Vin=Max)

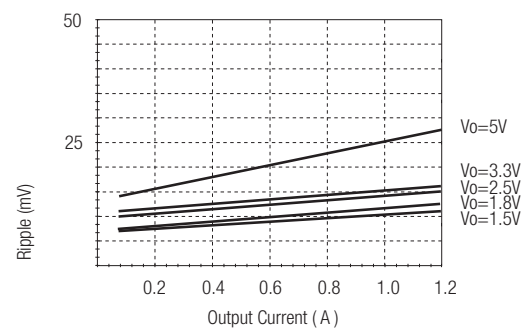


Efficiency Vs Load (Vin=Min)

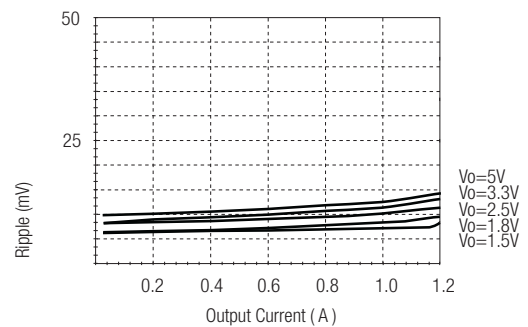
Ripple



Ripple Vs Vin (Full Load)

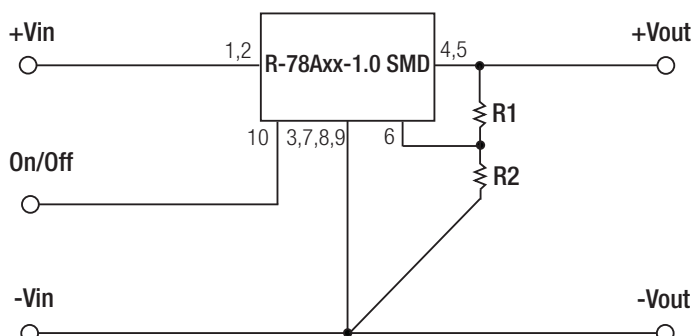


Ripple Vs Load (Vin=Max)



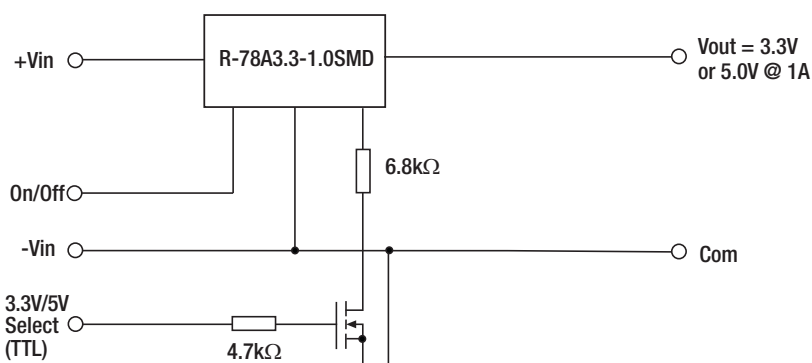
Ripple Vs Load (Vin=Min)

Standard Application Circuit



Application Examples

3.3V/5V Selectable 1A Power Supply

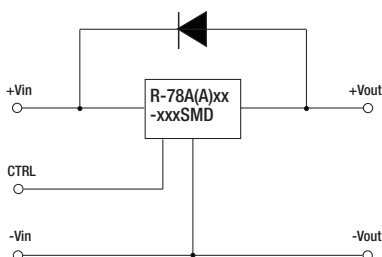


Optional Protection Circuit

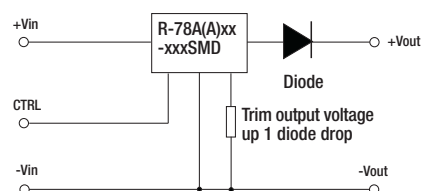
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



Optional Protection 2:



Application example:
Driving a high capacitive load

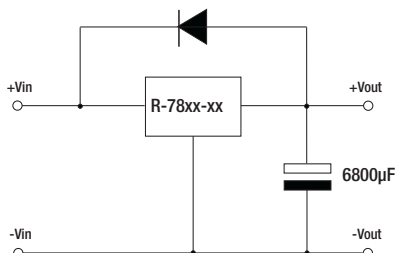
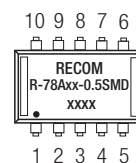
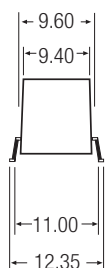
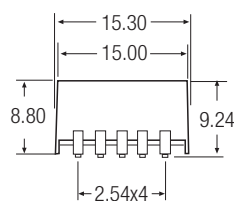


Table 1: Adjustment Resistor Values

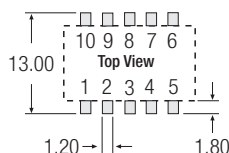
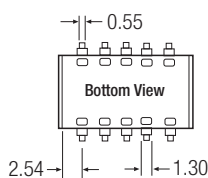
1.0A _{dc}	R-78A1.8-1.0SMD		R-78A2.5-1.0SMD		R-78A3.3-1.0SMD		R-78A5.0-1.0SMD	
V _{out} (nom.)	1.8V _{dc}		2.5V _{dc}		3.3V _{dc}		5.0V _{dc}	
V _{out} (adj)	R1	R2	R1	R2	R1	R2	R1	R2
1.5 (V)	3K Ω		200 Ω					
1.8 (V)			12K Ω					
2.5 (V)		11.8K Ω						
3.0 (V)		4.64K Ω		44.2K Ω	88.4K Ω		17K Ω	
3.3 (V)							27K Ω	
3.6 (V)						60.4K Ω	42K Ω	
3.9 (V)						28K Ω	58K Ω	
4.5 (V)						11.3K Ω	180K Ω	
4.9 (V)						7.15K Ω	850K Ω	
5.0 (V)						6.34K Ω		
5.1 (V)						5.9K Ω		231K Ω
5.5 (V)						3.9K Ω		56.2K Ω

Package Style and Pinning (mm)

SMD 10Pin Package



Recommended Footprint Details



Pin Connections

Pin #	
1,2	+Vin
3,7,8,9	GND
4,5	+Vout
6	V adj
10	Remote On/Off
xx.x	$\pm 0.5\text{mm}$
xx.xx	$\pm 0.25\text{mm}$

Features

- Efficiency up to 96%, no need for heatsinks!
- Pin-out compatible with LM78XX Linear Regs.
- Low profile (L*W*H=11.6*8.5*10.4mm)
- Wide input range (5V ~ 42V)
- Short circuit protection, thermal shutdown
- Non standard outputs available as specials
- Low ripple and noise
- See Innoline App Notes for use as a positive-to-negative inverter (alternative to 79xx regulator)

Selection Guide

Part Number SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency Min. Vin (%)	Max. Vin (%)
R-78C1.8-1.0	5 – 42	1.8	1.0	80	71
R-78C3.3-1.0	7 – 42	3.3	1.0	89	79
R-78C5.0-1.0	8 – 42	5	1.0	93	85
R-78C9.0-1.0	12 – 42	9	1.0	95	90
R-78C12-1.0	15 – 42	12	1.0	96	92
R-78C15-1.0	18 – 42	15	1.0	96	94

Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	All Series	Vout+3V		42V
Output Voltage Range	All Series	1.8V		15V
Output Current	All Series	0mA*		1000mA
Output Current Limit	All Series			3000mA
Short Circuit Input Current (Vin =24V)	All Series		65mA	
No Load Input Current			1mA	
Short Circuit Protection			Continuous, automatic recovery	
Output Voltage Accuracy (At 100% Load)	All Series		±2%	±3%
Line Regulation (100% Load, Vin max.)	All Series		0.2%	
Load Regulation (10 to 100% full load)	All Series		0.4%	
Dynamic Load Stability	100% <-> 50% load			±75mV
	100% <-> 10% load			±200mV
Ripple & Noise (20Mhz BW Limited)	Vin = 24V, Vout =1.8V-15V		75mVp-p	100mVp-p
With 10µF MLCC output capacitor	Full Load		30mVp-p	
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			470µF
	with <1 second start up time + diode protection circuit			6800µF
Switching Frequency		280kHz	350kHz	420kHz
Operating Temperature Range		-40°C		+85°C
Maximum Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				70°C/W
Thermal Shutdown	Internal IC junction			+160°C
Conducted Emissions (with filter)	EN55022			Class B
Radiated Emissions (with filter)	EN55022			Class B
ESD	EN61000-4-2			Class A
Radiated Immunity	EN61000-4-3			Class A
Fast Transient	EN61000-4-4			Class A
Conducted Immunity	EN61000-4-6			Class A
Magnetic Field Immunity	EN61000-4-8			Class A
Package Weight				2g
Packing Quantity				42 pcs per Tube

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1.0 AMP SIP3 Single Output



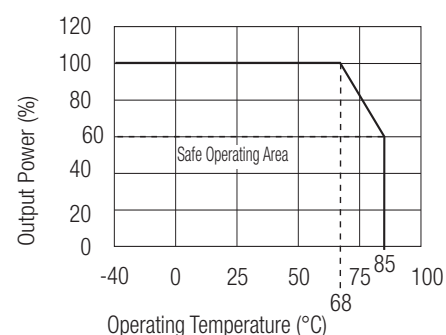
EN-60950-1 Certified

R-78C-1.0

Description

The R-78Cxx-1.0 series switching regulators are ideally suited to replace 1 Amp 78xx linear regulators and are pin compatible. Efficiencies of up to 96% means that very little energy is wasted as heat and the high input voltage is a useful feature.

Derating-Graph (Ambient Temperature)



Specifications (typical at 25°C, 10% minimum load, unless otherwise specified)

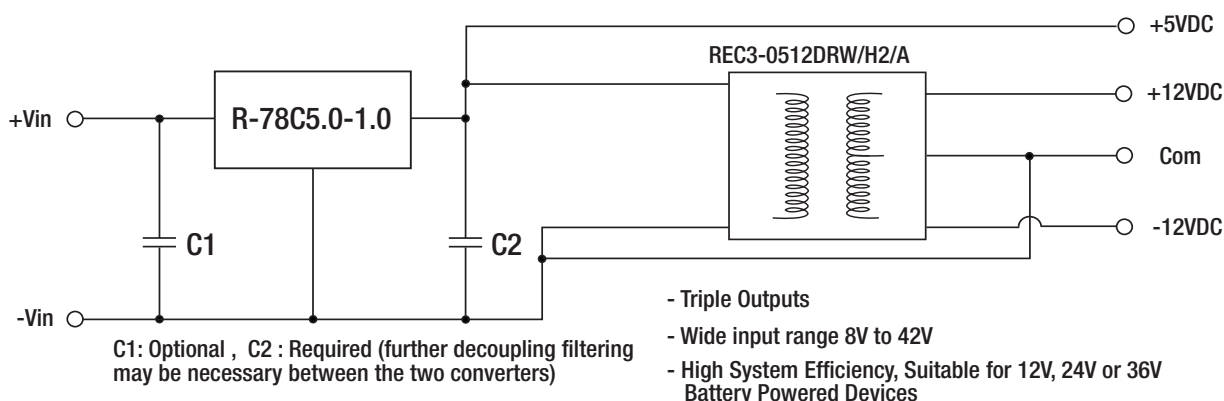
Case Material	Non-Conductive Black Plastic	
Potting Material	Epoxy (UL94V-0)	
Certifications		
General Safety	Report: SPCLVD 1301026-1	EN 60950-1:2006 + A12:2011
Standby Power		EN62301:2005
MTBF (+25°C)	using MIL-HDBK 217F	8600 x 10 ³ hours.
(+68°C)	using MIL-HDBK 217F	3880 x 10 ³ hours.

Note:

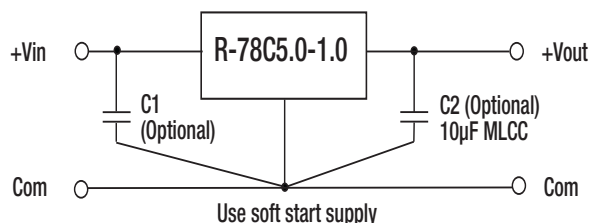
No load operation will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended.

Application Examples

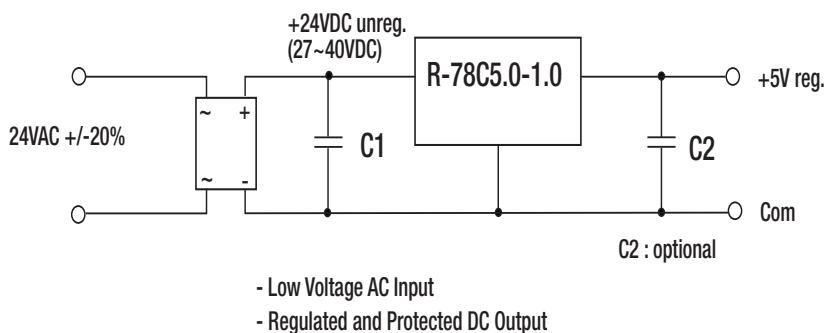
High efficiency regulated outputs



Standard Application Circuit with Class B EMC filter



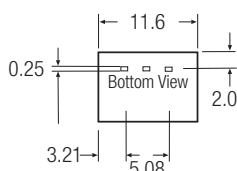
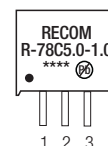
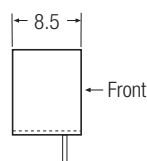
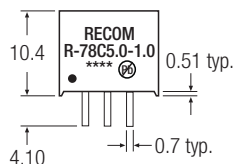
Low Voltage AC input, regulated DC output



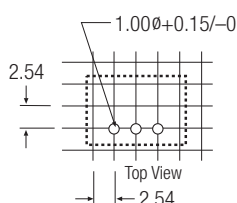
Package Style and Pinning (mm)

SIP3 PIN Package

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout

xx.x ±0.5mm
xx.xx ±0.25mm

Features

- Efficiency up to 97%, Non isolated, no need for heatsinks
- Pin-out compatible with LM78XX Linears
- Low profile (L*W*H=11.5*8.5*17.5mm)
- Wide input range (4.75V ~ 34V)
- Short circuit protection, Thermal shutdown
- Non standard outputs available as specials between 1.5V ~ 15V
- Low ripple and noise
- "L" version with 90° pins
- See InnoLine Application Notes for use as an inverter (alternative to LM79xx Linear)

Description

The R-78Bxx-1.0 Series high efficiency switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 97% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs.

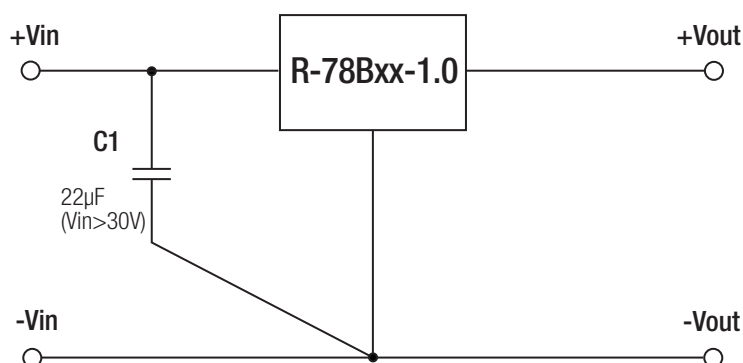
The L-Version with 90° pins allows direct replacement for laid-flat regulators where component height is at a premium. Low ripple and noise figures and a short circuit input current of typically only 10mA round off the specifications of this versatile converter series.

Selection Guide

Part Number SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency Min. Vin (%)	Max. Vin (%)
R-78B1.5-1.0	4.75 – 26	1.5	1.0	77	71
R-78B1.8-1.0	4.75 – 26	1.8	1.0	80	74
R-78B2.5-1.0	4.75 – 32	2.5	1.0	85	78
R-78B3.3-1.0	4.75 – 32	3.3	1.0	89	83
R-78B5.0-1.0	6.5 – 32	5.0	1.0	93	88
R-78B6.5-1.0	9.0 – 32	6.5	1.0	94	90
R-78B9.0-1.0	12 – 32	9.0	1.0	95	93
R-78B12-1.0	16 – 32	12	1.0	96	95
R-78B15-1.0	20 – 32	15	1.0	97	96

* add Suffix "L" for 90° bent pins, e.g. R-78B5.0-1.0L

Typical Application Circuit

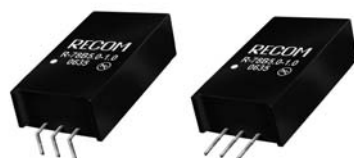


To protect the converter during power-up, use C1=22µF if Vin>30V

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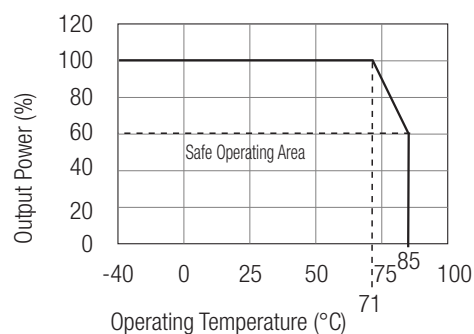
**1.0 AMP
SIP3
Single Output**



EN-55022 Certified
EN-55024 Certified
EN-60601-1-2 Certified
EN-60950-1 Certified

R-78B-1.0

Derating-Graph
(Ambient Temperature)



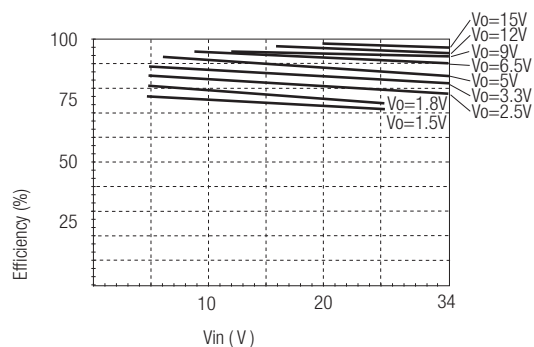
Specifications (refer to the standard application circuit, Ta: 25°C, minimum load = 10%)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	1.5V, 1.8V 2.5V to 15.5V	4.75V 4.75V	25 32	26V abs. max. 34V abs. max.
Output Voltage Range (for customized parts)	All Series	1.5V		15.5V
Output Current (see Note 1)	All Series	0mA*		1000mA
Output Current Limit	All Series			2000mA
Short Circuit Input Current (Vin = 24V)	All Series			60mA
Internal Power Dissipation				0.65W
Short Circuit Protection			Continuous, automatic recovery	
Output Voltage Accuracy (At 100% Load)	All Series		±2%	±3%
Line Voltage Regulation (Vin = min. to max. at full load)	1.5V to 6.5V 9V to 15.5V		0.2% 0.1%	0.4% 0.2%
Load Regulation (10% to 100% full load)	1.5V to 6.5V 9V to 15.5V		0.4% 0.25%	0.6% 0.4%
Dynamic Load Stability (with Output Capacitor=100µF)	100% <-> 50% load Transient Recovery Time		±100mV 1.0ms	±150mV 1.5ms
Ripple & Noise (without Output Capacitor) (10% to 100% full load)	1.5V to 6.5V 9V to 15.5V		15mVp-p 25mVp-p	20mVp-p 35mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components with <1 second start up time + diode protection circuit			470µF 6800µF
Switching Frequency		280kHz	330kHz	380kHz
Quiescent Current	Vin = min. to max. at 0% load		5mA	7mA
Input Reflected Ripple Current	All Series		150mA	200mA p-p
Operating Temperature Range		-40°C		+85°C
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				60°C / W
Thermal Shutdown	Internal IC junction			+160°C
Relative Humidity				95% RH
Thermal Shutdown	Internal IC junction		+160°C	
Case Material			Epoxy with Non-Conductive Plastic Case (UL94V-0)	
Package Weight			4g	
Packing Quantity				42 pcs per Tube
Conducted Emissions	EN55022			Class B
Radiated Emissions	EN55022			Class B
ESD	EN61000-4-2			Class A
Safety Certification	Report: SPCLVD 1301026-1		EN 60950-1:2006 + A12:2011	
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F		6584 x 10 ³ hours
(+71°C)		using MIL-HDBK 217F		1139 x 10 ³ hours

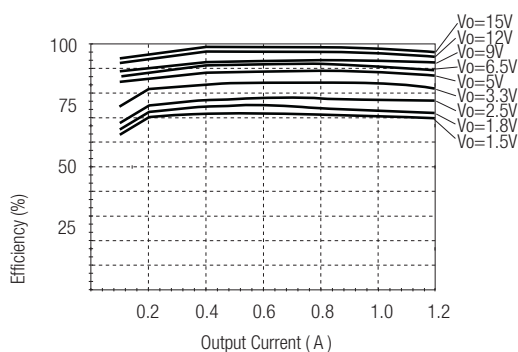
*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

Characteristics

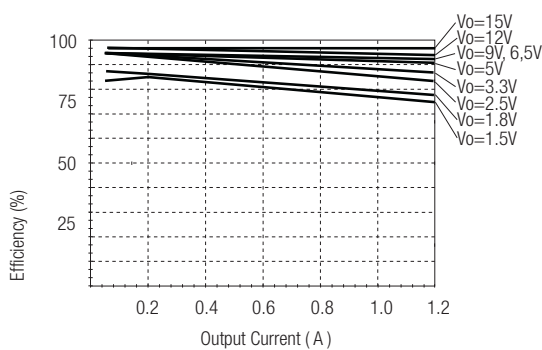
Efficiency



Efficiency Vs Vin (Full Load)

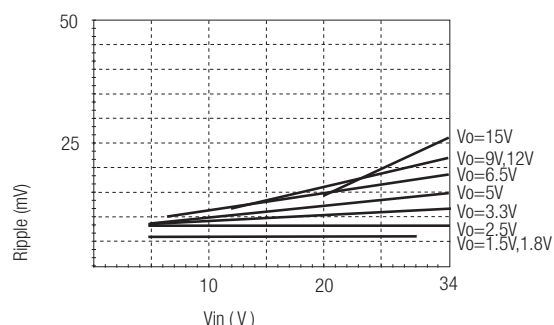


Efficiency Vs Load (Vin=Max)

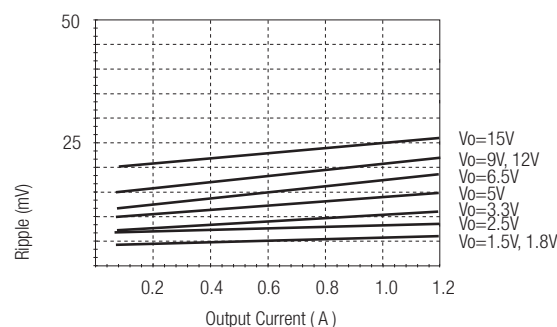


Efficiency Vs Load (Vin=Min)

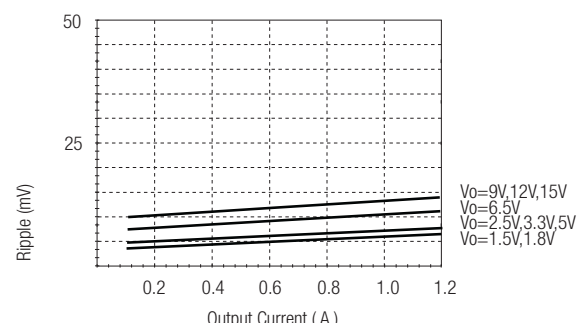
Ripple



Ripple Vs Vin (Full Load)



Ripple Vs Load (Vin=Max)



Ripple Vs Load (Vin=Min)

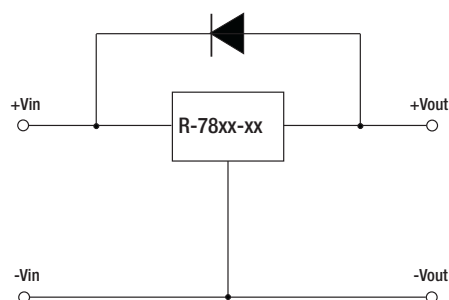
R-78B-1.0

Optional Protection Circuit

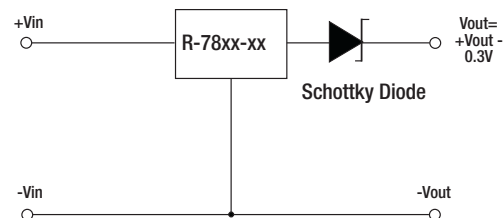
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).

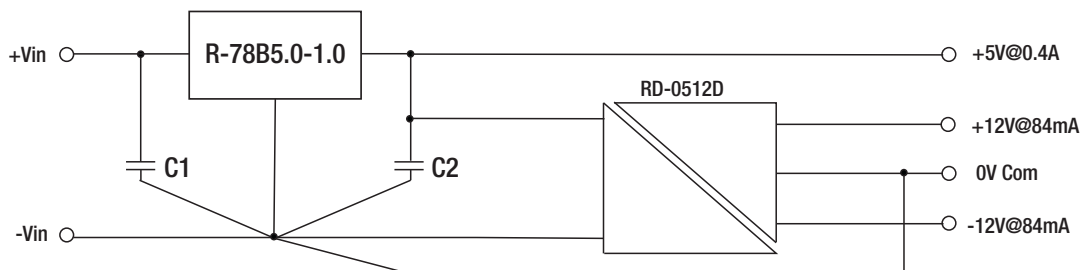


Optional Protection 2:



Application Examples

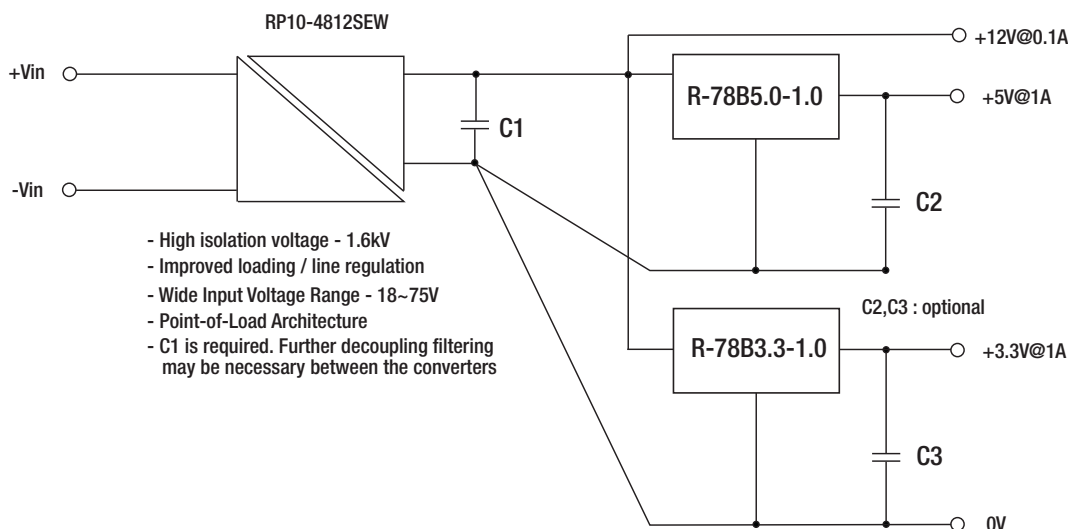
High efficiency multiple output



C1: optional, C2: required (further decoupling filtering may be necessary between the two converters)

- Wide input range 6.5V to 34V
- +/-12V outputs for analogue circuits, e.g. instrumentation amplifier
- +5V output for digital circuits

Isolated, wide Input range, Distributed Power Architecture (Point of Load)

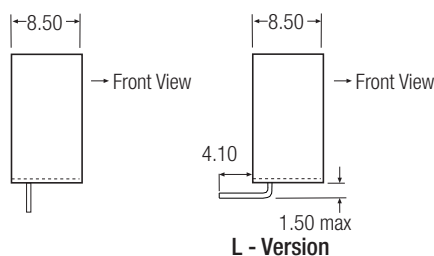
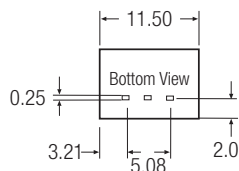
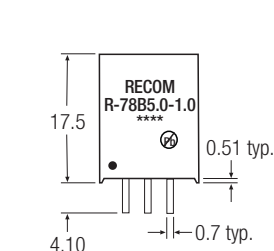


- High isolation voltage - 1.6kV
- Improved loading / line regulation
- Wide Input Voltage Range - 18~75V
- Point-of-Load Architecture
- C1 is required. Further decoupling filtering may be necessary between the converters

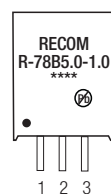
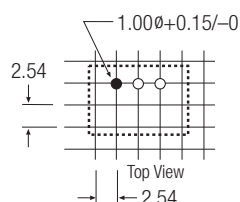
C2, C3 : optional

Package Style and Pinning (mm)

SIP3 PIN Package



Recommended Footprint Details



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout

xx.x ±0.5mm
xx.xx ±0.25mm

Features

- Efficiency up to 95%, Non isolated, no need for heatsinks
- Pin-out compatible with LM78XX Linears
- Low profile (L*W*H=11.5*8.5*17.5mm)
- Wide input range (4.75V ~ 18V)
- Short circuit protection, Thermal shutdown
- Non standard outputs available as specials between 1.5V ~ 6.5V
- Low ripple and noise
- "L" Version with 90° pins

Description

The R-78Bxx-1.5 Series high efficiency switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 95% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs. The L-Version with 90° pins allows direct replacement for laid-flat regulators where component height is at a premium. Low ripple and noise figures and a short circuit input current of typically only 10mA round off the specifications of this versatile converter series.

Selection Guide

Part Number* SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency	
				Min. Vin (%)	Max. Vin (%)
R-78B1.5-1.5	4.75 – 18	1.5	1.5	83	78
R-78B1.8-1.5	4.75 – 18	1.8	1.5	85	81
R-78B2.5-1.5	4.75 – 18	2.5	1.5	88	84
R-78B3.3-1.5	4.75 – 18	3.3	1.5	91	88
R-78B5.0-1.5	6.5 – 18	5.0	1.5	94	92
R-78B6.5-1.5	8.0 – 18	6.5	1.5	95	93

* add Suffix "L" for 90° bent pins, e.g. R-78B5.0-1.5L

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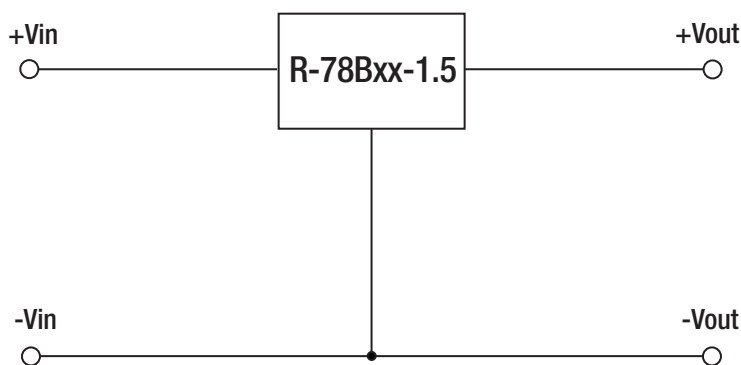
1.5 AMP SIP3 Single Output



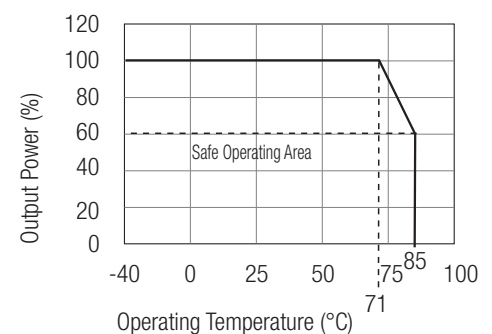
EN-55022 Certified
EN-55024 Certified
EN-60950-1 Certified

R-78B-1.5

Typical Application Circuit



Derating-Graph (Ambient Temperature)



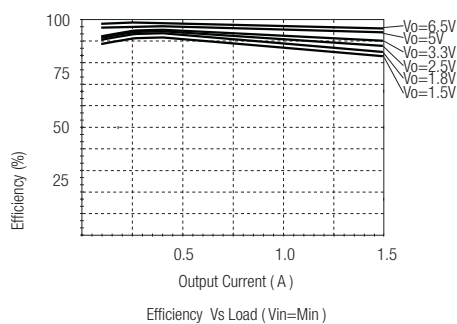
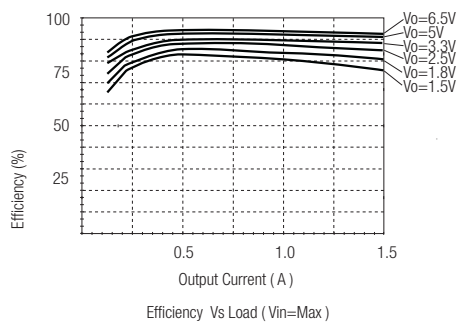
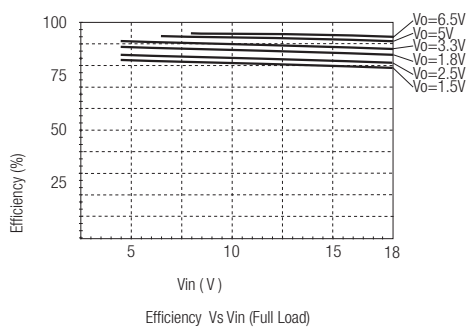
Specifications (refer to the standard application circuit, Ta: 25°C, minimum load = 10 %)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	All Series, see Selection Guide	4.75V		18.0V
Output Voltage Range (for customized parts)	All Series	1.5V		6.5V
Output Current	All Series	0mA*		1500mA
Output Current Limit	All Series			5000mA
Short Circuit Input Current (Vin = 12V)	All Series			100mA
Internal Power Dissipation				0.65W
Short Circuit Protection		Continuous, automatic recovery		
Output Voltage Accuracy (At 100% Load)	All Series		±2%	±3%
Line Voltage Regulation (Vin = min. to max. at full load)	All Series		0.3%	0.5%
Load Regulation (10% to 100% full load)	All Series		0.6%	0.8%
Dynamic Load Stability (with Output Capacitor=100µF)	100% <-> 50% load		±80mV	±120mV
	Transient Recovery Time		1.0ms	1.5ms
Ripple & Noise (10% to 100% full load)	All Series		15mV	30mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components			1000µF
	with <1 second start up time + diode protection circuit			6800µF
Switching Frequency		300kHz	340kHz	380kHz
Quiescent Current	Vin = min. to max. at 0% load		7mA	9mA
Input Reflected Ripple Current	All Series		150mA	200mA p-p
Operating Temperature Range		-40°C		+85°C
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				60°C / W
Thermal Shutdown	Internal IC junction			+160°C
Relative Humidity				95% RH
Case Material		Epoxy with Non-Conductive Plastic Case (UL94V-0)		
Package Weight			4g	
Packing Quantity				42 pcs per Tube
Conducted Emissions	EN55022			Class B
Radiated Emissions	EN55022			Class B
ESD	EN61000-4-2			Class A
Safety Certification	Report: SPCLVD 1301026-1		EN-60950-1:2006 + A12:2011	
MTBF (+25°C) (+71°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F		3250 x 10 ³ hours
		using MIL-HDBK 217F		1059 x 10 ³ hours

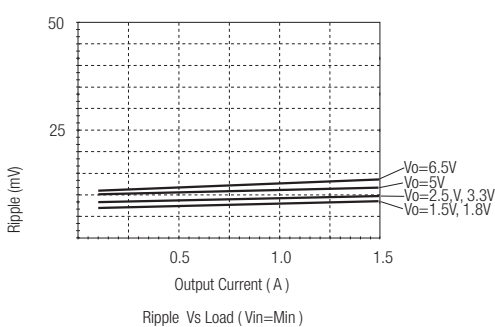
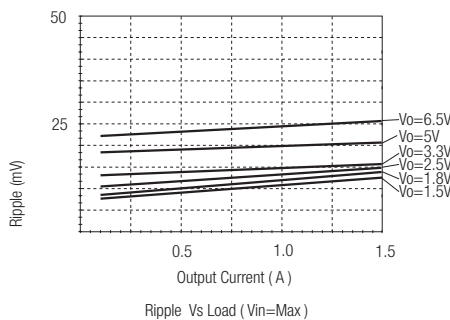
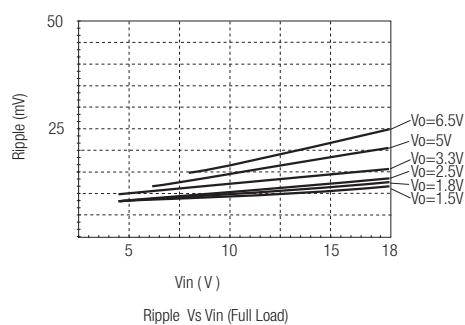
*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

Characteristics

Efficiency



Ripple

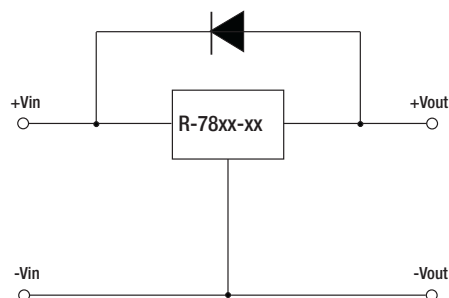


Optional Protection Circuit

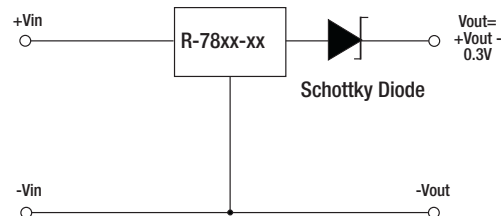
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).

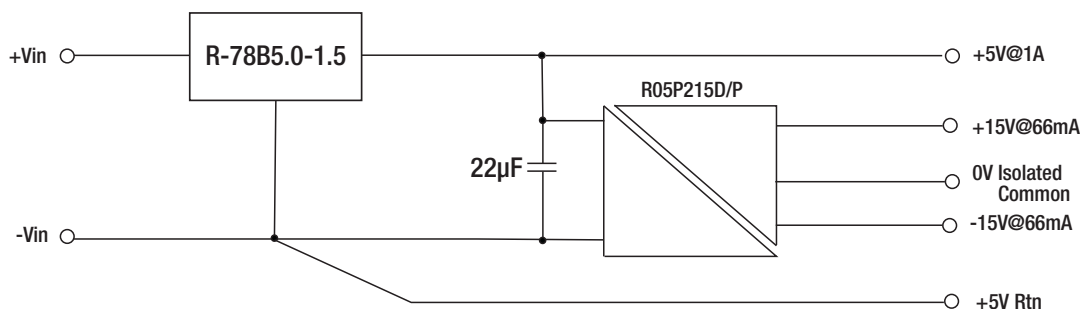


Optional Protection 2:



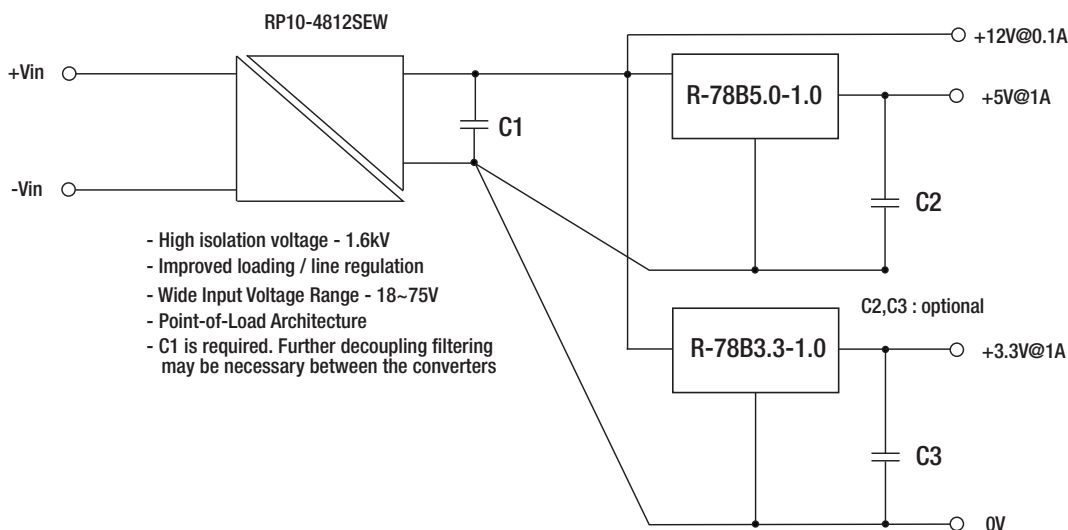
Application Examples

High efficiency multiple output



- Wide input range suits both 12V and 7.2V battery packs
- 5.2kV isolated short circuit protected outputs for analogue circuits, e.g. medical grade interface
- High efficiency +5V/1A protected output for digital circuits
- Further decoupling filtering may be necessary between the converters

Isolated, wide Input range, Distributed Power Architecture (Point of Load)

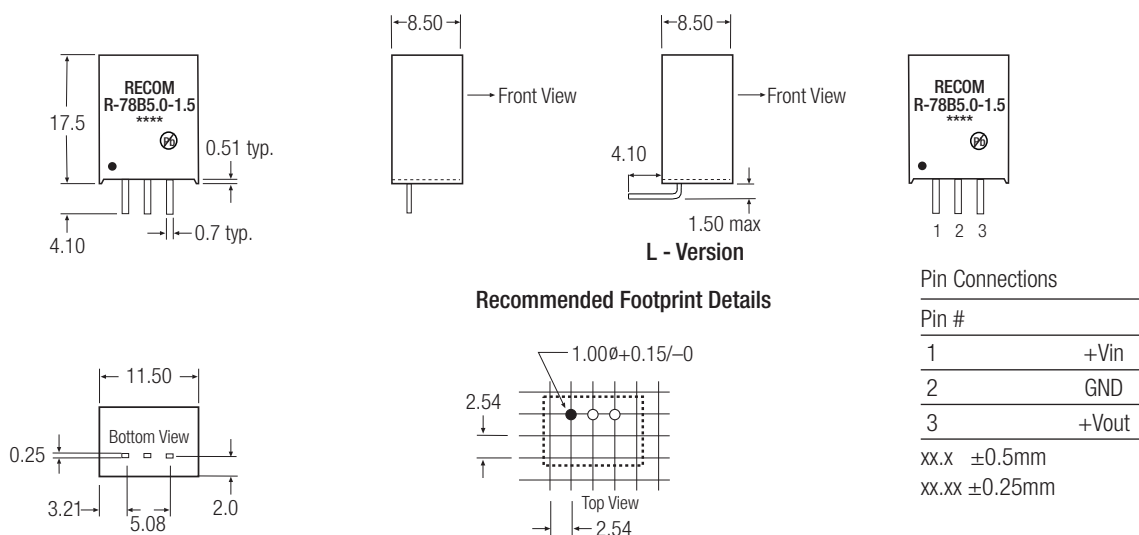


- High isolation voltage - 1.6kV
- Improved loading / line regulation
- Wide Input Voltage Range - 18~75V
- Point-of-Load Architecture
- C1 is required. Further decoupling filtering may be necessary between the converters

Package Style and Pinning (mm)

SIP3 PIN Package

3rd angle projection



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout
xx.x	±0.5mm
xx.xx	±0.25mm

Features

- Efficiency up to 96%, Non isolated, no need for heatsinks
- Pin-out compatible with LM78XX Linears
- Low profile(L*W*H=11.5*8.5*17.5mm)
- High voltage input range, up to 72V
- Short circuit protection, Thermal shutdown
- Non standard outputs available as specials between 3.3V~24V
- Low ripple and noise
- "L" version with 90° pins
- See Innoline Application Notes for use as an inverter (alternative to LM79xx Linear)

Description

The R-78HBxx-Series high efficiency, high input voltage switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 96% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs.

An input voltage range of up to 8:1 is unsurpassed by any other converter and allows the full stored energy utilisation of standard and high voltage batteries. The fully protected output is ideal for industrial applications (especially for industry standard 24VDC bus supplies) and the L-Version with 90° pins allows direct replacement for laid-flat regulators where component height is at a premium. Low ripple and noise figures and a short circuit input current of typically only 15mA round off the specifications of this versatile converter series.

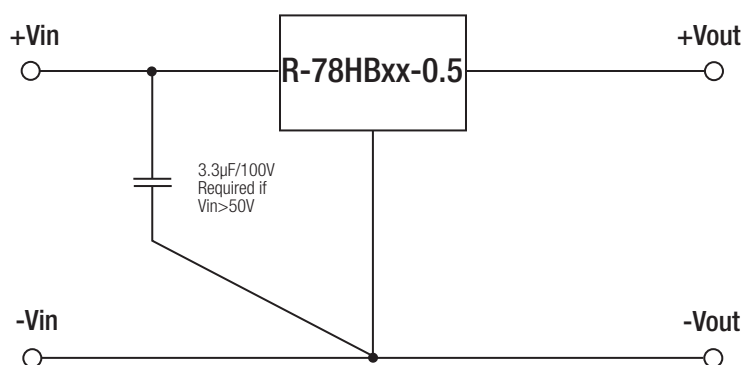
Typical applications include telecommunication, automotive, industrial, aerospace and battery powered applications.

Selection Guide

Part Number SIP3	Input Range (V)	Output Voltage (V)	Output Current (A)	Efficiency		
				Vmin. (%)	30V (%)	72V (%)
R-78HB3.3-0.5	9 - 72	3.3	0.5	82	80	76
R-78HB5.0-0.5	9 - 72	5.0	0.5	87	85	81
R-78HB6.5-0.5	9 - 72	6.5	0.5	91	87	84
R-78HB9.0-0.5	14 - 72	9.0	0.5	92	90	86
R-78HB12-0.5	17 - 72	12	0.5	94	93	89
R-78HB15-0.5	20 - 72	15	0.5	95	94	91
R-78HB24-0.3	36 - 72	24	0.3	96		92

* add Suffix "L" for 90° bent pins, e.g. R-78HB5.0-0.5L

Typical Application Circuit

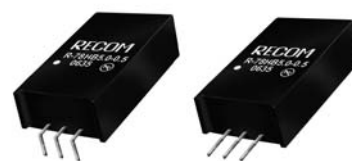


The converter has a built in soft start circuit. Rapidly changing the input voltage from Vin(min) ↔ Vin(max) can bypass this circuit and damage the converter.

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DC/DC-Converter
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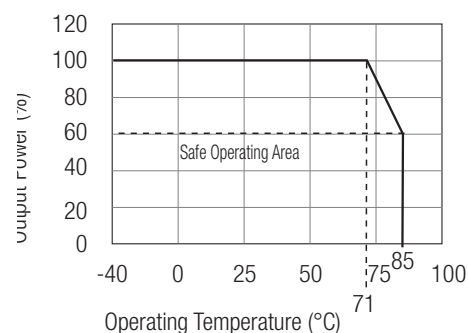
0.5 AMP
SIP3
Single Output



EN-55022 Certified
EN-55024 Certified
EN-60950-1 Certified

R-78HB

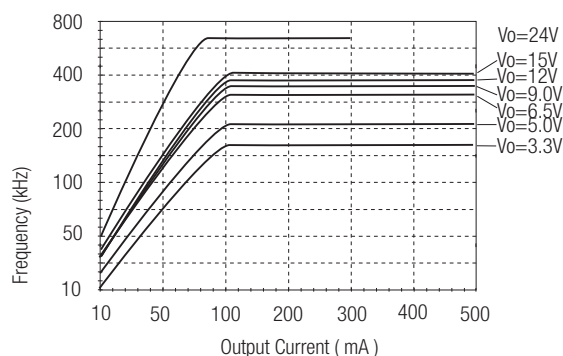
Derating-Graph (Ambient Temperature)



Specifications (refer to the standard application circuit, Ta: 25°C, minimum load = 10%)

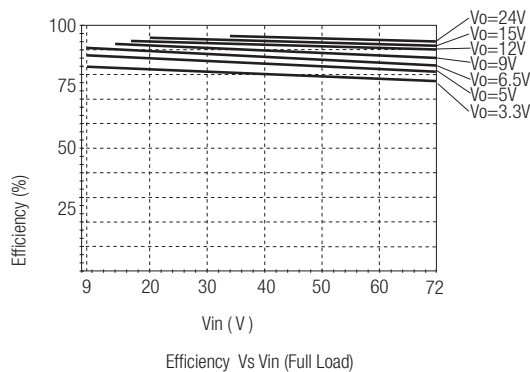
Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	See table	9V	72V	75V Absolute Max.
Output Voltage Range (for customized parts)	All Series	3.3V		24V
Output Current (see Note 1)	3.3V, 5V, 6.5V, 9V, 12V, 15V	10mA		500mA
	24V	6mA		300mA
Output Current Limit (Vin = 48VDC)	All Series		700mA	1200mA
Short Circuit Input Current	All Series		15mA	25mA
Internal Input Filter				1μF Capacitor
Internal Power Dissipation				0.65W
Short Circuit Protection		Continuous, automatic recovery		
Output Voltage Accuracy	At 100% Load		±2%	±3%
Line Voltage Regulation	Vin = min. to max. at full load		0.4%	1%
Load Regulation	10% to 100% full load		0.3%	0.6%
Dynamic Load Stability (with Output Capacitor=100μF)	100% <-> 50% load		±75mV	±100mV
Ripple & Noise (without Output Capacitor)	10% to 100% full load		20mVp-p	60mVp-p
Temperature Coefficient	-40°C ~ +85°C ambient			0.015%/°C
Max capacitance Load	with normal start-up time, no external components with <1 second start up time + diode protection circuit			100μF 6800μF
Switching Frequency (See Graph)	Full Load	120kHz		800kHz
Quiescent Current	Vin = 48VDC. at minimum load	1mA		5mA
Operating Temperature Range		-40°C		+85°C
Operating Case Temperature				+100°C
Storage Temperature Range		-55°C		+125°C
Case Thermal Impedance				60°C / W
Thermal Shutdown	Internal IC junction			+160°C
Relative Humidity				95% RH
Case Material				Non-Conductive Black Plastic
Potting Material				Epoxy (UL94V-0)
Package Weight			4g	
Packing Quantity				42 pcs per Tube
Soldering Temperature				265°C max./10 sec.
Conducted Emissions	EN55022			Class B
Radiated Emissions	EN55022			Class B
ESD	EN61000-4-2			Class A
Safety Certification	Report: SPCLVD 1301026-1			EN-60950-1:2006 + A12:2011
MTBF (+25°C)	} Detailed Information see Application Notes chapter "MTBF"	using MIL-HDBK 217F		7395 x 10 ³ hours
(+71°C)		using MIL-HDBK 217F		1242 x 10 ³ hours

Switching Frequency VS Load

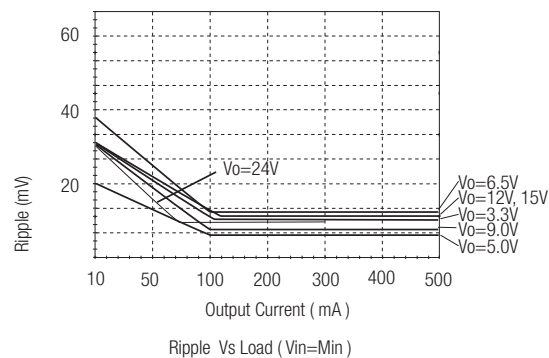
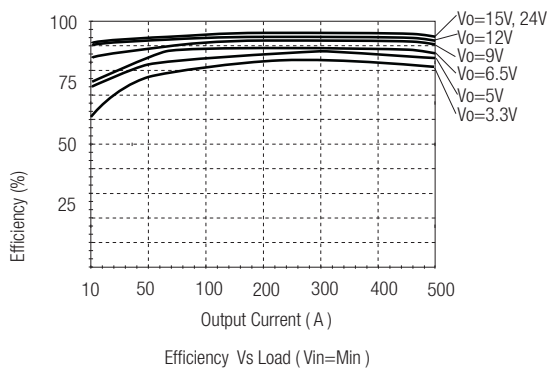
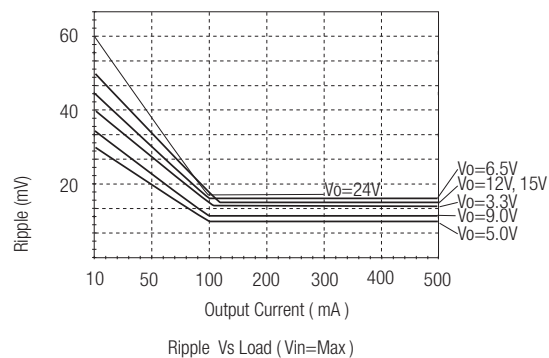
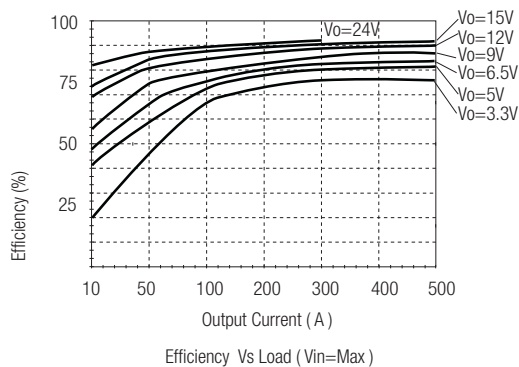
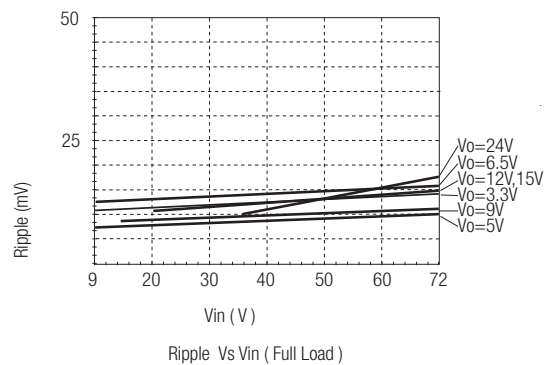


Switching Frequency Vs Load (Vin=30~72V)

Efficiency



Ripple



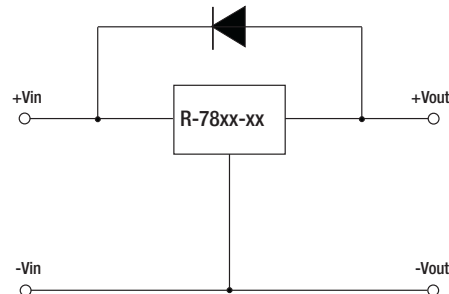
*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

Optional Protection Circuit

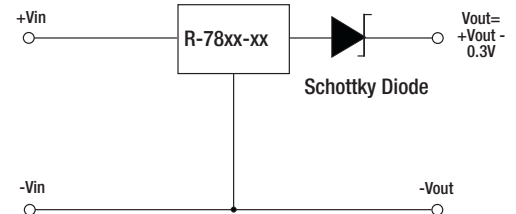
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).

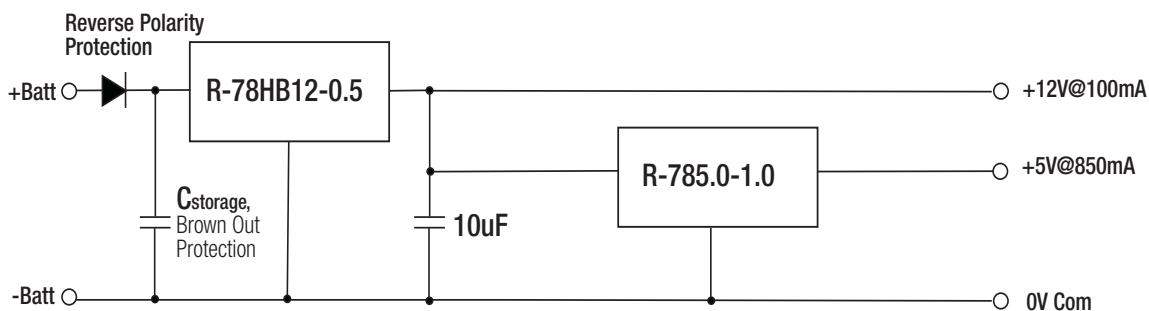


Optional Protection 2:



Typical Application

High Input Voltage Multiple Output Supply

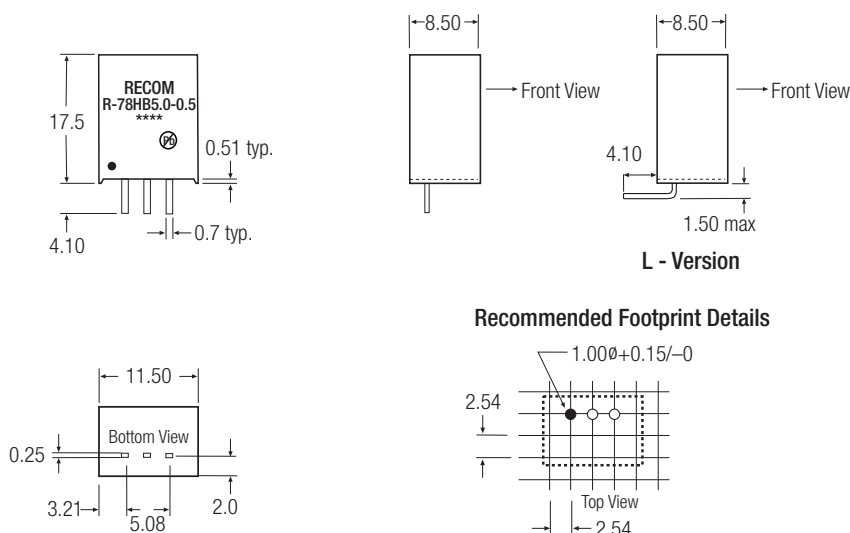


- Wide input range 18V to 72V - can be used with 24V, 48V or 60V batteries
- +12V output for interface and display electronics
- +5V high current output for digital electronics
- Further decoupling filtering may be necessary between the converters

R-78HB

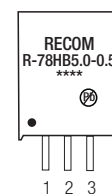
Package Style and Pinning (mm)

SIP3 PIN Package



L - Version

Recommended Footprint Details



Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout
xx.x	±0.5mm
xx.xx	±0.25mm

Features

- Low Profile 4.5mm
- Low Cost
- Wide Input Range (5V - 36V)
- Short Circuit Protection
- Castellated Connections

Selection Guide

Part Number	Input Range (VDC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)
ROF-78E3.3-0.5SMD	5 - 36	3.3	500	73 - 84
ROF-78E5.0-0.5SMD	9 - 36	5.0	500	79 - 87

Specifications (measured at Ta=25°C, Full Load after Warm-Up)

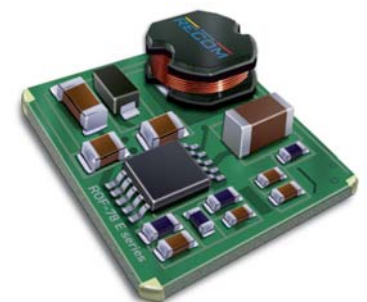
Input Voltage Range	5 - 36 VDC (12/24V typ)	
No Load Input Current	5mA max.	
Maximum Input Current	0.5A max.	
Short Circuit Input Current	200mA max.	
Voltage Accuracy	±5% max.	
Line Regulation	(LL to HL at Full Load)	±1% max.
Load Regulation	(10 ~ 100%)	±3% max.
Minimum Load*	10%	
Ripple & Noise	(20MHz Limited)	100mV max.
Transient Response	100% ~ 50% Load	±100mV
(20MHz Limited)	100% ~ 10% Load	±200mV
Operating Frequency	650KHz typ.	
ON/OFF Enable Pin	ON: Open or >1.75V	
(max. Input Voltage = 5V)	OFF: GND or <0.7V	
Current Limit	950mA typ.	
Short Circuit Protection	Auto Recovery	
Operating Temperature	-40°C ~ 85°C	
Storage Temperature	-55°C ~ 125°C	
Humidity	95% RH	
Dimension (L x W x H)	12.5 x 13.5 x 4.5 mm	
Weight	1g	
Cooling Method	Free Air Convection	
MTBF (25°C)	MIL-HDBK-217F	3500 x 10 ³ hours

*Operation at no load will not damage these devices, but they may not meet all of the datasheet specifications.

INNOLINE
DC/DC-Converter

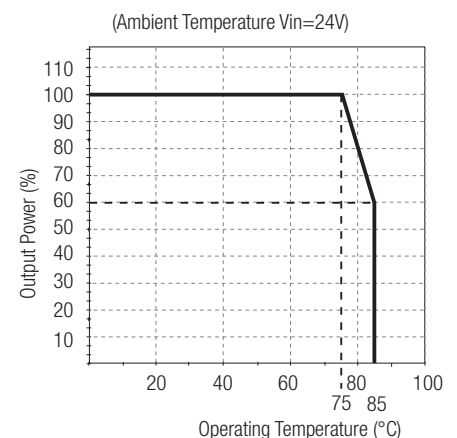
RECOM

Non Isolated Power Module



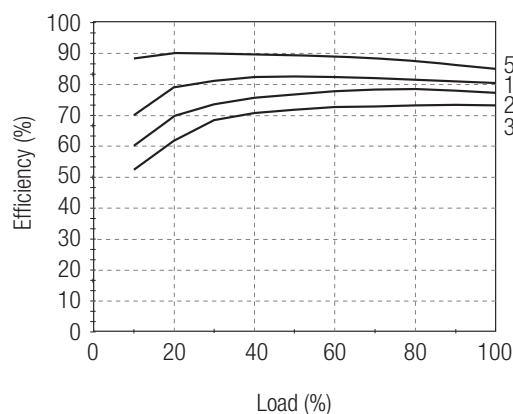
ROF-78E

Derating-Graph (Ambient Temperature)

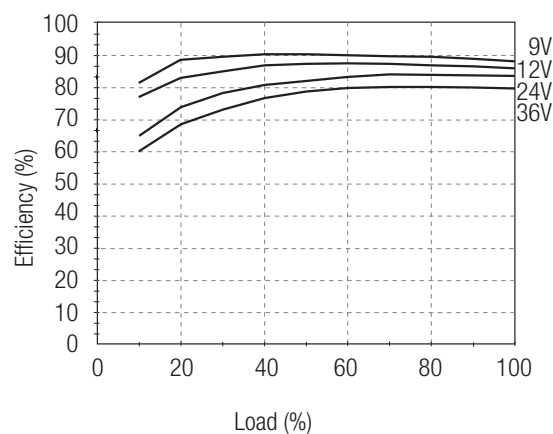


Characteristics

Efficiency

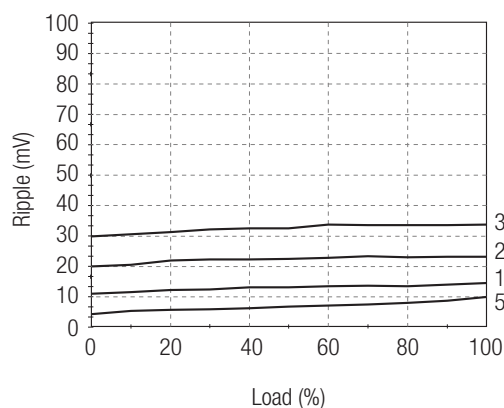


ROF-78E3.3-0.5SMD

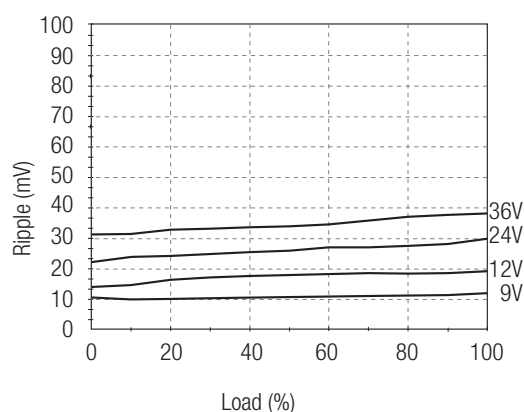


ROF-78E5.0-0.5SMD

Ripple



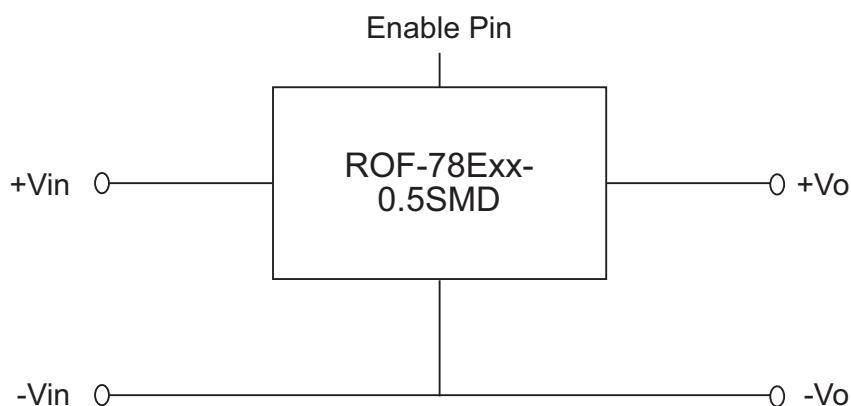
ROF-78E3.3-0.5SMD



ROF-78E5.0-0.5SMD

Applications

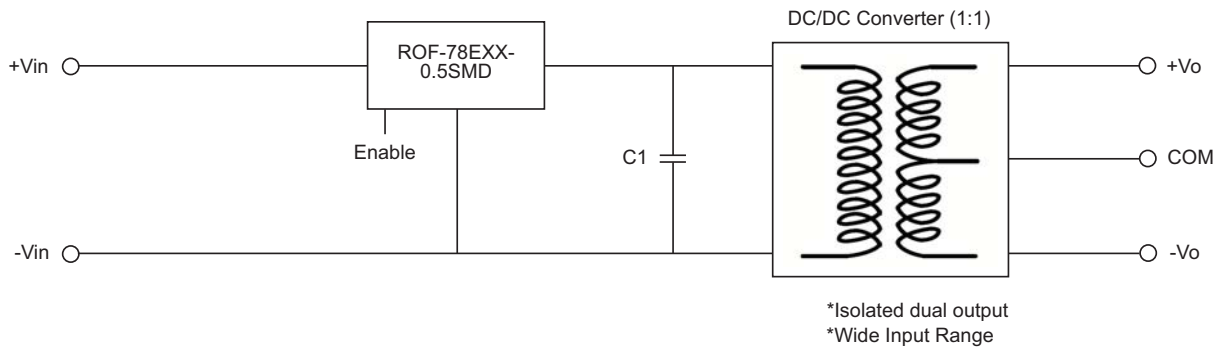
Standard Application Circuit



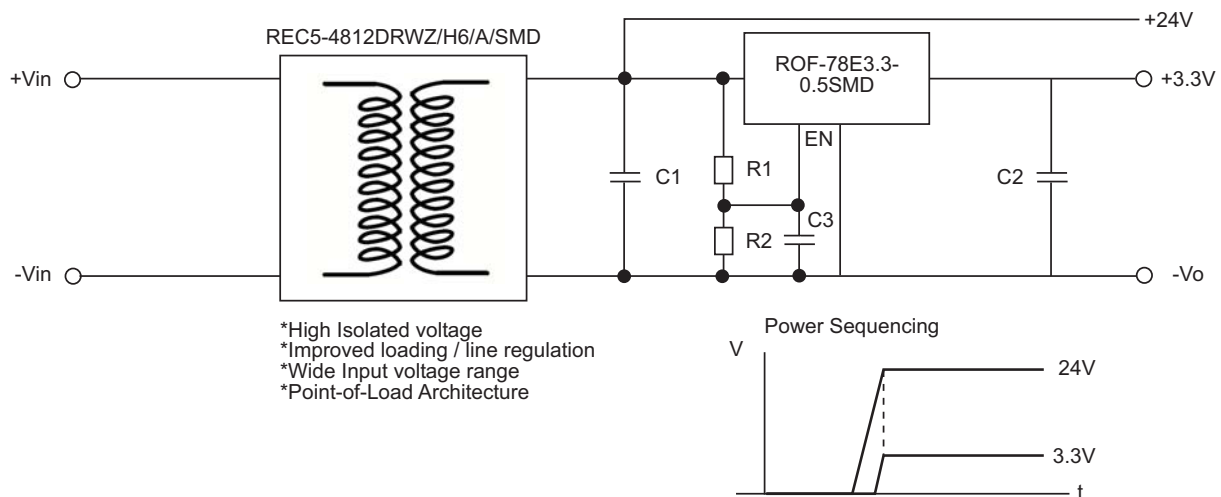
Applications

Application Examples

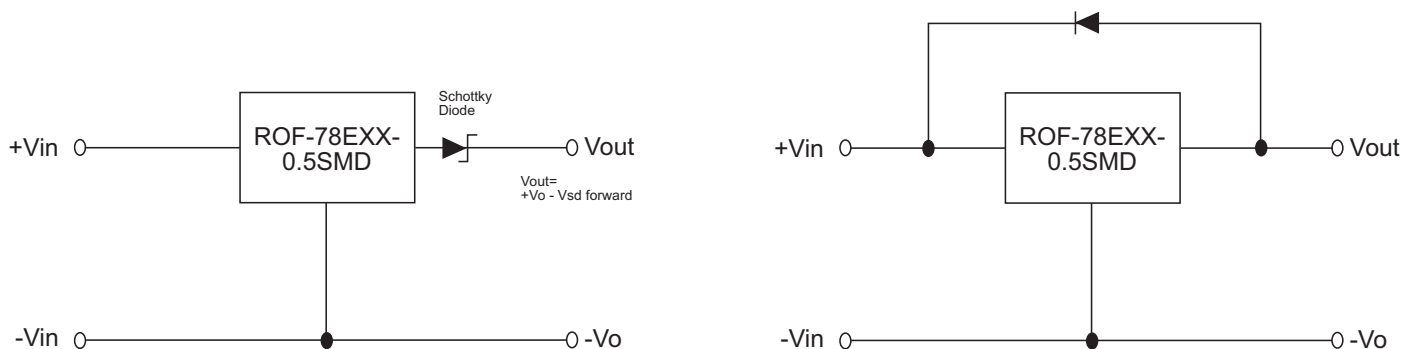
High efficiency, isolated, dual unregulated outputs



Isolated (Up to 6KV), wide input range regulated output



Optional Protection Circuit



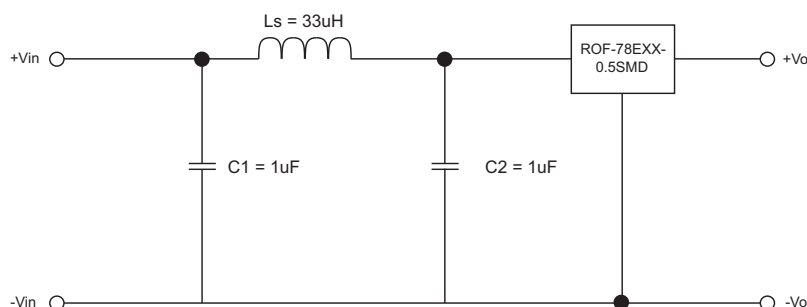
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output.

Applications

Conduction / Radiation Emission Filter Suggestion

Suggestion for conduction Emission Class A, meet radiation emission Class B

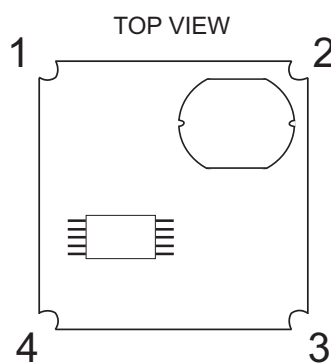


The capacitors used are ceramic capacitors, rated voltage 50V

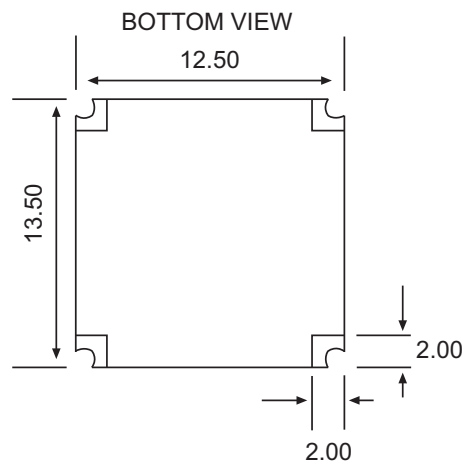
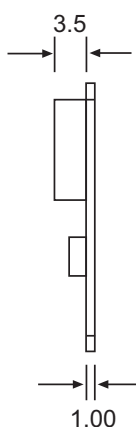
Package Style and Pinning (mm)

ROF-78EXX-0.5SMD Surface Mount Package

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	Out
1	+Vin
2	GND
3	+Vout
4	EN

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

- Low Cost Switching Regulator
- Efficiency up to 92 %
- Short Circuit Protection
- Pin Compatible with 78 Series Regulators
- 3.3V, 5V / 500 mA Output

INNOLINE
DC/DC-Converter

RECOM

500mA
Single Output

Selection Guide

Part Number	Input Range (V)	Output Voltage (V)	Output Current (mA)	Efficiency (%)
R-78E5.0-0.5	7 - 28	5	500	82 - 92
R-78E3.3-0.5	6 - 28	3.3	500	75 - 88

Specifications (valid at nominal input voltage 24V full load after warm-up time unless otherwise states)

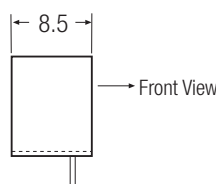
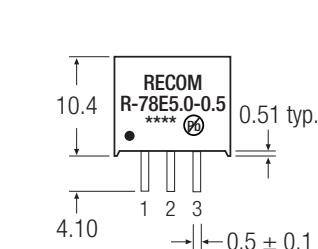
Input Voltage Range	5V Version	7 - 28 VDC
	3.3V Version	6 - 28 VDC
Output Voltage		5.0 VDC
		3.3VDC
Output Current Range		5 - 500 mA
Output Voltage Accuracy		± 3% max.
Efficiency		see Table
Switching Frequency $V_{in} = 24V$		570 KHz typ.
Output Ripple & Noise @ 20MHz	at $V_{in} = 24$ VDC, $I_o =$ Full Load	50mVp-p max.
Line Voltage Regulation		± 0.5 % max.
Load Voltage Regulation	10% to 100% Full Load	± 1 % max.
Short Circuit Protection		Automatic Restart
Operating Ambient Temperature Range	(see Derating Graph)	-40°C - +85°C
Storage Temperature Range		- 55°C - +125°C
Packing Quantity		42 pcs per tube
Thermal Shutdown	Internal IC Junction	+165°C
Output Current Limit	all Series	2300mA min. / 3500mA typ.
(when $V_{in} = 12V$)		
Certifications		
EN General Safety	Report: SPCLVD 1301026-1	EN60950-1:2006 + A12:2011



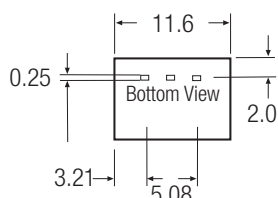
EN-60950-1 Certified

R-78E

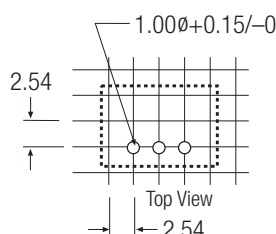
Package Style and Pinning (mm)



3rd angle projection



Recommended Footprint Details

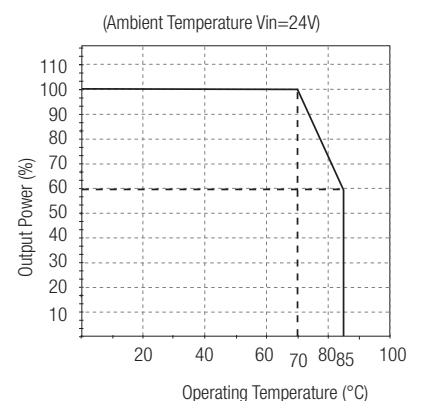


Pin Connections

Pin #	
1	+Vin
2	GND
3	+Vout

xx.x ± 0.5mm
xx.xx ± 0.25mm

Derating-Graph (Ambient Temperature)



Features

- Auto-sense
- Non-Isolated
- Synchronous rectification design
- Adjustable Output voltage
- 2, 3, 4 & 5AMP Adjustable Positive Step Down Integrated Switching Regulator
- Over load protection (125% full load typical)
- Remote ON/OFF Control(Ground Off)
- Wide Input Range
- UL94V-0 Package Material
- Continuous short circuit protection (Short Circuit Input Current, $I_{in\ sc} < 50mA$)
- Input voltage range 4.5V~18V
- Efficiency to 96 %

Description

The R-5XXX series is a high performance 1.2V to 5.0V , 2Amp to 5Amp, 12-Pin SIP (single in-line package) integrated switching regulator (ISR). Synchronous - rectified design yields excellent efficiencies up to 96%. Short circuit protection with crowbar function to reduce the short circuit input current to under 50mA. Autosense function compensates for any losses in long circuit loops.

Selection Guide

Part Number SIP12	Input Range (V)	Nominal Output Voltage (V)	Vout Adjust Range (V)	Output Current (A)	min.Vin (%)	12V (%)	max.Vin (%)
R-521.2xA	4.5 – 18	1.2	1.0 – 3.0	2	83	79	75
R-521.8xA	4.5 – 18	1.8	1.1 – 4.5	2	88	85	82
R-522.5xA	4.5 – 18	2.5	1.6 – 5.5	2	91	88	86
R-523.3xA	4.5 – 18	3.3	1.6 – 5.5	2	92	90	89
R-525.0xA	6.5 – 18	5.0	3.0 – 5.5	2	95	93	92
R-531.2xA	4.5 – 18	1.2	1.0 – 3.0	3	85	84	82
R-531.8xA	4.5 – 18	1.8	1.1 – 4.5	3	89	88	86
R-532.5xA	4.5 – 18	2.5	1.6 – 5.5	3	92	91	89
R-533.3xA	4.5 – 18	3.3	1.6 – 5.5	3	94	93	92
R-535.0xA	6.5 – 18	5.0	3.0 – 5.5	3	96	95	94
R-541.2xA	4.5 – 18	1.2	1.0 – 3.0	4	82	81	79
R-541.8xA	4.5 – 18	1.8	1.1 – 4.5	4	87	86	85
R-542.5xA	4.5 – 18	2.5	1.6 – 5.5	4	91	89	88
R-543.3xA	4.5 – 18	3.3	1.6 – 5.5	4	93	92	91
R-545.0xA	6.5 – 18	5.0	3.0 – 5.5	4	95	94	93
R-551.2xA	4.5 – 18	1.2	1.0 – 3.0	5	81	80	78
R-551.8xA	4.5 – 18	1.8	1.1 – 4.5	5	86	85	84
R-552.5xA	4.5 – 18	2.5	1.6 – 5.5	5	90	89	88
R-553.3xA	4.5 – 18	3.3	1.6 – 5.5	5	92	91	90
R-555.0xA	7.0 – 18	5.0	3.0 – 5.5	5	94	93	92

Note: $V_{in} - V_{out} \geq 1.5V$ if adjust function is used!

Suffix x: (see mechanical drawing for details)

x = P pins vertical through hole

x = D pins bent for horizontal through hole mounting

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

2, 3, 4, 5 AMP
SIP12
Vertical &
Horizontal



EN-60950-1 Certified

R-5xxxA

Specifications (refer to the standard application circuit, Ta: 25°C)

Characteristics	Conditions	Min.	Typ.	Max.
Output Voltage Range	All Series	0.8		6.0V
Output Current	R-52xxPA/DA R-53xxPA/DA R-54xxPA/DA R-55xxPA/DA	0.2 0.3 0.4 0.5		2.0A 3.0A 4.0A 5.0A
Output Current Limit	R-52xxPA/DA R-53xxPA/DA R-54xxPA/DA R-55xxPA/DA		2.5 3.75 5.0 6.0	3.0A 4.25A 5.5A 6.5A
Short Circuit Input Current	All Series			50mA
Short Circuit Protection			Continuous, automatic recovery	
Output Voltage Accuracy	At 100% Load All Series		±1%	±2%
Line Voltage Regulation (Vin = min. to max. at full load)	R-52xxPA/DA R-53xxPA/DA & R-54xxPA/DA & R-55xxPA/DA		0.25 0.5	0.5% 1.0%
Load Regulation (10 to 100% full load)	R-52xxPA/DA R-53xxPA/DA & R-54xxPA/DA & R-55xxPA/DA		0.5 1.0	1.0% 2.0%
Ripple & Noise	R-52xxPA/DA R-53xxPA/DA & R-54xxPA/DA & R-55xxPA/DA		40mVp-p 80mVp-p	70mVp-p 120mVp-p
Transient Response (see note 1)	50% Load Change Vout Over / Undershoot		100µs	200µs 100mV
Remote ON / OFF (see note 2) (positive logic)	Open or High (Power ON) Low (Power OFF)	4.5		18V 0.8V
Remote Off Input Current	Remote ON/OFF low level			100µA
Max capacitance Load	with normal start-up time, no external diodes with <1 second start up time + diode protection circuit			300µF 6800µF
Switching Frequency		270	300	330kHz
Quiescent Current	Vin = min. to max. at 0% load			20mA
Operating Temperature Range		-40°C		+85°C
Storage Temperature Range		-40°C		+125°C
Case Material				Non-Conductive Black Plastic
Potting Material				Epoxy (UL94V-0)
Internal Power Dissipation	Io x Vo x (1-Efficiency)			1.4W
Package Weight				9g
Packing Quantity				15 pcs per Tube
MTBF (Nominal Vout, 100% load)	Tamb. = +25°C Tamb. = +85°C	Detailed Information see Application Notes chapter "MTBF"		749 x 10 ³ hours 150 x 10 ³ hours
EN General Safety	Report: SPCLVD1301028-1			EN60950-1:2006 + A12:2011

Notes:

- Requires an electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor to be placed as close as possible to the output pins)
100µF for R-52xxPA/DA, R-53xxPA/DA and R-54xxPA/DA or 220µF for R-55xxPA/DA.
- ON / OFF pin driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET.
- Output Current vs. Input Voltage (see graph below).

Output Current vs Input Voltage

How to calculate the max output current

The internal power dissipation(P_D)follows the equation:

$$P_D = I_o \times V_o \times (1-\eta)$$

$$I_o = P_D / V_o \times (1-\eta)$$

Where P_D = Internal power dissipation
 I_o = Output current
 V_o = Output voltage
 η = Efficiency

Example: R-545.0P , at Vin = 18Vdc , Vo = 5Vdc , η =93% (see "Selection Guide" table)

(a) When Ta = 60°C , P_D = 1.4 Watt (see adjacent diagram)

$$I_o = 1.4(W) / 5(V) \times (1-0.93) = 4(A)$$

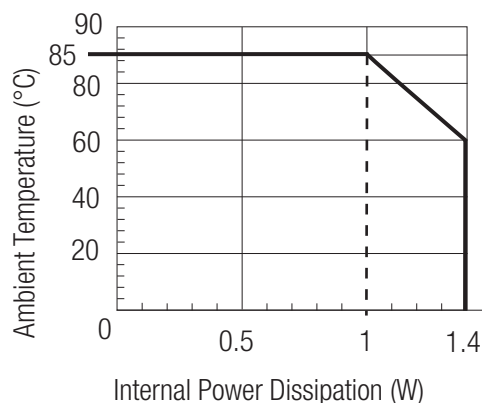
(b) When Ta = 85°C , P_D = 1 Watt (see adjacent diagram)

$$I_o = 1(W) / 5(V) \times (1-0.93) = 2.857(A)$$

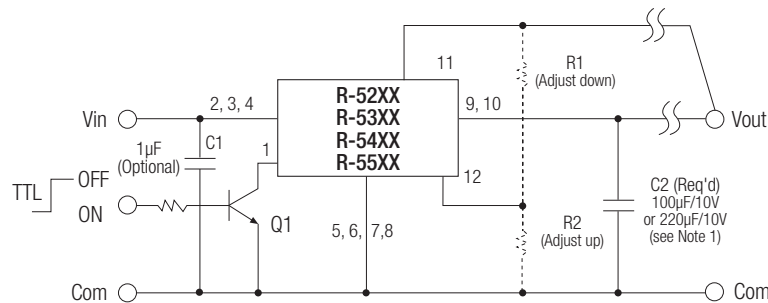
(c) At Vin = 12Vdc efficiency = 94% (see "Selection Guide" table)

When Ta = 85°C , P_D = 1 Watt (see adjacent diagram)

$$I_o = 1(W) / 5(V) \times (1-0.94) = 3.33(A)$$



Standard Application Circuit



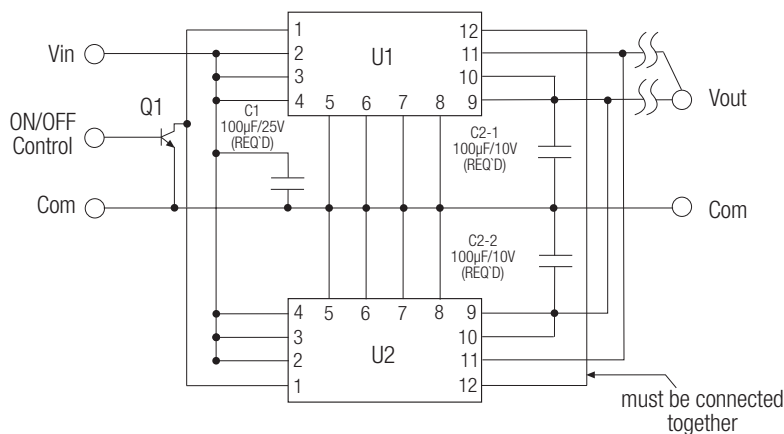
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter..

Parallel Application Circuit

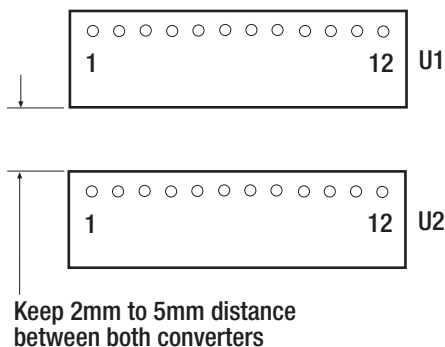
The R-52xx, R-53xx, R-54xx series can be used in parallel to upgrade the output current capacity for the same output voltage.

For example, the R-543.3PA can parallel up with another R-554.3PA to give up to 8 amps or with the R-533.3PA or R-523.3PA types to give output currents of up to 7 Amps or 6 Amps.

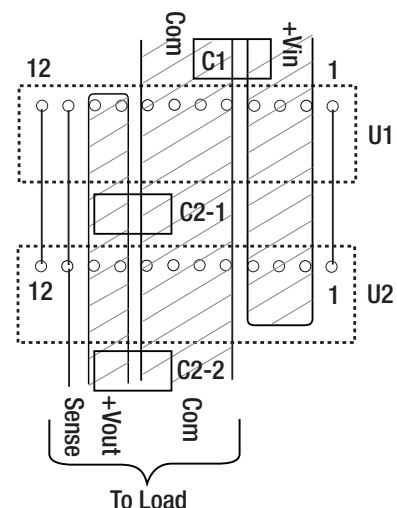
The R-55xx series cannot be paralleled.



Component side

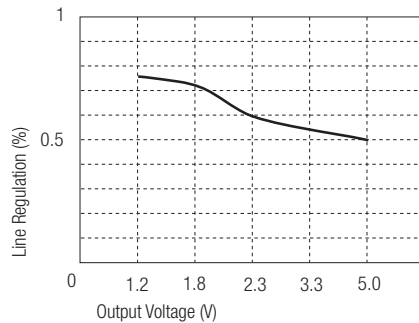


Solder side

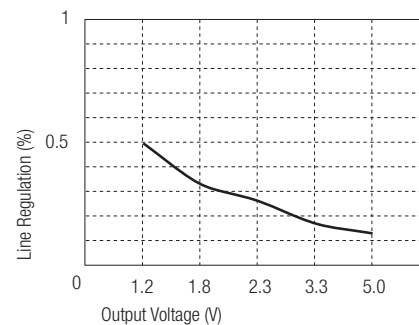


Characteristics

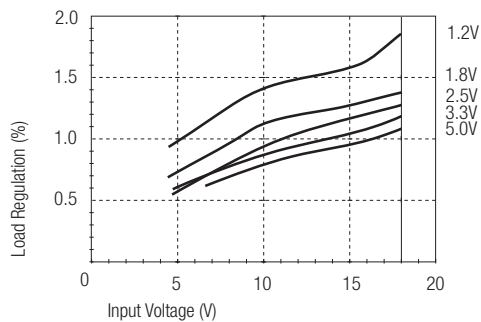
R-53xx / R-54xx
Output Voltage Line Regulation VS Vout



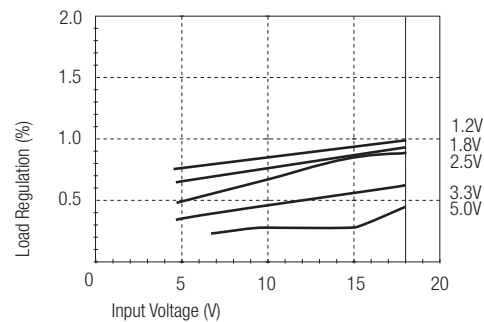
R-52xx / R-55xx
Output Voltage Line Regulation VS Vout



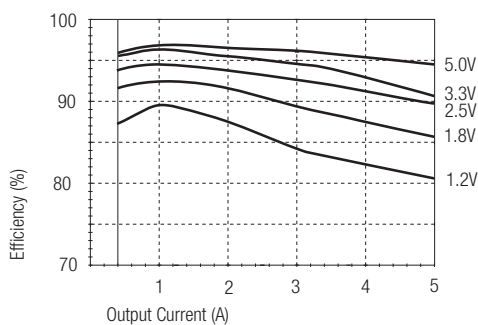
R-53xx / R-54xx
Input Voltage Load Regulation VS Vin



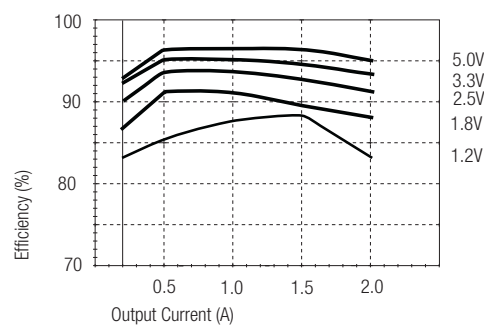
R-52xx / R-55xx
Input Voltage Load Regulation VS Vin



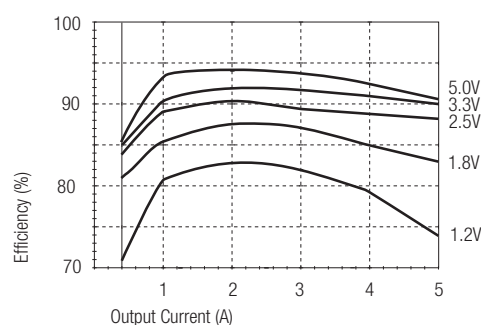
R-53xx / R-54xx / R-55xx
Output Current Efficiency vs I_{out} (Vin = Min)



R-52xx
Output Current Efficiency vs I_{out} (Vin = Min)



R-53xx / R-54xx / R-55xx
Output Current Efficiency vs I_{out} (Vin = 18V)



R-52xx
Output Current Efficiency VS I_{out} (Vin = 18V)

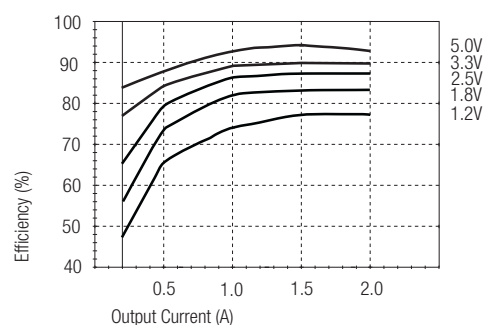


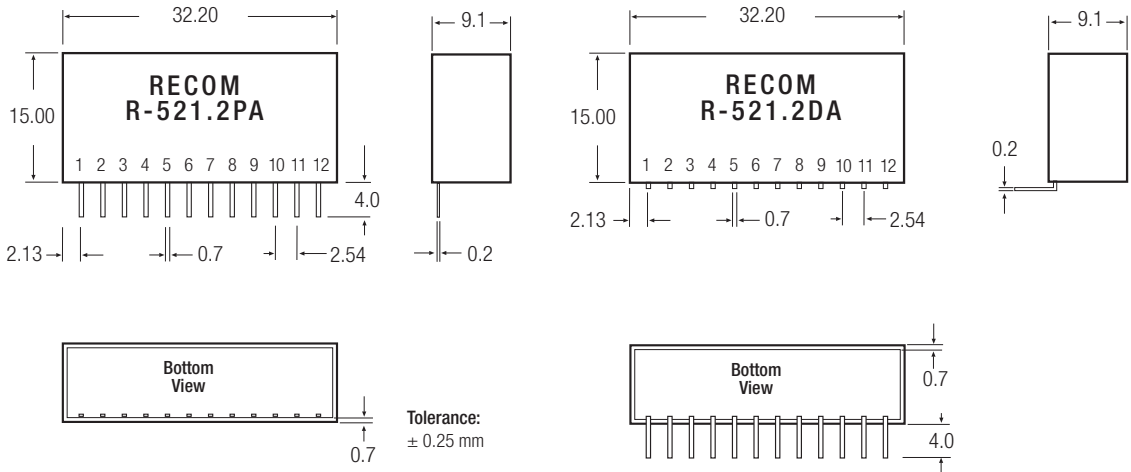
Table 1: Adjustment Resistor Values

2Adc	R-521.2PA/DA		R-521.8PA/DA		R-522.5PA/DA		R-523.3PA/DA		525.0PA/DA	
3Adc	R-531.2PA/DA		R-531.8PA/DA		R-532.5PA/DA		R-533.3PA/DA		535.0PA/DA	
4Adc	R-541.2PA/DA		R-541.8PA/DA		R-542.5PA/DA		R-543.3PA/DA		545.0PA/DA	
5Adc	R-551.2PA/DA		R-551.8PA/DA		R-552.5PA/DA		R-553.3PA/DA		555.0PA/DA	
Vout (nominal)	1.2Vdc		1.8Vdc		2.5Vdc		3.3Vdc		5.0Vdc	
Vout (adj)	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
0.8 (V)										
0.9 (V)	740Ω									
1.0 (V)	3.9KΩ									
1.1 (V)	13KΩ		1.05KΩ							
1.2 (V)			2.1KΩ		270Ω					
1.3 (V)		37KΩ	3.7KΩ		750Ω					
1.5 (V)		11.5KΩ	10KΩ		2.1KΩ		390Ω			
1.6 (V)		8.2KΩ	18KΩ		3.0KΩ		750Ω			
1.7 (V)		6.5KΩ	41KΩ		4.1KΩ		1.2KΩ			
1.8 (V)		5.2KΩ			5.6KΩ		1.7KΩ			
1.9 (V)		4.3KΩ		36KΩ	7.5KΩ		2.2KΩ			
2.0 (V)		3.6KΩ		1.8KΩ	10.5KΩ		2.8KΩ			
2.4 (V)		2.1KΩ		5.2KΩ	82KΩ		6.8KΩ			
2.5 (V)		1.8KΩ		4.3KΩ			8.5KΩ			
2.6 (V)		1.65KΩ		3.6KΩ		33KΩ	10.5KΩ			
3.0 (V)		1.05KΩ		2.1KΩ		6.2KΩ	33KΩ		470Ω	
3.2 (V)				1.65KΩ		4.1KΩ	110KΩ		1.6KΩ	
3.3 (V)				1.5KΩ		3.4KΩ			2.2KΩ	
3.4 (V)				1.35KΩ		2.9KΩ		36KΩ	3.0KΩ	
3.6 (V)				1.07KΩ		2.2KΩ		11KΩ	4.7KΩ	
3.9 (V)				780Ω		1.4KΩ		4.7KΩ	8.5KΩ	
4.5 (V)				390Ω		650Ω		1.6KΩ	30KΩ	
4.9 (V)						350Ω		820Ω	220KΩ	
5.0 (V)						290Ω		680Ω		
5.1 (V)						220Ω		560Ω		28KΩ
5.5 (V)						39Ω		190Ω		2.6KΩ

Package Style and Pinning (mm)

SIP12 PIN Package

3rd angle projection



Pin Connections

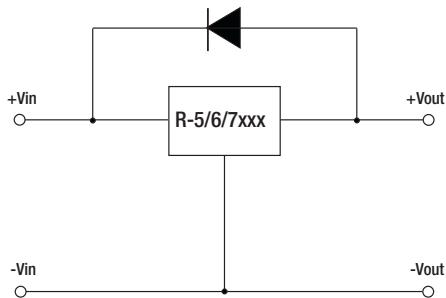
Pin #	Name	Description
1	ON / OFF	Input pin : Active low (less than 0.8V) to disable the device
2, 3, 4	Vin	Power input
5, 6, 7, 8	GND	Input and output ground (common)
9, 10	Vout	Power output
11	Vout (Auto Sense)	If unused this pin must be connected to Pin 9 and 10
12	Vout-Adj	With external resistors R1,R2 to selected output voltage

Optional Diode Protection Circuit

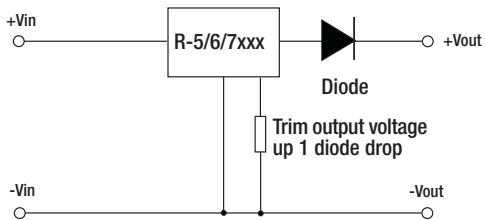
Optional Protection 1:

Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down. Protection diodes are required for high capacitive loads.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



Optional Protection 2:



Features

- Adjustable Output Voltage
- Non-Isolated
- 1-2AMP Adjustable Positive Step Down Integrated Switching Regulator
- Internal Short Circuit Protection
- ON/OFF Control(Ground Off)
- UL94V-0 Package Material
- Wide Input Range
- Efficiency to 96 %
- See Innoline Application Notes for use as an inverter

Description

The R-6XXX series is a high performance 1.5V to 15V (18V), 1.1Amp to 2.0Amp, 12-Pin SIP (single in-line package) switching regulator. Synchronous rectification yields excellent efficiencies of up to 97%. The devices feature short circuit protection with internal crowbar function to reduce the short circuit input current to under 50mA during fault conditions.

Selection Guide

Part Number SIP12	Input Range (V)	Nominal Output Voltage (V)	Vout Adjust Range (V)	Output Current (A)	Efficiency (%) Vin min. (%)	Vin max. (%)
R-611.8x	9 – 32	1.8	1.5 – 3.6	1	79	67
R-612.5x	9 – 32	2.5	1.5 – 4.5	1	84	74
R-613.3x	9 – 32	3.3	1.8 – 6	1	88	79
R-615.0x	9 – 32	5	1.8 – 9	1	92	84
R-619.0x	11 – 32	9	3.3 – 15	1	96	90
R-6112x	14 – 32	12	3.3 – 15	1	97	92
R-6118x	20 – 32	18	fixed	1	97	92
R-621.8x	9 – 32	1.8	1.5 – 3.6	2	76	68
R-622.5x	9 – 32	2.5	1.5 – 4.5	2	81	74
R-623.3x	9 – 32	3.3	1.8 – 6	2	86	80
R-625.0x	9 – 32	5	1.8 – 9	2	90	85
R-629.0x	11 – 32	9	3.3 – 15	2	95	91
R-6212x	14 – 32	12	3.3 – 15	2	96	93

Note: $V_{in} - V_{out} \geq 1.5V$ if adjust function is used!

Suffix x: (see mechanical drawing for details)

x = P pins vertical through hole

x = D pins bent for horizontal through hole mounting

Specifications (refer to the standard application circuit, Ta: 25°C)

Characteristics	Conditions	Min.	Typ.	Max.
Input Voltage Range	Vout = 1.8V	9V		32V
	Vout = 2.5V	9V		32V
	Vout = 3.3V	9V		32V
	Vout = 5V	9V		32V
	Vout = 9V	11V		32V
	Vout = 12V	14V		32V
	Vout = 18V	20V		32V
Output Voltage Adjust Range (see table 1)	Vout = 1.8V	1.5V	1.8V	3.6V
	Vout = 2.5V	1.5V	2.5V	4.5V
	Vout = 3.3V	1.8V	3.3V	6V
	Vout = 5V	1.8V	5V	9V
	Vout = 9V	3.3V	9V	15V
	Vout = 12V	3.3V	12V	15V
	Vout = 18V		18V	

Continued on next page

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

**1-2 AMP
SIP12
Vertical &
Horizontal**



EN-60950-1 Certified

R-6xxx

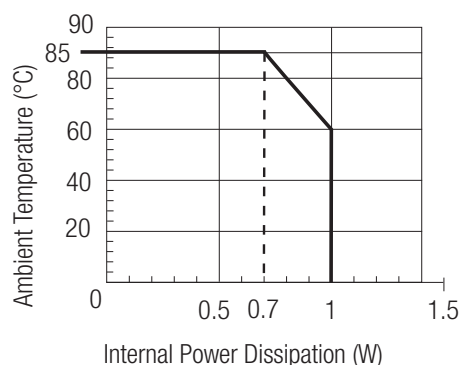
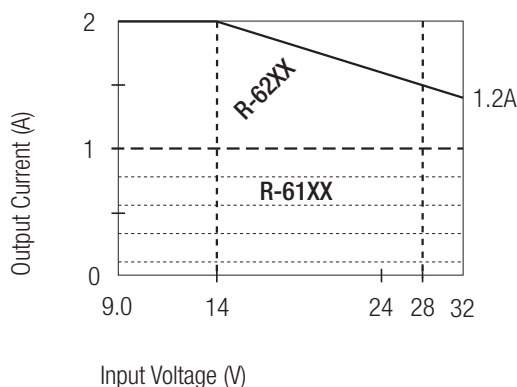
Specifications (refer to the standard application circuit, Ta: 25°C)

Characteristics	Conditions	Min.	Typ.	Max.
Output Current	R-61xxP/D R-62xxP/D	0.1A 0.2A		1.1A 2.0A
Output Current Limit		4A	4.5A	5A
Short Circuit Input Current	Vin > 12V	20mA		100mA
Short Circuit Protection		Continuous, automatic recovery		
Output Voltage Accuracy	At 100% Load		±1%	±2%
Line Voltage Regulation (Vin = min. to max. at full load)			0.5%	
Load Regulation (10 to 100% full load)	R-61xxP/D R-62xxP/D			0.5% 1.0%
Vo Ripple & Noise	R-61xxP/D R-62xxP/D		40mVpp 40mVpp	100mVpp 120mVpp
Transient Response (see note 1)	50% Load Change Vout Over / Undershoot		100us 5%	200us
Remote ON / OFF (see note 2) (positive logic)	Open or high (Power ON) Low (Power OFF)	2.0V		10V 0.8V
Remote Off Input Current	Remote ON/OFF low level		100μA	
Max capacitance Load	with normal start-up time, no external diodes with <1 second start up time + diode protection circuit			200μF 6800μF
Switching Frequency		200kHz	250kHz	300kHz
Quiescent Current	Vin = min. to max. at 0% load		6mA	10mA
Operating Temperature Range		-40°C		+85°C
Storage Temperature Range		-40°C		+125°C
Case Material		Non-Conductive Black Plastic		
Potting Material		Epoxy (UL94V-0)		
internal Power Dissipation	Io x Vo x (1-Efficiency)			1.0W
Package Weight				9g
Packing Quantity				15 pcs per Tube
MTBF (Nominal Vout, 100% load)	Tamb. = +25°C Tamb. = +71°C	Detailed Information see Application Notes chapter "MTBF"		563 x 10 ³ hours 117 x 10 ³ hours
EN General Safety	Report: SPCLVD 1301028-1			EN60950-1:2006 + A12:2011

Notes:

- Requires a 100μF electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor to be placed as close as possible to the output pins).
- ON / OFF pin can be driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET.
- Output Current vs. Input Voltage (see graph below).

Output Current vs Input Voltage



Max output current calculation:

Internal power dissipation
 $(1W) = I_o \times V_o \times (1 - \text{Efficiency})$
 $I_o = 1(W) / V_o \times (1 - \text{Efficiency})$

Example : R-6212P

at Vin = 28VDC

Efficiency = 94% (see "Selection Guide" table)

$V_o = 12VDC$

$I_o = 1W / 12V \times (1 - 0.94) = 1.388A \approx 1.5A$

at Vin = 14VDC

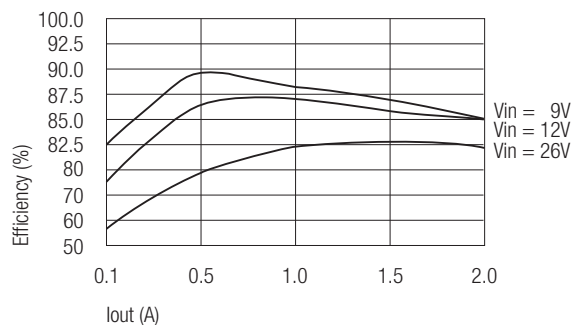
Efficiency = 96% (see "Selection Guide" table)

$V_o = 12Vdc$

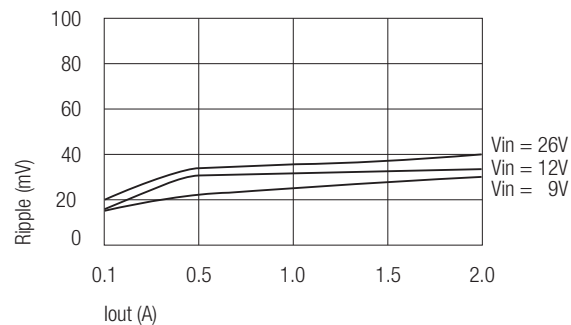
$I_o = 1W / 12V \times (1 - 0.96) = 2.08A$ (spec. = 2A max.)

Characteristics

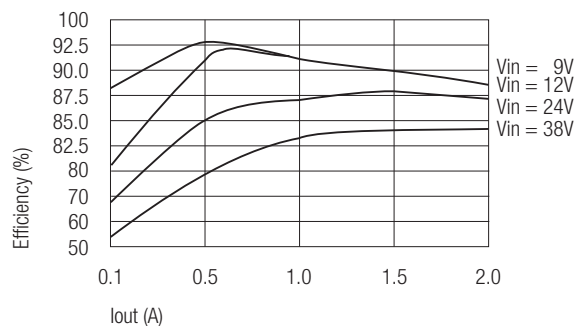
R-623.3 / R-613.3
Efficiency vs Output Current



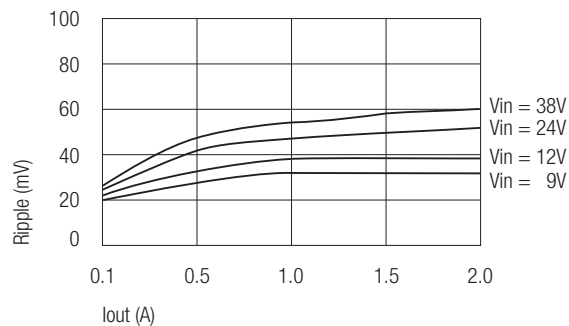
R-623.3 / R-613.3
Ripple vs Output Current



R-625.0 / R-615.0
Efficiency vs Output Current



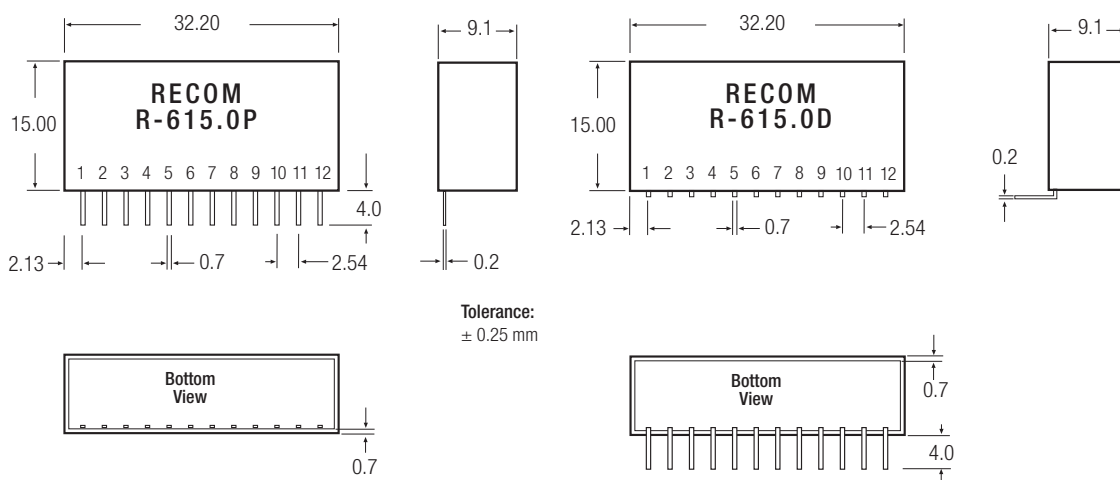
R-625.0 / R-615.0
Ripple vs Output Current



Package Style and Pinning (mm)

SIP12 PIN Package

3rd angle projection



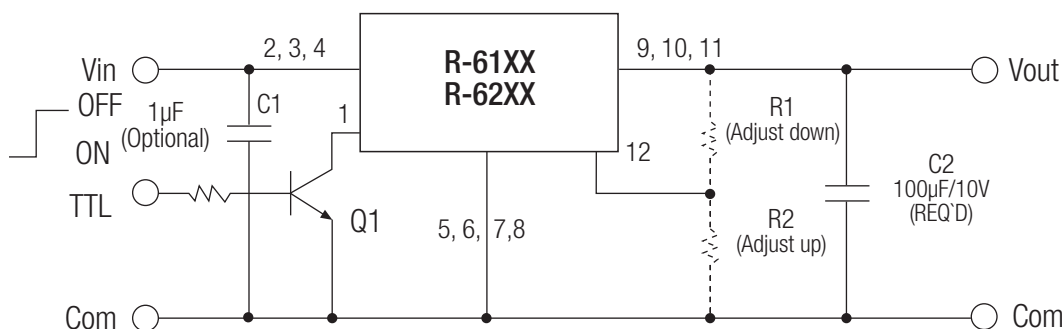
Pin Connections

Pin #	Name	Description
1	ON / OFF	Input pin : Active low (less than 0.8V) to disable the device
2, 3, 4	Vin	Power input
5, 6, 7, 8	GND	Input and output ground (common)
9, 10, 11	Vout	Power output
12	Vout-Adj	With external resistors R1,R2 to selected output voltage

Table 1: Adjustment Resistor Values

1.1Adc	R-611.8P/D		R-621.5P/D		R-613.3P/D		R-615.0P/D		R-619.0P/D		R-6112P/D	
2.0Adc	R-621.8P/D		R-622.5P/D		R-623.3P/D		R-625.0P/D		R-629.0P/D		R-6212P/D	
Vout (nominal)	1.8Vdc		2.5Vdc		3.3Vdc		5Vdc		9Vdc		12Vdc	
Vout (adj)	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
1.5	13.6K Ω		3.3K Ω									
1.8			8.2K Ω		3.1K Ω		820 Ω					
2.0		10K Ω	15K Ω		5.1K Ω		1.5K Ω					
2.5		5.1K Ω			13K Ω		3.6K Ω					
3.0		2.5K Ω		10K Ω	51K Ω		7.0K Ω					
3.3		1.7K Ω		5.9K Ω			9.7K Ω		0 Ω		0 Ω	
3.6		1.2K Ω		3.9K Ω		18K Ω	14K Ω		1.5K Ω		560 Ω	
3.9				2.8K Ω		9.1K Ω	20K Ω		3.3K Ω		1.2K Ω	
4.5				1.6K Ω		3.9K Ω	60K Ω		7.5K Ω		2.1K Ω	
5.0						2.4K Ω			11K Ω		4.0K Ω	
5.1						2.2K Ω		60K Ω	12K Ω		4.3K Ω	
5.5						1.6K Ω		15K Ω	17K Ω		5.6K Ω	
6.0						1.1K Ω		7.2 Ω	24K Ω		7.5K Ω	
7.0								2.8K Ω	51K Ω		12K Ω	
8.0								1.5K Ω	130K Ω		19K Ω	
9.0								880 Ω			31K Ω	
10								450 Ω		36K Ω	55K Ω	
11								180 Ω		15K Ω	125K Ω	
12										8.2K Ω		
13										4.7K Ω		11K Ω
14										2.7K Ω		4.0K Ω
15										1.3K Ω		1.6K Ω

Standard Application Circuit



Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter.

Protection diodes are required for high capacitive loads.

Refer to R-5xxxA Datasheet (see Optional Diode Protection Circuit) for circuit suggestions.

Features

- Non-Isolated
- Synchronous rectification design
- Adjustable Output voltage
- 2, 3, 4AMP Adjustable Positive Step Down Integrated Switching Regulator
- Over load protection (125% full load typical)
- Remote ON/OFF Control(Ground Off)
- Wide Input Range
- UL94V-0 Package Material
- Continuous short circuit protection (Very low short current $I_{sc} < 50mA$)
- Input voltage range 4.5V~28V
- Efficiency to 97 %

Description

The R-7XXX series is a high performance 2.5V to 15V , 2Amp to 4Amp, 12-Pin SIP (single in-line package), Integrated switching regulator (ISR). The Synchronous - rectified design yields excellent efficiencies up to 97%. Short circuit protection with crowbar function reduces the short circuit current to under 50mA of input current.

Selection Guide

Part Number SIP12	Input Range (V)	Nominal Output Voltage (V)	Vout Adjust Range (V)	Output Current (A)	Efficiency (%)		
					Min. Vin	12V	Max. Vin
R-723.3x	4.5 – 28	3.3	2.5 – 5.5	2	95	93	89
R-725.0x	6.5 – 28	5.0	3.0 – 5.5	2	96	95	91
R-726.5x	8.5 – 28	6.5	5.0 – 8.0	2	97	96	93
R-729.0x	12 – 28	9.0	7.0 – 11	2	96	-	93
R-7212x	15 – 28	12	10 – 14	2	97	-	95
R-7215x	19 – 28	15	13 – 17	2	97	-	96
R-733.3x	4.5 – 28	3.3	2.5 – 5.5	3	94	93	89
R-735.0x	6.5 – 28	5.0	3.0 – 5.5	3	95	95	92
R-736.5x	8.5 – 28	6.5	5.0 – 8.0	3	97	96	93
R-739.0x	12 – 28	9.0	7.0 – 11	3	96	-	94
R-7312x	15 – 28	12	10 – 14	3	97	-	96
R-7315x	19 – 28	15	13 – 17	3	97	-	96
R-743.3x	4.5 – 28	3.3	2.5 – 5.5	4	93	92	88
R-745.0x	6.5 – 28	5.0	3.0 – 5.5	4	95	94	91
R-746.5x	8.5 – 28	6.5	5.0 – 7.5	4	96	96	93

Note: $V_{in} - V_{out} \geq 1.5V - 4.0V$ depending on V_{out} if adjust function is used!

Suffix x: (see mechanical drawing for details)

x = P pins vertical through hole

x = D pins bent for horizontal through hole mounting

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

**2, 3, 4 AMP
SIP12
Vertical &
Horizontal**



EN-60950-1 Certified

R-7xxx

Specifications (refer to the standard application circuit, Ta: 25°C)

Characteristics	Conditions	Min.	Typ.	Max.
Output Voltage Range	All Series	2.5		17V
Output Current	R-72xxP/D R-73xxP/D R-74xxP/D	0.2 0.3 0.4		2.0A 3.0A 4.0A
Output Current Limit	R-72xxP/D R-73xxP/D R-74xxP/D		2.5 3.75 5.0	3.0A 4.25A 5.5A
Short Circuit Input Current	All Series		50	100mA
Short Circuit Protection	Continuous, automatic recovery			
Output Voltage Accuracy (At 100% Load)	All Series		±1%	±2%
Line Voltage Regulation (Vin = min. to max. at full load)	All Series		0.5	1.0%
Load Regulation (10 to 100% full load)	All Series		0.5	1.0%
Ripple & Noise	All Series		40mVp-p	70mVp-p
Transient Response (see note 1)	50% Load Change – Vout Over / Undershoot		100µs	200µs 100mV
Remote ON / OFF (see note 2)	Open or High (Power ON) Low (Power OFF)	4.5		28V 0.8V
Max capacitance Load	with normal start-up time, no external diodes with <1 second start up time + diode protection circuit			200µF 6800µF
Switching Frequency		270	300	330kHz
Shutdown current	ON / OFF Pin pulled low			100µA
Quiescent Current	Vin = min. to max. at 0% load			30mA
Operating Temperature Range		-40°C		+85°C
Operating Case Temperature				+110°C
Storage Temperature Range		-40°C		+125°C
Case Material	Non-Conductive Black Plastic			
Potting Material	Epoxy (UL94V-0)			
Thermal Impedance	Natural Convection			25°C/W
Internal Power Dissipation	Ta < 60°C			1.4W
Package Weight				9g
Packing Quantity				15 pcs per Tube
MTBF (Nominal Vout, 100% load)	Tamb. = +25°C Tamb. = +85°C	} Detailed Information see Application Notes chapter "MTBF"		749 x 10³hours 150 x 10³hours
EN General Safety	Report: SPCLVD1301028-1			EN60950-1:2006 + A12:2011

Notes:

- Requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor to be placed as close as possible to the output pins).
- ON / OFF pin driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET.

Output Current vs Input Voltage

How to calculate the max output current

The internal power dissipation(P_D)follows the equation:

$$P_D = I_o \times V_o \times (1-\eta)$$

$$I_o = P_D / V_o \times (1-\eta)$$

Where P_D = Internal power dissipation
 I_o = Output current
 V_o = Output voltage
 η = Efficiency

Example: R-745.0P, at Vin = 28Vdc, Vo = 5Vdc, η=91% (see "Selection Guide" table)

(a) When Ta = 60°C, P_D = 1.4 Watt (see beside diagram)

$$I_o = 1.4(W) / 5(V) \times (1-0.91) = 3.11(A)$$

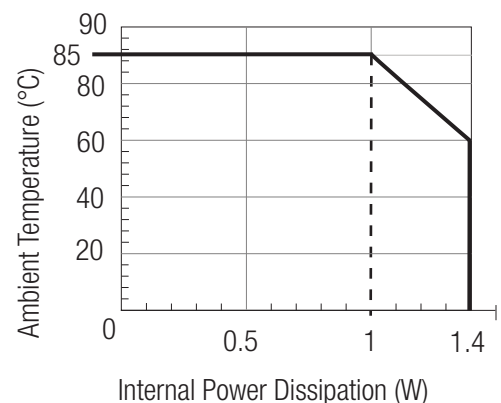
(b) When Ta = 85°C, P_D = 1 Watt (see beside diagram)

$$I_o = 1(W) / 5(V) \times (1-0.91) = 2.222(A)$$

(c) At Vin = 12Vdc efficiency = 94% (see "Selection Guide" table)

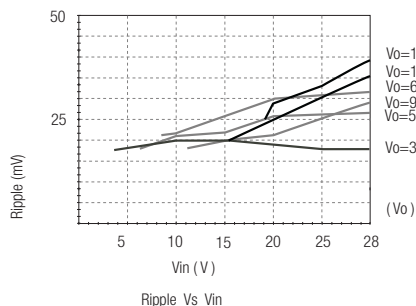
When Ta = 85°C, P_D = 1 Watt (see beside diagram)

$$I_o = 1(W) / 5(V) \times (1-0.94) = 3.33(A)$$

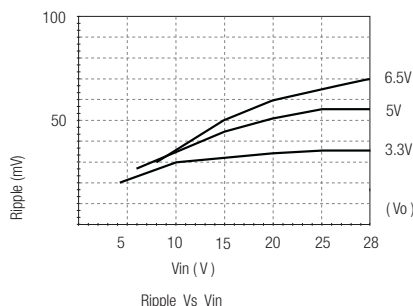


Characteristics

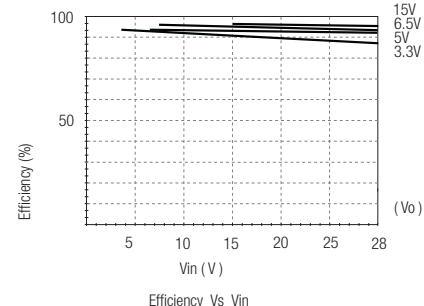
R-72xx / R-73xx
Ripple VS Vin



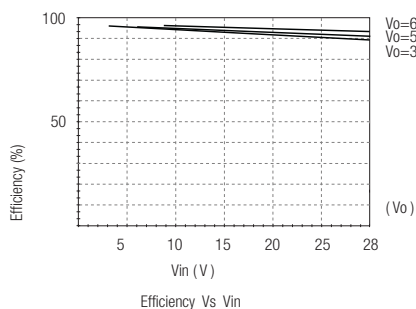
R-74xx
Ripple VS Vin



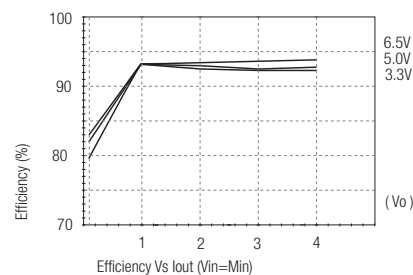
R-72xx / R-73xx
Efficiency VS Vin



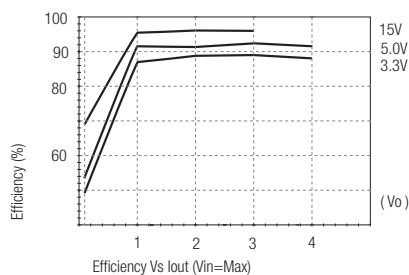
R-74xx
Efficiency VS Vin



R-72xx / R-73xx / R-74xx
Efficiency / Load Vin=Min

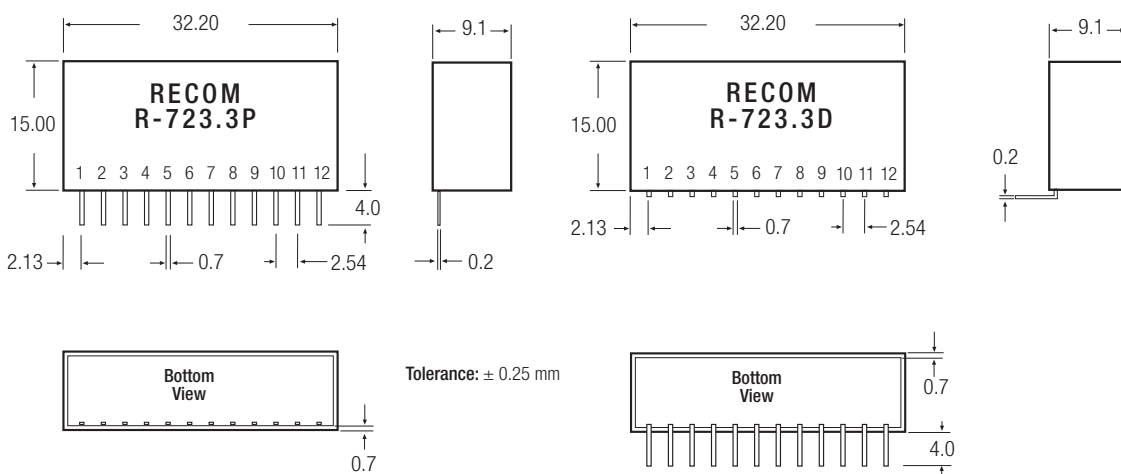


R-72xx / R-73xx / R-74xx
Efficiency / Load Vin=Max



Package Style and Pinning (mm)

SIP12 PIN Package



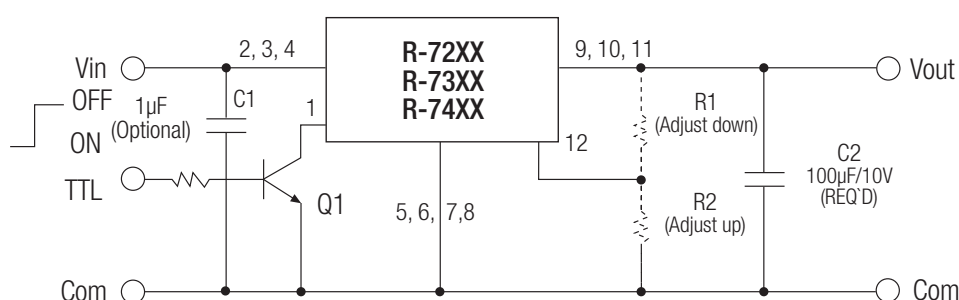
Pin Connections

Pin #	Name	Description
1	ON / OFF	Input pin : Active low (less than 0.8V) to disable the device
2, 3, 4	Vin	Power input
5, 6, 7, 8	GND	Input and output ground (common)
9, 10, 11	Vout	Power output
12	Vout-Adj	With external resistors R1,R2 to selected output voltage

Table 1: Adjustment Resistor Values

2ADC	R-723.3P/D		R-725.0P/D		R-726.5P/D		R-729.0P/D		R-7212P/D		R-7215P/D	
3ADC	R-733.3P/D		R-735.0P/D		R-736.5P/D		R-739.0P/D		R-7312P/D		R-7315P/D	
4ADC	R-743.3P/D		R-745.0P/D		R-746.5P/D							
Vout (nominal)	3.3Vdc		5.0Vdc		6.5Vdc		9.0Vdc		12Vdc		15Vdc	
Vout (adj)	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
2.5	8.5K Ω											
3.0	33K Ω		470 Ω									
3.2	110K Ω		1.6K Ω									
3.3			2.2K Ω									
3.4		36K Ω	3.0K Ω									
3.6		11K Ω	4.7K Ω									
3.9		4.7K Ω	8.5K Ω									
4.5		1.6K Ω	30K Ω									
4.9		820 Ω	220K Ω									
5.0		680 Ω			11K Ω							
5.1		560 Ω		28K Ω	12K Ω							
5.5		190 Ω		2.6K Ω	20K Ω							
6.0					47K Ω							
6.5												
7.0						560 Ω	13K Ω					
8.0						330 Ω	31K Ω					
9.0												
10								2.2K Ω	20K Ω			
11								390 Ω	47K Ω			
12												
13										2.4K Ω	36K Ω	
14										390 Ω	76K Ω	
15												
16												2.6K Ω
17												860 Ω
18												

Standard Application Circuit



Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter.

Protection diodes are required for high capacitive loads.

Refer to R-5xxxA Datasheet (see Optional Diode Protection Circuit) for circuit suggestions.

Features

Regulated Converters

- High Output Voltage DIP24 converter
- Improved Version of Rxx-100_150A Series with higher efficiency and reduced ripple.
- Input Voltage 5, 12, 15 or 24VDC
- Adjustable Output Voltage up to 210VDC
- Cascadeable for Output Voltages up to 420VDC
- 3kVDC Input/Output Isolation
- Remote Voltage Programming by External Voltage or Resistance
- Continuous Short Circuit Protection
- Ambient Temperature up to +85°C

Selection Guide

Part Number	Input Range (VDC)	Output Voltage Range (VDC)	Max Output Current (mA)	Efficiency at Full Load (%)
DIP 24				
R05-100B	5 (4.5 – 6)	+40...+120	25	77
R12-100B	12 (10 – 14)	+55...+135	50	82
R15-100B	15 (14 – 17)	+55...+135	50	82
R24-100B	24 (21 – 27)	+55...+135	50	84
R12-150B	12 (10 – 14)	+95...+210	50	82
R15-150B	15 (14 – 17)	+95...+210	50	82
R24-150B	24 (21 – 27)	+95...+210	50	84

Specifications (typical at 25°C, nominal input voltage, full load unless otherwise specified)

Input Voltage Range	5, 12, 15 or 24VDC	
Rated Power	5V	25mA max. or 3 Watts max.
	All others	50mA max. or 5 Watts max.
Output Voltage Adjustment Range	55..135 or 95..210VDC	
Output Voltage Accuracy	±5% max	
Line Voltage Regulation	0.5% max	
Load Voltage Regulation	20% to 100% full load	0.5% max
Output Ripple and Noise	20MHz limited	60mVp-p typ.
Operating Frequency	200kHz typ.	
Efficiency at Full Load	80 ~ 86% typ.	
Isolation Voltage (tested for 1 second)	3000VDC min.	
Isolation Capacitance	20pF typ.	
Isolation Resistance	1 GΩ min.	
Short Circuit Protection	Continuous, Automatic Restart	
Short Circuit Input Current	30mA typ.	
Temperature Coefficient	±0.02%/°C	
Operating Temperature Range (free air convection)	With derating	-40°C to +85°C
	Full Power	-40°C to +70°C
Storage Temperature Range	-50°C to +125°C	
Case Material	Non-Conductive Black Plastic	
Potting Material	Epoxy (UL94V-0)	
MTBF (25°C)	Mil-Std 217F	1.4 x 10 ³ hours
Output Voltage Adjust	External Voltage	0 - 4VDC
	External Resistor	0 - 5kΩ
Internal Voltage Reference	Regulated 5V with 1kΩ series resistor	
EN General Safety	Report: SPCLVD 1207005	EN60950-1:2006 + A12:2011

INNOLINE
DC/DC-Converter
with 3 year Warranty

RECOM

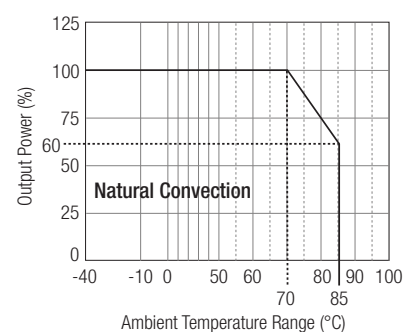
**5 Watt
Single
Output**

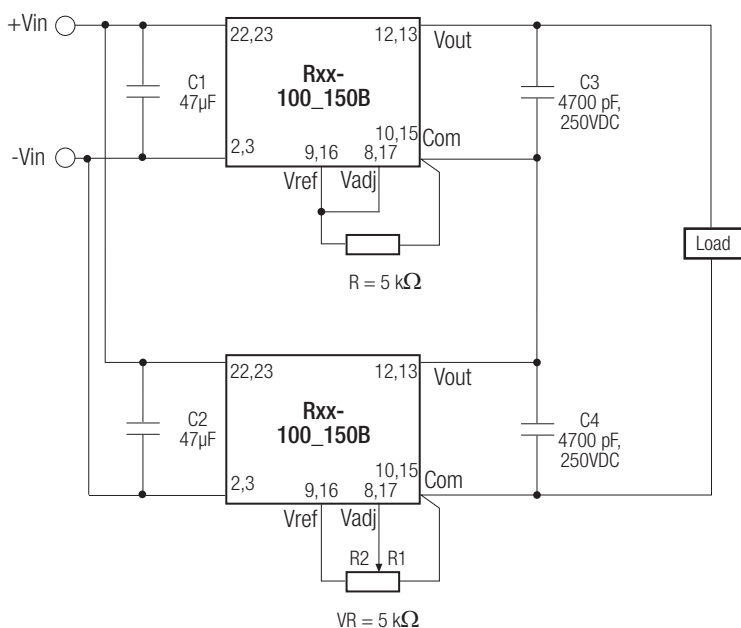
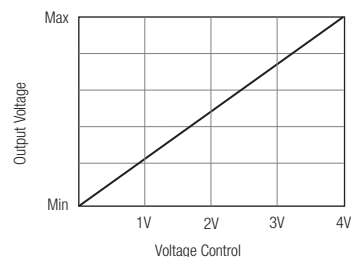
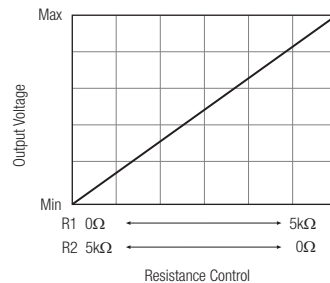


EN-60950-1 Certified

Rxx-B

Derating Graph (Ambient Temperature)





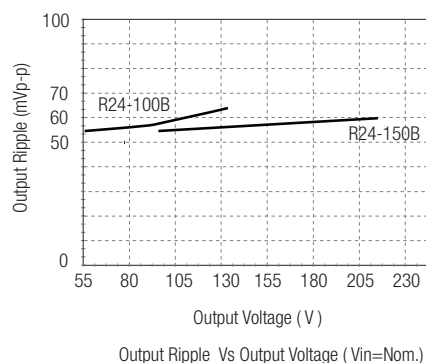
U1	U2	Vout Range
R05-100B	R05-100B	160-240
Rxx-100B	Rxx-100B	190~270
Rxx-150B	Rxx-100B	230~345
Rxx-150B	Rxx-150B	305~420

xx = 12, 15 or 24

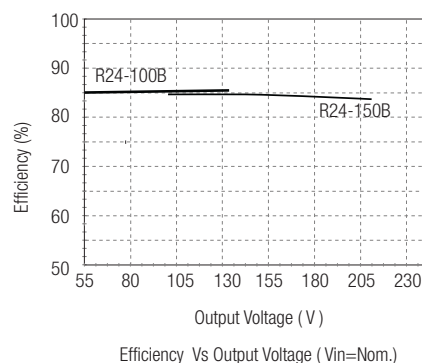
Note: When cascaded, only one Rxx-A may be adjustable, the other must be fixed voltage.

Typical Characteristics

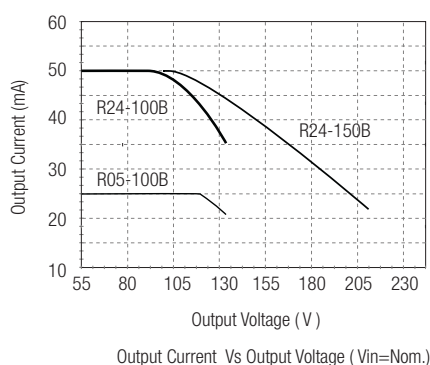
R24-100B _ R24-150B



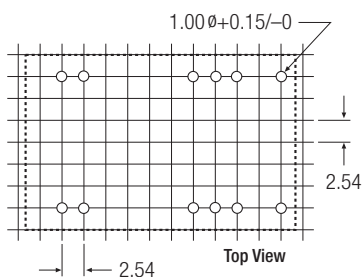
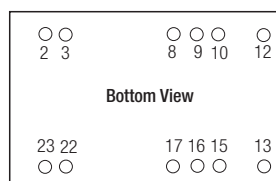
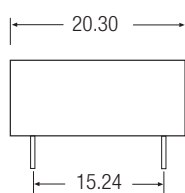
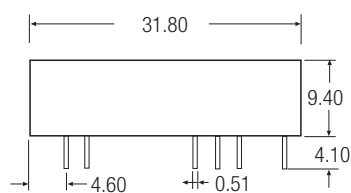
R24-100B _ R24-150B



Power Limit



Package Style and Pinning



Pin Connections

Pin #	Out
2,3	-Vin
8,17	Vadj
9,16	V ref
10,15	-Vout
12,13	+Vout
22,23	+Vin
XX.X	± 0.5 mm
XX.XX	± 0.25 mm

LIGHTLINE - DC/DC and AC/DC Constant Current LED Drivers

LIGHTLINE - CONTENTS

CONSTANT CURRENT LED DRIVERS



DC/DC Constant Current LED Drivers

Series	Current Limit	Input Voltage	Power/Type	Dimming	Mounting/Connections	Page
RCD-24-0.30 (Vref)	300mA	4.5 – 36VDC	10W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-0.35 (Vref)	350mA	4.5 – 36VDC	12W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-0.50 (Vref)	500mA	4.5 – 36VDC	17.5W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-0.60 (Vref)	600mA	4.5 – 36VDC	21W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-0.70 (Vref)	700mA	4.5 – 36VDC	25W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-1.00	1000mA	6 – 40VDC	33W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-1.20	1200mA	6 – 40VDC	40W Buck	Ana + PWM	DIP/Wired	L-3
RCD-24-0.30/PL	300mA	4.5 – 36VDC	10W Buck	Ana + PWM	Pinless SMD	L-9
RCD-24-0.35/PL	350mA	4.5 – 36VDC	12W Buck	Ana + PWM	Pinless SMD	L-9
RCD-24-0.50/PL	500mA	4.5 – 36VDC	17.5W Buck	Ana + PWM	Pinless SMD	L-9
RCD-24-0.60/PL	600mA	4.5 – 36VDC	21W Buck	Ana + PWM	Pinless SMD	L-9
RCD-24-0.70/PL	700mA	4.5 – 36VDC	25W Buck	Ana + PWM	Pinless SMD	L-9
RCD-48	350, 500, 700, 1200mA	9 – 60VDC	70W B	Ana + PWM	DIP/Wired	L-12
RBD-12	350 or 500mA	8 – 36VDC	1 – 20W Buck	Ana + PWM	DIP/Wired	L-16

AC/DC Constant Current LED Drivers

RACD03	350, 700mA	Universal AC	3W Isolated	None	Wired	L-19
RACD06	350, 700mA	Universal AC	6W Isolated	None	Screw Terminals	L-21
RACD07	350, 500, 700mA	Universal AC	7W Isolated	None	Wired	L-23
RACD12	350, 500, 700mA	Universal AC	12W Isolated	None	Screw Terminals, Socket	L-25
RACD20	350, 500, 700, 1050mA	Universal AC	20W Isolated	None	Screw Terminals, Socket	L-27
RACD20/277	350, 500, 700, 1050mA	Universal AC	20W Isolated	None	Wired	L-29
RACD20-350D	350+350 or 700mA	230VAC	20W Isolated	1-10VDC	Screw Terminals	L-31
RACD20-350D-US	350+350 or 700mA	115VAC	20W Isolated	1-10VDC	Screw Terminals	L-31
RACT20	350, 500, 700, 1050mA	Universal AC	20W Isolated	Triac Dimming F.	Wired	L-33
RACD25	500, 700, 1050, 1400mA	Universal AC	25W Isolated	None	Wired	L-35
RACV25	520	Universal AC	25W Isolated	None	Wired	L-37
RACD30	500, 700mA	Universal AC	30W Isolated	None	Screw Terminals, Socket	L-39
RACV30	1250, 2500mA	Universal AC	30W Isolated	None	Screw Terminals, Socket	L-41
RACD60-700/1050	700mA - 1050mA	Universal AC	60W Isolated	/TOF (1-10VDC)	Screw terminals	L-42
RACD60-1400/2100	1400mA - 2140mA					
RACD60-2400	2150mA - 2500mA					
RACD60-4200	3570mA - 4200mA					
RACD60-700/IP67	700mA	Universal AC	60W Isolated	None	Wired	L-42
RACD60-1050/IP67	1050mA					
RACD60-1400/IP67	1400mA					
RACD60-2100/IP67	2100mA					
RACD60-2400/IP67	2400mA					
RACD60-4200/IP67	4200mA					
RACD100	8300, 4200, 2800, 2100mA	Universal AC	100W Isolated	None	Wired	L-46
RACD150	6300, 4200, 3200	Universal AC	150W Isolated	None	Wired	L-48
Application Notes						L-50

Features

Regulated Converters

- UL Certified Constant Current LED Driver
- Wide Input and Output Voltage Range
- Digital PWM and Analogue Voltage Dimming
- Short Circuit and Overtemperature Protected
- Pinned or Wired Versions
- IP67 rated for /W Version
- 96% Efficiency
- 5 year Warranty

Description

The RCD series is a step-down constant current source designed for driving high power white LEDs. Standard output currents available are 300mA, 350mA, 500mA, 600mA, 700mA, 1000mA and 1200mA to make this driver compatible with a wide range of LEDs applications. Despite its compact size, the RCD series is fully featured with very high efficiency, wide input voltage range, high ambient operating temperature and two means of dimming: PWM/digital control and analogue voltage dimming. Both dimming controls are independent and can be combined. The driver is also designed to be as reliable as the LEDs it is driving, even at the full operating temperature. Options include an IP67-rated wired version (/W) and a version with built-in reference output voltage (/Vref) to power sensors or for easy analogue dimming.

Selection Guide

Part Number	Input Range (VDC)	Output Current (mA)	Output Voltage (Vmin-Vmax)	Dimming Control	Options	Mounting Style
RCD-24-0.30 ^{(a)(b)}	4.5-36V	0-300	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.35 ^{(a)(b)}	4.5-36V	0-350	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.50 ^{(a)(b)}	4.5-36V	0-500	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.60 ^{(a)(b)}	4.5-36V	0-600	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.70 ^{(a)(b)}	4.5-36V	0-700	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-1.00 ^(b)	6-36V	0-1000	3-31	Digital + Analogue		Pins or Wired
RCD-24-1.20 ^(b)	6-36V	0-1200	3-31	Digital + Analogue		Pins or Wired

^{(a)(b)} Standard is no suffix with PCB Pins.

^(a) Add suffix /Vref for pinned version with Vref output and analogue dimming

^(b) Add suffix /W for wired version without dimming control (four wires)

^(b) Add suffix /W/X1 for wired version with analogue dimming control (five wires)

^(b) Add suffix /W/X2 for wired version with PWM dimming control (five wires)

^(b) Add suffix /W/X3 for wired version with both analogue and PWM dimming controls (six wires)

^(a) Add suffix /W/Vref for wired version with Vref output and analogue dimming (six wires)

Specifications

(typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Input Voltage (absolute maximum)	40VDC max	
Recommended Input Voltage	300mA-700mA	5V min. / 24V typ. / 36VDC max
	1000mA-1200mA	6V min. / 24V typ. / 36VDC max
Input Filter	Capacitor	
Output Current Accuracy (Vin = 24DC)	300mA-700mA	±1% typ, ±3% max.
	1000mA-1200mA	±2% typ, ±5% max.
Internal Power Dissipation	Worst case load of 5 LEDs	800mW max
Output Current Stability	Vin=36V, Vout =1-9 LEDs	±1% max
Output Ripple and Noise (20MHz BW)	300mA-700mA	150mVp-p max
Vin=36V, Vout =1-9 LEDs	1000mA-1200mA	300mVp-p max
Temperature Coefficient	-40°C~+85°C ambient	±0.015%/°C max
Maximum Capacitive Load	100µF	
Operating Frequency	300mA-700mA	210kHz min/ 250kHz typ/ 280kHz max
	1000mA-1200mA	350kHz min/ 450kHz typ/ 550kHz max
Efficiency at Full Load	96% max.	
Short Circuit Protection	Regulated at rated output current	

continued on next page

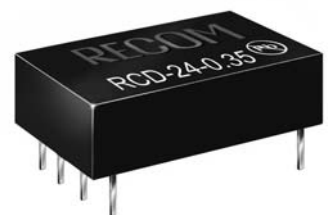
LIGHTLINE

DC/DC-Converter

with 5 year Warranty

RECOM

Constant Current LED Driver



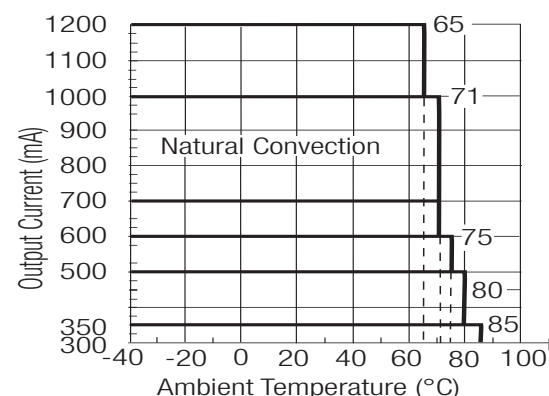
E358085

EN-60950-1 Certified
UL-60950-1 Certified

RCD-24

Derating Graph

(Ambient Temperature)



Refer to Application Notes

Specifications -Continued

Operating Temperature Range (free air convection)	300mA-350mA	-40°C to +85°C
	500mA	-40°C to +80°C
	600mA	-40°C to +75°C
	700mA-1000mA	-40°C to +71°C
	1200mA	-40°C to +65°C

Storage Temperature Range	-55°C to +125°C	

Overtemperature Shutdown (Auto-restart after cool down)	Internal IC Temperature	150°C typ.
	Temperature Hysteresis	20°C typ.

Maximum Case Temperature	100°C	

Thermal Impedance	Natural Convection	55°C/Watt

Case Material (Pinned or Wired Versions)	Non Conductive Black Plastic	

Potting Material (Pinned or Wired Versions)	Epoxy (UL94-V0)	

Dimensions	Pinned/Wired	22.1 x 12.6 x 8.5mm

Weight	Pinned/Wired	4.5g/6.8g

Soldering Profile	Pinned	265°C/10 sec. max

Packing Quantities (Refer to App Notes for Tube sizes)	Pinned Versions	39pcs per Tube
	Wired Versions	5pcs per Bag

PWM Dimming and ON/OFF Control (Leave open if not used - do not tie to +Vin)

Remote ON/OFF	DC/DC ON	300mA-700mA	Open or $0V < V_r < 0.6V$
Threshold Voltages	DC/DC OFF (Standby)	1000mA-1200mA	Open or $0V < V_r < 0.8V$
		300mA-700mA	$0.6 < V_r < 2.9V$

	DC/DC OFF (Shutdown)	1000mA-1200mA	$1.4 < V_r < 2.2V$
		300mA-700mA	$2.9V < V_r < 6V$
		1000mA-1200mA	$2.2V < V_r < 15V$

Remote Pin Drive Current	$V_r = 5V$	1mA max

Quiescent Input Current in Shutdown Mode	$V_{in} = 36V$	200µA max

Maximum PWM Frequency	For $\pm 1\%$ Linear Operation	200Hz max.
	Frequency Limit	2000Hz max.

Analogue Dimming Control (leave open if not used - do not tie to +Vin)

Input Voltage Limits	Standard	-0.3V - 15V
	Vref Version	-0.3V - 5V

Control Voltage Range (see Graphs)	Full On	$0.13V \pm 50mV$
	300-1000mA: Full Off	$4.5V \pm 50mV$
	1100-1200mA: Full Off	$4.2V \pm 50mV$
	Vref Version: Full Off	$3.3V \pm 50mV$

Analogue Pin Drive Current	$V_c = 5V$	0.2mA max.

Vref Version	Vref Voltage	$3.3V \pm 70mV$
	Vref Output Current	5mA
	Vref Output Short Circuit Current	18mA typ.

Environmental

Relative Humidity	5% to 95% RH, non-condensing	

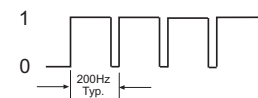
/W Versions	IP67	

Conducted Emissions	(with filter, see note)	EN55022	Class B
Radiated Emissions	(all series except >700mA)	EN55022	Class B
ESD	(all series)	EN61000-4-2	Class A
Radiated Immunity	(all series)	EN61000-4-3	Class A
Fast Transient	(all series)	EN61000-4-4	Class A
Conducted Immunity	(all series)	EN61000-4-6	Class A
MTBF (RCD-24-0.70, Nominal Vin, Full Load)	+25°C	605 x 10 ³ hours	
	+71°C	516 x 10 ³ hours	

Note: Requires an input filter to meet EN55022 Class B conducted emissions - see next page

Digital Dimming

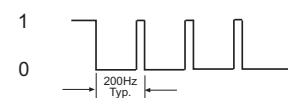
PWM Digital Control Signal



Output Current (LED appears dim)



PWM Digital Control Signal

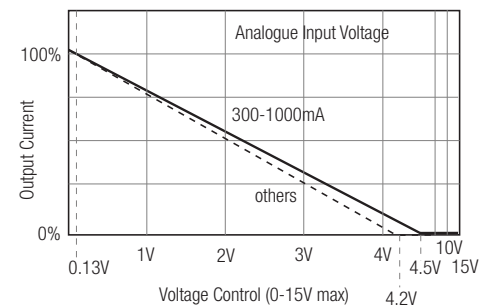


Output Current (LED appears bright)

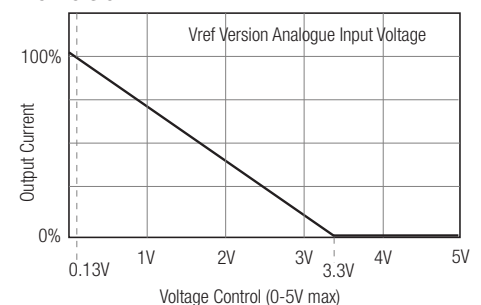


Analogue Dimming

Standard Version:



Vref Version:

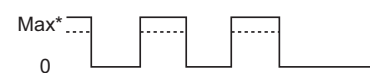


Combined PWM and Analogue Dimming

PWM Digital Control Signal

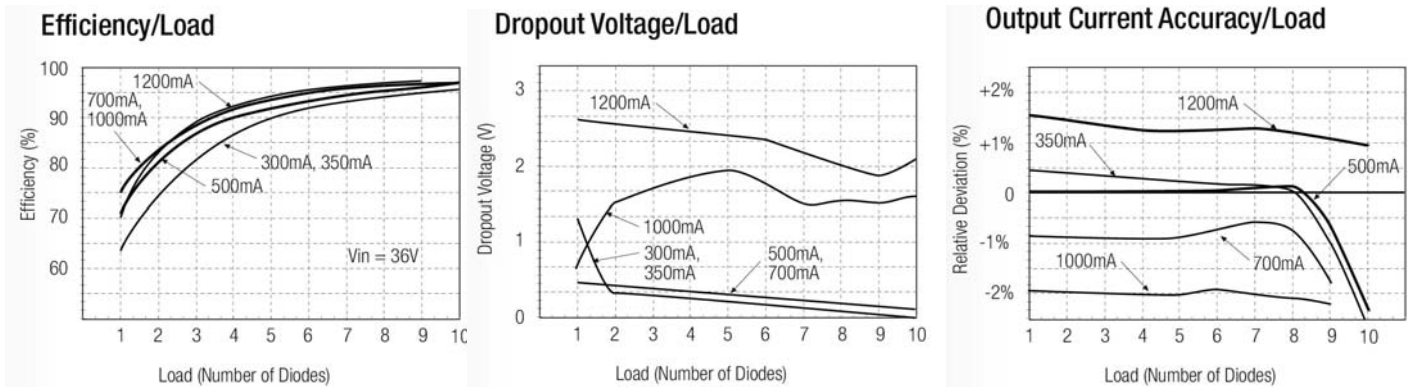


Output Current

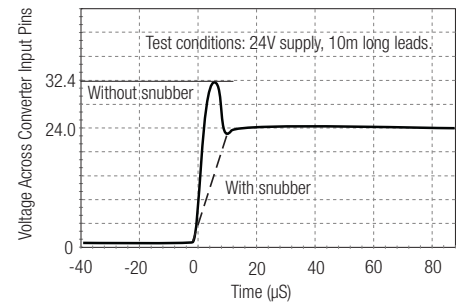
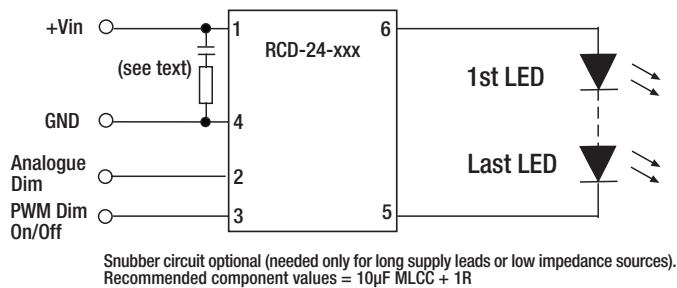


* Max output current can also be set using Analogue input

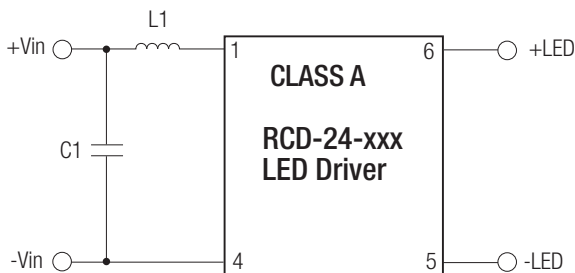
Typical Characteristics



Standard Application Circuit (no external components required for normal use)



EMI Filter Suggestions



RCD-24-0.30 - RCD-24-0.70

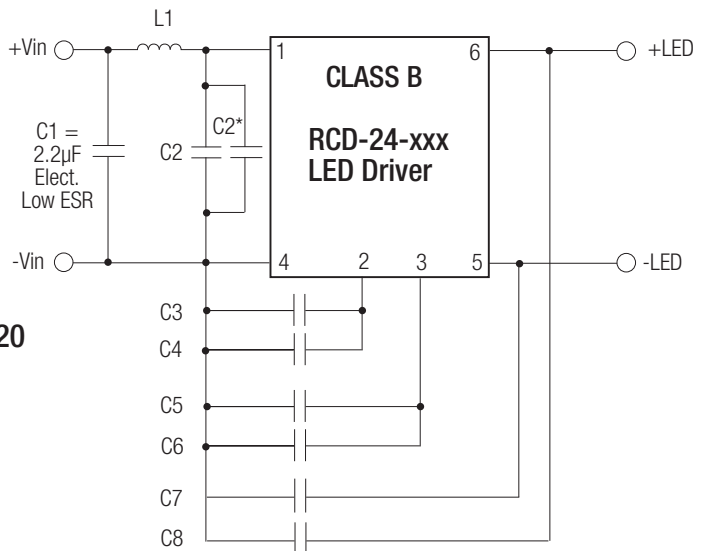
$C1 = 1\mu F$ MLCC

$L1 = 22\mu H$

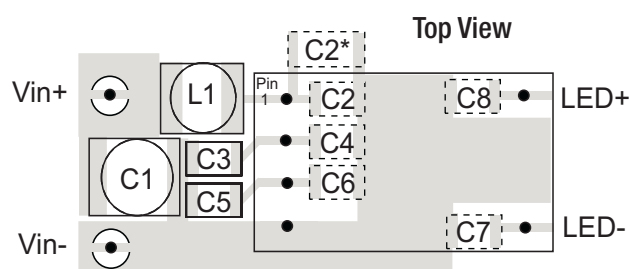
RCD-24-1.00 - RCD-24-1.20

$C1 = 2.2\mu F$ MLCC

$L1 = 47\mu H$



Recommended Class B PCB Layout for Pinned Version



RCD-24-0.30 - RCD-24-0.70

No dimming or PWM dimming:

$L1 = 47\mu H$

$C2 = C3 = 10nF$ MLCC

Other caps not required

Analogue Dimming used:

$L1 = 120\mu H$

$C2 = C7 = 10nF$ MLCC

Other caps not required

RCD-24-1.00 - RCD-24-1.20

$L1 = 220\mu H$

$C2 = 10nF$

$C3 = C5 = 2.2nF$

$C4 = C6 = C7 = C8 = 100nF$

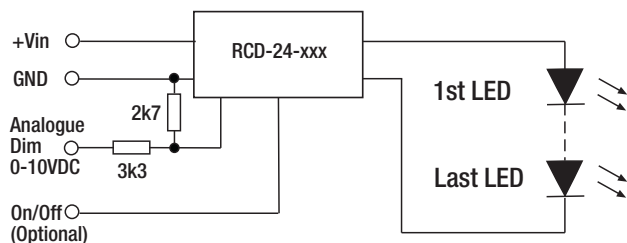
All capacitors MLCC

$C2^*$ = optional $2\mu 2$ MLCC only if $L1$ starts to resonate with the back ripple current.

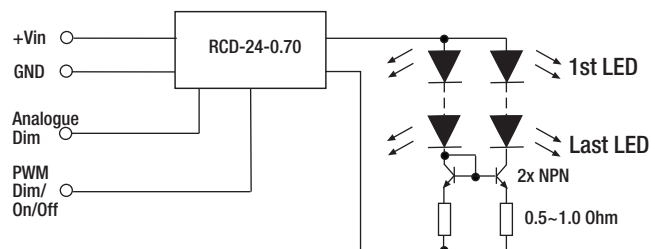
DC/DC-Converter

Application Examples

LED DRIVER with 0-10V Interface

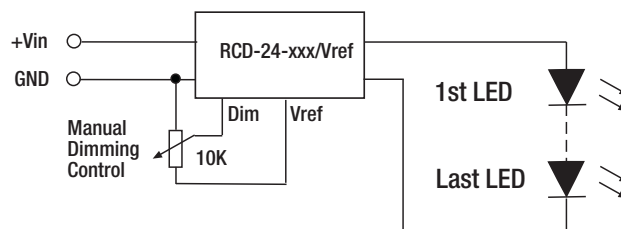


MULTIPLE LED DRIVER (up to 20 LEDS)

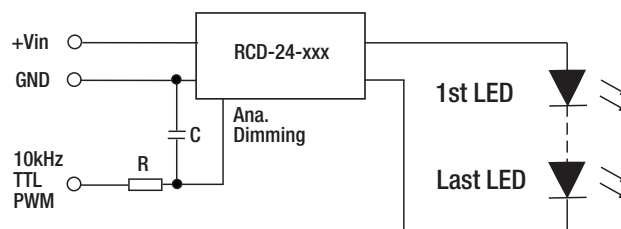


Driving Two Strings of 350mA LEDs with one 700mA Driver using a current mirror

LED DIMMER for up to 10 white LEDs

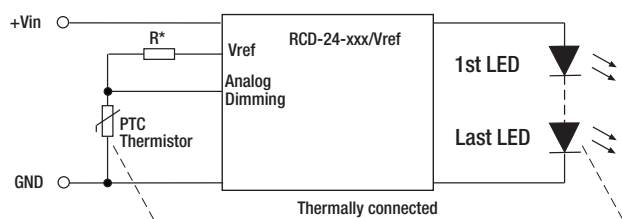


LED DIMMER with high frequency PWM control



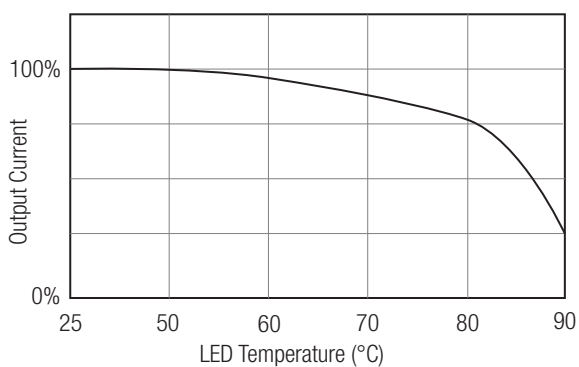
LED Temperature Monitoring

Automatic LED Overtemperature Protection



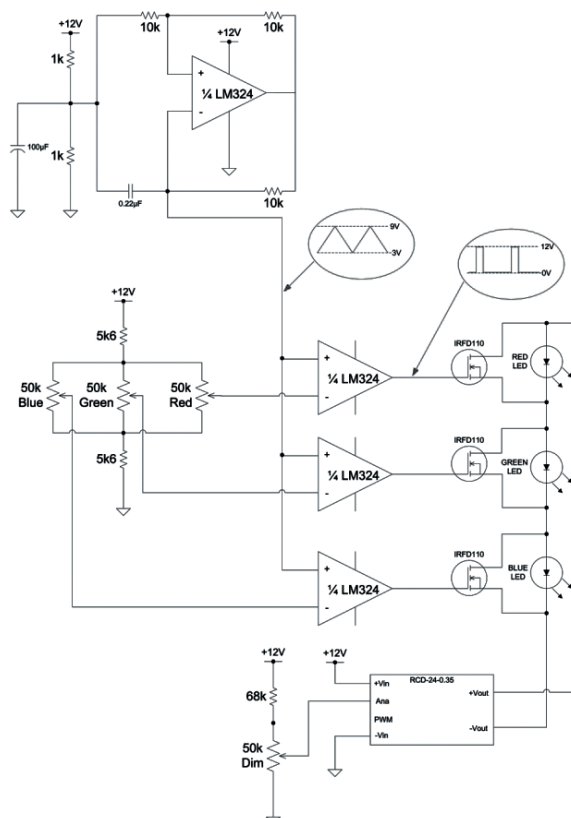
*Typically, choose R so that $R = R_{ptc} @ 85^{\circ}\text{C}$ and $R > 660 \text{ Ohm}$.

Typical Response Curve (PTC = 500 Ohm @ 70°C)



RGB Driver

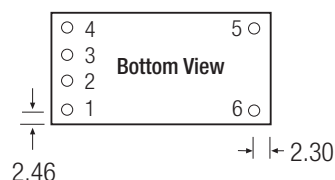
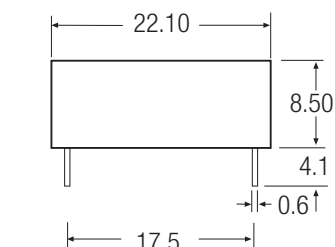
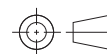
SIMPLE RGB Mixer



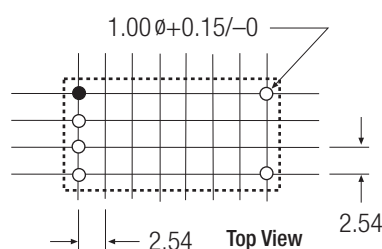
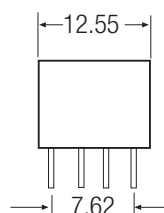
Package Style and Pinning

Pinned Version

3rd angle projection



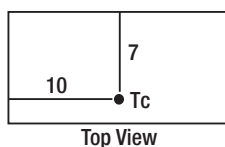
Leave >1mm space around case on PCB for air circulation



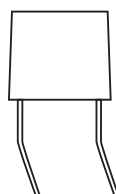
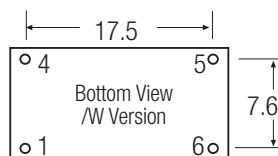
Recommended Footprint Details

Pin Connections RCD-24 Series		
Pin #	Out	Comments
1	+Vin	DC Supply
2	Analogue Dimming	Leave open if not used
3	PWM/ON/OFF	Leave open if not used
(3	Vref	Vref Version only)
4	GND	Do not connect to -Vout
5	-Vout	LED Cathode Connection
6	+Vout	LED Anode Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm
Pin Tolerance ± 0.1 mm



Wired Versions

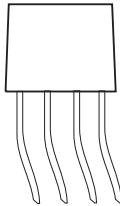
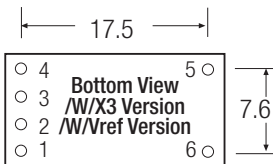
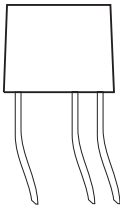
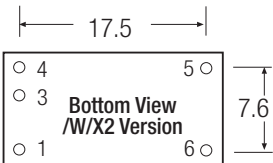
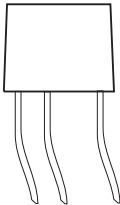
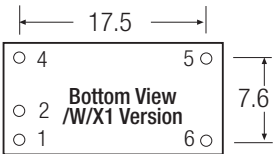


Wire Connections RCD-24/W Series		
Wire #	Function	Comments
1 (Red)	+Vin	DC Supply
4 (Black)	GND	Do not connect to -Vout
5 (Brown)	-Vout	LED Cathode Connection
6 (Yellow)	+Vout	LED Anode Connection

Wire length = 100mm + 10mm stripped & tinned = 110mm total
Wire outside diameter = 1.6mm
Wire core diameter = 0.75mm
Wire is UL/CSA listed/ 22AWG / 300V Rated

Package Style and Pinning

Wired Versions



RCD-24/W/X Series		
Wire #	Function	Comments
2 (Green)	Ana Dimming	/X1
3 (Blue)	PWM Dimming	/X2
2 + 3 (Green + Blue)	Ana + PWM Dimming	/X3
2 + 3 (Green + Yellow)	Ana Dimming + Vref	/Vref

Wire length = 100mm + 10mm stripped & tinned = 110mm total
Wire outside diameter = 1.6mm
Wire core diameter = 0.75mm
Wire is UL/CSA listed/ 22AWG / 300V Rated

Wired Versions are packed in bags - 5pcs per bag.

Warning: Do not connect or disconnect the LED load while the converter is powered on.
This may damage or reduce the lifetime of the LED.

Features

Regulated Converters

- SMD Constant Current LED Driver
- Built-in Class A or Class B EMC Filter
- Wide Input and Output Voltage Range
- Digital PWM and Analogue Voltage Dimming
- Short Circuit and Overtemperature Protected
- Low Cost
- 96% Efficiency
- 5 Year Warranty

Description

The RCD-24-xxx/PL series is a step-down constant current source designed for driving high power LEDs. The converter uses a pinless SMD open frame design to reduce cost and size. Output currents available are 300mA, 350mA, 500mA, 600mA, 700mA and 1000mA with either Class A (Suffix /A) or Class B (suffix /B) built-in EMC filtering. Despite its compact size, the RCD-PL series is fully featured with very high efficiency, wide input voltage range, high ambient operating temperature and two means of LED dimming: PWM/digital control and analogue voltage dimming. Both dimming controls are independent and can be combined. The driver is also designed to be as reliable as the LEDs it is driving, even at the full ambient operating temperature and is designed for strip lighting, wall washers and fluorescent tube replacement designs, where a low profile and narrow width are demanded.

Selection Guide

Part Number	Input Range (VDC)	Output Current (mA)	Output Voltage (Vmin-Vmax)	Dimming Control	Mounting Style
RCD-24-0.30/PL*	4.5-36V	0-300	2-35	Digital + Analogue	Pinless SMD
RCD-24-0.35/PL*	4.5-36V	0-350	2-35	Digital + Analogue	Pinless SMD
RCD-24-0.50/PL*	4.5-36V	0-500	2-35	Digital + Analogue	Pinless SMD
RCD-24-0.60/PL*	4.5-36V	0-600	2-35	Digital + Analogue	Pinless SMD
RCD-24-0.70/PL*	4.5-36V	0-700	2-35	Digital + Analogue	Pinless SMD
RCD-24-1.00/PL/A	6-36V	0-1000	2-32	Digital + Analogue	Pinless SMD

* /A for EMC Class A input Filter

add -R for Tape and Reel Packaging e.g. RCD-24-0.35/PL/B-R

* /B for EMC Class B input Filter

Note: RCD-24-1.00/PL/A only available with Class A Filter

Specifications

(typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Input Voltage (absolute maximum)	40VDC max	
Recommended Input Voltage	6V min. / 24V typ. / 36VDC max	
Input Filter	Suffix /A Suffix /B RCD-24-1.00/PL/A	Capacitor Class B with Pi Filter Class A with Pi Filter
Output Current Accuracy (Vin=24V)	300-700mA 1000mA	±2% typ, ±3% max ±3% typ, ±5% max
Internal Power Dissipation	Worst case load of 5 LEDs (300-700mA) Worst case load of 8 LEDs (1000mA), Vin=36V	700mW max. 1.6W typ.
Output Current Stability	Vin = 36V, Vout = 1-9 LEDs (300-700mA) Vin = 36V, Vout = 1-8 LEDs (1000mA)	±1% max ± 1.5% max.
Output Ripple and Noise (20MHz BW)	Vin=36V, Vout = 1-9 LEDs (300-700mA) Vin=36V, Vout = 1-8 LEDs (1000mA)	300mVp-p max
Temperature Coefficient	-40°C~+85°C ambient	±0.015%/°C max
Maximum Capacitive Load	100µF	
Operating Frequency	300-1000mA	212kHz min/ 250kHz typ/ 280kHz max
Efficiency at Full Load	300-700mA Vin=36V, Vout=8 LEDs (1000mA)	96% typ. 94% typ.
Short Circuit Protection	Regulated at rated output current	
Operating Temperature Range	300/350mA 500mA 600/700mA 1000mA	-40°C to +85°C -40°C to +80°C -40°C to +75°C -40°C to +65°C
Storage Temperature Range	-55°C to +125°C	
Relative Humidity	5% to 95% RH, non-condensing	
Dimensions	31.0 x 11.4 x 6.6mm	
Weight	1.9g	

LIGHTLINE

DC/DC-Converter

with 5 year Warranty

RECOM

Constant Current LED Driver



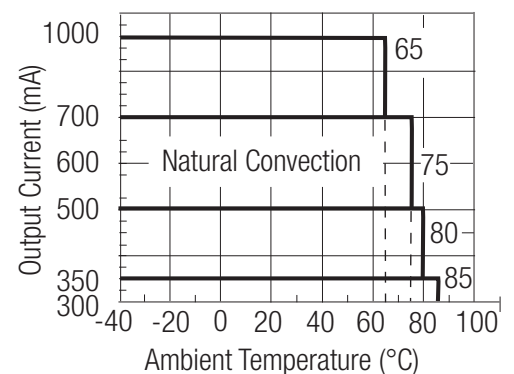
E358085

EN-60950-1 Certified
UL-60950-1 Certified

RCD-24-PL

Derating Graph

(Ambient Temperature)

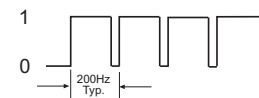


Specifications -Continued

Packing Quantity	12 pcs per Tube / 400 pcs per Reel	
Reflow Soldering Profile	265°C/10 sec max	
MTBF	25°C	>600 khours
(using MIL HDBK 217F)		
PWM Dimming and ON/OFF Control (Leave open if not used)		
Remote ON/OFF	DC/DC ON	Open or $0V < V_r < 0.6V$
Threshold Voltages	DC/DC OFF (Standby)	$0.6 < V_r < 2.9V$
	DC/DC OFF (Full Shutdown)	$2.9V < V_r < 6V$
Remote Pin Drive Current	$V_r = 5V$	1mA max
Quiescent Input Current in Shutdown Mode	$V_{in} = 36V$	200µA max
Recommended PWM Frequency	For Linear Operation	20 - 200Hz
(measured 10%~90% Dimming)	Maximum Frequency	2000Hz
Analogue Dimming Control (leave open if not used)		
Input Voltage Range	300-1000mA	-0.3V - 15V
Control Voltage Range Limits (see Graph)	300-1000mA / Full On	$0.13V \pm 50mV$
	300-1000mA / Full Off	$4.2V \pm 200mV$
Analogue Pin Drive Current	300-1000mA / $V_c = 5V$	0.2mA max.
Environmental		
Conducted Emissions	300-1000mA (/A Suffix)	EN55022 Class A
	300-700mA (/B Suffix)	EN55022 Class B
Radiated Emissions	(all series)	EN55022 Class B
ESD	(all series)	EN61000-4-2 Class A
Radiated Immunity	(all series)	EN61000-4-3 Class A
Fast Transient	(all series)	EN61000-4-4 Class A
Conducted Immunity	(all series)	EN61000-4-6 Class A

Digital Dimming

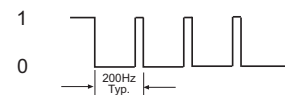
PWM Digital Control Signal



Output Current (LED appears dim)



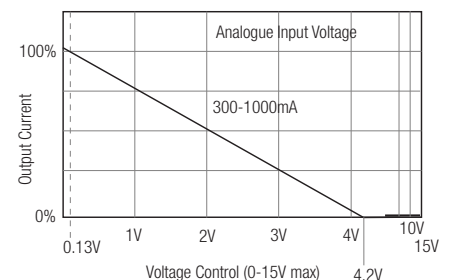
PWM Digital Control Signal



Output Current (LED appears bright)

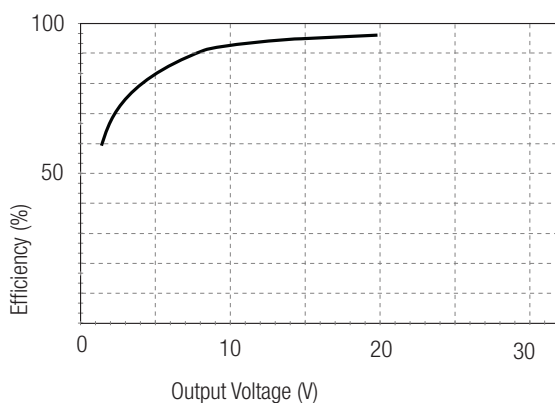


Analogue Dimming

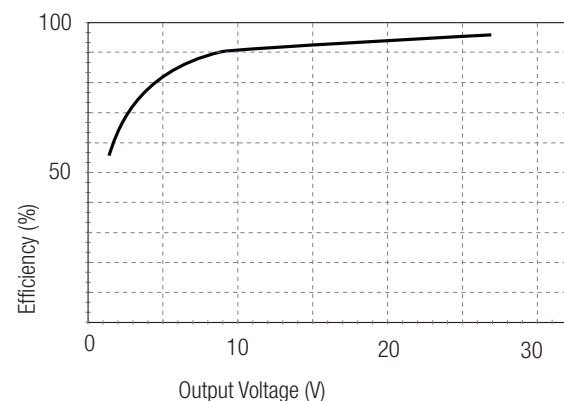


Typical Characteristics

$V_{in} = 24V$, $I_{out} = 300 \sim 1000mA$

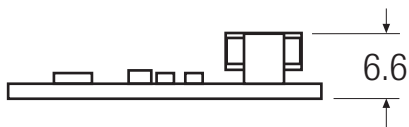


$V_{in} = 32V$, $I_{out} = 300 \sim 1000mA$



Package Style and Pinning

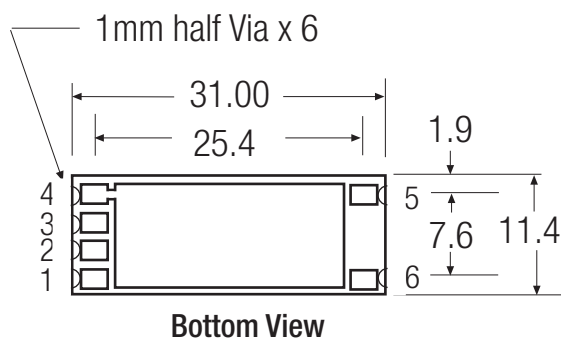
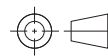
Class A Version



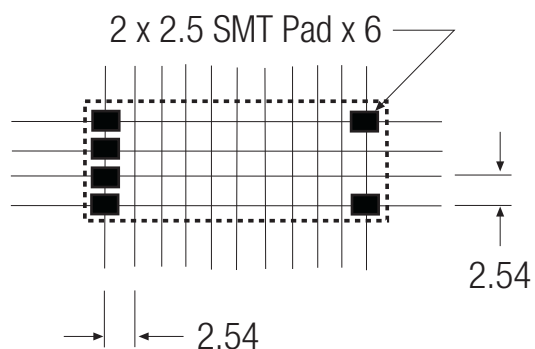
Class A (1.00A-Version)
Class B Version



3rd angle projection



PCB Layout Top View



RCD-24-PL Series		
Pad #	Out	Comments
1	+Vin	DC Supply
2	Analogue Dimming	Leave open if not used
3	PWM/ON/OFF	Leave open if not used
4	GND	Do not connect to -Vout
5	-Vout	LED Cathode Connection
6	+Vout	LED Anode Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

LED DRIVER

- 70W Buck LED Driver
- Constant Current Output (350 to 1200mA)
- Digital PWM and Analogue Voltage Dimming
- High Efficiency to 96%
- EN and UL
- Metal or Plastic Case Version
- IP67 Rated for /W, Plastic Case Version
- 5 Year Warranty

Description

The RCD-48 series is a step-down constant current source designed for driving high power LED applications. Four output currents are available. The maximum output voltage is 56V. The buck drivers have digital PWM and/or analogue voltage dimming control and are special featured with very high efficiency. Typical applications are 48V bus lighting solutions or high voltage LED arrays (e.g. high bay lights).

Selection Guide

Part Number	Input Range (VDC)	Output Current (mA)	Output Voltage (VDC)	Dimming Control	Efficiency Typ. (%)
RCD-48-0.35*	9-60	0-350	2-56	Digital + Analogue	96
RCD-48-0.50*	9-60	0-500	2-56	Digital + Analogue	96
RCD-48-0.70*	9-60	0-700	2-56	Digital + Analogue	96
RCD-48-1.00*	9-60	0-1000	2-56	Digital + Analogue	96
RCD-48-1.20/M	9-60	0-1200	2-56	Digital + Analogue	96

*add suffix "/W" for wired version with Vref output and analogue + PWM dimming control (seven wires)

Note:

Add suffix "/M" for metal case (RCD-48-1.20/M only). No metal case with wires available.

Standard version (no suffix) and wired version (suffix /W) only in plastic case.

Specifications (typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Operating Input Voltage Range		9-60VDC
Absolute Maximum Input Voltage		65VDC max.
Output LED String Voltage Range		2V min. / 56V max.
(depend on the input voltage, defined by the output impedance, see Safe Operating Area)		
Input Filter		Capacitor
Output Current Accuracy		±3% typ. / ±5% max.
Internal Power Dissipation (Vin=60V, Vout=56V)	350mA	0.8W typ.
	500mA	1.0W typ.
	700mA	1.1W typ.
	1000mA	1.3W typ.
	1200mA	1.4W typ.
Output Current Stability	Vin=60V, Vout=2-56V, Iout=350-1200mA	±1% max.
Output Ripple and Noise (20MHz BW)	Vin=60V, Vout=2-56V, Iout=350-1200mA	300mVp-p max.
Maximum Capacitive Load		100µF max.
Switching Frequency		50kHz min. / 1000kHz max.
Efficiency at Full Load		96% typ.
PWM DIMMING CONTROL & REMOTE ON/OFF CONTROL		
Input Voltage Range		5V typ. / 10V max.
Threshold Voltage	Device ON	0.5V max.
	Device OFF	2.0V min.
Frequency		100Hz min. / 1000Hz max.
ANALOGUE DIMMING CONTROL (Leave open if not used - do not tie to +Vin)		
Input Voltage Range		0V min. / 10V max.
Control Voltage Range		0V min. / 5.1V max.
<i>Note: The analogue dimming range is from 0% to 100%, but the output can be unstable below 10%, when using the analogue dimming function.</i>		
Vref Version	Vref Voltage	4.95V
	Vref Output Current	0.5mA
	Vref Output Short Circuit Current	0.1µA typ.
Ambient Temperature (free air convection)	350mA	-40°C to +80°C
	500mA	-40°C to +80°C
	700mA	-40°C to +75°C
	1000mA	-40°C to +60°C
	1200mA	-40°C to +50°C

Analogue and PWM Dimming Control Note: Leave open if not used - do not tie to +Vin

LIGHTLINE
DC/DC-Converter
with 5 year Warranty

RECOM

Constant Current Buck LED Driver

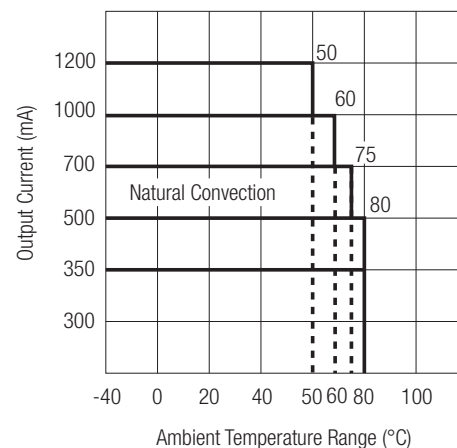


E224736

EN-60950-1 Certified
UL-60950-1 Certified

RCD-48

Derating Graph

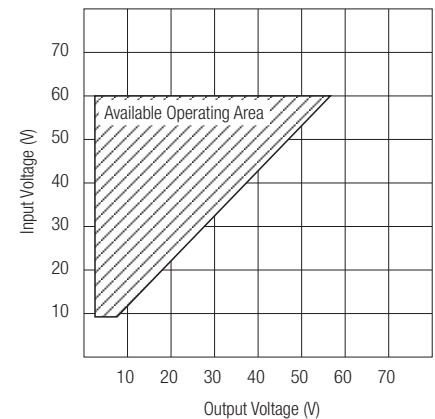


Please Read Application Notes

Specifications

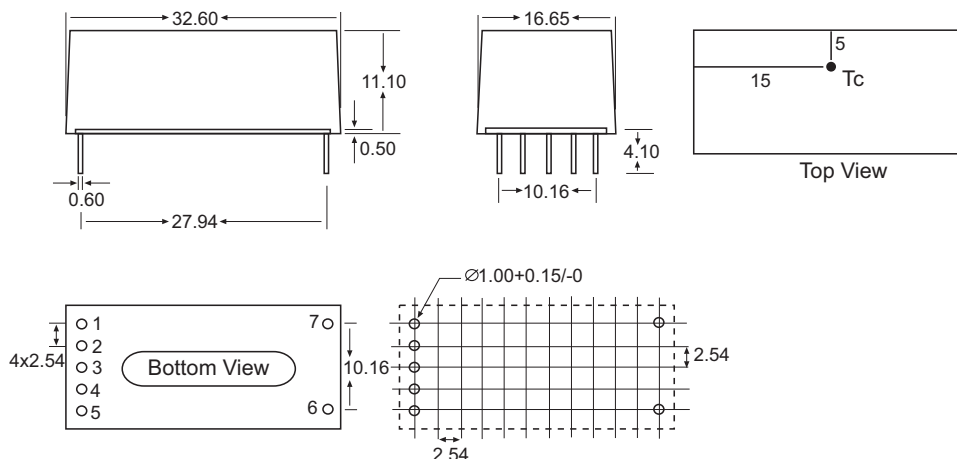
Storage Temperature	-55°C to +125°C	
Case Thermal Impedance	10°C/W typ.	
Soldering Temperature	265°C / 10sec. max.	
Relative Humidity	95% RH	
Input Filter	Capacitor only	
Short Circuit Protection	Continuous, Auto Recovery	
Case Material	Non Conductive Black Plastic Metal Case	
Potting Material	Silicone Potting Material (UL94V-0)	
Case Dimensions	Plastic Case	32.6 x 16.65 x 11.10 mm
	Metal Case	32.6 x 16.0 x 11.2 mm
Package Weight	Pinned (Plastic Case)	13g
	Wired (Plastic Case)	16g
	Pinned (Metal Case)	16g
Packing Quantity	Pinned (Plastic/Metal Case)	29 pcs.
	Wired (Plastic Case)	3 pcs.
MTBF (using MIL-HDBK217F) (Nominal Vin at Full Load)	+25°C	1700 x 10 ³ hours
<i>Note: Detailed Information see Application Notes chapter "MTBF"</i>		

Safe Operating Area

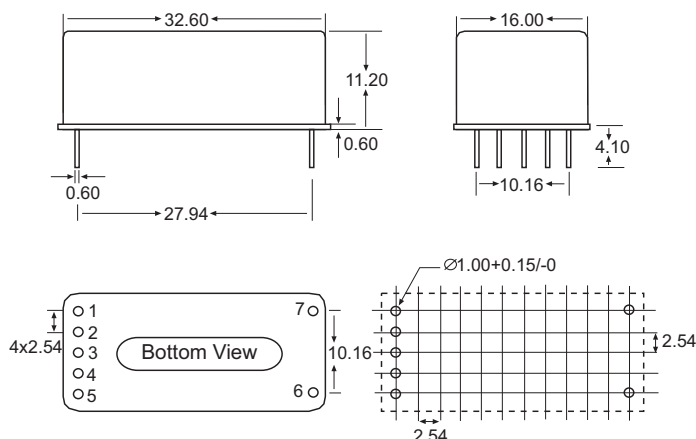


Package Style and Pinning

Through Hole Case (Plastic)



Through Hole Case (Metal)



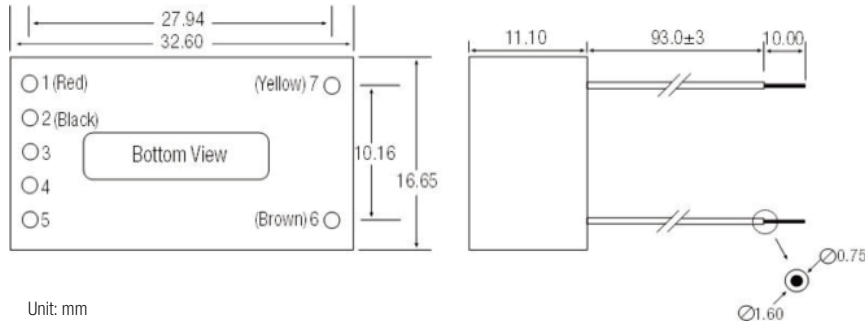
Pin Connections		RCD-48-x.xx
Pin#	Function	Comments
1	+Vin	DC Supply
2	GND	Do not connect to -Vout
3	Vref	Vref Voltage 5V typ.
4	PWM/ON/OFF	Leave open if not used
5	Analogue Dimming	Leave open if not used
6	-Vout	LED Cathode Connection
7	+Vout	LED Anode Connection

Unit: mm
Tolerance:
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Package Style and Pinning

Wired Version (Plastic)

3rd angle projection



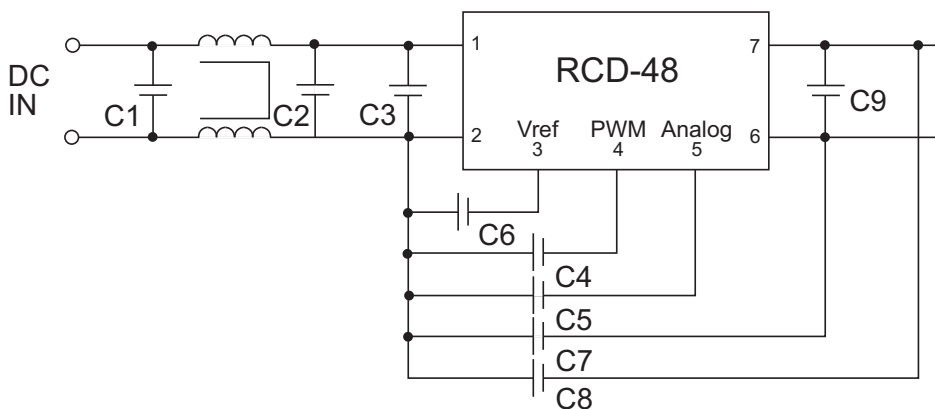
Unit: mm
Tolerance:
XX.X ± 1.0 mm
XX.XX ± 0.25 mm

Wire Connections Pin#	Function	RCD-48-x.xx/W Wire color
1	+Vin	Red
2	GND	Black
3	Vref	Yellow
4	PWM/ON/OFF	Blue
5	Analogue Dimming	Green
6	LED-	Brown
7	LED+	Yellow

Wires: UL/CSA approved (22AWG/300V)

EMI Filter Suggestions

Class B

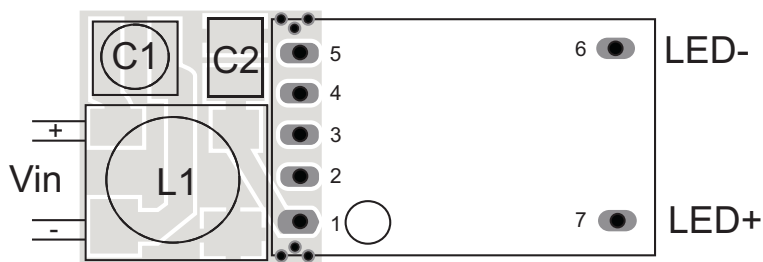


LOAD

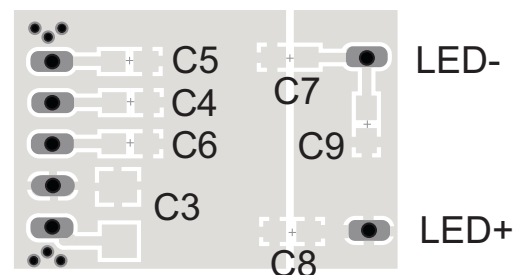
L1	1mH (e.g. WE744272102)
C1	10µF
C2	1µF
C3	100nF close to Pins
C4 - C9	10nF

Filter Suggestion

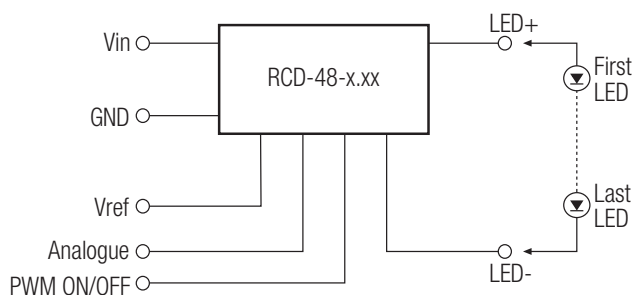
Top Layer



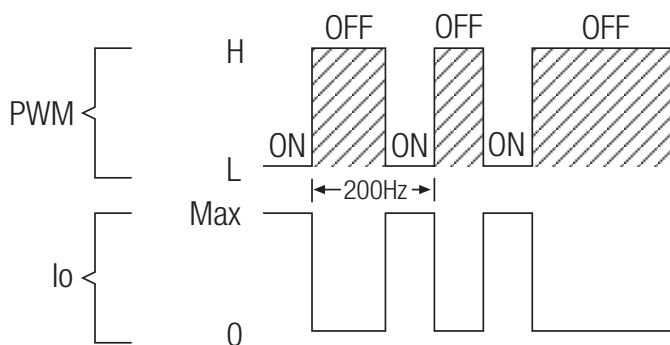
Bottom Layer



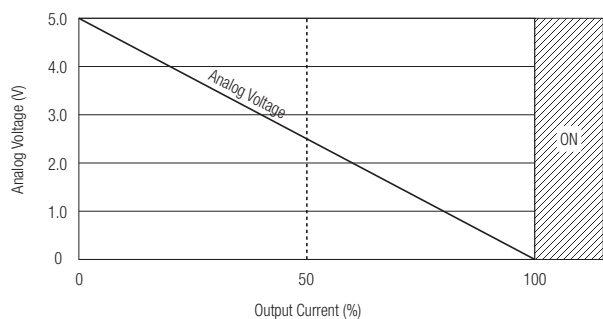
Single String Application



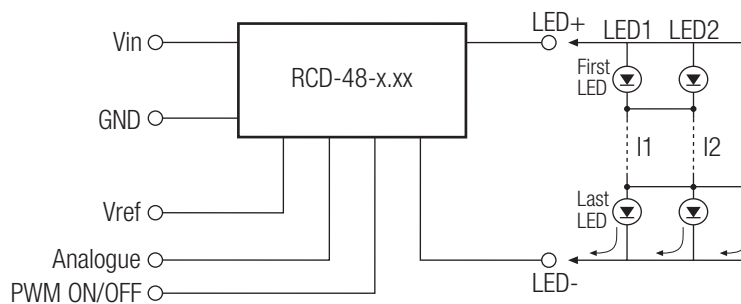
PWM Dimming Controlled



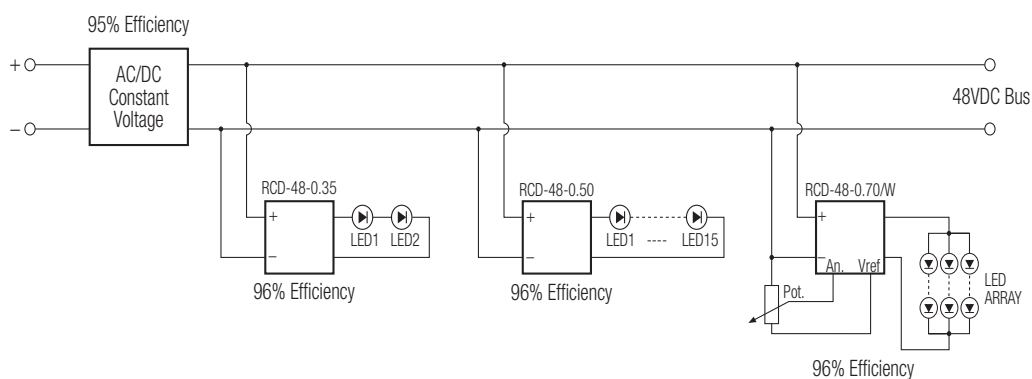
Dimming Controlled by Analog Voltage



Lighting/Backlighting Wall Application



High Efficiency Lighting



Features LED DRIVER

- Buck- Boost LED Driver up to $V_{out}=40V$
- Constant Current Output (350 or 500mA)
- Digital PWM and Analogue Voltage Dimming
- High Efficiency to 92%
- EN60950-1 and UL60950-1 Certified
- EMC Class A Without Extern Components
- Pinned or Wired Version
- 5 Year Warranty

Description

The RBD-12 series is a Buck-Boost constant current source designed for driving high power LED applications. Two output currents are available, 350mA and 500mA, and the maximum output voltage is 40V. The drivers have digital and analogue voltage dimming control and a regulated reference 5V output. Typical applications are solar, off-grid lighting, mobile traffic signs and battery-powered lighting. The wired version is IP67 rated.

Selection Guide

Part Number	Input Range (VDC)	Output Current (mA)	Output Voltage (VDC)	Dimming Control	Efficiency typ. (%)
RBD-12-0.35*	8-36	0-350	2-40	Digital + Analogue	92
RBD-12-0.50*	8-36	0-500	2-40	Digital + Analogue	92

*add suffix "/W" for wired version with Vref output and analogue + PWM dimming control (seven wires)

Specifications (typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Operating Input Voltage Range		8-36VDC
Absolute Maximum Input Voltage		38VDC
Output LED String Voltage Range (depending on the input voltage, see Safe Operating Area)		2V min. / 40V max.
Input Filter		Capacitor
Max. Capacitance Load		100μF max.
Output Current Accuracy	(Note 1)	±5% typ.
Internal Power Dissipation	350mA (Vin=36V, Vout=40V)	1.63W typ.
	500mA (Vin=36V, Vout=40V)	2.33W typ.
Output Current Stability (Note 2)	Vin=24V, Vout=2-40V	±2% max.
Output Current Ripple and Noise (20MHz BW)	350mA (Vin=24V, Vout=40V)	35mA _{p-p} typ.
	500mA (Vin=24V, Vout=40V)	45mA _{p-p} typ.
Reflected Back Ripple Current (20MHz BW)	Vin=24V, Vout=6-40V	70mA _{p-p} max.
Switching Frequency		350kHz typ.
Efficiency at Full Load	Vin=24V	92% typ.
Vref	Nominal 5V	0.8mA max.
PWM DIMMING CONTROL & REMOTE ON/OFF CONTROL		
Input Voltage Range		0V min. / 5V typ. / 10V max.
Threshold Voltage	Device ON	2V min.
	Device OFF	0.1V max.
Frequency		1000Hz max.
ANALOGUE DIMMING CONTROL		
Input Voltage Range		0V min. / 10V max.
Control Voltage Range		0.2±0.1V min. / 1.5±0.1V max.
Operating Temperature	350mA	-40°C to +75°C
(see Derating Graph)	500mA	-40°C to +65°C
Case Temperature		115°C max.
Storage Temperature		-55°C to +125°C
Case Thermal Impedance		10°C/W
Soldering Temperature	Pinned Version	265°C/10sec. max.
Relative Humidity		95% RH max.
Short Circuit Protection	Continuous	Auto Recovery
Overtemperature Protection	(Auto Recovery)	125°C ± 5°C (MOSFET)
Case Material		Non Conductive Black Plastic

LIGHTLINE
DC/DC-Converter
with 5 year Warranty

RECOM

Constant Current Buck-Boost LED Driver

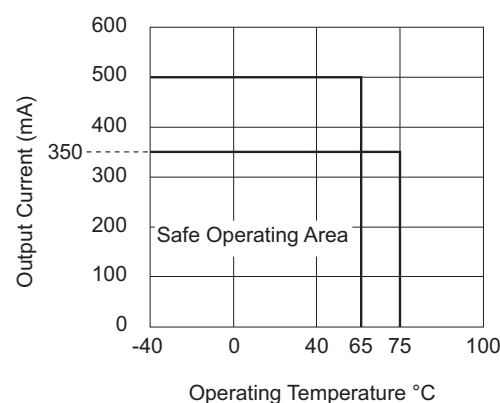


E224736

EN-60950-1 certified
UL-60950-1 certified

RBD-12

Derating Graph



Please Read Application Notes

Specifications

Potting Material		Silicone Potting Material (UL94V-0)	
Case Dimensions		32.60 x 16.65 x 11.10 mm	
Package Wight	pinned version	13g	
	wired version	17g	
Packing Quantity	pinned version	29 pcs.	
	wired version	12 pcs.	
MTBF (using MIL-HDBK217F at 25°C)		1700 x 10 ³ hours	
Certification			
EN General Safety	Report: SPCLVD1111102	EN60950-1:2006	
IEC General Safety	Report: SPCLVD1111102	IEC60950-1:2005, 2nd Edition	
UL General Safety	Report: E224736	UL60950-1, 2nd Edition	

Note 1: Output Current Accuracy is defined as:

$$\left[\frac{I_{out} - I_{out \text{ "rated" }}}{I_{out \text{ "rated" }}} \right] \times 100$$

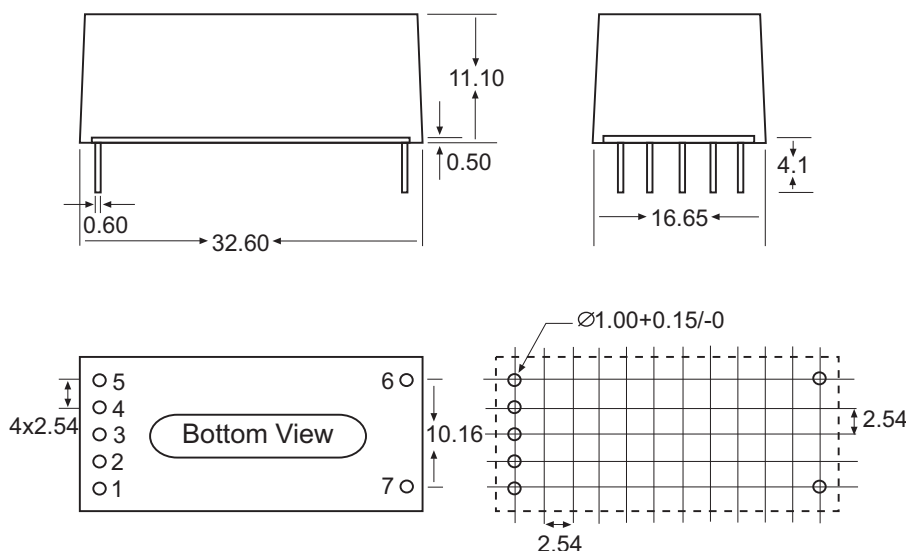
Note 2: Output Current Stability is defined as:

$$\left[\frac{I_{out \text{ "deviation" }} - I_{out \text{ "nominal" }}}{I_{out \text{ "nominal" }}} \right] \times 100$$

$$I_{out \text{ (deviation) }} = \text{maximum Deviation (min. Load, max. Load)}$$

Package Style and Pinning

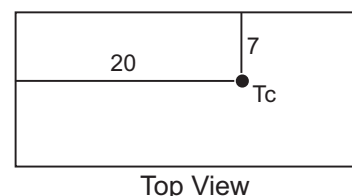
RBD-12-x.xx - Through Hole Case



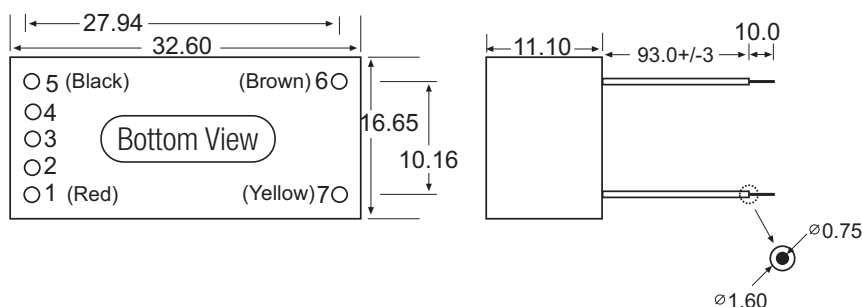
Pin Connections		RBD-12-x.xx
Pin#	Function	Comments
1	+Vin	DC Supply
2	Vref	Vref Voltage 5V typ.
3	Analogue Dimming	Leave open if not used
4	PWM/ON/OFF	Leave open if not used
5	GND	Do not connect to -Vout
6	-Vout	LED Cathode Connection
7	+Vout	LED Anode Connection

3rd angle projection

Unit: mm
Tolerance:
XX.X ± 0.5 mm
XX.XX ± 0.25 mm



RBD-12-x.xx/W - Wired Version



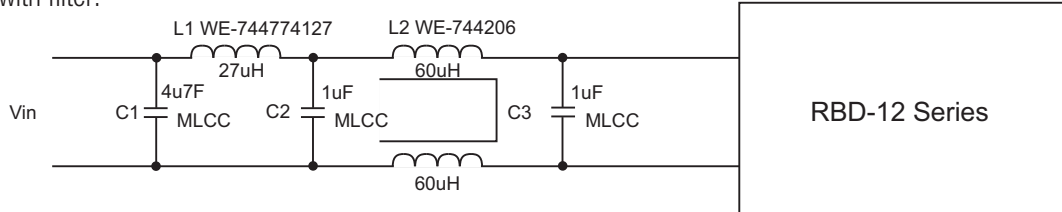
Wire Connections		RBD-12-x.xx/W
Pin#	Function	Wire color
1	+Vin	Red
2	Vref (5V typ.)	Yellow
3	Analogue Dimming	Green
4	PWM/ON/OFF	Blue
5	GND	Black
6	LED-	Brown
7	LED+	Yellow

Unit: mm
Tolerance:
X ± 1 mm
XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Wires: UL/CSA approved (22AWG/300V)

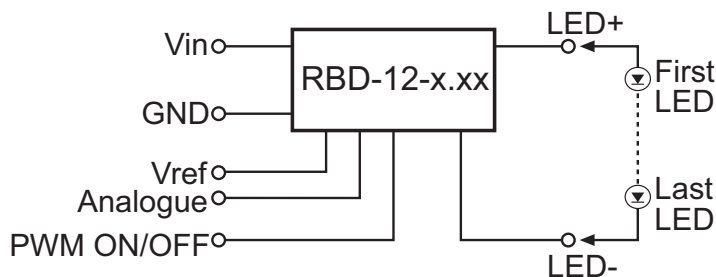
Standard Applications

- EN55022 Class A without external filter
EN55015 without filter
EN55022 Class B with filter:

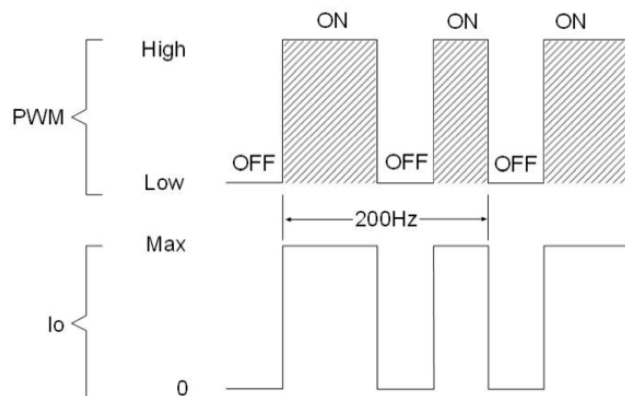


Standard Application

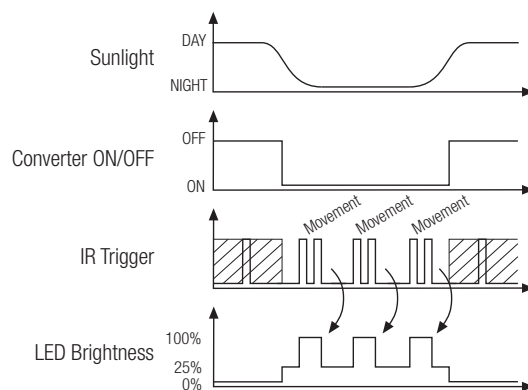
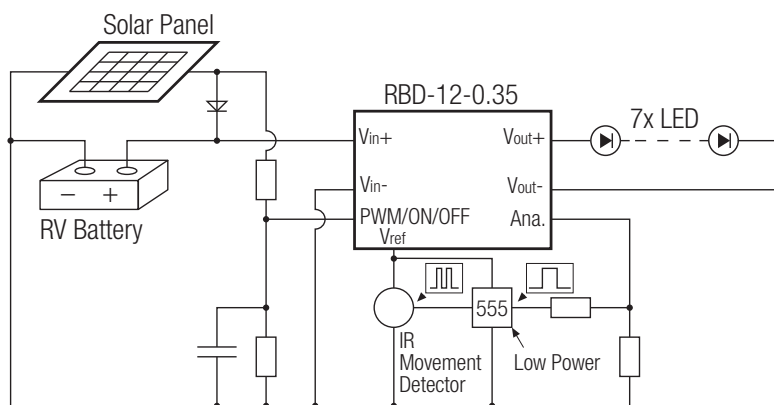
Single String Application



PWM Dimming Controlled

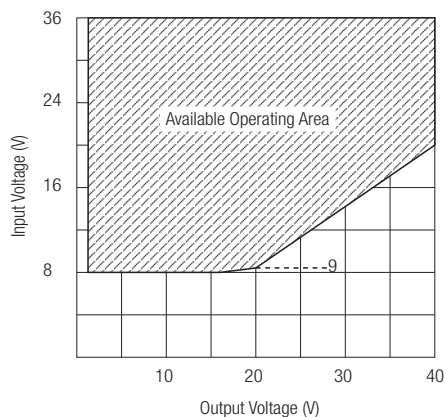


Solar Lighting Application



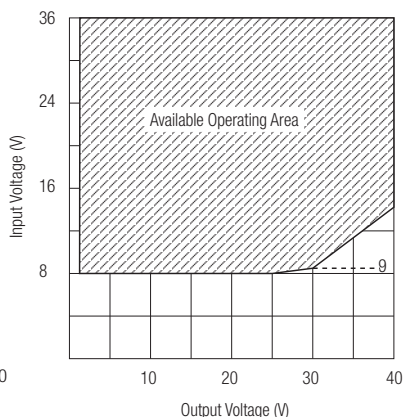
Safe Operating Area

500mA



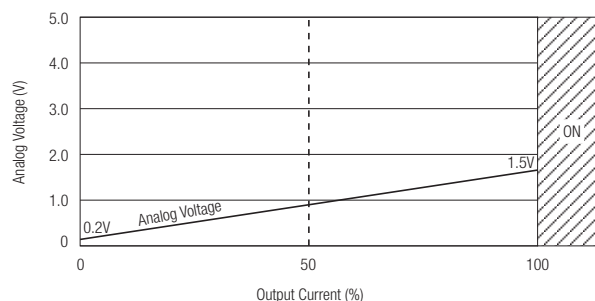
Vin 8V up to Vout = 17V
Vin 9V up to Vout = 20V
Vin 12V up to Vout = 24V
Vin 16V up to Vout = 32V

350mA



Vin 8V up to Vout = 25V
Vin 9V up to Vout = 27V
Vin 12V up to Vout = 36V

Dimming Controlled by Analog Voltage



Features

LED Driver

- 3W Class II AC-DC LED Power Supply
- 350mA to 700mA CC/CV Output
- Drives 1 - 6 High brightness LEDs
- Universal Input Voltage Range
- Fused Input and Protected Output
- 3kVAC Isolation
- IP66
- Low Cost
- 3 Year Warranty

Description

A compact universal AC input 3W constant current switching power module suitable for driving 1 - 6 high power LEDs. The output (dual constant voltage / constant current mode) current limit is fixed at 350mA, 500mA or 700mA. At lower output currents, the output is constant voltage. Connections are via 118mm long flying leads.

Selection Guide

Part Number	CV Mode		CC Mode		Efficiency typ. (%)
	(VAC)	(mA)	(VDC)	(mA)	
RACD03-350	15	0-350	3-15	350	72
RACD03-500	11	0-500	3-11	500	71
RACD03-700	6	0-700	3-6	700	62

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	3W nom. / 5W max.	
Input Frequency Range	47-63 Hz	
Output Voltage Range	3 - 15VDC max.	
Inrush Current (<2mS)	230VAC	10A max.
Leakage Current	240VAC/50Hz	0.2mA typ.
Input Fuse	Built-in	T1A
Input Current	350mA Version	20mA
	500mA Version	25mA
	700mA Version	38mA
Output Current Accuracy	(combined Tolerance, Load Regulation and Line Regulation)	±10%
Minimum Load	Open Circuit Protected	1 LED
Output Ripple	0.1Ap-p max.	
Hold Up Time	18ms min.	
Operating Frequency	66kHz typ.	
AC RMS Isolation Voltage (input to output)	3.75kV / 1 minute typ., 3kV / 1 minute min.	
Temperature Coefficient	±0.02%/°C typ.	
Overload Protection	120% typ.	
Short Circuit Protection	Continuous Current Limit	
Output Overvoltage Protection	Zener Diode Clamp	
Overtemperature Protection	Shutdown, Automatic restart after cooling down	
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +50°C
	Case Temperature	85°C max.
Storage Temperature Range	-25°C to +85°C	
Humidity	95% RH max.	
IP Rating	IP66	

continued on next page

LIGHTLINE

AC/DC-Converter

with 3 year Warranty

RECOM

3 Watt Single Output



UL-8750 Certified
EN-61347 Certified
SEMKO Certified

RACD03

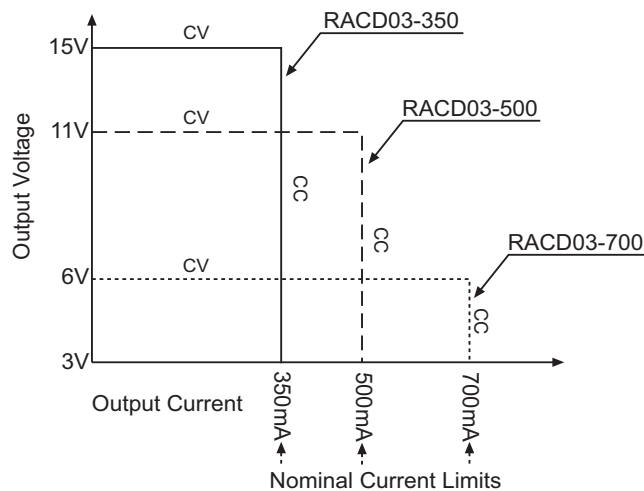
Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

PCB Material	Plastic Resin with Fibreglass (UL94V-0)	
Case Material	Plastic	
Weight	45g	
Packing Quantity	1pc	
Designed to meet Standards	Electrical Lighting, EMC Emissions	EN55015:2006 + A1: 2007 + A2:2009
	Limits for Harmonics Emissions	EN 61000-3-2:2006
	EMC Compatibility: Flicker and Voltage Variations	EN 61000-3-3:2006
	Electrical Lighting: EMC Immunity	EN 61547:1995 + A1:2000
	Class II Power Supply Safety	UL1310
	FCC	FCC18A
Certifications	LED Lighting Safety	UL8750
		(UL Report No. E340696)
	General Safety	EN 61347-1: 2008
	Safety of AC supplied Control Gear for LED Modules	EN 61347-2-13: 2006
Design Lifetime	25°C ambient	>20 x 10 ³ hours in operation
Connections	AC Input Live	Brown Wire, AWG22, 172mm + 5-7mm stripped and tinned
	AC Input Neutral	Blue Wire, AWG22, 172mm + 5-7mm stripped and tinned
	LED +	Red Wire, AWG24, 128mm + 5-7mm stripped and tinned*
	LED -	Black Wire, AWG24, 128mm + 5-7mm stripped and tinned*

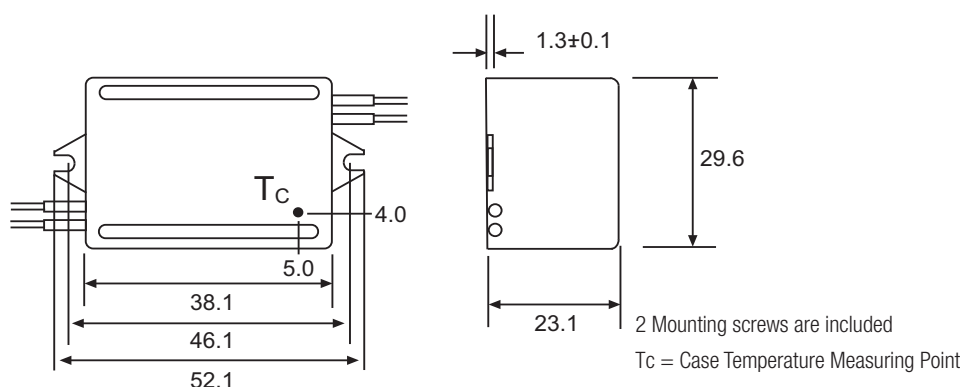
* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Characteristics

Constant Current (CC) and Constant Voltage (CV) Graph



Package Style and Pinning



Wire Connections

Wire	Function
Brown	VAC in (L)
Blue	VAC in (N)
Red	LED+
Black	LED-

Tolerance

XX = +1mm/ -0.5mm

XX.X = +/- 0.25mm

Features

LED Driver

- 6W AC-DC Class II LED Power Supply
- 350mA to 700mA CC/CV Output
- Drives 1 - 12 High brightness LEDs
- Universal Input Voltage Range
- Fused Input, Protected Output
- 3kVAC Isolation
- Low Cost
- 3 Year Warranty

Description

A compact universal input 6W constant current switching power module suitable for driving up to 12 high power LEDs. The output (dual constant voltage / constant current mode) current limit is fixed at 350mA, 500mA or 700mA. At lower output currents, the output is constant voltage.

Selection Guide

Part Number	Nominal Input Voltage (VAC)	Input Current at full load (mA)	Output Voltage Range (VDC)	Output Current (mA)	Max # LEDs	Efficiency typ. (%)
RACD06-350	universal	120	3-24	350	6 x 1W	79
RACD06-500	universal	120	3-14	500	12 x 0.5W	70
RACD06-700	universal	120	3-12	700	2 x 2W	72

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	6W nom. / 7.5W max.	
Input Frequency Range	47-63 Hz	
Power Factor	Full Load, 115VAC/230VAC	0.4
Output Voltage Range	350mA CC	3 - 22VDC
	0-300mA CV	24V
	500mA CC	3 - 12VDC
	0-490mA CV	14V
	700mA CC	3 - 8.4VDC
	0-600mA CV	12V
Inrush Current (<2mS)	115VAC/230VAC	10A max.
Leakage Current	115VAC/240VAC - 60/50Hz	0.4mA typ.
Input Fuse (Built-in)	Standard	T2A
Input Current	Full Load, Nominal Vin	see table
Output Current Accuracy (combined Tolerance, Load Regulation and Line Regulation)	±10%	
Minimum Load	Open Circuit Protected	1 LED
Output Ripple	0.2Ap-p max.	
Hold Up Time	18ms min.	
Operating Frequency	132kHz max.	
AC RMS Isolation Voltage (input to output)	3.75kV / 1 minute typ., 3kV / 1 minute min.	
Temperature Coefficient	±0.02%/°C typ.	
Overload Protection	120% typ.	
Short Circuit Protection	Continuous Current Limit	
Output Overvoltage Protection	350mA Version	24V Zener Diode Clamp
	500mA Version	14V Zener Diode Clamp
	700mA Version	12V Zener Diode Clamp
Overtemperature Protection	Shutdown, Automatic restart after cooling down	
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +65°C
	Case Temperature	80°C max.

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LIGHTLINE

AC/DC-Converter

with 3 year Warranty

RECOM

6 Watt Single Output



UL-8750 Certified
EN 61347 Certified
SEMKO Certified

RACD06

Please Read Application Notes

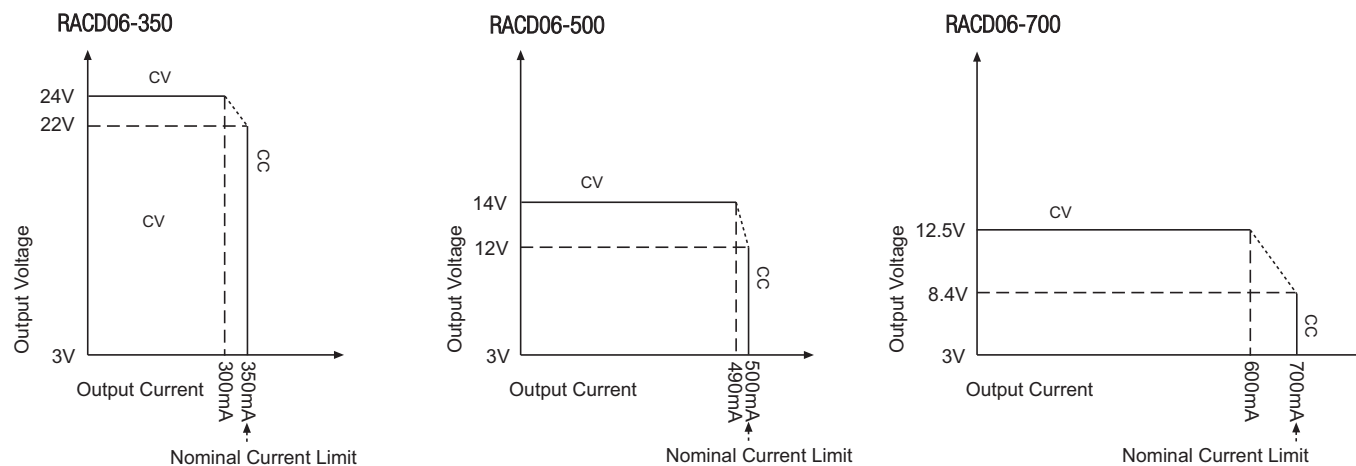
Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
IP Rating	IP20, Indoor Use Only	
Weight	34g	
Packing Quantity	1pc	
PCB Material	(UL94V-0)	Plastic Resin with Fibreglass
Case Material	(UL94V-0)	Plastic
Designed to meet Standards	Electrical Lighting, EMC Emissions Limits for Harmonics Emissions EMC Compatibility: Flicker and Voltage Variations Electrical Lighting: EMC Immunity Class II Power Supply Safety FCC	EN55015:2006 + A1: 2007 + A2:2009 EN 61000-3-2:2006 EN 61000-3-3:2006 EN 61547:1995 + A1:2000 UL1310 FCC18A
Certifications	LED Lighting Safety (E340696) General Safety Safety of AC supplied Control Gear for LED Modules	designed to meet UL8750 EN 61347-1: 2008 EN 61347-2-13: 2006
Design Lifetime	25°C ambient	>20 x 10 ³ hours in operation
Connections	AC Input LED Output	Screw terminal Screw Terminal*

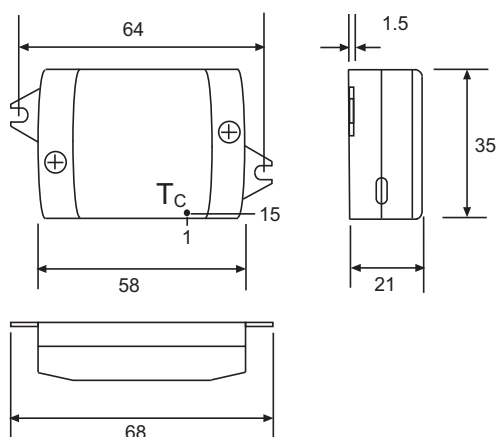
* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Characteristics

Constant Current (CC) and Constant Voltage (CV) Graph



Package Style and Pinning



2 Mounting screws are included

T_c = Case Temperature Measuring Point



Connections

CN1	Function
L	VAC in (L)
N	VAC in (N)
CN2	Function
+	LED+
-	LED-

Tolerance

XX = +/-0.5mm

XX.X = +/-0.25mm

Features

LED DRIVER

- Universal AC Input 90-295VAC
- 350mA, 500mA, 700mA Output
- Constant Current Operation
- Isolation 3.75kVAC
- Overcurrent and Short Circuit Protection
- IP67 Rated

Selection Guide

Part Number	Rated Power (W)	Output Current (mA)	Output Voltage (VDC)	Constant Current Range (VDC)	Efficiency (min.)
RACD07-350	7	350	21	10 - 20	70%
RACD07-500	7	500	14.5	5 - 14.5	70%
RACD07-700	7	700	11	3 - 10.5	70%

Specifications (measured at 115VAC / 230VAC and 25°C ambient temperature)

Input Voltage Range		90-295 VAC
Rated Power		7W nom.
Input Frequency Range		47-63Hz
Current Accuracy		±3% typ. / ±7% max.
Output Current Ripple		30mA _{p-p} typ.
Voltage Accuracy (includes load, line and tolerance)		±5%
AC Input Current		0.2A
Set Up Time		<1S
Hold-Up Time		18ms min.
Operating Frequency		45kHz
Isolation Voltage		3.75kVAC / 1 min
Short Circuit Protection		Continuous
Over Current Protection		Constant Current Mode Protection
Overload Protection		105% - 120% typ.
Output Overvoltage Protection		Zener Diode Clamp
Storage Humidity		10% - 90% RH
Operating Humidity		20% - 90% RH Non-Condensing
Weight		74g
Dimension		57 x 41 x 24mm
Packing Quantity		100pcs / Carton
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +40°C
	Case Temperature	65°C max.
Storage Temperature Range		-40°C to +80°C
IP Rating		IP67
Isolation Resistance		100MΩ / 500VDC at 25°C
PCB Material	(UL94V-0)	Plastic Resin with Fibreglass
Case Material	(UL94V-0)	Plastic
Safety Standards	General Safety (Report 1201032E-01)	EN61347-1
	LVD Safety (Report PSE101-0791)	EN61347-2-13
	EMC Harmonics (Report 1201032E-01)	EN61000-3-2
	EMC Flicker (Report 1201032E-01)	EN61000-3-3
	EMC Emissions (Report 1201032E-01)	EN55015
MTBF (+25°C)	using MIL-HDBK 217F	200 x 10 ³ hours min.

Notes:

1. Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.
2. The use of a circuit breaker with C-characteristic is recommended.

LIGHTLINE
AC/DC-Converter
with 3 year Warranty

RECOM

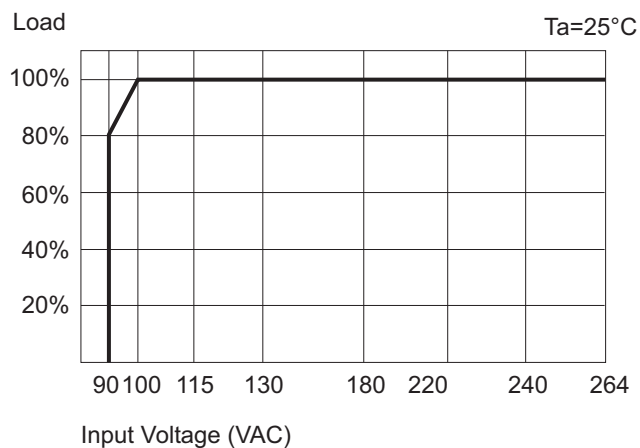
**7 Watt
Single
Output**



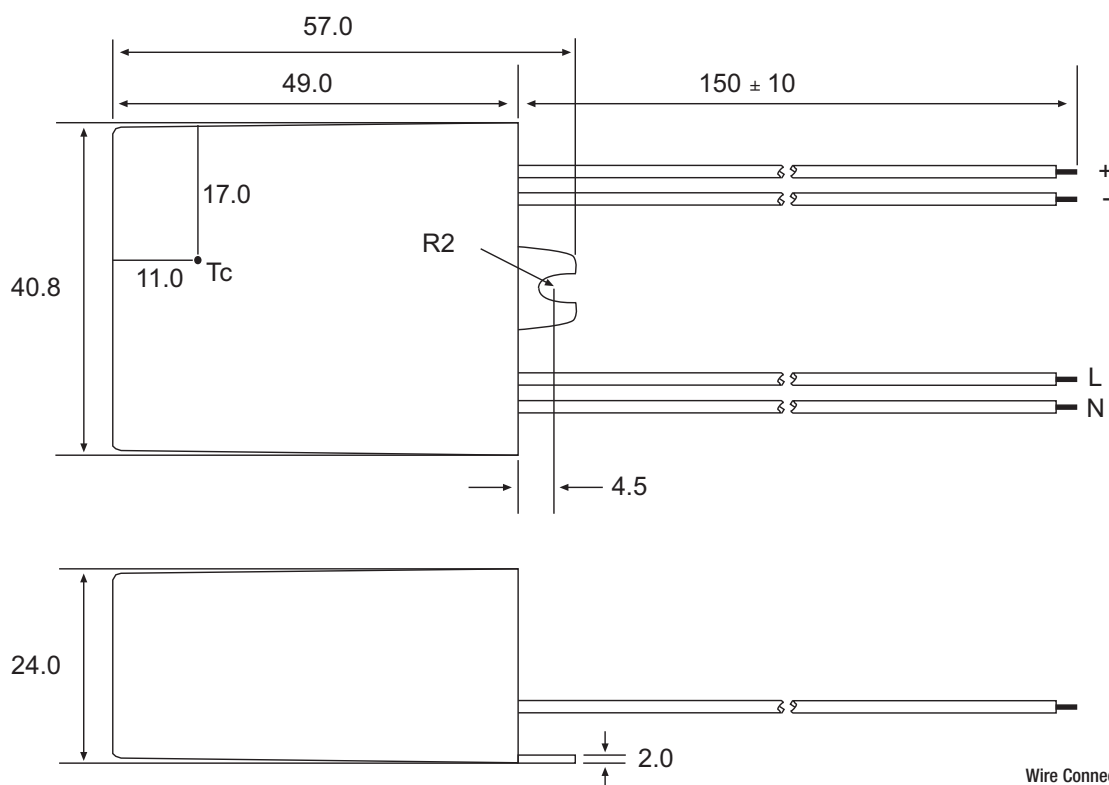
EN 61347 Certified
EN 61347-2-13 Certified

RACD07

Typical Characteristics



Package Style & Pinning



Wire Connections

Wire	Function
Red	LED+
Black	LED-
Brown	VAC in (L)
Blue	VAC in (N)

Tolerance

XX.X = +/- 0.2mm

Features

LED DRIVER

- 12W Class II AC/DC LED Power Supply
- 350mA or 700mA Constant Current Output
- Drives 1 - 10 High Brightness LEDs
- Universal AC Input
- Active Power Factor Corrected >0.95
- Fused Input, Protected Output
- 3kVAC Input/Output Isolation
- Output Socket Connector
- cUL/UL-8750 Certified
- Low Cost
- Long 5 Year Warranty

Description

A compact 12W constant current switching power module suitable for driving up to ten high power LEDs ($V_f = 3.6V$). The output current is fixed at 350mA, 500mA or 700mA. Active power factor correction is standard and the converters are UL8750 certified for use with LED assemblies. The driver modules features both screw terminal and socket output connections. The socket connector avoids the possibility of miswiring and damaging the LED load if the LEDs are pre-assembled into a wiring harness or lamp fitting.

Selection Guide

Part Number	Nominal Input Voltage (VAC)	Input Current at 230VAC (mA)	Output Voltage Range (VDC)	Output Current (mA)	Max # LEDs
RACD12-350	universal	200	3-36	350	10 x 1W
RACD12-500	universal	200	3-24	500	6 x 2W
RACD12-700	universal	200	3-17	700	4 x 2W, 8 x 1W

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90VAC-264VAC
Rated Power	12 Watts max.
Input Frequency Range	47-63 Hz
Power Factor	Full Load, 115VAC/230VAC 0.95
Open Circuit Voltage (Zener Clamp)	350mA Version 39VDC 500mA Version 26VDC 700mA Version 19VDC
Inrush Current (<2mS)	115VAC/230VAC 10A max.
Input Current	230VAC, Full Load 200mA max.
Leakage Current	115VAC/240VAC - 60/50Hz 0.5mA typ.
Input Fuse	Standard T1A
Output Current Accuracy	(combined Tolerance, Load Regulation and Line Regulation) $\pm 10\%$.
Minimum Load	Open Circuit Protected 1 LED
Hold Up Time	18ms min.
Operating Frequency	50-120kHz typ.
Efficiency at Full Load	78%
RMS Isolation Voltage (input to output)	3kVAC / 1 minute
Temperature Coefficient	$\pm 0.02\%/^{\circ}C$ typ.
Overload Protection	120% typ.
Short Circuit Protection	Continuous Current Limit
Output Overvoltage Protection	Zener Diode Clamp

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LIGHTLINE

AC/DC-Converter

with 5 year Warranty

RECOM

12 Watt PFC

Single

Output

eRL[®]us

E340696



UL-8750 Certified
cUL-8750 Certified
EN 61347 Certified

RACD12

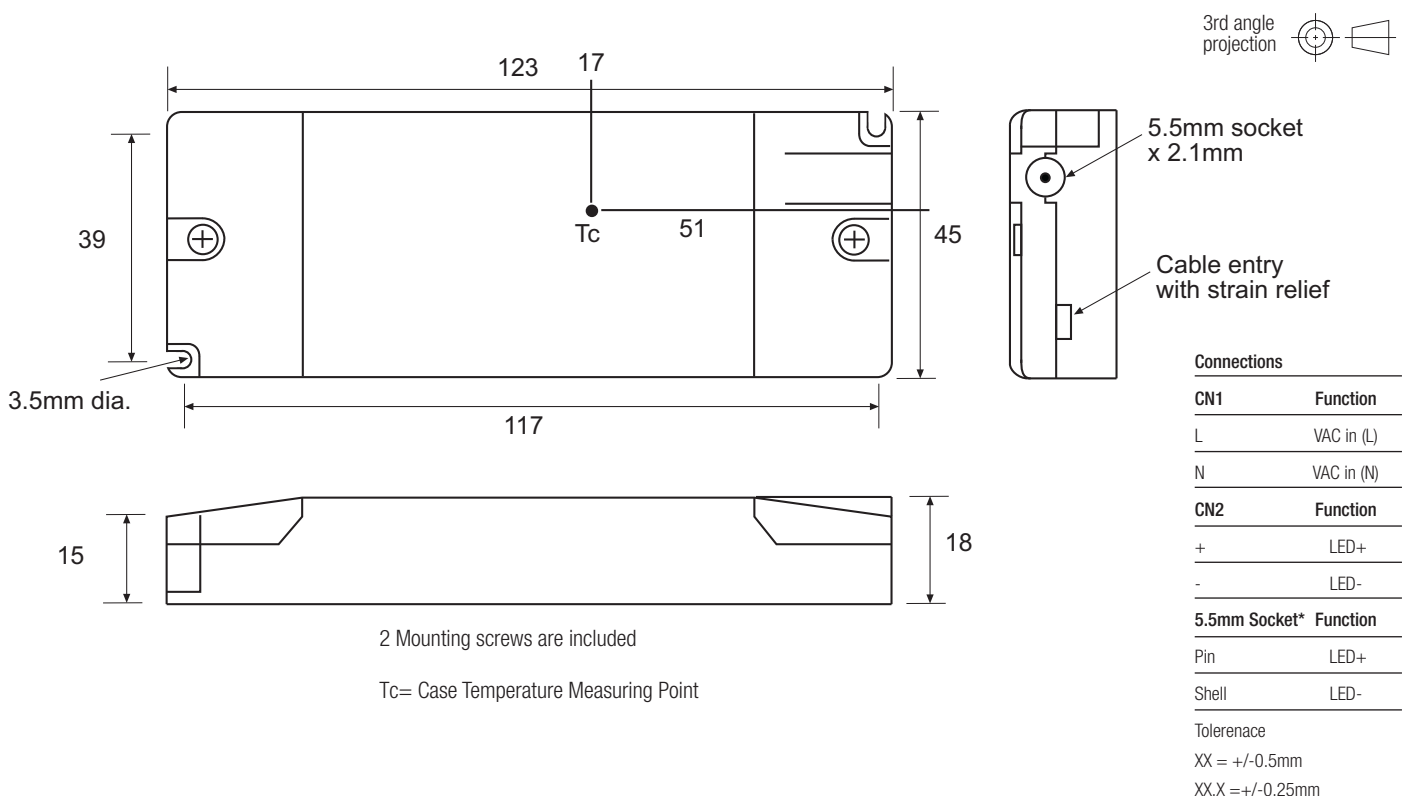
Please Read Application Notes

Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

Overtemperature Protection	Shutdown, Automatic restart after cooling down	
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +50°C
Weight	Case Temperature	85°C max.
Packing Quantity		100g
Storage Temperature Range		1pc
Humidity		-40°C to +100°C
IP Rating		95% RH max.
PCB Material		IP20, Indoor Use Only
Case Material		Plastic Resin with Fibreglass (UL94V-0)
Designed to meet Standards	Electrical Lighting, EMC Emissions Limits for Harmonics Emissions EMC Compatibility: Flicker and Voltage Variations Electrical Lighting: EMC Immunity Class II Power Supply Safety FCC	EN55015:2006 + A1: 2007 + A2:2009 EN 61000-3-2:2006 EN 61000-3-3:2006 EN 61547:1995 + A1:2000 complies with UL1310 complies with FCC18A
THD		<20%
Certifications	LED Lighting Safety LED Lighting Safety (Canada) SEMKO CE Certification, General Safety SEMKO CE Certification, Safety of AC supplied Control Gear for LED Modules	UL8750 cUL8750 EN 61347-1: 2008 EN 61347-2-13: 2006
Design Lifetime	25°C ambient	>70 x 10 ³ hours in operation
Connections	AC Input LED Output LED Output	Screw terminal Screw Terminal 5.5mm Socket with 2mm Pin (Suitable matching plug Switchcraft S760 or similar)*

* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Package Style and Pinning



Features

LED DRIVER

- 20W Class II AC-DC LED Power Supply
- 350mA , 500mA, 700mA or 1050mA Outputs
- Drives 2 - 15 high brightness LEDs
- Universal AC Input
- Active Power Factor Correction >0.95
- Fused Input, Protected Output
- 3kVAC Isolation
- cUL/UL8750 Certified, CE Marked
- Output Connector to avoid miswiring
- Low Cost
- Long 5 Year Warranty

Description

A compact 20W constant current switching power module suitable for driving high power LEDs ($V_f = 3.6V$). The output current is fixed at 350mA, 500mA, 700mA or 1050mA. Active power factor correction is standard.

This series features both screw terminal and socket output connections. The socket connector avoids the possibility of miswiring and damaging the LED load if the LEDs are preassembled into a wiring harness or lamp fitting.

Selection Guide

Part Number	Input Voltage Range (VAC)	Input Current at full load (mA)	Nom. Output Voltage Range (VDC)	Output Current (mA)	Max # LEDs
RACD20-350	universal	260	6-56	350	15 x 1W
RACD20-500	universal	260	6-40	500	11 x 2W
RACD20-700	universal	260	6-29	700	8 x 2W, 8+8 x 1W
RACD20-1050	universal	260	5-17	1050	6 x 3W, 5+5 x 2W

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	Standard	90-264VAC
Rated Power		20 Watts max.
Input Frequency Range		47-63 Hz
Power Factor	Full Load, 115VAC/230VAC	0.95
Open Circuit Voltage	350mA Version	57VDC
(Zener Clamp)	500mA Version	43VDC
	700mA Version	32VDC
	1050mA Version	19VDC
Inrush Current (<2mS)	115VAC/230VAC	10A max.
Input Current	230VAC, Full Load	260mA typ.
Leakage Current	115VAC/240VAC - 60/50Hz	0.5mA typ.
Input Fuse	Standard	T1A
Output Current Accuracy	(combined Tolerance, load Regulation and Line Regulation)	±10%
Minimum Load	Open Circuit Protected	2 LEDs
Hold Up Time		18ms min.
Operating Frequency		40 - 100 kHz typ.
Efficiency at Full Load		83%
RMS Isolation Voltage (input to output)		3kVAC / 1 minute
Temperature Coefficient		±0.02%/°C typ.
Overload Protection		120% typ.
Short Circuit Protection		Continuous Current Limit
Output Overvoltage Protection		Zener Diode Clamp

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LIGHTLINE

AC/DC-Converter
with 5 year Warranty

RECOM

20 Watt PFC Single Output


E340696



UL 8750 Certified
cUL 8750 Certified*
EN 61347 Certified

RACD20

* RACD20-700 and -1050
only has cUL

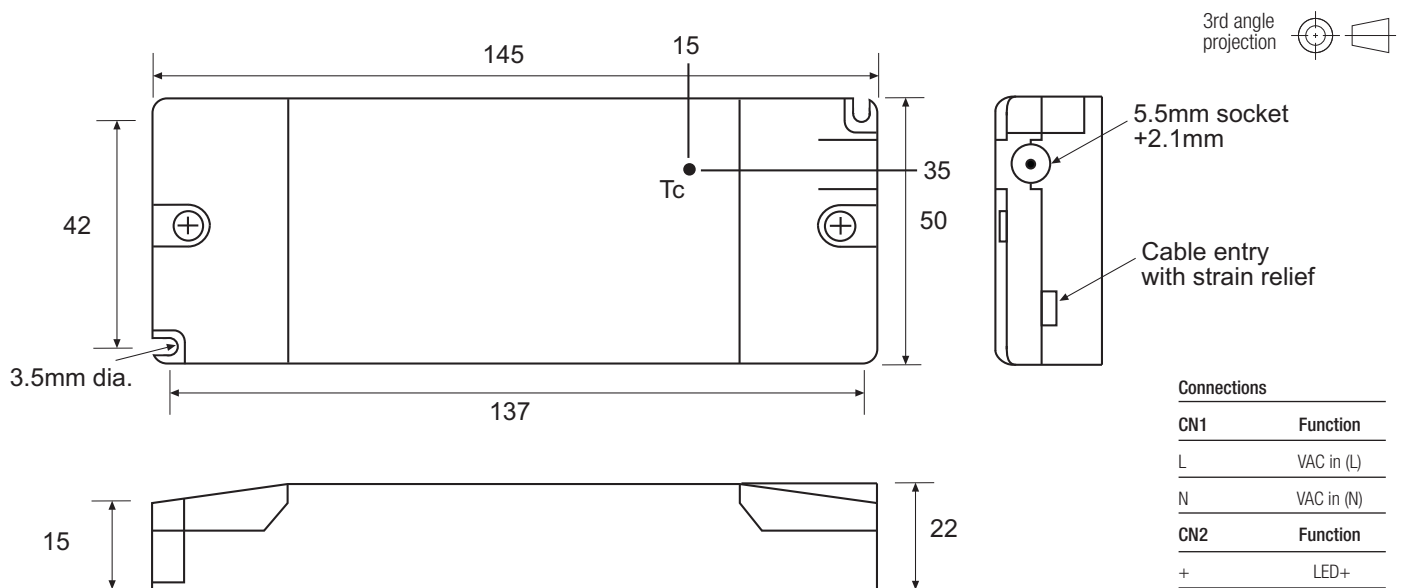
Please Read Application Notes

Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

Overtemperature Protection	Shutdown, Automatic restart after cooling down	
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +50°C
	Case Temp.	85°C max. (350mA version: 90°C max.)
Weight	140g	
Packing Quantity	1pc	
Storage Temperature Range	-40°C to +100°C	
Humidity	95% RH max.	
IP Rating	IP20, Indoor Use Only	
PCB Material	Plastic Resin with Fibreglass (UL94V-0)	
Case Material	Plastic	
Designed to meet Standards	Electrical Lighting, EMC Emissions	EN55015:2006 + A1: 2007 + A2:2009
	Limits for Harmonics Emissions	EN 61000-3-2:2006
	EMC Compatibility: Flicker and Voltage Variations	EN 61000-3-3:2006
	Electrical Lighting: EMC Immunity	EN 61547:1995 + A1:2000
	Class II Power Supply Safety	complies with UL1310
	FCC	complies with FCC18A
THD	<20%	
Certifications	LED Lighting Safety	UL8750
	LED Lighting Safety (Canada)	cUL8750 (RACD20-700 only)
	SEMKO CE Certification, General Safety	EN 61347-1: 2008
	SEMKO CE Certification, Safety of AC supplied Control Gear for LED Modules	EN 61347-2-13: 2006
Design Lifetime	25°C ambient	>70 x 10 ³ hours in operation
Connections	AC Input	Screw terminal
	LED Output	Screw Terminal
	LED Output	5.5mm Socket with 2mm Pin (Suitable matching plug Switchcraft S760 or similar)*

* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Package Style and Pinning



2 Mounting screws are included

Tc=Case Temperature Measuring Point

Connections	
CN1	Function
L	VAC in (L)
N	VAC in (N)
CN2	Function
+	LED+
-	LED-
5.5mm Socket*	Function
Pin	LED+
Shell	LED-
Tolerance	
XX = +/-1mm	
XX.X = +/-0.5mm	

Features LED DRIVER

- 20W Class II AC-DC LED Power Supply
- 350mA, 500mA, 700mA, 1050mA Output
- Universal AC Input (90-305VAC)
- Active Power Factor Correction
- Isolation Voltage 3.75kVAC
- Efficiency to 80%
- EN and UL Certified
- Low Cost

Selection Guide

Part Number	Input Range (VAC)	Output Current (mA)	Output Voltage (VDC)	Efficiency (typ.)
RACD20-350/277	90 - 305	350	28 - 57	80%
RACD20-500/277	90 - 305	500	20 - 40	80%
RACD20-700/277	90 - 305	700	14 - 29	80%
RACD20-1050/277	90 - 305	1050	10.8 - 19	80%

Specifications

Input Voltage Range	90-305 VAC	
Output Power Range	other types	10 Watts min., 20 Watts max.
	1050mA Version	12 Watts min., 20 Watts max.
Input Frequency Range	50/60 Hz typ.	
Power Factor	Full Load, 115VAC	>0.90
	Full Load, 230VAC	>0.90
	Full Load, 277VAC	>0.85
Open Circuit Voltage	350mA Version	59 VDC
	500mA Version	44 VDC
	700mA Version	33 VDC
	1050mA Version	23 VDC
No Load Power Consumption	2 Watts max.	
Input / Output Isolation	3750 VAC / 1 minute	
Operating Frequency	50/60 Hz	
Overload Protection	105% ~ 110%	
Weight	195g	
Dimension Drawing	80 x 74 x 26.5mm	
THD	<20%	
Temperature Coefficient	according to standards	
Operating Temperature	-20°C to +50°C	
Storage Temperature	-40°C to +80°C	
Max. Case Temperature (Tc)	90°C	
Acoustic Noise	30dB (10cm)	
IP Rating	IP66	
Certifications	Safety	EN61547-1 EN61347-2-13 UL1310 Class B, UL8750
	Harmonics	EN61000-3-2 Class C
	EMC	EN55015 Class B FCC Part 18 Class B
Design Lifetime	50 x 10 ³ hours	

LIGHTLINE
AC/DC-Converter
with 5 year Warranty

RECOM

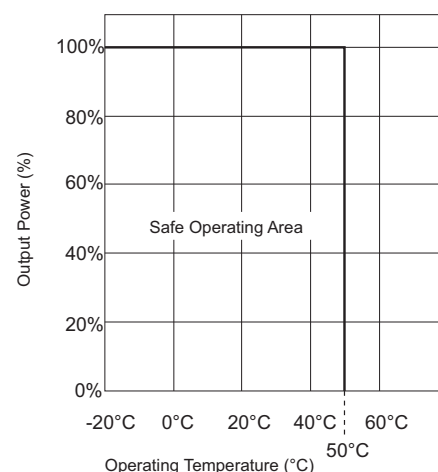
20 Watt PFC Single Output



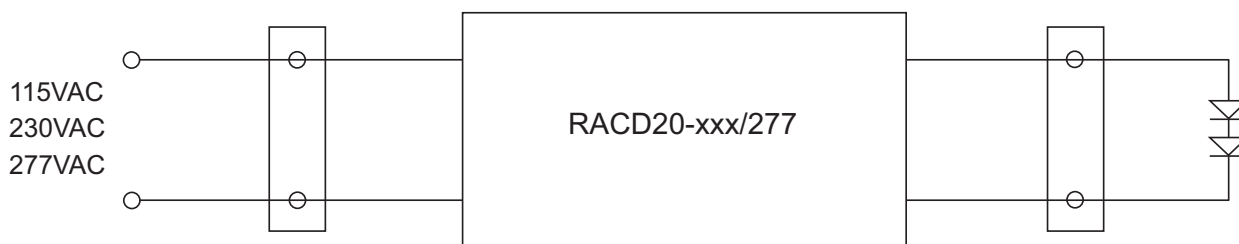
UL 8750 Certified
EN 61347 Certified

RACD20/277

Derating-Graph (Ambient Temperature)



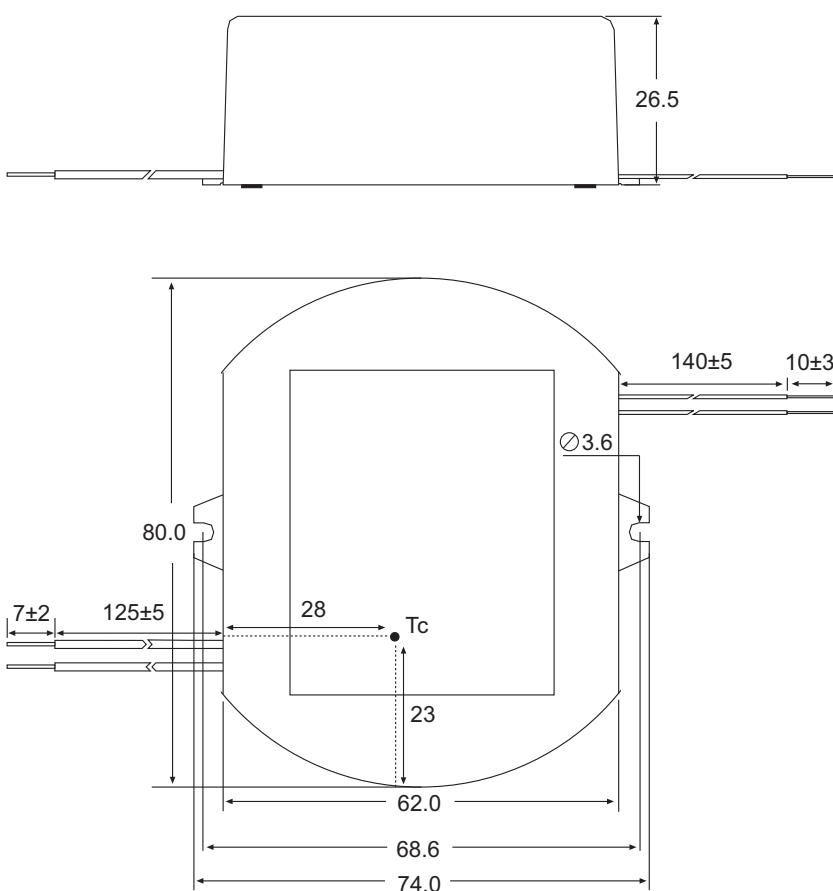
Standard Application Circuit



Notes:

- LED power supply is internally fused. No external fuse is required.
- Do not connect or disconnect LED load while the converter is on. This may damage the LED or reduce its life.
- Class 2 Power supply

Standard Package Style & Pinning



3rd angle projection

Wire Connections

Wire	Function
Brown	VAC in (L)
Blue	VAC in (N)
Red	LED+
Black	LED-

Tolerance

XX = +1mm/ -0.5mm

XX.X = +/- 0.25mm

Features

LED DRIVER

- 20W Class II AC-DC LED Power Supply
- 2x Independent Constant Current Outputs or Single High Current Output (Jumper selectable)
- 1-10V or Rheostat Dimmable (15%~100%)
- 3kVAC Isolation
- Active Power Factor Correction >0.95
- Fused Input, Protected Outputs
- CE Marked
- Long 5 Year Warranty

Description

A compact 20W constant current switching power module suitable for driving either two independent strings of LEDs or a single string high power LEDs (mode selection is via a jumper under the output cover plate). When used in dual output mode, the two outputs are independently regulated and can be used with asymmetric LED loads. The output current can be dimmed using either an external 150kOhm rheostat or via a 1-10V external voltage. Active power factor correction is standard. Connections are via screw terminals and the AC input feature loop-through connections to allow daisy-chaining of the converters.

Selection Guide

Part Number	Input Voltage Range (Nominal VAC)	Input Current at full load (mA)	Output Voltage Range (VDC)	Output Current (mA)	Max # LEDs
RACD20-350D (700mA single output mode)	230VAC	260	2x (3-34) 3-34	2x (50~350) 100~700	2x (10 x 1W) 10 x 2W
RACD20-350D-US (700mA single output mode)	110VAC	510	2x (3-34) 3-34	2x (50~350) 100~700	2x (10 x 1W) 10 x 2W
RACD20-500D (1050mA single output mode)	230VAC	260	2x (3-20) 3-20	2x (50~500) 100~1050	2x (6 x 2W) 6 x 3W
RACD20-500D-US (1050mA single output mode)	110VAC	510	2x (3-20) 3-20	2x (50~500) 100~1050	2x (6 x 2W) 6 x 3W

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	230VAC 110VAC	200-264VAC 90-130VAC
Rated Power		20 Watts max.
Input Frequency Range		47-63 Hz
Power Factor	Full Load, 115VAC/230VAC	0.95
Output Voltage Range	350mA Dual Output Mode 700mA Single Output Mode 500mA Dual Output Mode 1050mA Single Output Mode	3-34VDC + 3-34VDC 3-34VDC 3-20VDC + 3-20VDC 3-20VDC
Inrush Current (<2mS)	115VAC/230VAC	10A max.
Input Current	230VAC, Full Load	260mA typ.
Leakage Current	115VAC/240VAC - 60/50Hz	0.5mA typ.
Input Fuse	115VAC/230VAC	T2A/T1A
Output Current Accuracy	(combined Tolerance, load Regulation and Line Regulation)	±10%
Minimum Load	Open Circuit Protected	1 LED
Output Ripple		150mA max.
Hold Up Time		18ms min.
Operating Frequency		40 - 100 kHz typ.
Efficiency at Full Load	230VAC	>80%
RMS Isolation Voltage (input to output)		3kVAC / 1 minute
Temperature Coefficient		±0.02%/°C typ.
Overload Protection		120% typ.
Short Circuit Protection		Continuous Current Limit

continued on next page

LIGHTLINE

AC/DC-Converter

with 5 year Warranty

RECOM

20 Watt PFC Single/Dual Dimmable



EN 61347 Compliant

RACD20-D

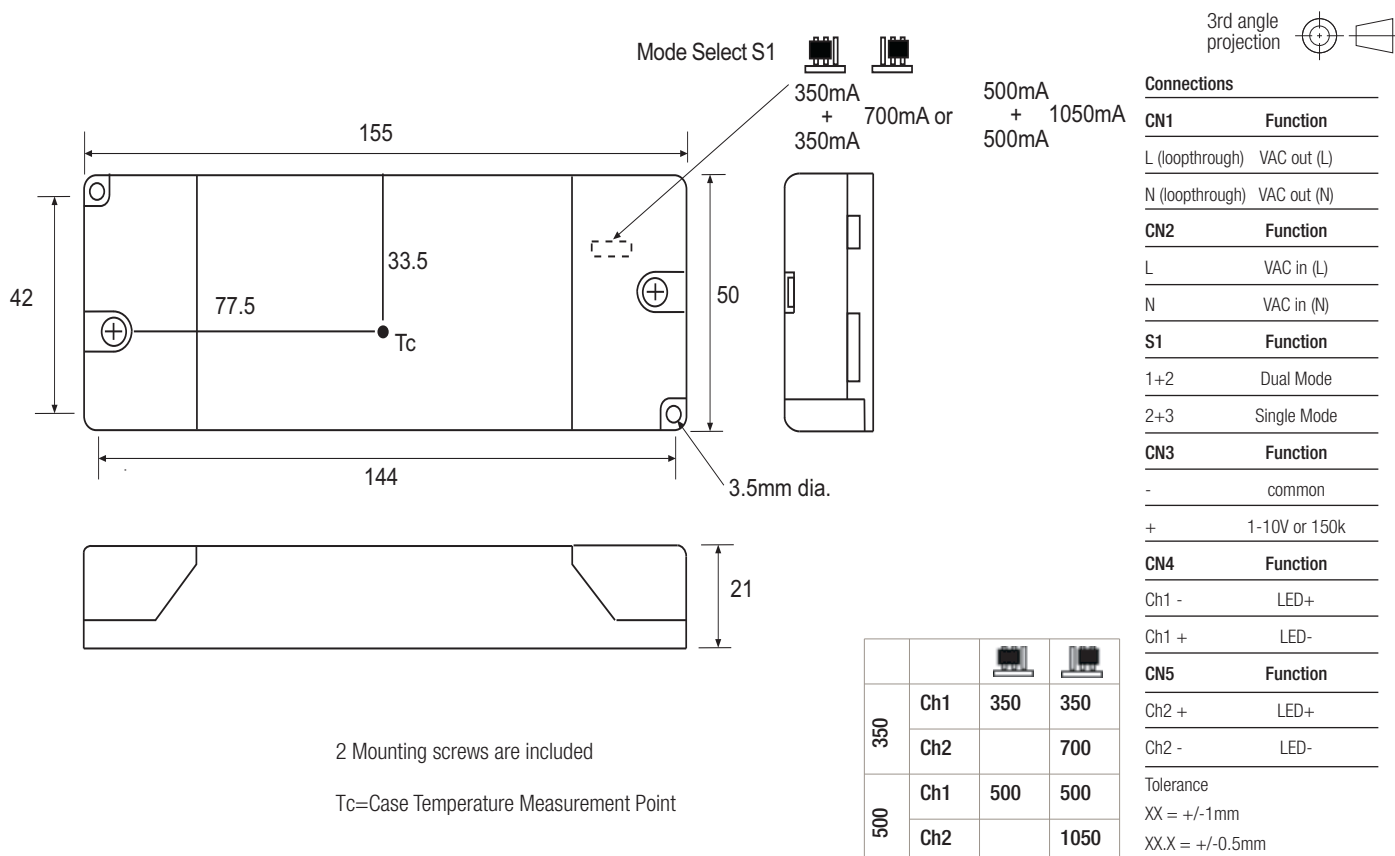
Please Read Application Notes

Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

Dimming Control	Rheostat (15%~100%)	0-150kOhm	External Voltage (15%-100%)	1-10VDC
Overtemperature Protection				Shutdown, Automatic restart after cooling down
Operating Temperature Range (free air convection)	Ambient Temperature			-20°C to +40°C Case Temp. 85°C max.
Weight				140g
Packing Quantity				1pc
Storage Temperature Range				-40°C to +100°C
Humidity				95% RH max.
IP Rating				IP20, Indoor Use Only
PCB Material				Plastic Resin with Fibreglass (UL94V-0)
Case Material				Plastic
Designed to meet Standards	Electrical Lighting, EMC Emissions Limits for Harmonics Emissions EMC Compatibilty: Flicker and Voltage Variations Electrical Lighting: EMC Immunity Class II Power Supply Safety FCC	EN55015:2006 + A1: 2007 + A2:2009 EN 61000-3-2:2006 EN 61000-3-3:2006 EN 61547:1995 + A1:2000 UL1310 FCC18A		
THD				<20%
Certifications	LED Lighting Safety Certification, General Safety	designed to meet UL8750 designed to meet EN 61347-1: 2008		
Design Lifetime	25°C ambient			>70 x 10 ³ hours in operation
Connections	AC Input AC Output (loop through) LED Outputs	Screw terminal Screw terminal Screw Terminal*		

* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Package Style and Pinning



Features

LED DRIVER

- 20W Dimmable AC-DC LED Power Supply
- 350mA, 500mA, 700mA or 1050mA Outputs
- Drives 5 - 15 High Brightness LEDs
- Deep Dimming to 0% *
- Active Power Factor Correction >0.95
- 3.75kVAC Isolation
- Output Connector to avoid miswiring
- 5 Year Warranty

Description

The RACT20 series is a constant current dimmable AC/DC source for driving high power LED applications. The phase angle dimming function works with leading or trailing edge dimmers. This driver is suitable for indoor LED lighting systems and powers 5-15 high power LEDs or single LED arrays from 350mA up to 1A.

Selection Guide

Part Number	Input Voltage (VAC)	Output Current (mA)	Output Voltage (VDC)	Dimming Control	Efficiency typ. (%)	Max. # LEDs
RACT20-350	230	350	30-56	Triac	82	15 x 1W
RACT20-500	230	500	21-39	Triac	82	12 x 1W
RACT20-700	230	700	15-28	Triac	81	8 x 2W, 8+8 x 1W
RACT20-1050	230	1050	12-18	Triac	81	5 x 3W, 5+5 x 2W
RACT20-350-US	115	350	30-56	Triac	82	15 x 1W
RACT20-500-US	115	500	21-39	Triac	82	12 x 1W
RACT20-700-US	115	700	15-28	Triac	81	8 x 2W, 8+8 x 1W
RACT20-1050-US	115	1050	12-18	Triac	81	5 x 3W, 5+5 x 2W

Specifications (typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Input Voltage Range	RACT20-xxxx	180-264VAC
	RACT20-xxxx-US	90-135VAC
Rated Power		20W max.
Output Current Accuracy		±5% max.
Input Current	115VAC	0.4A max.
	230VAC	0.2A max.
Input Frequency Range		47-63Hz
Power Factor	Full Load, 115VAC	>0.95
Leakage Current	230VAC	<0.75mA
Open Circuit Voltage (No Load V _{out})	350mA	60VDC max.
	500mA	44VDC max.
	700mA	33VDC max.
	1050mA	22VDC max.
Output Ripple and Noise	350mA, 500mA	4.5Vp-p max.
	700mA, 1050 mA	4.0Vp-p max.
Short Circuit Protection		Hiccup mode, Auto recovery
Overtemperature Protection	95°C ±10°C (RT1)	Hiccup mode, Auto recovery
Isolation Voltage	1 minute	3750VAC
Efficiency at Full Load		see selection guide
Dimming	AC phase-cut dimming, work with leading/trailing edge dimmers	
Operating Temperature	(Ambient Temperature)	-30°C to +50°C
Storage Temperature		-40°C to +85°C
Relative Humidity		95% RH
EMC	design refer to EN55022	Class B
IP Rating	suitable for indoor LED lighting system	IP20
Design Lifetime	25°C ambient	>70 x 10 ³ hours in operation
Package Weight		145g
Packing Quantity		1 pc.
PCB Material		Plastic Resin with Fibreglass (UL94V-0)
Case Material		Plastic
Connections	AC Input	Screw Terminal
	LED Output	Screw Terminal
	LED Output	5.5mm Socket with 2mm Pin
		(suitable matching plug Switchcraft S760 or similar)**

*The triac dimmer must be capable of dimming down to zero

** Do not connect or disconnect the LED load while the driver is on. This may damage the LED or reduce its life.
continued on next page

LIGHTLINE

AC/DC-Converter

with 5 year Warranty

RECOM

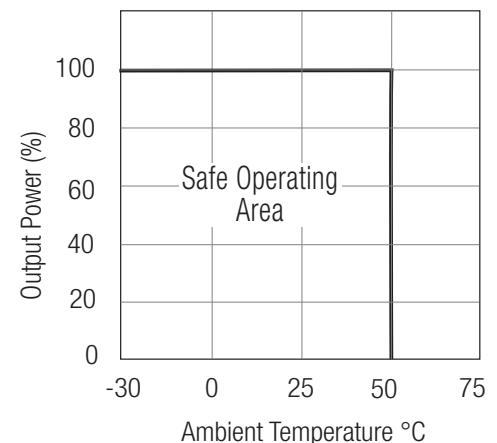
20W Triac Dimmable LED Driver



UL-8750 certified
UL-60950-1 certified
European Version only:
EN-61347 certified

RACT20

Derating Graph



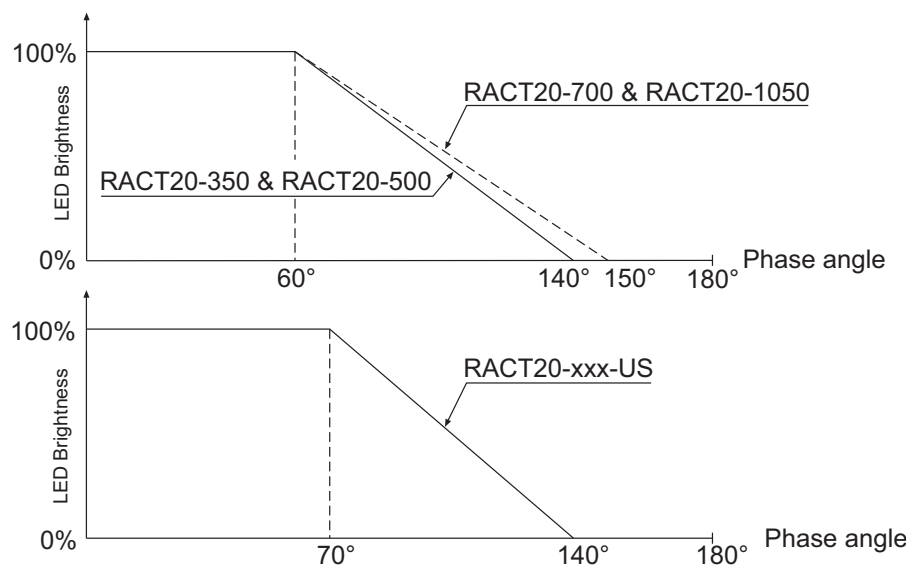
Please Read Application Notes

Specifications

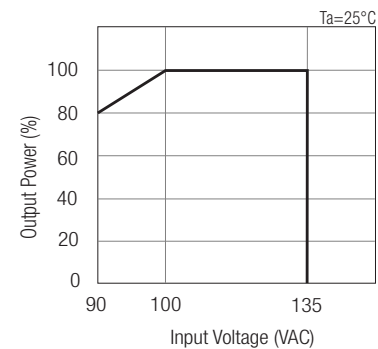
Designed to meet Standards	Lamp Controlgear	EN61347-2-13:2006 EN61347-1:2008 EN55015:2006 + A2:2009 EN 61000-3-2:2006 + A2:2009 EN 61000-3-3:2006 EN 61547:2009 IEC61000-4-2:2008 IEC61000-4-3:2006 + A1:2007 + A2:2010 IEC61000-4-4:2004 + A1:2010 IEC61000-4-5:2005 IEC61000-4-6:2008 IEC61000-4-8:2009 IEC61000-4-11:2004 FCC15B
Certifications	FCC LED Lighting Safety Information Technology Equipment - Safety	UL8750 UL60950-1 CAN/CSA C22.2 No. 60950-1-07

Characteristics

Dimming Response

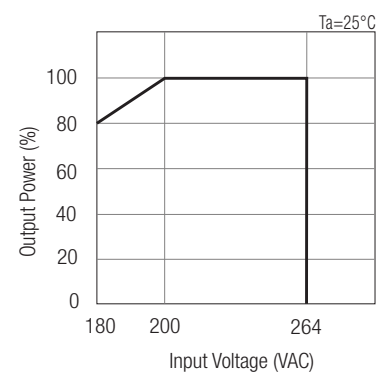


115VAC - Version

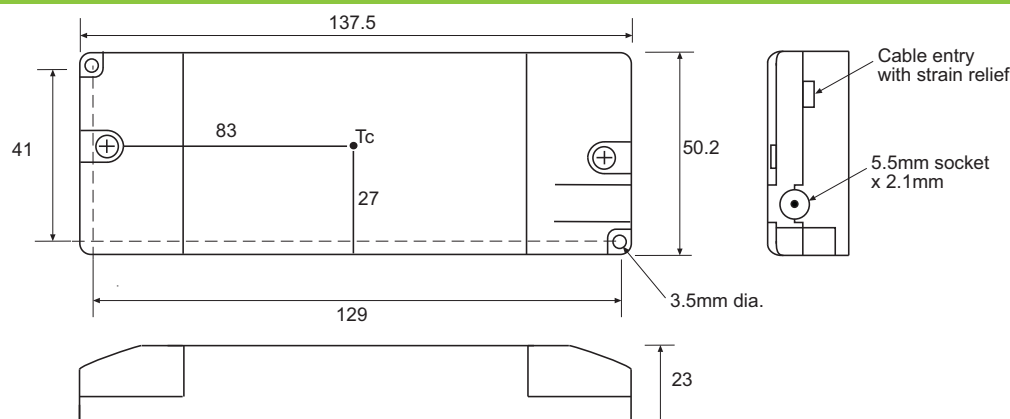


Note: The us

230VAC - Version



Package Style and Pinning



Connections

CN1	Function
L	VAC in (L)
N	VAC in (N)
CN2	Function
+	LED+
-	LED-
5.5mm Socket*	Function
Pin	LED+
Shell	LED-

Tolerance
XX = +/-1mm
XX.X = +/-0.5mm

Features

LED DRIVER

- 25W Class II AC-DC LED Power Supply
- 350mA, 700mA, 1050mA Output
- Active Power Factor Correction >0.90
- Efficiency to 85%
- EN and UL

Selection Guide

Part Number	Rated Power (W)	Output Current (mA)	Output Voltage (VDC)	Efficiency (typ.)
RACD25-500	25	500	42 - 52	82%
RACD25-700	25	700	21 - 36	85%
RACD25-1050	25	1050	16 - 24	84%
RACD25-1400	25	1400	12-18	83%

Specifications (measured at 230VAC and 25°C ambient temperature)

Input Voltage Range	90-295 VAC or 127-417 VDC		
Input Frequency Range	47-63Hz		
Power Factor	C characteristic is suggested		Full Load, 240VAC
			Full Load, 115VAC
Current Accuracy	700mA Version		±7%
	others		±8%
AC Input Current	120VAC		0.4A
	240VAC		0.2A
Inrush Current (<2ms)	264VAC		Cold Start 20A
Isolation Voltage	3.75kVAC		
Short Circuit Protection	Continuous		
Over Voltage Protection	110% - 150%		
Over Temperature Protection	Rth	Internal Thermistor	
	Type	Auto-Recovery Mode	
Vibration	10-500Hz	2G for 60 min. each along X, Y, Z axes	
Storage Humidity	10% - 95% RH		
Operating Humidity	20% - 95% RH Non-Condensing		
Weight	220g		
Dimension	174.5 x 30.5 x 25mm		
Operating Temperature	-20°C to +50°C		
Storage Temperature	-40°C to +80°C		
Ripple & Noise	3V max.		
IP Rating	IP65		
Isolation Resistance	100MΩ / 500VDC at 25°C		
Safety Standards	EN61347-1		
	EN61347-2-13		
	UL8750		
	EN61000-3-2 Class C		
	EN61000-4-2,3,4,5,6,11		
	EN61547		
	EN55015 FCC15		
MTBF (+25°C)	using MIL-HDBK 217F		200 x 10³ hours
Desing Lifetime	70 x 10³ hours		

The use of a circuit breaker with C-characteristic is recommended.

LIGHTLINE

AC/DC-Converter

with 5 year Warranty

RECOM

25 Watt PFC Single Output



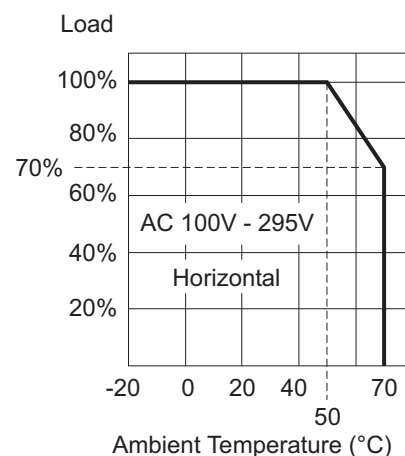
CE



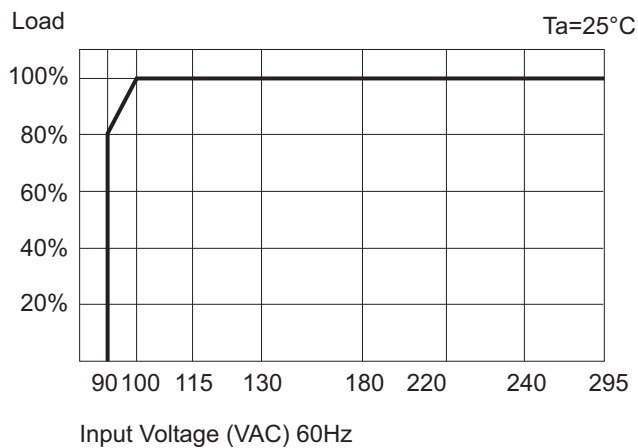
UL 8750 Certified
EN 61347 Certified

RACD25

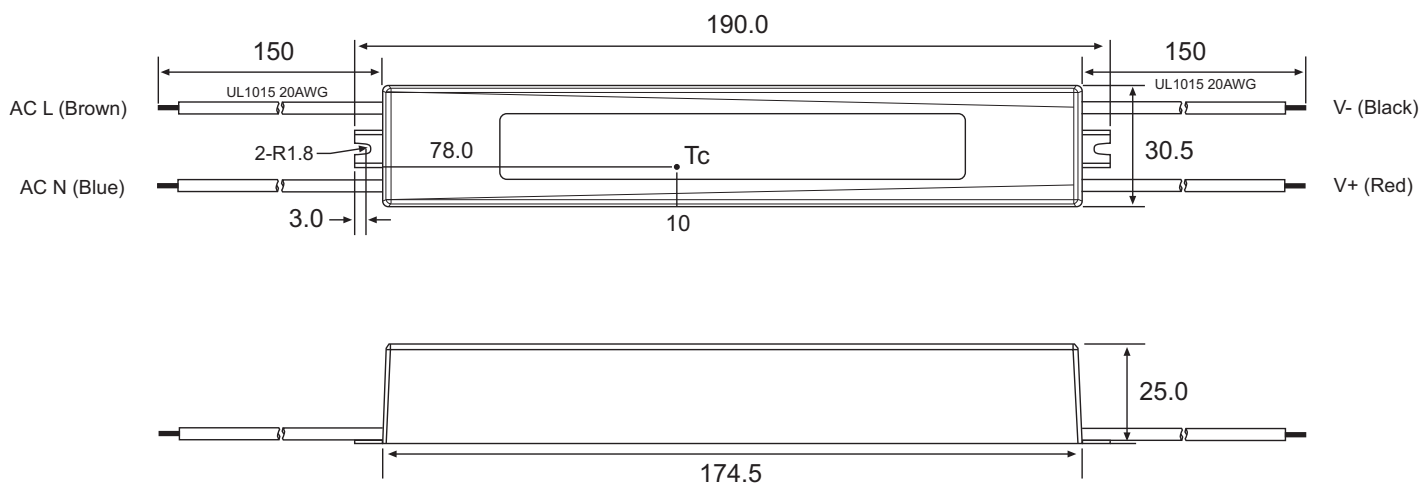
Derating-Graph (Ambient Temperature)



Typical Characteristics



Package Style & Pinning



Features

LED DRIVER

- 30W Class II AC-DC LED Power Supply
- 500mA or 700mA Constant Current
- Drives 3 - 15 High brightness LEDs
- Universal AC Input
- Active Power Factor Correction >0.95
- Fused Input, Protected Output
- 3kVAC Isolation
- UL-8750 Certified
- Output Connector to avoid miswiring
- Low Cost
- Long 5 Year Warranty

Description

A compact 30W constant current switching power module suitable for driving up to 15 high power LEDs ($V_f = 3.6V$). The output current is fixed at 500mA or 700mA. Active power factor correction is standard.

This series features both screw terminal and socket output connections. The socket connector avoids the possibility of miswiring and damaging the LED load if the LEDs are preassembled into a wiring harness or lamp fitting.

Selection Guide

Part Number	Input Voltage Range (VAC)	Input Current at full load (mA)	Output Voltage Range (VDC)	Output Current (mA)	Max # LEDs
RACD30-500	universal	390	10-56	500	15 x 2W
RACD30-700	universal	390	10-43	700	12 x 3W, 12+12 x 1W

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	Standard	90-264VAC
Rated Power		30 Watts max.
Input Frequency Range		47-63 Hz
Power Factor	Full Load, 115VAC/230VAC	0.9
Open Circuit Voltage (Zener Clamp)	500mA Version	58VDC
	700mA Version	48VDC
Inrush Current (<2ms)	115VAC/230VAC	10A max.
Input Current	230VAC, Full Load	390mA typ.
Leakage Current	115VAC/240VAC - 60/50Hz	0.5mA typ.
Input Fuse	Standard	T1A
Output Current Accuracy	(combined Tolerance, load Regulation and Line Regulation)	±10%
Minimum Load	Open Circuit Protected	3 LEDs
Hold Up Time		18ms min.
Operating Frequency		40 - 100 kHz typ.
Efficiency at Full Load		85%
RMS Isolation Voltage (input to output)		3kVAC / 1 minute
Temperature Coefficient		±0.02%/°C typ.
Overload Protection		120% typ.
Short Circuit Protection		Continuous Current Limit
Output Overvoltage Protection	500mA Version	56V Zener Diode Clamp
	700mA Version	43V Zener Diode Clamp

continued on next page

LIGHTLINE

AC/DC-Converter

with 5 year Warranty

RECOM

30 Watt PFC

Single Output



E340696



UL-8750 Certified

EN 61347 Certified

RACD30

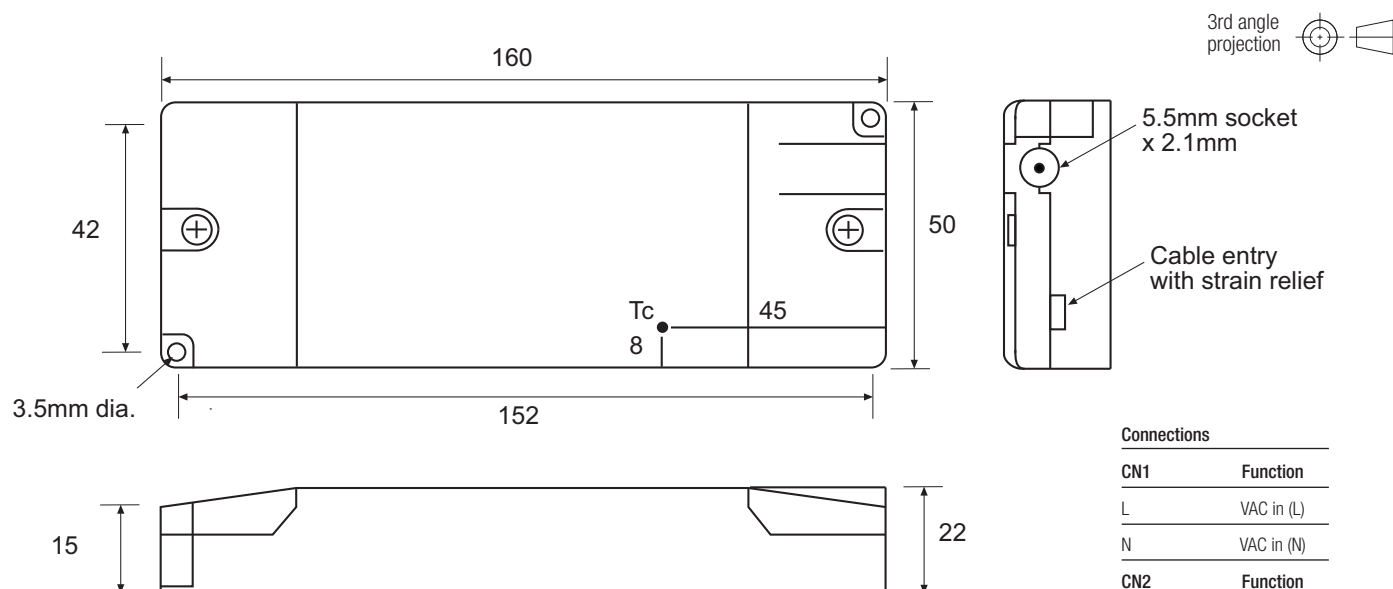
Please Read Application Notes

Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

Overtemperature Protection	Shutdown, Automatic restart after cooling down	
Operating Temperature Range (free air convection)	Ambient Temperature	-20°C to +50°C
	Case Temp.	85°C max. (500mA version: 90°C max.)
Weight	169g	
Packing Quantity	1pc	
Storage Temperature Range	-40°C to +100°C	
Humidity	95% RH max.	
IP Rating	IP20, Indoor Use Only	
PCB Material	Plastic Resin with Fibreglass (UL94V-0)	
Case Material	Plastic	
Designed to meet Standards	Electrical Lighting, EMC Emissions	EN55015:2006 + A1: 2007 + A2:2009
	Limits for Harmonics Emissions	EN 61000-3-2:2006
	EMC Compatibility: Flicker and Voltage Variations	EN 61000-3-3:2006
	Electrical Lighting: EMC Immunity	EN 61547:1995 + A1:2000
	Class II Power Supply Safety	UL1310
	FCC	FCC18A
THD	<20%	
Certifications	LED Lighting Safety	UL8750
	SEMKO CE Certification, General Safety	EN 61347-1: 2008
	SEMKO CE Certification, Safety of AC supplied Control Gear for LED Modules	EN 61347-2-13: 2006
Design Lifetime	25°C ambient	>70 x 10 ³ hours in operation
Connections	AC Input	Screw terminal
	LED Output	Screw Terminal
	LED Output	5.5mm Socket with 2mm Pin (Suitable matching plug Switchcraft S760 or similar)*

* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or reduce its life.

Package Style and Pinning



2 Mounting screws are included
Tc=Case Temperature Measuring Point

Connections

CN1	Function
L	VAC in (L)
N	VAC in (N)
CN2	Function
+	LED+
-	LED-
5.5mm Socket	Function
Pin	LED+
Shell	LED-

Tolerance

XX = +/-1mm

XX.X = +/-0.5mm

Features LED DRIVER

- Constant Voltage Output
- cUL/CE Certified
- Power Factor Corrected
- Short Circuit, Overload and Overtemperature Protected

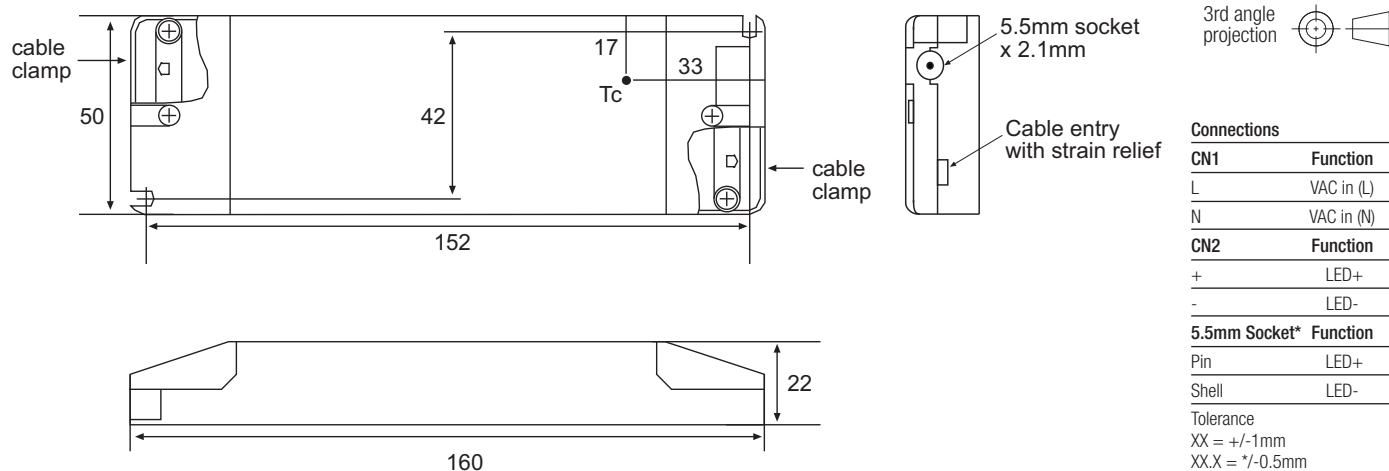
Selection Guide

Part Number	Input Voltage (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)
RACV30-24	100-240	24	0-1250	84
RACV30-12	100-240	12	0-2500	83

Specifications (typical at 25°C, nominal input voltage and full load)

Input Voltage Range		90-264VAC or 140-370VDC
Input Frequency Range		47-63Hz
Input Current	(Full Load)	< 380mA
Power Factor Correction	(Full Load)	>0.92
Inrush Current	(2ms peak)	30A max.
Input Fuse		internal 2A/250V
Output Voltage Accuracy	(Output Load min <-> max)	±5%
Load Regulation	(Output Load min <-> max)	2% max.
Line Regulation	(VACin min <-> VACin max)	2% max.
Output Ripple		3% max.
Operating Frequency		≤125kHz
Isolation Voltage		3kVAC / 1 minute
Ambient Temperature Operating Range		-20°C~50°C
Humidity		85% RH max.
Case Material		Epoxy UL94V-0
Weight	RACV30-24	167g
	RACV30-12	170g
Reliability	MIL STD 217F	30x10³ hours
EMC Standards		EN55015 FCC18A
Screw Terminal Specification		14AWG or 2.5mm²
Connector Plug Specification		5.5mm connector
Short Circuit Protection		Current Limit, Automatic Restart
Overload Protection	Full Load	110~160%
Overtemperature Protection	Tj=110°C	Automatic Restart

Package Style and Pinning



LIGHTLINE
AC/DC-Converter
with 5 year Warranty

RECOM

**30 Watt PFC
Single CV
Output**

ALiUS
E340696



EN-61347-2-13 Pending
cUL-8750 Certified

RACV30

Please Read Application Notes

Features

LED DRIVER

- 60W Class II AC-DC LED Power Supply
- Dual Mode CV or CC Output
- Power Factor Corrected
- Universal Input Voltage Range
- User Adjustable Current Limit (/OF)
- Thermal Feedback Dimming (/TOF)
- Waterproof Enclosure (/IP67)
- cUL/UL8750 Certified, CE Marked
- High Efficiency
- Long 5 Year Warranty

Selection Guide

Part Number	Output Voltage Range (min - max)	Output Current Range (min - max)	Factory Set Current Limit	Efficiency (230VAC) Typ.	Output Power Range
RACD60-4200*	11 - 13.5V	3570 - 4200mA	4.2A	85%	40-60W
RACD60-2400*	17 - 24V	2150 - 2500mA	2.4A	87%	30-60W
RACD60-2100*	21 - 28V	1400 - 2140mA	2.1A	89%	30-60W
RACD60-1400*	21 - 28V	1400 - 2140mA	1.4A	89%	30-60W
RACD60-1050*	38 - 54V	700 - 1100mA	1.0A	89%	27-60W
RACD60-700*	38 - 54V	700 - 1100mA	0.7A	89%	27-60W

* use suffix /OF for open frame version (standard) - output current limit adjustable with on-board trimmer

* use suffix /TOF for open frame version with thermal feedback - output current limit externally adjustable.

* use suffix /IP67 for waterproof potted version - fixed output currents only

ordering examples:

RACD60-700/OF= open frame, adjustable current limit preset to 700mA.

RACD60-1050/TOF=open frame, 1050mA, adjustable 700-1050mA with ext. voltage or PWM signal.

RACD60-1400/IP67 = enclosed IP67 waterproof, non-adjustable 1400mA output.

Note: all currents within range are available - use RACD60-xxxx/IP67 where xxxx is the desired fixed current e.g. RACD60-900/IP67 = enclosed IP67 waterproof, non-adjustable 900mA output.

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	All Versions	90-264VAC
Rated Power		60 Watts max.
Input Frequency Range	All Versions	50/60 Hz
Power Factor Correction	Full Load, 115VAC/230VAC	> 0.9
Input Current (full load)	115VAC/230VAC	0.8A / 0.4A max.
Inrush Current (cold start)	115VAC/230VAC	25A / 50A max.
Leakage Current	230VAC/63Hz	<0.7mA max.
Input Fuse	Built-in	3.15A Slow Blow
Output Current Accuracy	Full load	±5%
Output Current Adjust	Preset Potentiometer (/OF) External Voltage (/TOF)	75% to 100% approx.
Line Voltage Regulation	LL to HL at Full Load	±4% typ.
Load Voltage Regulation	60% to 100% Load	±5% typ.
Minimum Load Current		see table
Operating Frequency	All Versions	65kHz typ.
Efficiency at Full Load		see table
Isolation Voltage (60Hz RMS)	input to output input to filter ground output to filter ground	3.75kVAC / 1 minute 1880VAC / 1 minute 500VAC / 1 minute
Temperature Coefficient	All Versions	±0.02%/°C typ.
Overload Protection	All Versions	105% typ.
Short Circuit Protection		Continuous, Hiccup, Automatic Restart

LIGHTLINE
AC/DC-Converter
with 5 year Warranty

RECOM

60 Watt PFC Single Output



PLUS
E340696



UL 8750 Certified
cUL 8750 Certified*
EN 61347 Certified

RACD60

* except 700mA/1100mA Versions

Description

The RACD60 is a compact universal input voltage 60W constant constant current power module suitable for driving high power LEDs. The LED driver has a dual mode of operation:-
CV mode: at loads below the preset current limit, the RACD60 behaves as a fixed voltage source.
CC mode: at loads above the preset current limit, the RACD60 behaves as a fixed current source.
Thus the same power supply can be used with both CV and CC LED modules.
The RACD60 series have a universal input voltage range with active power factor correction and are fully protected against output short circuit, overload and over-temperature.
Three versions are available: a low cost open-frame with either internal (/OF) or external user-adjustable current limit (/TOF), and a sealed IP67 potted version (/IP67) with factory set output currents for outdoor or high humidity applications.

Please Read Application Notes

LIGHTLINE

AC/DC-Converter

Specifications cont. (typical at 25°C and after warm up time unless otherwise specified)

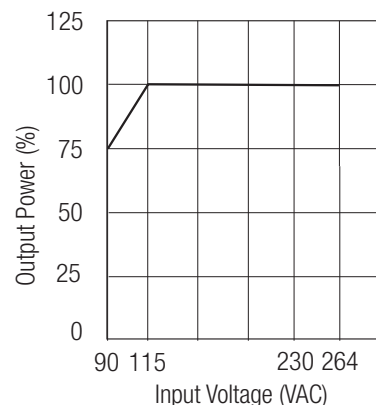
Open Circuit Output Voltage	4200mA	19VDC
(Zener Diode Clamp)	2400mA	25VDC
Typical Values	2100mA/1400mA	29VDC
	1050mA/700mA	55VDC
Output Current Adjust (/TOF only)	External Voltage (1-10V)	10.5V max.
	External PWM (10V)	300Hz max.
Operating Temperature Range	free air convection, with derating	-30°C to +70°C
(refer to derating graphs)	Case temperature (/IP67)	85°C max.
Storage Temperature Range		-40°C to +85°C
Humidity	non-condensing	95% RH max.
Environmental Protection	Open Frame (/OF, /TOF)	Indoor Use Only
	Potted Version (/IP67)	IP67
PCB Material	Plastic Resin with Fibreglass (UL94V-0)	
Weight	Open Frame (/OF, /TOF)	165g
	Potted Version (/IP67)	200g
Packing Quantity	1pc	
EMC	EN 55015, EN61347-1, EN61347-2-13	
Harmonics	Certified to meet EN 61000-3-2 (Class C, Full load) and EN 61000-3-3	
MTBF	(using MIL-HDBK-217F, 25°C)	583 x 10 ³ hours
Certifications	LED Lighting Safety -all models	UL8750
	LED Lighting Safety (Canada) -1400, 2100, 2400 4200mA only	cUL8750
	CE LVD Directive -all models	EN61347
Input/Output Connections	/OF	Pin Header (suitable matching connector JST VHR or similar)
.	/IP67	340mm Cable ± 20mm

* Do not connect or disconnect the LED load while the converter is on. This may damage the LED or sharply reduce its life.

RACD60

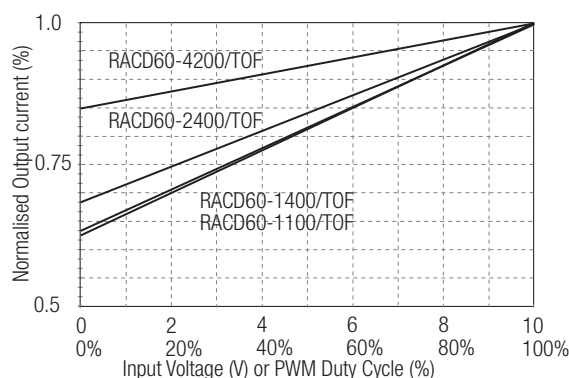
Series

Input Voltage Derating (Ta=25°C)

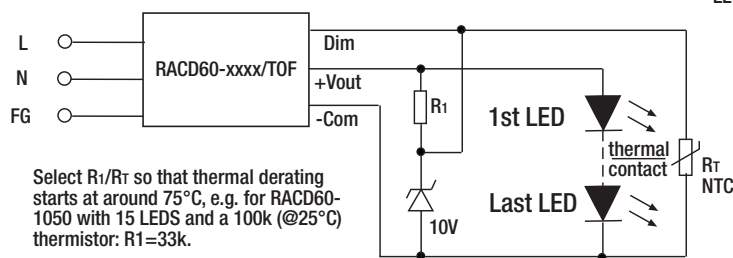


/TOF Output Current Adjustment

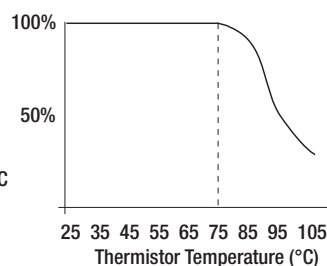
The /TOF offers the possibility to derate the output current with an external voltage or PWM signal. Thermal feedback derating is an effective way to reduce the LED current at high temperatures to avoid over-stressing the LED.



SIMPLE THERMAL FEEDBACK DIMMING CIRCUIT



LED Current



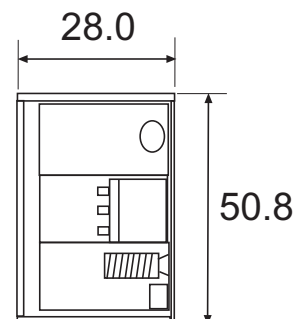
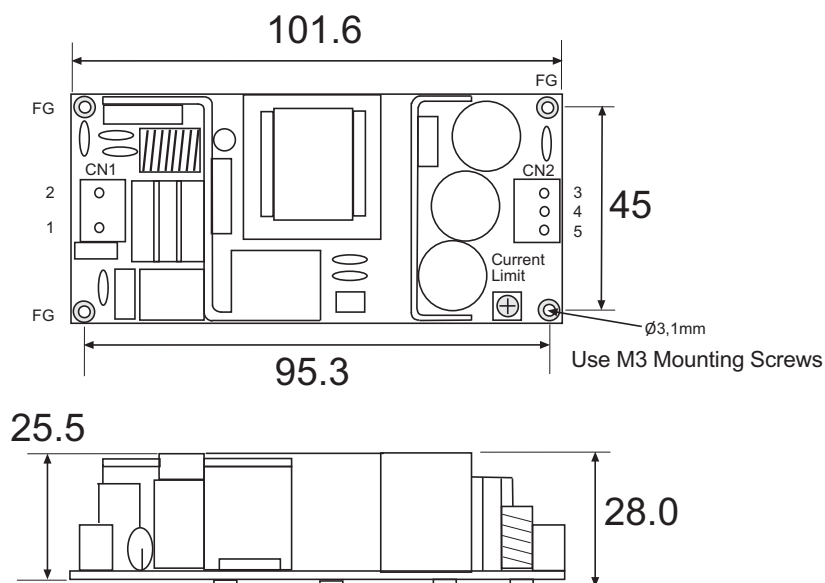
LIGHTLINE

AC/DC-Converter

RACD60 Series

Package Style and Pinning

RACD60-xxxx/OF and RACD60-xxxx/TOF



Pin Connections

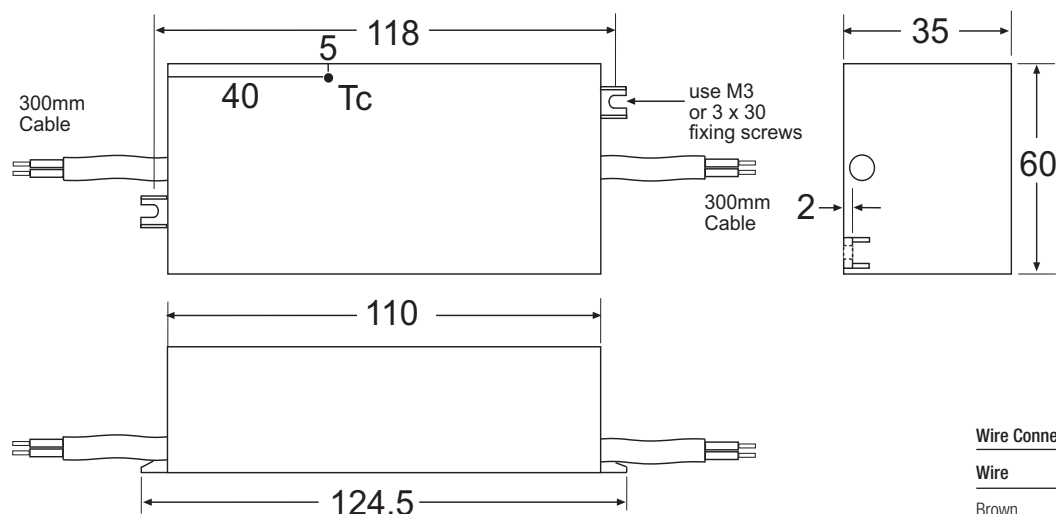
Pin #	/OF	/TOF
1	VAC in (L)	VAC in (L)
2	VAC in (N)	VAC in (N)
3	NC	Thermal feedback
4	+VDC Out	+VDC Out
5	-VDC Out	Com

Filter Ground connection via mounting holes
Dimension Tolerance ± 0.25 mm

RACD60

Package Style and Pinning

RACD60-xxxx/IP67

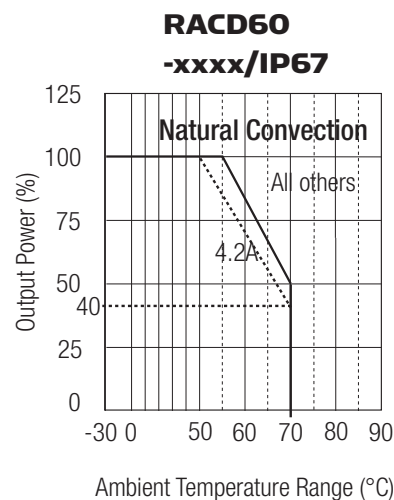
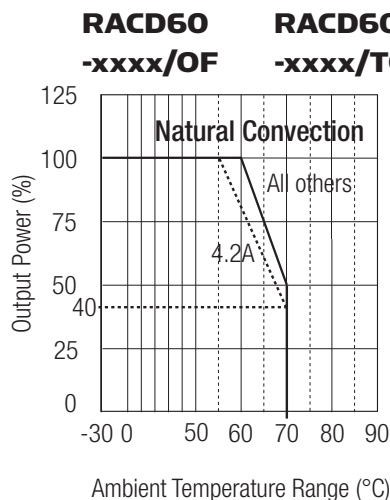


Wire Connections

Wire	Function
Brown	VAC in (L)
Blue	VAC in (N)
Red	+VDC Out
Black	-VDC Out

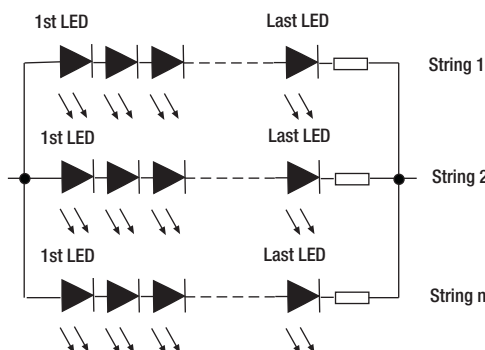
Dimension Tolerance ± 0.25 mm

Derating Graphs



Application Information

LEDs are typically wired in series to make a string of LEDs and then the strings can be wired in parallel to generate enough light. If only two or three strings are wired in parallel then it is recommended to add resistors (e.g. 0.5R) to each string to help balance out the LED currents in each string. All strings must share a common heatsink for better current matching.



A typical 1W high brightness white LED has a forward voltage of around 3.3V at its operating temperature and draws 350mA. Thus each LED actually draws about 1.15W. Similarly, 3W white LEDs have usually the same forward voltage but can be run at 700mA or more. Using the LED datasheet specification, the optimum LED arrangement and the best driver for each application can be worked out.

The tables below show some examples. Other LED combinations may have different forward voltages at their recommended operating currents.

1W LEDs	LED Arrangement	AC/DC Driver
24	2 Strings of 12	RACD60-700
26	2 Strings of 13	RACD60-700
28	4 Strings of 7	RACD60-1400
30	3 Strings of 10	RACD60-1050
33	3 Strings of 11	RACD60-1050
35	5 Strings of 7	RACD60-2100
35	7 Strings of 5	RACD60-2400
36	3 Strings of 12	RACD60-1050
39	3 Strings of 13	RACD60-1050
42	3 Strings of 14	RACD60-1050
42	7 Strings of 6	RACD60-2400
42	14 Strings of 3	RACD60-4200
45	3 Strings of 15	RACD60-1050

3W LEDs	LED Arrangement	AC/DC Driver
12	12 in series	RACD60-700
14	2 Strings of 7	RACD60-1400
18	3 Strings of 6	RACD60-2100
18	6 Strings of 3	RACD60-4200

High Power LEDs	LED Arrangement	AC/DC Driver
Cree CXA2011	Single Array	RACD60-1050
Cree XM-L	6 in series	RACD60-2100
Lumiled Rebel	13 in series	RACD60-700
Osram Dragon	14 in series	RACD60-1050
Bridgelux RS	Single Array	RACD60-2100
Helieon	Single Module	RACD60-1400

Features

LED DRIVER

- Universal AC Input
- Constant Voltage / Constant Current Operation
- CE and UL Certified Class 1 LED Driver
- Active Power Factor Correction
- IP67 Design for Indoor and Outdoor Use
- Cooling by Free Air Convection

Selection Guide

Part Number	CV Mode		CC Mode		Efficiency (230VAC) (%)
	Constant Voltage (V)	Current Range (A)	DC Voltage Range (V)	Constant Current (A)	
RACD100-12	12	0-8.3	9-12	8.3	88
RACD100-24	24	0-4.2	14-24	4.2	90
RACD100-36	36	0-2.8	26-36	2.8	90
RACD100-48	48	0-2.1	34-48	2.1	91

Specifications

Input Voltage Range	90-305 VAC or 127-430VDC	
Input Frequency Range	47-63Hz.	
Power Factor	Full Load, 115VAC	>0.98
	Full Load, 230VAC	>0.95
	Full Load, 277VAC	>0.94
AC Current	115VAC	0.7A max.
	230VAC	1.4A max.
Input/Output Isolation	3.75kVAC	
Input/Case Isolation	1.8kVAC	
Output/Case Isolation	0.5kVAC	
Leakage Current	240VAC	<0.75mA
Voltage Tolerance	-1% to 5%	
Set up Time (@ Full Load)	115VAC	1.5s
	230VAC / 277VAC	0.7s
Ripple & Noise	48V Version	200mV max.
	others	150mV max.
Over Current Protection	95%-105% rated current	Auto-Recovery
Short Circuit Protection	Hiccup Mode	
Over Voltage Protection	12V	15V typ.
Latch Mode	24V	31V typ.
(Power off to recover)	36V	45V typ.
	48V	58V typ.
Over Temperature Protection	Tcase 95°C ±10°C	
Operation Temperature	(Refer to Output Load Derating Curve)	
	-30°C to +70°C	
Operation Humidity	20%-90% RH Non-Condensing	
Storage Temperature	-40°C to +80°C	
Storage Humidity	10%-90% RH	
Vibration	2G 10min/1Cycle, Period for 60 min	10-500Hz
IP Rating	IP67	
Safety Standards	UL/cUL LED Lighting Safety (E340696)	UL8750
	CE LVD Directive, Safety	EN61347-2-13
EMC Standards	EMC Compatibility	EN55015
		FCC, Part 15
	Harmonic Current	EN61000-3-2 Class C (≥75% load)
	EMC Immunity	EN61000-3-3
Dimension	222*68*39mm	
Weight	940g	
MTBF	using MIL-HDBK-217F (25°C)	250 x 10 ³ hours
Design Lifetime	70 x 10 ³ hours	

The use of a circuit breaker with C-characteristic is recommended.

LIGHTLINE
AC/DC-Converter
with 5 year Warranty

RECOM

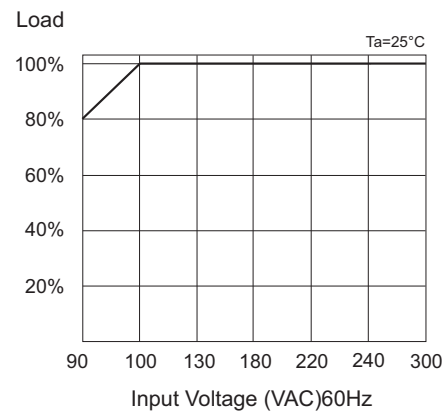
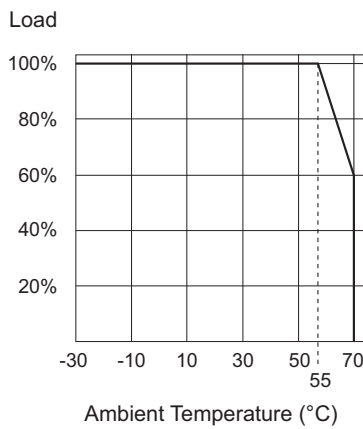
**100 Watt
Single
Output**



**UL 8750 Certified
EN 61347 Certified**

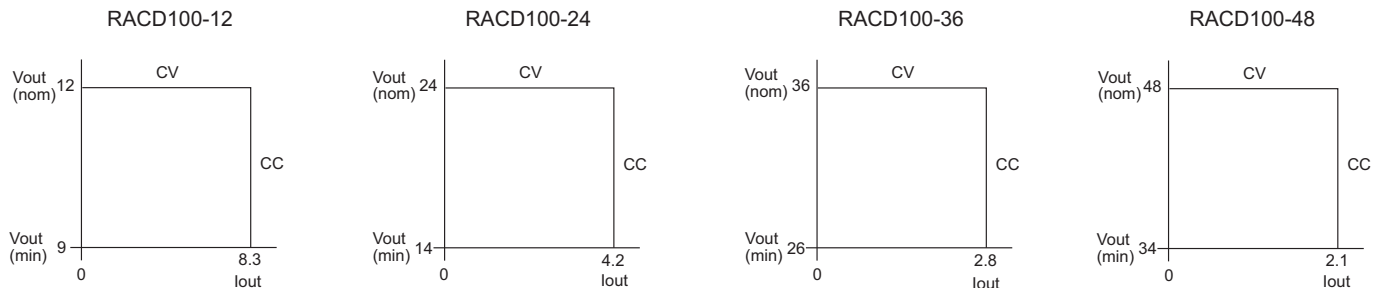
RACD100

Derating Curve



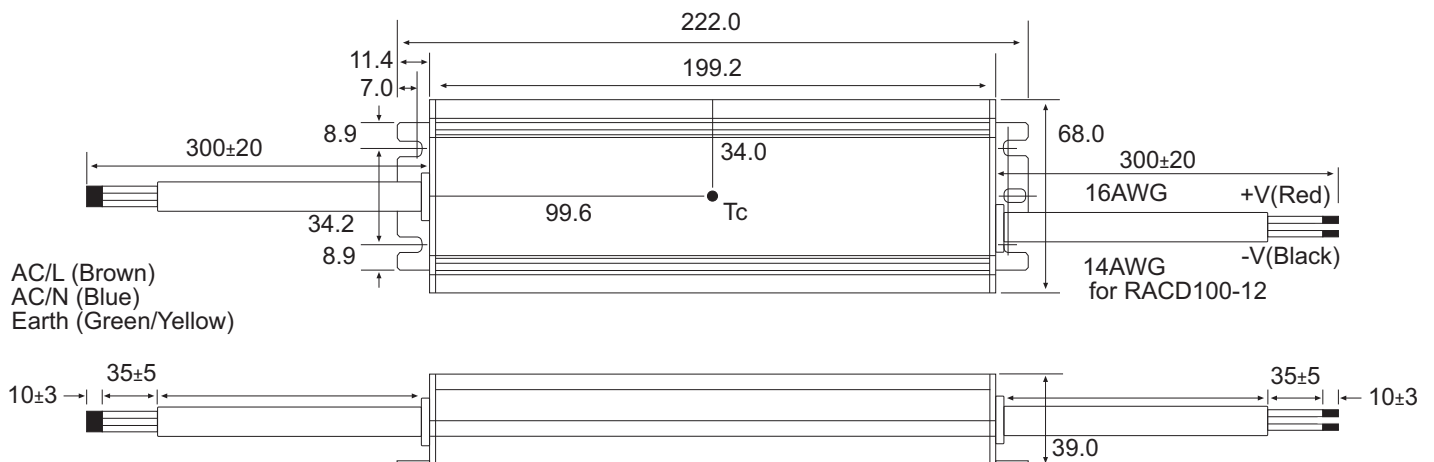
Characteristics

Constant Voltage / Constant Current Curve



Package Style and Pinning

3rd angle projection



Features

LED DRIVER

- Universal AC Input
- Constant Voltage / Constant Current Operation
- CE and UL Certified Class 1 LED Driver
- Active Power Factor Correction
- IP67 Design for Indoor and Outdoor Use
- Cooling by Free Air Convection

Selection Guide

Part	CV Mode		CC Mode		Efficiency (230VAC) (typ.)
	Constant Voltage (V)	Current Range (A)	DC Voltage Range (V)	Constant Current (A)	
RACD150-24	24	0-6.3	14-24	6.3	90%
RACD150-36	36	0-4.2	26-36	4.2	90%
RACD150-48	48	0-3.2	34-48	3.2	90%

Specifications

Input Voltage Range	90-305 VAC or 127-430VDC	
Input Frequency Range	47-63Hz.	
Power Factor	Full Load, 115VAC	>0.98
	Full Load, 230VAC	>0.95
	Full Load, 277VAC	>0.94
AC Current	115VAC	2A max.
	230VAC	1A max.
Input / Output Isolation	3.75kVAC	
Input / Case Isolation	1.8kVAC	
Output / Case Isolation	0.5kVAC	
Leakage Current	230VAC	<0.5mA
Current Tolerance	±5%	
Voltage Tolerance	-1% to 5%	
Set up Time	115VAC	1.0s
(@ Full Load)	230VAC / 277VAC	0.8s
Ripple & Noise	48V Version	200mV max.
	others	150mV max.
(with 20MHz bandwidth & 47µF Elco + 0.1µF MLCC)		
Over Current Protection	95%-105% rated current	Auto-Recovery
Short Circuit Protection	Hiccup Mode	
Over Voltage Protection	24V	24.5V typ.
Latch Mode	36V	36.5V typ.
(Power off to recover)	48V	48.5V typ.
Over Temperature Protection	Tcase 95°C ±10°C	
Operation Temperature	(Refer to Output Load Derating Curve)	
	-30°C to +70°C	
Operation Humidity	20%-90% RH Non-Condensing	
Storage Temperature	-40°C to +80°C	
Storage Humidity	10%-90% RH	
Vibration	2G 10min/1Cycle, Period for 60 min	10-500Hz
IP Rating	IP67	
Safety Standards	UL/cUL LED Lighting Safety (E340696)	cUL8750
	CE LVD Directive, Safety	EN61347-2-13
EMC Standards	EMC Compatibility	EN55015
		FCC, Part 15
	Harmonic Current	EN61000-3-2 Class C (≥75% load)
		EN61000-3-3
	EMC Immunity	EN61000-4-2, 3, 4, 5, 6, 11
Dimension	199.2*68*39mm	
Weight	940g	
MTBF	using MIL-HDBK-217F (25°C)	200 x 10 ³ hours
Design Lifetime	70 x 10 ³ hours	

LIGHTLINE
AC/DC-Converter
with 5 Year Warranty

RECOM

**150 Watt
Single
Output**



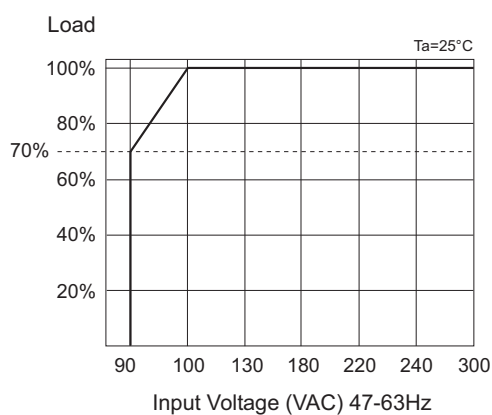
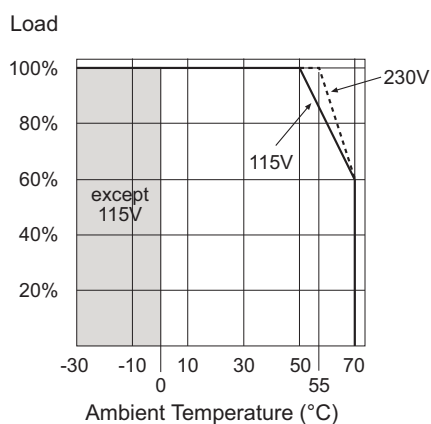
**UL 8750 Certified
EN 61347 Certified**

RACD150

Note:

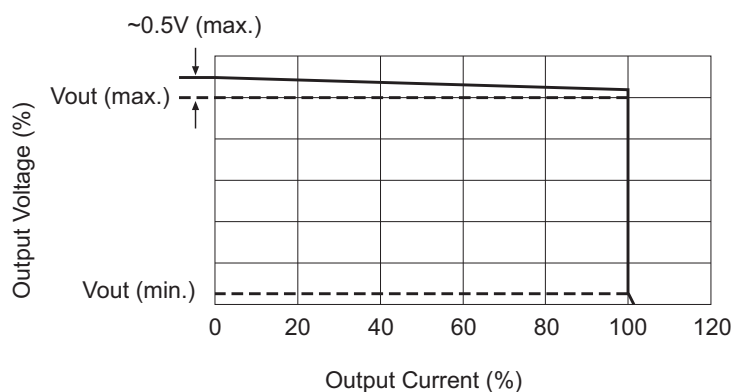
The use of a circuit breaker with C-characteristic is recommended.

Derating Curve

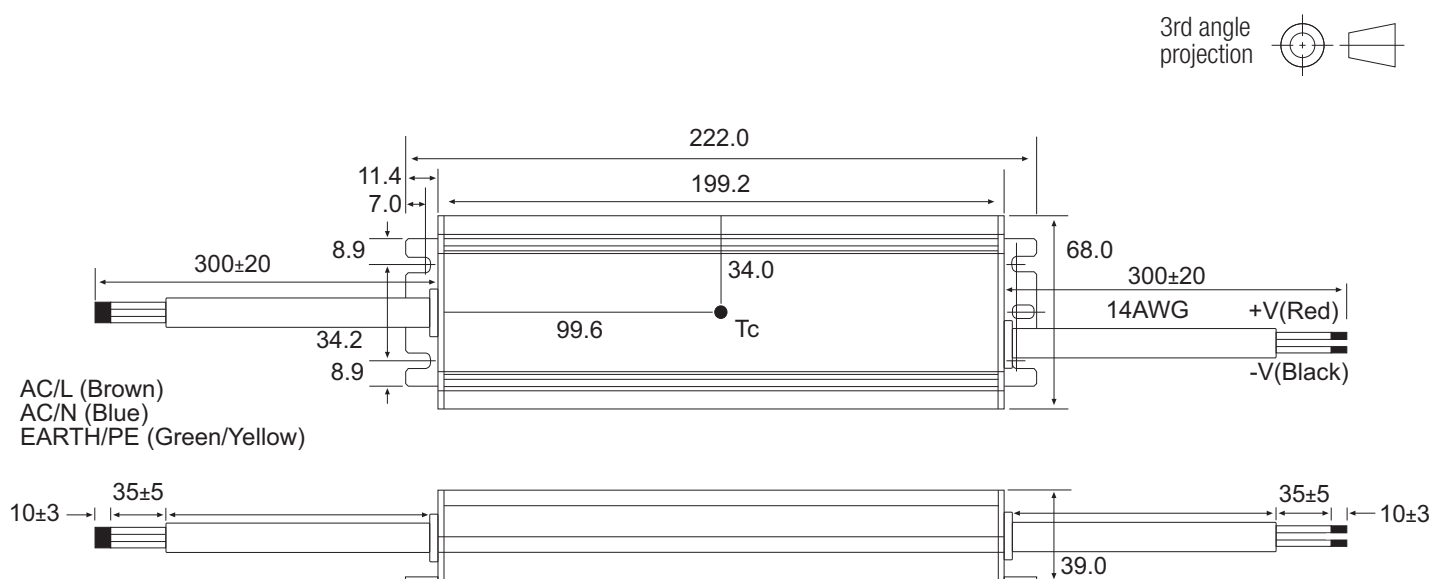


Characteristics

Constant Voltage / Constant Current Curve



Package Style and Pinning



RACD150

3rd angle projection

Symbols Used

CE Mark - RECOM declares that the product conforms to the European legislation on safety, health or environmental requirements. Not to be confused with the "China Export" mark which has no meaning.



RoHS 6/6- RECOM declares that the product conforms to the European legislation on the Restriction of Hazardous Substances (RoHS) and contains none of the six restricted chemicals.



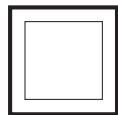
UL, cUL- The product has been tested and certified by Underwriters Laboratories (UL) to meet US and Canadian safety standards. The UL file reference number is given under the symbol.



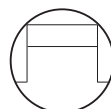
Lead-Free. The product contains no lead (<1000 ppm)



WEEE-Recycling Symbol. The product is electronic equipment that must be properly disposed of under the European Waste of Electrical and Electronic Equipment (WEEE) regulations.



Double Isolated Class 2 Power Supply. No Earth connection required.



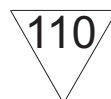
Independent Converter



Short Circuit Proof Isolating Safety Transformer

SELV

Safe Extra Low Voltage (SELV) outputs



Maximum Case Temperature even in abnormal conditions



Product is safe to fit onto materials combustable above 200°C



Product is safe for use in furniture

POWERLINE AC/DC - CONTENTS



Single and Dual Output Models

Series	Isolation (kVAC)	Power (Watts)	Input Voltages (VAC)	Output Voltages (VDC)	Case Dimensions mm	Page
RAC01-RAC02-SC	3	1 or 2	90 - 264	3.3, 5, 9, 12, 15, 24	37.8 x 23.9 x 15.7	PA-2
RAC02-SC/277	3	2	80 - 305	3.3, 5, 12, 24	33.7 x 22.2 x 17.75	PA-4
RAC03-SC	3	3	90 - 264	3.3, 5, 9, 12, 15, 24	37.8 x 23.9 x 15.7	PA-6
RAC03-SC/277	3	3	80 - 305	3.3, 5, 12, 24	38.25 x 24.35 x 17.4	PA-8
RAC03-SCR/277	3	3	85 - 305	3.3, 5, 12, 24	50.3 x 50.3 x 11	PA-10
RAC04-SA_DA(-ST)	3	4	90 - 264	3.3, 5, 9, 12, 15, 24, 5/12	36.7 x 27.2 x 17.1	PA-12
RAC04-SA_DA(-ST)/277			90 - 305			
RAC04-SC_DC/277	3.75	4	80-305	3.3, 5, 12, 15, 24, 5/12, ± 5 , ± 12	36.7 x 27.2 x 17.1	PA-14
RAC05-SA_DA(-E)(-ST)	3	5	90 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	55.0 x 45.0 x 20.5	PA-16
RAC05-SB(-E)(-ST)	3	5	90 - 264	3.3, 5, 12, 15, 24	50.8 x 25.4 x 15.2	PA-19
RAC05-SC	3	5	80-264	3.3, 5, 12, 15, 24	50.9 x 25.5 x 15.65	PA-21
RAC05-DC				± 5 , ± 12 , ± 15	53.5 x 27.8 x 15.65	
RAC06-SC_DC(W)	3	6	80 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	50.8 x 25.4 x 15.2	PA-24
RAC10-SA_DA(-E)(-ST)	3	10	90 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	64.0 x 45.0 x 21.5	PA-26
RAC10-SB(-E)(-ST)	3	10	90 - 264	3.3, 5, 12, 15, 24	52.4 x 27.2 x 23.5	PA-28
RAC10-S_DC(/277)	3.75	10	80-305	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	52.4 x 27.4 x 23.5	PA-30
RAC15-SA_DA(-E)(-ST)	3	15	90 - 264	5, 12, 15, 24, ± 5 , ± 12 , ± 15	74.0 x 54.0 x 22.0	PA-34
RAC15-SB_DB(-E)(-ST)	4	15	90 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	64.0 x 45.0 x 21.5	PA-36
RAC20-SA_DA(-ST)	3	20	90 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15	70.0 x 48.0 x 22.0	PA-38
RAC20-SB(-ST)	3	20	90 - 264	3.3, 5, 12, 15, 24	52.4 x 27.2 x 23.5	PA-40
RAC30-SA_DA(-E)(-ST)	3	30	90 - 264	3.3, 5, 12, 15, 24, ± 5 , ± 12 , ± 15 , 5/12	89.0 x 63.5 x 25.0	PA-42
RAC40-SA_DA(-E)(-ST)	4	40	90 - 264	5, 12, 15, 24, ± 5 , ± 12 , ± 15 , 5/12	89.0 x 63.5 x 27.0	PA-44
RAC40-SB_DB(-E)(-ST)	4	40	90 - 264	5, 12, 15, 24, ± 5 , ± 12 , ± 15 , 5/12	89.0 x 63.5 x 27.0	PA-46
RAC60-SB	4	60	85 - 264	5, 12, 15, 24	109.0 x 58.5 x 30.0	PA-48

AC/DC

Triple Output Models

Series	Isolation (kVAC)	Power (Watts)	Input Voltages (VAC)	Output Voltages (VDC)	Case Dimensions mm	Features	Page
RAC15-TA(-E)(-ST)	3	15	90 - 264	5 / ± 12 , 5 / ± 15	74.0 x 54.0 x 22.0	Standard	PA-34
RAC15-TB(-E)(-ST)	4	15	95 - 264	5 / ± 12 , 5 / ± 15	64.0 x 45.0 x 21.5	Medical	PA-36
RAC20-TA(-ST)	3	20	90 - 264	5 / ± 12 , 5 / ± 15	70.0 x 48.0 x 22.0	Standard	PA-38
RAC30-TA(-E)(-ST)	3	30	90 - 264	5 / ± 12 , 5 / ± 15	89.0 x 63.5 x 25.0	Standard	PA-42
RAC40-TA(-E)(-ST)	4	40	90 - 264	5 / ± 12 , 5 / ± 15	89.0 x 63.5 x 25.0	Medical	PA-44
RAC40-TB(-E)(-ST)	4	40	90 - 264	5 / ± 12 , 5 / ± 15	89.0 x 63.5 x 25.0	Standard	PA-46

Suffix -E = Extended Temperature range (-40°C)

Suffix -ST = Screw Terminal version (supplied with DIN Rail mounting bracket)

Features

Regulated Converters

- Ultracompact Low Profile AC-DC Power Supply
- Ultra-low 30mW Standby Power Consumption
- 1 Watt or 2 Watt PCB Mount Package
- Extra Wide Input Voltage Range (80~277VAC)
- Class II Power Supply with 3kVAC Isolation
- -25°C to +85°C Operating Temp
- Low Output Ripple
- Short Circuit Protected Outputs
- EN, UL and CE Certified

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max Capacitive Load*
RAC01-3.3SC	80-277	3.3	300	65	1500µF
RAC02-3.3SC			600	66	2000µF
RAC01-05SC	80-277	5	200	68	1000µF
RAC02-05SC			400	70	1200µF
RAC01-09SC	80-277	9	111	70	180µF
RAC02-09SC			222	72	450µF
RAC01-12SC	80-277	12	83	72	100µF
RAC02-12SC			167	74	180µF
RAC01-15SC	80-277	15	67	72	82µF
RAC02-15SC			133	74	180µF
RAC01-24SC	80-277	24	42	73	47µF
RAC02-24SC			83	77	47µF

*Max. Capacitive Load measured at 115VAC/60Hz with constant resistant mode at full load.

Specifications

(Ta=-25°C and after warm up time, measured at 115VAC/60Hz and 230VAC/50Hz)

Input Voltage Range (with derating)	80-277VAC or 115-390VDC	
Rated Power	1 or 2 Watts max.	
Input Frequency Range (for AC Input)	47-63Hz	
Input Current (full load)	RAC01 (115/230VAC)	34mA/23mA max.
	RAC02 (115/230VAC)	55mA/36mA max.
No Load Power Consumption	30mW typ.	
Inrush Current (<0.5ms)	30/60A max.	
Leakage Current	0.25mA max.	
Output Voltage Tolerance (combined Tolerance, Line Reg and Load Reg at full load)	±5% max.	
Line Voltage Regulation	low line, high line at full load	±2% max.
Load Voltage Regulation	10% to 100% full load	±6% max.
Output Ripple (20MHz BW limited)	3.3V Output	<150mVrms
	All others	<100mVrms
Operating Frequency (full load)	30kHz typ.	
Minimum Load = 0%	specifications valid for 10% minimum load only	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Isolation Resistance	1 GΩ min.	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	(1W, natural convection, no derating)	-25°C to +80°C
	(2W natural convection, no derating)	-25°C to +75°C
	(natural convection, with derating)	-25°C to +85°C
Storage Temperature Range	-40°C to +100°C	
Humidity	non-condensing	95% RH max
Case Material	Plastic Case, Silicone potting material (UL94V-0)	
Package Weight	25g	
Packing Quantity	22 pcs	

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

1 - 2 Watt Single Output

E224736



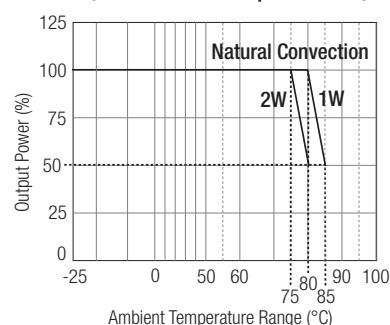
EN-60950-1 Certified
UL-60950-1 Certified

RAC01-C RAC02-C

Description

The RAC01-SC and RAC02-SC series are ultra-compact universal input AC/DC power modules for PCB mounting. They feature high efficiency, low standby power, high operating temperature, soft start and short-circuit protection as well as a built-in EMC Class B filter. Output voltages range from 3.3VDC to 24VDC.

Derating Graph (Ambient Temperature)



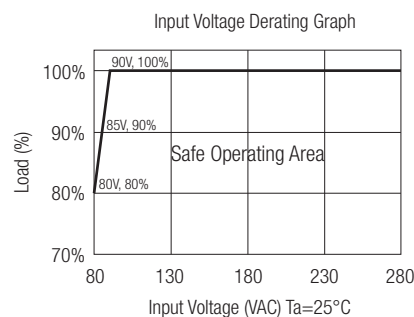
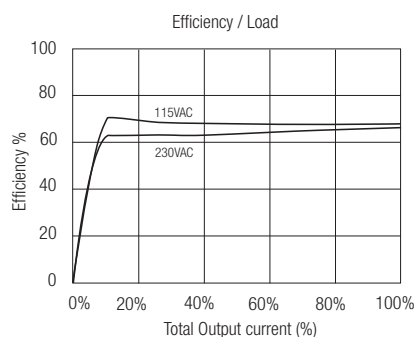
Please Read Application Notes

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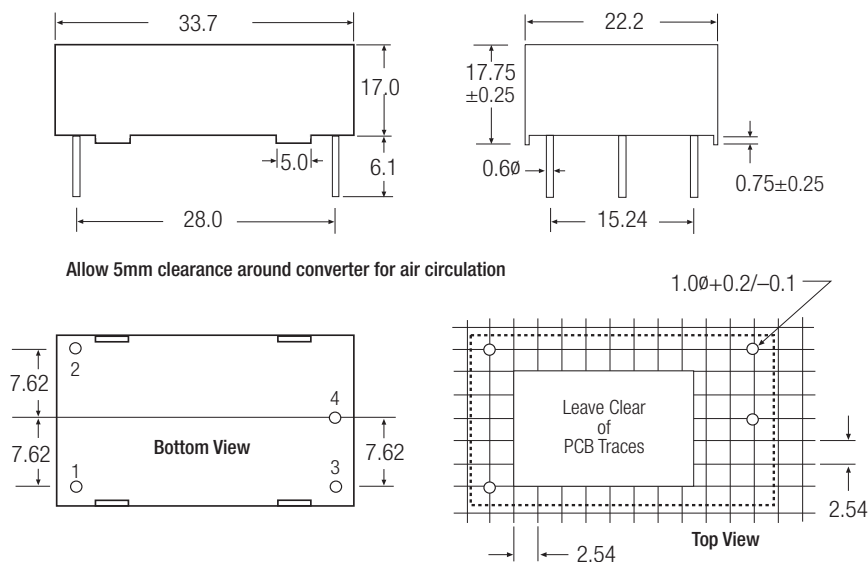
Specifications (cont.)

EMC	Conducted and Radiated Noise Immunity	EN 55022 Class B EN 55024
MTBF	+25°C	666 x 10 ³ hours
230VAC	+55°C	395 x 10 ³ hours
using MIL-HDBK-217F	+80°C	125 x 10 ³ hours
Certifications:		
UL General Safety	File Nr. E224736	UL-60950-1, 2nd Edition
EN General Safety	SPCLVD 1202026	EN-60950-1, 2nd Edition
CE	Report: 2011-04-19	EN55022 Class B

RAC02-05SC



Standard Package Style and Pinning



Pin Connections

Pin #	Single Output
1	VAC in (N)
2	VAC in (L)
3	-VDC out
4	+VDC out

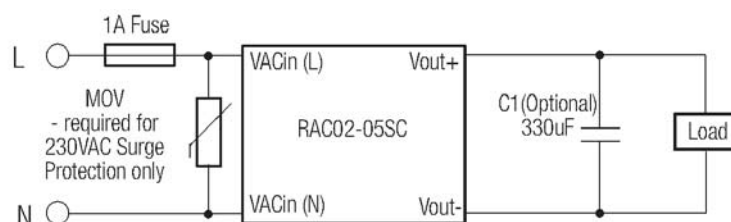
Tolerance ± 0.5 mm
unless otherwise specified

Recommended Application Circuit

Compact single output regulated power supply

Suggested fuse rating: 1A Slow Blow.

An external MOV is required for 230VAC operation. The varistor should comply with IEC-61051-2 e.g. Epcos S14 series



Add C1 to reduce output ripple (use low ESR type)

Features

Regulated Converters

- 35mW max of No Load Power Consumption
- Output CV/CC Control
- Isolated Output 3kVAC / 1 min
- Short Circuit Protection
- Overvoltage Protection
- Meet EN55022 and FCC Class B
- Built-In Fusible Resistor

Selection Guide

Part Number	Output Voltage (VDC)	Max. Current (Io, max)	Total Regulation(1)	Ripple & Noise(2)	Efficiency (Typ.)	Max. Capacitive Load
RAC02-3.3SC/277	3.3	600mA	±6%	300mV	67%	24000µF
RAC02-05SC/277	5	400mA	±6%	200mV	71%	7500µF
RAC02-12SC/277	12	167mA	±6%	200mV	74%	1200µF
RAC02-24SC/277	24	83mA	±6%	200mV	76%	200µF

Specifications (measured at TA 25°C, full load after warm-up)

Input Voltage Range (with Derating)	80-305VAC or 110-430VDC	
Input Frequency	47-440Hz	
Input Current (full load)	115VAC/230VAC	47mA / 30mA typ.
Inrush Current	115VAC/230VAC	15A / 30A max.
No Load Power Consumption	80-305VAC	35mW max.
Output Voltage (Vout nom.)	3.3V-24V	
Output Voltage Tolerance	±6% max.	
Minimum Load	2%	
Line Voltage Regulation	LL-HL at full Load	±1.5% max.
Load Voltage Regulation	2-100% Load	see Selection Guide
Switching Frequency	at full Load	45kHz typ.
Isolation Voltage	Input-Output	3kVAC / 1 minute
Leakage Current	80-305VAC	10uA max.
Isolation Resistance	1G Ω min	
Short Circuit Protection	Continuous, Auto Restart	
Over-Voltage Protection	Zener clamp, set at 4.4~5.0V for 3.3V and 110~140% of its nominal output voltage for others.	
Operating Temperature Range	natural convection, without derating	-25°C ~ +75°C
	natural air convection, with derating	-25°C ~ +85°C
Storage Temperature Range	-40°C ~ +85°C	
Case Material	UL94V-0 black plastic	
Potting Material	Silicon	
Relative Humidity	95% RH max.	
Package Weight	24.5g typ.	
Package Quantity	22 pcs	
MTBF	TA = 25°C	> 1300x10 ³ hours
(using MIL-HDBK217F)	TA = 75°C	> 165x10 ³ hours
Physical	Dimension (LxWxH)	33.7 x 22.2 x 17.75 mm
EMI	EN55022, Class B	
Safety Standard		
IEC/EN General Safety	Report: SPCLVD1208051	IEC/EN-60950-1
UL General Safety	Report: E224736-A17-UL	UL-60950-1

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

2 Watt Single Output

eFET^{us}
E224736



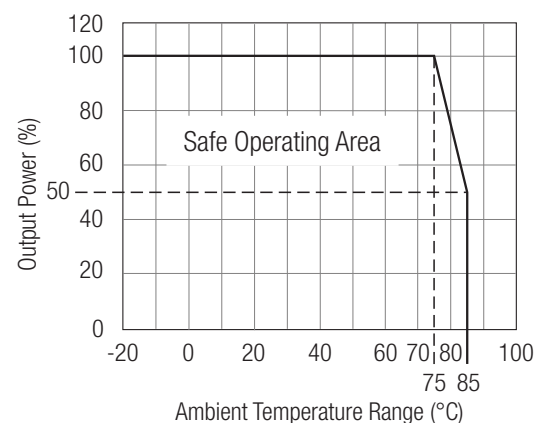
EN-60950-1 Certified

UL-60950-1 Certified

RAC02-SC/277

Derating Graph

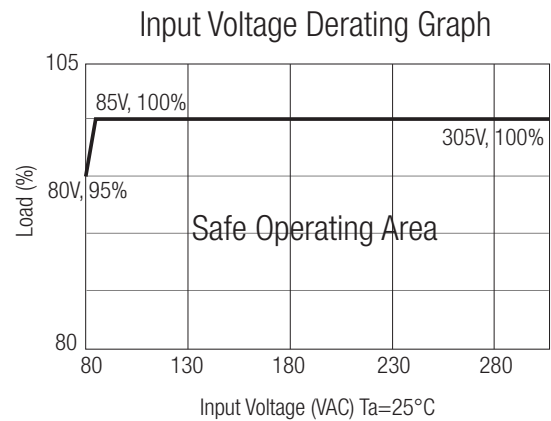
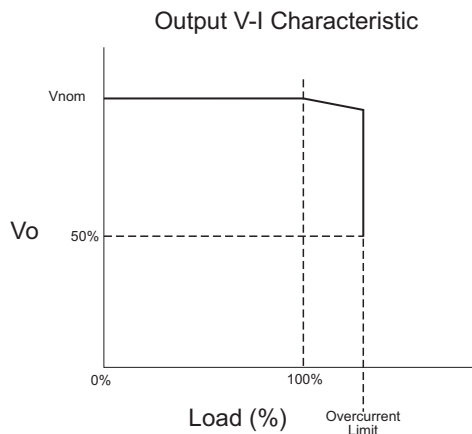
(Ambient Temperature)



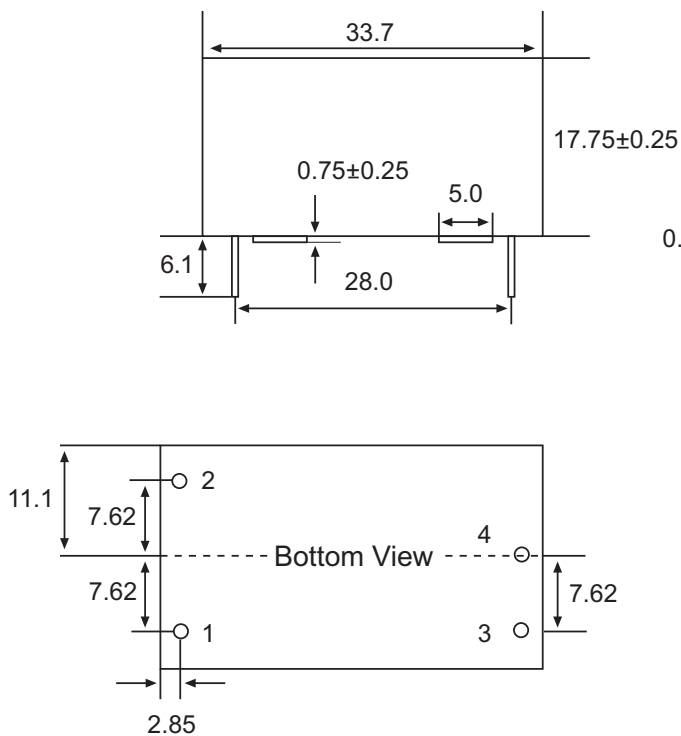
Specifications (measured at TA 25°C, full load after warm-up)

Notes:

1. „Total Regulation“ is the output voltage tolerance which includes initial voltage accuracy, thermal drift, line regulation and load regulation at rated input voltage and load condition.
2. „Ripple & Noise“ is maximum peak-to-peak voltage value measured at output within 20MHz bandwidth at rated line voltage and output load ranges, and with a 47 μ F low-ESR electrolytic capacitor in parallel with a 0.1 μ F ceramic capacitor across the output.



Package Style and Pinning



Pin Connections

Pin #	Single Out
1	VAC in (N)
2	VAC in (L)
3	-VDC out
4	+VDC out

Tolerance ± 0.5 mm unless otherwise specified

Features

Regulated Converters

- Ultracompact Low Profile AC-DC Power Supply
- 3 Watt PCB Mount Package
- Universal Input Voltage Range
- Class II Power Supply with 3kVAC Isolation
- Only 80mW Consumption in Standby
- -25°C to +85°C Operating Temperature
- Low Output Ripple/Noise
- Short Circuit Protected Outputs
- EN, UL and CE Certified

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load*
RAC03-3.3SC	80-264	3.3	900	67	2200µF
RAC03-3.8SC	80-264	3.8	900	67	2200µF
RAC03-05SC	80-264	5	600	72	2000µF
RAC03-09SC	80-264	9	333	76	1200µF
RAC03-12SC	80-264	12	250	76	600µF
RAC03-15SC	80-264	15	200	76	300µF
RAC03-24SC	80-264	24	125	78	100µF

*measured @ 115VAC/60Hz with full load

Specifications (Ta=25°C and after warm up time, measured at 115VAC/60Hz and 230VAC/50Hz)

Input Voltage Range (with derating)	80-264VAC or 115-370VDC	
Rated Power	3 Watts max.	
Input Frequency Range (for AC Input)	47-63Hz	
Input Current (full load)	115/230VAC	85mA/40mA max.
No Load Power Consumption	80mW typ.	
Inrush Current (<0.5ms)	115/230VAC	30/60A max.
Leakage Current	0.85mA max.	
Output Voltage Tolerance (combined Tolerance, Line Reg and Load Reg at full load)	±5% max.	
Line Voltage Regulation	low line, high line at full load	±3% max.
Load Voltage Regulation	10% to 100% full load	±6% max.
Output Ripple and Noise (20MHz BW limited)	3.3V, 3.8V, 5V Output	120mVp-p max.
	All others	150mVp-p max.
Operating Frequency @ full load	35kHz typ	
Minimum Load = 0%	specifications valid for 10% minimum load only	
RMS Isolation Voltage	input to output	3kVAC / 1 minute
Isolation Resistance	input to output	1 GΩ min.
Isolation Capacitance	input to output	1000pF typ.
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	(natural convection, without derating)	-25°C to +75°C
	(natural convection, with derating)	-25°C to +85°C
Storage Temperature Range	-40°C to +100°C	
Humidity	non-condensing	95% RH max
Case Material	Plastic Case, Silicon filled (UL94V-0)	
Package Weight	30g	
Packing Quantity	12 pcs	
EMC	Conducted and Radiated	EN 55022 Class B
	Noise Immunity	EN 55024
MTBF	+25°C	>550 x 10 ³ hours
230VAC	+55°C	>285 x 10 ³ hours
using MIL-HDBK-217F	+80°C	>76 x 10 ³ hours
Certifications:		
UL General Safety	File Nr. E224736	UL-60950-1, 2nd Edition
EN General Safety	SPCLVD 1202026	EN-60950-1, 2nd Edition
CE	Report: T110809202-E	EN55022 Class B

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

3 Watt Single Output

E224736



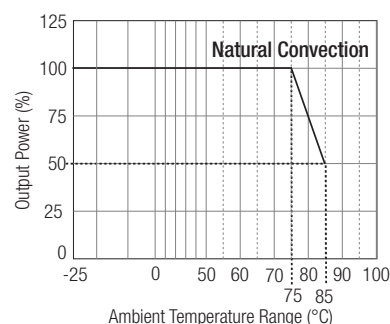
EN-60950-1 Certified
UL-60950-1 Certified

RAC03-C

Description

The RAC03-SC series is an ultra-compact universal input AC/DC power module for PCB mounting. It features high efficiency, low standby power, high operating temperature, soft start, low output ripple/noise, overload and short-circuit protection as well as a built-in EMC Class B filter. Output voltages range from 3.3VDC to 24VDC, including a 3.8VDC version designed for battery chargers and GSM modems.

Derating Graph (Ambient)

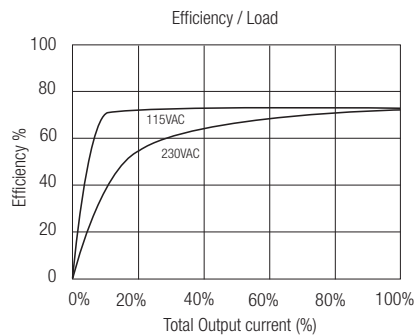


Please Read Application Notes

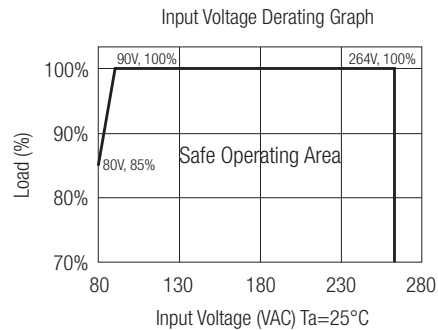
www.recom-electronic.com

Specifications (typical at 25°C and after warm up time unless otherwise specified)

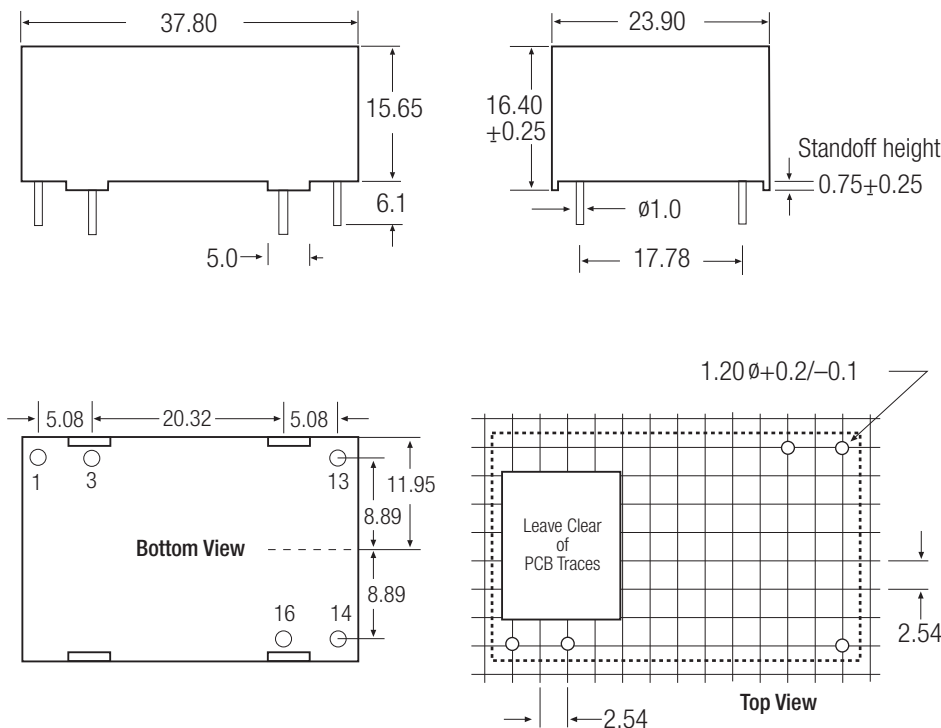
RAC03-05SC



Input Voltage Derating Graph



Standard Package Style and Pinning



3rd angle projection

Pin Connections

Pin #	Single Output
1	VAC in (L)
3	VAC in (N)
13	NC
14	-VDC out
16	+VDC out
NC = No Connection	

Tolerance ± 0.5 mm
unless otherwise specified

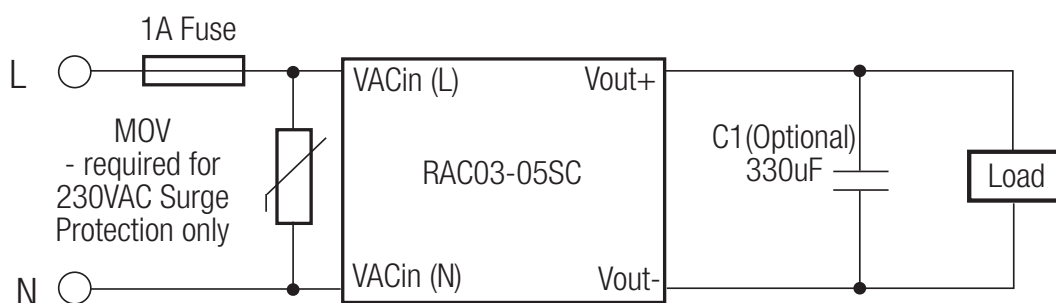
RAC03-C

Recommended Application Circuit

Compact single output regulated power supply

Suggested fuse rating: 1A Slow Blow

An external MOV is required for 230VAC operation. The varistor should comply with IEC-61051-2. e.g. Epcos S14 Series



Add C1 to reduce output ripple (use low ESR type)

Features

Regulated Converters

- 30mW max of No Load Power Consumption
- High efficiency up to 80%
- Isolated Output 3kVAC / 1 min
- Short Circuit Protection
- Overvoltage Protection
- Meet EN55022 and FCC Class B
- Built-In Fusible Resistor

Selection Guide

Part Number	Output Voltage (VDC)	Max. Current (Io, max)	Total Regulation(1)	Ripple & Noise(2)	Efficiency (Typ.)	Max. Capacitive Load
RAC03-3.3SC/277	3.3	900mA	±6%	200mV	71%	47000µF
RAC03-05SC/277	5	600mA	±6%	150mV	76%	15000µF
RAC03-12SC/277	12	250mA	±6%	150mV	78%	2200µF
RAC03-24SC/277	24	125mA	±6%	150mV	80%	390µF

Specifications (measured at TA 25°C, full load after warm-up)

Input Voltage Range (with Derating)	80-305VAC or 110-430VDC	
Input Frequency	47-440Hz	
Input Current (full Load)	115VAC/230VAC	70mA / 45mA typ.
Inrush Current	115VAC/230VAC	15A/30A max.
No Load Power Consumption	80-305VAC / 47-440Hz	30mW max.
Output Voltage (Vout nom.)	3.3V-24V	
Output Voltage Tolerance	±6% max.	
Minimum Load	2%	
Line Voltage Regulation	LL-HL at full Load	±1% typ. / ±1.5% max.
Load Voltage Regulation	2-100% Load	see Selection Guide
Overcurrent Limit	116% - 156%	
Switching Frequency	at full Load	45kHz typ.
Isolation Voltage	Input-Output	3kVAC / 1 minute
Leakage Current	80-305VAC / 47-440Hz	10uA max.
Isolation Resistance	1G Ω min	
Short Circuit Protection	Continuous, Auto Restart	
Over-Voltage Protection	Zener clamp, set at 4.4V-5.0V for 3.3V and others 112-140% of its nominal output voltage	
Operating Temperature	natural convection, without derating	-25°C ~ +75°C
	natural air convection, with derating	-25°C ~ +85°C
Storage Temperature	-40°C ~ +85°C	
Case Material	UL94V-0 black plastic	
Potting Material	Silicon	
Relative Humidity	95% RH max.	
Package Weight	28g	
Package Quantity	12 pcs	
MTBF	TA = 25°C	> 1000x10 ³ hours
(using MIL-HDBK217F)	TA = 75°C	> 100x10 ³ hours
Physical	Dimension (LxWxH)	38.25 x 24.35 x 17.40 mm
EMI	EN55022, Class B	
Safety Standard		
EC/EN General Safety	Report: SPCLVD1208051	IEC/EN-60950-1
UL General Safety	Report: E224736-A17-UL	UL-60950-1

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

3 Watt Single Output

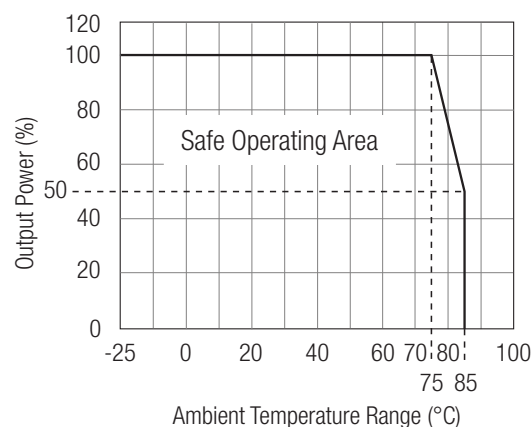


EN-60950-1 Certified
UL-60950-1 Certified

RAC03-SC/277

Derating Graph

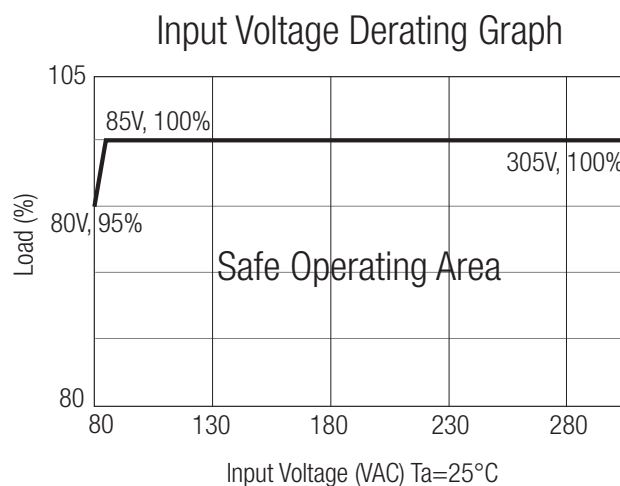
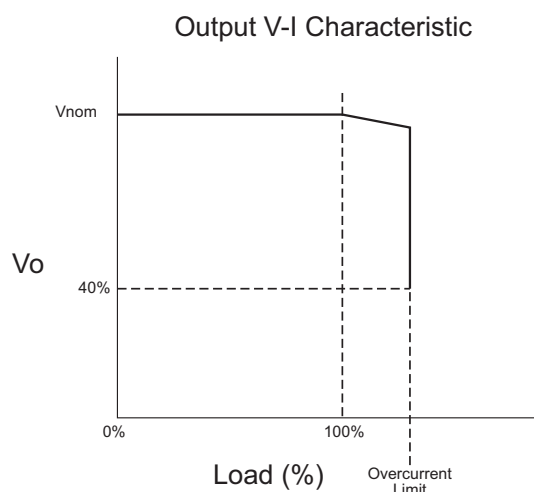
(Ambient Temperature)



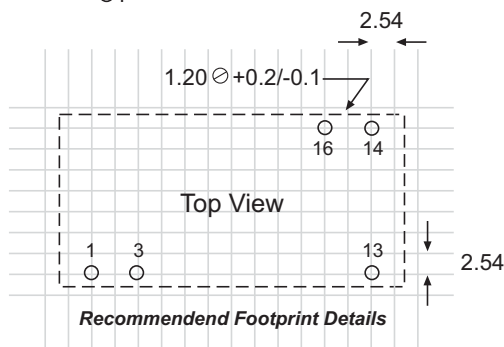
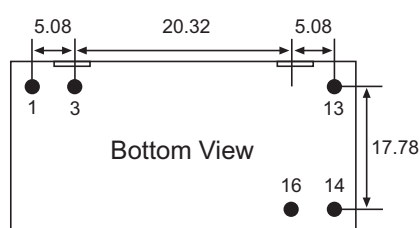
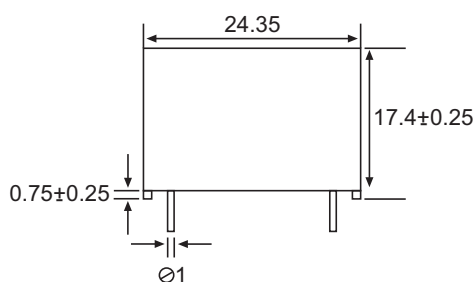
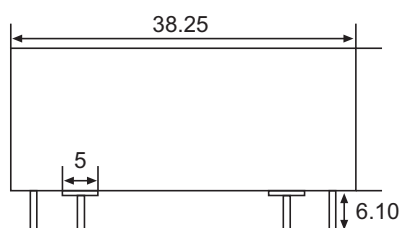
Specifications (measured at TA 25°C, full load after warm-up)

Notes:

1. „Total Regulation“ is the output voltage tolerance which includes initial voltage precise, thermal drift, line regulation and load regulation at rated input voltage and load condition.
2. „Ripple & Noise“ is maximum peak-to-peak voltage value measured at output within 20MHz bandwidth at rated line voltage and output load ranges, and with a 47 μ F low-ESR electrolytic capacitor in parallel with a 0.1 μ F ceramic capacitor across the output.



Package Style and Pinning



3rd angle projection

Pin Connections

Pin #	Single Out
1	VAC in (L)
3	VAC in (N)
13	NC
14	-VDC out
16	+VDC out

Tolerance $\pm$ 0.5mm unless otherwise specified

Features

Regulated Converters

- Regulated Power Supply
- Constant Voltage / Constant Current Output
- Continuous Short Circuit Protection
- Isolated Output 3kVAC / 1 min
- Meet EN55022 and FCC Class B
- Ultra-low Stand-By Power Consumption

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Typical Efficiency (%)	Constant Current Range** (mA)	Max. Capacitive Load
RAC03-3.3SCR/277*	85-305	3.3	900	69	950-1200	22000
RAC03-05SCR/277*	85-305	5	600	71	650-850	10000
RAC03-12SCR/277*	85-305	12	250	76	280-370	1500
RAC03-24SCR/277*	85-305	24	125	78	140-185	200

* add „-Tray“ for Tray packaging, e.g. RAC03-05SCR/277-Tray

Specifications (measured at TA 25°C)

Input Voltage Range	85-305VAC or 120-430VDC	
Rated Power	3 Watts	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (Full Load)	115VAC / 230VAC	70mA / 45mA typ.
No Load Power Consumption	85-305VAC / 47-440Hz	40mW max.
Inrush Current (<2ms)	115VAC	15A max.
	230VAC	30A max.
Output Voltage	3.3V-24V	
Output Voltage Tolerance***	3.3V	±4% typ. / ±8% max.
	5V	±3% typ. / ±5% max.
	12V / 24V	±2.5% typ. / ±3.5% max.
Output Current	see Selection Guide	
Output Ripple & Noise**** (with 47µF + 0.1µF on output)	3.3V	200mVp-p
	others	150mVp-p
Switching Frequency	@ Full Load	45KHz typ.
Minimum Load	Specification valid	10%
Line Voltage Regulation	LL-HL @ Full Load	±0.7% typ. / ±1% max.
Load Regulation (10%-100% Load)	3.3V	±5.5% typ. / ±9% max.
	5V	±5% typ. / ±7.5% max.
	12V	±4% typ. / ±5.5% max.
	24V	±3.5% typ. / ±4.5% max.
Leakage Current	85-305VAC / 47-440Hz	10mA max.
Isolation Voltage	3kVAC / 1minute	
Isolation Resistance	1GΩ min	
Short Circuit Protection	Continuous, Auto Restart	
Over Current Limit	105% - 150%	
Over Voltage Protection (Zener diode clamp)	130%-160%	
Operating Temperature Range	natural convection, without derating	-25°C to +75°C
	natural air convection, with derating	-25°C to +85°C
Storage Temperature Range	-40°C to +85°C	
Relative Humidity	95% RH max.	
Case Material	UL94V-0 Black Plastic	
Potting Material	Epoxy	

continued on next page

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

3 Watt Single Output



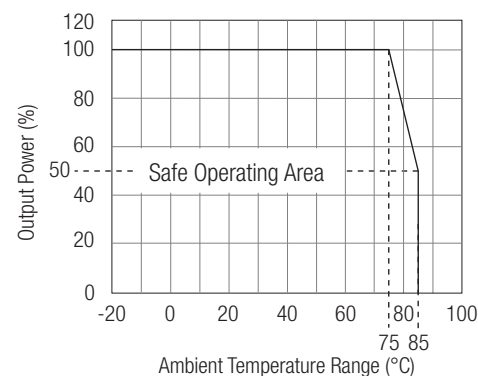
CE Marked

UL-60590-1 Certified

RAC03-SCR/277

Derating Graph

(Ambient Temperature)



Specifications (measured at TA 25°C)

Package Weight	41g typ.	
Package Quantity	12pcs	
	„-Tray“-Version	72pcs
Physical Dimension (LxWxH)	50.3 x 50.3 x 11.0mm	
RoHS	Test Report: KA/2012/91224	
EMC	EN55022 Class B	
UL General Safety	File Number: E224736	UL-60950-1
EN General Safety	Report: T120925N01-E	EN-55022: 2010 Class B, EN55024:2010
MTBF	TA = 25°	1300 x 10 ³ hours
(using MIL-HDBK-217F)	TA = 75°	160 x 10 ³ hours

Notes:

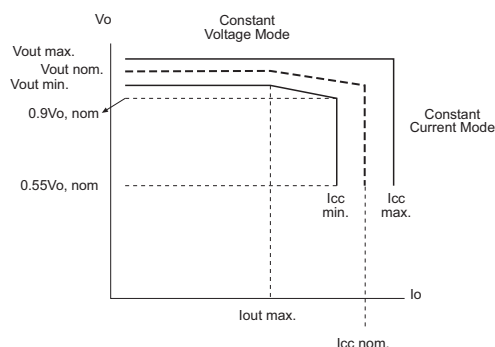
**The “constant current operation range” is over 55% - 90% of Vo nom. The specification includes all the tolerances of current accuracy, line regulation and load regulation. Typically, the constant current tolerance could be within ±7%.

***The “output voltage tolerance” includes initial voltage accuracy, thermal drift, line regulation and load regulation at rated input voltage and load conditions.

****“Ripple and Noise” is the maximum peak-to-peak voltage value measured at the output with a 20 MHz bandwidth, at rated line voltage at full load.

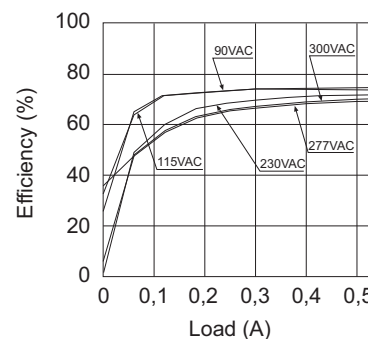
RAC03-xxSCR/277

Output V-I Characteristics

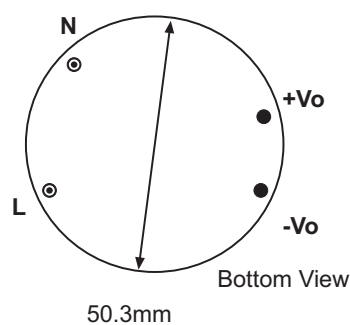
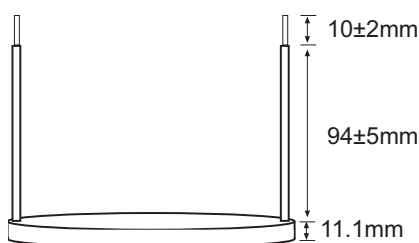


RAC03-3.3SCR/277

Efficiency vs Load



Mechanical Dimension



3rd angle projection

Wire Connections

Wire #			
1 (Brown)	AWG#22	1015	VAC in (L)
2 (Blue)	AWG#22	1015	VAC in (N)
3 (Red)	AWG#22	1430	+VDC out
4 (Black)	AWG#22	1430	-VDC out

Tolerance ±0.5mm unless otherwise specified

Features

Regulated Converters

- Ultracompact AC-DC Power Supply
- 4 Watt PCB Mount Package
- Universal Input Voltage Range including 277VAC
- 3kVAC Isolation (Class II)
- Very Low No Load Input Current
- Dual output version for standby relay circuits
- Short Circuit Protected
- EN/UL Certified, CE Marked.

Selection Guide

Part Number	Input Range (VAC)*		Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load
	(Std)	(/277)				
RAC04-3.3SA	90-264	90-305	3.3	1200	68	14000µF
RAC04-05SA	90-264	90-305	5	800	72	8000µF
RAC04-09SA	90-264	90-305	9	444	75	2400µF
RAC04-12SA	90-264	90-305	12	333	76	1000µF
RAC04-15SA	90-264	90-305	15	267	76	700µF
RAC04-24SA	90-264	90-305	24	167	77	220µF
RAC04-0512DA	90-264	90-305	5/12	120/250	75	4700/330µF

* add suffix /277 for 90-305VAC input. High input voltage converters are identified by omitting pin 1.

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	standard	90-264VAC or 120-370VDC
	/277 versions	90-305VAC or 120-430VDC
Rated Power		4 Watts max
Input Frequency Range (for AC Input)		47-440Hz
Input Current (full load)	115/230VAC	95/65mA max.
	/277	75/55mA max.
No Load Power Consumption	115/230/277VAC	150/210/220mW typ.
Inrush Current (<0.5ms)	115/230VAC	15/25A max.
Leakage Current		0.25mA max
Output Voltage Accuracy (full load)	single outputs	±2%
	3.3V (/277 Version)	±0.5%
Dual output version	5V/12V	±5%/±2%
Line Voltage Regulation (low line, high line at full load)		±0.2% typ
Dual output version	5V/12V	±3%/±0.2% typ
Load Voltage Regulation	3.3V output	±1% typ
(0% to 100% full load)	All others	±0.5% typ
Dual output version	5V/12V	±5%/±0.5% typ
Output Ripple and Noise	3.3V output	<250mVp-p max
(measured @ 20MHz of bandwidth with	5V output	<200mVp-p max.
0.1µF & 47µF parallel capacitor)	All others	100mVp-p max
Operating Frequency		132kHz typ
Hold-up time		15ms min.
Minimum Load	single outputs	0%
	5V/12V	25%
RMS Isolation Voltage (input to output)		3kVAC / 1minute
Temperature Coefficient		±0.02%/°C typ
Isolation Resistance		100 MΩ max
Short Circuit Protection		Hiccup, Automatic Restart
Output Overvoltage Protection		Zener Clamping Diode
Operating Temperature Range	All others	-40°C to +70°C
(natural convection, with derating)	Dual output version	-40°C to +70°C
Storage Temperature Range		-40°C to +85°C
Humidity		95% RH max
Case Material		Epoxy with Fibreglass (UL94V-0)
Package Weight		26g
Packing Quantity		12 pcs
EMC	Conducted and Radiated	EN 55022 Class B
	Noise Immunity	EN 55024
MTBF (+25°C)	using MIL-HDBK-217F	>350 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

4 Watt Single/Dual Output



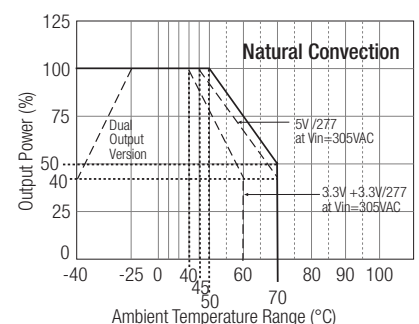
EN 55022/55024 Certified
UL-60950-1 Certified

RAC04

Description

The RAC04 series is an ultra-compact universal input AC/DC power module for PCB mounting. It features ultralow no-load power consumption, short circuit, overload and output overvoltage protection as well as a built-in EMC Class B filter. A high input voltage version (suffix /277) is also available for input voltages of up to 305VAC or 430VDC.

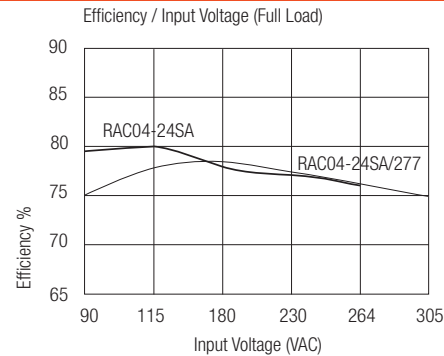
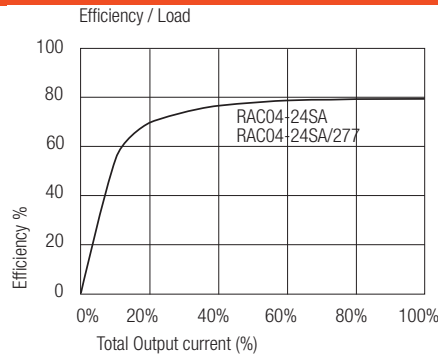
Derating Graph (Ambient Temperature)



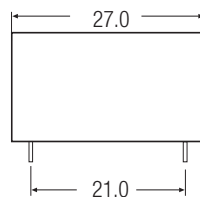
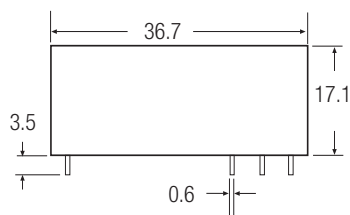
Please Read Application Notes

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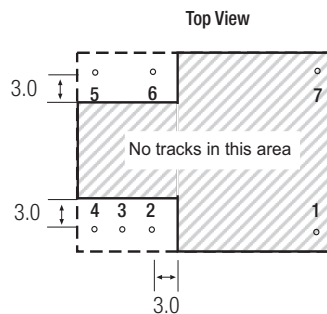
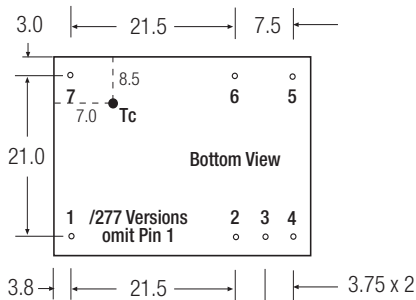
Typical Characteristics



Standard Package Style and Pinning



3rd angle projection



Pin Connections

Pin #	Single Output	Dual Output	/277 Versions
1	NC	NC	No Pin
2	+VDC out	+12V	same
3	-VDC out	Com	same
4	NC	+5V	same
5	VAC in (L)	VAC in (L)	VAC in (L)
6	VAC in (N)	VAC in (N)	VAC in (N)
7	NC	NC	NC

NC = No Connection

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

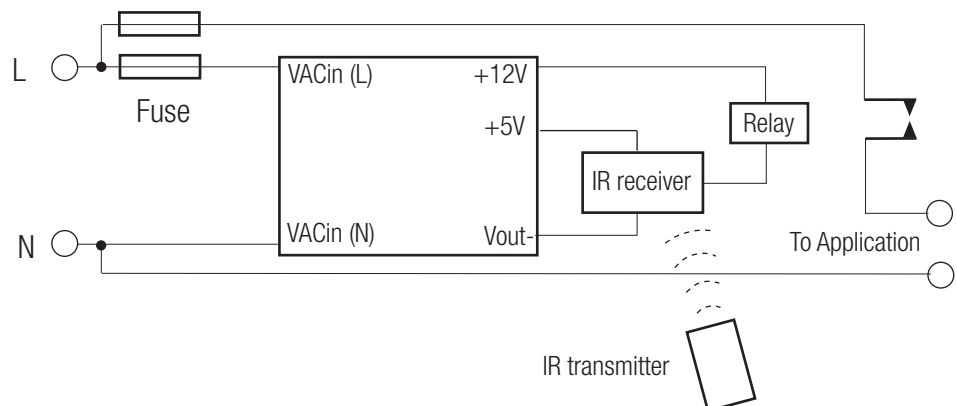
It is recommended to additionally bond the /277 version of the converter to the PCB if the application is subject to vibration or mechanical shock.

Standard Application Circuit

Standby Relay Application

With 110VAC supply and 10mA standby load, the circuit consumes typically only 150mW.

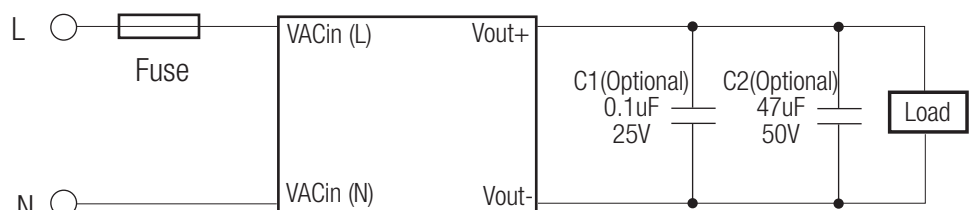
Once activated by the remote handset, the standard 12V relay can switch a 16A load.



Compact single output regulated power supply

Suggested fuse rating:

1A Slow Blow



Features

Regulated Converters

- Universal Input 80-305VAC
- High efficiency up to 79%
- Isolated Output 3.75kVAC / 1 min
- Short Circuit Protection
- Maximum No Load <50mW, Maximum Input Power <0.5W @0.3W Output Power
- Meet EN55022 Class B
- Fixed Output Voltage

Selection Guide

Part Number	Input Voltage (VAC)	Output Voltage (VDC)	Output Current (max.)	Efficiency (Typ.)	Max. Capacitive Load
RAC04-3.3SC/277	80-305	3.3	1200	72	10000
RAC04-05SC/277	80-305	5	800	75	7200
RAC04-12SC/277	80-305	12	333	78	1000
RAC04-15SC/277	80-305	15	267	79	820
RAC04-24SC/277	80-305	24	167	79	220
RAC04-0512DC/277	80-305	5/12	720/33	75	4700/100
RAC04-05DC/277	80-305	±5	±400	76	±3300
RAC04-12DC/277	80-305	±12	±166	78	±680

Specifications (measured at TA 25°C, full load after warm-up)

Input Voltage Range (with Derating)	80-305VAC or 113-430VDC	
Input Frequency	47-440Hz	
Input Current (Full Load)	115VAC/230VAC	98mA / 64mA max.
Inrush Current	115VAC/230VAC	15A / 30A max.
No Load Power Consumption	115VAC/230VAC/277VAC / 50/60Hz	50mW max.
Output Voltage Accuracy (Full Load)	Single Outputs	±2% typ.
	Dual Outputs	±2% typ.
	5V/12V	±2% / ±10% typ.
Line Voltage Regulation (90-305VAC)	Single Outputs	±0.2% typ.
	Dual Outputs	±0.2% typ.
	5V/12V	±0.2% / ±1% typ.
Load Voltage Regulation	3.3V/5V Output	±1% typ.
	All Others	0.5% typ.
(5V Minimum Load 5% @12V Full Load)	5V/12V	±1%/- typ.
Output Ripple&Noise @115/230VAC (20MHz limited)	3.3V/5V/±5V Output	150mV max.
	All Others	100mV max.
	5V/12V	150mV/- max.
Switching Frequency (Full Load)	67kHz	
Hold-Up Time (@115VAC)	15ms min.	
Minimum Load	5V/12V	5% / 0% typ.
	All Others	0%
Isolation Voltage	Input-Output	3.75kVAC / 1minute
Leakage Current	277VAC / 50Hz	0.25mA max.
Isolation Resistance	100M Ω min.	
Short Circuit Protection	Auto Recovery	
Operating Temperature Range	-25°C to +65°C (without Derating)	
(Natural Convection, with Derating)	-25°C to +80°C (with Derating)	
Storage Temperature Range	-40°C to +100°C	
Case Material	UL94V-0 Black Plastic	

continued on next page

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

4 Watt Single / Dual Output



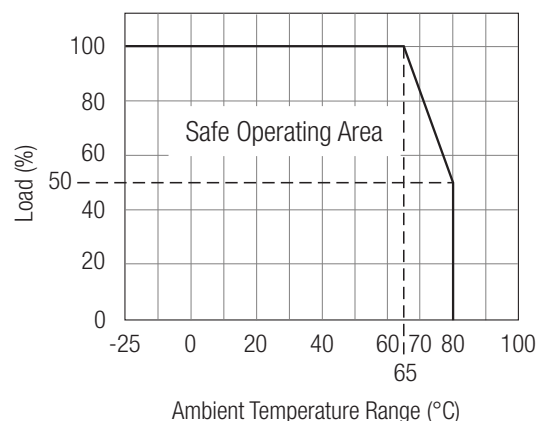
EN-60950-1 Certified

UL-60950-1 Certified

RAC04/277

Derating Graph

(Ambient Temperature)

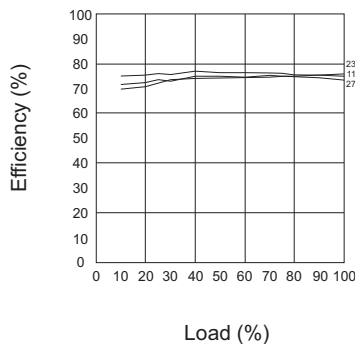


Specifications (measured at TA 25°C, full load after warm-up)

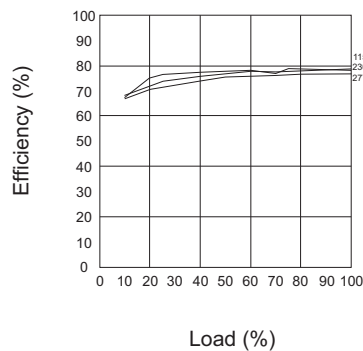
Relative Humidity	Non Condensing	95% RH max.
Package Weight		31.5g typ.
Physical Dimenstions	(LxWxH)	36.7x27.2x17.1 mm
EMC	Conducted and Radiated	EN55022 Class B
	Noise Immunity	EN55024
MTBF (+25°C)	MIL-HDBK-217F	500 x 10 ³ hours
Certification	CE (Report: T121109N01-E)	EN55022 Class B
	UL General Safety (Report: E224736-A18-UL)	UL60950-1, 2nd Edition
	EN General Safety (Report: SPCLVD1210098)	EN60950-1, 2nd Edition

Specifications (measured at TA 25°C, full load after warm-up)

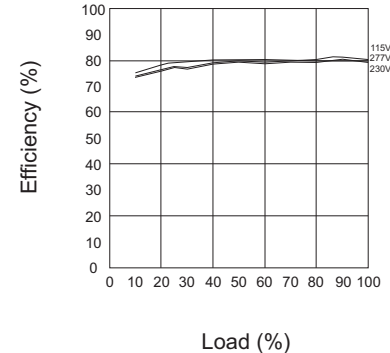
RAC04-3.3SC/277



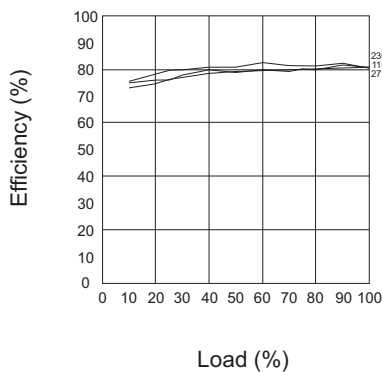
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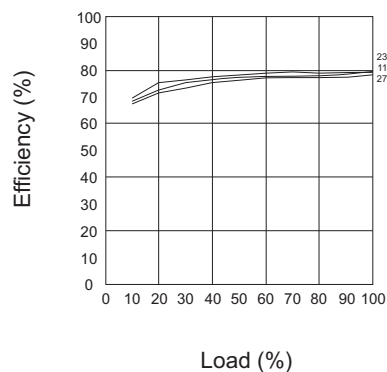
RAC04-12SC/277



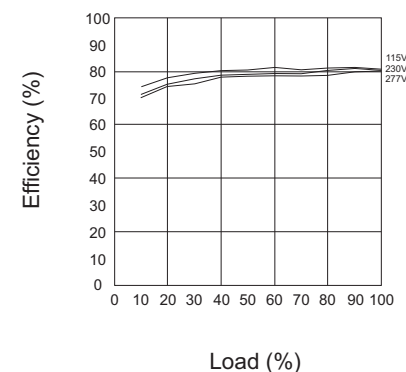
RAC04-15SC/277



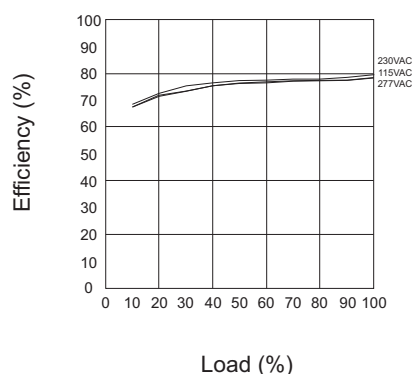
RAC04-05DC/277



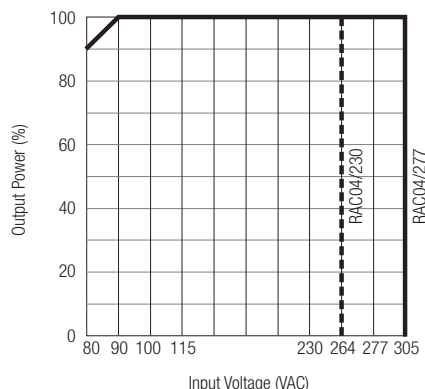
RAC04-12DC/277



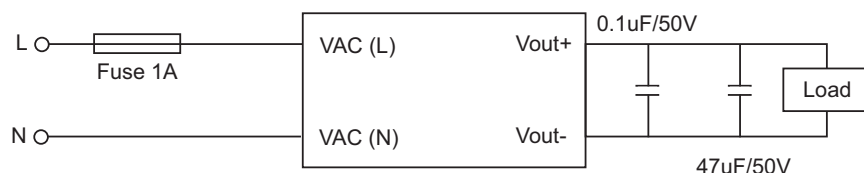
RAC04-0512DC/277



Specifications (measured at TA 25°C, full load after warm-up)



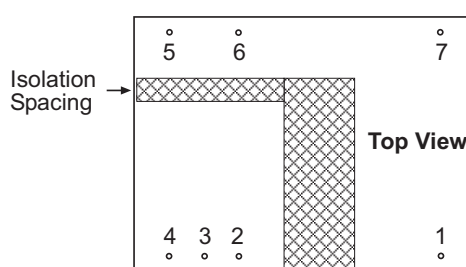
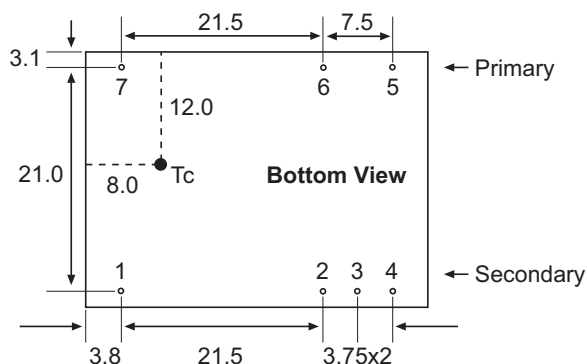
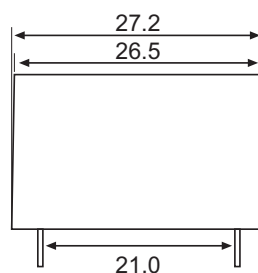
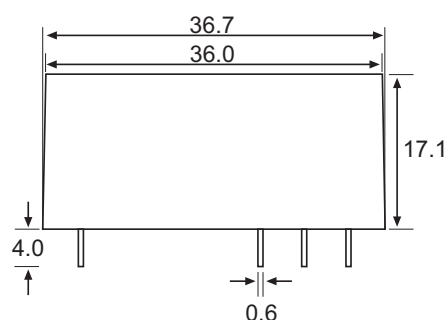
Application Note:



1. Recommended external input fuse 1A/slow blow type.
2. To measure the output ripple & noise short runs by 0.1uF/50V&47uF/50V @20MHz, nominal input and full load. Please see as above.
3. That Pin 7 is NC but need 4mm minimum clearance to ground for safety.

Package Style and Pinning

3rd angle projection



Pin Connections

Pin #	Single Out	Dual Output	Dual Output
1	No Pin	No Pin	No Pin
2	+VDC out	+Vout	+Vout
3	-VDC out	Com	Com
4	NC	-Vout	+12V
5	VAC in (L)	VAC in (L)	VAC in (L)
6	VAC in (N)	VAC in (N)	VAC in (N)
7	NC	NC	NC

NC = No Connection
xx.x = $\pm 0.5\text{mm}$
xx.xx = $\pm 0.25\text{mm}$

Features

Regulated Converters

- AC-DC Power Supply
- 5 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- UL Approved, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max Capacitive Load
RAC05-3.3SA	90-264	3.3	1500	62	40000 μ F
RAC05-05SA	90-264	5	1000	65	19000 μ F
RAC05-12SA	90-264	12	416	70	4000 μ F
RAC05-15SA	90-264	15	333	70	3500 μ F
RAC05-24SA	90-264	24	200	71	900 μ F
RAC05-05DA	90-264	$\pm$ 5	$\pm$ 500	70	$\pm$ 9500 μ F
RAC05-12DA	90-264	$\pm$ 12	$\pm$ 200	67	$\pm$ 1400 μ F
RAC05-15DA	90-264	$\pm$ 15	$\pm$ 160	67	$\pm$ 950 μ F

*add suffix "-E" for extended temperature range, e.g. RAC05-05SA-E

*add suffix "-ST" for screw terminal module e.g. RAC05-05SA-ST, RAC05-05DA-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	5 Watts max	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	120mA /70mA max.
No Load Power Consumption	115VAC/230VAC	1.18W max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.75mA max	
Output Voltage Accuracy (full load)	$\pm$ 2%	
Line Voltage Regulation (low line, high line at full load)	$\pm$ 0.3% typ	
Load Voltage Regulation (5% to 100% full load)	$\pm$ 0.5% typ	
Output Ripple and Noise (20MHz limited)	Ripple	<0.2% Vout + 40mVp-p max
	Noise	0.5% Vout + 50mVp-p max
Operating Frequency	100kHz typ	
Efficiency at full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC / 1minute	
Temperature Coefficient	$\pm$ 0.02%/°C typ	
Isolation Resistance	100 M Ω max	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	80g	
Packing Quantity	5 pcs (-ST Version: 1 pc)	
EMC	EN 55022 ClassB / EN 50082-1	
MTBF (+25°C)	using MIL-HDBK-217F	300 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

5 Watt Single/Dual Output

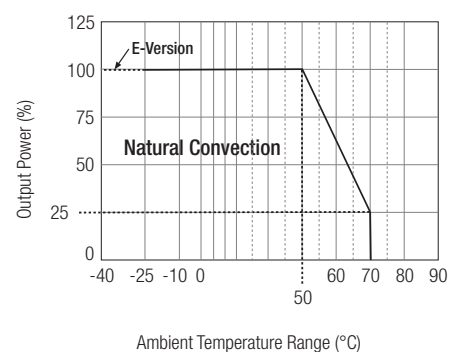


UL-60950-1 Certified

RAC05-A

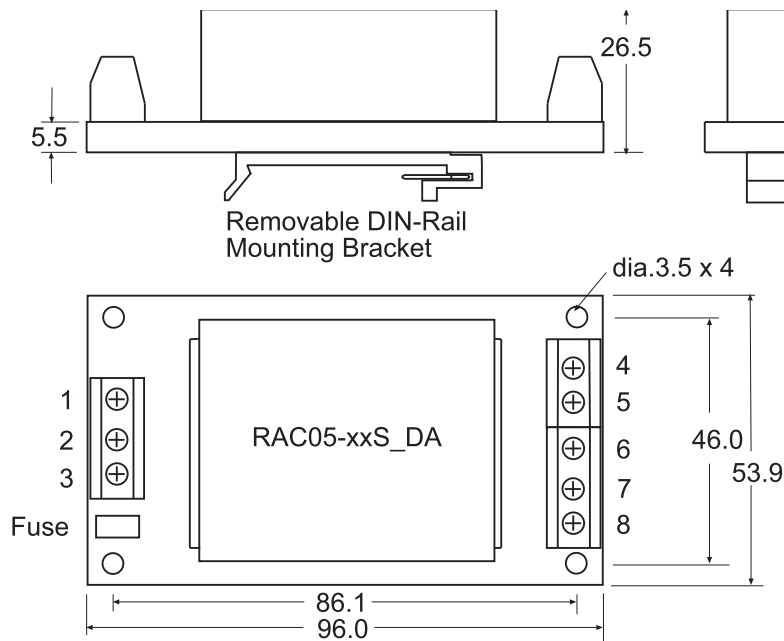
Derating Graph

(Ambient Temperature)



Please Read Application Notes

Screw Terminal Module Option (suffix -ST)



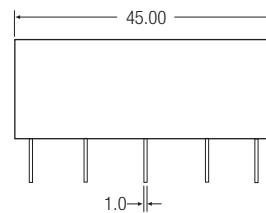
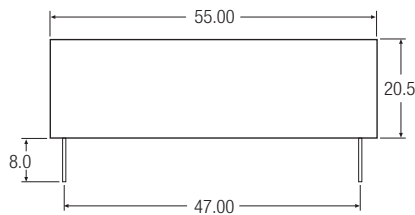
3rd angle projection

Pin Connections-

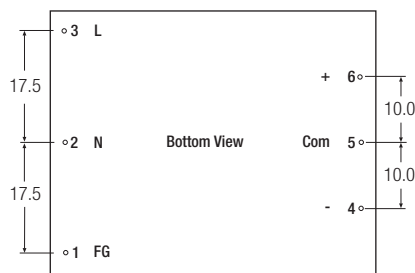
Pin #	Single Out	Dual Out
1	FG	FG
2	VAC in (N)	VAC in (N)
3	VAC in (L)	VAC in (L)
4	NC	NC
5	-VDC out	-VDC out
6	NC	Com
7	+VDC out	+VDC out
8	NC	NC

NC = No Connection

Standard Package Style and Pinning



3rd angle projection



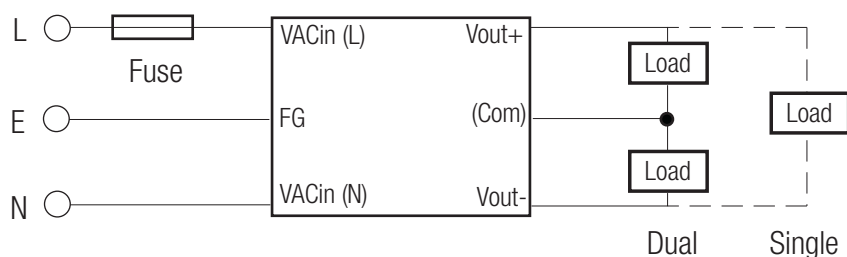
Pin Connections-

Pin #	Single Out	Dual Out
1	FG	FG
2	VAC in (N)	VAC in (N)
3	VAC in (L)	VAC in (L)
4	-VDC out	-VDC out
5	No Pin	Com
6	+VDC out	+VDC out

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Standard Application Circuit

Suggested fuse rating
1A Slow Blow



Features

Regulated Converters

- Very Compact AC-DC Power Supply
- 5 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- Very Low No Load Power Consumption
- UL Certified, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC05-3.3SB	90-264	3.3	1250	68	13800µF
RAC05-05SB	90-264	5	1000	71	6000µF
RAC05-12SB	90-264	12	420	75	1400µF
RAC05-15SB	90-264	15	333	75	1000µF
RAC05-24SB	90-264	24	230	77	170µF

*add suffix "-E" for extended temperature range, e.g. RAC05-05SB-E

*add suffix "-ST" for screw terminal module e.g. RAC05-05SB-ST, RAC05-05SB-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	5 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	110mA / 70mA max.
No Load Power Consumption	115VAC/230VAC	80mW max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.75mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regulation (low line, high line at full load)	±0.3% typ.	
Load Voltage Regulation (5% to 100% full load)	±0.5% typ.	
Output Ripple and Noise (20MHz limited)	Noise	0.5% Vout + 50mVp-p max.
	Ripple	<0.2% Vout + 40mVp-p max.
Operating Frequency	132kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MΩ max.	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	30g	
Packing Quantity	9 pcs (-ST Version: 1 pc)	
EMC	EN 55022 Class B / EN 55024	
MTBF (+25°C)	using MIL-HDBK-217F	360 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

5 Watt Single Output

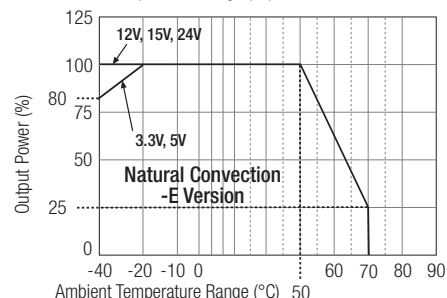
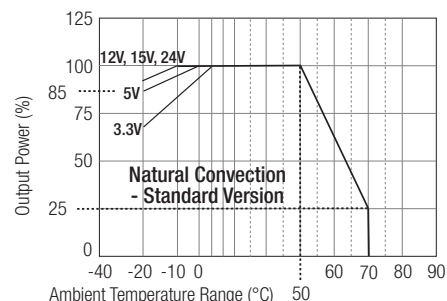


E196683

UL-60950-1 Certified

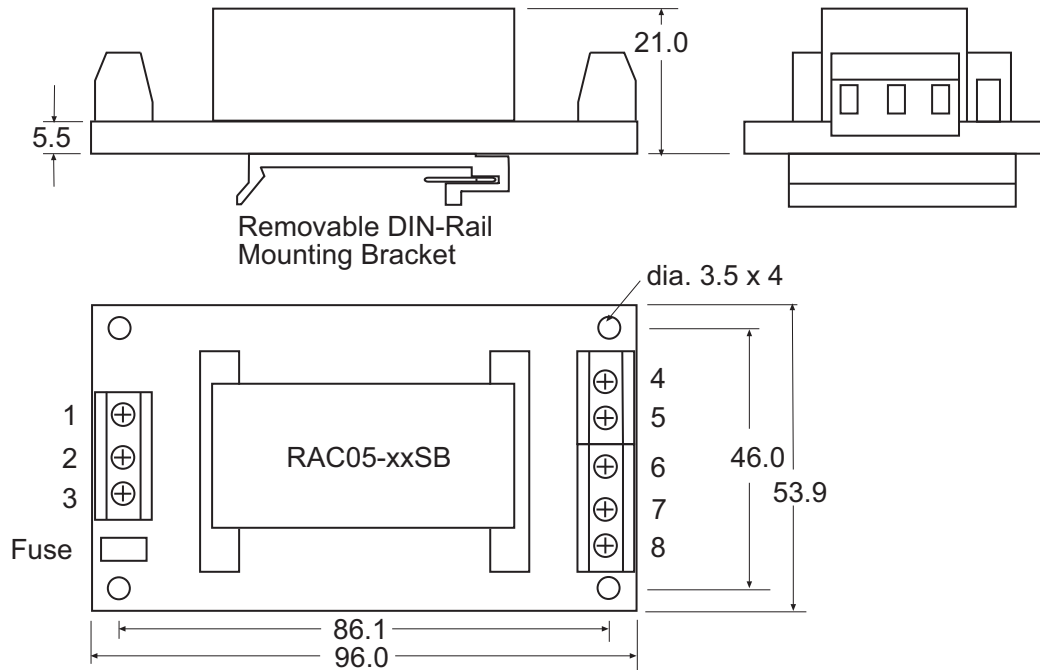
RAC05-B

Derating Graphs (Ambient Temperature)



Screw Terminal Module Option (suffix -ST)

3rd angle projection



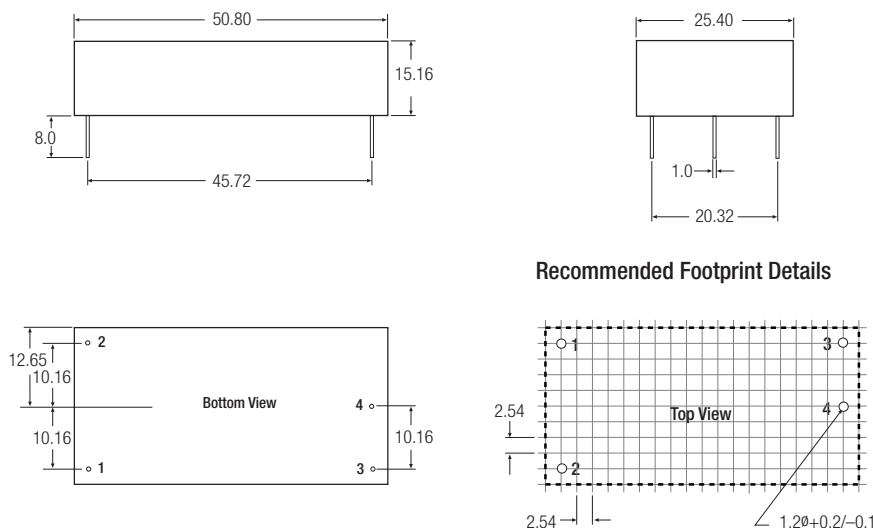
Pin Connections-

Pin #	Single Out
1	NC
2	VAC in (N)
3	VAC in (L)
4	NC
5	+VDC out
6	-VDC out
7	NC
8	NC

NC = No Connection

Package Style and Pinning

3rd angle projection



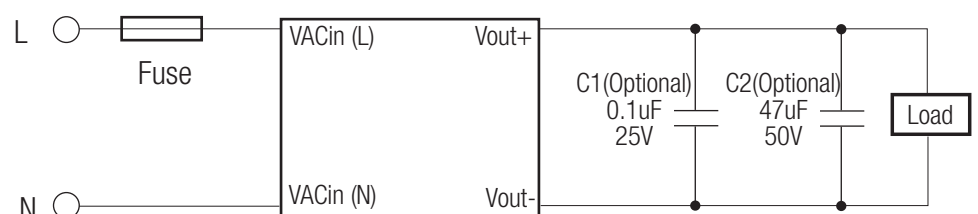
Pin Connections

Pin #	Single Out
1	VAC in (N)
2	VAC in (L)
3	+VDC out
4	-VDC out

Tolerance ± 0.5 mm

Standard Application Circuit

Suggested fuse rating
1A Slow Blow



Please Read Application Notes

Features

Regulated Converters

- Universal Input 80-264VAC
- High efficiency up to 77%
- Isolated Output 3kVAC / 1 min
- Short Circuit Protection
- Meet EN55022 Class B
- Low Standby Power Consumption

Selection Guide

Part Number	Input Voltage (VAC)	Output Voltage (VDC)	Output Current (max.)	Efficiency (Typ.)	Max. Capacitive Load**
RAC05-3.3SC*	80-264	3.3	1250	70	2500μF
RAC05-05SC*	80-264	5	1000	73	2200μF
RAC05-09SC*	80-264	9	556	75	1200μF
RAC05-12SC*	80-264	12	420	76	680μF
RAC05-15SC*	80-264	15	340	76	450μF
RAC05-24SC*	80-264	24	210	77	220μF
RAC05-05DC*	80-264	±5	±500	73	±900μF
RAC05-12DC*	80-264	±12	±210	76	±220μF
RAC05-15DC*	80-264	±15	±170	76	±150μF

* add suffix /W for wired version

** defined @ 115VAC/60Hz with full load

Specifications

(Ta=25°C and after warm-up, measured at 115VAC/60Hz and 230VAC/50Hz)

Input Voltage Range (with derating)	80-264VAC or 115-370VDC	
Rated Power	5 Watts max.	
Input Frequency (for AC Input)	47-440Hz	
Input Current (Full Load)	115VAC / 230VAC	110mA / 70mA typ.
Inrush Current (<2ms)	115VAC / 230VAC	30A / 60A max.
Minimum Load (Specifications valid with 5% min.)	0%	
No Load Power Consumption	0.25W max.	
Recommended External Input Fuse	1.5A / Slow Blow Type	
Output Voltage Accuracy (Full Load)	115VAC / 230VAC	±2% max.
Line Voltage Regulation (Full Load)	LL-HL	±0.3% typ.
Load Voltage Regulation	5-100% Load	±0.5% typ.
Output Ripple&Noise @115/230VAC	3.3V	120mV max.
(20MHz limited with 100nF across output)	All Others	150mV max.
Switching Frequency (Full Load)	132kHz typ.	
Efficiency (Full Load)	see Selection Guide	
Hold-Up Time (Full Load)	115VAC	10ms typ.
Leakage Current	0.85mA max.	
Isolation Voltage	Input-Output	3kVAC / 1 minute
Isolation Capacitance	Input-Output	1000pF typ.
Isolation Resistance	Input-Output	1G Ω min.
Short Circuit Protection	Hiccup, Automatic Restart	
Overvoltage Protection	3.3V	4.8 V - 5.4V
(of Nominal Output Voltage)	All Others	110% - 135%
Operating Temperature Range	-25°C to +55°C (without Derating)	
(Natural Convection)	-25°C to +75°C (with Derating)	
Storage Temperature Range	-40°C to +100°C	
Case Material	UL94V-0 Black Plastic	
Potting Material	Epoxy UL94V-0	
Relative Humidity	95% RH max.	

continued on the next page

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

5 Watt Single / Dual Output



CE
E224736

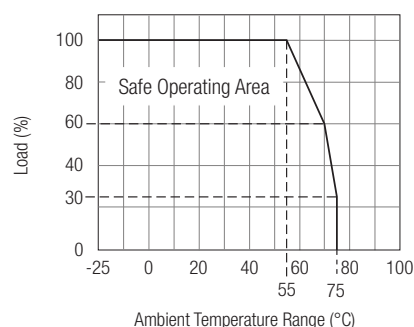
EN-60950-1 Certified
UL-60950-1 Certified

RAC05-C

Description

Compact, low cost, high efficiency, universal input switching AC/DC power module for PCB or wired mounting with single or dual outputs. CE marked and UL/cUL certified.

Derating Graph (Ambient Temperature)

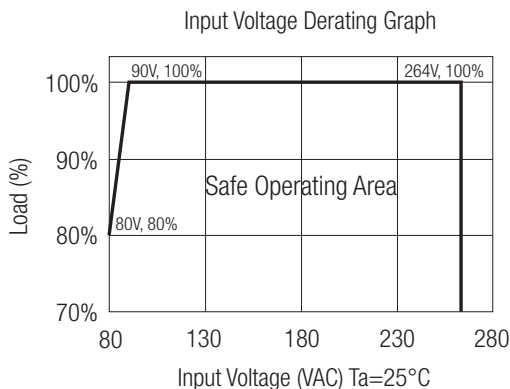
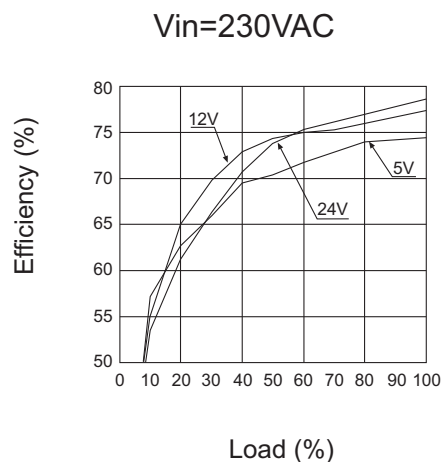
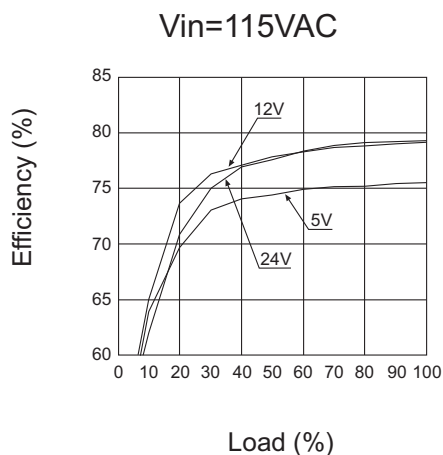


Specifications (measured at TA 25°C, full load after warm-up)

Package Weight		35g / 38g
Packing Quantity	Single Output	10pcs
	Dual Output	9pcs
	Wired Version	1pc
MTBF (25°C)	Using MIL-HDBK 217F	>400 x 10 ³ hours
(65°C)	Using MIL-HDBK 217F	>200 x 10 ³ hours
Emmissions	CE	EN 55022: 2006 + A1: 2007 / Class B
	EMC	EN 55024:1998 + A1:2001 + A2:2003
	Harmonics	EN 61000-3-2:2006 / Class A
	Flicker	EN 61000-3-3:1995 + A1:2001 +A2:2005
Immunity	ESD	IEC 61000-4-2 / Criterion B
	RS	IEC 61000-4-3 / Criterion A
	EFT	IEC 61000-4-4 / Criterion B
	Surge	IEC 61000-4-5 / Criterion B
	CS	IEC 61000-4-6 / Criterion A
	PMF	IEC 61000-4-8 / Criterion A
	Voltage Variations	IEC 61000-4-11 / Criteria B + C
Certifications:		
UL General Safety	Report: E224736	UL-60950-1, 2nd Edition
cUL	Report: E224736	C22.2 No. 60950-1-07, 2nd Edition
EN General Safety	Report: SPCLVD1105038	EN-60950-1, 2nd Edition
CE		EN55022 Class B

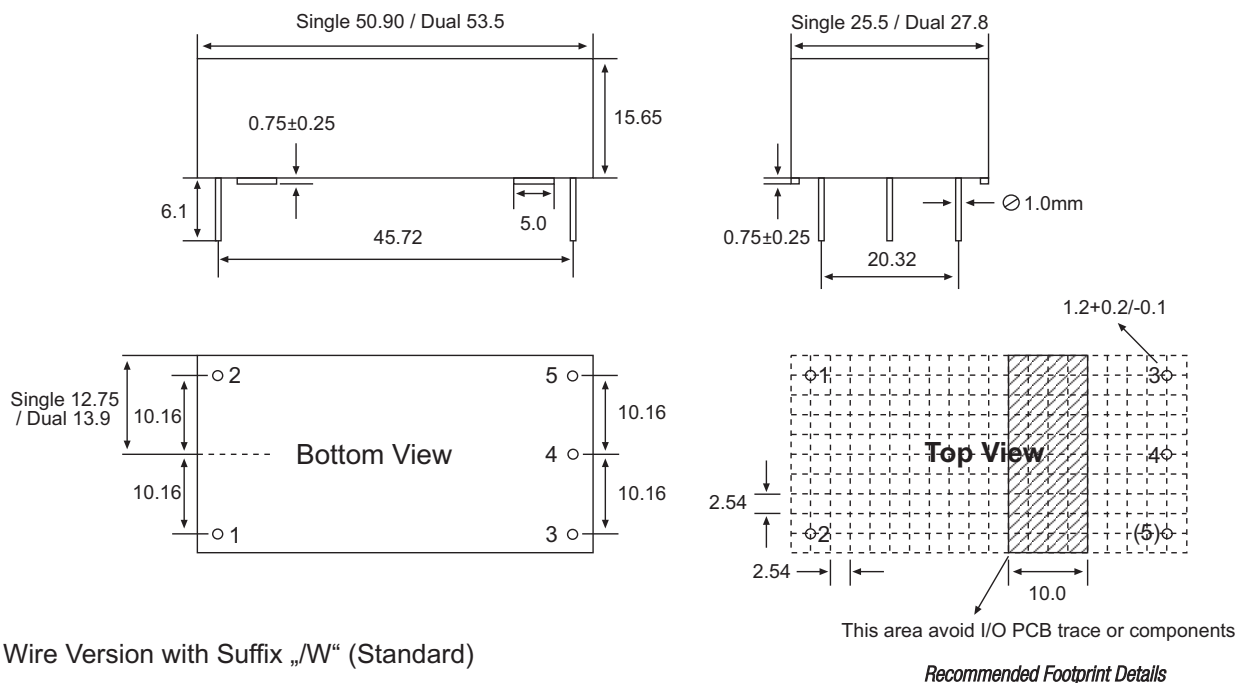
Typical Characteristics

RAC05

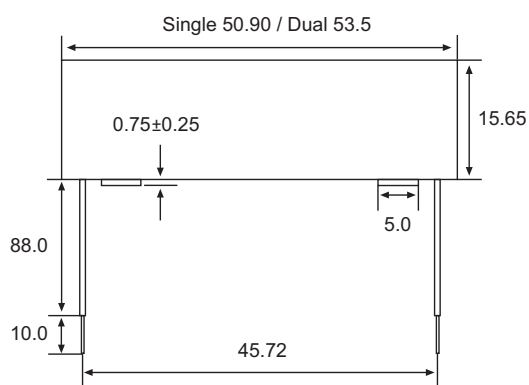


Package Style and Pinning

PCB Mount Version (Standard)



Wire Version with Suffix „W“ (Standard)



Pin Connections

Pin #	Single Out	Dual Out
1	VAC in (N)	VAC in (N)
2	VAC in (L)	VAC in (L)
3	+VDC out	+VDC out
4	-VDC out	Com
5	no Pin	-VDC out

NC = No Connection

xx.x = ±0.5mm

xx.xx = ±0.25mm

Wire Connections

Pin #			Single out	Dual out
1 (Blue)	AWG#22	1015	VAC in (N)	VAC in (N)
2 (Brown)	AWG#22	1015	VAC in (L)	VAC in (L)
3 (Red)	AWG#22	1007	+VDC out	+VDC out
4 (Black)	AWG#22	1007	-VDC out	Common
5 (Orange)	AWG#22	1007	no Wire	-VDC out

NC = No Connection

xx.x = ±0.5mm

xx.xx = ±0.25mm

Features

Regulated Converters

- Very Compact AC-DC Power Supply
- 6 Watt PCB Mount Package
- Single and Dual Output Versions
- Universal Input Voltage Range
- Class II Power Supply with 3kVAC Isolation
- Low Output Ripple and Noise
- Short Circuit, Overload, Overtemp Protected
- Low Standby Power Consumption
- UL/cUL Certified, CE Marked

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency** (%)	Max Capacitive Load**
RAC06-3.3SC*	80-264	3.3	1500	70	2500μF
RAC06-05SC*	80-264	5	1200	75	2200μF
RAC06-09SC*	80-264	9	667	77	1200μF
RAC06-12SC*	80-264	12	500	78	680μF
RAC06-15SC*	80-264	15	400	79	450μF
RAC06-24SC*	80-264	24	250	79	220μF
RAC06-05DC*	80-264	±5	±600	75	±1000μF
RAC06-12DC*	80-264	±12	±250	78	±330μF
RAC06-15DC*	80-264	±15	±200	79	±220μF

* add suffix /W for wired version

** measured @ 115VAC/60Hz with full load

Specifications

(Ta=25°C and after warm up time, measured at 115VAC/60Hz and 230VAC/50Hz)

Input Voltage Range (with derating)	80-264VAC or 115-370VDC	
Rated Power	6 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115/230VAC	120mA / 78mA typ.
No Load Power Consumption	250mW max.	
Inrush Current (<2ms)	115/230VAC	30A/60A max.
Holdup Time (Full Load)	115VAC	10ms typ.
Leakage Current	0.85mA max.	
Output Voltage Accuracy (Full load)	±2% max.	
Line Voltage Regulation (low line, high line at full load)	±0.3% typ.	
Load Voltage Regulation (5% to 100% full load)	±0.5% typ.	
Output Ripple and Noise (20MHz BW)	3.3V Output	120mVp-p max.
(with 100nF across each output)	All Others	150mVp-p max.
Operating Frequency (full load)	132kHz typ.	
Minimum Load = 0%	specifications valid for 5% minimum load only	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Isolation Resistance (input to output)	1 GΩ min.	
Isolation Capacitance (input to output)	1000pF typ.	
Short Circuit Protection	Hiccup, Automatic Restart	
Overload Protection	115VAC/230VAC	115% ~ 145%
Output Overvoltage Protection	Zener Diode Clamp	
(set at 4.8V - 5.4V for 3.3V and others 110% - 135% of its Nominal Output Voltage)		
Operating Temperature Range	(free air convection, without derating)	-25°C to +55°C
	(free air convection, with derating)	-25°C to +75°C
Storage Temperature Range	-40°C to +100°C	

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

6 Watt Single/Dual Output



E224736

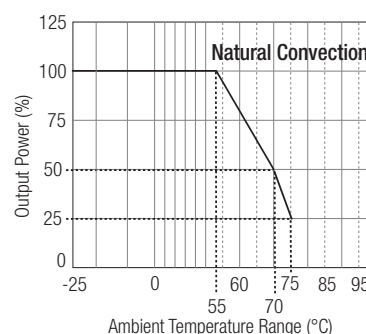
EN-60950-1 Certified
UL-60950-1 Certified

RAC06-C

Description

Compact, low cost, high efficiency, universal input switching AC/DC power module for PCB or wired mounting with single or dual outputs. CE marked and UL/cUL Certified.

Derating Graph (Ambient Temperature)



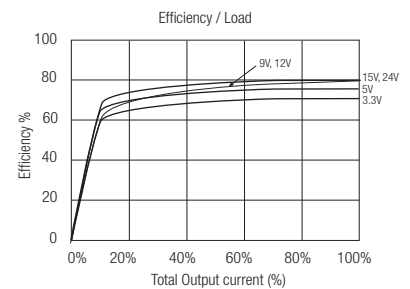
Please Read Application Notes

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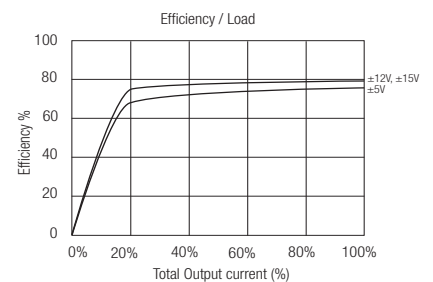
Typical Characteristics

Recommended External Input Fuse		1.5A Slow Blow
Humidity	95% RH max.	
Case Material	Plastic Case filled with Epoxy (UL94V-0)	
Package Weight	Single/Dual	35g/38g
Packing Quantity	Single Output	10 pcs
	Dual Output	9 pcs
	/W Version	1 pc
Emissions	CE	EN 55022: 2006 + A1: 2007 / Class B
	EMC	EN 55024:1998 + A1:2001 + A2:2003
	Harmonics	EN 61000-3-2:2006 / Class A
	Flicker	EN 61000-3-3:1995 + A1:2001 +A2:2005
Immunity	ESD	IEC 61000-4-2 / Criterion B
	RS	IEC 61000-4-3 / Criterion A
	EFT	IEC 61000-4-4 / Criterion B
	Surge	IEC 61000-4-5 / Criterion B
	CS	IEC 61000-4-6 / Criterion A
	PMF	IEC 61000-4-8 / Criterion A
	Voltage Variations	IEC 61000-4-11 / Criteria B + C
MTBF (+25°C)	using MIL-HDBK-217F	>400 x 10 ³ hours
(+65°C)		>200 x 10 ³ hours
Certifications:		
UL General Safety	Report: E224736	UL-60950-1, 2nd Edition
cUL	Report: E224736	C22.2 No. 60950-1-07, 2nd Edition
EN General Safety	Report: SPCLVD1105038	EN-60950-1, 2nd Edition
CE		EN55022 Class B

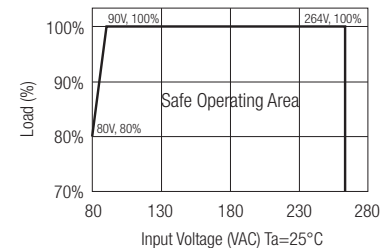
Single Output



Dual Output

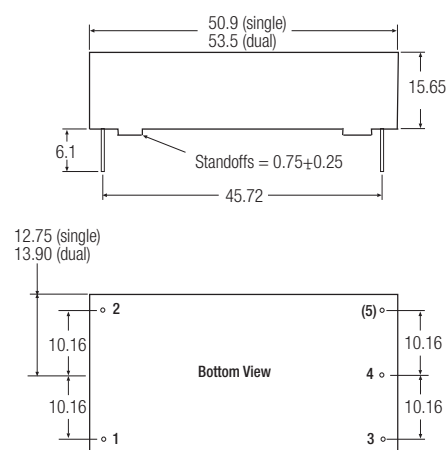


Input Voltage Derating Graph

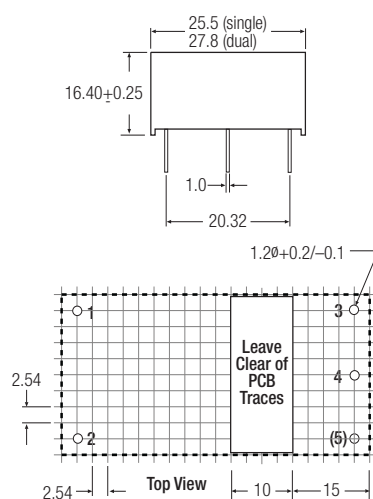
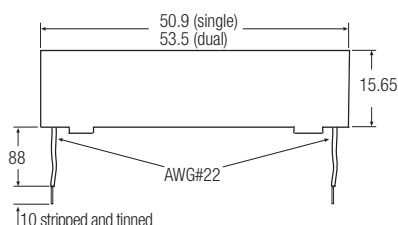


Package Style and Pinning

PCB Mounting Version (Standard)



Wired Version (Suffix /W)



Recommended Footprint Details

3rd angle projection

Pin Connections

Pin #	Single Out	Dual Out
1	VAC in (N)	VAC in (N)
2	VAC in (L)	VAC in (L)
3	+VDC out	+VDC out
4	-VDC out	Com
5	No Pin	-VDC out
Tolerance ± 0.5 mm		

Wire Connections

Wire	AWG#22	Single Out	Dual Out
Blue	1015	VAC in (N)	VAC in (N)
Brown	1015	VAC in (L)	VAC in (L)
Red	1007	+VDC out	+VDC out
Black	1007	-VDC out	Com
Orange	1007		-VDC out

Features

Regulated Converters

- Compact AC-DC Power Supply
- 10 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- UL Certified, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC10-3.3SA	90-264	3.3	3000	65	70000µF
RAC10-05SA	90-264	5	2000	71	35000µF
RAC10-12SA	90-264	12	833	76	11000µF
RAC10-15SA	90-264	15	666	75	7000µF
RAC10-24SA	90-264	24	426	76	2300µF
RAC10-05DA	90-264	±5	±800	73	±22000µF
RAC10-12DA	90-264	±12	±380	75	±3000µF
RAC10-15DA	90-264	±15	±300	74	±2000µF

*add suffix "-E" for extended temperature range, e.g. RAC10-05SA-E

*add suffix "-ST" for screw terminal module e.g. RAC10-05SA-ST, RAC010-05DA-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	10 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	200mA / 130mA max.
No Load Power Consumption	115VAC/230VAC	1.65W max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.75mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regulation (low line, high line at full load)	±0.3% typ.	
Load Voltage Regulation (5% to 100% full load)	±0.5% typ.	
Output Ripple and Noise (20MHz limited)	Noise	0.5% Vout + 50mVp-p max.
	Ripple	<0.2% Vout + 40mVp-p max.
Operating Frequency	100kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC / 1minute	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MΩ min.	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	92g	
Packing Quantity	5 pcs (-ST Version: 1 pc)	
EMC	EN 55022 Class B / EN 50082-1	
MTBF (+25°C)	using MIL-HDBK-217F	250 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

10 Watt Single/Dual Output

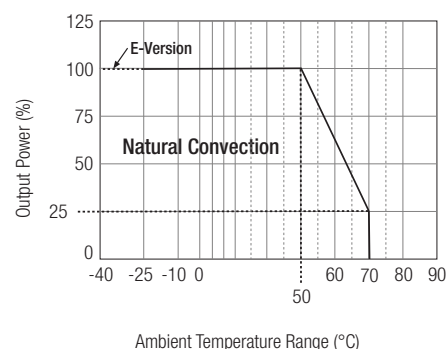


UL-60950-1 Certified

RAC10-A

Derating Graph

(Ambient Temperature)



Please Read Application Notes

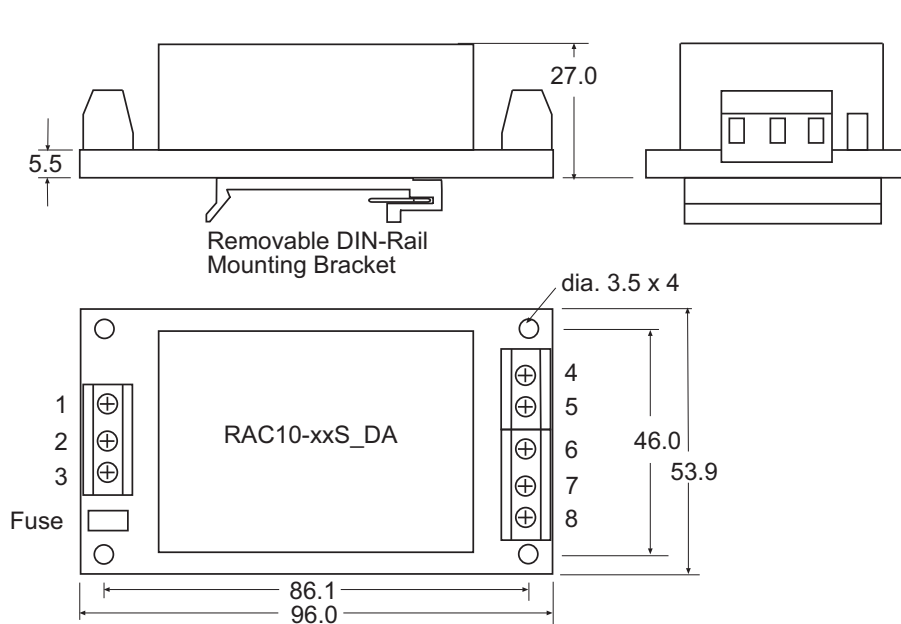
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POWERLINE

AC/DC-Converter

RAC10-S_DA Series

Screw Terminal Module Option (suffix -ST)



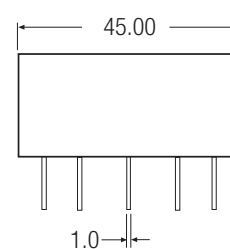
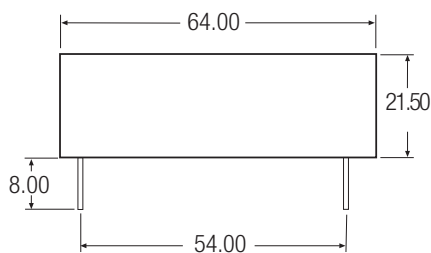
3rd angle projection

Pin Connections

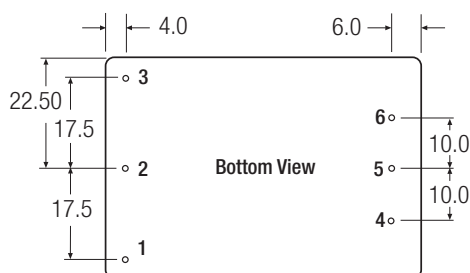
Pin #	Single Out	Dual Out
1	FG	FG
2	VAC in (N)	VAC in (N)
3	VAC in (L)	VAC in (L)
4	NC	NC
5	-VDC out	-VDC out
6	NC	Com
7	+VDC out	+VDC out
8	NC	NC

NC = No Connection

Standard Package Style and Pinning



3rd angle projection



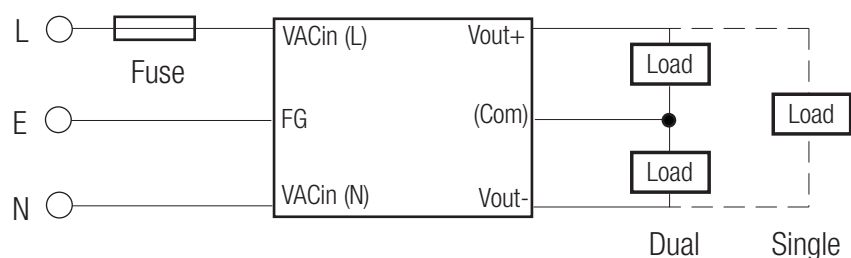
Pin Connections-

Pin #	Single Out	Dual Out
1	FG	FG
2	VAC in (N)	VAC in (N)
3	VAC in (L)	VAC in (L)
4	-VDC out	-VDC out
5	No Pin	Com
6	+VDC out	+VDC out

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Standard Application Circuit

Suggested fuse rating
2A Slow Blow



Features

Regulated Converters

- Compact AC-DC Power Supply
- 10 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- UL Certified, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.
Pin compatible with RAC5-xxSB models.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC10-3.3SB	90-264	3.3	2500	74	75000 μ F
RAC10-05SB	90-264	5	2000	79	40000 μ F
RAC10-12SB	90-264	12	833	82	8500 μ F
RAC10-15SB	90-264	15	667	78	3500 μ F
RAC10-24SB	90-264	24	417	80	1200 μ F

*add suffix "-E" for extended temperature range, e.g. RAC10-05SB-E

*add suffix "-ST" for screw terminal module e.g. RAC10-05SB-ST, RAC10-05SB-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	10 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	220mA/ 150mA max.
No Load Power Consumption	230VAC	490mW max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.25mA max.	
Output Voltage Accuracy (Full load)	$\pm 2\%$	
Line Voltage Regulation (low line, high line at full load)	$\pm 0.3\%$ typ.	
Load Voltage Regulation (5% to 100% full load)	$\pm 0.5\%$ typ.	
Output Ripple and Noise (20MHz limited)	Noise	0.5% Vout + 50mVp-p max.
	Ripple	<0.2% Vout + 40mVp-p max.
Operating Frequency	125kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC / 1minute	
Temperature Coefficient	$\pm 0.02\%/^{\circ}\text{C}$ typ.	
Isolation Resistance	100 M Ω min.	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range (free air convection, with derating)	Standard	-25°C to +70°C
	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	20%-85% RH	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	51g	
Packing Quantity	8 pcs (-ST Version: 1 pc)	
EMC	EN 55022 Class B / EN 55024	
MTBF (+25°C)	using MIL-HDBK-217F	330 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

10 Watt Single Output



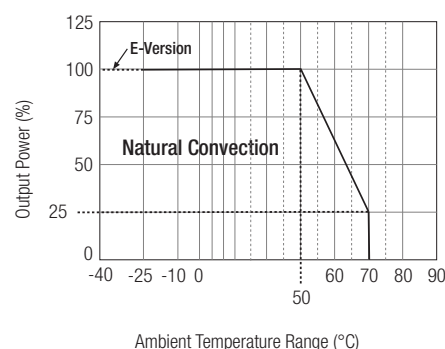
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UL-60950-1 Certified

RAC10-B

Derating Graph

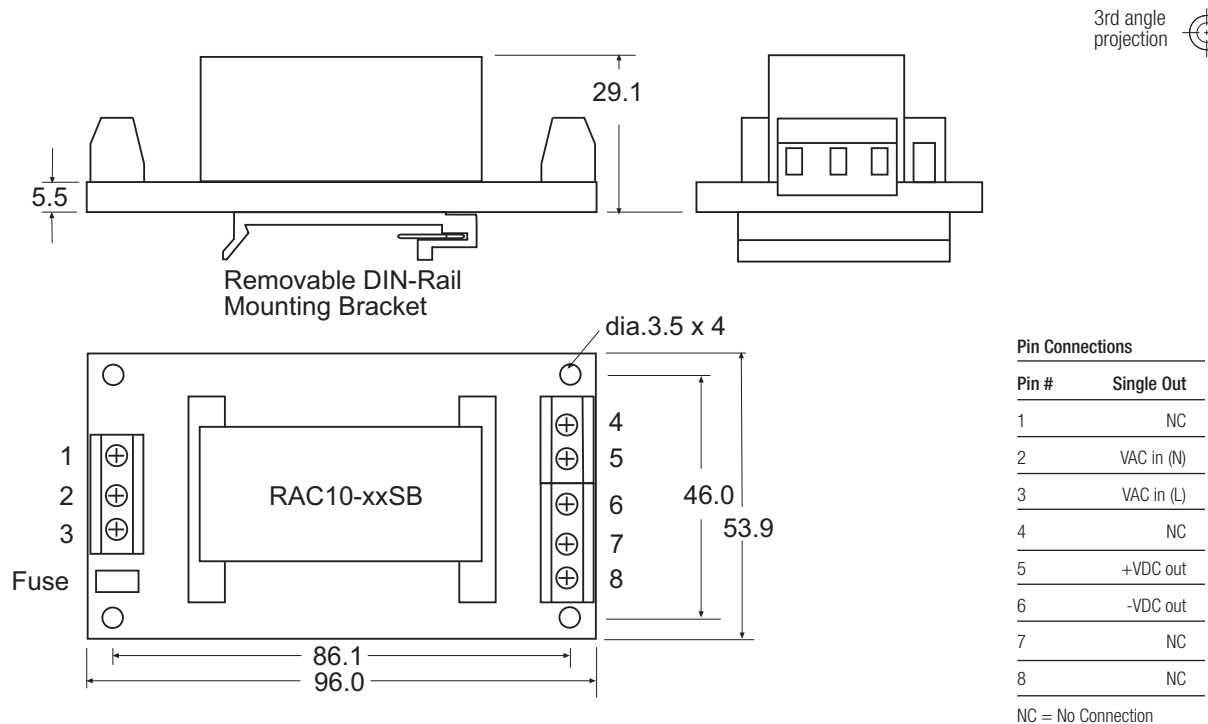
(Ambient Temperature)



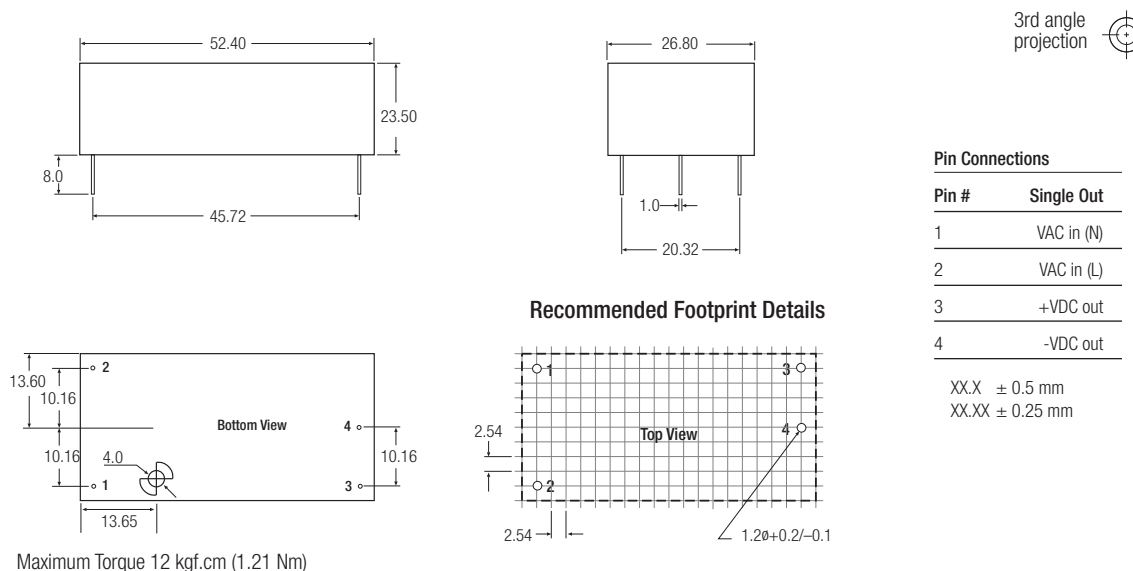
Please Read Application Notes

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Screw Terminal Module Option (suffix -ST)



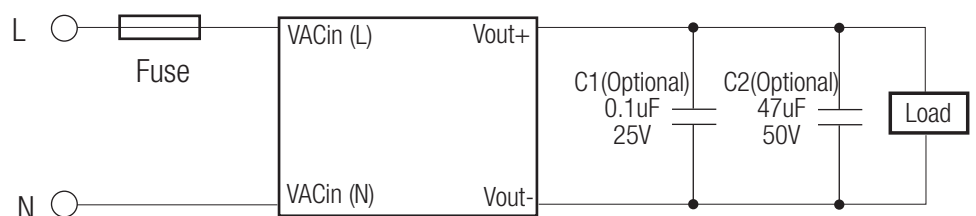
Standard Package Style and Pinning



RAC10-B

Standard Application Circuit

Suggested fuse rating
2A Slow Blow



Features

Regulated Converters

- Very Compact Low AC/DC Power Supply
- High Efficiency
- Single & Dual Output Options
- Continuous Short Circuit Protection
- Isolated Output 3.75kVAC/1 min
- EN55022 Class B Compliant
- High Operating Temperature
- Low Standby Power Consumption

Selection Guide

Part Number	Input Range VAC	Output Voltage (VDC)	Output Current (mA)	Efficiency (typ.) (%)
RAC10-3.3SC/277	80-305	3.3	2500	75
RAC10-05SC/277	80-305	5	2000	78
RAC10-12SC/277	80-305	12	840	80
RAC10-15SC/277	80-305	15	670	78
RAC10-24SC/277	80-305	24	420	80
RAC10-05DC/277	80-305	±5	±1000	77
RAC10-12DC/277	80-305	±12	±420	79
RAC10-15DC/277	80-305	±15	±340	79

Specifications

(Ta=25°C and after warm up time, measured at 115VAC/60Hz and 230VAC/50Hz)

Input Voltage Range (with Derating)	80-305VAC or 113-430VDC	
Rated Power	10 Watts	
Input Frequency Range (for AC Input)	47-63Hz	
Input Current (full load)	115VAC	250mA typ.
	230VAC	160mA typ.
No Load Power Consumption	230VAC	300mW max.
Inrush Current (cold Start-Up)	115VAC	15A max.
	230VAC	30A max.
Leakage Current	250VAC/50Hz	0.25mA max.
External Fuse Recommended	1.5A slow blow type	
Output Voltage Accuracy	3.3V	±3% typ.
	all others	±2% typ.
Line Voltage Regulation	(low line, high line at full load)	±0.3% typ.
Load Voltage Regulation	3.3V, 5V	-1.5% typ.
(0 -100% Load)	12V	±1% typ.
	all others	±0.5% typ.
Minimum Load	0%	
Output Ripple and Noise	3.3V / 5V	50mVp-p typ.
(with 0.1µF across outputs	12V / 15V / 24V	125mVp-p typ.
@20mHz bandwidth)	±5	200mVp-p typ.
	±12	125mVp-p typ.
	±15	200mVp-p typ.
Operating Frequency	100kHz	
Hold-up time	230VAC/50Hz	60ms min.
Isolation Voltage (input to output)	3.75kVAC / 1 minute	
Short Circuit Protection	Hiccup, Automatic Restart	

continued on next page

POWERLINE

AC/DC-Converter
with 3 year Warranty

RECOM

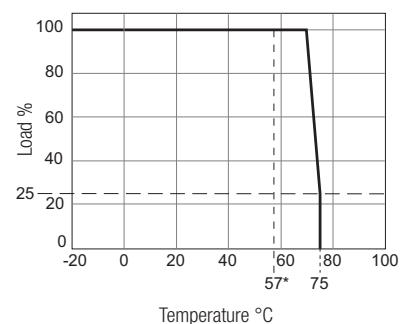
10 Watt Single / Dual Output



EN60950-1 Certified
UL60950-1 Certified
CE marked

RAC10-C/277

Derating-Graph (Ambient Temperature)

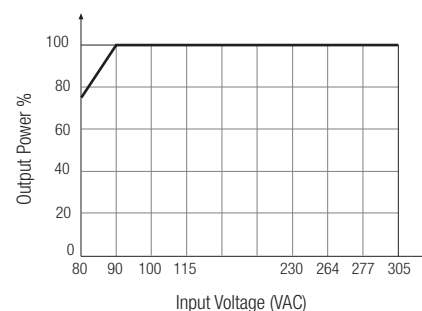


Please Read Application Notes

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Output Overvoltage Protection	Latch off	
Overcurrent Protection	Automatic Recovery	
Operating Temperature Range	(free air convection, with derating)	-20°C to +75°C
Storage Temperature Range		-40°C to +75°C
Humidity		95% RH max.
Case Material	Epoxy with Fibreglass (UL94V-0)	
Dimension (L x W x H)	52.4 x 27.4 x 23.5mm	
Package Weight	62g±5g	
EMC	EMI	EN 55022 Class B
	EMS	EN 55024
Certifications	UL General Safety (Report: E224736)	UL60950-1
	EMC (Report: T121026N02-E)	EN55022, EN55024
MTBF (+25°C)	using MIL-HDBK-217F	320 x 10 ³ hours
(+70°C)	using MIL-HDBK-217F	120 x 10 ³ hours

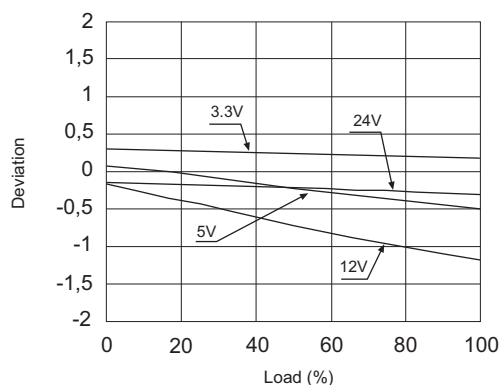
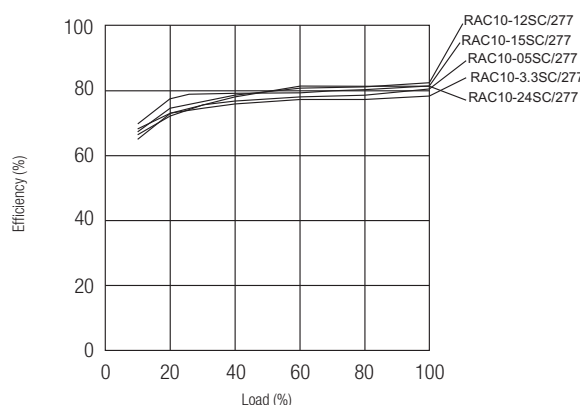
Input Voltage vs Load



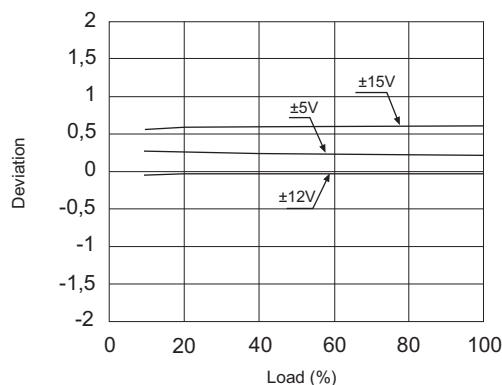
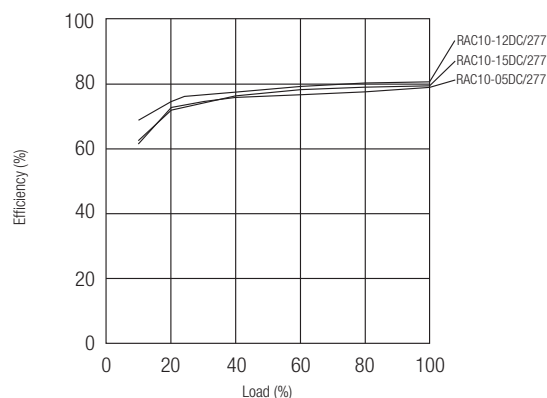
*The RAC10-C/277 series has been recognized by Underwriters Laboratory (UL) to UL 60950 for functional isolation in a maximum still air ambient temperature of 57°C.

Characteristics (measured @ 115/230VAC, 50/60Hz after warm up)

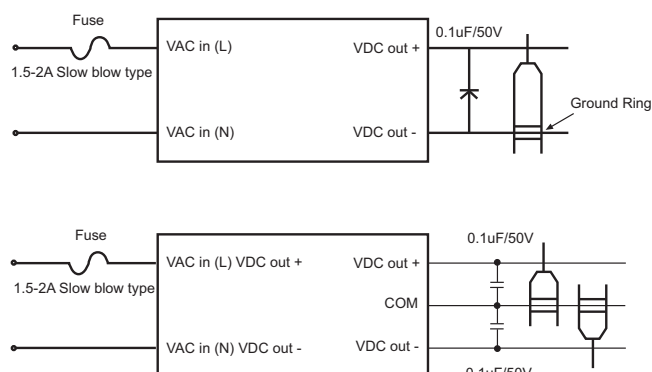
RAC10-xxSC/277



RAC10-xxDC/277

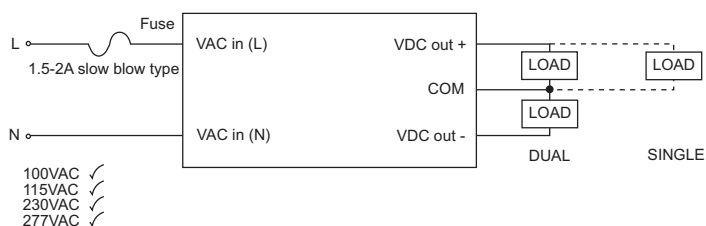


Application Notes



1. Recommended external input fuse 1.5A / slow blow type.
2. Do not use scope ground lead to measure the output ripple & noise.

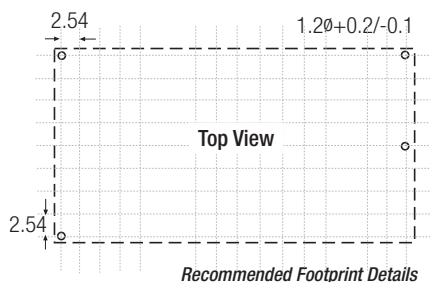
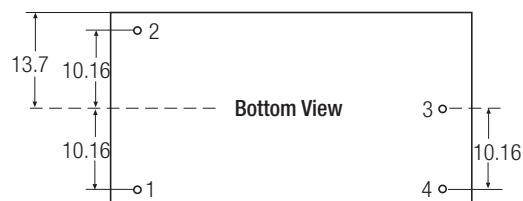
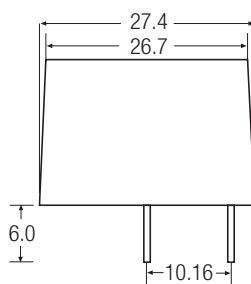
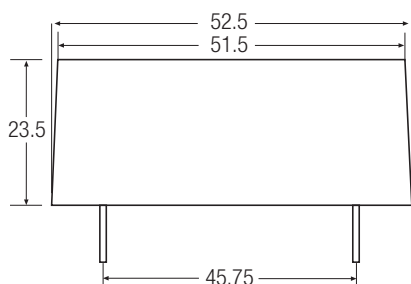
Standard Application Circuit



Standard Package Style and Pinning

RAC10-xxSC/277

3rd angle projection



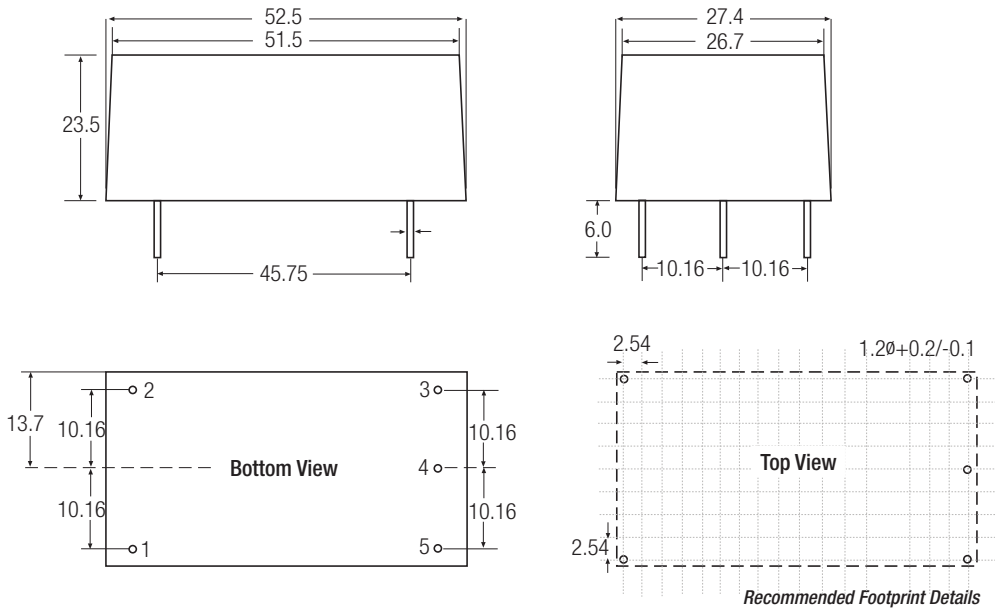
Recommended Footprint Details

Pin Connections-

Pin #	Single Out
1	VAC in (N)
2	VAC in (L)
3	-VDC out
4	+VDC out

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

RAC10-xxDC/277



Pin Connections-

Pin #	Single Out
1	VAC in (N)
2	VAC in (L)
3	-VDC out
4	COM
5	+VDC out

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Features

Regulated Converters

- Compact AC-DC Power Supply
- 15 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- UL Certified, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC15-05SA	90-264	5	3000	74	31000µF
RAC15-12SA	90-264	12	1250	79	4500µF
RAC15-15SA	90-264	15	1000	78	2700µF
RAC15-24SA	90-264	24	625	80	900µF
RAC15-05DA	90-264	±5	±1500	76	±13500µF
RAC15-12DA	90-264	±12	±650	79	±2700µF
RAC15-15DA	90-264	±15	±500	77	±1400µF
RAC15-0512TA	90-264	5/±12	2000/±200	73	14000/±900µF
RAC15-0515TA	90-264	5/±15	2000/±150	73	14000/±680µF

*add suffix "-E" for extended temperature range, e.g. RAC15-05SA-E

*add suffix "-ST" for screw terminal module e.g. RAC15-05DA-ST, RAC10-0512TA-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	15 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	310mA / 170mA max.
No Load Power Consumption	115VAC/230VAC	1.37W max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.75mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regul. (low line, high line at full load)	Single, Dual	±0.5% typ.
	Triple	±1%/±5% typ.
Load Voltage Regulation (5% to 100% full load)	Single	±0.5% typ.
	Dual	±3% typ.
	Triple	±2%/±5% typ.
Output Ripple and Noise (20MHz limited)	Noise	0.5% Vout + 50mVp-p max.
	Ripple	<0.2% Vout + 40mVp-p max.
Operating Frequency	100kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MΩ max.	
Short Circuit Protection	Hiccup, Automatic Restart	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	114g	
Packing Quantity	3 pcs (-ST Version: 1 pc)	
EMC	EN 55022 Class B / EN 55024	
MTBF (+25°C)	using MIL-HDBK-217F	200 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

15 Watt Single/Dual & Triple Output



CE

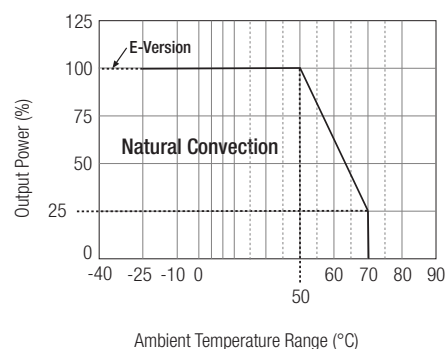


UL-60950-1 Certified

RAC15-A

Derating Graph

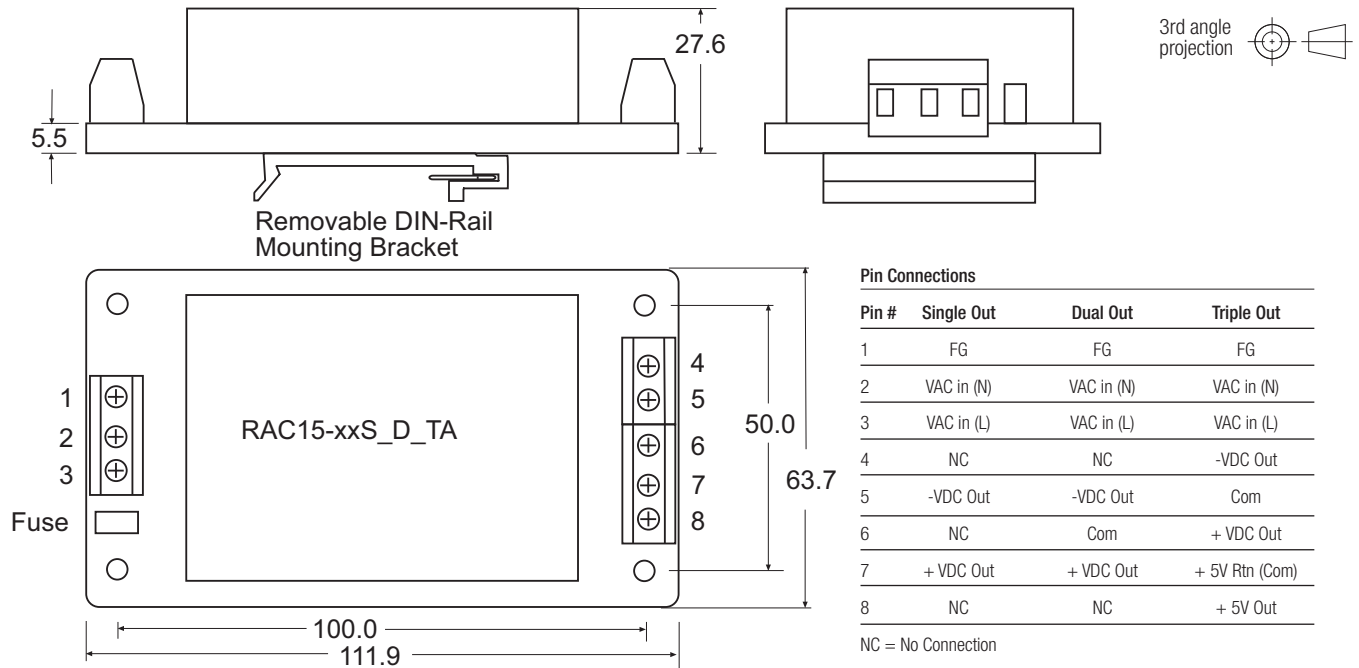
(Ambient Temperature)



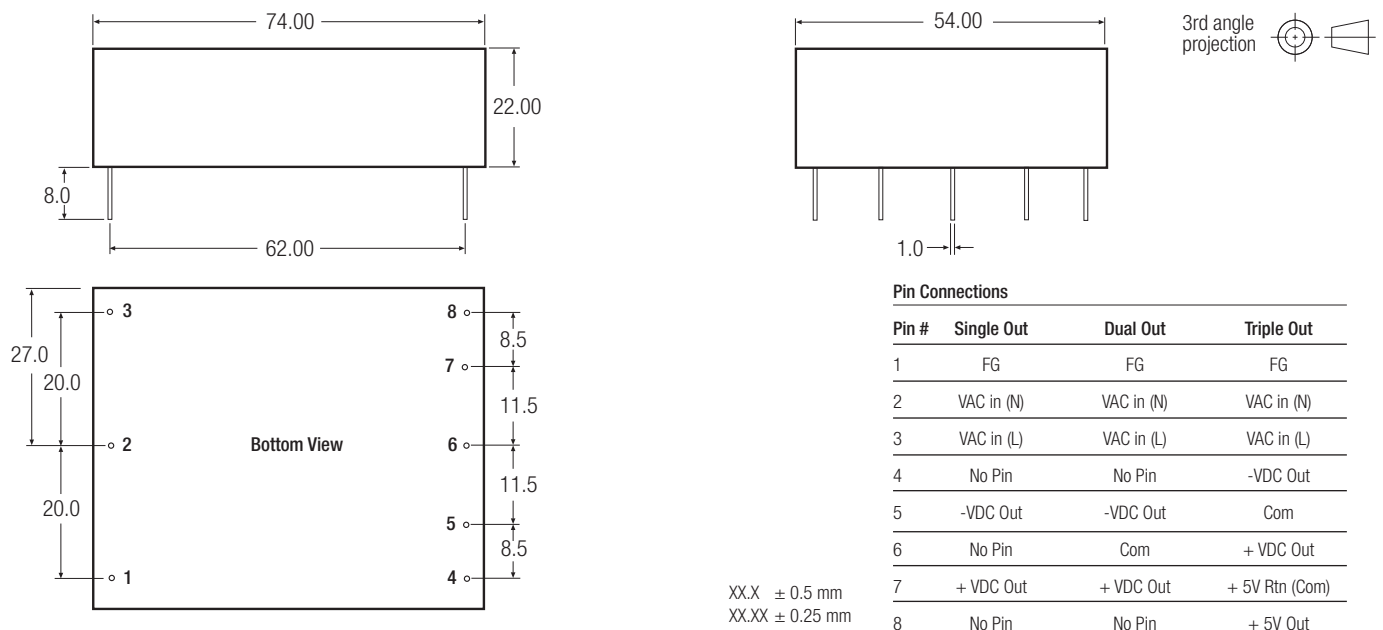
Please Read Application Notes

www.recom-electronic.com

Screw Terminal Module Option (suffix -ST)



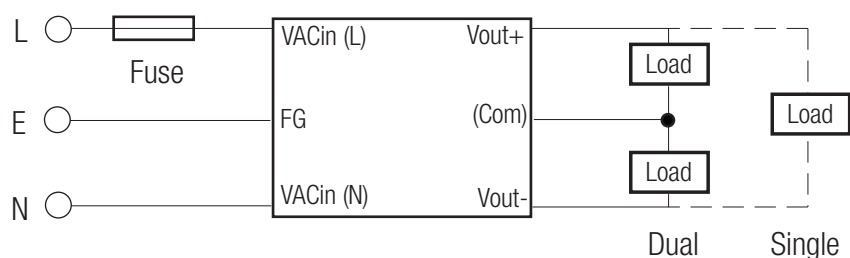
Standard Package Style and Pinning



RAC15-A

Standard Application Circuit

Suggested fuse rating
2A Slow Blow



Features

Regulated Converters

- Compact AC-DC Power Supply
- 15 Watt PCB Mount Package
- Universal Input Voltage Range
- 4000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- Triple Output with Independent Outputs
- UL-60601 Certified for Medical Applications
- CE Marked

Description

Compact switching power module for PCB or DIN-rail mounting with medical certification UL-60601-1.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC15-3.3SB	90-264	3.3	3000	75	40000µF
RAC15-05SB	90-264	5	3000	79	10000µF
RAC15-09SB	90-264	9	1666	80	3000µF
RAC15-12SB	90-264	12	1250	81	1100µF
RAC15-15SB	90-264	15	1000	82	1000µF
RAC15-24SB	90-264	24	625	83	820µF
RAC15-05DB	90-264	±5	±1500	79	±4700µF
RAC15-12DB	90-264	±12	±625	82	±560µF
RAC15-15DB	90-264	±15	±500	82	±500µF
RAC15-0512TB	90-264	5/±12	+2000/±200	78	10000/±470µF
RAC15-0515TB	90-264	5/±15	+2000/±150	78	10000/±600µF

*add suffix "-E" for extended temperature range, e.g. RAC15-05SB-E

*add suffix "-ST" for screw terminal module e.g. RAC15-05SB-ST, RAC15-05DB-ST, RAC15-0512TB-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 100-370VDC	
Rated Power	15 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	220mA / 118mA max.
No Load Power Consumption	115VAC/230VAC	590mW max.
Inrush Current (<2ms)	115VAC/230VAC	10A / 20A max.
Leakage Current	115VAC/230VAC	100µA/ 200µA max.
Output Voltage Accuracy (Full load)	Single and Dual ±2% max.	
(Note 5)	Triple ±2% / ±3% max.	
Line Voltage Regulation (low line, high line at full load)	Single&Dual	±0.5% max.
See Note 1	Triple	±2% / ±3% max.
Load Voltage Regulation (10% to 100% symmetric load)	Single&Dual	±1% max.
See Note 2	Triple	1% / 5% max.
Output Ripple and Noise - See Note 3	1% Vout max.	
Operating Frequency	132kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	4kVAC / 1 minute	
Temperature Coefficient	±0.01%/°C typ.	
Over-Current Protection	105% typ.	
Short Circuit Protection	Hiccup, Automatic Restart	
Over-Voltage Protection	Zener Diode Clamp	
Over-Temperature Protection	100°C	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +100°C	

continued on next page

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

15 Watt Single/Dual & Triple Output

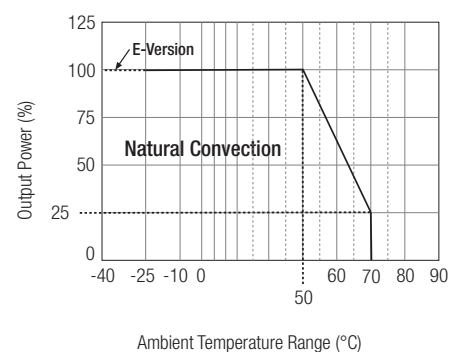


UL-60601-1 Certified

RAC15-B

Derating Graph

(Ambient Temperature)



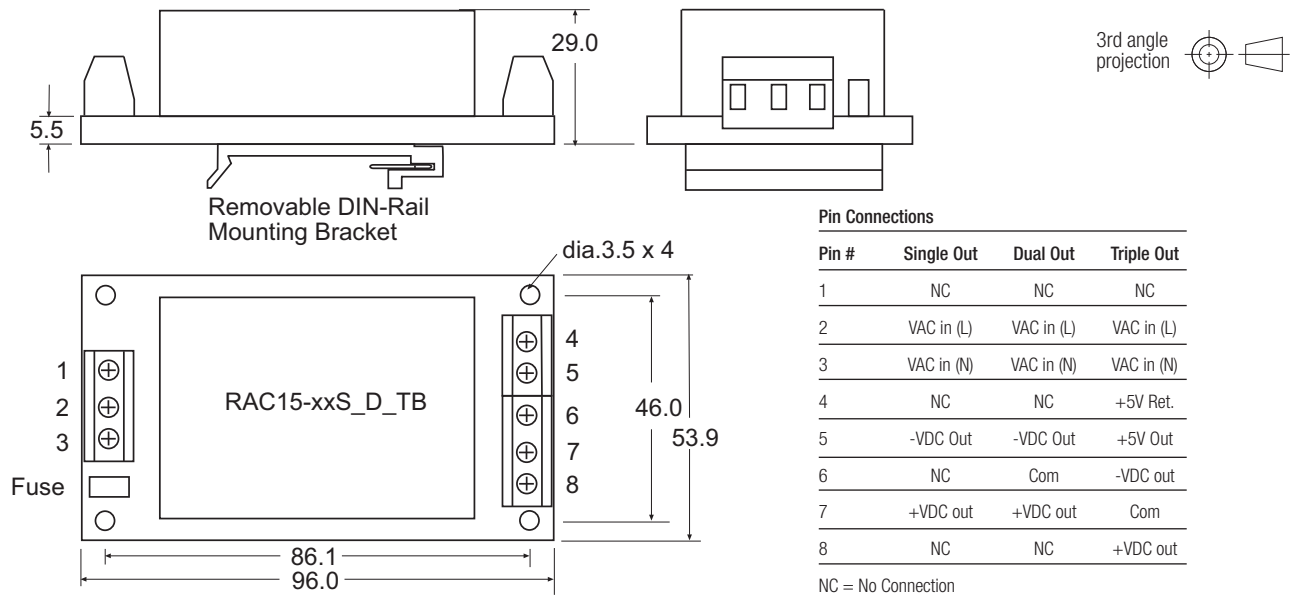
Please Read Application Notes

www.recom-electronic.com

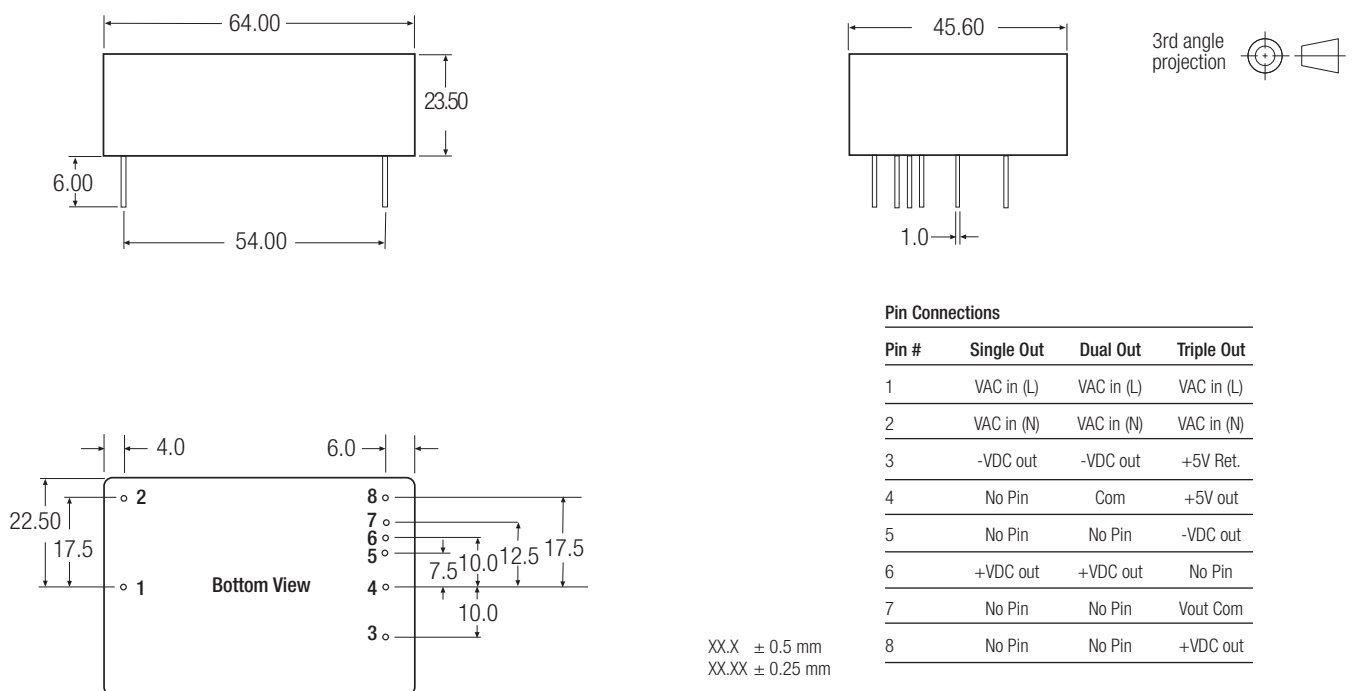
Specifications continued

Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	120g	
Packing Quantity	5 pcs (-ST Version: 1 pc)	
EMC	EN 55011 Class B / EN60601-1-2	
MTBF (+25°C)	using MIL-HDBK-217F	200~400 x 10 ³ hours

Screw Terminal Module Option (suffix -ST)



Package Style and Pinning



Notes

Note 1: Line Regulation = 2% max. for triple output +Vout and -Vout.

Note 2: Load Regulation = 5% max. for triple output +Vout and -Vout.

Note 3: Ripple & Noise measured with 20MHz BW probe and 0.1µF + 47µF capacitors in parallel across the outputs.

Note 4: Suggested input fuse rating = 2A Slow Blow

Note 5: Triple output version has +/-Vout common that is not connected to +5V Return pin internally.

Features

Regulated Converters

- Compact AC-DC Power Supply
- 20 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- High Efficiency
- UL Certified, CE Marked

Description

Compact universal input voltage switching power module for PCB or DIN-rail mounting available with single, dual or triple output voltages

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Capacitive Load (max)
RAC20-3.3SA	90-264	3.3	4500	75	25000 μ F
RAC20-05SA	90-264	5	4000	79	13000 μ F
RAC20-09SA	90-264	9	2230	82	1100 μ F
RAC20-12SA	90-264	12	1670	83	920 μ F
RAC20-15SA	90-264	15	1340	83	820 μ F
RAC20-24SA	90-264	24	840	84	600 μ F
RAC20-05DA	90-264	± 5	± 2000	79	$\pm 4300\mu$ F
RAC20-12DA	90-264	± 12	± 833	82	$\pm 560\mu$ F
RAC20-15DA	90-264	± 15	± 677	82	$\pm 220\mu$ F
RAC20-0512TA	90-264	5/ ± 12	+2800/ ± 250	81	3500/ $\pm 200\mu$ F
RAC20-0515TA	90-264	5/ ± 15	+2800/ ± 200	81	3500/ $\pm 150\mu$ F

*add suffix "-ST" for screw terminal module e.g. RAC20-05SA-ST, RAC20-05DA-ST, RAC20-0512TA-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 100-375VDC	
Rated Power	20 Watts max	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	400mA/ 230mA max.
No Load Power Consumption	115VAC/230VAC	470mW max.
Inrush Current (<2ms)	115VAC/230VAC	30A/ 50A max.
Leakage Current	0.25mA max	
Output Voltage Accuracy (Full load)	$\pm 2\%$ max	
Line Voltage Regulation (low line, high line at full load)	- Single /Dual Output - Triple Output	$\pm 0.5\%$ max $\pm 1\% / \pm 5\%$ max
Load Voltage Regulation (10% to 100% symmetric load)	- Single - Dual - Triple	$\pm 1\%$ max $\pm 3\%$ max $\pm 2\% / \pm 5\%$ max
Output Ripple and Noise (see Note 1)	Noise Ripple	<0.9% Vout + 50mVp-p max. <0.2% Vout + 40mVp-p max.
Minimum Load	Single/Dual = 0%, Triple = 10% main /20% auxilliary	
Operating Frequency	100kHz typ	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Temperature Coefficient	$\pm 0.02\%/^{\circ}\text{C}$ typ	
Over-Current Protection	105% typ	
Short Circuit Protection	Continuous, Automatic Restart	
Over-Voltage Protection	Zener Diode Clamp	
Operating Temperature Range (free air convection, with derating)	-25°C to $+70^{\circ}\text{C}$	
Storage Temperature Range	-40°C to $+85^{\circ}\text{C}$	

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POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

20 Watt Single/Dual & Triple Output

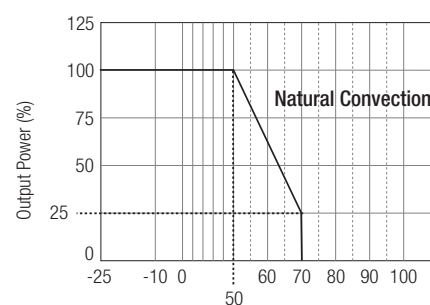


UL-60950-1 Certified

RAC20-A

Derating Graph

(Ambient Temperature)



Ambient Temperature Range ($^{\circ}\text{C}$)

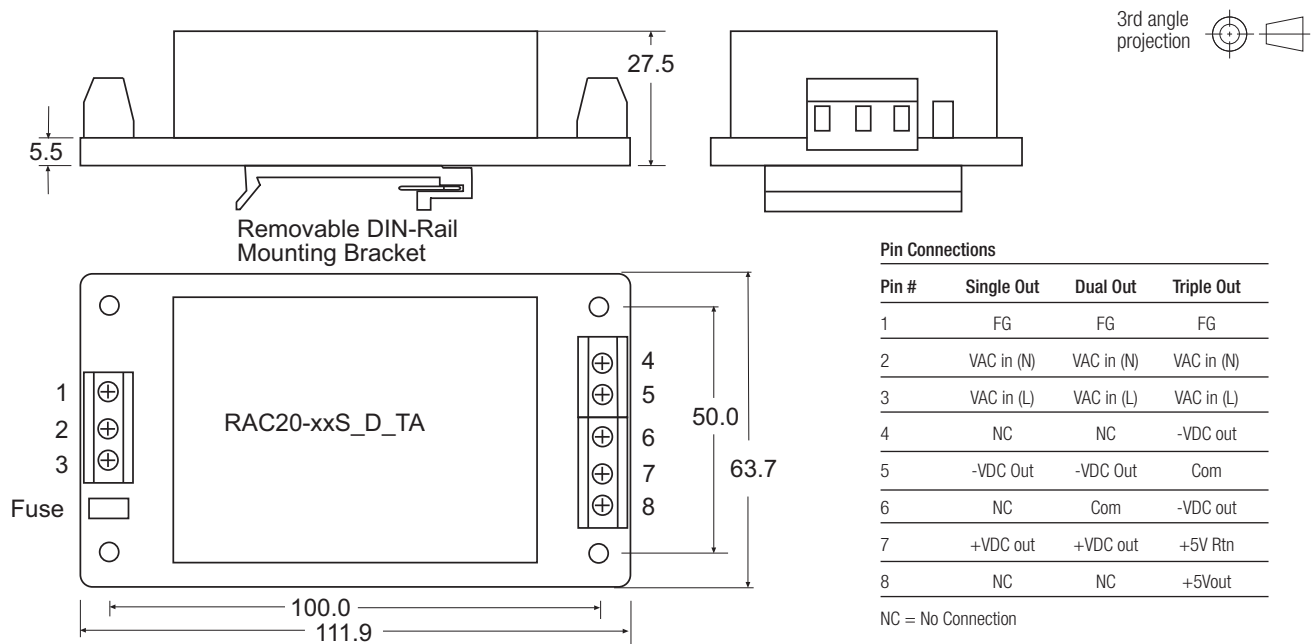
Please Read Application Notes

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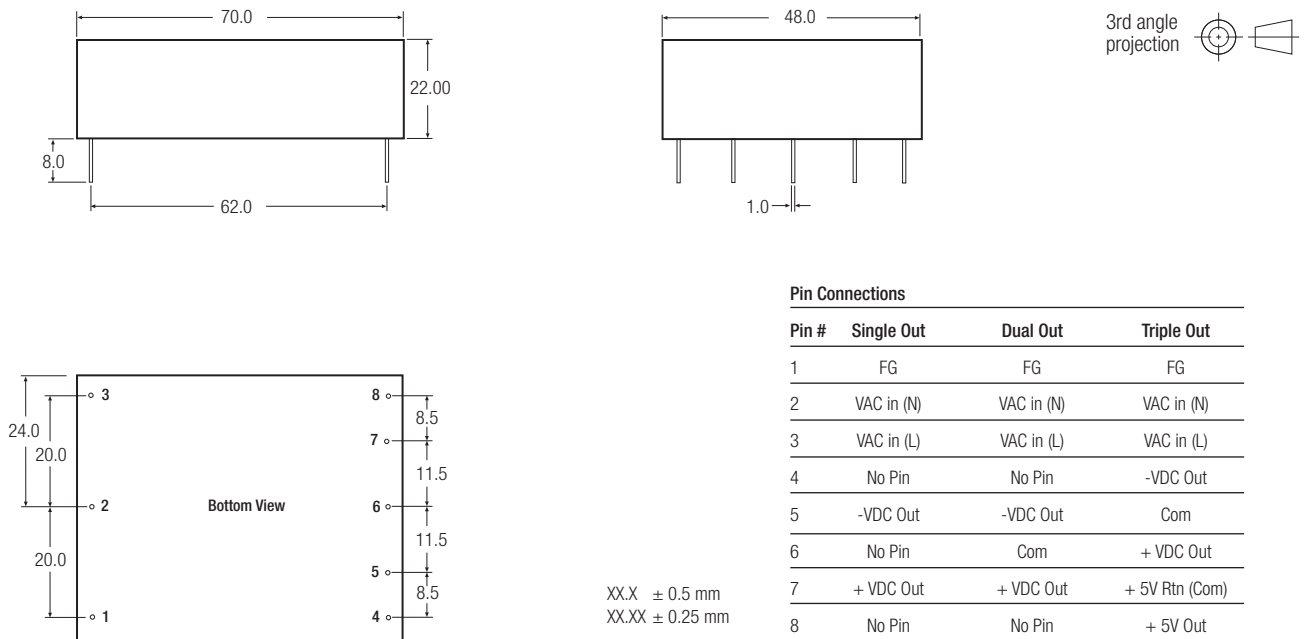
Specifications continued

Humidity	95% RH max.	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	110g	
Packing Quantity	3 pcs (-ST Version: 1 pc)	
EMC	EN 55022 Class B / EN 55024	
MTBF (+25°C)	using MIL-HDBK-217F	>200 x 10 ³ hours

Screw Terminal Module Option (suffix -ST)



Package Style and Pinning



Notes

Note 1: Ripple & Noise measured with 20MHz BW probe and 0.1µF + 47µF capacitors in parallel across the outputs.

Note 2: Suggested input fuse rating 2A Slow Blow

Features

Regulated Converters

- Compact AC-DC Power Supply
- 20 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- Low Temperature Operation
- Anti Vibration Mechanical Fixing
- CE Marked

Description

Compact switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting. The converter is pin compatible with the RAC05-SB and RAC10-SB models. A threaded insert is provided for additional mechanical fixing.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Typical Efficiency (%)	Maximum Power (W)	Max. Capacitive Load
RAC20-3.3SB	90-264	3.3	3600	74	11.9W	4500µF
RAC20-05SB	90-264	5	3600	78	18W	3500µF
RAC20-12SB	90-264	12	1660	82	20W	1800µF
RAC20-15SB	90-264	15	1330	83	20W	1500µF
RAC20-24SB	90-264	24	833	83	20W	1200µF

*add suffix "-ST" for screw terminal module e.g. RAC20-05SB-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	20 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	385mA / 250mA max.
No Load Power Consumption	115VAC/230VAC	470mW max.
Inrush Current (<2ms)	115VAC	20A max.
	230VAC	40A max.
Leakage Current	0.75mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regulation (low line, high line at full load)	±0.5% typ.	
Load Voltage Regulation (5% to 100% full load)	±1% typ.	
Output Ripple and Noise (note 1)	Ripple (3.3V, 5V)	75mVp-p max.
	Noise (3.3V, 5V)	120mVp-p max.
	Others (Ripple and Noise)	1% Vout
Operating Frequency	100 - 130kHz typ.	
Minimum Load	0%	
Isolation Voltage (input to output)	3000VAC min.	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MΩ min.	
Short Circuit Protection	Continuous, Automatic Restart	
Operating Temp. Range	(Natural Convection, with derating)	-40°C to +70°C
	3.3V, 5V (no derating)	-40°C to +40°C
	Others (no derating)	-40°C to +45°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
Case Material	Epoxy with Fibreglass (UL94V-0)	
Package Weight	59g	
Packing Quantity	5 pcs (-ST Version: 1 pc)	
EMC	designed to meet EN 55022 Class B / EN 55024	
MTBF (+25°C)	using MIL-HDBK-217F	>250 x 10 ³ hours

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

20 Watt Single Output

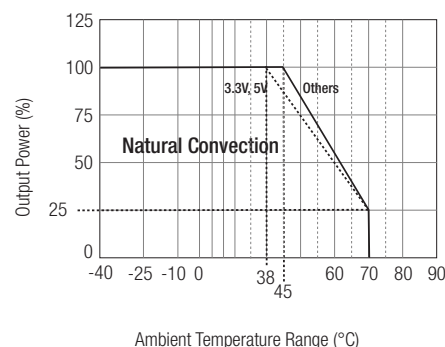


CE Marked

RAC20-B

Derating Graph

(Ambient Temperature)

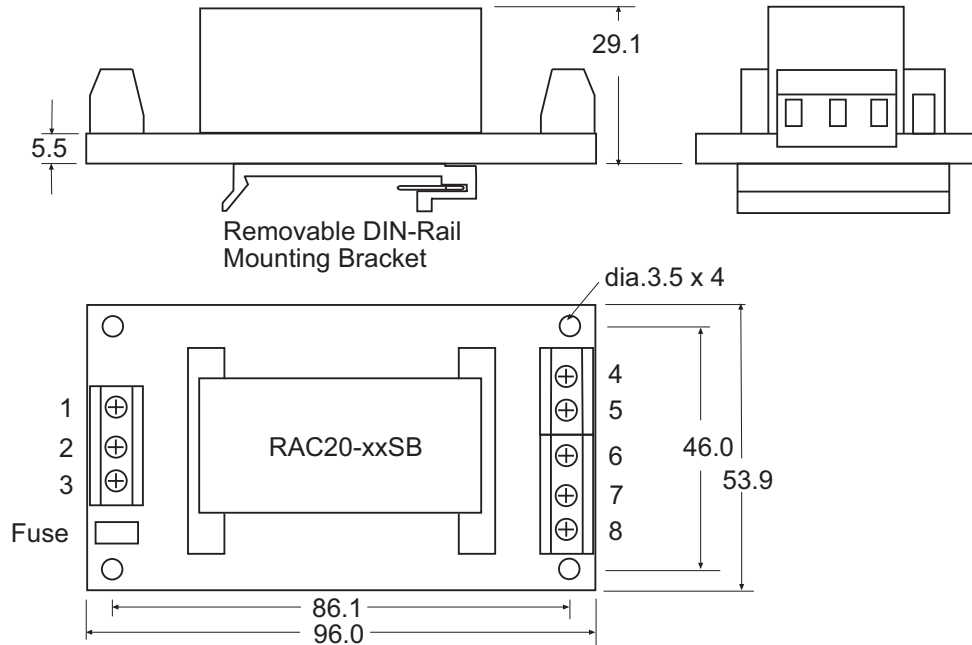


Please Read Application Notes

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Screw Terminal Module Option (suffix -ST)

3rd angle projection



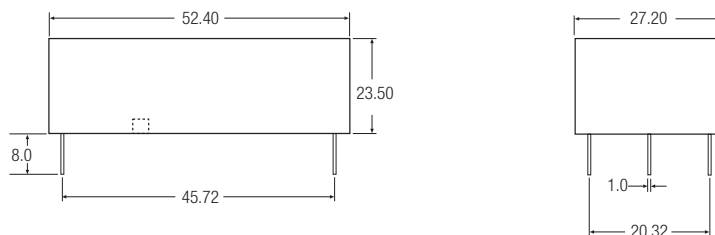
Pin Connections

Pin #	Single Out
1	NC
2	VAC in (L)
3	VAC in (N)
4	NC
5	+VDC out
6	-VDC out
7	NC
8	NC

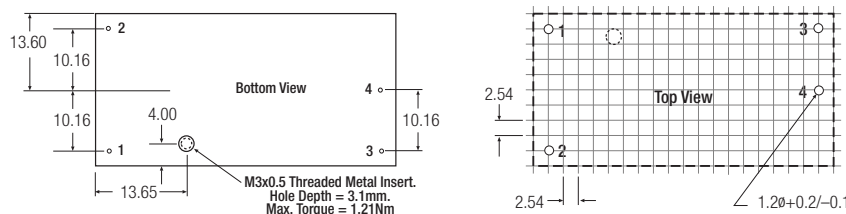
NC = No Connection

Standard Package Style and Pinning

3rd angle projection



Recommended Footprint Details



Pin Connections

Pin #	Single Out
1	VAC in (L)
2	VAC in (N)
3	+VDC out
4	-VDC out

XX.X ± 0.5 mm
XX.XX ± 0.25 mm

Notes

Note 1: Ripple & Noise measured with 20MHz BW probe and 0.47µF capacitor in parallel across the outputs.

Note 2: Suggested input fuse rating 2A Slow Blow

Features

Regulated Converters

- AC-DC Power Supply
- 30 Watt PCB Mount Package
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- Triple Output with Independent Outputs
- UL Certified, CE Marked

Description

Compact UL certified switching AC/DC power module for PCB, screw-terminal connection or DIN-rail mounting.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC30-3.3SA	90-264	3.3	6000	75	80000µF
RAC30-05SA	90-264	5	6000	79	70000µF
RAC30-12SA	90-264	12	2500	82	14000µF
RAC30-15SA	90-264	15	2000	82	11000µF
RAC30-24SA	90-264	24	1250	82	5900µF
RAC30-05DA	90-264	±5	±3000	79	±50000µF
RAC30-12DA	90-264	±12	±1250	82	±14000µF
RAC30-15DA	90-264	±15	±1000	80	±10000µF
RAC30-0512DA	90-264	5/12	3000/1250	79	13200/±6400µF
RAC30-0512TA	90-264	5/±12	3000/±630	79	15000/±5400µF
RAC30-0515TA	90-264	5/±15	3000/±500	78	10000/3200µF

*add suffix "-E" for extended temperature range, e.g. RAC30-05SA-E

*add suffix "-ST" for screw terminal module e.g. RAC30-05DA-ST, RAC30-0512TA-E-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 120-370VDC	
Rated Power	30 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	520mA/ 320mA max.
No Load Power Consumption	115VAC/230VAC	2.58W max.
Inrush Current (<2ms)	115VAC	10A max. (-E = 23A max.)
	230VAC	20A max. (-E = 46A max.)
Leakage Current	0.75mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regul. (low line, high line at full load) (note 2)	Single, Dual	±1% typ.
	Double, Triple	±1%/±5% typ.
Load Voltage Regulation (5% to 100% full load)	Single, Dual	±1%, ±3%typ.
	Double, Triple	±2%/±6% typ.
Minimum Load	Single	3.3V: 5%/ 5V: 8%/ 12V, 15V, 24V: 2%
	Dual	±5V: 2%/ ±12V: 3%/ ±15V: 1%
	Double, Triple	20%
Output Ripple and Noise (20MHz limited)	Noise	0.5% Vout + 50mVp-p max.
	Ripple	<0.2% Vout + 40mVp-p max.
Operating Frequency	100kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	3kVAC min.	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MΩ max.	
Short Circuit Protection	Continuous, Automatic restart	

continued on next page

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

30 Watt Single/Dual/ Double & Triple Output



CE

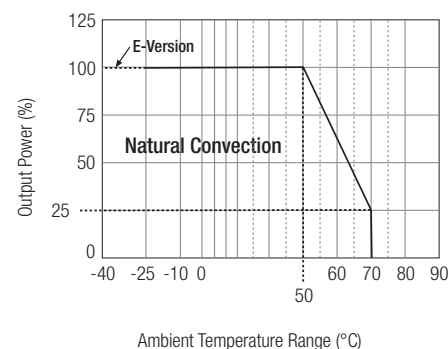


UL-60950-1 Certified

RAC30-A

Derating Graph

(Ambient Temperature)



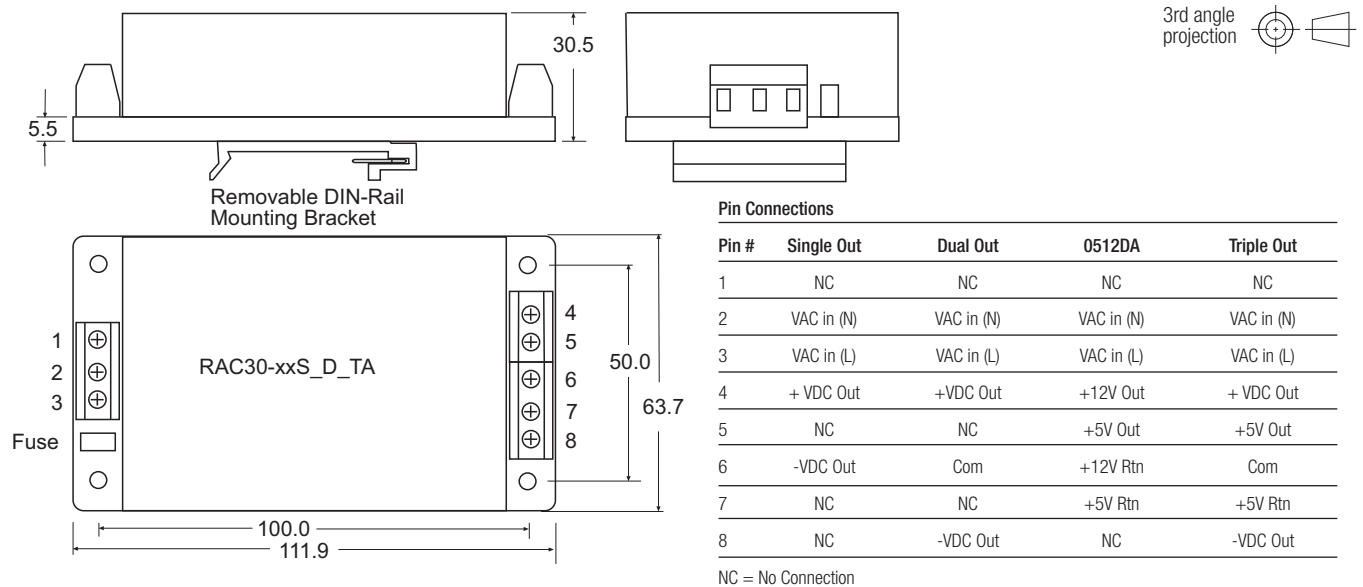
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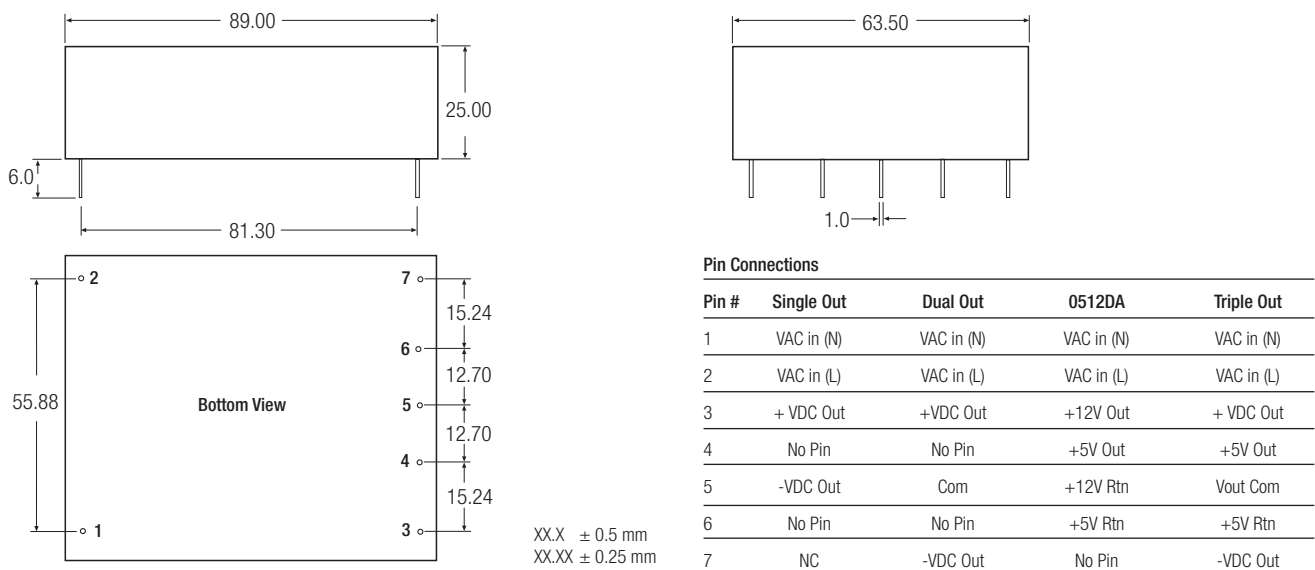
Specifications continued

Operating Temperature Range (free air convection, with derating)	Standard Suffix -E	-25°C to +70°C -40°C to +70°C
Storage Temperature Range		-40°C to +85°C
Humidity		95% RH max.
Case Material		Epoxy with Fibreglass (UL94V-0)
Package Weight		212g
Packing Quantity		2 pcs (-ST Version: 1 pc)
EMC		EN 55022 Class B / EN 55024
MTBF (+25°C)	using MIL-HDBK-217F	200 x 10 ³ hours

Screw Terminal Module Option (suffix -ST)



Standard Package Style and Pinning



Notes

Note 1: Suggested input fuse rating 3.15A Slow Blow

Note 2: Triple output version has +/-Vout common that is not connected to +5V Return pin internally.

Features

Regulated Converters

- Compact 40W AC-DC Power Supply
- Universal Input Voltage Range
- 4000VAC Isolation, Low Leakage Current
- Low Output Ripple and Noise
- Short Circuit Protected
- Triple Output with Independent Outputs
- UL-60601 Certified for Medical Applications
- CE Marked

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC40-3.3SA	90-264	3.3	8000	76	70000µF
RAC40-05SA	90-264	5	8000	79	33000µF
RAC40-12SA	90-264	12	3333	83	4000µF
RAC40-15SA	90-264	15	2666	83	3000µF
RAC40-24SA	90-264	24	1667	83	1200µF
RAC40-05DA	90-264	±5	±4000	80	±6000µF
RAC40-12DA	90-264	±12	±1666	83	±1000µF
RAC40-15DA	90-264	±15	±1333	83	±2000µF
RAC40-0512DA	90-264	5/12	5000/1250	80	15000/750µF
RAC40-0512TA	90-264	5/±12	+5000/±600	79	18000/±150µF
RAC40-0515TA	90-264	5/±15	+5000/±500	79	18000/±400µF

*add suffix "-E" for extended temperature range, e.g. RAC40-05SA-E

*add suffix "-ST" for screw terminal module e.g. RAC40-05SA-ST, RAC40-05DA-ST, RAC40-0512TA-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 100-370VDC	
Rated Power	40 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	860mA/ 460mA max.
No Load Power Consumption	115VAC/230VAC	720mW max.
Inrush Current (<2ms)	115VAC/230VAC	10A / 20A max.
Leakage Current	115VAC/230VAC	100µA/ 200µA max.
Output Voltage Accuracy (Full load)	Single, Dual Outputs ±2% typ.	
(note 2)	Others: Main Output ±3% typ., Secondary Output(s) ±5% typ.	
Line Voltage Regulation (low line, high line at full load)	Single, Dual Outputs ±0.5% typ.	
	Double&Triple: Main Output ±0.5% typ., Secondary Output(s) ±5% typ.	
Load Voltage Regulation (10% to 100% symmetric load)	Single, Dual Outputs ±1% typ.	
	Double: Main Output 2% typ., Secondary Output 6% typ.	
	Triple: Main Output ±3% typ., Secondary Output(s) ±7% typ.	
Cross Regulation	Dual	±5% typ.
	Double	Main Output 1%, Secondary Output 7% typ.
	Triple	Main Output ±3%, Secondary Output ±7% typ.
Output Ripple and Noise	3.3V Output	50mVp-p max.
(20MHz limited, 0.1µF and 47µF across outputs)	Others	1% Vout max.
Operating Frequency	132kHz typ.	
RMS Isolation Voltage (input to output)	4kVAC / 1 minute	
Temperature Coefficient	±0.01%/°C typ.	
Isolation Resistance	100 MΩ min.	
Short Circuit Protection	Continuous, Automatic Restart	
Overcurrent Protection	105% typ.	
Over Temperature Protection	100°C	
Operating Temperature Range	Standard	-25°C to +70°C
(free air convection, with derating)	Suffix -E	-40°C to +70°C
Storage Temperature Range	-40°C to +100°C	
Humidity	95% max.	

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POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

40 Watt Single/Dual, Double & Triple Output



UL-60601-1 Certified

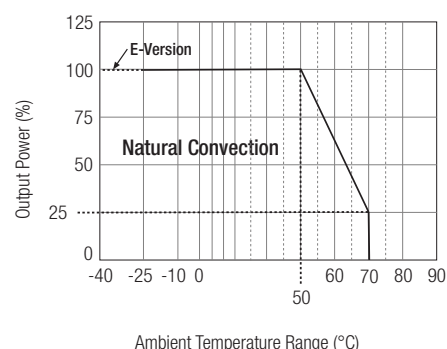
RAC40-A

Description

Compact switching power module for PCB or DIN-rail mounting with medical certification UL-60601-1.

Derating Graph

(Ambient Temperature)



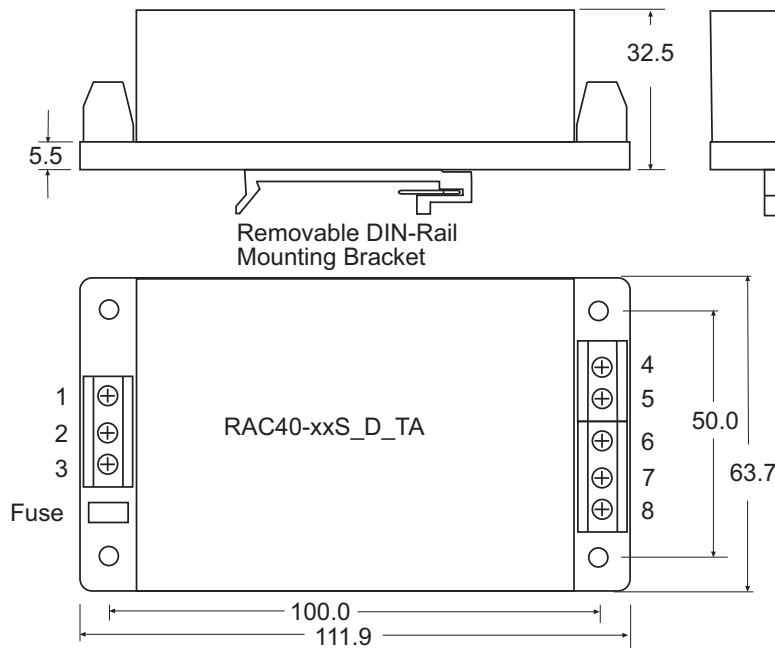
Please Read Application Notes

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Specifications continued

Case Material	Epoxy with Fibreglass (UL94V-0)
Package Weight	280g
suffix (-ST)	300g
Packing Quantity	5 pcs (-ST Version: 1 pc)
EMC	EN 55011 Class B / EN60601-1-2
MTBF (+25°C)	using MIL-HDBK-217F 200~400 x 10 ³ hours

Screw Terminal Module Option (suffix -ST)

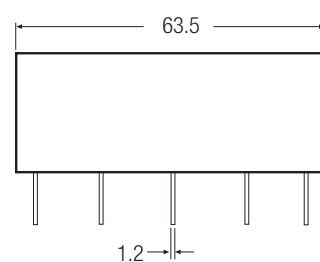
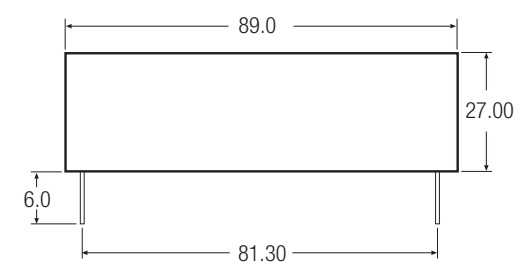


Pin Connections

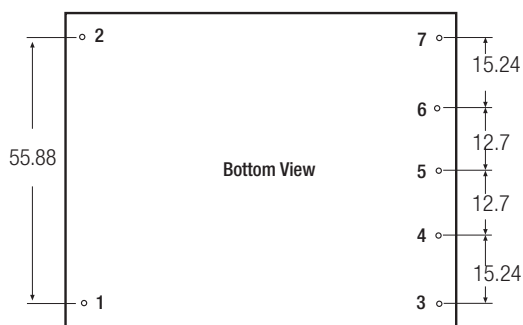
Pin #	Single Out	Dual Out	Double Out	Triple Out
1	NC	NC	NC	NC
2	VAC in (L)	VAC in (L)	VAC in (L)	VAC in (L)
3	VAC in (N)	VAC in (N)	VAC in (N)	VAC in (N)
4	+VDC out	+VDC out	+12V Out	+VDC out
5	NC	NC	+5V Out	+5V Out
6	-VDC out	Com	+12V Rtn	Com
7	NC	NC	+5V Rtn	+5V Rtn
8	NC	-VDC out	NC	-VDC out

NC = No Connection

Package Style and Pinning



3rd angle projection



Tolerance = ± 0.5 mm

Pin Connections

Pin #	Single Out	Dual Out	Double Out	Triple Out
1	VAC in (L)	VAC in (L)	VAC in (L)	VAC in (L)
2	VAC in (N)	VAC in (N)	VAC in (N)	VAC in (N)
3	+VDC out	+VDC out	+12V Out	+VDC out
4	No Pin	No Pin	+5V Out	+5V Out
5	-VDC out	Com	+12V Rtn	Vout Com
6	No Pin	No Pin	+5V Rtn	+5V Rtn
7	NC	-VDC out	No Pin	-VDC out

Notes

Note 1: Suggested input fuse rating 3.15A Slow Blow.

Note2: Triple output version has +/-Vout common that is not connected to +5V Return pin internally.

Features

Regulated Converters

- Compact 40W AC-DC Power Supply
- Universal Input Voltage Range
- 3000VAC Isolation
- Low Output Ripple and Noise
- Short Circuit Protected
- Triple Output with Independent Outputs
- Suitable for Industrial Applications
- UL Certified, CE Marked

Description

Compact switching power module for PCB or DIN-rail mounting

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Efficiency (%)	Max. Capacitive Load
RAC40-05SB	90-264	5	8000	81	40000 μ F
RAC40-12SB	90-264	12	3333	84	8600 μ F
RAC40-15SB	90-264	15	2666	83	6600 μ F
RAC40-24SB	90-264	24	1667	83	1400 μ F
RAC40-05DB	90-264	± 5	± 4000	81	$\pm 12000\mu$ F
RAC40-12DB	90-264	± 12	± 1666	83	$\pm 4400\mu$ F
RAC40-15DB	90-264	± 15	± 1333	83	$\pm 1000\mu$ F
RAC40-0512DB	90-264	5/12	5000/1250	82	10000/470 μ F
RAC40-0512TB	90-264	5/ ± 12	+5000/ ± 600	82	10000/ $\pm 780\mu$ F
RAC40-0515TB	90-264	5/ ± 15	+5000/ ± 500	81	10000/ $\pm 900\mu$ F

*add suffix "-ST" for screw terminal module e.g. RAC40-05SB-ST, RAC40-05DB-ST, RAC40-0512TB-ST

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	90-264VAC or 100-375VDC	
Rated Power	40 Watts max.	
Input Frequency Range (for AC Input)	47-440Hz	
Input Current (full load)	115VAC/230VAC	860mA/ 460mA max.
No Load Power Consumption	115VAC/230VAC	720mW max.
Inrush Current (<2ms)	115VAC/230VAC	30A / 50A max.
Leakage Current	0.75mA max.	
Holdup time	10ms min.	
Output Voltage Accuracy (Full load)	Single, Dual Outputs $\pm 2\%$ typ.	
(note 2)	Double/Triple: Main Output $\pm 3\%$ typ., Secondary Output(s) $\pm 5\%$ typ.	
Line Voltage Regulation (low line, high line at full load)	Single, Dual Outputs $\pm 0.5\%$ typ.	
	Double/Triple: Main Output $\pm 0.5\%$ typ., Secondary Output(s) $\pm 5\%$ typ.	
Load Voltage Regulation	(1% to 100% Load)	Single: $\pm 1\%$ typ.
(10% to 100% Load)	Dual: Main Output $\pm 1\%$ typ., Secondary Output $\pm 1\%$ typ.	
(10% to 100% Load)	Double: Main Output $\pm 2\%$ typ., Secondary Output $\pm 6\%$ typ.	
(10% to 100% Load)	Triple: Main Output $\pm 3\%$ typ., Secondary Outputs $\pm 7\%$ typ.	
Cross Regulation	Dual: Main Output $\pm 5\%$, Secondary Output $\pm 5\%$ typ.	
	Double: Main Output $\pm 1\%$ typ., Secondary Output $\pm 7\%$ typ.	
	Triple: Main output $\pm 3\%$ typ., Secondary Outputs $\pm 7\%$ typ.	
Output Ripple and Noise (20MHz limited, 0.1 μ F and 47 μ F across outputs)	1% Vout max.	
Operating Frequency	132kHz typ.	
RMS Isolation Voltage (input to output)	3kVAC / 1 minute	
Temperature Coefficient	$\pm 0.01\%/^{\circ}\text{C}$ typ.	
Isolation Resistance	100 M Ω min.	
Short Circuit Protection	Continuous, Automatic Restart	
Overcurrent Protection	105% typ.	
Over Temperature Protection	100 $^{\circ}\text{C}$	
Operating Temperature Range (free air convection, with derating)	-40°C to $+70^{\circ}\text{C}$	
Storage Temperature Range	-40°C to $+85^{\circ}\text{C}$	
Humidity	95% RH	

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POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

40 Watt Single/Dual/ Double & Triple Output

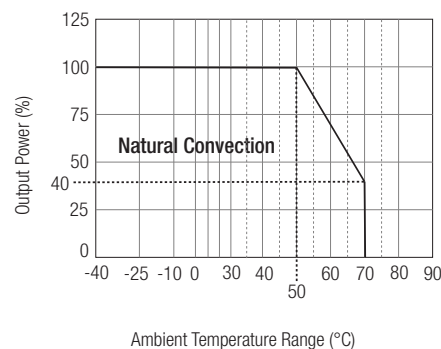


UL-60950-1 Certified

RAC40-B

Derating Graph

(Ambient Temperature)



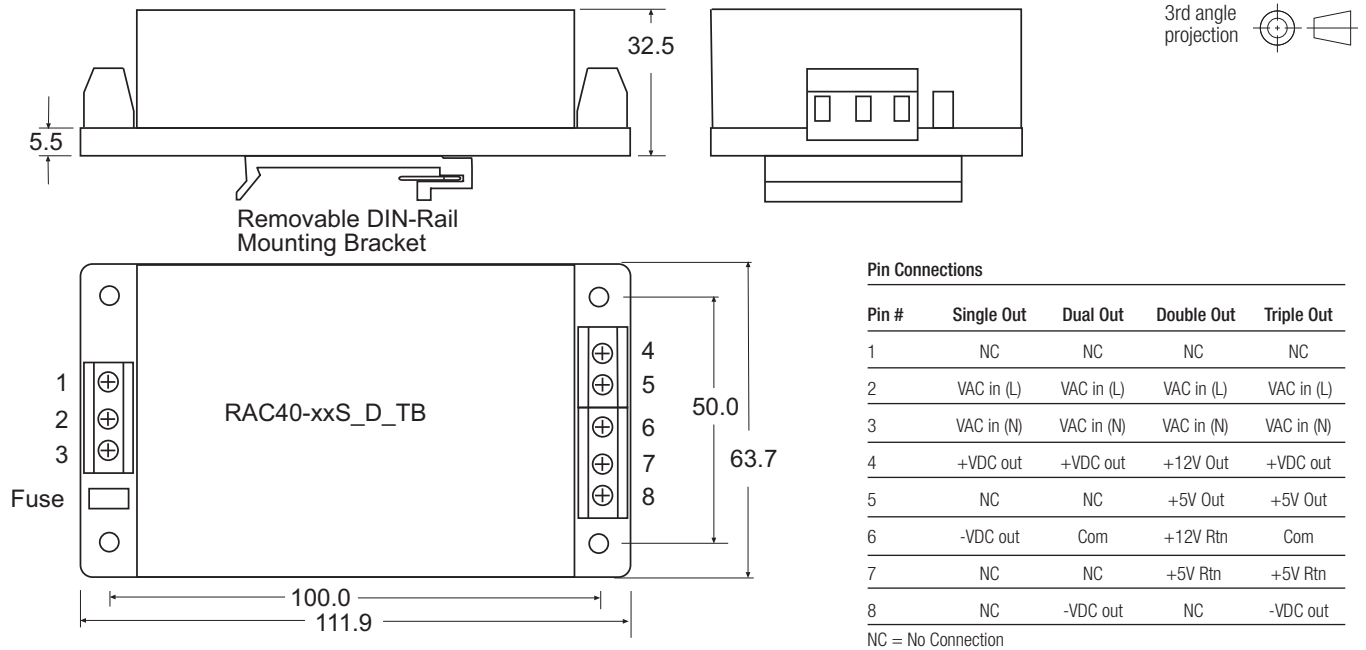
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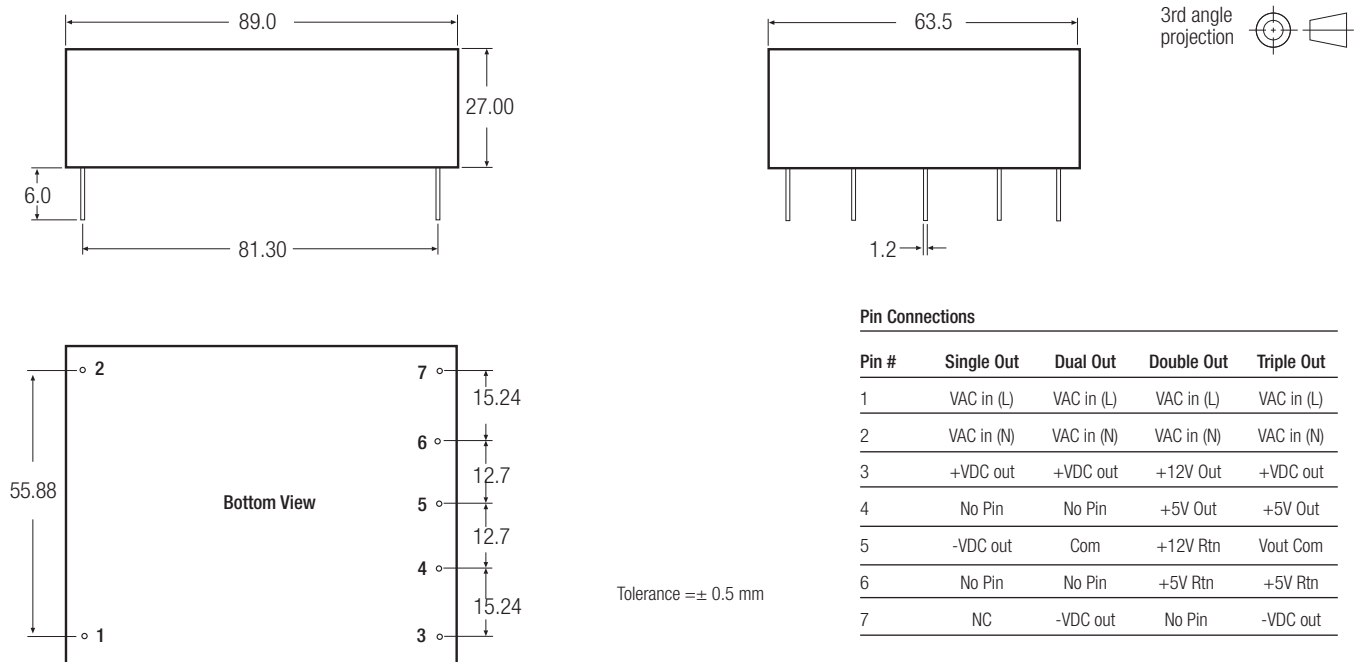
Specifications continued

Case Material	Epoxy with Fibreglass (UL94V-0)
Package Weight	280g
suffix (-ST)	300g
Packing Quantity	5 pcs (-ST Version: 1 pc)
EMC	EN 55022 Class B, EN55024
MTBF (+25°C)	using MIL-HDBK-217F 200~400 x 10 ³ hours

Screw Terminal Module Option (suffix -ST)



Package Style and Pinning



Notes

Note 1: Suggested input fuse rating 3.15A Slo Blo

Note 2: Triple output version has +/-Vout common that is not connected to +5V Return pin internally.

Features

Regulated Converters

- AC-DC Power Supply
- 60 Watt PCB Mount Package
- Universal Input Voltage Range
- 4kVAC Isolation RMS
- Low Output Ripple and Noise
- Short Circuit Protected
- Output Trim
- UL Certified, CE Marked

Description

Compact high power switching power module for PCB mounting. This switching converter has an universal AC or DC input voltage range with single high current outputs which are trimmable to compensate for any voltage drops on the output connections. Threaded inserts ensure mechanical fixing.

Selection Guide

Part Number	Input Range (VAC)	Output Voltage (VDC)	Output Current (mA)	Output Power (W)	Efficiency at 230V %	Max Capacitive Load
RAC60-05SB	85-265	5	10000	50	82	80000µF
RAC60-09SB	85-265	9	6600	60	84	28000µF
RAC60-12SB	85-265	12	5000	60	86	14000µF
RAC60-15SB	85-265	15	4000	60	86	12000µF
RAC60-24SB	85-265	24	2500	60	86	4000µF
RAC60-48SB	85-265	48	1250	60	86	950µF

Specifications (typical at 25°C and after warm up time unless otherwise specified)

Input Voltage Range	85-265VAC or 100-370VDC	
Rated Power	60 Watts max.	
Input Frequency Range (for AC Input)	47-63Hz	
Input Current (full load)	115VAC/230VAC	2A/ 1A max.
No Load Power Consumption	115VAC/230VAC	520mW max.
Inrush Current (<2mS)	115VAC/230VAC	30A/ 50A max.
Leakage Current	3.5mA max.	
Output Voltage Accuracy (Full load)	±2%	
Line Voltage Regulation (LL to HL at full load)	Single	±1% typ.
Load Voltage Regulation (5% to 100% full load)	Single	±1% typ.
Minimum Load	1%	
Output Noise (20MHz limited)	0.5%Vout + 50mVp-p max	
Output Ripple (20MHz limited)	<0.2%Vout + 40mVp-p max	
Output Trim	±10%	
Operating Frequency	100kHz typ.	
Efficiency at Full Load	see table	
RMS Isolation Voltage (input to output)	4kVAC / 1 minute	
Temperature Coefficient	±0.02%/°C typ.	
Isolation Resistance	100 MOhm max.	
Short Circuit Protection	Continuous, Hiccup, Automatic Restart	
Operating Temperature Range	free air convection, with derating	-40°C to +70°C
Storage Temperature Range	-40°C to +85°C	
Humidity	95% RH max.	
Case Material	Plastic Resin with Fibreglass (UL94V-0)	
Package Weight	310g	
Packing Quantity	1 pc	
EMC	EN 55011 Class B / EN 55022 Class B / EN 60601-1-2/ EN61000-3-2 -3 EN 55024 / EN61000-4-2 -3 -4 -5 -6 -8 -11	
MTBF (using MIL-HDBK-217F, 25°C)	>130 x 10 ³ hours	

POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

60 Watt Single Output

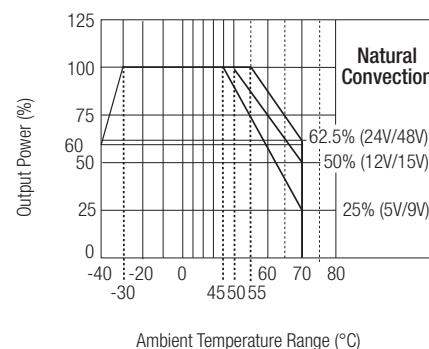


UL-60950-1 Certified

RAC60-B

Derating Graph

(Ambient Temperature)

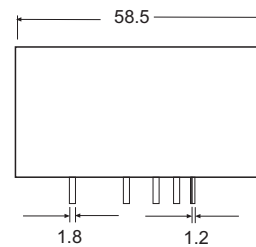
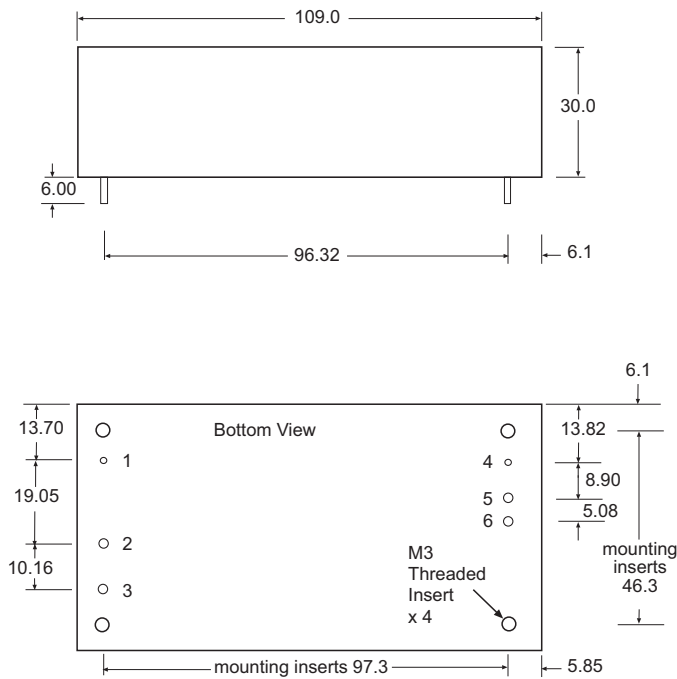


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Package Style and Pinning

3rd angle projection

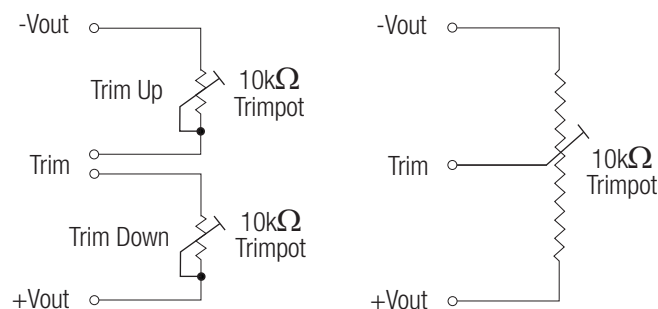


Pin Connections – Single Output

Pin #	Dia.(mm)	Function
1	1.2	FG
2	1.8	VAC in (L)
3	1.8	VAC in (N)
4	1.2	Trim
5	1.8	-VDC Out
6	1.8	+VDC Out

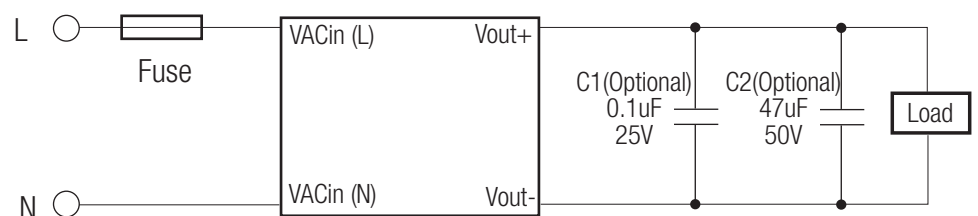
Tolerance ± 0.5 mm

Output Trim Adjustment



Standard Application Circuit

Suggested fuse rating
4A Slow Blow



POWERLINE - CONTENTS

RECOM

Powerline DC/DC Converters

8W - 60W, Single, Dual and Triple Outputs
12VDC, 24VDC and 48VDC 2:1 Inputs
24VDC and 48VDC 4:1 Inputs
Power Modules

PowerlinePlus DC/DC Converters

20W - 50W, Single and Dual Outputs
12VDC, 24VDC and 48VDC 2:1 Inputs
24VDC and 48VDC 4:1 Inputs
Built-in Heatsink and Class B Filter

Powerline AC/DC Converters

3W - 100W, Single, Dual and Triple Outputs
Universal Input Voltage
PCB Mounting and Screw Terminal Options

POWERLINE DC/DC - CONTENTS

Regulated Converters

Series	Isolation (kV)	Power (Watts)	Input Voltages (VDC)	Output Voltages (VDC)	Case Dimensions mm	Heatsink Part No.* (Power Module)	Page No.
RP08-A	1.6	8	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	DIP24 (SMD)	N/A	P1
RP08-AW	1.6	8	9-36, 18-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	DIP24 (SMD)	N/A	P5
RP10-E	1.6	10	9-18, 18-36, 36-75	5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P10
RP10-EW	1.6	10	9-36, 18-75	5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P14
RP12-A	1.6	12	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	DIP24	N/A	P18
RP12-AW	1.6	12	9-36, 18-75 $\pm 5, \pm 12, \pm 15$	3.3, 5.1, 12, 15	DIP24	N/A	P22
RP15-B	1.6	15	9-18, 18-36, 36-75 $\pm 5, \pm 12, \pm 15$	3.3, 5.1, 12, 15	DIP24	N/A	P25
RP15-BW	1.6	15	9-18, 18-36, 36-75 $\pm 5, \pm 12, \pm 15$	3.3, 5.1, 12, 15	DIP24	N/A	P29
RP15-SOF	2.25	15	18-36, 36-75	3.3, 5, 12, 15	27.9 x 23.9 x 8.5	Open Frame SMD	P33
RP15-SOFW	2.25	15	9-36, 18-75	3.3, 5, 12, 15	27.9 x 23.9 x 8.5	Open Frame SMD	P37
RP15-A	1.6	15	9-18, 18-36, 36-75 $\pm 5, \pm 12, \pm 15$	3.3, 5, 12, 15	25.4 x 25.4 x 10.2 (1" x 1")	7G-0047C	P41
RP15-AW	1.6	15	9-36, 18-75 $\pm 5, \pm 12, \pm 15$	3.3, 5, 12, 15	25.4 x 25.4 x 10.2 (1" x 1")	7G-0047C	P45
RP15-F	1.6	15	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P49
RP15-FW	1.6	15	9-36, 18-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P53
RP20-A	1.6	20	9-18, 18-36, 36-75 $\pm 12, \pm 15$	3.3, 5, 12, 15	25.4 x 25.4 x 10.2 (1" x 1")	7G-0047C	P56
RP20-AW	1.6	20	9-36, 18-75 $\pm 12, \pm 15$	3.3, 5, 12, 15	25.4 x 25.4 x 10.2 (1" x 1")	7G-0047C	P60
RP20-F	1.6	20	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P64
RP20-FW	1.6	20	9-36, 18-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P68
RP30-E	1.6	30	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 12, \pm 15$	50.8 x 40.6 x 10.2 (2" x 1.6")	7G-0011C RPM30-E	P71 P101
RP30-EW	1.6	30	10-40, 18-75	3.3, 5, 12, 15 $\pm 12, \pm 15$	50.8 x 40.6 x 10.2 (2" x 1.6")	7G-0011C RPM30-EW	P75 P101
RP30-F	1.6	30	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 25.4 x 10.2 (2" x 1")	7G-0020C	P79
RP30-FW	1.6	30	9-36, 18-75	3.3, 5, 12, 15 $\pm 5, \pm 12, \pm 15$	50.8 x 40.6 x 10.2 (2" x 1")	7G-0020C	P84
RP40-G	1.6	40	9-18, 18-36, 36-75	3.3, 5, 12, 15 $\pm 12, \pm 15$ 5 $\pm 12, 5\pm 15$	50.8 x 50.8 x 10.2 (2" x 2")	7G-0026C RPM40-G	P89 P101
RP40-GW	1.6	40	9-36, 18-75	3.3, 5, 12, 15 $\pm 12, \pm 15$	51.3 x 51.3 x 10.2 (2" x 2")	7G-0026C RPM40-GW	P93 P101
RP60-G	1.6	60	18-36, 36-75	3.3, 5, 12, 15	51.3 x 51.3 x 10.2 (2" x 2")	7G-0026C RPM60-G	P97 P101

*Heatsinks include mounting clips and double-sided adhesive pad. Add -HC to part number for pre-assembled heatsinks

Recom Power Module is a panel mounting adapter with screw terminals, built-in EMC Filter and DIN rail bracket. Refer to end of section for more details.

Features

Regulated Converters

- 2:1 Wide Input Voltage Range
- 8 Watts Regulated Output Power
- 1.6kVDC Isolation
- UL Certified
- Low Profile, 10.2 mm Height
- Over Current Protection
- Five-Sided Shield
- Standard DIP24 and SMD-Pinning
- Efficiency to 87 %

Description

The RP08-A series DC/DC converters are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required.

The DIP24 package is available in both pinned and SMD case styles and meets military standards for thermal shock and vibration tolerance.

Selection Guide

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
DIP24 (SMD)						
RP08-123.3SA**	9-18	3.3	2000	724	80	3300µF
RP08-1205SA**	9-18	5	1500	801	83	1600µF
RP08-1212SA**	9-18	12	666	833	88	350µF
RP08-1215SA**	9-18	15	533	843	87	240µF
RP08-243.3SA**	18-36	3.3	2000	362	80	3300µF
RP08-2405SA**	18-36	5	1500	396	83	1600µF
RP08-2412SA**	18-36	12	666	416	86	350µF
RP08-2415SA**	18-36	15	533	416	85	240µF
RP08-483.3SA**	36-75	3.3	2000	181	80	3300µF
RP08-4805SA**	36-75	5	1500	198	83	1600µF
RP08-4812SA**	36-75	12	666	208	86	350µF
RP08-4815SA**	36-75	15	533	208	86	240µF
RP08-1205DA**	9-18	±5	±800	843	83	±1000µF
RP08-1212DA**	9-18	±12	±333	833	87	±160µF
RP08-1215DA**	9-18	±15	±267	834	85	±100µF
RP08-2405DA**	18-36	±5	±800	427	82	±1000µF
RP08-2412DA**	18-36	±12	±333	422	86	±160µF
RP08-2415DA**	18-36	±15	±267	411	85	±100µF
RP08-4805DA**	36-75	±5	±800	211	85	±1000µF
RP08-4812DA**	36-75	±12	±333	206	87	±160µF
RP08-4815DA**	36-75	±15	±267	206	87	±100µF

** add Suffix SMD for SMD package

POWERLINE

DC/DC-Converter

with 3 year Warranty

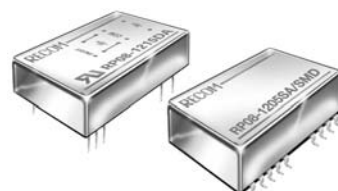
RECOM

8 Watt

DIP24/SMD

Single &

Dual Output

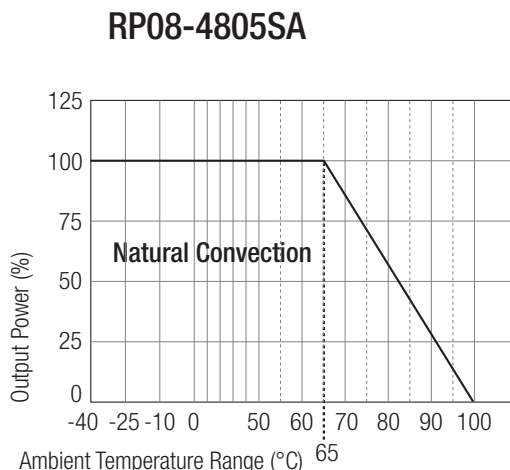


UL-60950-1 Certified
E196683

RP08

Please Read Application Notes

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (see Note 3)	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load)		20mAp-p
Start Up Time (nominal Vin and constant resistor load)		600ms typ.
Remote ON/OFF (see Note 7)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		8W max.
Output Voltage Accuracy (full Load and nominal Vin)		±2%
Minimum Load (see Note 1)		10% of full load
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (25% to 100% full load)	Single	±0.5%
	Dual	±1%
Cross Regulation (asymmetrical 25%<->100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)		50mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		200µs

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		none
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to out I/O to case I/O to case	1600VDC DIP type 1600VDC SMD type 1000VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		300pF max.
Operating Frequency		100kHz min.
Approved to Safety Standards		UL 1950, EN60950
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	20°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 8)	EN55022	Level A
Radiated Emissions	EN55022	Level A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight	DIP SMD	16g 18g
Packing Quantity	Refer to App Notes for tube dimensions	7 pcs per Tube
Dimensions	DIP SMD	31.8 x 20.3 x 10.2mm 32.0 x 20.3 x 10.9mm
MTBF (see Note 2)		3165 x 10 ³ hours

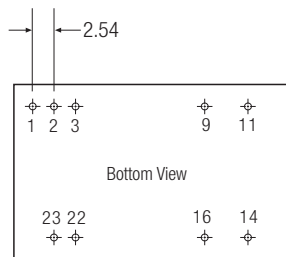
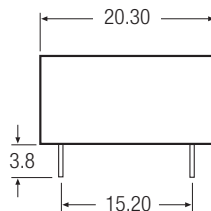
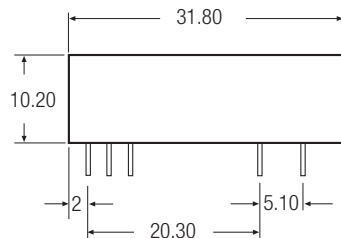
Notes:

1. The RP08 series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Start up voltage : 10VDC
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control pin voltage is referenced to negative input.
8. Vin=12V, fit a 4.7μF 1210 MLCC capacitor across the input pins to meet EN55022 Class A. 24V and 48V Types meet Class A without external components
See application notes for Class B Filter suggestion.

Package Style and Pinning (mm)

DIP24 Package Style

3rd angle projection



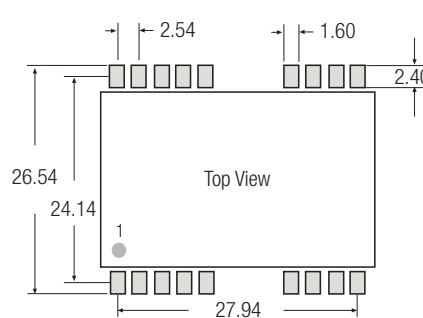
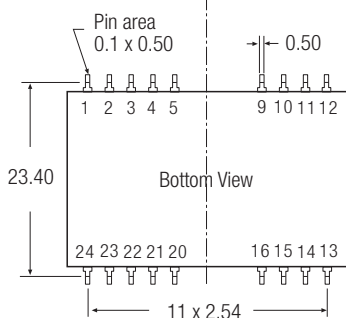
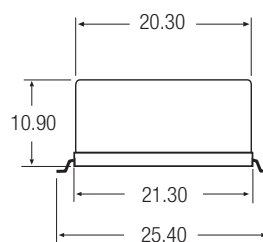
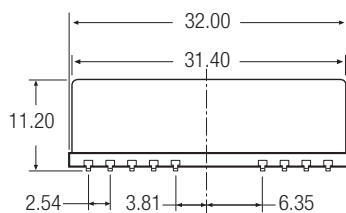
Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

SMD Package Style



SMD Package Style

Same spec. as the original DIP spec. and pin definition, excl. of the SMD type pin.

Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
Others	NC	NC

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

Regulated Converters

- 4:1 Wide Input Voltage Ranges
- High Input Voltage Range (110VDC)
- 8 Watts Regulated Output Power
- 1.6kVDC Isolation
- Protected Outputs
- Five-Sided Shield
- No Derating to 81°C Ambient
- Standard DIP24 and SMD-Pinning
- Efficiency up to 88%

Description

The RP08-AW series wide range input DC/DC converters are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The 24V and 110VDC input versions have been especially designed for railway applications. The DIP24 package is available in both pinned and SMD case styles and meets military standards for thermal shock and vibration tolerance.

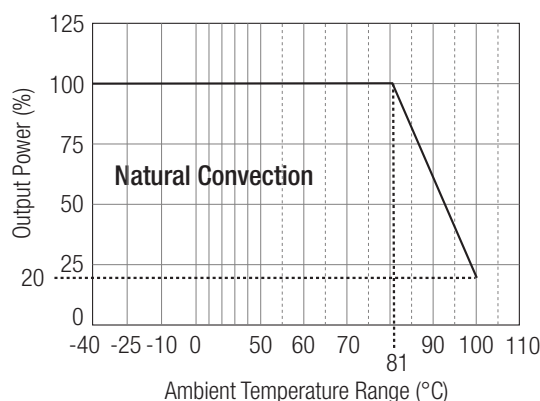
Selection Guide 24V, 48 and 110V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(4,5) Current mA	Efficiency ⁽⁶⁾ %	Capacitive ⁽⁷⁾ Load max.
DIP24 (SMD)						
RP08-243.3SAW**	9-40 ⁽⁹⁾	3.3	2400	40/407	85	1330µF
RP08-2405SAW**	9-40 ⁽⁹⁾	5	1600	40/402	87	1330µF
RP08-2412SAW**	9-40 ⁽⁹⁾	12	666	25/407	86	288µF
RP08-2415SAW**	9-40 ⁽⁹⁾	15	533	25/407	86	200µF
RP08-483.3SAW**	18-75	3.3	2400	20/204	85	1330µF
RP08-4805SAW**	18-75	5	1600	20/201	87	1330µF
RP08-4812SAW**	18-75	12	666	13/201	87	288µF
RP08-4815SAW**	18-75	15	533	13/198	88	200µF
RP08-1103.3SAW**	43-160	3.3	2400	8/90	85	1330µF
RP08-11005SAW**	43-160	5	1600	8/90	85	1330µF
RP08-11012SAW**	43-160	12	666	4/88	86	288µF
RP08-11015SAW**	43-160	15	533	4/88	86	200µF
RP08-2405DAW**	9-40 ⁽⁹⁾	±5	±800	20/417	84	±900µF
RP08-2412DAW**	9-40 ⁽⁹⁾	±12	±333	25/407	86	±133µF
RP08-2415DAW**	9-40 ⁽⁹⁾	±15	±267	25/407	86	±90µF
RP08-4805DAW**	18-75	±5	±800	10/208	84	±900µF
RP08-4812DAW**	18-75	±12	±333	13/201	87	±133µF
RP08-4815DAW**	18-75	±15	±267	13/201	87	±90µF
RP08-11005DAW**	43-160	±5	±800	5/93	82	±900µF
RP08-11012DAW**	43-160	±12	±333	5/90	85	±133µF
RP08-11015DAW**	43-160	±15	±267	5/90	85	±90µF

** add Suffix SMD for SMD package

Derating Graph (Ambient Temperature)

RP08-4805SAW



Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part-number not shown here please contact our technical support service at info@recom-development.at

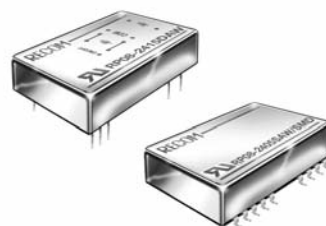
POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

8 Watt DIP24/SMD, Single & Dual Output



**UL-60950-1 Certified
E196683
(Except 110VDC Input
- UL Pending)**

RP08-W

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24VDC Input	9-40 ^W VDC
	48VDC Input	18-75VDC
	110VDC Input	43-160VDC
Input Filter		Pi Type
Input Surge Voltage (100ms max)	24VDC Input	50VDC
	48VDC Input	100VDC
	110VDC Input	170VDC
Undervoltage Lockout	24VDC Input	Startup: 9V, Shutdown 8V
	48VDC Input	Startup: 18V, Shutdown 16V
	110VDC Input	Startup: 43V, Shutdown 42V
Input Reflected Ripple (nominal Vin and full load)		20mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		450ms typ.
Remote ON/OFF (see note 1)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		8W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (0% to 100% Load)	Single (0% to 100% Load)	±0.5%
	Dual (0% to 100% Load)	±1.0%
	Single (10% to 90% Load)	±0.3%
	Dual (10% to 90% Load)	±0.8%
Cross Regulation Dual Output (asymmetrical 25%<->100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)		75mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Input Voltage Variation, dv/dt	complies with ETS300 132, part 4.4	5V/ms
Over Load Protection (% of full load at nominal Vin)		150% typ
Overvoltage Protection	3.3V	3.9V
Single output only	5.1V	6.2V
Zener Diode Clamp	12V	15V
	15V	18V
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to Out and I/O to Case	1600VDC
	I/O to Case (SMD)	1000VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		300kHz typ.
Operating Temperature Range (no derating)	5, 12, 15, ±12, ±15V	-40°C to +78°C
	3.3, ±5V	-40°C to +74°C
	(with derating)	All types
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	20°C/Watt

cont.

Specifications (typical at nominal input and 25°C unless otherwise noted)

Case Material	Nickel-coated copper with non-conductive black plastic base	
Potting Material	Epoxy (UL94-V0)	
Weight	18g (DIP), 20g (SMD)	
Packing Quantity	Refer to App Notes for tube dimensions	7pcs per Tube
Packing Quantity	Refer to App Notes for tube dimensions	7pcs per Tube
Conducted Emissions (see note 3)	EN55022	Class A
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (Note 8)	EN61000-4-4	Perf. Criteria A
Surge (Note 8)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Thermal Shock	MIL-STD-810F	
Vibration	10-55Hz, 10G, 30 Min. along X, Y and Z	
Relative Humidity	5% to 95% RH	
MTBF (see note 2)	Bellcore-TR-NWT-000332	2350 x 10 ³ hours
	MIL-HDBK-217F	1078 x 10 ³ hours

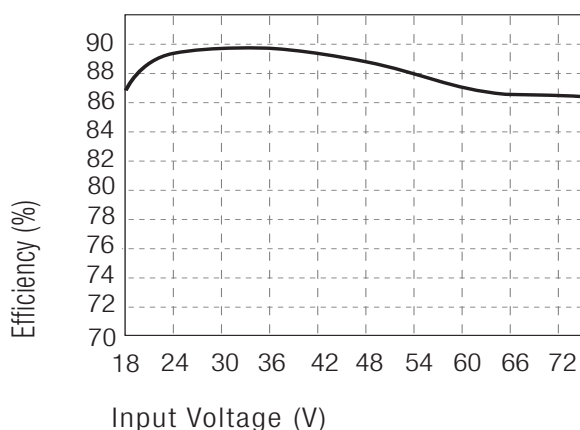
Notes :

1. The ON/OFF control pin voltage is referenced to negative input.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground Benign and controlled environment). Mil-HDBK-217F, Notice 2, Full Load, 25°C, Ground Benign.
3. Vin=24V, fit a 1.0μF/50V 1210 MLCC capacitor across the input pins to meet EN55022 Class A.
Vin=48V, fit a 0.47μF/100V 1810 MLCC capacitor across the input pins to meet EN55022 Class A.
Vin=110V, fit 2x 0.47μF/250V 1810 MLCC capacitor in parallel across the input pins to meet EN55022 Class A
See application notes for Class B Filter suggestion.
4. Typical value at nominal input voltage and no load.
5. Maximum value at nominal input voltage and full load
6. Typical value at nominal input voltage and full load.
7. Test by minimum Vin and constant resistor load.
8. Meets EN61000-4-4,-5 with a capacitor across the input. Recom suggests Nippon Chemi-Con KY series, 220μF/100V (24V and 48V) or 150μF/200V (110V)
9. The 24V input voltage range can be used up to 40VDC for 1 second. For a continuous input voltage, 36V is the limit.

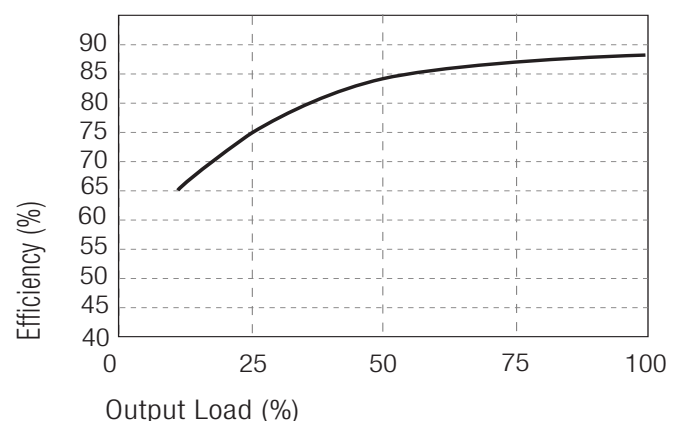
Typical Performance Graphs

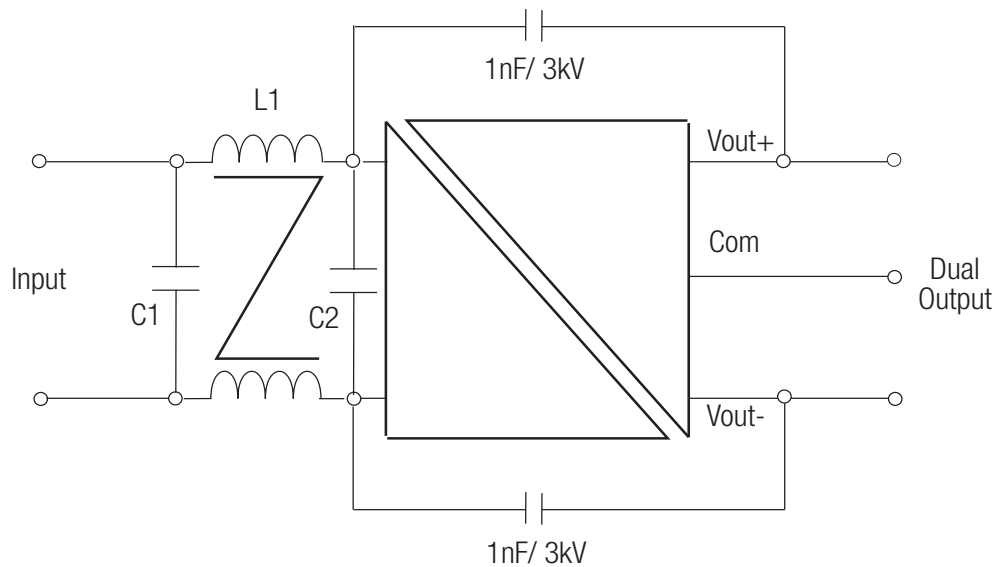
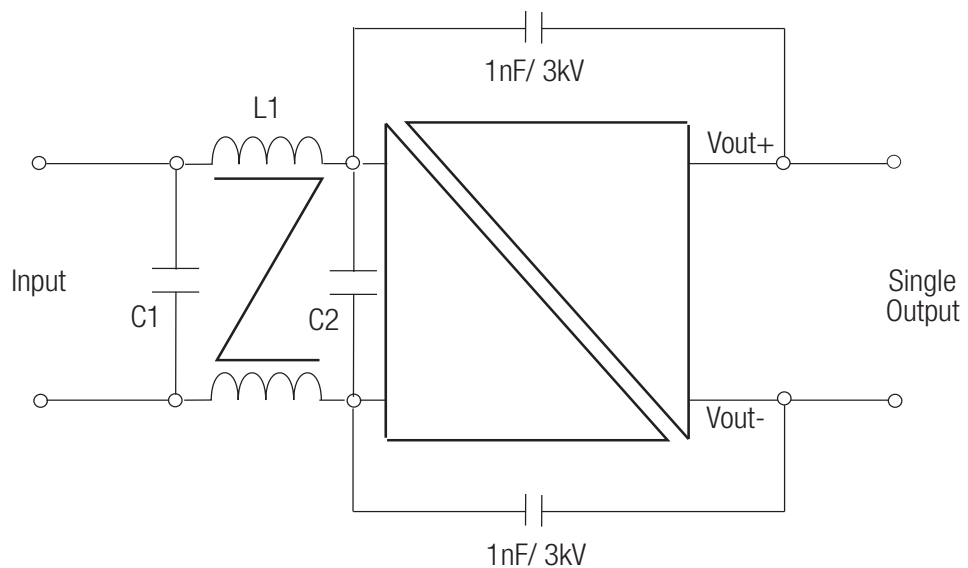
RP08-4805SAW

Efficiency VS Input Voltage



Efficiency VS Output load



Class B Filter

Vin=24V: C1=4.7 μ F/50V 1812 MLCC, L1 = CMC-06, C2=omit

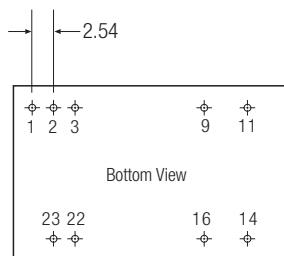
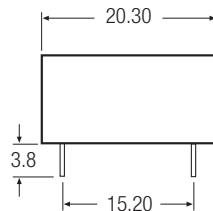
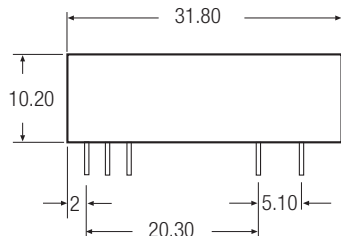
Vin=48V: C1= 1.5 μ F/100V 1812 MLCC, L1 = CMC-06, C2=1.5 μ F/100V 1812 MLCC

Vin=110V: C1= 0.47 μ F/250V 1812 MLCC, L1 = CMC-06, C2=0.47 μ F/250V 1812 MLCC

CMC-06 = 2x325 μ H Common Mode Choke, 3.3A rated, 35mOhm DCR.

Package Style and Pinning (mm)

DIP24 Package Style



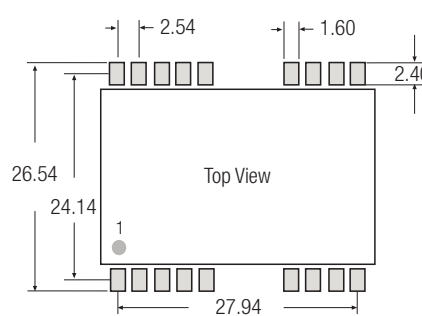
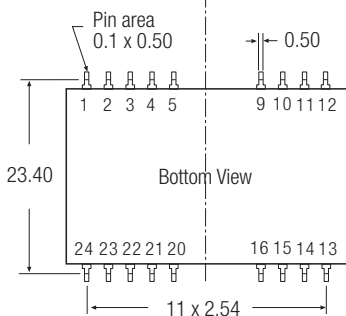
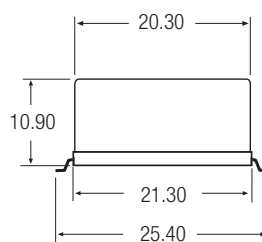
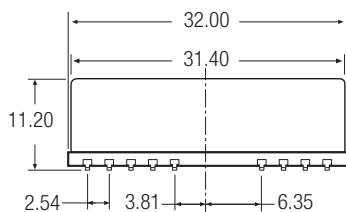
Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

SMD Package Style



SMD Package Style

Same spec. as the original DIP spec. and pin definition, excl. of the SMD type pin.

Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
Others	NC	NC

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

- 2:1 Wide Input Voltage Range
- 10 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x 25.4 x 10.2mm Package
- Efficiency to 86 %

Description

The RP10-E series DC/DC converters are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required.

The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance and is available with an optional remote on/off control pin.

This series is also available with the /M1 option which is particularly suitable for extended temperature range applications.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP10-1205SE	9-18	5	2000	1082	81	4700µF
RP10-1212SE	9-18	12	830	1064	82	690µF
RP10-1215SE	9-18	15	670	1088	81	470µF
RP10-2405SE	18-36	5	2000	534	82	4700µF
RP10-2412SE	18-36	12	830	519	84	690µF
RP10-2415SE	18-36	15	670	523	84	470µF
RP10-4805SE	36-75	5	2000	260	84	4700µF
RP10-4812SE	36-75	12	830	253	86	690µF
RP10-4815SE	36-75	15	670	258	85	470µF
RP10-1205DE	9-18	±5	±1000	1068	82	±680µF
RP10-1212DE	9-18	±12	±416	1053	83	±330µF
RP10-1215DE	9-18	±15	±333	1041	84	±110µF
RP10-2405DE	18-36	±5	±1000	548	80	±680µF
RP10-2412DE	18-36	±12	±416	520	84	±330µF
RP10-2415DE	18-36	±15	±333	520	84	±110µF
RP10-4805DE	36-75	±5	±1000	267	82	±680µF
RP10-4812DE	36-75	±12	±416	254	86	±330µF
RP10-4815DE	36-75	±15	±333	260	84	±110µF

* add suffix /M1 for higher efficiencies and extended temperature range.

* add suffix /P for CTRL function with Positive Logic (1=ON, 0=OFF)

* add suffix /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP10-1205SE/P = 12V Input, 5V Output, Standard Temp. Range, Positive Logic CTRL pin fitted

RP10-4805DE/M1-HC = 48V Input, ±5V Output, Extended Temp. Range, No CTRL pin, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

10 Watt

2" x 1"

Single &

Dual Output



UL-60950-1 Certified
E196683

RP10-E

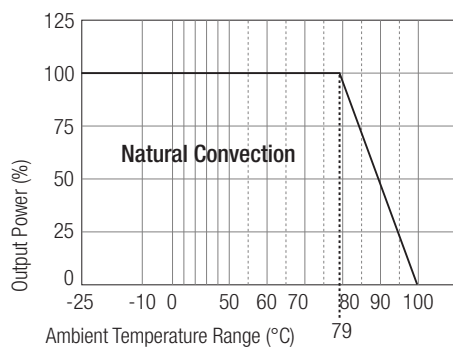
RP10-E

Please Read Application Notes

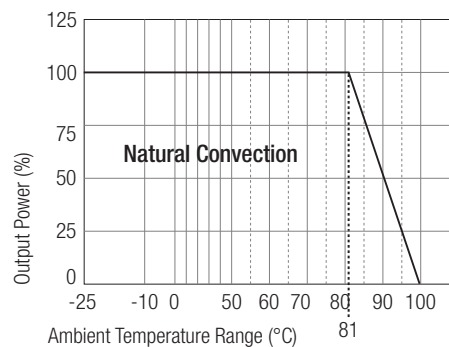
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Derating Graph (Ambient Temperature)

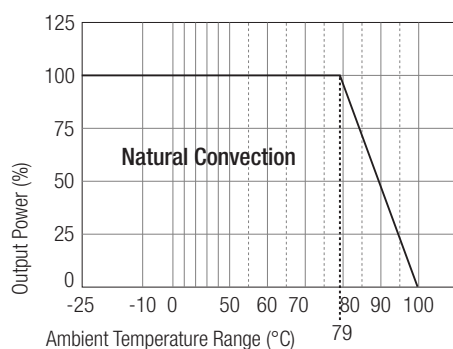
RP10-2405SE



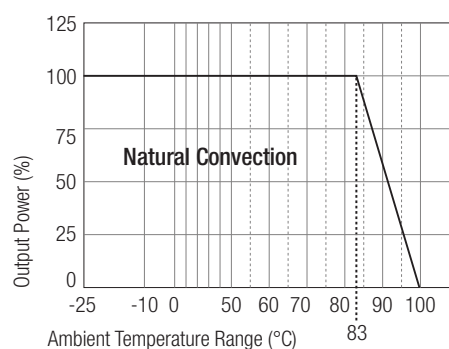
RP10-2405SE With Heat Sink



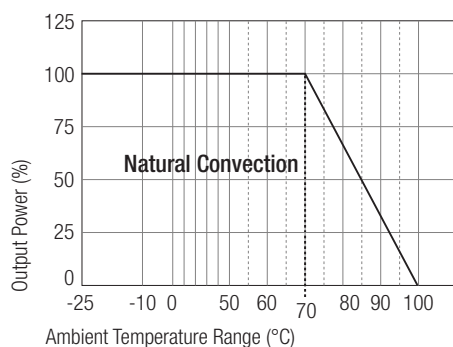
RP10-2405DE



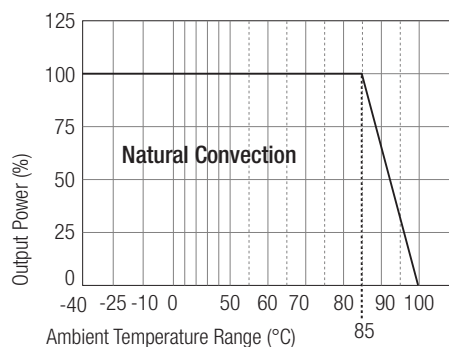
RP10-2405DE With Heat Sink



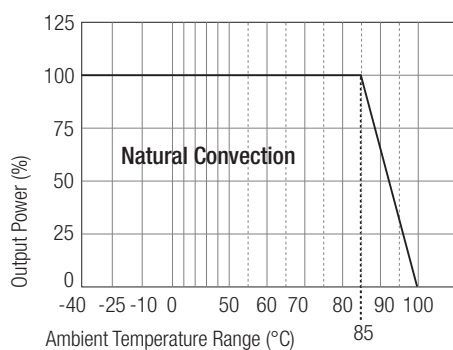
RP10-4805SE



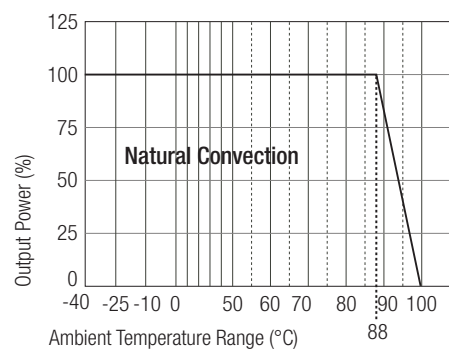
RP10-2405SE_DE/M1



RP10-4805SE/M1



RP10-2405SE_DE/M1 With Heat Sink



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

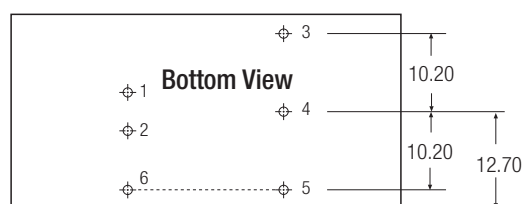
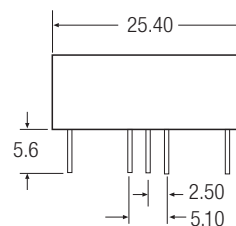
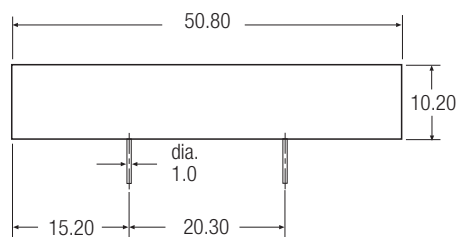
Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)		30mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		20ms typ.
Remote ON/OFF (Optional. See Note 7) (Positive logic)	DC-DC ON	Open or 3.5V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
	DC-DC ON	Short or 0V < Vr < 1.2V
	DC-DC OFF	Open or 3.5V < Vr < 12V
Remote OFF input current	Nominal input	20mA
Output Power		10W max.
Output Voltage Accuracy (full Load and nominal Vin)		±2%
Minimum Load (see Note 1)		10% of full load
Line Regulation (low line, high line at full load)		±1%
Load Regulation (25% to 100% full load)	Single	±1%
	Dual	±2%
Cross Regulation (asymmetrical 25% <-> 100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	Single	50mV _{p-p}
	Dual	75mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		500µs
Over Voltage Protection	3.3V output	3.9V
Zener diode clamp	5V output	6.2V
	12V output	15V
	15V output	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		none
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		300pF max.
Operating Frequency		300kHz typ.
Approved to Safety Standards (see Note 9)		UL 1950, EN60950
Operating Temperature Range (Reference Derating Curve) (see Note 10)	Standard	-25°C to +85°C (with derating)
	M1	-40°C to +85°C (non derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 8)	Natural convection	12°C/Watt
	Natural convection with Heat Sink	10°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 11)	EN55022	Level A
Radiated Emissions	EN55022	Level A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9 pcs per Tube
Dimensions		50.8 x 25.4 x 10.2mm
MTBF (see Note 2)		1976 x 10 ³ hours

Package Style and Pinning (mm)



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6*	CTRL*	CTRL*

*Optional. See Note 7.

Pin Pitch Tolerance ± 0.35 mm

Notes :

- The RP10 (W) series required a minimum 10% loading on the output to maintain specified regulation.
Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C. (Ground fixed and controlled environment).
- Simulated source impedance of 12 μ H. 12 μ H inductor in series with +Vin.
- Maximum value at nominal input voltage and full load of standard type.
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP10-2405SE/P), Negative logic ON/OFF is marked with suffix-N (eg. RP10-2405SE/N).
If no suffix is specified, the control pin will be omitted.
- Heat sink is optional and P/N: 7G-0020C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- The M1 version (RP10-xxxxSE/M1, RP10-xxxxDE/M1) does not carry the UL certification.
- M1 version is more efficient, therefore, it can be operated in a more extensive temperature range than standard version.
- See application notes for EMI-filtering.

Features

- 4:1 Wide Input Voltage Range
- 10 Watts Output Power
- 1.6kVDC Isolation
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x 25.4 x 10.2mm Package
- Efficiency to 84%

Description

The RP10-EW series wide input range DC/DC converter are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance and is available with an optional remote on/off control pin. This series is also available with the /M2 option which is particularly suitable for extended temperature range applications.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP10-2405SEW	9-36	5	2000	548	80	4700µF
RP10-2412SEW	9-36	12	830	532	82	690µF
RP10-2415SEW	9-36	15	670	551	80	470µF
RP10-4805SEW	18-75	5	2000	274	80	4700µF
RP10-4812SEW	18-75	12	830	259	84	690µF
RP10-4815SEW	18-75	15	670	262	84	470µF
RP10-2405DEW	9-36	±5	±1000	548	80	±680µF
RP10-2412DEW	9-36	±12	±416	547	80	±330µF
RP10-2415DEW	9-36	±15	±333	548	80	±110µF
RP10-4805DEW	18-75	±5	±1000	271	81	±680µF
RP10-4812DEW	18-75	±12	±416	281	78	±330µF
RP10-4815DEW	18-75	±15	±333	270	81	±110µF

* add suffix /M2 for higher efficiencies and extended temperature range.

* add suffix /P for CTRL function with Positive Logic (1=ON, 0=OFF)

* add suffix /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP10-2405SE/P = 24V 4:1 Input, 5V Output, Standard Temp. Range, Positive Logic CTRL pin fitted

RP10-4805DE/M1-HC = 48V 4:1 Input, ±5V Output, Extended Temp. Range, No CTRL, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

10 Watt
2" x 1"
Single &
Dual Output

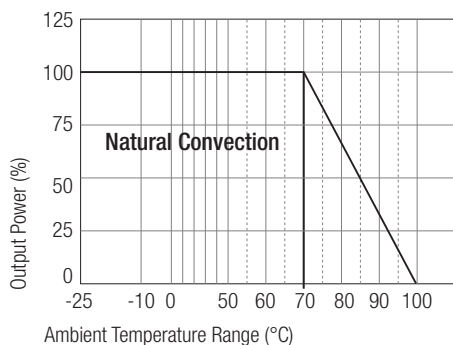


UL-60950-1 Certified
E196683

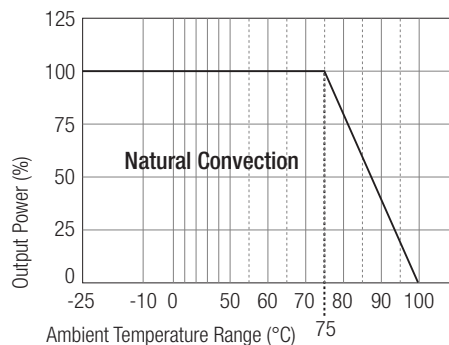
RP10-EW

Derating Graph (Ambient Temperature)

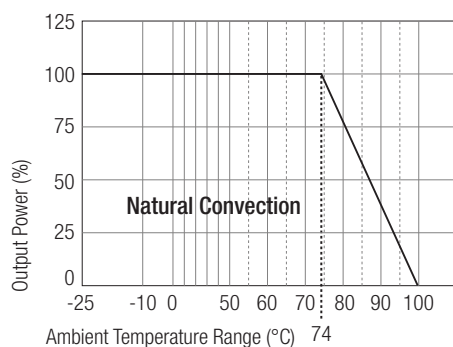
RP10-2405SEW



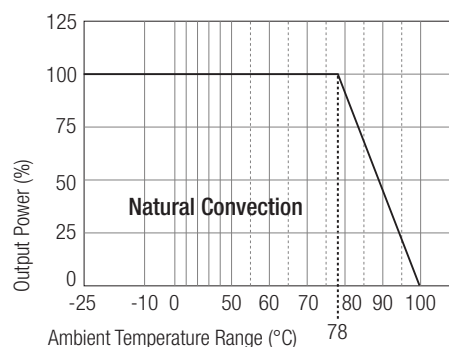
RP10-2405SEW With Heat Sink



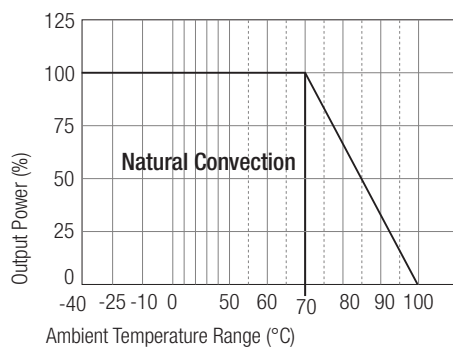
RP10-2405DEW



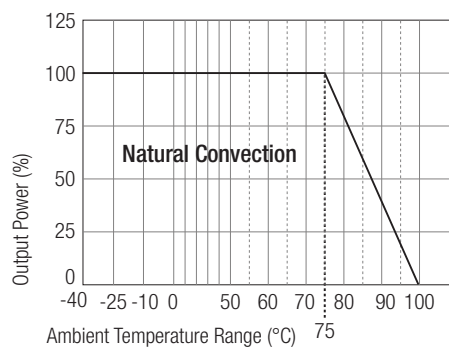
RP10-2405DEW With Heat Sink



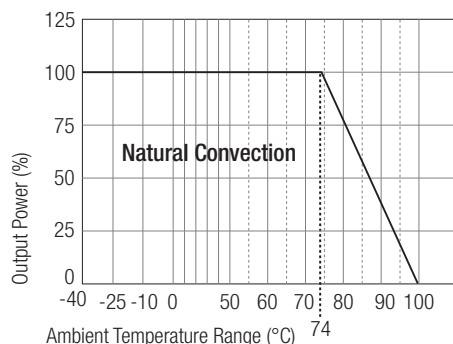
RP10-2405SEW/M2



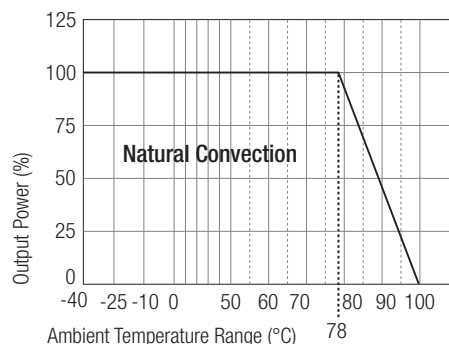
RP10-2405SEW/M2 With Heat Sink



RP10-2405DEW/M2



RP10-2405DEW/M2 With Heat Sink



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

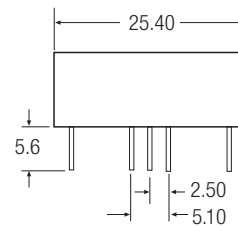
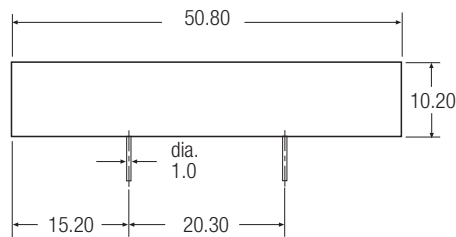
Input Voltage Range	24V nominal input 48V nominal input	9-36VDC 18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input 48V Input	50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load)		30mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		20ms typ.
Remote ON/OFF (Optional. See Note 7)		
(Positive logic)	DC-DC ON DC-DC OFF	Open or 3.5V < Vr < 12V Short or 0V < Vr < 1.2V
(Negative logic)	DC-DC ON DC-DC OFF	Short or 0V < Vr < 1.2V Open or 3.5V < Vr < 12V
Remote OFF input current	Nominal input	20mA
Output Power		10W max.
Output Voltage Accuracy (full Load and nominal Vin)		±2%
Minimum Load (see Note 1)		10% of full load
Line Regulation (low line, high line at full load)		±1%
Load Regulation (25% to 100% full load)	Single Dual	±1% ±2%
Cross Regulation (asymmetrical 25%<>100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	Single Dual	50mV _{p-p} 75mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		500µs
Over Voltage Protection	5V output	6.2V
Zener diode clamp	12V output 15V output	15V 18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		none
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		300pF max.
Operating Frequency		300kHz typ.
Operating Temperature Range (Reference Derating Curve) (see Note 9)	Standard M2	-25°C to +85°C(with derating) -40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 8)	Natural convection Natural convection with Heat Sink	12°C/Watt 10°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)

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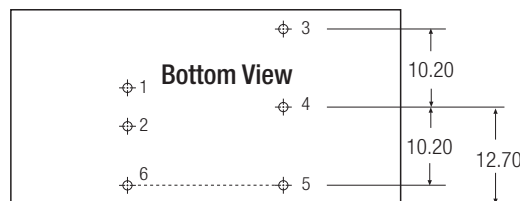
Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 10)	EN55022	Level A
Radiated Emissions	EN55022	Level A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9pcs per Tube
Dimensions		50.8 x 25.4 x 10.2mm
MTBF (see Note 2)	BELLCORE TR-NWT-000332	1976 x 10 ³ hours
	MIL-HDBK-217F	1416 x 10 ³ hours

Package Style and Pinning (mm)



3rd angle projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6*	CTRL*	CTRL*

* Optional. See Note 7

Pin Pitch Tolerance ± 0.35 mm

Notes :

- The RP10 (W) series required a minimum 10% loading on the output to maintain specified regulation.
Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C. (Ground fixed and controlled environment).
- Simulated source impedance of 12 μ H. 12 μ H inductor in series with +Vin.
- Maximum value at nominal input voltage and full load of standard type.
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP10-2405SEW/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP10-2405SEW/N).
If no suffix is specified, the control pin will be omitted.
- Heat sink is optional and P/N: 7G-0020C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- M2 version is more efficient, therefore, it can be operated in a more extensive temperature range than standard version.
- See application notes for EMI-filtering.

Features

- 2:1 Wide Input Voltage Range
- 12 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Over Current Protection
- Five-Sided Shield
- Standard DIP24 and SMD-Pinning
- Efficiency to 88 %

Description

The RP12-A series DC/DC converter are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required.

The DIP24 package is available in both pinned and SMD case styles and meets military standards for thermal shock and vibration tolerance.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
DIP24 (SMD)						
RP12-123.3SA**	9-18	3.3	3500	1646	84	2000µF
RP12-1205SA**	9-18	5	2400	1606	86	2000µF
RP12-1212SA**	9-18	12	1000	1606	86	430µF
RP12-1215SA**	9-18	15	800	1606	86	300µF
RP12-243.3SA**	18-36	3.3	3500	823	85	2000µF
RP12-2405SA**	18-36	5	2400	803	87	2000µF
RP12-2412SA**	18-36	12	1000	803	87	430µF
RP12-2415SA**	18-36	15	800	803	87	300µF
RP12-483.3SA**	36-75	3.3	3500	411	85	2000µF
RP12-4805SA**	36-75	5	2400	401	87	2000µF
RP12-4812SA**	36-75	12	1000	401	87	430µF
RP12-4815SA**	36-75	15	800	401	87	300µF
RP12-1205DA**	9-18	±5	±1200	1687	82	±1250µF
RP12-1212DA**	9-18	±12	±500	1626	87	±200µF
RP12-1215DA**	9-18	±15	±400	1626	87	±120µF
RP12-2405DA**	18-36	±5	±1200	843	83	±1250µF
RP12-2412DA**	18-36	±12	±500	813	88	±200µF
RP12-2415DA**	18-36	±15	±400	813	88	±120µF
RP12-4805DA**	36-75	±5	±1200	422	83	±1250µF
RP12-4812DA**	36-75	±12	±500	406	88	±200µF
RP12-4815DA**	36-75	±15	±400	406	88	±120µF

** add Suffix SMD for SMD package

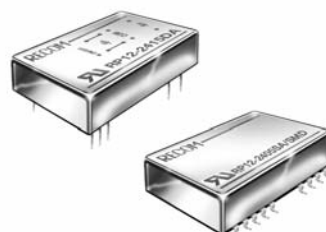
POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

12 Watt DIP24/SMD Single & Dual Output



**UL-60950-1 Certified
E196683**

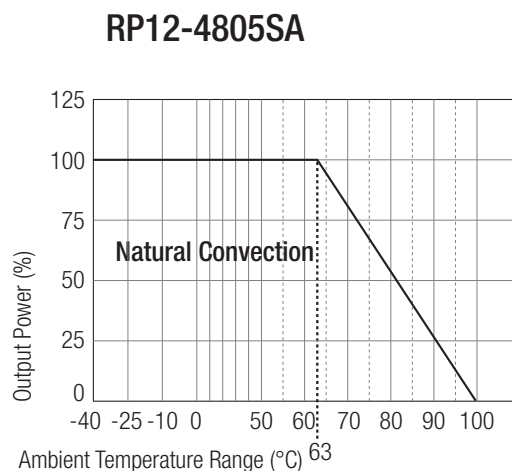
RP12-A

RP12-A

Please Read Application Notes

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Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	12V Input DC-DC ON	9VDC
	DC-DC OFF	8VDC
	24V Input DC-DC ON	18VDC
	DC-DC OFF	16VDC
	48V Input DC-DC ON	36VDC
	DC-DC OFF	33VDC
Input Filter	Pi Type	
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)	5V/ms max.
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)	20mA _{p-p}	
Start Up Time (nominal Vin and constant resistor load)	600ms typ.	
Remote ON/OFF (see Note 7)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power	12W max.	
Output Voltage Accuracy (full Load and nominal Vin)	±1.2%	
Minimum Load (see Note 1)	10% of full load	

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

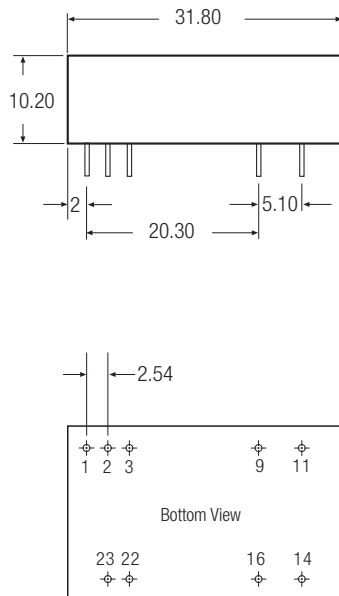
Line Regulation (low line, high line at full load)	Single	±0.2%
	Dual	±0.5%
Load Regulation (25% to 100% full load)	Single	±0.5%
	Dual	±1%
Cross Regulation (asymmetrical 25% <>100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)		85mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		300µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V	6.2V
	12V	15V
	15V	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to out	1600VDC min.
	I/O to case	1600VDC min.
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1200pF max.
Operating Frequency		400kHz typ.
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	20°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 8)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight	DIP	18g
	SMD	20g
Packing Quantity	Refer to App Notes for tube dimensions	7pcs per Tube
Dimensions		31.8 x 20.3 x 10.2mm
MTBF (see Note 2)		2750 x 10 ³ hours

Notes :

1. The RP12 series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control pin voltage is referenced to negative input.
8. See application notes for EMI-filtering.

Package Style and Pinning (mm)

DIP24 Package Style



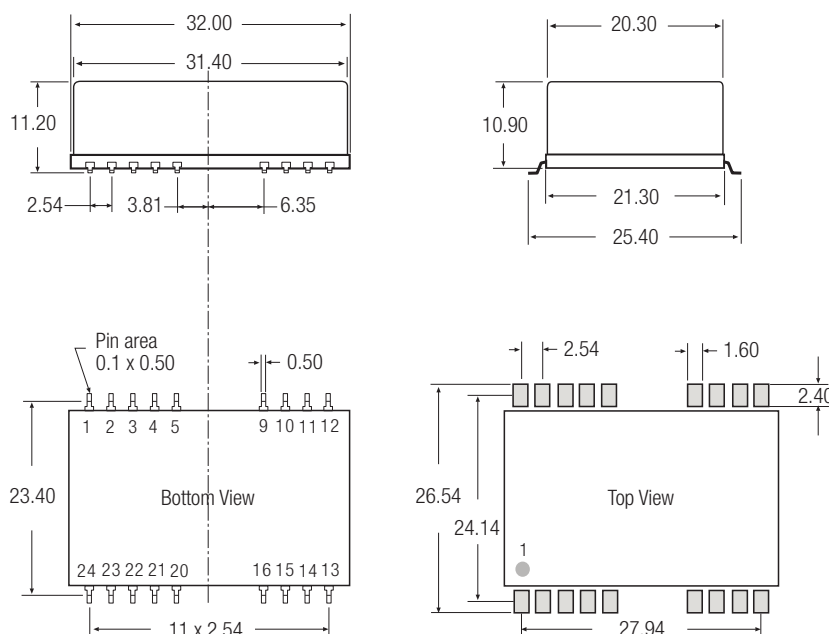
Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

SMD Package Style



SMD Package Style

Same spec. as the original DIP spec. and pin definition, excl. of the SMD type pin.

Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
Others	NC	NC

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

Regulated Converters

- 4:1 Wide Input Voltage Range
- 12 Watts Regulated Output Power
- 1.6kVDC Isolation
- Over Current and Over Voltage Protection
- Five-Sided Shield
- No Derating to 61°C
- Standard DIP24 Pinning
- Efficiency to 88 %

Description

The RP12-AW series wide range input DC/DC converter are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The DIP24 package is available in both pinned and SMD case styles and meets military standards for thermal shock and vibration tolerance.

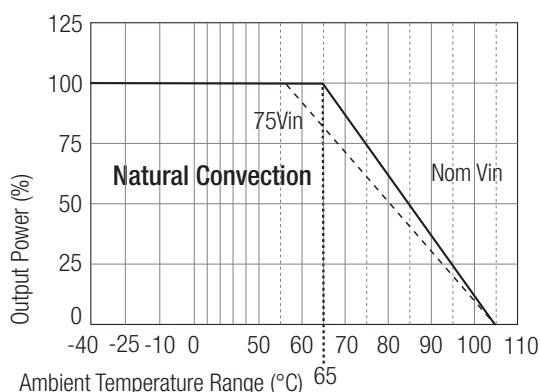
Selection Guide 24V and 48V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(4,5) Current mA	Efficiency ⁽⁶⁾ %	Capacitive ⁽⁷⁾ Load max.
DIP24 (SMD)						
RP12-243.3SAW**	9-36	3.3	3500	55/602	84	2000µF
RP12-2405SAW**	9-36	5.1	2400	55/614	87	2000µF
RP12-2412SAW**	9-36	12	1000	25/610	86	430µF
RP12-2415SAW**	9-36	15	800	25/610	86	300µF
RP12-483.3SAW**	18-75	3.3	3500	20/301	84	2000µF
RP12-4805SAW**	18-75	5.1	2400	20/307	87	2000µF
RP12-4812SAW**	18-75	12	1000	13/302	87	430µF
RP12-4815SAW**	18-75	15	800	13/298	88	300µF
RP12-2405DAW**	9-36	±5	±1200	20/625	84	±1250µF
RP12-2412DAW**	9-36	±12	±500	25/610	86	±200µF
RP12-2415DAW**	9-36	±15	±400	25/610	86	±120µF
RP12-4805DAW**	18-75	±5	±1200	10/309	85	±1250µF
RP12-4812DAW**	18-75	±12	±500	13/301	87	±200µF
RP12-4815DAW**	18-75	±15	±400	13/301	87	±120µF

** add Suffix SMD for SMD package

Derating Graph (Ambient Temperature)

RP12-4805SAW



Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part-number not shown here, please contact our technical support service at: info@recom-development.at

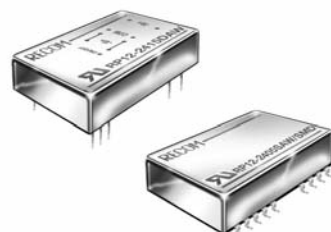
POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

12 Watt DIP24 & SMD, Single & Dual Output



UL-60950-1 Certified
E196683

RP12-AW

Please Read Application Notes

www.recom-electronic.com

Specifications (typical at nominal input and 25°C unless otherwise noted)

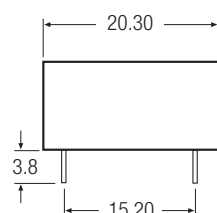
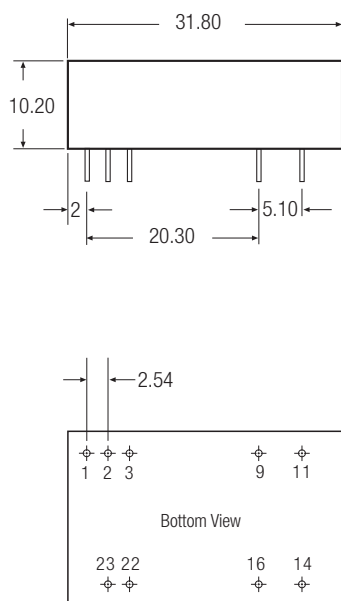
Input Voltage Range	24V nominal input 48V nominal input	9-36VDC 18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100ms max)		50VDC (24V Type), 100VDC (48V Type)
Input Reflected Ripple (nominal Vin and full load)		20mAp-p
Start Up Time (nominal Vin and constant resistor load)		450ms typ.
Remote ON/OFF (see note 1)	DC-DC ON DC-DC OFF	Open or 3.0V < Vr < 12V Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		12W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1.2%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (0% to 100% load)		±0.5% Single, ±0.5%
Cross Regulation Dual Output (asymmetric 25% <> 100% Load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)		85mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Input Voltage Variation, dv/dt	complies with ETS300 132, part 4.4	5V/ms
Over Load Protection (% of full load at nominal Vin)		150% typ
Overvoltage Protection (Single)		Zener Diode Clamp
Undervoltage Protection		See Application Notes
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to Out and I/O to case	1600VDC
Isolation Resistance		10 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		400kHz typ.
Operating Temperature Range (No derating)	5.1, 12, 15, ±12, ±15V 3.3, ±5V	-40°C to +65°C -40°C to +61°C
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	20°C/Watt
Case Material		Nickel plated copper with non-conductive plastic base
Potting Material		Epoxy (UL94-V0)
Weight		18g (DIP), 20g (SMD)
Packing Quantity	Refer to App Notes for tube dimensions	7pcs per Tube
Conducted Emissions (see note 3)	EN55022	Class A
Radiated Emissions (see note 3)	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
MTBF (see note 2)	Bellcore-TR-NWT-000332	2350 x 10 ³ hours

Notes :

1. The ON/OFF control pin voltage is referenced to negative input.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Requires external filter to meet EN55022 Class A
4. Typical value at nominal input voltage and no load.
5. Maximum value at nominal input voltage and full load
6. Typical value at nominal input voltage and full load.
7. Test by minimum Vin and constant resistor load.

Package Style and Pinning (mm)

DIP24 Package Style



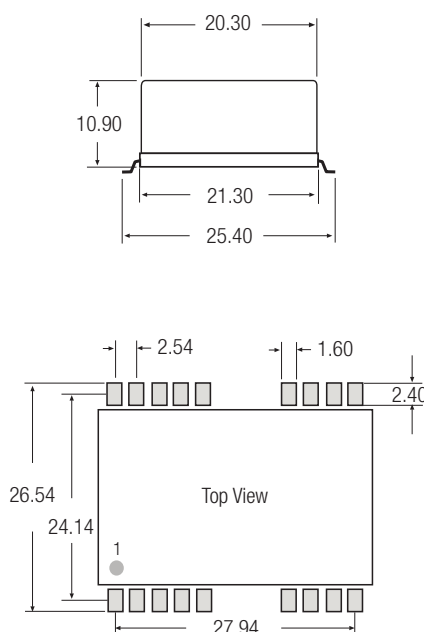
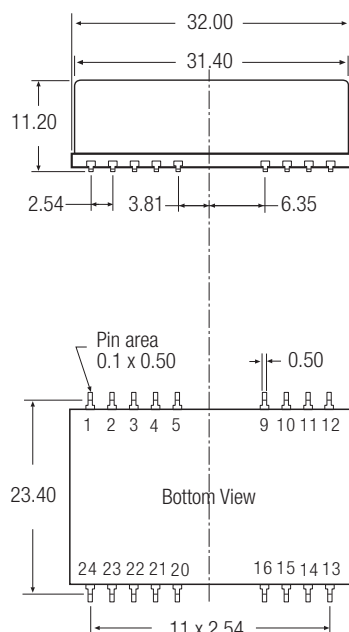
Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

SMD Package Style



SMD Package Style

Same spec. as the original DIP spec. and pin definition, excl. of the SMD type pin.

Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin
Others	NC	NC

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

Regulated Converters

- 15 Watts Regulated Output Power
- 2:1 Wide Input Voltage Range
- Six-Sided Shield, meets Class A without external filter
- Standard Pinning
- Remote On/Off Pin
- Fully Protected Outputs
- 1.6kVDC Isolation
- Very Low Quiescent Current
- Efficiency to 91%

Description

The RP15-B series DC/DC converters are high power density converters that offer 15W in the industry standard DIP24 case size with very high efficiency and low quiescent current. The DIP24 package is fully six-sided shielded and meets EN55022 Class A without any external components.

Selection Guide

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽²⁾ Current mA	Efficiency ⁽³⁾ %	Capacitive ⁽⁴⁾ Load max.
DIP24 (SMD)						
RP15-123.3SB	9-18	3.3	4000	1325/10	87	4700µF
RP15-1205SB	9-18	5.1	3000	1482/10	90	3300µF
RP15-1212SB	9-18	12	1250	1453/5	90	600µF
RP15-1215SB	9-18	15	1000	1453/10	90	400µF
RP15-243.3SB	18-36	3.3	4000	654/6	88	4700µF
RP15-2405SB	18-36	5.1	3000	741/6	90	3300µF
RP15-2412SB	18-36	12	1250	718/4	91	600µF
RP15-2415SB	18-36	15	1000	718/6	91	400µF
RP15-483.3SB	36-75	3.3	4000	327/4	88	4700µF
RP15-4805SB	36-75	5.1	3000	371/4	90	3300µF
RP15-4812SB	36-75	12	1250	363/4	90	600µF
RP15-4815SB	36-75	15	1000	359/4	91	400µF
RP15-1205DB	9-18	±5	±1500	1524/10	86	±1500µF
RP15-1212DB	9-18	±12	±625	1453/6	90	±288µF
RP15-1215DB	9-18	±15	±500	1453/10	90	±200µF
RP15-2405DB	18-36	±5	±1500	753/4	87	±1500µF
RP15-2412DB	18-36	±12	±625	726/6	90	±288µF
RP15-2415DB	18-36	±15	±500	727/6	90	±200µF
RP15-4805DB	36-75	±5	±1500	376/4	87	±1500µF
RP15-4812DB	36-75	±12	±625	363/4	90	±288µF
RP15-4815DB	36-75	±15	±500	363/4	90	±200µF

POWERLINE
DC/DC-Converter

RECOM

**15 Watt
DIP24
Single &
Dual Output**

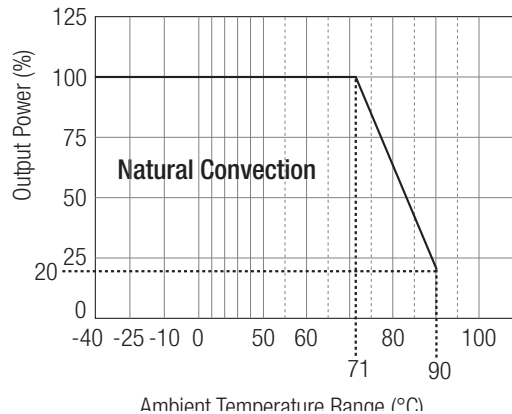


UL-60950-1 Pending

RP15-B

Derating Graph (Ambient Temperature)

RP15-4805SB



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (see Note 3)	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Voltage Undervoltage Lockout	12V nominal input	startup: 9VDC, shutdown: 8VDC
	24V nominal input	startup: 18VDC, shutdown: 16VDC
	48V nominal input	startup: 36VDC, shutdown: 33VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load)		20mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		30ms typ.
Remote ON/OFF (see Note 5)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		15W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single	±0.2%
	Dual	±0.5%
Load Regulation	Single (0% to 100% full load)	±0.5%
	Single (10% to 90% full load)	±0.3%
	Dual (0% to 100% full load)	±1%
	Dual (10% to 90% full load)	±0.8%
Cross Regulation (asymmetrical 25%<->100% load)		±5%
Ripple and Noise (20MHz bandwidth limited, with 1µF MLCC on output)		75mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

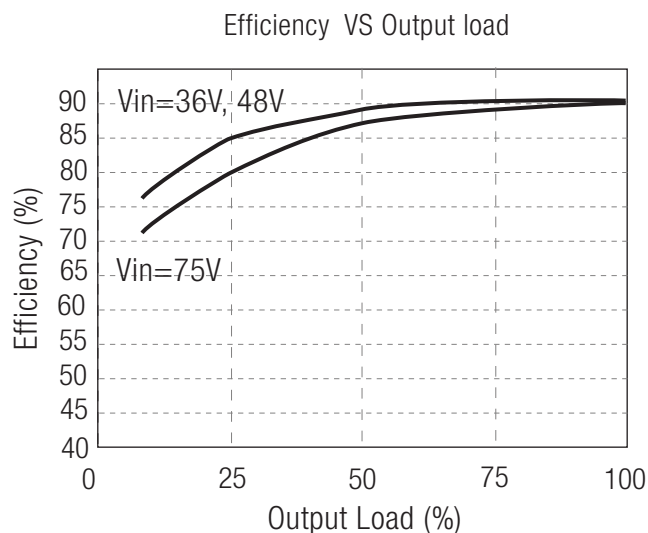
Over Load Protection (% of full load at nominal Vin)		150% typ
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input to Output	1600VDC
	I/O to case	1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		2000pF max.
Operating Frequency		330kHz typ..
Designed to meet Safety Standards		UL 1950, EN60950
Operating Temperature Range		-40°C to +90°C (with derating)
		-40°C to +71°C (without derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance		Natural convection 20°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Silicone (UL94-V0)
Conducted Emissions (without filter)	EN55022	Level A
Conducted Emissions (with filter)	EN55022	Level B
Radiated Emissions	EN55022	Level B
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (note 6)	EN61000-4-4	Perf. Criteria A
Surge (Note 6)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight		14.4g
Packing Quantity	Refer to App Notes for tube dimensions	7 pcs per Tube
Dimensions		31.8 x 20.3 x 10.2mm
MTBF (note 1)	BELLCORE TR-NWT-000332	3378 x 10 ³ hours
	MIL-HDBK-217F	4645 x 10 ³ hours

Notes:

1. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment). MIL-HDBK-217F, Notice 2, Full Load, 25°C, Ground Benign.
2. Full Load/No Load input current at Nominal Vin.
3. Typical value at nominal input voltage and full load.
4. Test by minimum Vin and constant resistor load.
5. The ON/OFF control pin voltage is referenced to negative input.
6. Requires external capacitor to meet EN61000-4-4, -5: Recom suggests Nippon Chemicon KY series, 220µF/100V, ESR=48mOhm)

Typical Performance Graph

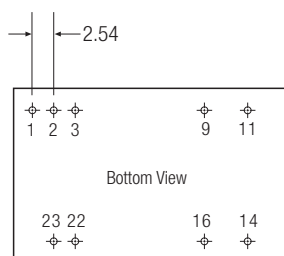
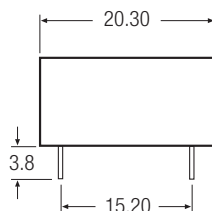
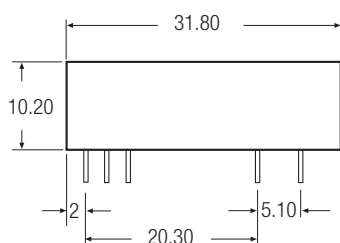
RP15-4805SB



Package Style and Pinning (mm)

DIP24 Package Style

3rd angle projection



Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

Regulated Converters

- 15 Watts Regulated Output Power
- 4:1 Wide Input Voltage Range
- Six-Sided Shield, meets Class A without external filter
- Standard Pinning
- Remote On/Off Pin
- Fully Protected Outputs
- 1.6kVDC Isolation
- Very Low Quiescent Current
- Efficiency to 90%

Description

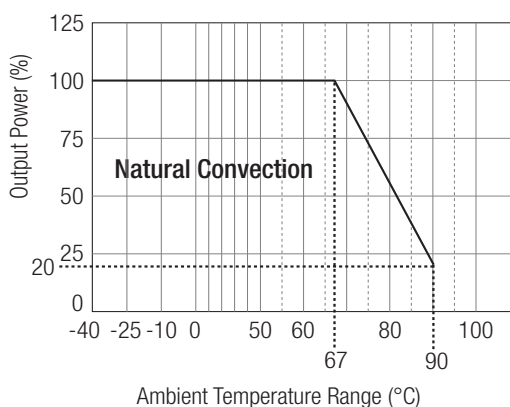
The RP15-B series DC/DC converters are high power density converters that offer 15W in the industry standard DIP24 case size with very high efficiency and low quiescent current. The DIP24 package is fully six-sided shielded and meets EN55022 Class A without any external components.

Selection Guide

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽²⁾ Current mA	Efficiency ⁽³⁾ %	Capacitive ⁽⁴⁾ Load max.
DIP24 (SMD)						
RP15-243.3SBW	9-36	3.3	4000	654/6	88	4700µF
RP15-2405SBW	9-36	5.1	3000	741/6	90	3300µF
RP15-2412SBW	9-36	12	1250	726/6	90	600µF
RP15-2415SBW	9-36	15	1000	726/6	90	400µF
RP15-483.3SBW	18-75	3.3	4000	323/4	89	4700µF
RP15-4805SBW	18-75	5.1	3000	375/4	89	3300µF
RP15-4812SBW	18-75	12	1250	363/4	90	600µF
RP15-4815SBW	18-75	15	1000	363/4	90	400µF
RP15-2405DBW	9-36	±5	±1500	762/6	86	±1500µF
RP15-2412DBW	9-36	±12	±625	735/6	89	±288µF
RP15-2415DBW	9-36	±15	±500	726/6	90	±200µF
RP15-4805DBW	18-75	±5	±1500	381/4	86	±1500µF
RP15-4812DBW	18-75	±12	±625	368/4	89	±288µF
RP15-4815DBW	18-75	±15	±500	363/4	90	±200µF

Derating Graph (Ambient Temperature)

RP15-4805SBW



POWERLINE

AC/DC-Converter

with 3 year Warranty

RECOM

15 Watt DIP24 Single & Dual Output



UL-60950-1 Pending

RP15-BW

Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Please Read Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (see Note 3)	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Input Voltage Undervoltage Lockout	24V nominal input	startup: 9VDC, shutdown: 8VDC
	48V nominal input	startup: 18VDC, shutdown: 16VDC
Input Filter		Pi Type
Input Surge Voltage (1s max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load)		20mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		30ms typ.
Remote ON/OFF (see Note 5)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		15W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation	Single (0% to 100% full load)	±0.5%
	Single (10% to 90% full load)	±0.3%
	Dual (0% to 100% full load)	±1%
	Dual (10% to 90% full load)	±0.8%
Cross Regulation (asymmetrical 25%<>100% load)		±5%
Ripple and Noise (20MHz bandwidth limited, with 1µF MLCC on output)		60mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Load Protection (% of full load at nominal Vin)		150% typ
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input to Output	1600VDC
	I/O to case	1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		2000pF max.
Operating Frequency		330kHz typ.
Designed to meet Safety Standards		UL 60950-1, EN60950-1
Operating Temperature Range		-40°C to +100°C (with derating)
		-40°C to +67°C (without derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	20°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

Case Material	Nickel plated copper	
Base Material	FR4	
Potting Material	Silicone (UL94-V0)	
Conducted Emissions (without filter)	EN55022	Level A
Conducted Emissions (with filter)	EN55022	Level B
Radiated Emissions	EN55022	Level B
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (note 6)	EN61000-4-4	Perf. Criteria A
Surge (Note 6)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight	14.4g	
Packing Quantity	Refer to App Notes for tube dimensions	7 pcs per Tube
Dimensions	31.8 x 20.3 x 10.2mm	
MTBF (note 1)	BELLCORE TR-NWT-000332	3374 x 10 ³ hours
	MIL-HDBK-217F	4135 x 10 ³ hours

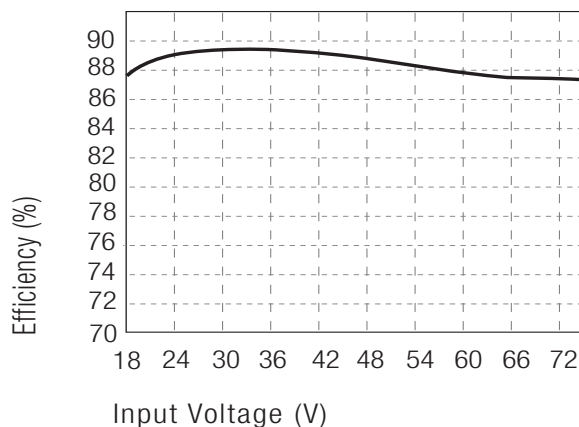
Notes:

1. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment). MIL-HDBK-217F, Notice 2, Full Load, 25°C, Ground Benign.
2. Full Load/No Load input current at Nominal Vin.
3. Typical value at nominal input voltage and full load.
4. Test by minimum Vin and constant resistor load.
5. The ON/OFF control pin voltage is referenced to negative input.
6. Requires external capacitor to meet EN61000-4-4, -5: Recom suggests Nippon Chemicon KY series, 220µF/100V, ESR=48mOhm)

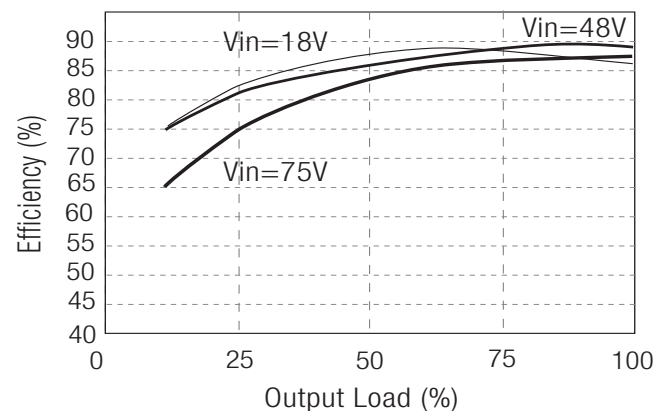
Typical Performance Graphs

RP15-4805SBW

Efficiency VS Input Voltage

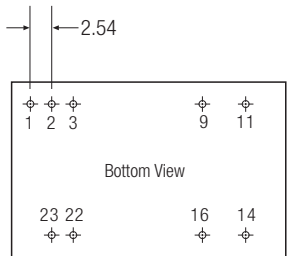
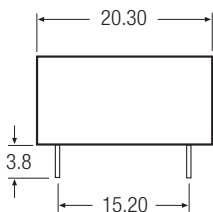
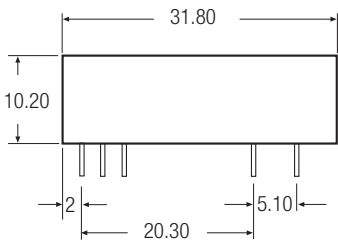


Efficiency VS Output load



Package Style and Pinning (mm)

DIP24 Package Style



Pin Connections

Pin #	Single	Dual
1	ON/OFF	ON/OFF
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Com
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Features

- Ultraminiature Open Frame SMD
- 15 Watts Output Power
- 2:1 Input Voltage Range
- Single Outputs
- 2.25kVDC Isolation
- Fixed Operating Frequency
- Optional Remote On/Off and Trim pins
- Efficiency to 88%

Description

The RP15-SOF series are SMD open frame ultraminiature power DC/DC converters in a case half the size of industry standard 15W converters. The converters use solder ball pins to enable SMD mounting and can be reflow soldered. Despite their small size, these converters are fully specified devices with output currents up to 3.5 Amps, no minimum load, 2250VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The RP15-SOF series will find many uses in telecommunications and other demanding applications where cost, board space or board height is at a premium.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP15-243.3SOF**	18-36	3.3	3500	20/587	86	1000µF
RP15-2405SOF**	18-36	5	3000	20/753	87	1000µF
RP15-2412SOF**	18-36	12	1250	15/753	87	330µF
RP15-2415SOF**	18-36	15	1000	15/744	88	220µF
RP15-483.3SOF**	36-75	3.3	3500	15/297	85	1000µF
RP15-4805SOF**	36-75	5	3000	15/377	87	1000µF
RP15-4812SOF**	36-75	12	1250	10/377	87	330µF
RP15-4815SOF**	36-75	15	1000	10/372	88	220µF

** Standard part is without suffixes and trim and CTRL pins are not fitted.

* add suffix /**P** for CTRL function with positive logic (1=ON, 0=OFF) including trim pin for single output

* add suffix /**N** for CTRL function with negative logic (0=ON, 1=OFF) including trim pin for single output

* add suffix -**R** for Tape and Reel Packaging

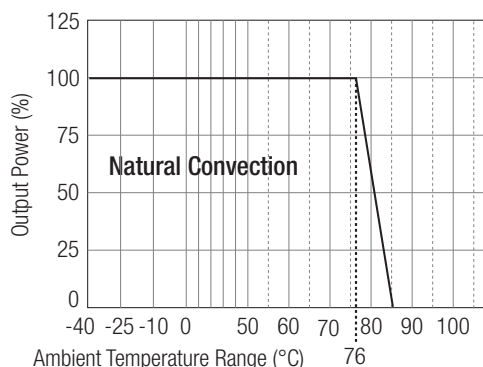
Ordering Examples

- RP15-2405SOF = 24 Input, 5V Output, No CTRL or trim connections
- RP15-2412SOF/P = 24V Input, 12V Output, Positive logic. CTRL and trim SMD pins fitted
- RP15-4803.3SOF-R = 48V Input, 3.3V Output, Tape and Reel Packaging

Derating Graphs (ambient Temperature)

RP15-4805SOF

Derating graphs are valid only for the shown part number. If you need detailed derating information about a part number not shown here please contact our technical support service at info@recom-development.at



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DC/DC-Converter

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RECOM

15 Watt Single Output Open Frame SMD



**UL-60950-1 Certified
E196683**

RP15-SOF

Please Read Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mA _{p-p} typ.
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5)	DC-DC ON	Short or 0V < Vr < 1.2V
Negative logic (/N)	DC-DC OFF	Open or 3.0V < Vr < 15V
	DC-DC ON	Open or 3.0V < Vr < 15V
Positive logic (/P)	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote Pin drive current	Nominal Vin	-0.5mA~1.0mA
Remote OFF input current	Nominal Vin	20mA max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single	±0.2%
Load Regulation (0% to full load)	Single	±0.2%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V Outputs	75mV _{p-p}
	Others	100mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response	25% load step change	250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V	5.4-7.0V
	12V	13.5-19.6V
	15V	16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Basic Isolation	2225VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF typ.
Operating Frequency	3.3V , 5V	270kHz typ.
	All others	400kHz typ.
Operating Temperature Range		-40°C to +85°C (with derating)
Storage Temperature Range		-55°C to +125°C
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 2G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Base Material		FR4 PCB
Weight		10.5g
Packing Quantity	Refer to App Notes for tube dimensions	20 pcs per Tube
		120 pcs per Reel
Dimensions		27.9 x 23.9 x 8.5mm

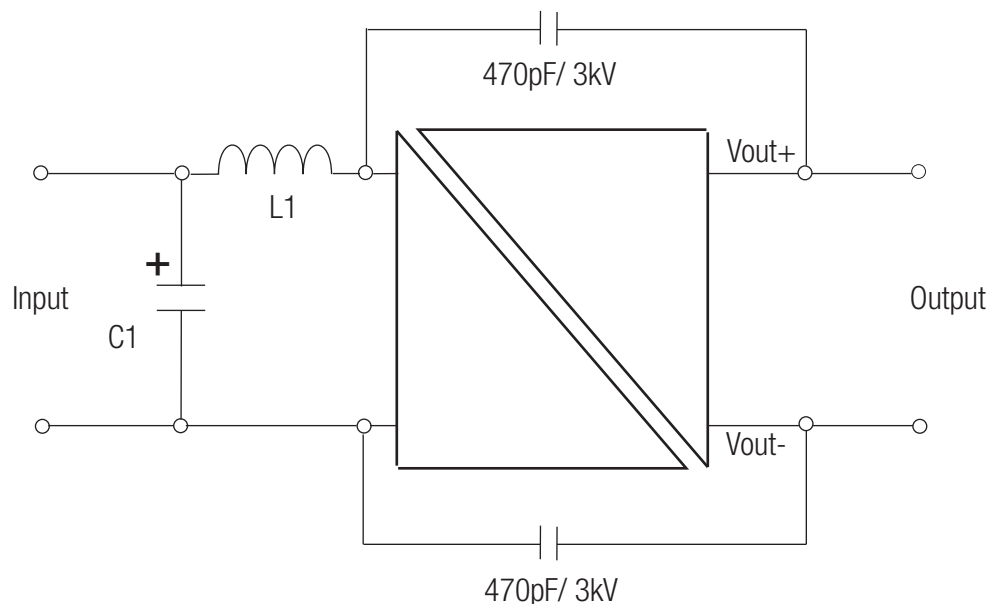
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Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 6)	EN55022	Class A/B
Radiated Emissions	EN55022	Class A/B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (see note 7)	EN61000-4-4	Perf. Criteria A
Surge (see note 7)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF (see Note 8)	Belcore TR-NWT-000332	2200 x 10 ³ hours
	MIL-HDBK 217F	1314 x 10 ³ hours

EMC Filtering - For Class B filter suggestion, see Application Notes

Class A Filter



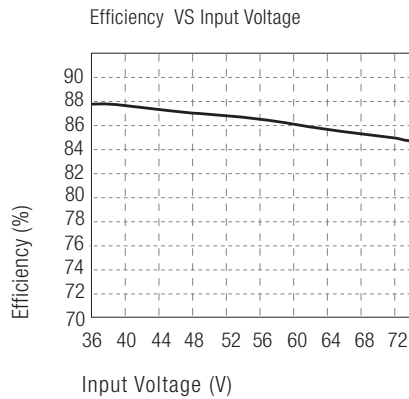
Vin=24V: C1=6.8μF/50V 1812 MLCC, L1 = 10μH, 1.4A, 100mOhm, 0504 SMD
 Vin=48V: C1= 2.2μF/100V 1812 MLCC, L1 = 10μH, 1.4A, 100mOhm, 0504 SMD

Notes :

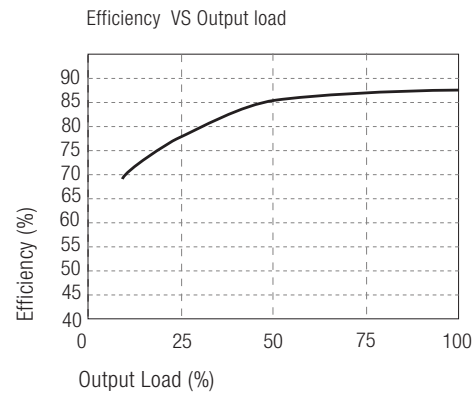
1. Values at nominal input voltage and no load/full load.
2. Typical Value at nominal input voltage and full load.
3. Test by minimum Vin and constant resistor load.
4. Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
5. If no suffix is specified, the control pin will be omitted. If fitted, the ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
 Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SOF/P).
 Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SOF/N).
6. Meets Class A with external components shown above. Will meet Class B with external common mode filter (see Application Notes)
7. Requires external capacitor to meet EN61000-4-5: 220μF/100V, low ESR (48mOhm)
8. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
 MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground, Benign, controlled environment).

Typical Characteristics

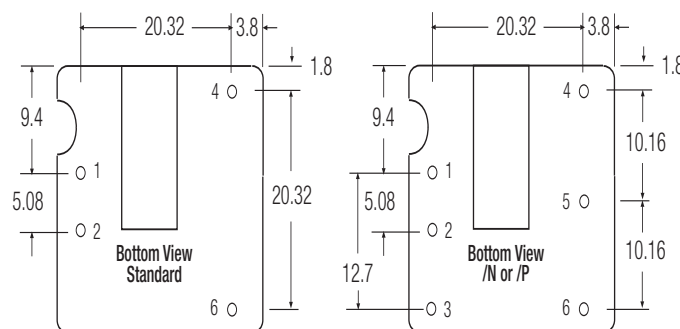
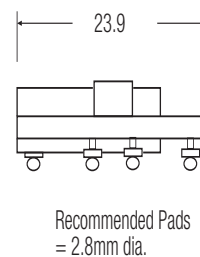
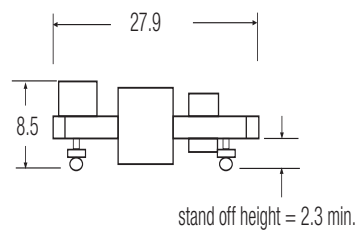
RP15-4805SOF



RP15-4805SOF



Package Style and Pinning (mm)



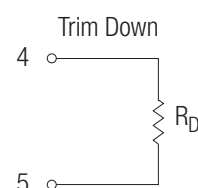
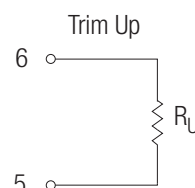
Pin Connections

Pin #	Standard	/P or /N
1	+Vin	+Vin
2	-Vin	-Vin
3	no pin	CTRL
4	+Vout	+Vout
5	no pin	Trim
6	-Vout	-Vout

PCB Tolerance ± 0.5 mm
SMD Pin Pitch Tolerance ± 0.25 mm

External Output Trimming (optional)

With suffix /P or /N, the output can be externally trimmed by using the method shown here.
See Application Notes for details



Features

- Ultraminiature Open Frame SMD
- 15 Watts Output Power
- 4:1 Input Voltage Range
- Single Output
- 2.25kVDC Isolation
- Fixed Operating Frequency
- Optional Remote On/Off and Trim pins
- Efficiency to 87%

Description

The RP15-SOFW series are SMD open frame ultraminiature power DC/DC converters in a case half the size of industry standard 15W converters. The converters use solder ball pins to enable SMD mounting and can be reflow soldered. Despite their small size, the RP15-SOFW converters are fully specified devices with output currents up to 4 Amps, no minimum load, 2250VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage.

The RP15-SOFW series will find many uses in telecommunications and other demanding applications where price, board space or board height is at a premium.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP15-243.3SOFW**	9-36	3.3	4000	60/680	85	1000µF
RP15-2405SOFW**	9-36	5	3000	70/754	87	1000µF
RP15-2412SOFW**	9-36	12	1300	10/793	86	330µF
RP15-2415SOFW**	9-36	15	1000	10/763	86	220µF
RP15-483.3SOFW**	18-75	3.3	4000	40/340	85	1000µF
RP15-4805SOFW**	18-75	5	3000	40/377	87	1000µF
RP15-4812SOFW**	18-75	12	1300	10/397	86	330µF
RP15-4815SOFW**	18-75	15	1000	10/382	86	220µF

** Standard part is without suffix and has no Trim or CTRL connections

* add suffix **/P** for CTRL function with positive logic (1=ON, 0=OFF) including trim pin

* add suffix **/N** for CTRL function with negative logic (0=ON, 1=OFF) including trim pin

. * add suffix **-R** for Tape and Reel Packaging

Ordering Examples

RP15-4805SOFW = 48V 4:1 Input, 5V Output, No CTRL pin, No Trim Pin

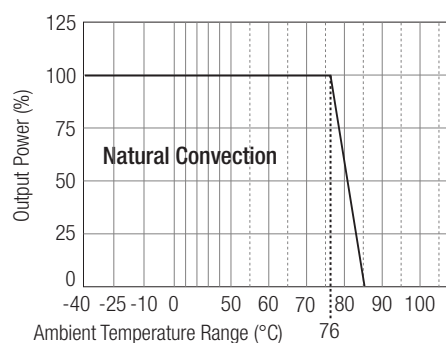
RP15-4805SOFW/P = 48V 4:1 Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted.

RP15-243.3SOFW/N = 24V 4:1 Input, 3.3V Output, Negative Logic CTRL pin and Trim pin fitted

Derating Graph (Ambient Temperature)

RP15-4805SOFW

Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at



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**15 Watt
Single
Output
Open Frame
SMD**



**UL-60950-1 Certified
E196683**

RP15-SOFW

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input 48V nominal input	9-36VDC 18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input 48V Input	50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5)	DC-DC ON	Short or 0V < Vr < 1.2V
Negative logic (/N)	DC-DC OFF	Open or 3.0V < Vr < 15V
	DC-DC ON	Open or 3.0V < Vr < 15V
Positive logic (/P)	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote Pin drive current	Nominal Vin	-0.5mA~1.0mA
Remote OFF input current	Nominal Vin	2.5mA
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	All Output voltages	±0.2%
Load Regulation (0% to full load)	All Output voltages	±0.2%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	All Output voltages	100mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V	5.4-7.0V
	12V	13.5-19.6V
	15V	16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Basic Isolation	2250VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency	3.3V, 5V All others	350kHz typ 400kHz typ
Operating Temperature Range		-40°C to +85°C (with derating)
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	18.2°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 2G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Base Material		FR4 PCB
Weight		10.5g
Packing Quantity	Refer to App Notes for tube dimensions	20 pcs per Tube 120 pcs per Reel
Dimensions		27.9 x 23.9 x 8.5mm

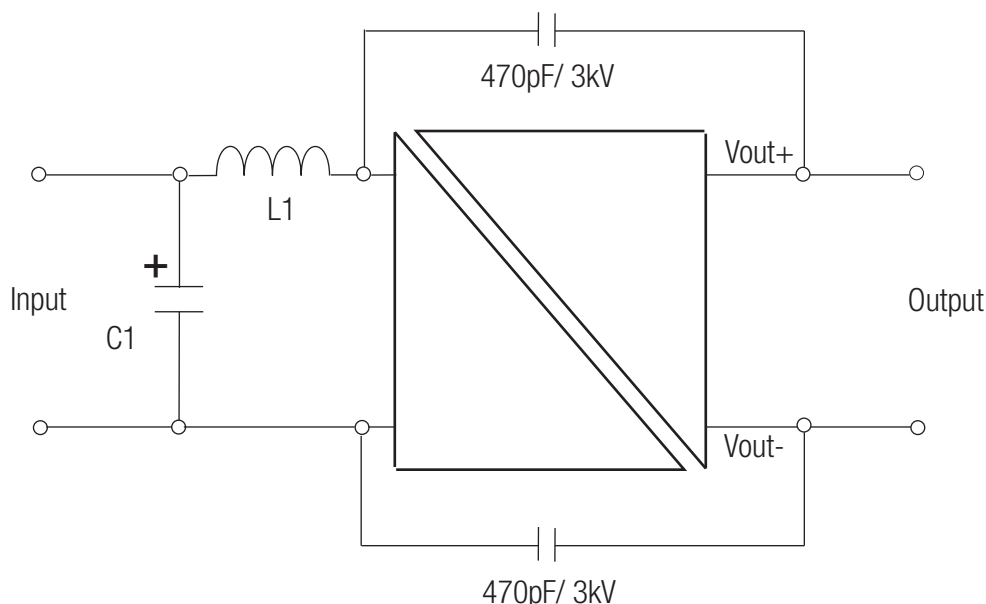
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Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 6)	EN55022	Class A/B
Radiated Emissions	EN55022	ClassB
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (see note 7)	EN61000-4-4	Perf. Criteria A
Surge (see note 7)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF (see Note 8)	Bellcore TR-NWT-000332	1322 x 10 ³ hours
	MIL-HDBK 217F	515 x 10 ³ hours

EMC Filtering - For Class B filter suggestion, see Application Notes

Class A Filter



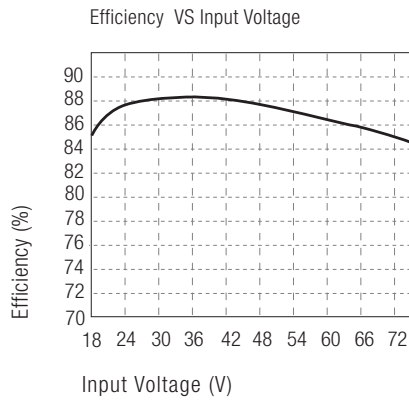
Vin=24V: C1=6.8μF/50V 1812 MLCC, L1 = 10μH, 2.6A, 40mOhm, 0705 SMD
 Vin=48V: C1= 2.2μF/100V 1812 MLCC, L1 = 18μH, 1.6A, 10hm, 0705 SMD

Notes :

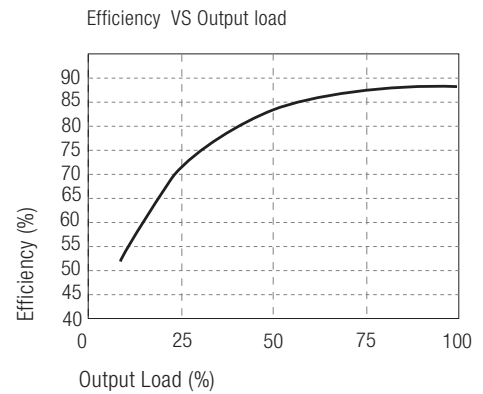
1. Values at nominal input voltage and no load/full load.
2. Typical Value at nominal input voltage and full load.
3. Test by minimum Vin and constant resistor load.
4. Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
5. If no suffix is specified, the control and trim pins will be omitted. If fitted, the ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
 Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SOFW/P)
 Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SOFW/N).
6. Meets Class A with external components shown above. Will meet Class B with external common mode filter (see Application Notes)
7. Requires external capacitor to meet EN61000-4-4_5: 220μF/100V, low ESR (48mOhm)
8. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
 MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground Benign, controlled environment).

Typical Characteristics

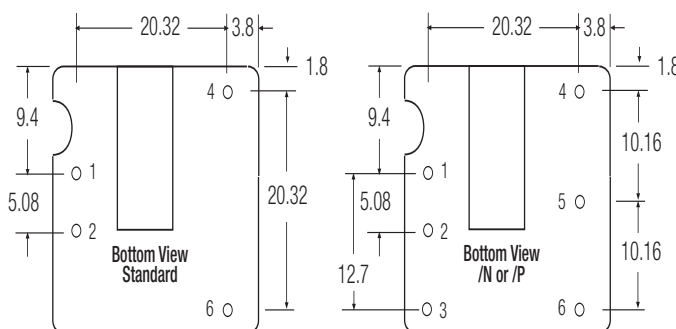
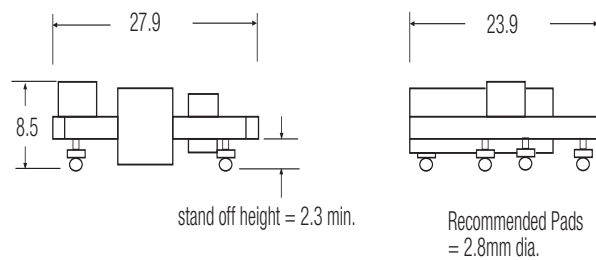
RP15-4805SOFW



RP15-4805SOFW



Package Style and Pinning (mm)



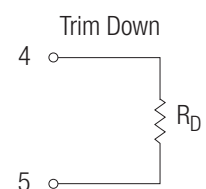
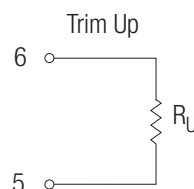
Pin Connections

Pin #	Standard	/P or /N
1	+Vin	+Vin
2	-Vin	-Vin
3	no pin	CTRL
4	+Vout	+Vout
5	no pin	Trim
6	-Vout	-Vout

PCB Tolerance ± 0.5 mm
SMD Pin Pitch Tolerance ± 0.25 mm

External Output Trimming (optional)

With /P or /N suffix, output can be externally trimmed by using the method shown here.
See Application Notes for details.



Features

- Ultraminiature 25.4 x25.4x9.9mm Package
- 15 Watts Output Power
- Single and Dual Outputs
- 1.6kVDC Isolation
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Industry Standard Pinout
- Remote On/Off and Trim pins
- Efficiency to 89%

Description

The RP15-SA series are ultraminiature power DC/DC converters in a case half the size of industry standard 15W converters. Despite their small size, the RP15-SA converters are fully specified devices with output currents up to 4 Amps, no minimum load, 1600VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage.

The RP15-SA series will find many uses in applications where board space and/or board height is at a premium.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP15-123.3SA**	9-18	3.3	4000	120/1375	84	1000µF
RP15-1205SA**	9-18	5	3000	90/1524	86	1000µF
RP15-1212SA**	9-18	12	1300	40/1605	85	330µF
RP15-1215SA**	9-18	15	1000	40/1506	87	220µF
RP15-243.3SA**	18-36	3.3	4000	50/671	86	1000µF
RP15-2405SA**	18-36	5	3000	65/763	86	1000µF
RP15-2412SA**	18-36	12	1300	20/783	87	330µF
RP15-2415SA**	18-36	15	1000	20/744	88	220µF
RP15-483.3SA**	36-75	3.3	4000	40/336	86	1000µF
RP15-4805SA**	36-75	5	3000	40/372	88	1000µF
RP15-4812SA**	36-75	12	1300	15/387	88	330µF
RP15-4815SA**	36-75	15	1000	15/372	88	220µF
RP15-1205DA**	9-18	±5	±1500	30/1543	85	±500µF
RP15-1212DA**	9-18	±12	±625	30/1506	87	±150µF
RP15-1215DA**	9-18	±15	±500	30/1488	87	±100µF
RP15-2405DA**	18-36	±5	±1500	20/772	85	±500µF
RP15-2412DA**	18-36	±12	±625	15/744	88	±150µF
RP15-2415DA**	18-36	±15	±500	25/744	88	±100µF
RP15-4805DA**	36-75	±5	±1500	15/386	85	±500µF
RP15-4812DA**	36-75	±12	±625	15/368	89	±150µF
RP15-4815DA**	36-75	±15	±500	20/372	88	±100µF

** Standard part is without suffixes and Trim and CTRL pins are not fitted.

* add suffix /P for CTRL function with positive logic (1=ON, 0=OFF) including trim pin for single output

* add suffix /N for CTRL function with negative logic (0=ON, 1=OFF) including trim pin for single output

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP15-2405SA/P = 24V Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted

RP15-4805DA-HC = 48V Input, ±5V Output, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

15 Watt

Single &

Dual Output

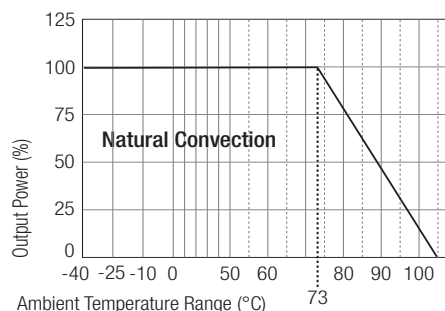
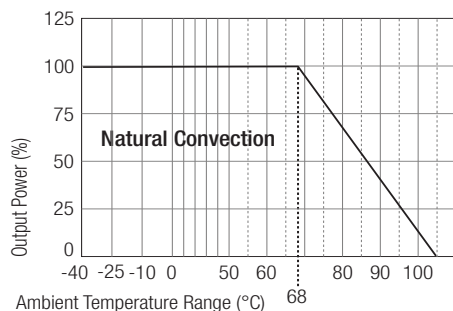


UL-60950-1 Certified
E196683

RP15-A

Please Read Application Notes

Derating Graphs (ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input 24V nominal input 48V nominal input	9-18VDC 18-36VDC 36-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	12V Input 24V Input 48V Input	36VDC 50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mAp-p
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5) (Negative logic)	DC-DC ON DC-DC OFF	Short or $0V < V_r < 1.2V$ Open or $3.0V < V_r < 12V$
Remote Pin drive current	Nominal Vin	-0.5mA~1.0mA
Remote OFF input current	Nominal Vin	2.5mA
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single Dual	±0.2% ±0.5%
Load Regulation (0% to full load)	Single Dual	±0.2% ±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual Output	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V Outputs Others	75mVp-p 100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response	25% load step change	250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V 12V 15V	5.4-7.0V 13.5-19.6V 16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

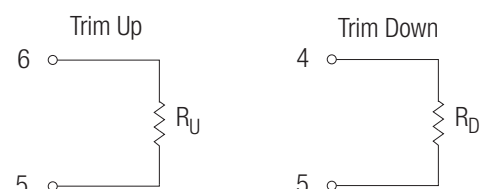
Operating Frequency		400kHz typ.
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 6)	Natural convection	18.2°C/Watt
	Natural convection with Heat Sink	15.8°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		FR4 PCB
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 7)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria A
Surge (see note 8)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight		15g
Packing Quantity	Refer to App Notes for tube dimensions	8 pcs per Tube
Dimensions		25.4 x 25.4 x 9.9mm
MTBF (see Note 9)	Belcore TR-NWT-000332	1330 x 10 ³ hours
	MIL-HDBK 217F	563 x 10 ³ hours

Notes :

- Values at nominal input voltage and no load/full load.
- Typical Value at nominal input voltage and full load.
- Test by minimum V_{in} and constant resistor load.
- Simulated source impedance of 12 μ H. 12 μ H inductor in series with + V_{in} .
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SA/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SA/N).
If no suffix is specified, the control pin will be omitted.
- Optional Heat-sink P/N is 7G-0047-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- Meets Class A with external input capacitors shown below. Will meet Class B with external common mode filter (see Application Notes)
- Requires external capacitor to meet EN61000-4-5: 220 μ F/100V, low ESR (48mOhm)
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
MIL-HDBK 217F Notice 2. $T_a = 25^\circ\text{C}$, full load, (Ground, Benign, controlled environment).

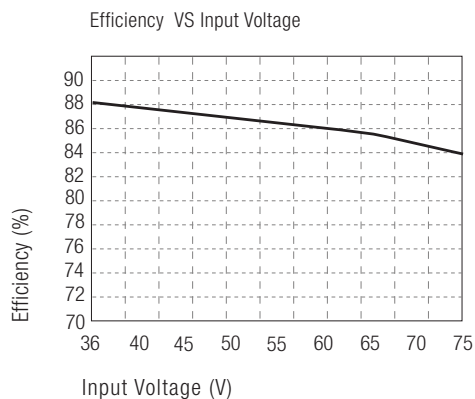
External Output Trimming (optional)

With suffix /CTRL, the output can be externally trimmed by using the method shown here.
See Application Notes for details

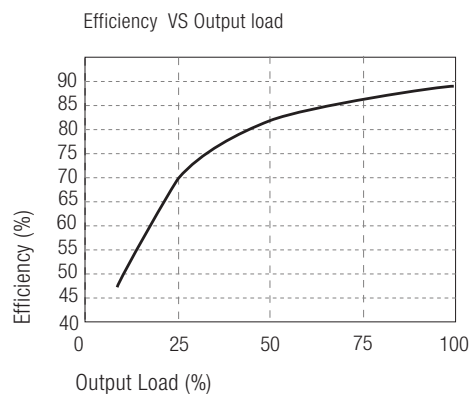


Typical Characteristics

RP15-4805SA

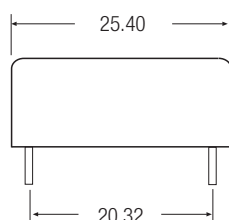
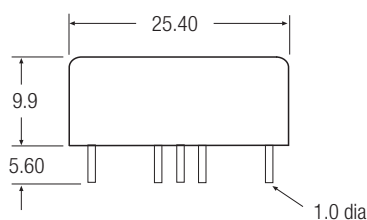


RP15-4805SA



Package Style and Pinning (mm)

3rd angle projection

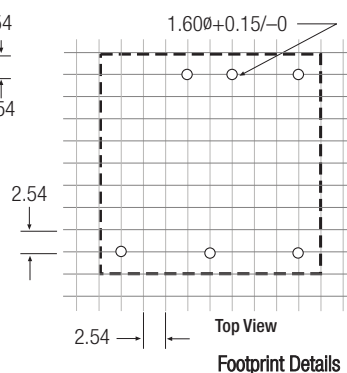
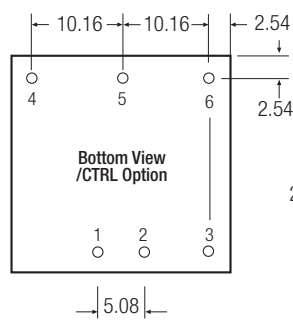
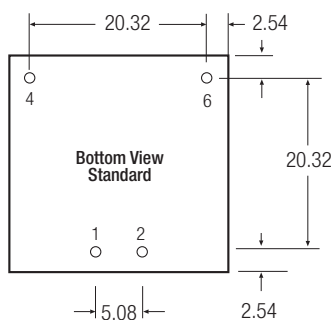


Pin Connections

Pin #	Single	Single/ P or /N	Dual	Dual/ P or /N
1	+Vin	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin	-Vin
3	no pin	CTRL	no pin	CTRL
4	+Vout	+Vout	+Vout	+Vout
5	no pin	Trim	Com	Com
6	-Vout	-Vout	-Vout	-Vout

Case Tolerance ± 0.5 mm

Pin Pitch Tolerance ± 0.25 mm

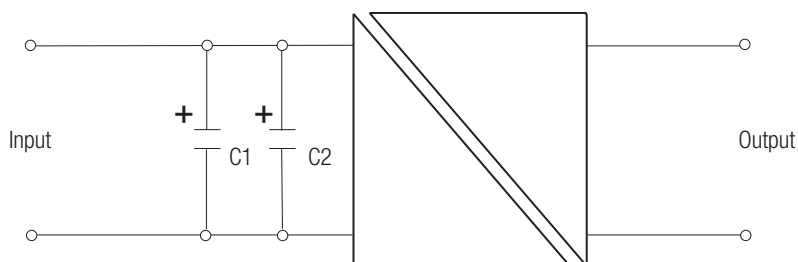


RP15-A

EMC Filtering - For Class B filter suggestion, see Application Notes

Class A Filter

Vin=12V: C1=10 μ F/25V 1812 MLCC, C2 omitted.
 Vin=24V: C1=6.8 μ F/50V 1812 MLCC, C2 omitted.
 Vin=48V: C1, C2 = 2.2 μ F/100V 1812 MLCC



Features

- Ultraminiature 25.4 x25.4x9.9mm Package
- 15 Watts Output Power
- Single or Dual Outputs
- Wide 4:1 Input Voltage Range
- 1.6kVDC Isolation
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Industry Standard Pinout
- Remote On/Off and Trim pins
- Efficiency to 87 %

Description

The RP15-SAW series are ultraminiature wide input voltage range power DC/DC converters in a case half the size of industry standard 15W converters. Despite their small size, the RP15-SAW converters are fully specified devices with output currents up to 4 Amps, no minimum load, 1600VDC isolation and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The RP15-SAW series will find many uses in applications where board space and/or board height is at a premium.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP15-243.3SAW**	9-36	3.3	4000	50/688	86	1000µF
RP15-2405SAW**	9-36	5	3000	70/762	86	1000µF
RP15-2412SAW**	9-36	12	1300	20/783	87	330µF
RP15-2415SAW**	9-36	15	1000	20/753	87	220µF
RP15-483.3SAW**	18-75	3.3	4000	40/336	86	1000µF
RP15-4805SAW**	18-75	5	3000	40/382	86	1000µF
RP15-4812SAW**	18-75	12	1300	15/392	87	330µF
RP15-4815SAW**	18-75	15	1000	15/377	87	220µF
RP15-2405DAW**	9-36	±5	±1500	20/772	85	±500µF
RP15-2412DAW**	9-36	±12	±625	25/753	87	±150µF
RP15-2415DAW**	9-36	±15	±500	25/744	88	±100µF
RP15-4805DAW**	18-75	±5	±1500	15/386	85	±500µF
RP15-4812DAW**	18-75	±12	±625	15/382	86	±150µF
RP15-4815DAW**	18-75	±15	±500	15/377	87	±100µF

** Standard part is without suffixes and Trim and CTRL pins are not fitted.

* add suffix **/P** for CTRL function with positive logic (1=ON, 0=OFF) including trim pin for single output

* add suffix **/N** for CTRL function with negative logic (0=ON, 1=OFF) including trim pin for single output

* add suffix **-HC** for premounted heatsink and clips

Ordering Examples

RP15-2405SAW/P = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted.

RP15-4805DAW-HC = 48V 4:1 Input, ±5V Output, Premounted Heatsink

RP15-483.3DAW/N = 48V 4:1 Input, ±5V Output, Negative Logic CTRL pin
(no trim pin with dual output)

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

15 Watt Single & Dual Output

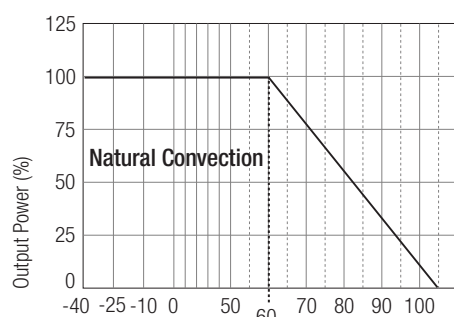


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E196683

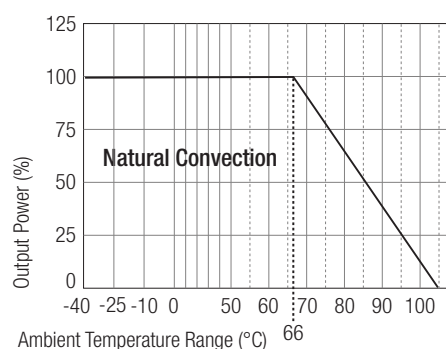
RP15-AW

Please Read Application Notes

Typical Characteristics



RP15-4805SAW



**RP15-4805SAW
With Heat Sink**

Ambient Temperature Range (°C)

Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input 48V nominal input	9-36VDC 18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input 48V Input	50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5)	DC-DC ON	Short or 0V < Vr < 1.2V
(Negative logic)	DC-DC OFF	Open or 3.0V < Vr < 12V
Remote Pin drive current	Nominal Vin	-0.5mA~1.0mA
Remote OFF input current	Nominal Vin	2.5mA
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single Dual	±0.2% ±0.5%
Load Regulation (0% to full load)	Single Dual	±0.2% ±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual Output	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V Outputs Others	75mV _{p-p} 100mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V	5.4-7.0V
	12V	13.5-19.6V
	15V	16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.

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Specifications (typical at nominal input and 25°C unless otherwise noted)

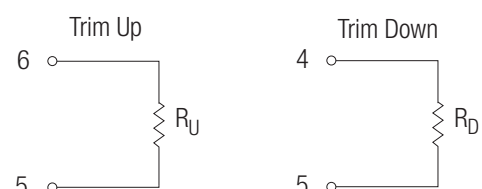
Operating Frequency	400kHz typ	
Operating Temperature Range	-40°C to +85°C(with derating)	
Maximum Case Temperature	+105°C	
Storage Temperature Range	-55°C to +125°C	
Thermal Impedance (see Note 6)	Natural convection	18.2°C/Watt
	Natural convection with Heat Sink	15.8°C/Watt
Thermal Shock	MIL-STD-810F	
Vibration	10-55Hz, 10G, 30 Min. along X, Y and Z	
Relative Humidity	5% to 95% RH	
Case Material	Nickel plated copper	
Base Material	FR4 PCB	
Potting Material	Epoxy (UL94-V0)	
Conducted Emissions (see Note 7)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria A
Surge (see note 8)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight	15g	
Packing Quantity	Refer to App Notes for tube dimensions	8 pcs per Tube
Dimensions	25.4 x 25.4 x 9.9mm	
MTBF (see Note 9)	Belcore TR-NWT-000332	1330 x 10 ³ hours
	MIL-HDBK 217F	563 x 10 ³ hours

Notes :

- Values at nominal input voltage and no load/full load.
- Typical Value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SAW/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SAW/N).
If no suffix is specified, the control pin will be omitted.
- Optional Heat-sink P/N is 7G-0047-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- Meets Class A with external input capacitors shown below. Will meet Class B with external common mode filter (see Application Notes)
- Requires external capacitor to meet EN61000-4-5: 220μF/100V, low ESR (48mOhm)
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground Benign, controlled environment).

External Output Trimming (optional)

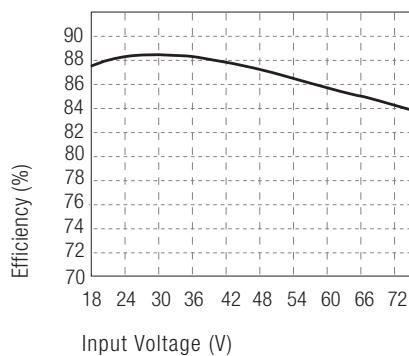
With /CTRL suffix, output can be externally trimmed by using the method shown here.
See Application Notes for details.



Typical Characteristics

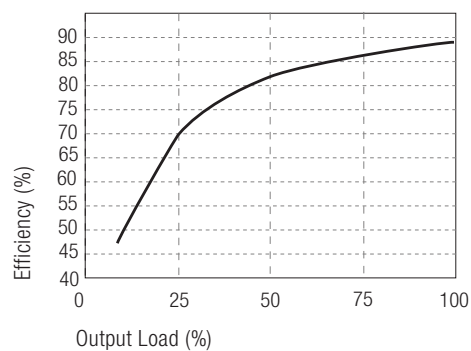
RP15-4805SAW

Efficiency VS Input Voltage



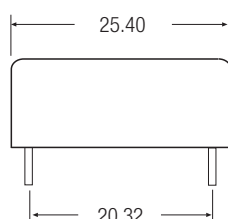
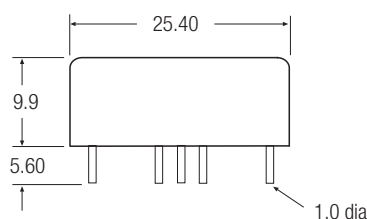
RP15-4805SAW

Efficiency VS Output load



Package Style and Pinning (mm)

3rd angle projection

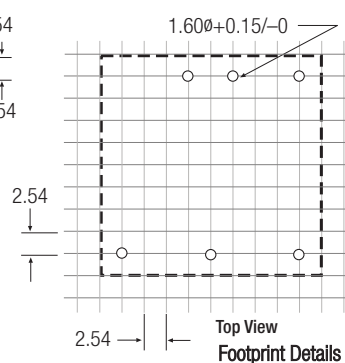
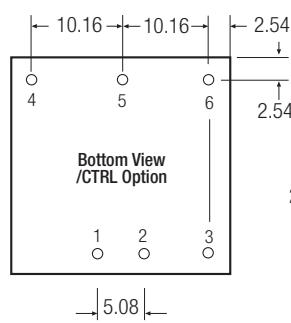
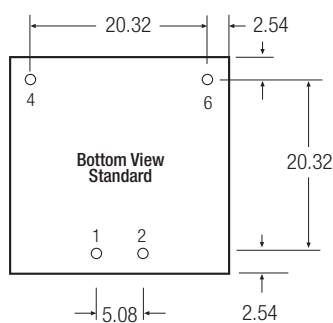


Pin Connections

Pin #	Single	Single/ P or /N	Dual	Dual/ P or /N
1	+Vin	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin	-Vin
3	no pin	CTRL	no pin	CTRL
4	+Vout	+Vout	+Vout	+Vout
5	no pin	Trim	Com	Com
6	-Vout	-Vout	-Vout	-Vout

Case Tolerance ± 0.5 mm

Pin Pitch Tolerance ± 0.25 mm



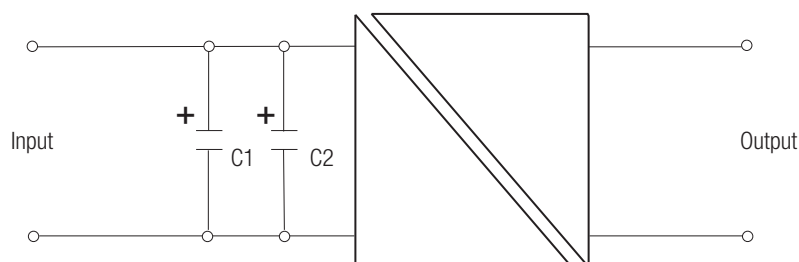
RP15-AW

EMC Filtering - For Class B filter suggestion, see Application Notes

Class A Filter

Vin=24V: C1=6.8 μ F/50V 1812 MLCC, C2 omitted.

Vin=48V: C1, C2 = 2.2 μ F/100V 1812 MLCC



Features

- 2:1 Wide Input Voltage Range
- 15 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x 25.4 x 10.2mm Package
- Efficiency to 88 %

Description

The RP15-F series DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP15-123.3SF	9-18	3.3	4000	1467	79	10200µF
RP15-1205SF	9-18	5	3000	1603	82	7050µF
RP15-1212SF	9-18	12	1250	1524	86	1035µF
RP15-1215SF	9-18	15	1000	1524	86	705µF
RP15-243.3SF	18-36	3.3	4000	724	80	10200µF
RP15-2405SF	18-36	5	3000	781	84	7050µF
RP15-2412SF	18-36	12	1250	772	85	1035µF
RP15-2415SF	18-36	15	1000	772	85	705µF
RP15-483.3SF	36-75	3.3	4000	357	81	10200µF
RP15-4805SF	36-75	5	3000	396	83	7050µF
RP15-4812SF	36-75	12	1250	377	87	1035µF
RP15-4815SF	36-75	15	1000	381	86	705µF
RP15-1205DF	9-18	±5	±1500	1582	83	±1020µF
RP15-1212DF	9-18	±12	±625	1524	86	±495µF
RP15-1215DF	9-18	±15	±500	1563	84	±165µF
RP15-2405DF	18-36	±5	±1500	781	84	±1020µF
RP15-2412DF	18-36	±12	±625	762	86	±495µF
RP15-2415DF	18-36	±15	±500	762	86	±165µF
RP15-4805DF	36-75	±5	±1500	386	85	±1020µF
RP15-4812DF	36-75	±12	±625	372	88	±495µF
RP15-4815DF	36-75	±15	±500	377	87	±165µF

* add /P for CTRL function with Positive Logic (1=ON, 0=OFF)

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP15-2405SF/P = 24V Input, 5V Output, Positive Logic CTRL pin fitted

RP15-4805DF-HC = 48V Input, ±5V Output, No CTRL pin, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

15 Watt

2" x 1"

Single &

Dual Output



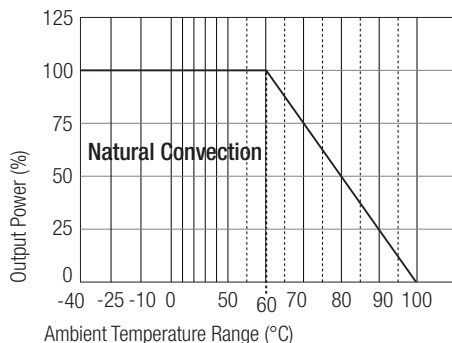
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E196683

RP15-F

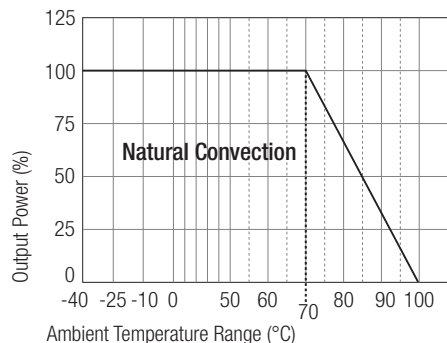
Please Read Application Notes

Derating Graph (Ambient Temperature)

RP15-4805SF



RP15-4805SF With Heat Sink

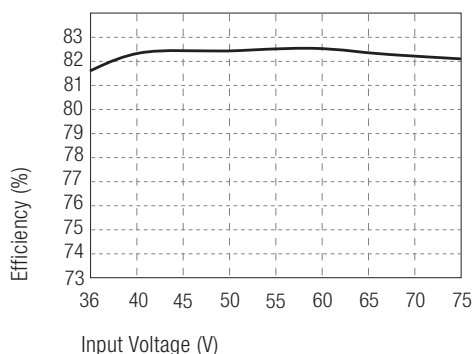


Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical customer service at info@recom-development.at

Typical Characteristics

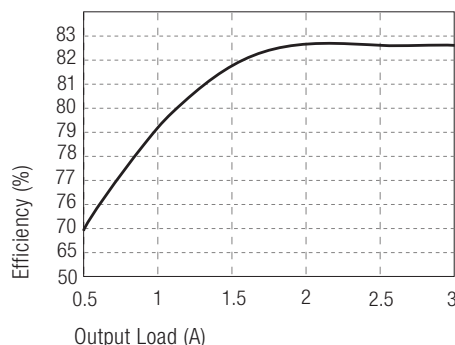
RP15-4805SF

Efficiency VS Input Voltage



RP15-4805SF

Efficiency VS Output load



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter	Pi Type	
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)	20mA _{p-p}	
Start Up Time (nominal Vin and constant resistor load)	20ms typ.	
Remote ON/OFF (Optional. See Note 7)		
(Positive logic)	DC-DC ON	Open or 3.5V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
(Negative logic)	DC-DC ON	Short or 0V < Vr < 1.2V
	DC-DC OFF	Open or 3.5V < Vr < 12V
Remote OFF input current	Nominal input	20mA
Output Power	15W max.	
Output Voltage Accuracy (full Load and nominal Vin)	±1%	
Minimum Load (see Note 1)	10% of full load	

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

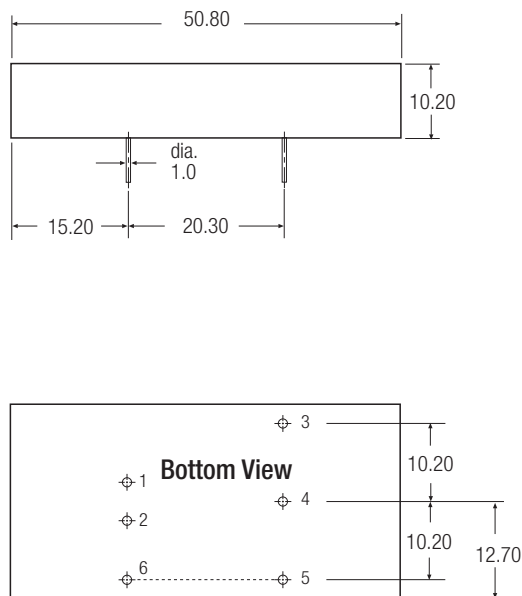
Line Regulation (low line, high line at full load)		±1%
Load Regulation (25% to 100% full load)	Single	±1%
	Dual	±2%
Cross Regulation (asymmetrical 25% y<>100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	Single	50mVp-p
	Dual	75mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		500µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V	6.2V
	12V	15V
	15V	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		none
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		300pF max.
Operating Frequency	Single	500kHz typ.
	Dual	300kHz typ.
Approved to Safety Standards		UL 1950, EN60950
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance	Natural convection	12°C/Watt
(see Note 8)	Natural convection with Heat Sink	10°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 9)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient (see Note 9)	EN61000-4-4	Perf. Criteria B
Surge (see Note 9)	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9 pcs per Tube
Dimensions		50.8 x 25.4 x 10.2mm
MTBF (see Note 2)		2041 x 10 ³ hours

Notes :

1. The RP15 series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Simulated source impedance of 12 μ H. 12 μ H inductor in series with +Vin.
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SF/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SF/N).
If no suffix is specified, the control pin will be omitted.
8. Heat sink is optional and P/N: 7G-0020-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. RP15-24xx meets Class A. RP15-48xx requires 1 μ F MLCC across input to meet Class A.
An external capacitor (220 μ F/Low ESR) is required to meet EN61000-4-4 and -5
See application notes for Class B common mode filter suggestion.

Package Style and Pinning (mm)

3rd angle projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6*	CTRL*	CTRL*

* Optional. See Note 7.

Pin Pitch Tolerance ± 0.35 mm

Features

Regulated Converters

- 4:1 Wide Input Voltage Range
- 15 Watts Regulated Output Power
- 1.6kVDC Isolation
- Over Current and Over Voltage Protection
- Six-Sided Shield
- No Derating to 65°C
- Standard 2" x 1" Package and Pinning
- Efficiency to 86 %

Description

The RP15-FW series wide range input DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 24V and 48V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(4,5) Current mA	Efficiency ⁽⁶⁾ %	Capacitive ⁽⁷⁾ Load max. μ F
RP15-243.3SFW	9-36	3.3	4500	60/773	84	14750 μ F
RP15-2405SFW	9-36	5	3000	60/777	86	7200 μ F
RP15-2412SFW	9-36	12	1250	75/771	85	1250 μ F
RP15-2415SFW	9-36	15	1000	75/762	86	800 μ F
RP15-483.3SFW	18-75	3.3	4500	30/422	84	14750 μ F
RP15-4805SFW	18-75	5	3000	30/381	86	7200 μ F
RP15-4812SFW	18-75	12	1250	40/385	85	1250 μ F
RP15-4815SFW	18-75	15	1000	40/381	86	800 μ F
RP15-2405DFW	9-36	$\pm$ 5	$\pm$ 1500	85/801	82	$\pm$ 3600 μ F
RP15-2412DFW	9-36	$\pm$ 12	$\pm$ 625	100/771	85	$\pm$ 625 μ F
RP15-2415DFW	9-36	$\pm$ 15	$\pm$ 500	100/762	86	$\pm$ 400 μ F
RP15-4805DFW	18-75	$\pm$ 5	$\pm$ 1500	45/400	82	$\pm$ 3600 μ F
RP15-4812DFW	18-75	$\pm$ 12	$\pm$ 625	50/385	85	$\pm$ 625 μ F
RP15-4815DFW	18-75	$\pm$ 15	$\pm$ 500	50/381	86	$\pm$ 400 μ F

* add /P for CTRL function with Positive Logic (1=ON, 0=OFF)

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

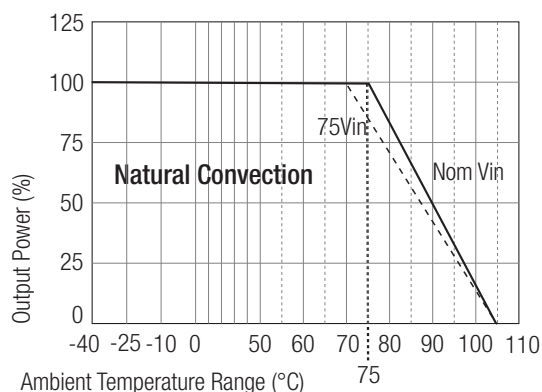
Ordering Examples

RP15-2405SFW/P = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin fitted

RP15-4805DFW-HC = 48V 4:1 Input, $\pm$ 5V Output, No CTRL pin, Heatsink fitted

Derating Graph (Ambient Temperature)

RP15-4805SFW



Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part number not shown here please contact our technical customer service at info@recom-development.at

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

15 Watt

2" x 1"

Single &

Dual Output



UL-60950-1 Certified
E196683

RP15-FW

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load)		20mAp-p
Start Up Time (nominal Vin and constant resistor load)		20ms typ.
Remote ON/OFF (Optional. See note 1)	DC-DC ON	Open or $3.0V < V_r < 12V$
	DC-DC OFF	Short or $0V < V_r < 1.2V$
Remote OFF input current	Nominal input	2.5mA
Output Power		15W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (0% to 100% full load)	Single	±0.5%
	Dual	±1%
Cross Regulation Dual Output (asymmetrical 25% <> 100%load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output) (measured with a 104pF ceramic across the output)	3.3, 5.0V	50mVp-p
	12, 15, ±5, ±12, ±15V	75mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Input Voltage Variation, dv/dt	complies with ETS300 132, part 4.4	5V/ms
Over Load Protection (% of full load at nominal Vin)		150% typ
Overvoltage Protection (Single)		Zener Diode Clamp
Undervoltage Protection		See Application Notes
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to Out and I/O to case	1600VDC min.
Isolation Resistance		10 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		400kHz typ.
Operating Temperature Range	5.1, 12, 15, ±12, ±15V	-40°C to +75°C
	3.3, ±5V	-40°C to +65°C
	with derating	-40°C to +105°C
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see note 8)	Natural convection	12°C/Watt
	with Heatsink	10°C/Watt
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9 pcs per Tube

continued on next page

Specifications, cont. (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see note 3)	EN55022	Class A
Radiated Emissions (see note 3)	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient (see note 3)	EN61000-4-4	Perf. Criteria B
Surge (see note 3)	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
MTBF (see note 2)	Belcore-TR-NWT-000332	2350 x 10 ³ hours

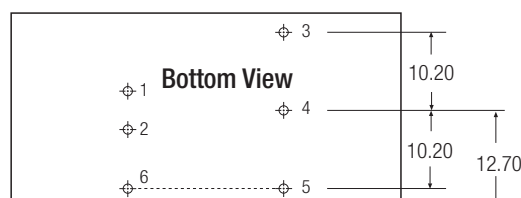
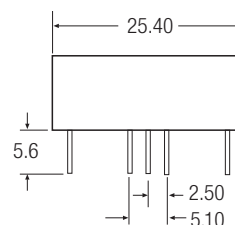
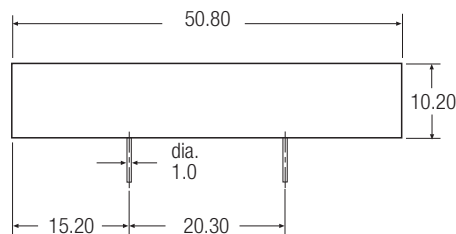
Notes :

- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP15-2405SFW/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP15-2405SFW/N).
If no suffix is specified, the control pin will be omitted.
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
- RP15-24xxW meets Class A. RP15-48xxW requires 1μF MLCC across input to meet Class A.
An external capacitor (220μF/Low ESR) is required to meet EN61000-4-4 and -5
See application notes for Class B common mode filter suggestion.
- Typical value at nominal input voltage and no load.
- Maximum value at nominal input voltage and full load
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- Optional Heatsink Part Number 7G-0020-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.

Package Style and Pinning (mm)

2" x 1" Package Style

3rd angle projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Com
5	-Vout	-Vout
6*	CTRL*	CTRL*

* Optional. See Note 1.

Pin Pitch Tolerance ±0.35 mm

Features

- Ultraminiature 25.4 x 25.4 x 9.9mm Package
- 20 Watts Output Power
- Single or Dual Outputs
- Wide 2:1 Input Voltage Range
- 1.6kVDC Isolation
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Industry Standard Pinout
- Remote On/Off and Trim pins
- Undervoltage Lockout
- Efficiency to 90%

Description

The RP20-SA series are ultraminiature 2:1 input voltage range power DC/DC converters in a case half the size of industry standard 20W converters. Despite their small size, the RP20-SA converters are fully specified devices with output currents up to 4.5 Amps, up to 91% efficiency, no minimum load, 1600VDC isolation, a built-in Class A EMC filter and low ripple/noise figures. The outputs are also fully protected against short circuits, over-current and overvoltage. The no load input current is particularly low (only 4mA/6mA).

The RP20-SA series will find many uses in applications where board space and/or board height is at a premium or in battery-powered systems where standby current is important.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP20-123.3SA**	9-18	3.3	4500	10/1510	86	7000µF
RP20-1205SA**	9-18	5	4000	10/1960	89	5000µF
RP20-1212SA**	9-18	12	1670	10/1960	89	850µF
RP20-1215SA**	9-18	15	1330	10/1960	89	700µF
RP20-243.3SA**	18-36	3.3	4500	6/749	87	7000µF
RP20-2405SA**	18-36	5	4000	6/969	90	5000µF
RP20-2412SA**	18-36	12	1670	6/969	90	850µF
RP20-2415SA**	18-36	15	1330	6/958	91	700µF
RP20-483.3SA**	36-75	3.3	4500	4/373	87	7000µF
RP20-4805SA**	36-75	5	4000	4/490	89	5000µF
RP20-4812SA**	36-75	12	1670	4/484	90	850µF
RP20-4815SA**	36-75	15	1330	4/484	90	700µF
RP20-1212DA**	9-18	±12	±833	10/1960	89	±500µF
RP20-1215DA**	9-18	±15	±677	10/1938	90	±350µF
RP20-2412DA**	18-36	±12	±833	6/969	90	±500µF
RP20-2415DA**	18-36	±15	±677	6/969	90	±350µF
RP20-4812DA**	36-75	±12	±833	4/490	89	±500µF
RP20-4815DA**	36-75	±15	±677	4/484	90	±350µF

** Standard part is without suffixes and Trim and CTRL pins are not fitted.

* add suffix /P for CTRL function with positive logic (1=ON, 0=OFF) including trim pin for single output

* add suffix /N for CTRL function with negative logic (0=ON, 1=OFF) including trim pin for single output

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP20-2405SA/P = 24V Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted

RP20-4812DA-HC = 48V Input, ±12V Output, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

1" x 1"

Single &

Dual Output



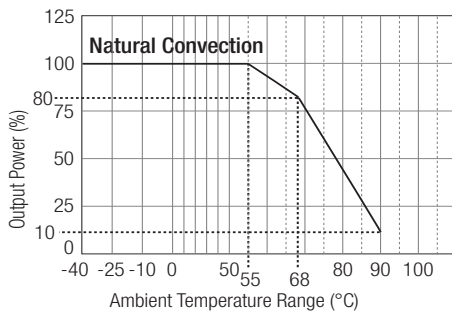
UL-60950-1 Certification
Pending

RP20-A

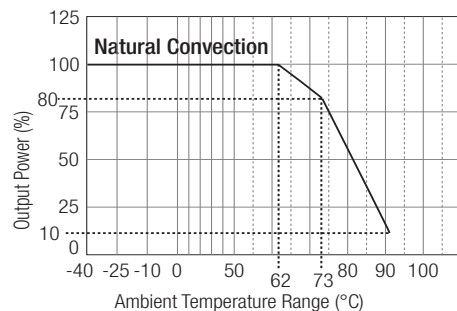
Please Read Application Notes

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Derating Graphs (ambient Temperature)



RP20-4805SA



**RP20-4805SA
With Heat Sink**

Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input 24V nominal input 48V nominal input	9-18VDC 18-36VDC 36-75VDC
Input Filter	Pi Type	Class A
Input Surge Voltage (1000 ms max.)	12V Input 24V Input 48V Input	25VDC 50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mAp-p
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5) (Negative logic)	DC-DC ON DC-DC OFF	Short or 0V < Vr < 1.2V Open or 3.0V < Vr < 15V
Remote Pin drive current	Nominal Vin	-0.5mA~1mA
Remote OFF input current	Nominal Vin	2mA
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single Dual	±0.2% ±0.5%
Load Regulation (0% to full load)	Single Dual	±0.2% ±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual Output	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V Outputs Others	75mVp-p 100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response	25% load step change	250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V 12V 15V	5.4-7.0V 13.5-19.6V 16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.

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Specifications (typical at nominal input and 25°C unless otherwise noted)

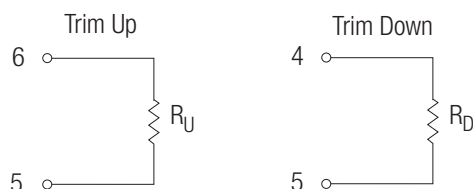
Operating Frequency		330kHz typ.
Operating Temperature Range		-40°C to +90°C(with derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 6)	Natural convection	18.2°C/Watt
	Natural convection with Heat Sink	15.8°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		FR4 PCB
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 7)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria A
Surge (see note 8)	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight		15g
Packing Quantity	Refer to App Notes for tube dimensions	8 pcs per Tube
Dimensions		25.4 x 25.4 x 9.9mm
MTBF (see Note 9)	Belcore TR-NWT-000332	1766 x 10 ³ hours
	MIL-HDBK 217F	553 x 10 ³ hours

Notes :

- Values at nominal input voltage and no load/full load.
- Typical Value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP20-2405SA/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP20-2405SA/N).
If no suffix is specified, the control pin will be omitted.
- Optional Heat-sink P/N is 7G-0047-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- Meets Class A with external input capacitors shown below. Will meet Class B with external common mode filter (see Application Notes)
- Requires external capacitor to meet EN61000-4-5: 220μF/100V, low ESR (48mOhm)
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground, Benign, controlled environment).

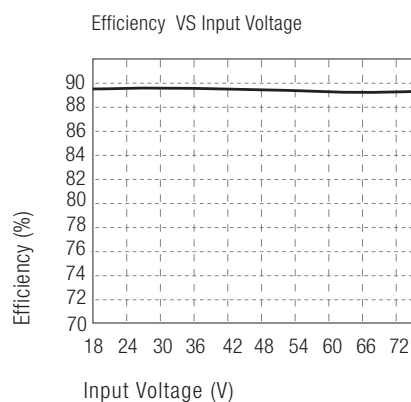
External Output Trimming (optional)

With suffix /CTRL, the output can be externally trimmed by using the method shown here.
See Application Notes for details

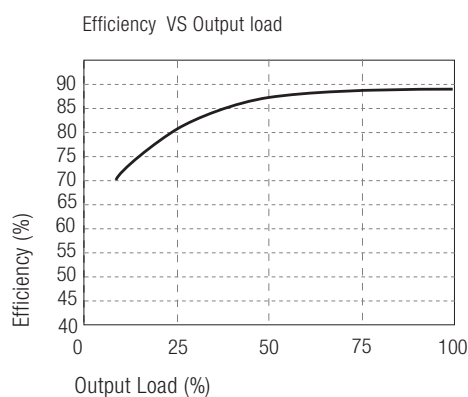


Typical Characteristics

RP20-4805SA (Full Load)

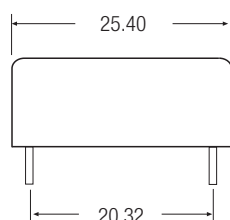
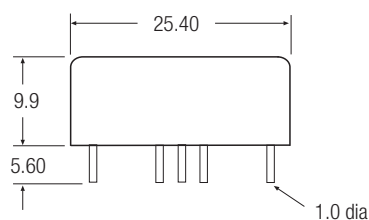


RP20-4805SA (Vin=48V)



Package Style and Pinning (mm)

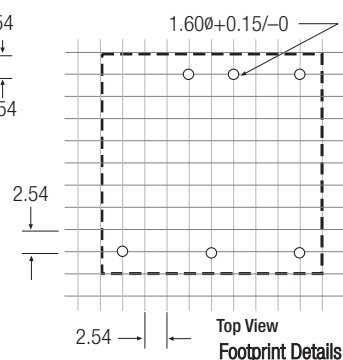
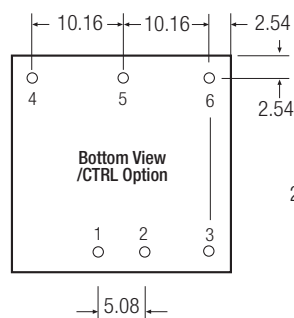
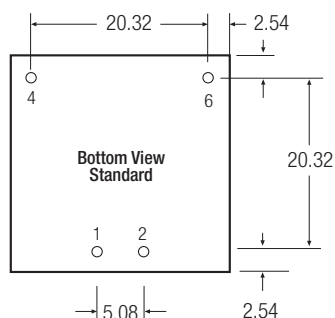
3rd angle projection



Pin Connections

Pin #	Single	Single/ P or /N	Dual	Dual/ P or /N
1	+Vin	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin	-Vin
3	no pin	CTRL	no pin	CTRL
4	+Vout	+Vout	+Vout	+Vout
5	no pin	Trim	Com	Com
6	-Vout	-Vout	-Vout	-Vout

Case Tolerance ± 0.5 mm
Pin Pitch Tolerance ± 0.25 mm



RP20-A

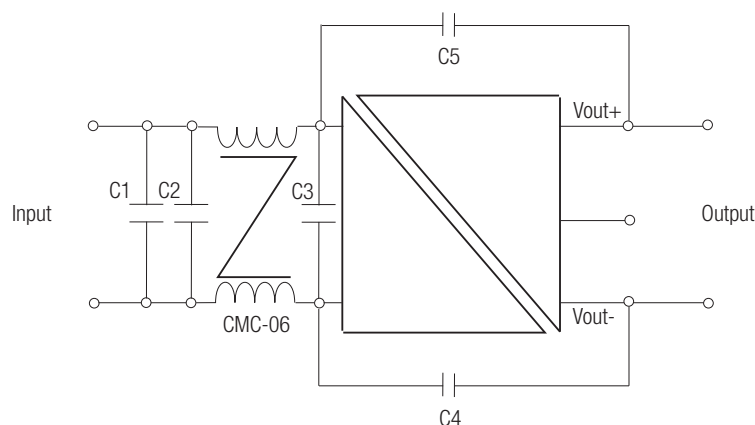
EMC Filtering

Class B Filter

Vin=24V: C1=4.7 μ F/25V 1812 MLCC, C2 & C3 omitted,
C4 & C5 =470pF/2kV

Vin=24V: C1=4.7 μ F/50V 1812 MLCC, C2 & C3 omitted,
C4 & C5 =470pF/2kV

Vin=48V: C1, C2 & C3 = 2.2 μ F/100V 1812 MLCC,
C4 & C5 =1nF/2kV



Features

- Ultraminiature 25.4 x 25.4 x 9.9mm Package
- 20 Watts Output Power
- Single or Dual Outputs
- Wide 4:1 Input Voltage Range
- 1.6kVDC Isolation
- Fixed Operating Frequency
- Built-in Class A EMC Filter
- Six-Sided Continuous Shield
- Industry Standard Pinout
- Remote On/Off and Trim pins
- Efficiency to 90%

Description

The RP20-SAW series are ultraminiature wide input voltage range power DC/DC converters in a case half the size of industry standard 20W converters. Despite their small size, the RP20-SAW converters are fully specified devices with output currents up to 4.5 Amps, up to 90% efficiency, no minimum load, 1600VDC isolation, a built-in Class A EMC filter and low ripple/noise figures. The outputs are also fully protected against short circuits, overcurrent and overvoltage. The no load input current is particularly low (only 4mA/6mA). The RP20-SAW series will find many uses in applications where board space and/or board height is at a premium or in battery-powered systems where standby current is important.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ %	Capacitive ⁽³⁾ Load max.
RP20-243.3SAW**	9-36	3.3	4500	6/754	86	7000µF
RP20-2405SAW**	9-36	5	4000	6/980	89	5000µF
RP20-2412SAW**	9-36	12	1670	6/980	89	850µF
RP20-2415SAW**	9-36	15	1330	6/980	89	700µF
RP20-483.3SAW**	18-75	3.3	4500	4/737	87	7000µF
RP20-4805SAW**	18-75	5	4000	4/490	89	5000µF
RP20-4812SAW**	18-75	12	1670	4/490	89	850µF
RP20-4815SAW**	18-75	15	1330	4/484	90	700µF
RP20-2412DAW**	9-36	±12	±833	6/980	89	±500µF
RP20-2415DAW**	9-36	±15	±667	6/969	90	±350µF
RP20-4812DAW**	18-75	±12	±833	4/490	89	±500µF
RP20-4815DAW**	18-75	±15	±667	4/484	90	±350µF

** Standard part is without suffixes and Trim and CTRL pins are not fitted.

* add suffix **/P** for CTRL function with positive logic (1=ON, 0=OFF) including trim pin for single output

* add suffix **/N** for CTRL function with negative logic (0=ON, 1=OFF) including trim pin for single output

* add suffix **-HC** for premounted heatsink and clips

Ordering Examples

RP20-2405SAW/P = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted.

RP20-483.3SAW-HC = 48V 4:1 Input, 3.3V Output, Premounted Heatsink, No Trim or CTRL pins.

RP20-4812DAW/N = 48V 4:1 Input, ±12V Output, Negative Logic CTRL pin

(no trim pin available with dual output)

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt Single & Dual Output



**UL-60950-1 Certification
Pending**

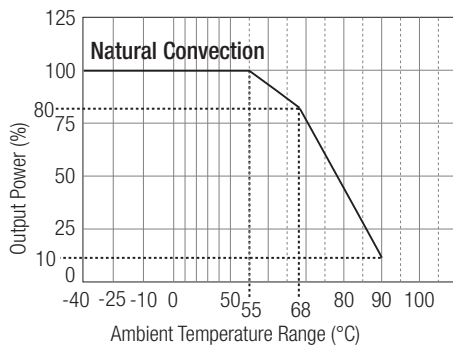
RP20-AW

RP20-AW

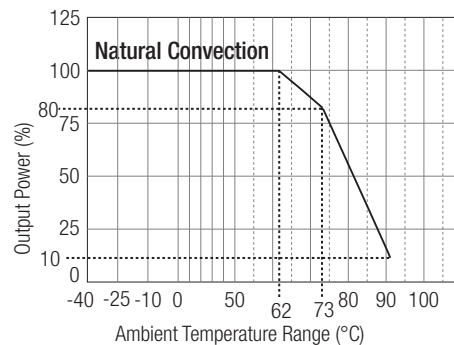
Please Read Application Notes

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Typical Characteristics



RP20-4805SAW



**RP20-4805SAW
With Heat Sink**

Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input 48V nominal input	9-36VDC 18-75VDC
Input Filter	Pi Type	EN55022 Class A
Input Surge Voltage (1000 ms max.)	24V Input 48V Input	50VDC 100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 4)		30mAp-p
Start Up Time (nominal Vin and constant resistor load)		30ms max.
Optional Remote ON/OFF (See Note 5) (Negative logic)	DC-DC ON DC-DC OFF	Short or $0V < V_r < 1.2V$ Open or $3.0V < V_r < 15V$
Remote Pin drive current	Nominal Vin	-0.5mA~1mA
Remote OFF input current	Nominal Vin	2mA
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Optional Output Trim (see Note 5)		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)	Single Dual	±0.2% ±0.5%
Load Regulation (0% to full load)	Single Dual	±0.2% ±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual Output	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V Outputs Others	75mVp-p 100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.7-5.4V
Zener diode clamp (only single)	5V 12V 15V	5.4-7.0V 13.5-19.6V 16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input - Output	1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1500pF max.

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

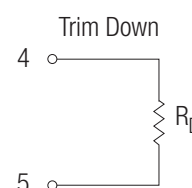
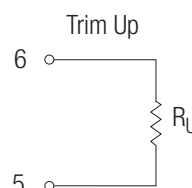
Operating Frequency			330kHz typ
Operating Temperature Range			-40°C to +90°C (with derating)
Maximum Case Temperature			+105°C
Storage Temperature Range			-55°C to +125°C
Thermal Impedance (see Note 6)	Natural convection		18.2°C/Watt
	Natural convection with Heat Sink		15.8°C/Watt
Thermal Shock			MIL-STD-810F
Vibration			10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity			5% to 95% RH
Case Material			Nickel plated copper
Base Material			FR4 PCB
Potting Material			Epoxy (UL94-V0)
Conducted Emissions	(see Note 7)	EN55022	Class A
Radiated Emissions		EN55022	Class B
ESD	±8kV Air, ±6kV Contact	EN61000-4-2	Perf. Criteria A
Radiated Immunity	10V/m	EN61000-4-3	Perf. Criteria A
Fast Transient	±2kV	EN61000-4-4	Perf. Criteria A
Surge (see note 8)	±2kV	EN61000-4-5	Perf. Criteria A
Conducted Immunity	10Vrms	EN61000-4-6	Perf. Criteria A
Weight			15g
Packing Quantity		Refer to App Notes for tube dimensions	8 pcs per Tube
Dimensions			25.4 x 25.4 x 9.9mm
MTBF (see Note 9)	Bellcore TR-NWT-000332		1766 x 10³ hours
	MIL-HDBK 217F		553 x 10³ hours

Notes :

- Values at nominal input voltage and no load/full load.
- Typical Value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is marked with suffix-P (eg. RP20-2405SAW/P)
Negative logic ON/OFF is marked with suffix-N (eg. RP20-2405SAW/N).
If no suffix is specified, the control pin will be omitted.
- Optional Heat-sink P/N is 7G-0047-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- Will meet Class B with external common mode filter (see Application Notes). Meets Class A with no external components.
- Requires external capacitor to meet EN61000-4-5: 220μF/100V, low ESR (48mOhm)
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C.
MIL-HDBK 217F Notice 2. Ta = 25°C, full load, (Ground Benign, controlled environment).

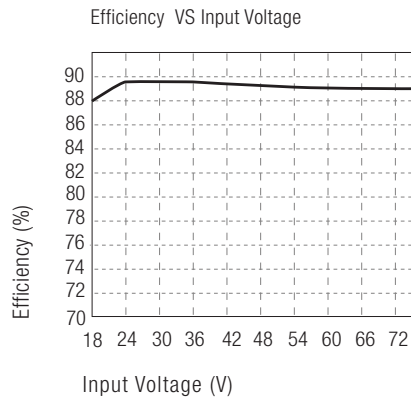
External Output Trimming (optional)

With /CTRL suffix, output can be externally trimmed by using the method shown here.
See Application Notes for details.

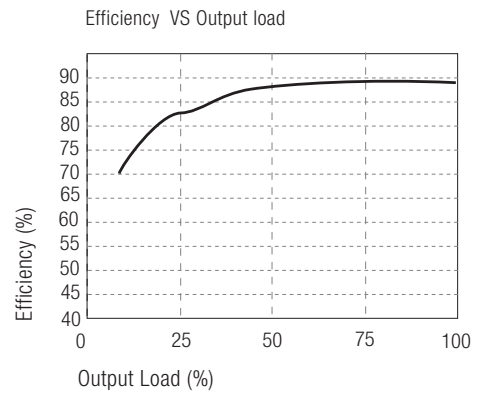


Typical Characteristics

RP20-4805SAW (Full Load)

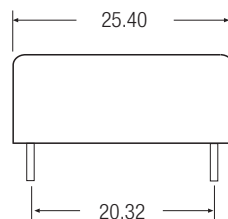
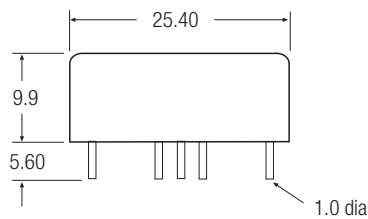


RP20-4805SAW (Vin=48V)



Package Style and Pinning (mm)

3rd angle projection

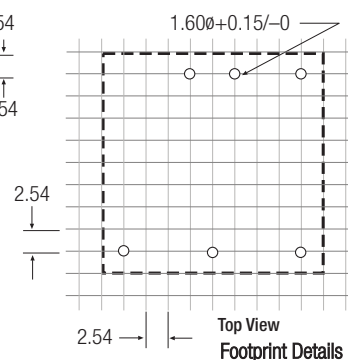
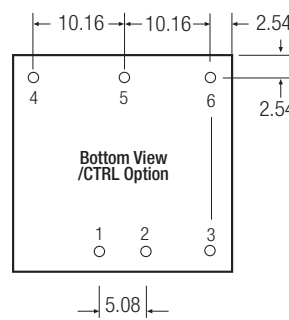
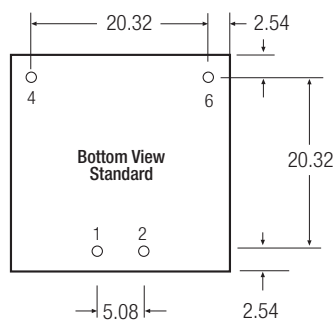


Pin Connections

Pin #	Single	Single/ P or /N	Dual	Dual/ P or /N
1	+Vin	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin	-Vin
3	no pin	CTRL	no pin	CTRL
4	+Vout	+Vout	+Vout	+Vout
5	no pin	Trim	Com	Com
6	-Vout	-Vout	-Vout	-Vout

Case Tolerance ± 0.5 mm

Pin Pitch Tolerance ± 0.25 mm



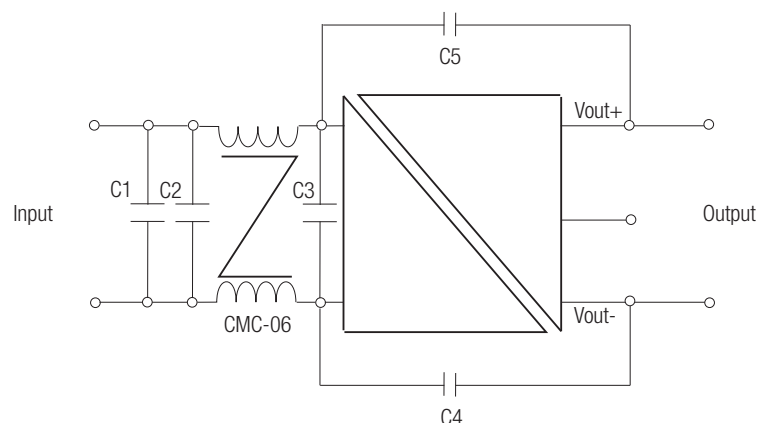
RP20-AW

EMC Filtering

Class B Filter

Vin=24V: C1=4.7 μ F/50V 1812 MLCC, C2 & C3 omitted,
C4 & C5 =470pF/2kV

Vin=48V: C1, C2 & C3 = 2.2 μ F/100V 1812 MLCC,
C4 & C5 =1nF/2kV



Features

- 2:1 Wide Input Voltage Range
- 20 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x 25.4 x 10.2mm Package
- Efficiency to 89%

Description

The RP20-F series DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP20-123.3SF	9-18	3.3	5000	1719	84	13000µF
RP20-1205SF	9-18	5	4000	2008	87	6800µF
RP20-1212SF	9-18	12	1670	2062	85	2200µF
RP20-1215SF	9-18	15	1330	2052	85	755µF
RP20-243.3SF	18-36	3.3	5000	838	86	13000µF
RP20-2405SF	18-36	5	4000	980	89	6800µF
RP20-2412SF	18-36	12	1670	1006	87	2200µF
RP20-2415SF	18-36	15	1330	1002	87	755µF
RP20-483.3SF	36-75	3.3	5000	414	87	13000µF
RP20-4805SF	36-75	5	4000	490	89	6800µF
RP20-4812SF	36-75	12	1670	497	88	2200µF
RP20-4815SF	36-75	15	1330	500	87	755µF
RP20-1212DF	9-18	±12	±833	2032	86	±680µF
RP20-1215DF	9-18	±15	±667	2034	86	±450µF
RP20-2412DF	18-36	±12	±833	1004	87	±680µF
RP20-2415DF	18-36	±15	±667	1005	87	±450µF
RP20-4812DF	36-75	±12	±833	496	88	±680µF
RP20-4815DF	36-75	±15	±667	502	87	±450µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP20-2405SF = 24V Input, 5V Output, Positive Logic CTRL pin fitted

RP20-4812DF/N-HC = 48V Input, ±12V Output, Negative Logic CTRL pin fitted, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

2" x 1"

Single &

Dual Output



UL-60950-1 Certified
E196683

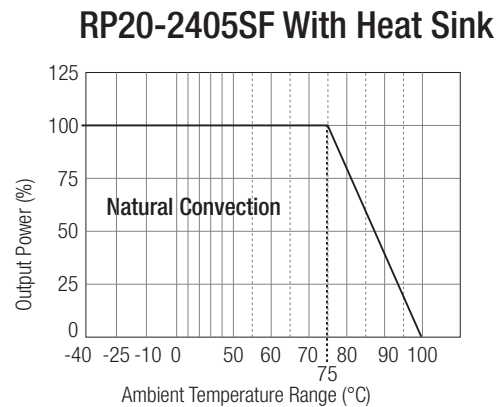
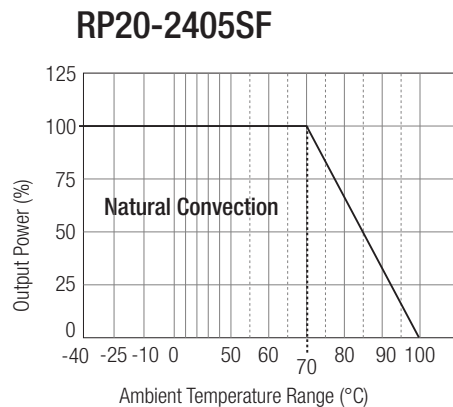
RP20-F

RP20-F

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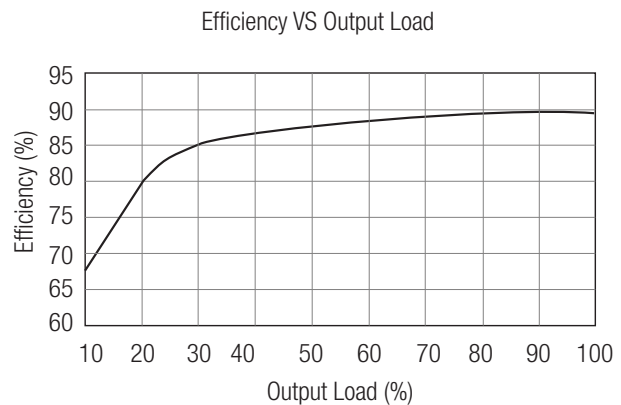
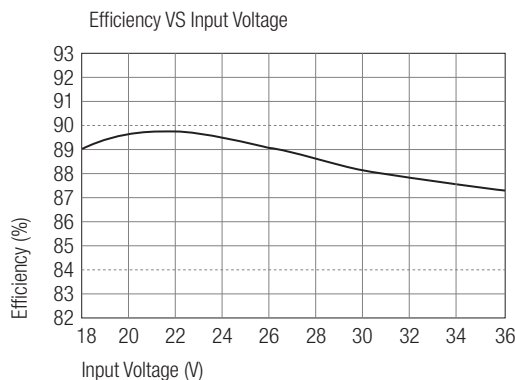
Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Typical Characteristics

RP20-2405SF



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter (see Note 9)	L-C Type	
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)	5V/ms max
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)	20mAp-p	
Start Up Time (nominal Vin and constant resistor load)	10ms typ.	
Remote ON/OFF (see Note 7)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
	Nominal input	2.5mA
Remote OFF input current		
Output Power	20W max.	
Output Voltage Accuracy (full Load and nominal Vin)	±1%	
Voltage Adjustability	±10%	

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

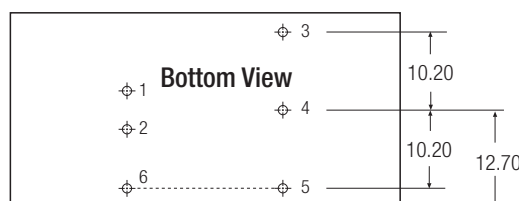
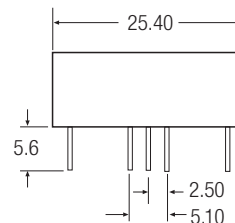
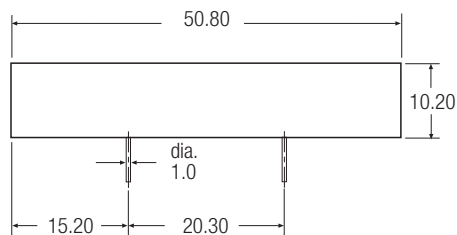
Minimum Load (see Note 1)	Single Dual	0% 10% of full load
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (25% to 100% full load)		±0.5%
Cross Regulation (asymmetrical 25% <>100% load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output) (Measured with a 1004pF/50V MLCC)	Single 1.5, 1.8, 2.5, 3.3V Single 5, 12, 15V Dual 5, 12, 15V	60mVp-p 75mVp-p 100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		500µs
Over Voltage Protection	1.5, 1.8, 2.5, 3.3V	3.9V
Zener diode clamp (only single)	5V 12V 15V	6.2V 15V 18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		none
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input to Output Input (Output) to case	1600VDC 1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.
Operating Frequency		500kHz typ.
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 8)	Natural convection Natural convection with Heat Sink	12°C/Watt 10°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Notes 9, 10)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9 pcs per Tube
Dimensions		50.8 x 25.4 x 10.2mm
MTBF (see Note 2)		1791 x 10 ³ hours

Notes :

1. The RP20-S_DF series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Simulated source impedance of 12 μ H. 12 μ H inductor in series with +Vin.
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is standard, no suffix (Ex. RP20-2405SF)
Negative logic ON/OFF is marked with suffix-N (Ex. RP20-2405SF/N).
8. Heat sink is optional and P/N: 7G-0020-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. An external filter capacitor is required for normal operation. The capacitor should be capable of handling 1A ripple current for 48V/24V models.
RECOM suggest: Nippon chemi-con KY series, 220 μ F/100V, ESR 90m Ω .
10. See application notes for Class B common mode filter suggestion.

Package Style and Pinning (mm)

3rd angle projection



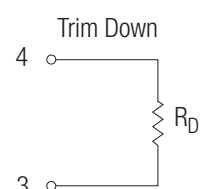
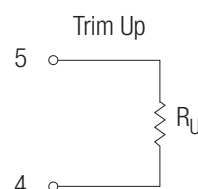
Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Com
5	-Vout	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

External Output Trimming

Output can be externally trimmed by using the method shown below. See Application Notes for details.



Features

Regulated Converters

- 4:1 Wide Input Voltage Range
- 20 Watts Regulated Output Power
- 1.6kVDC Isolation
- Over Current and Over Voltage Protection
- Six-Sided Shield
- No Derating to 63°C
- Standard 2" x 1" Package and Pinning
- Efficiency to 86 %

Description

The RP20-FW series wide rangew input DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 24V and 48V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(4,5) Current mA	Efficiency ⁽⁶⁾ %	Capacitive ⁽⁷⁾ Load max.
RP20-243.3SFW	9-36	3.3	5500	60/922	84	18000µF
RP20-2405SFW	9-36	5	4000	60/1016	86	9600µF
RP20-2412SFW	9-36	12	1670	75/1031	85	1650µF
RP20-2415SFW	9-36	15	1330	75/1014	86	1050µF
RP20-483.3SFW	18-75	3.3	5500	30/461	84	18000µF
RP20-4805SFW	18-75	5	4000	30/508	86	9600µF
RP20-4812SFW	18-75	12	1670	40/515	85	1650µF
RP20-4815SFW	18-75	15	1330	40/507	86	1050µF
RP20-2405DFW	9-36	±5	±2000	85/1068	82	±4800µF
RP20-2412DFW	9-36	±12	±833	100/1028	85	±625µF
RP20-2415DFW	9-36	±15	±667	100/1017	86	±525µF
RP20-4805DFW	18-75	±5	±2000	45/534	82	±4800µF
RP20-4812DFW	18-75	±12	±833	50/514	85	±825µF
RP20-4815DFW	18-75	±15	±667	50/508	86	±525µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

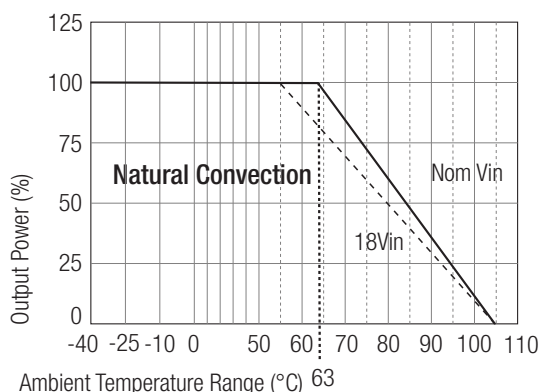
Ordering Examples

RP20-2405SFW = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin fitted

RP20-4812DFW/N-HC = 48V 4:1 Input, ±12V Output, Negative Logic CTRL pin fitted, Heatsink fitted

Derating Graph (Ambient Temperature)

RP20-4805SFW



Derating graphs are valid only for the shown part numbers.

If you need detailed derating information about a part number not shown here please contact our technical customer support at info@recom-development.at

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

2" x 1"

Single &

Dual Output



UL-60950-1 Certified
E196683

RP20-FW

Please Read Application Notes

www.recom-electronic.com

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Input Filter		Pi Type
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load)		20mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		20ms typ.
Remote ON/OFF (see Note 1)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		20W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (0% to 100% full load)	Single	±0.5%
	Dual	±1%
Cross Regulation Dual Output (asymmetrical load 25% <-> 100% load)		±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3V	60mV _{p-p}
	5.0, 12, 15V	75mV _{p-p}
	±5, ±12, ±15V	100mV _{p-p}
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Input Voltage Variation, dv/dt	complies with ETS300 132, part 4.4	5V/ms
Over Load Protection (% of full load at nominal Vin)		150% typ
Overvoltage Protection (Single)		Zener Diode Clamp
Undervoltage Protection		See Application Notes
Short Circuit Protection		Continuous, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	In to Out and I/O to case	1600VDC
Isolation Resistance		10 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		400kHz typ.
Operating Temperature Range	no derating	-40°C to +63°C
	with derating	-40°C to +105°C
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 8)	Natural convection	12°C/Watt
	with Heatsink	10°C/Watt
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Weight		27g
Packing Quantity	Refer to App Notes for tube dimensions	9 pcs per Tube

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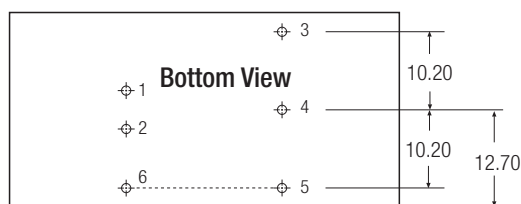
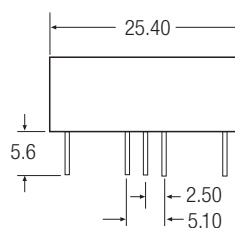
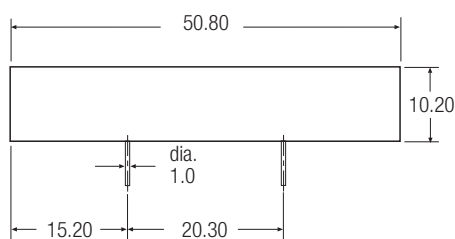
Specifications, cont. (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 3)	EN55022	Class A
Radiated Emissions (see Note 3)	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Thermal Shock	MIL-STD-810D	
Vibration	10-55Hz, 10G, 30 Min. along X, Y and Z	
Relative Humidity	5% to 95% RH	
MTBF (see Note 2)	Belcore-TR-NWT-000332	2350 x 10 ³ hours
	MIL-HDBK-217F	659 x 10 ³ hours

Notes :

1. The RP20-S_DFW series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Requires external filter to meet EN55022 Class A and B. Refer to Application Notes.
4. Typical value at nominal input voltage and no load.
5. Maximum value at nominal input voltage and full load.
6. Typical value at nominal input voltage and full load.
7. Test by minimum Vin and constant resistor load.
8. Optional Heatsink Part Number 7G-0020-C . Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is standard, no suffix (Ex. RP20-2405SF)
Negative logic ON/OFF is marked with suffix-N (Ex. RP20-2405SF/N).

Package Style and Pinning (mm)



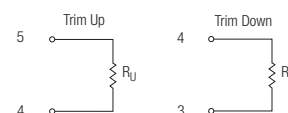
Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Com
5	-Vout	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

External Output Trimming

Single Output can be trimmed $\pm 10\%$ by using external resistors
See Application Notes for details



Features

- 2:1 Wide Input Voltage Range
- 30 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- International Safety Standard Approvals
- Standard 50.8 x 40.6 x 10.2mm Package
- Efficiency to 90 %
- Available as Power Module (RPM30-E)

Description

The RP30-E series DC/DC converters are certified to UL 60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required.

The industry standard 2" x 1.6" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP30-123.3SE	9-18	3.3	6000	2037	85	19500µF
RP30-1205SE	9-18	5	6000	3012	87	10200µF
RP30-1212SE	9-18	12	2500	2976	88	3240µF
RP30-1215SE	9-18	15	2000	2976	88	1100µF
RP30-243.3SE	18-36	3.3	6000	1031	86	19500µF
RP30-2405SE	18-36	5	6000	1490	88	10200µF
RP30-2412SE	18-36	12	2500	1470	89	3300µF
RP30-2415SE	18-36	15	2000	1470	89	1100µF
RP30-483.3SE	36-75	3.3	6000	500	87	19500µF
RP30-4805SE	36-75	5	6000	740	89	10200µF
RP30-4812SE	36-75	12	2500	730	90	3300µF
RP30-4815SE	36-75	15	2000	730	90	1100µF
RP30-1212DE	9-18	±12	±1250	3012	87	±1020µF
RP30-1215DE	9-18	±15	±1000	3012	87	±675µF
RP30-2412DE	18-36	±12	±1250	1488	88	±1020µF
RP30-2415DE	18-36	±15	±1000	1488	88	±675µF
RP30-4812DE	36-75	±12	±1250	744	88	±1020µF
RP30-4815DE	36-75	±15	±1000	744	88	±675µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add suffix **-HC** for premounted heatsink and clips

Ordering Examples

RP30-2405SE = 24V Input, 5V Output, Positive Logic CTRL pin.

RP20-4812DE-HC = 48V Input, ±12V Output, Positive Logic CTRL pin, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

30 Watt Single & Dual Output

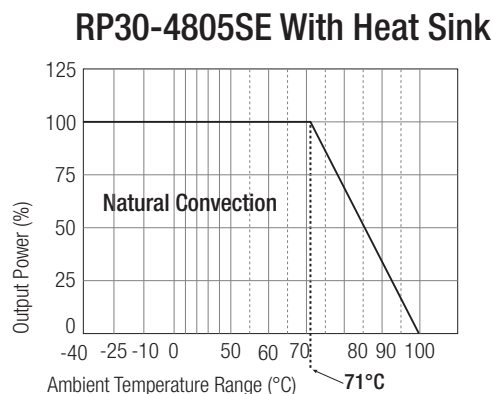
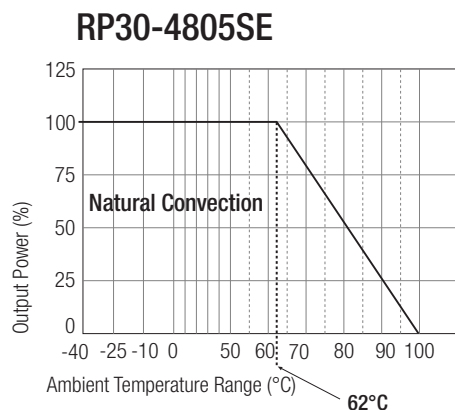


UL-60950-1 Certified
E196683

RP30-E

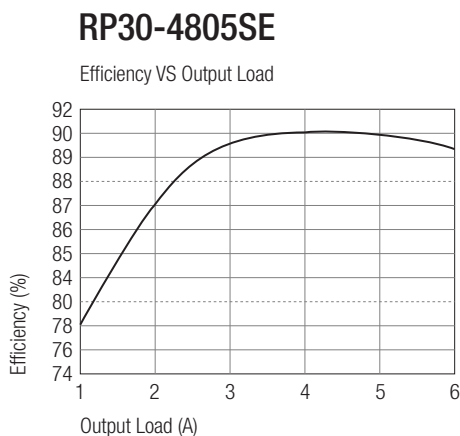
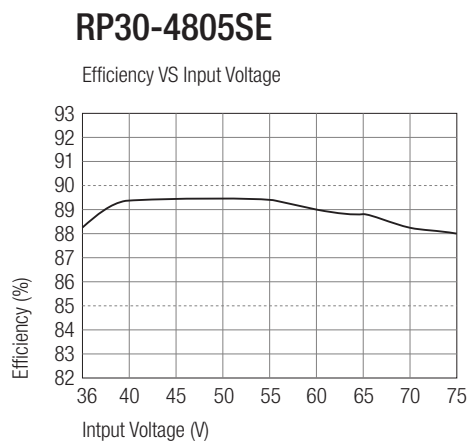
Please Read Application Notes

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical customer service at info@recom-development.at

Typical Characteristics



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	12V input	DC-DC ON 9VDC
		DC-DC OFF 8VDC
	24V input	DC-DC ON 17.8VDC
		DC-DC OFF 16VDC
	48V input	DC-DC ON 36VDC
		DC-DC OFF 33VDC
Input Filter (see Note 1)		L-C Type
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)	5V/ms max
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)		30mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		25ms typ.
Remote ON/OFF (see Note 7)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA

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Specifications (typical at nominal input and 25°C unless otherwise noted)

Output Power		30W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Voltage Adjustability		±10%
Minimum Load	Single & Dual	0%
Line Regulation (low line, high line at full load)	Single	±0.2%
	Dual	±0.5%
Load Regulation (25% to 100% full load)	Single	±0.5%
	Dual	±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output) (Measured with a 1004pF/50V MLCC)	Single 3.3, 5V	50mVp-p
	Single 12, 15V	75mVp-p
	Dual 5, 12, 15V	100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		300µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V	6.2V
	12V	15V
	15V	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.
Operating Frequency		300kHz typ.
Approved to Safety Standards		UL 1950, EN60950
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		115°C typ.
Thermal Impedance (see Note 8)	Natural convection	10°C/Watt
	Natural convection with Heat Sink	8.24°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Weight		48g
Packing Quantity	Refer to App Notes for tube dimensions	5 pcs per Tube
Dimensions		50.8 x 40.6 x 10.2mm

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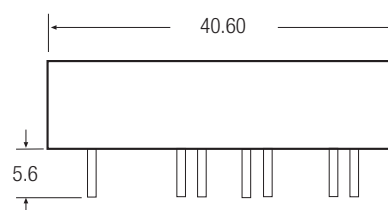
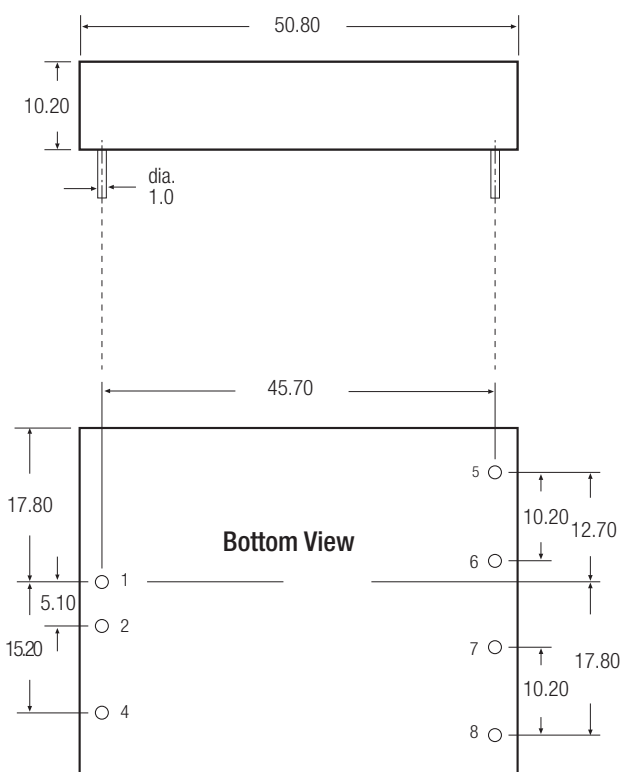
Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 9)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
MTBF (see Note 2)	1535 x 10 ³ hours	

Notes :

1. An external filter capacitor is required for normal operation. The capacitor should be capable of handling 1A ripple current for 48V/24V models.
RECOM suggest: Nippon chemi-con KY series, 220µF/100V, ESR 90m Ω.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Simulated source impedance of 12µH. 12µH inductor in series with +Vin.
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control pin voltage is referenced to negative input
8. Heat sink is optional and P/N: 7G-0011-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. See application notes for Class B common mode filter suggestion.

Package Style and Pinning (mm)



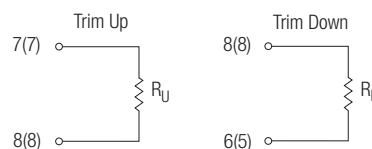
Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4	CTRL	CTRL
5	No Pin	+Vout
6	+Vout	Com
7	-Vout	-Vout
8	Trim	Trim

Pin Pitch Tolerance ±0.35 mm

External Output Trimming

Output can be externally trimmed by using the method shown below. () for dual output trim.
See Application Notes for details.



Features

- 4:1 Wide Input Voltage Range
- 30 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x 40.6 x 10.2mm Package
- Efficiency to 88 %
- Available as Power Module (RPM30-EW)

Description

The RP30-EW series wide input range DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1.6" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP30-243.3SEW	10-40	3.3	6000	994	87	19500µF
RP30-2405SEW	10-40	5	6000	1506	87	10200µF
RP30-2412SEW	10-40	12	2500	1506	87	3300µF
RP30-2415SEW	10-40	15	2000	1488	88	1100µF
RP30-483.3SEW	18-75	3.3	6000	497	87	19500µF
RP30-4805SEW	18-75	5	6000	744	88	10200µF
RP30-4812SEW	18-75	12	2500	753	87	3300µF
RP30-4815SEW	18-75	15	2000	744	88	1100µF
RP30-2412DEW	10-40	±12	±1250	1563	84	±1000µF
RP30-2415DEW	10-40	±15	±1000	1543	86	±680µF
RP30-4812DEW	18-75	±12	±1250	772	85	±1000µF
RP30-4815DEW	18-75	±15	±1000	762	86	±680µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

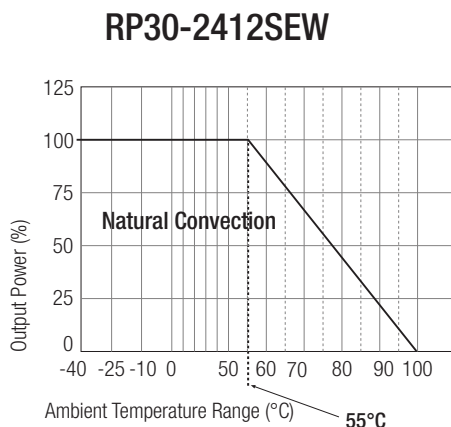
* add suffix -HC for premounted heatsink and clips

Ordering Examples

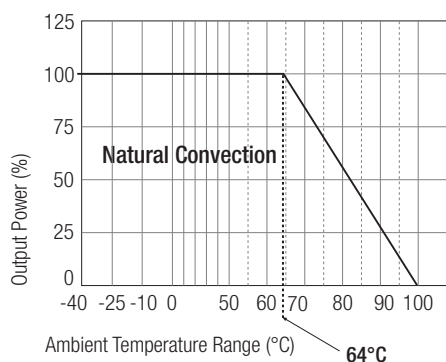
RP30-2405SEW = 24V Input, 5V Output, Positive Logic CTRL pin.

RP20-4812DEW/N-HC = 48V Input, ±12V Output, Negative Logic CTRL pin, Heatsink fitted

Derating Graph (Ambient Temperature)



RP30-2412SEW With Heat Sink



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

30 Watt Single & Dual Output



UL-60950-1 Certified
E196683

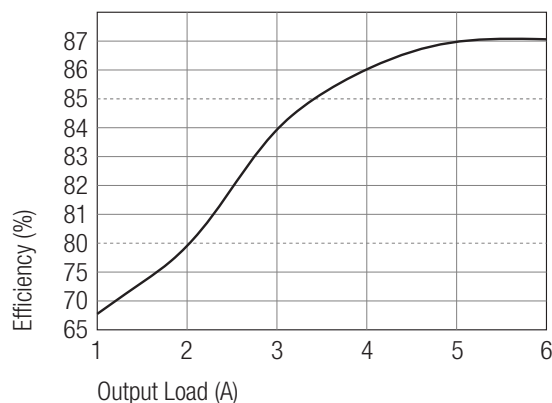
RP30-EW

Please Read Application Notes

Typical Characteristics

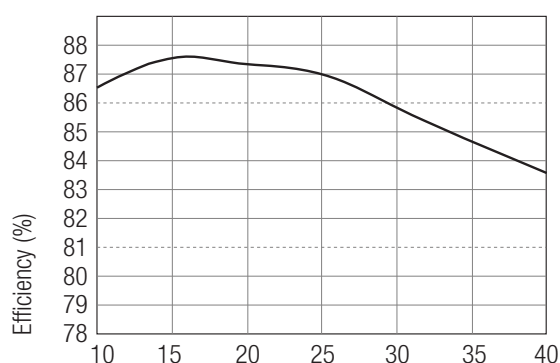
RP30-483.3SEW

Efficiency VS Output Load



RP30-483.3SEW

Efficiency VS Input Voltage



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	10-40VDC
	48V nominal input	18-75VDC
Under Voltage Lockout	24V input	DC-DC ON
		DC-DC OFF
	48V input	DC-DC ON
		DC-DC OFF
Input Filter (see Note 1)		L-C Type
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)	5V/ms max
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)		20mAp-p
Start Up Time (nominal Vin and constant resistor load)		10ms typ.
Remote ON/OFF (see Note 7)	DC-DC ON	Open or 3.0V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	3mA
Output Power		30W max.

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Specifications (typical at nominal input and 25°C unless otherwise noted)

Output Voltage Accuracy (full Load and nominal Vin)		±1%
Voltage Adjustability		±10%
Minimum Load	Single	0%
	Dual	10% of full load
Line Regulation (low line, high line at full load)		±0.5%
Load Regulation (25% to 100% full load)	Single	±0.5%
(see Note 9)	Dual	±1%
Cross Regulation (Asymmetrical 25% <> 100% load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	Single 3.3V	60mVp-p
(Measured with a 100nF/50V MLCC)	Single 5V	75mVp-p
	Single 12, 15V	100mVp-p
	Dual 12, 15V	100mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp	5V	6.2V
	12V	15V
	15V	18V
Over Load Protection (% of full load at nominal Vin)		150% max.
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.
Operating Frequency		300kHz typ.
Approved to Safety Standards		EN60950
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		+100°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		115°C typ.
Thermal Impedance	Natural convection	10°C/Watt
(see Note 8)	Natural convection with Heat Sink	8.24°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic
Potting Material		Epoxy (UL94-V0)
Weight		48g
Packing Quantity	Refer to App Notes for tube dimensions	5 pcs per Tube
Dimensions		50.8 x 40.6 x 10.2mm

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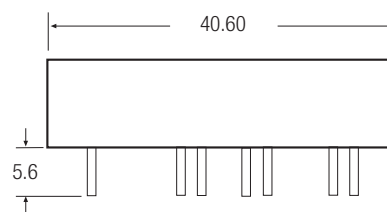
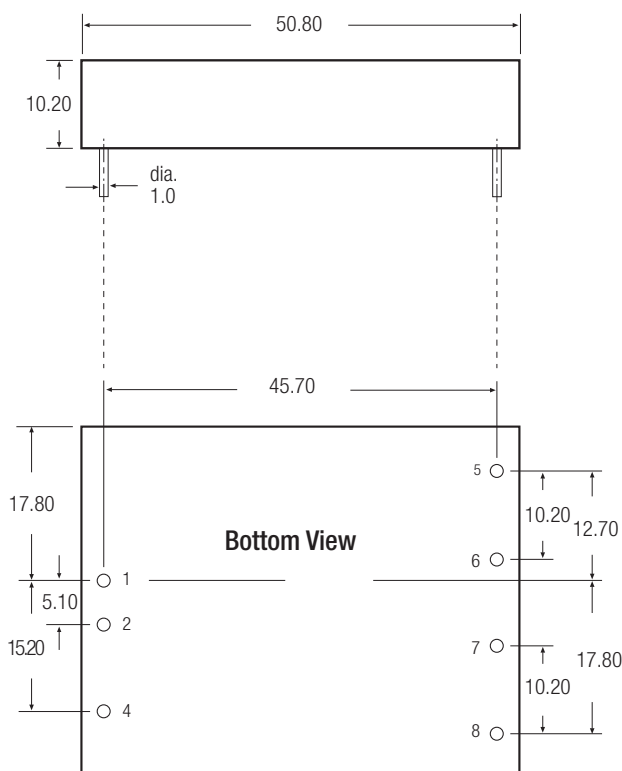
Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 10)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF (see Note 2)	1315 x 10 ³ hours	

Notes :

1. An external filter capacitor is required for normal operation. The capacitor should be capable of handling 1A ripple current for 48V/24V models.
RECOM suggest: Nippon chemi-con KY series, 220µF/100V, ESR 90m Ω.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. Simulated source impedance of 12µH. 12µH inductor in series with +Vin.
4. Maximum value at nominal input voltage and full load of standard type.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistor load.
7. The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is standard, no suffix (Ex. RP30-2405SEW)
Negative logic ON/OFF is marked with suffix -N (Ex. RP30-2405SEW/N).
8. Heat sink is optional and P/N: 7G-0011 -C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. The dual output required a minimum 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
10. See application notes for class B common mode filter suggestion.

Package Style and Pinning (mm)



Pin Connections

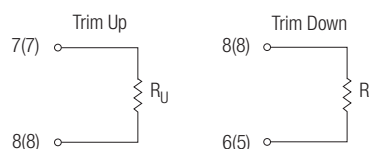
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
4 ^	CTRL	CTRL
5	No Pin	+Vout
6	+Vout	Com
7	-Vout	-Vout
8	Trim	Trim

Pin Pitch Tolerance ±0.35 mm

External Output Trimming

Output can be externally trimmed by using the method shown below. () for dual output trim.

See Application Notes for details.



Features

- 2:1 Wide Input Voltage Range
- 30 Watts Output Power
- 1.6kVDC Isolation
- UL Pending
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x25.4x10.2mm Package
- Efficiency to 91%

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

Description

The RP30-F series DC/DC converters are designed to meet to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input Current ⁽⁴⁾		Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
				No Load mA	Full Load mA		
RP30-123.3SF	9-18	3.3	8000	90	2716	85	20000µF
RP30-1205SF	9-18	5	6000	130	3012	87	14400µF
RP30-1212SF	9-18	12	2500	90	2941	89	3000µF
RP30-1215SF	9-18	15	2000	80	2941	89	2000µF
RP30-243.3SF	18-36	3.3	8000	50	1325	87	20000µF
RP30-2405SF	18-36	5	6000	75	1453	90	14400µF
RP30-2412SF	18-36	12	2500	40	1437	91	3000µF
RP30-2415SF	18-36	15	2000	30	1437	91	2000µF
RP30-483.3SF	36-75	3.3	8000	30	663	87	20000µF
RP30-4805SF	36-75	5	6000	45	727	90	14400µF
RP30-4812SF	36-75	12	2500	40	718	91	3000µF
RP30-4815SF	36-75	15	2000	40	718	91	2000µF
RP30-1205DF	9-18	±5	±3000	90	3012	87	±3000µF
RP30-1212DF	9-18	±12	±1250	50	3012	87	±2000µF
RP30-1215DF	9-18	±15	±1000	40	3012	87	±1300µF
RP30-2405DF	18-36	±5	±3000	70	1453	90	±3000µF
RP30-2412DF	18-36	±12	±1250	30	1471	89	±2000µF
RP30-2415DF	18-36	±15	±1000	30	1453	90	±1300µF
RP30-4805DF	36-75	±5	±3000	35	727	90	±3000µF
RP30-4812DF	36-75	±12	±1250	30	744	88	±2000µF
RP30-4815DF	36-75	±15	±1000	20	735	89	±1300µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP30-2405SF = 24V Input, 5V Output, Positive Logic CTRL pin fitted

RP30-4812DF/N-HC = 48V Input, ±12V Output, Negative Logic CTRL pin fitted, Heatsink fitted

30 Watt 2" x 1" Package Single & Dual Output

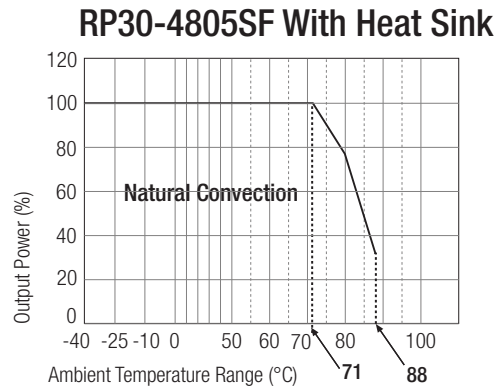
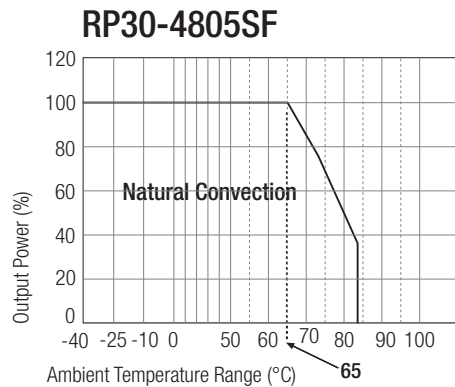


**UL-60950-1 Certified
E196683**

RP30-F

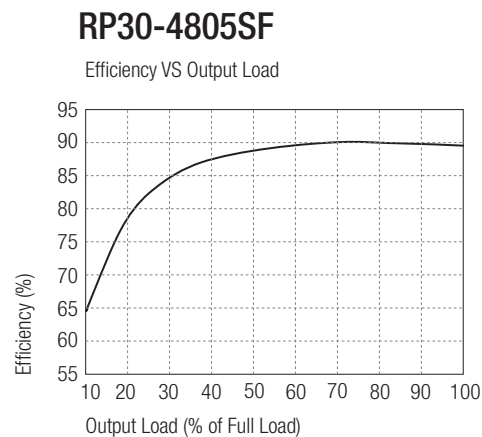
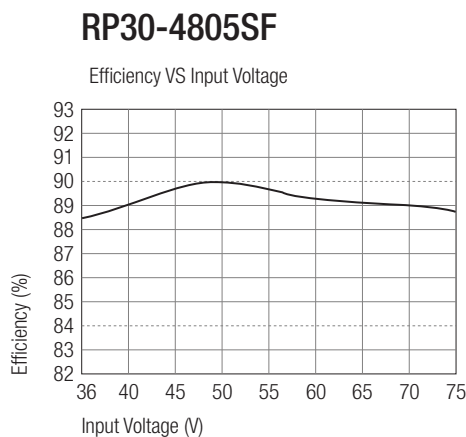
Please Read Application Notes

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Typical Characteristics



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Input Filter	Pi Type	
Input Surge Voltage (100 ms max.)	12V Input	25VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)	20mA _{p-p}	
Start Up Time (nominal Vin and constant resistor load)	Power up	30ms typ.
	Remote ON/OFF	30ms typ.
Start-up voltage	12V Input	9VDC
	24V Input	18VDC
	48V Input	36VDC
Shutdown voltage	12V Input	8VDC
	24V Input	16VDC
	48V Input	32VDC

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

Remote ON/OFF (Optional. See Note 7) (Positive logic)(Standard)	DC-DC ON	Open or $3V < V_r < 12V$
	DC-DC OFF	Short or $0V < V_r < 1.2V$
(Negative logic)(Option)	DC-DC ON	Short or $0V < V_r < 1.2V$
	DC-DC OFF	Open or $3V < V_r < 12V$
Input current of Remote control pin	Nominal input	-0.5mA ~ +0.5mA
Remote OFF state input current	Nominal input	3mA
Output Power		30W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Voltage Adjustability		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (No load to full load)	Single	±0.5%
	Dual	±1%
Cross Regulation (asymmetrical 25% <> 100% load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output) (Measured with a 1µF/50V MLCC)	3.3, 5V	100mVp-p
	12, 15V	150mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V, ±5V	6.2V
	12V, ±12V	15V
	15V, ±15V	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input to Output	1600VDC
	Input (Output) to case	1600VDC
Isolation Resistance		1GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		430kHz typ.
Operating Temperature Range		-40°C to +50°C(without derating) -40°C to +85°C(with derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		+115°C typ.
Thermal Impedance (see Note 8)	Natural convection	12°C/Watt
	Natural convection with Heat Sink	10°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		FR4 PCB
Potting Material		Epoxy (UL94-V0)

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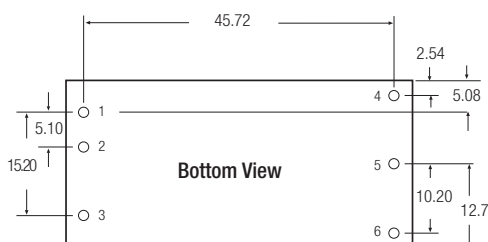
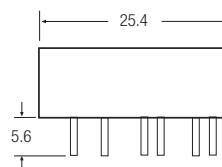
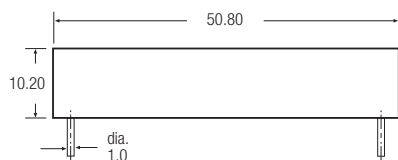
Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 10)	EN55022		Class A
Radiated Emissions	EN55022		Class B
ESD	EN61000-4-2	Air ±8KV	Perf. Criteria A
	EN61000-4-2	Contact ±6KV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast Transient (see Note 9)	EN61000-4-4	±2KV	Perf. Criteria A
Surge (see Note 9)	EN61000-4-5	±1KV	Perf. Criteria A
Conducted Immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
Weight			30.5g
Packing Quantity	Refer to App Notes for tube dimensions		9 pcs per Tube
Dimensions			50.8 x 25.4 x 10.2mm
MTBF (see Note 2)	Belcore-TR-NWT-000332		3.173 x 10 ⁶ hours
	MIL-HDBK-217F		5.548 x 10 ⁵ hours

Notes :

- The RP30-S_DF series does not require any minimum load.
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment)
MIL-HDBK-217F Notice2 @ TA= 25°C, Full load (Ground, Beginn, controlled environment)
- Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
- Typical value at nominal input voltage and no load of standard type
Maximum value at nominal input voltage and full load of standard type.
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is standard, no suffix (Ex. RP30-2405SF)
Negative logic ON/OFF is marked with suffix-N (Ex. R320-2405SF/N).
- Heat sink is optional and P/N: 7G-0020-C . Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- An external filter capacitor is required if the module has to meet EN61000-4-4,EN61000-4-5.
The filter capacitor RECOM suggest: 12Vin & 24Vin : Nippon chemi-con KY series, 330μF/50V, ESR 55mΩ.
48Vin : Nippon chemi-con KY series, 220μF/100V, ESR 48mΩ.
- Meets class A with external components shown below. See application notes for Class B common mode filter suggestion

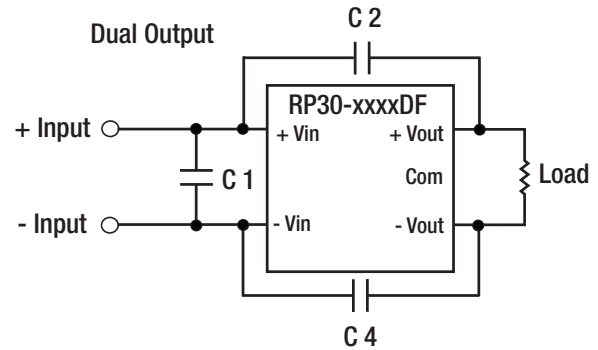
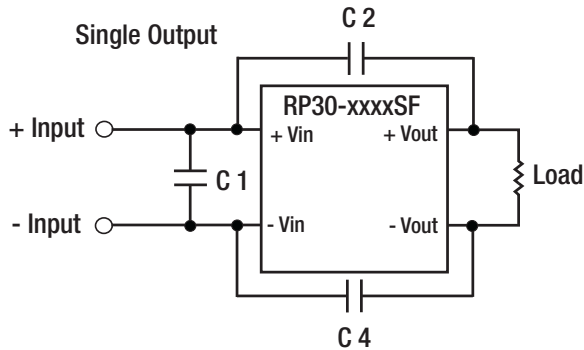
Package Style and Pinning (mm)



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	+Vout	+Vout
5	-Vout	Com
6	Trim	-Vout

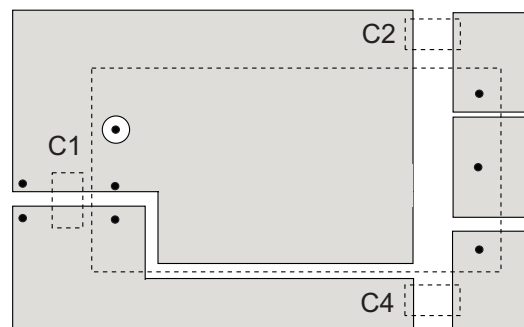
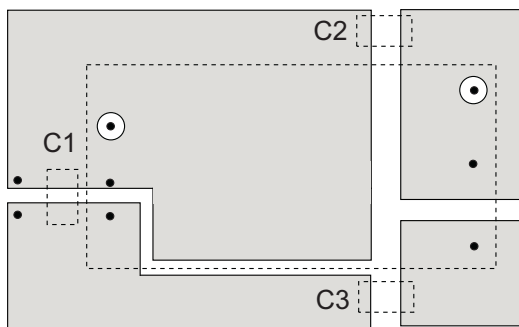
Pin Pitch Tolerance ±0.25 mm



Single Output	C1	C2 & C3
RP30-12xxSF	10 μ F/25V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-24xxSF	6.8 μ F/50V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-48xxSF	2.2 μ F/100V 1812 MLCC	1000pF/2KV 1808 MLCC

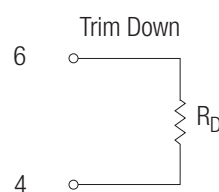
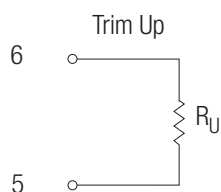
Dual Output	C1	C2 & C4
RP30-12xxDF	10 μ F/25V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-24xxDF	6.8 μ F/50V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-48xxDF	2.2 μ F/100V 1812 MLCC	1000pF/2KV 1808 MLCC

Recommended EN55022 Class A Filter Circuit Layouts



External Output Trimming

Output can be externally trimmed by using the method shown below. See Application Notes for details.



Features

- 4:1 Wide Input Voltage Range
- 30 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Standard 50.8 x25.4x10.2mm Package
- Efficiency to 91%

Description

The RP30-FW series DC/DC converters are designed to meet to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 1" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 24V and 48V Input Types

Part Number	Input Range	Output Voltage	Output Current	Input Current ⁽⁴⁾		Efficiency ⁽⁵⁾	Capacitive ⁽⁶⁾
	VDC	VDC	mA	No Load	Full Load	%	Load max.
RP30-243.3SFW	9-36	3.3	7500	70	1258	86	20000µF
RP30-2405SFW	9-36	5	6000	105	1488	88	14400µF
RP30-2412SFW	9-36	12	2500	20	1471	89	3000µF
RP30-2415SFW	9-36	15	2000	30	1471	89	2000µF
RP30-483.3SFW	18-75	3.3	7500	45	629	86	20000µF
RP30-4805SFW	18-75	5	6000	65	744	88	14400µF
RP30-4812SFW	18-75	12	2500	60	727	90	3000µF
RP30-4815SFW	18-75	15	2000	50	718	91	2000µF
RP30-2405DFW	9-36	±5	±3000	90	1488	88	±3000µF
RP30-2412DFW	9-36	±12	±1250	25	1506	87	±2000µF
RP30-2415DFW	9-36	±15	±1000	25	1506	87	±1300µF
RP30-4805DFW	18-75	±5	±3000	50	744	88	±3000µF
RP30-4812DFW	18-75	±12	±1250	15	744	88	±2000µF
RP30-4815DFW	18-75	±15	±1000	15	744	88	±1300µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add **/N** for CTRL function with Negative Logic (0=ON, 1=OFF)

* add suffix **-HC** for premounted heatsink and clips

Ordering Examples

RP30-2405SFW = 24V Input, 5V Output, Positive Logic CTRL pin fitted

RP30-4812DFW/N-HC = 48V Input, ±12V Output, Negative Logic CTRL pin fitted, Heatsink fitted

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

30 Watt

2" x 1"

Single &

Dual Output



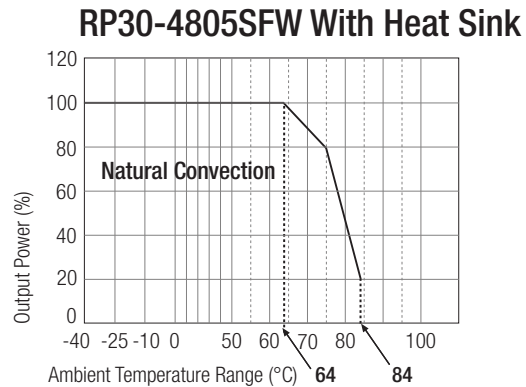
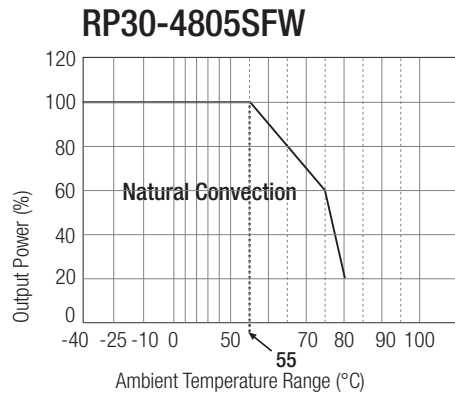
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UL-60950-1 Certified

RP30-FW

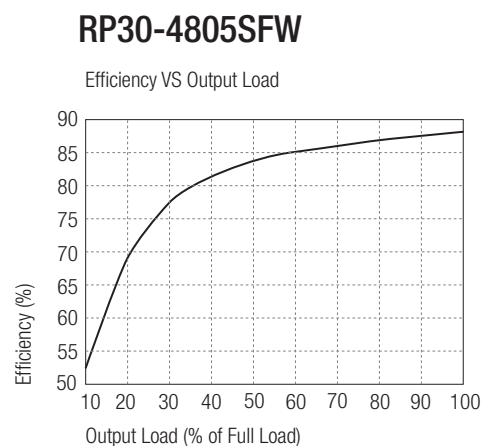
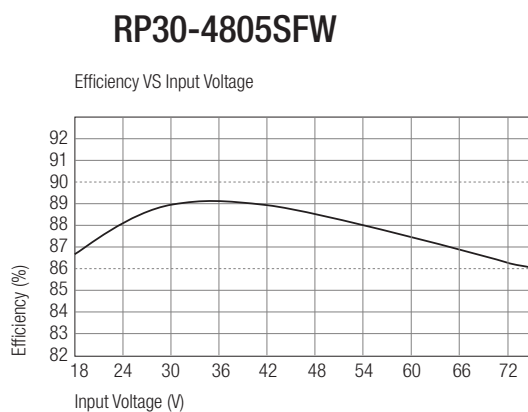
RP30-FW

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at info@recom-development.at

Typical Characteristics



RP30-FW

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Input Filter	Pi Type	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load) (see Note 3)	20mA _{p-p}	
Start Up Time (nominal Vin and constant resistor load)	Power up	30ms typ.
	Remote ON/OFF	30ms typ.
Start-up voltage	24V Input	9VDC
	48V Input	18VDC
Shutdown voltage	24V Input	8VDC
	48V Input	16VDC

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Specifications (typical at nominal input and 25°C unless otherwise noted)

Remote ON/OFF (Optional. See Note 7) (Positive logic)(Standard)	DC-DC ON	Open or $3V < V_r < 12V$
	DC-DC OFF	Short or $0V < V_r < 1.2V$
(Negative logic)(Option)	DC-DC ON	Short or $0V < V_r < 1.2V$
	DC-DC OFF	Open or $3V < V_r < 12V$
Input current of Remote control pin	Nominal input	-0.5mA ~ +0.5mA
Remote OFF state input current	Nominal input	3mA
Output Power		30W max.
Output Voltage Accuracy (full Load and nominal Vin)		±1%
Voltage Adjustability		±10%
Minimum Load		0%
Line Regulation (low line, high line at full load)		±0.2%
Load Regulation (No load to full load)	Single	±0.5%
	Dual	±1%
Cross Regulation (asymmetrical 25% <> 100% load)	Dual	±5%
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3, 5V	100mVp-p
(Measured with a 1µF/50V MLCC)	12, 15V	150mVp-p
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V, ±5V	6.2V
	12V, ±12V	15V
	15V, ±15V	18V
Over Load Protection (% of full load at nominal Vin)		150% typ
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)	Input to Output	1600VDC
	Input (Output) to case	1600VDC
Isolation Resistance		1GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		430kHz typ.
Operating Temperature Range		-40°C to +50°C(without derating) -40°C to +85°C(with derating)
Maximum Case Temperature		+105°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		+115°C typ.
Thermal Impedance (see Note 8)	Natural convection	12°C/Watt
	Natural convection with Heat Sink	10°C/Watt
Thermal Shock		MIL-STD-810F
Vibration		MIL-STD-810F
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		FR4 PCB
Potting Material		Epoxy (UL94-V0)

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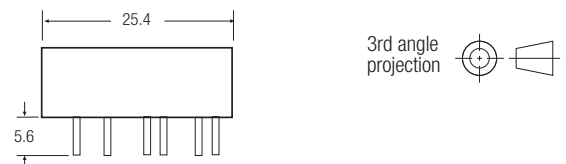
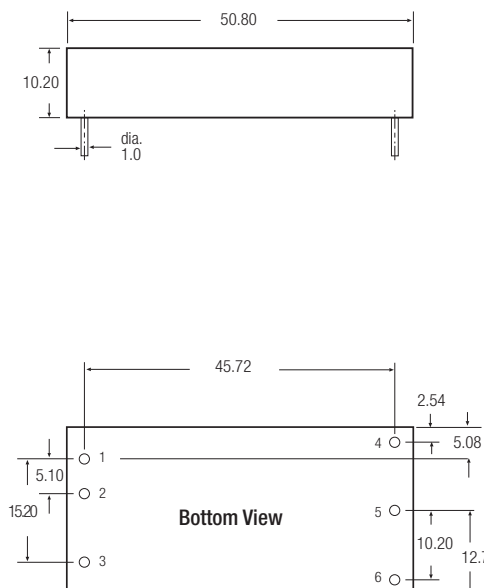
Specifications (typical at nominal input and 25°C unless otherwise noted)

Conducted Emissions (see Note 10)	EN55022		Class A
Radiated Emissions	EN55022		Class B
ESD	EN61000-4-2	Air ±8KV	Perf. Criteria A
	EN61000-4-2	Contact ±6KV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast Transient (see Note 9)	EN61000-4-4	±2KV	Perf. Criteria A
Surge (see Note 9)	EN61000-4-5	±1KV	Perf. Criteria A
Conducted Immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
Weight			30.5g
Packing Quantity	Refer to App Notes for tube dimensions		9 pcs per Tube
Dimensions			50.8 x 25.4 x 10.2mm
MTBF (see Note 2)	Belcore-TR-NWT-000332		3.163 x 10 ⁶ hours
	MIL-HDBK-217F		4.347 x 10 ⁵ hours

Notes :

- The RP30-S_DFW series does not require any minimum load.
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment)
MIL-HDBK-217F Notice2 @ TA= 25°C, Full load (Ground, Begign, controlled environment)
- Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
- Typical value at nominal input voltage and no load of standard type
Maximum value at nominal input voltage and full load of standard type.
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to negative input.
Positive logic ON/OFF is standard, no suffix (Ex. RP30-2405SFW)
Negative logic ON/OFF is marked with suffix-N (Ex. R320-2405SFW/N).
- Heat sink is optional and P/N: 7G-0020-C . Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- An external filter capacitor is required if the module has to meet EN61000-4-4,EN61000-4-5.
The filter capacitor RECOM suggest: 24Vin : Nippon chemi-con KY series, 330μF/50V, ESR 55mΩ.
48Vin : Nippon chemi-con KY series, 220μF/100V, ESR 48mΩ.
- Meets class A with external components shown below. See application notes for Class B common mode filter suggestion

Package Style and Pinning (mm)

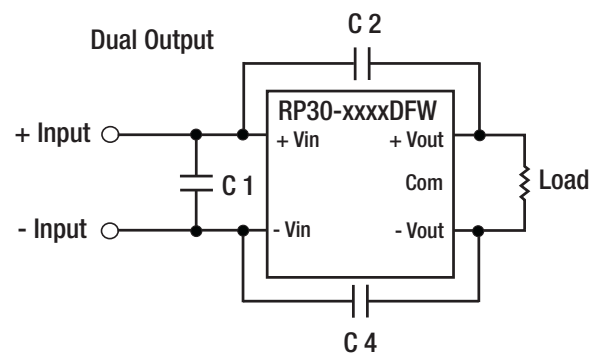
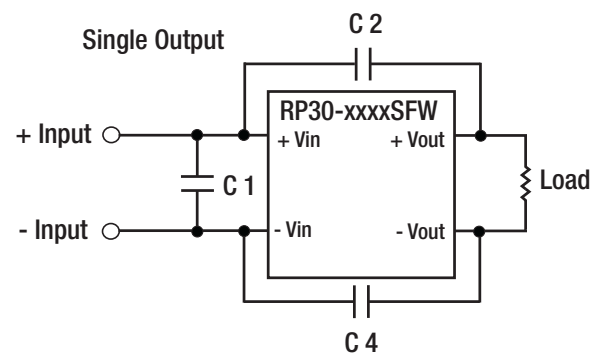


Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	+Vout	+Vout
5	-Vout	Com
6	Trim	-Vout

Pin Pitch Tolerance ±0.25 mm

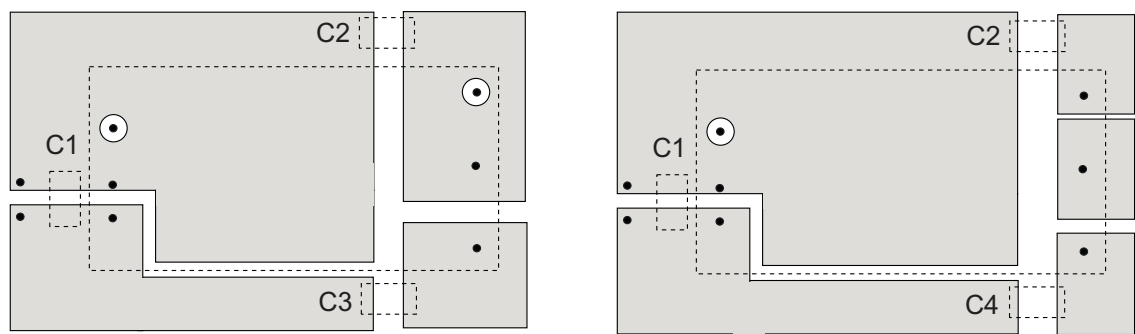
EMC Filtering - For Class A filter suggestion, see Application Notes



Single Output	C1	C2 & C3
RP30-24xxSFW	6.8µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-48xxSFW	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC

Dual Output	C1	C2 & C4
RP30-24xxDFW	6.8µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
RP30-48xxDFW	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC

Recommended EN55022 Class A Filter Circuit Layouts



External Output Trimming

Output can be externally trimmed by using the method shown below. See Application Notes for details.

RP30-FW

Features

- 2:1 Wide Input Voltage Range
- 40 Watts Output Power
- 1.6kVDC Isolation
- UL Certified
- Fixed Operating Frequency
- Six-Sided Continuous Shield
- Design Meet Safety Standard
- Standard 50.8 x 50.8 x 10.2mm Package
- Efficiency to 90 %
- Available as Power Module (RPM40-G)

Description

The RP40-G series DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required.

The industry standard 2" x 2" package meets military standards for thermal shock and vibration tolerance.

Selection Guide Single and Dual Outputs

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽⁴⁾ Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP40-123.3SG	9-18	3.3	8000	2750	84	21000µF
RP40-1205SG	9-18	5	8000	4065	86	13600µF
RP40-1212SG	9-18	12	3333	4065	86	2360µF
RP40-1215SG	9-18	15	2666	4015	87	1510µF
RP40-243.3SG	18-36	3.3	8000	1325	87	21000µF
RP40-2405SG	18-36	5	8000	1961	89	13600µF
RP40-2412SG	18-36	12	3333	2048	88	2360µF
RP40-2415SG	18-36	15	2666	1985	89	1510µF
RP40-483.3SG	36-75	3.3	8000	655	88	21000µF
RP40-4805SG	36-75	5	8000	969	90	13600µF
RP40-4812SG	36-75	12	3333	1000	89	2360µF
RP40-4815SG	36-75	15	2666	992	89	1510µF
RP40-1212DG	9-18	±12	±1800	4444	85	±1200µF
RP40-1215DG	9-18	±15	±1400	4321	85	±750µF
RP40-2412DG	18-36	±12	±1800	2169	87	±1200µF
RP40-2415DG	18-36	±15	±1400	2108	87	±750µF
RP40-4812DG	36-75	±12	±1800	1084	87	±1200µF
RP40-4815DG	36-75	±15	±1400	1054	87	±750µF
RP40-120512TG	9-18	5 / ±12	6000 / ±400	4024	86	6800µF/±330µF
RP40-120515TG	9-18	5 / ±15	6000 / ±300	3963	86	6800µF/±110µF
RP40-240512TG	18-36	5 / ±12	6000 / ±400	1989	87	6800µF/±330µF
RP40-240515TG	18-36	5 / ±15	6000 / ±300	1958	87	6800µF/±110µF
RP40-480512TG	36-75	5 / ±12	6000 / ±400	982	88	6800µF/±330µF
RP40-480515TG	36-75	5 / ±15	6000 / ±300	967	88	6800µF/±110µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add suffix **-HC** for premounted heatsink and clips

Ordering Examples

RP40-2405SG = 24V Input, 5V Output, Positive Logic CTRL pin.

RP20-4812DG-HC = 48V Input, ±12V Output, Positive Logic CTRL pin, Heatsink fitted

RP20-120512TG-HC = 24V Input, 5V and ±12V Outputs, Positive Logic CTRL pin, Heatsink fitted

Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part-number not shown here please contact our technical support service at info@recom-development.at

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

40 Watt Single, Dual & Triple Output

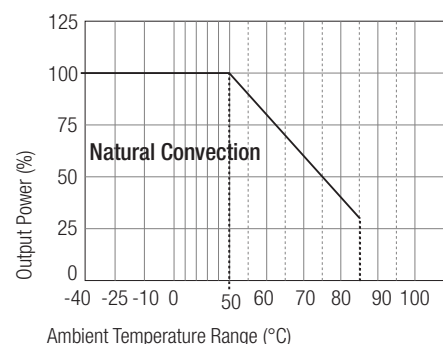


UL-60950-1 Certified
E196683

RP40-G

Derating-Graph (Ambient Temperature)

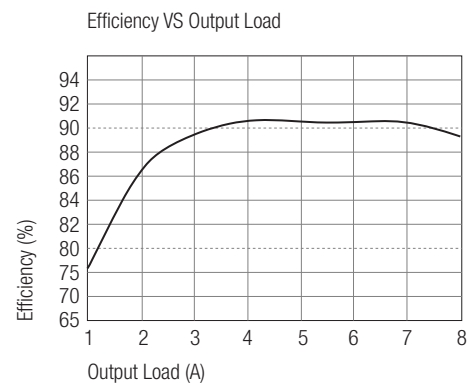
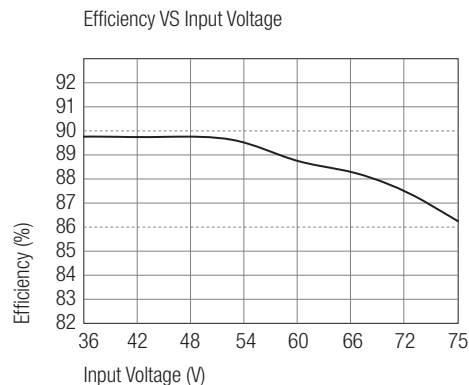
RP40-4805SG



Please Read Application Notes

Typical Characteristics

RP40-4805SG



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	12V input	DC-DC ON 9VDC
		DC-DC OFF 8VDC
	24V input	DC-DC ON 17.8VDC
		DC-DC OFF 16VDC
	48V input	DC-DC ON 36VDC
		DC-DC OFF 34VDC
Input Filter (see Note 13)		L-C Type
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)	5V/ms max
Input Surge Voltage (100 ms max.)	12V Input	36VDC
	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple (nominal Vin and full load see Note 3)		40mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)		25ms typ.
Remote ON/OFF (see Note 7) (Positive logic)	DC-DC ON	Open or 3.5V < Vr < 12V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2.5mA
Output Power		40W max.
Output Voltage Accuracy (full Load and nominal Vin)	Single & Dual	±1%
	Triple Main	±1%
	Auxiliary	±5%
Voltage Adjustability		±10%
Minimum Load	Single and Dual Positive	0%
	Dual and Triple	10% of full load
Line Regulation (low line, high line at full load)	Single & Dual	±0.5%
	Triple Main	±1%
	Triple Auxiliary	±5%
Load Regulation (10% to 100% full load see Note 9 and 10)	Single	±0.5%
	Dual	±1%
	Triple Main	±2%
	Auxiliary	±5%
Cross Regulation (Note 11) (Asymmetrical 25% <> 100% load)	Triple Main	±1%
	Dual / Triple Auxiliary	±5%

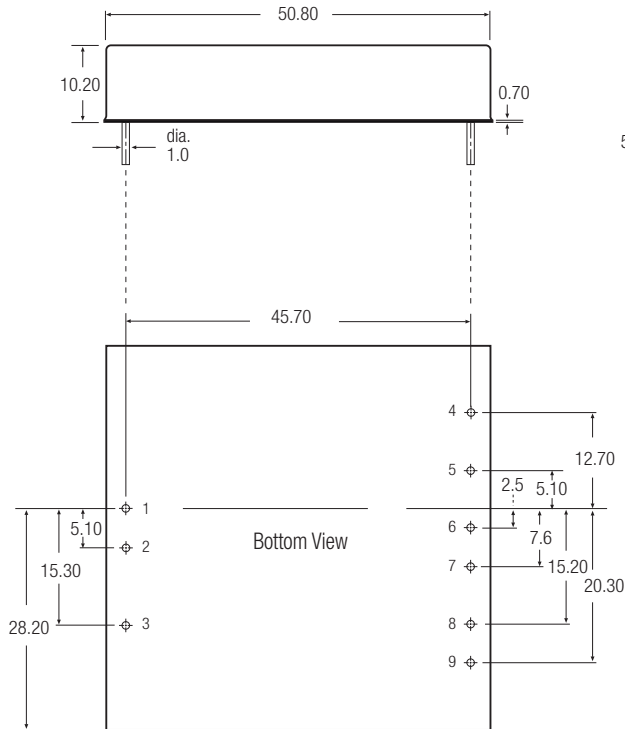
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Specifications (typical at nominal input and 25°C unless otherwise noted)

Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output) (Measured with a 1004pF/50V MLCC)	Single 3.3, 5V Single 12, 15V Dual 12V Dual 15V RP40-xxxxxxTG	50mVp-p 75mVp-p 120mVp-p 150mVp-p 50 / 75mVp-p
(see Note 12)		
Temperature Coefficient		±0.02%/°C max.
Transient Response (25% load step change)		300µs
Over Voltage Protection	3.3V	3.9V
Zener diode clamp (only single)	5V	6.2V
	12V	15V
	15V	18V
Over Load Protection (% of full load at nominal Vin)		150% max
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1000pF max.
Operating Frequency (see Note 14)		300kHz typ.
Approved to Safety Standards	Single, Triple Dual	UL 1950, EN60950 EN60950
Operating Temperature Range		-40°C to +85°C(with derating)
Maximum Case Temperature		100°C
Storage Temperature Range		-55°C to +125°C
Thermal Impedance (see Note 8)	Natural convection Heat Sink with 20LFM Heat Sink with 500LFM	9.2°C/Watt 8.5°C/Watt 2.8°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic FR4
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Note 16)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria B
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria B
Weight		60g
Packing Quantity	Refer to App Notes for tube dimensions	4 pcs per Tube
Dimensions		50.8 x 50.8 x 10.2mm
MTBF (see Note 2)		1398 x 10 ³ hours

Package Style and Pinning (mm)

3rd angle projection



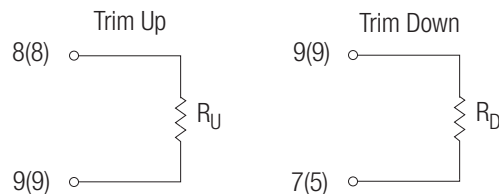
Pin Connections

Pin #	Single	Dual	Triple
1	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin
3	CTRL	CTRL	CTRL
4	NC	No Pin	+Aux
5	-Sense (Note1)	+Vout	Com
6	+Sense (Note1)	Com	-Aux
7	+Vout	Com	+Vout
8	-Vout	-Vout	-Vout(Com)
9	Trim	Trim	NC

NC = No Connection

Pin Pitch Tolerance ± 0.35 mm

Output can be externally trimmed by using the method shown below. () for dual output trim.
See Application Notes for more details



Notes :

- Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being used, the +Vsense should be connected to its corresponding +OUTPUT and likewise the sense should be connected to its corresponding -OUTPUT
- BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
- Simulated source impedance of 12 μ H. 12 μ H inductor in series with +Vin.
- Maximum value at nominal input voltage and full load of standard type.
- Typical value at nominal input voltage and full load.
- Test by minimum Vin and constant resistor load.
- The ON/OFF control pin voltage is referenced to negative input.
- Heat sink is optional and P/N: 7G-0026-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
- The triple output required a minimum 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
- Load regulation for triple output: Main output(V1):10 to 100% with 10% to 100% balanced on auxiliaries. Auxiliary outputs(V2 and V3):10% to 100% balanced on all outputs.
- Cross regulation for triple output: Main output 100% load, auxiliary 100%, other auxiliary 25% to 100%. Auxiliary outputs(V2 and V3):main output 100% load, auxiliary 100%, other auxiliary 25% to 100% or main output 25%, auxiliary 25%, other auxiliary 25% to 100%.
- The models of RP40-XX3.305DG are specified with a 1 μ F ceramic output capacitors.
- An external filter capacitor is required for normal operation. The capacitor should be capable of handling 1A ripple current for 48V/24V models. RECOM suggest: Nippon chemi-con KY series, 220 μ F/100V, ESR 90m Ω .
- Operating frequency for dual output: master (5Vo) 300KHz slave (3.3Vo) 500KHz.
- Any condition of dual output (3.3V/5V) rated lout current, not to exceed 8A of total output currents. The product safety approval pending.
- See application notes for Class B common mode filter suggestion

Features

Regulated Converters

- 4:1 Wide Input Voltage Range
- 40 Watts Regulated Output Power
- 1.6kVDC Isolation
- Over Current and Over Voltage Protection
- Six-Sided Shield
- No Derating to 55°C
- Standard 2" x 2" Package and Pinning
- Efficiency to 86 %
- Available as Power Module (RPM40-GW)

Description

The RP40-GW series wide input range DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2" x 2" package meets military standards for thermal shock and vibration tolerance.

Selection Guide 24V and 48V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(4,5) Current mA	Efficiency ⁽⁶⁾ %	Capacitive ⁽⁷⁾ Load max.
RP40-243.3SGW	9-36	3.3	10000	80/1677	86	25750µF
RP40-2405SGW	9-36	5	8000	100/2008	87	13600µF
RP40-2412SGW	9-36	12	3333	50/2008	87	2360µF
RP40-2415SGW	9-36	15	2666	50/2008	87	1510µF
RP40-483.3SGW	18-75	3.3	10000	60/838	86	25750µF
RP40-4805SGW	18-75	5	8000	65/992	88	13600µF
RP40-4812SGW	18-75	12	3333	30/1004	87	2360µF
RP40-4815SGW	18-75	15	2666	30/1004	87	1510µF
RP40-2412DGW	9-36	±12	±1667	60/2032	86	±1200µF
RP40-2415DGW	9-36	±15	±1333	70/2032	86	±750µF
RP40-4812DGW	18-75	±12	±1667	30/1016	86	±1200µF
RP40-4815DGW	18-75	±15	±1333	30/1016	86	±750µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

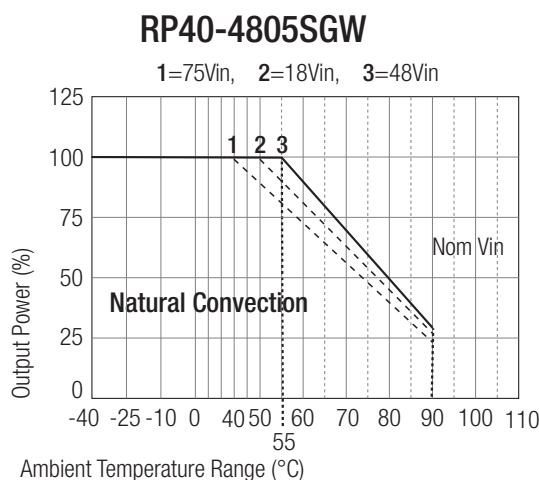
* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP40-2405SGW = 24V 4:1 Input, 5V Output, Positive Logic CTRL pin.

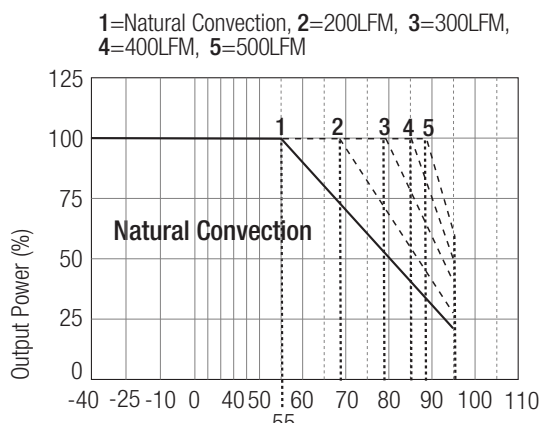
RP20-4812DGW/N-HC = 48V 4:1 Input, ±12V Output, Negative Logic CTRL pin, Heatsink fitted

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part number not shown here please contact our technical support service at info@recom-development.at

RP40-4805SGW with Heatsink



POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

40 Watt

2" x 2"

Single & Dual Output



UL-60950-1 Certified
E196683

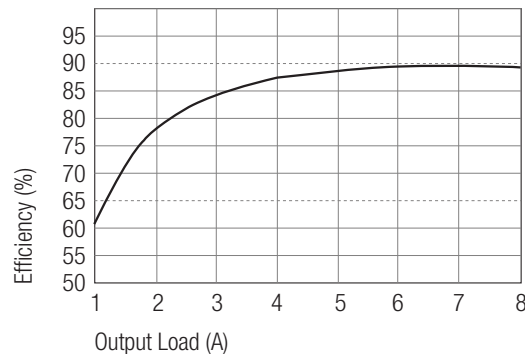
RP40-GW

Please Read Application Notes

Efficiency Graphs (25°C Ambient Temperature)

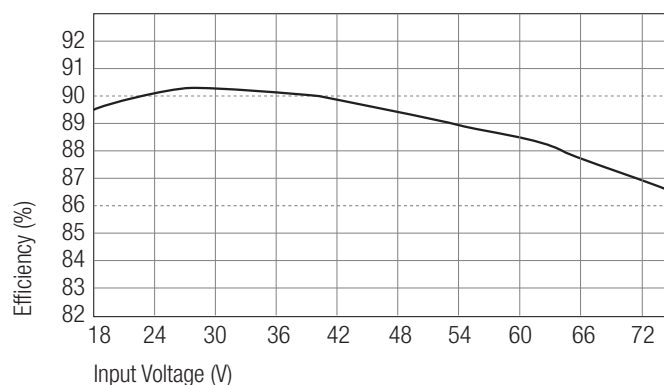
RP40-4805SGW

Efficiency VS Output Load



RP40-4805SGW

Efficiency VS Input Voltage



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input		9-36VDC
	48V nominal input		18-75VDC
Undervoltage Protection	24V Input	DC-DC ON = 9VDC, DC-DC OFF = 8VDC	
	48V Input	DC-DC ON = 18VDC, DC-DC OFF = 16VDC	
Input Filter			Pi Type
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)		5V/ms max
Input Surge Voltage (100 ms max.)	24V Input	50VDC	
	48V Input	100VDC	
Input Reflected Ripple (nominal Vin and full load)(see Note 3)			20mAp-p
Start Up Time (nominal Vin and constant resistive load)			20ms typ.
Remote ON/OFF (see Note 7)	(Positiv logic)	DC-DC ON	Open or $3V < V_r < 12V$
		DC-DC OFF	Short or $0V < V_r < 1.2V$
	(Negativ logic)	DC-DC ON	Short or $0V < V_r < 1.2V$
		DC-DC OFF	Open or $3V < V_r < 12V$
Remote OFF state input current	Nominal input		24Vin: 10mA
			48Vin: 5mA
Output Power			40W max.
Output Voltage Accuracy (full Load and nominal Vin)			±1%

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Specifications, cont. (typical at nominal input and 25°C unless otherwise noted)

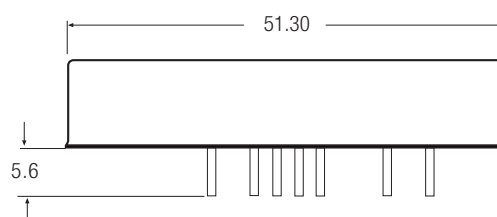
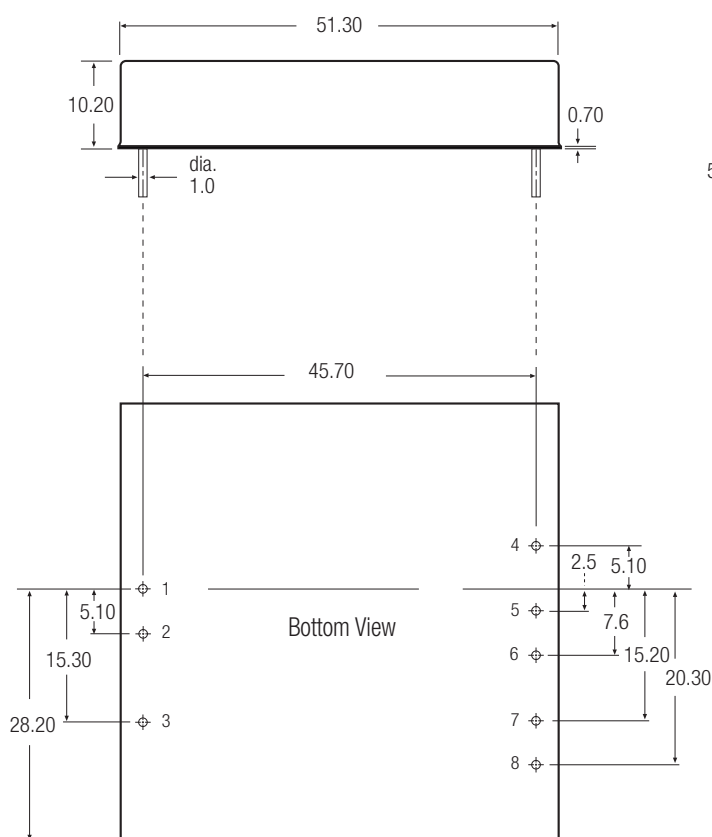
Voltage Adjustability (see Note 1)		±10%
Load Regulation (min. load to full load) (see Notes 9, 10)	Single	±0.5%
	Dual	±1%
Line Regulation (low line, high line at full load)		±0.2%
Cross Regulation (see Note 11)	Dual	±5%
Temperature Coefficient		±0.02%/°C max.
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	Single 3.3, 5V	50mVp-p
	Single 12, 15V	75mVp-p
	Dual 12V	120mVp-p
	Dual 15V	150mVp-p
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3 Vout	3.9V
Zener diode clamp (only single)	5 Vout	6.2V
	12 Vout / ±12 Vout	15V / ±15V
	15 Vout / ±15 Vout	18V / ±18V
Over Load Protection (% of full load at nominal Vin)		150% max.
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		2500pF max.
Operating Frequency		300kHz typ.
Operating Temperature Range		-40°C to +55°C(without derating)
		+55°C to +95°C(with derating)
Maximum Case Temperature		105°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		110°C typ.
Thermal Impedance (see Note 8)	Without Heat-Sink	9.2°C/Watt
	With Heat-Sink	7.6°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		RF4 PCB
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Notes 12, 13)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight		60g
Packing Quantity	Refer to App Notes for tube dimensions	4 pcs per Tube
Dimensions		50.8 x 50.8 x 10.2mm
MTBF (see Note 2)	Bellcore TR-NWT-000332	1105 x 10 ³ hours
	MIL-HDBK-217F	151 x 10 ³ hours

Notes :

1. For the single output: Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being used, the +sense should be connected to its corresponding +OUTPUT and likewise the -sense should be connected to its corresponding -OUTPUT.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C MIL-HDBK-217F Notice 2 @ Ta=25°C, full load (Ground Benign, controlled environment).
3. Simulated source impedance of 12μH. 12μH inductor in series with +Vin.
4. Maximum value at nominal input voltage and no load.
5. Typical value at nominal input voltage and full load.
6. Test by minimum Vin and constant resistive load.
7. The ON/OFF control function. There are positive logic (standard) and negative logic (option). The pin voltage is referenced to Vin- input. To order negative logic ON/OFF control add the suffix -N (Ex: RP40-4805SGW-N).
8. Heat sink is optional and P/N: 7G-0026-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. The dual output required a minimum loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
10. Load regulation for dual output : Min load to 100% load balanced on all outputs.
11. Cross regulation for dual output : asymmetrical load 25% <> 100% FL.
12. The RP40-GW series required external filter to meet EN55022 class A.
13. See application notes for Class B common mode filter suggestion

Package Style and Pinning (mm)

3rd angle projection



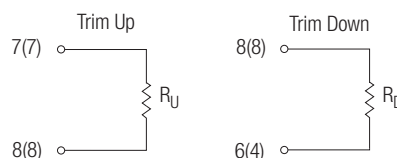
Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	-SENSE (Note 1)	+Vout
5	+SENSE (Note 2)	Com
6	+Vout	Com
7	-Vout	-Vout
8	TRIM	TRIM

Pin Pitch Tolerance ±0.25 mm

External Output Trimming

Output can be externally trimmed by using the method shown below. () for dual output tri.
See Application Notes for more details.



Features

Regulated Converters

- 60 Watts Regulated Output Power
- 2:1 Wide Input Voltage Range
- 1.6kVDC Isolation (Basic Insulation)
- Overload and Over Temperature Protection
- Six-Sided Shield
- No Derating to 40°C
- Standard 2" x 2" Package and Pinning
- Efficiency to 90 %
- Available as Power Module (RPM60-G)

Description

The RP60-G series DC/DC converters deliver 60W of power in an industry standard 2" x 2" package, which also meets military standards for thermal shock and vibration tolerance. Sense pins allow the output voltage at the point of load to be tightly regulated and automatically compensate for any voltage drops that may occur across any connections.

Selection Guide 24V and 48V Wide Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ^(5,4) Current mA	Efficiency ⁽⁵⁾ %	Capacitive ⁽⁶⁾ Load max.
RP60-243.3SG	18-36	3.3	14000	100/2264	89	36000µF
RP60-2405SG	18-36	5	12000	130/2941	90	20400µF
RP60-2412SG	18-36	12	5000	150/2907	90	3550µF
RP60-2415SG	18-36	15	4000	150/2907	90	2300µF
RP60-483.3SG	36-75	3.3	14000	80/1132	89	36000µF
RP60-4805SG	36-75	5	12000	90/1453	90	20400µF
RP60-4812SG	36-75	12	5000	100/1453	90	3550µF
RP60-4815SG	36-75	15	4000	100/1453	90	2300µF

* no suffix for CTRL function with Positive Logic (1=ON, 0=OFF), this is standard

* add /N for CTRL function with Negative Logic (0=ON, 1=OFF)

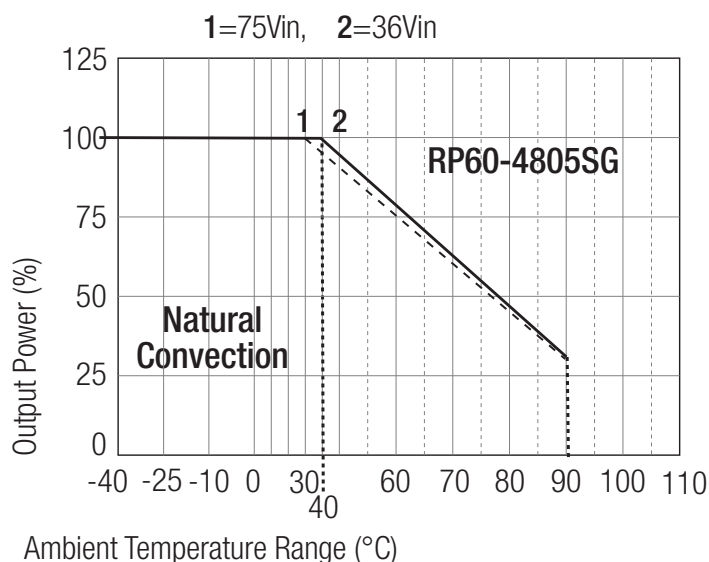
* add suffix -HC for premounted heatsink and clips

Ordering Examples

RP60-2405SG = 24V Input, 5V Output, Positive Logic CTRL pin.

RP20-4812SG/N-HC = 48V Input, 12V Output, Negative Logic CTRL pin, Heatsink fitted

Derating Graph (Ambient Temperature)



Derating graphs are valid only for the shown part numbers. If you need detailed derating information about a part number not shown here please contact our technical customer service at info@recom-development.at

POWERLINE

DC/DC-Converter

with 3 year Warranty

RECOM

60 Watt

2" x 2"

Single Output



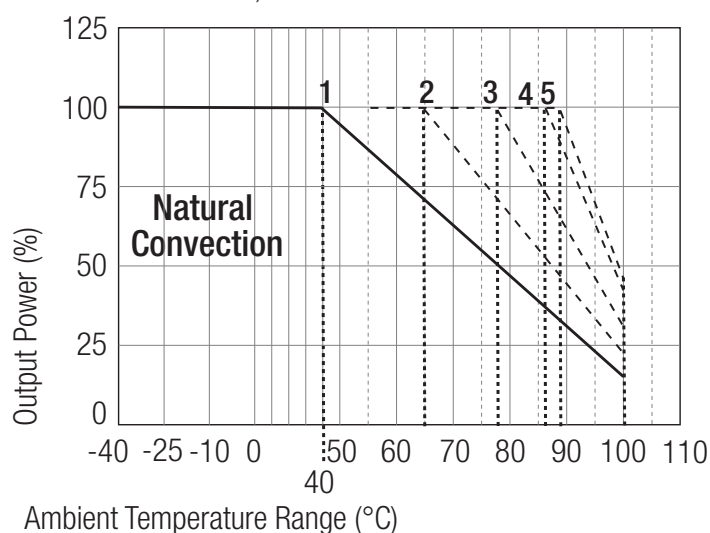
UL-60950-1 Certified
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RP60-G

Derating Graph (Ambient Temperature)

RP60-4805SG

1=Natural Convection, 2=200LFM, 3=300LFM,
4=400LFM, 5=500LFM



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input		18-36VDC
	48V nominal input		36-75VDC
Undervoltage Protection	24V Input	DC-DC ON = 17VDC, DC-DC OFF = 15VDC	
	48V Input	DC-DC ON = 34VDC, DC-DC OFF = 32VDC	
Input Filter			Pi Type
Input Voltage Variation dv/dt	(Complies with ETS300 132 part 4.4)		5V/ms max
Input Surge Voltage (100 ms max.)	24V Input	50VDC	
	48V Input	100VDC	
Input Reflected Ripple (nominal Vin and full load)(see Note 3)			20mA _{p-p}
Start Up Time (nominal Vin and constant resistor load)			20ms max.
Remote ON/OFF (see Note 7)	Positive logic - Standard	DC-DC ON	Open or 3V < Vr < 12V
		DC-DC OFF	Short or 0V < Vr < 1.2V
	Negative logic - /N Option	DC-DC ON	Short or 0V < Vr < 1.2V
		DC-DC OFF	Open or 3V < Vr < 12V
Remote Pin Drive Current	Nominal Vin		-0.5 -1.0mA
Remote OFF input current	Nominal Vin		4mA
Output Power			60W max.
Output Voltage Accuracy (full Load and nominal Vin)			±1%

continued on next page

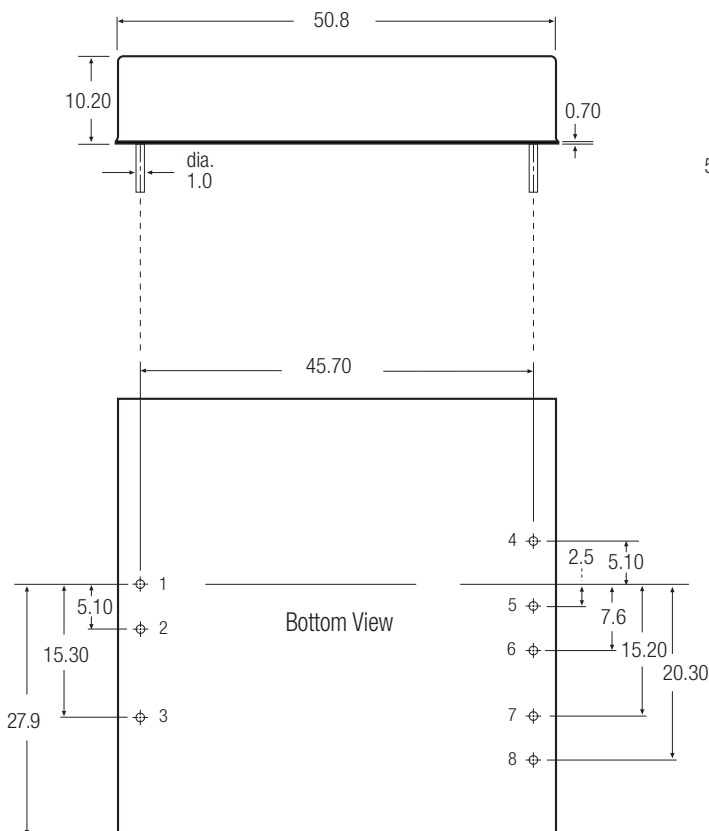
Specifications, cont. (typical at nominal input and 25°C unless otherwise noted)

Voltage Adjustability (see Note 1)		±10%
Line Regulation	LL to HL at Full Load	±0.2%
Load Regulation (see Note 3)	0% to 100% Load	±0.5%
Temperature Coefficient		±0.02%/°C max.
Ripple and Noise (20MHz bandwidth, with 1µF MLCC on output)	3.3,5V 12,15V	75mVp-p 100mVp-p
Transient Response (25% load step change)		250µs
Over Voltage Protection	3.3 Vout	3.7-5.4V
Zener diode clamp (only single)	5 Vout	5.6-7.0V
	12 Vout	13.7-17.5V
	15 Vout	16.8-20.5V
Over Load Protection (% of full load at nominal Vin)		150% max.
Undervoltage Lockout		See Application Notes
Short Circuit Protection		Hiccup, automatic recovery
Efficiency		see „Selection Guide“ table
Isolation Voltage (rated for one minute)		1600VDC
Isolation Resistance		1 GΩ min.
Isolation Capacitance		1500pF max.
Operating Frequency		300kHz typ.
Designed to meet Safety Standards		IEC60950-1, UL60950-1, EN60950-1
Operating Temperature Range		-40°C to +40°C(without derating) -40°C to +100°C(with derating)
Maximum Case Temperature		110°C
Storage Temperature Range		-55°C to +125°C
Over Temperature Protection		120°C typ.
Thermal Impedance (see Note 11)	Without Heat-Sink With Heat-Sink	10.5°C/Watt 8.4°C/Watt
Thermal Shock		MIL-STD-810D
Vibration		10-55Hz, 10G, 30 Min. along X, Y and Z
Relative Humidity		5% to 95% RH
Case Material		Nickel plated copper
Base Material		Non-conductive black plastic FR4
Potting Material		Epoxy (UL94-V0)
Conducted Emissions (see Notes 9, 10)	EN55022	Class A
Radiated Emissions	EN55022	Class A
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria B
Surge	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Weight		60g
Packing Quantity	Refer to App Notes for tube dimensions	4 pcs per Tube
Dimensions		50.8 x 50.8 x 10.2mm
MTBF (see Note 2)	Belcore TR-NWT-00332	1093 x 10 ³ hours
	MIL-STD-217F	1096 x 10 ³ hours

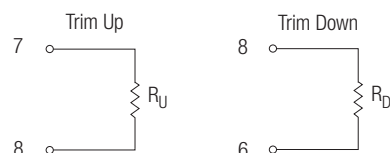
Notes :

1. Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being used, the +sense should be connected to its corresponding +OUTPUT and likewise the -sense should be connected to its corresponding -OUTPUT.
2. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment).
3. No minimum loading on the output is required to maintain specified regulation. Operation under no-load condition will not damage these devices
4. Maximum value at nominal input voltage and no load.
5. Typical value at nominal input voltage and full load.
6. Test by minimum V_{in} and constant resistive load.
7. The ON/OFF control pin voltage is referenced to the negative input (-Vin).
- To order negative logic ON/OFF control add the suffix-N (Example: RP60-4805SG-N).
8. Heat sink is optional and P/N: 7G-0026-C. Powerline DC/DC Converters can be ordered with pre-mounted heatsinks including antivibration fixing clips (add suffix -HC). See Application Notes for heatsink details.
9. The RP60-SG series meets EN55022 Class A with an external capacitor across the input pins (24Vin:6.8μF/50V MLCC, 48Vin:2x2,2μF/100V MLCC)
10. See application notes for Class B common mode filter suggestion.
11. Vertical orientation and natural convection.

Package Style and Pinning (mm)



Output can be externally trimmed by using the method shown below.
See Application Notes for more details.



Features

- DC/DC Power Module
- 15W to 40W with 4:1 inputs, 60W with 2:1
- Screw Terminal Connections
- Class B EMC Filter built-in
- Input Fuse
- Reverse Polarity Protected
- Inrush Current Limiting (Soft Start)
- Output Trim Potentiometer
- Output LED Indicator
- DIN Rail Mounting or Panel Mount Options

Description

The Recom Power Module takes a standard 15W-60W converter and mounts it on a PCB with screw terminals, an EMC filter, input protection circuitry and a built-in heatsink to offer a complete power module that can be mounted on a bulkhead or on a standard DIN rail. The Power Module is primarily designed for transport applications such as a GPS vehicle tracking power supply or a radio communications power supply, but will also find many uses in industrial, communications or battery-powered applications.

How to use this datasheet:

1. Select the converter that suits your application from the converter series list below

2. Decide on DIN Mount (RPMD) or bulkhead (RPM) version

Ordering example: 40W, 18-75 VDC in, single 12V out, DIN Mount = RPMD40-4812SGW

Selection Guide Single and Dual Outputs - Panel Mount Version

Power Module Part Number (Bulkhead Version)	Input Range VDC	Output Power Watts	Internal Fuse (Replaceable)	Converter Series
RPM15-24xxS_DFW**	9.5-36	15	F4A	RP15-24xxS_DFW
RPM15-48xxS_DFW**	18-75	15	F4A	RP15-48xxS_DFW
RPM20-24xxS_DFW**	9.5-36	20	F4A	RP20-24xxS_DFW
RPM20-48xxS_DFW**	18-75	20	F4A	RP20-48xxS_DFW
RPM30-24xxS_DEW**	10-40	30	F6A	RP30-24xxS_DEW
RPM30-48xxS_DEW**	18-75	30	F4A	RP30-48xxS_DGW
RPM40-48xxS_DGW**	18-75	40	F4A	RP40-48xxS_DGW
RPM60-24xxSG**	18-36	60	F8A	RP60-24xxSG
RPM60-48xxSG**	36-75	60	F4A	RP60-48xxSG

** add /P or /N for Positive or Negative CTRL logic

Selection Guide Single and Dual Outputs - DIN Rail Version

Power Module Part Number (DIN rail Version)	Input Range VDC	Output Power Watts	Internal Fuse (Replaceable)	Converter Series
RPMD15-24xxS_DFW**	9.5-36	15	F4A	RP15-24xxS_DFW
RPMD15-48xxS_DFW**	18-75	15	F4A	RP15-48xxS_DFW
RPMD20-24xxS_DFW**	9.5-36	20	F4A	RP20-24xxS_DFW
RPMD20-48xxS_DFW**	18-75	20	F4A	RP20-48xxS_DFW
RPMD30-24xxS_DEW**	10-40	30	F6A	RP30-24xxS_DEW
RPMD30-48xxS_DEW**	18-75	30	F4A	RP30-48xxS_DEW
RPMD40-24xxS_DGW**	9.5-36	40	F4A	RP40-24xxS_DGW
RPMD40-48xxS_DGW**	18-75	40	F4A	RP40-48xxS_DGW
RPMD60-24xxSG**	18-36	60	F8A	RP60-24xxSG
RPMD60-48xxSG**	36-75	60	F4A	RP60-48xxSG

** add /P or /N for Positive or Negative CTRL logic

Specifications (typical at nominal input and 25°C unless otherwise noted)

Specifications are as in individual converter datasheets with the following exceptions:
(move to top of next page)

POWERLINE

DC/DC-Converter
Power Module

with 3 year Warranty

RECOM

15-60 Watt

Single

& Dual

Outputs



EN-60950-1 Certified
CE Marked

Power Modules

xx = Output Voltage Options

Single Outputs:

3.3S = 3.3V

05S = 5V

12S = 12V

15S = 15V

Dual Outputs:

12D = ±12V

15D = ±15V

Refer to converter series datasheets for detailed information.

Please Read Application Notes

Bulkhead Version

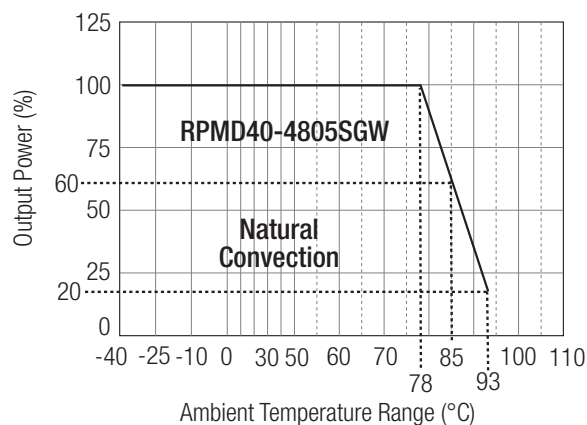
Input Voltage Range	see selection guide	
Inrush current	Nominal Vin and Full Load	soft start
Startup time	Power up: Nominal Vin and Full Load CTRL pin: Nominal Vin and Full Load	100ms typ. 20ms typ.
Thermal impedance	8.5°C/W	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria A
Surge	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Chassis Material	Aluminium	
Connectors	Screw Terminal	
Weight	134g	
Packing Quantity	1 pc.	
Dimensions	101.6 x 57.15 x 19.0mm	
Certifications	LVD20110124	EN-60950-1:2006 + A11:2009 + A1:2010

DIN-Rail Version

Input Voltage Range	see selection guide	
Inrush current	Nominal Vin and Full Load	<15A
Startup time	Power up: Nominal Vin and Full Load CTRL pin: Nominal Vin and Full Load	100ms typ. 20ms typ.
Thermal impedance	4.2°C/W	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria A
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient	EN61000-4-4	Perf. Criteria A
Surge	EN61000-4-5	Perf. Criteria A
Conducted Immunity	EN61000-4-6	Perf. Criteria A
Chassis Material	Aluminium	
Connectors	Screw Terminal	
Weight	182g	
Packing Quantity	30 pcs.	
Dimensions	125.0 x 57.6 x 24.5mm	
Certifications	LVD20110124	EN-60950-1:2006 + A11:2009 + A1:2010

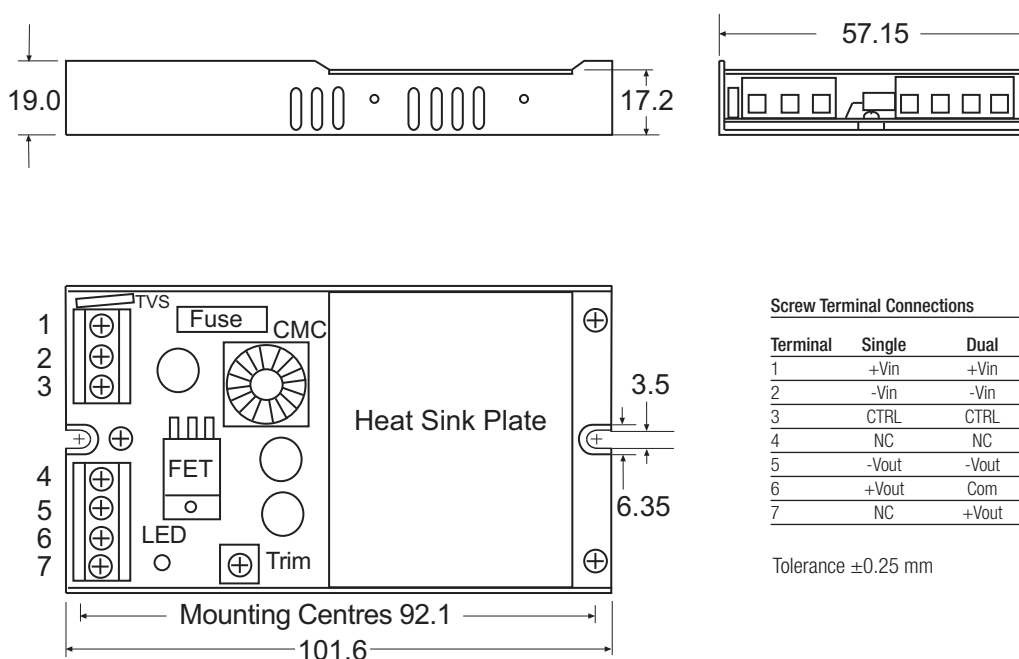
Derating Graph (Ambient Temperature) - DIN Rail version

Derating graphs are valid only for the shown part numbers.
If you need detailed derating information about a part number not shown here please contact our technical customer service at info@recom-development.at



Package Style and Connections

Panel Mount Version

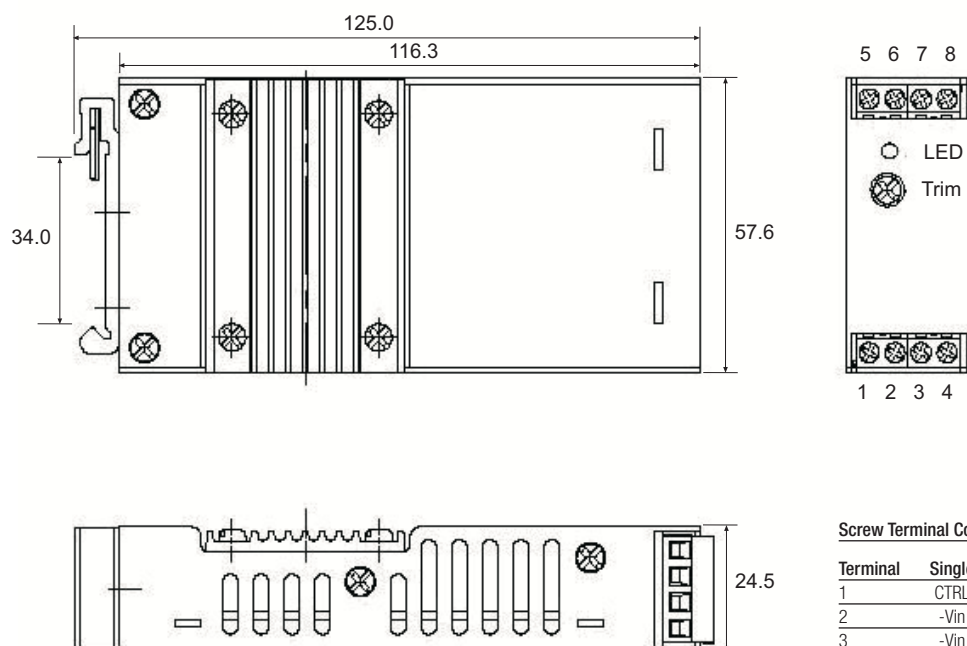


Screw Terminal Connections

Terminal	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	NC	NC
5	-Vout	-Vout
6	+Vout	Com
7	NC	+Vout

Tolerance ± 0.25 mm

DIN Rail Version



Screw Terminal Connections

Terminal	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3	-Vin	-Vin
4	+Vin	+Vin
5	NC	NC
6	-Vout	-Vout
7	+Vout	Com
8	NC	+Vout

Tolerance ± 0.5 mm

POWERLINE PLUS - CONTENTS

The POWERLINE PLUS uses ICE Technology. A combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters. RECOM - Green high-efficiency power solutions. SAVE ENERGY. NOW.



Introduction

The RPP series 2:1 and 4:1 input range DC/DC converters are ideal for high end industrial applications and COTS (Commercial Off-The-Shelf) Military applications where a high ambient operating temperature converter is required.

The converters series feature ICE Technology, a revolutionary method of extending the temperature range without increasing the converter dimensions over standard converters. The built-in aluminium heat sink ensures optimum heat transfer to ambient.

Although the case size is compact, the converters contain a built-in EN55022 Class B / FCC Level B filter without the need for any external components.

All RPP series converters are fully protected with undervoltage lockout protection, overload, overcurrent and overvoltage protection, short circuit current limiting and overtemperature shutdown.

In addition, the converters have a quiescent current that is an order of magnitude lower than equivalent power converters.

Regulated DC/DC Converters

Series (**)	Isolation (kVDC)	Power (Watts)	Input Voltages (VDC)	Output Voltages (VDC)	Case Options	Outputs	Page No.
RPP20	2	20	9-18, 18-36, 36-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP1
RPP20 (W)	2	20	9-36, 18-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP7
RPP30	2	30	9-18, 18-36, 36-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP13
RPP30 (W)	2	30	10-40, 18-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP19
RPP40	2	40	10-40, 18-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP25
RPP40 (W)	2	40	10-40, 18-75	3.3, 5, 12, 15, 24 $\pm 12, \pm 15, \pm 24$	Ribbed & Baseplate	Single and Dual	PP31
RPP50	2	50	18-36, 36-75	3.3, 5, 12, 15, 24	Ribbed & Baseplate	Single	PP37
App Notes							PP43

Features

ICE Technology*

- Up to 100°C Ambient with no derating
- +120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 2:1 Input Voltage Range
- Six Sided Shielded Enclosure
- Ribbed or Baseplate Case Styles
- Efficiency to >90%
- 2kVDC Isolation
- Low Quiescent Current

Description

The RPP20 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is very compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP20 is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Operating Temp
RPP20-123.3S**	9-18	3.3	6000	71/1860	88.8%	96°C
RPP20-1205S**	9-18	5	4000	57/1850	90.2%	99°C
RPP20-1212S**	9-18	12	1666	26/1890	88.0%	94°C
RPP20-1215S**	9-18	15	1333	24/1880	88.8%	96°C
RPP20-1224S**	9-18	24	830	24/1880	88.8%	96°C
RPP20-243.3S**	18-36	3.3	6000	40/930	88.7%	96°C
RPP20-2405S**	18-36	5	4000	57/920	90.4%	99°C
RPP20-2412S**	18-36	12	1666	15/930	90.2%	99°C
RPP20-2415S**	18-36	15	1333	16/930	90.3%	99°C
RPP20-2424S**	18-36	24	830	16/930	90.3%	99°C
RPP20-483.3S**	36-75	3.3	6000	23/458	90.7%	99°C
RPP20-4805S**	36-75	5	4000	23/458	90.8%	100°C
RPP20-4812S**	36-75	12	1666	10/469	88.8%	96°C
RPP20-4815S**	36-75	15	1333	10/462	90.2%	99°C
RPP20-4824S**	36-75	24	830	10/462	90.2%	99°C
RPP20-1212D**	9-18	±12	±833	24/1900	89.7%	98°C
RPP20-1215D**	9-18	±15	±666	27/1840	90.4%	99°C
RPP20-1224D**	9-18	±24	±416	27/1840	90.4%	99°C
RPP20-2412D**	18-36	±12	±833	17/950	88.9%	96°C
RPP20-2415D**	18-36	±15	±666	18/910	90.1%	99°C
RPP20-2424D**	18-36	±24	±416	34/940	89.0%	96°C
RPP20-4812D**	36-75	±12	±833	10/469	89.0%	96°C
RPP20-4815D**	36-75	±15	±666	12/458	89.7%	98°C
RPP20-4824D**	36-75	±24	±416	21/479	87.5%	94°C

** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

**SUFFIX INFORMATION

none = Standard Ribbed Case
-B = Baseplate Case

Derating graphs are valid only for the shown part number.
Please contact Technical Support for more information:
info@recom-development.at

POWERLINE+

DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

2:1 Single & Dual Output

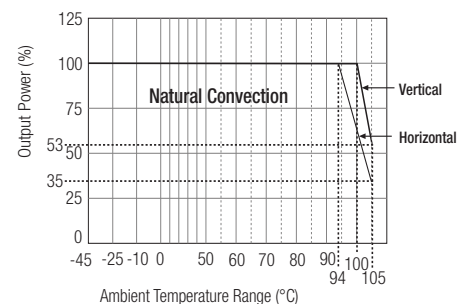


UL-60950-1 Certified
E224736

RPP20

Derating Graph (Ambient Temperature)

RPP20-4805S



* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	12V input	DC-DC ON (min.) 8.5VDC
		DC-DC OFF (max.) 8VDC
	24V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
	48V input	DC-DC ON (min.) 35VDC
		DC-DC OFF (max.) 34VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	12V, 24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	20mA _{p-p}
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	20W max.	
Output Voltage Accuracy	50% Load and nominal Vin	±1.5%
Voltage Adjustability	Single Output only	±10%
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Cross Regulation (10% <= 100% Load)	Dual Outputs only	3% typ. / 5% max.
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across outputs)	3.3V, ±24V	75mV-100mV _{p-p} typ.
	All others	40mV-60mV _{p-p} typ.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	800µs
Over Load Protection	% of full load at nominal Vin	120% min.
Short Circuit Protection	Power Limit, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 1600VDC/1 minute, Flash tested at 2000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	1500pF max.	
Operating Frequency	260kHz ± 40kHz	
Operating Temperature Range	Ambient, Free Convection	-45°C to +100°C (without derating)
		-45°C to +105°C (with derating)
Maximum Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	
Thermal Impedance (Natural convection)	Ribbed Case: Vertical	7.5°C/Watt
	Ribbed Case: Horizontal	11.5°C/Watt
Relative Humidity	5% to 95% RH	
Case Material ⁽⁷⁾	Aluminium	
Potting Material	Silicone (UL94-V0)	

cont.

Specifications (cont.)

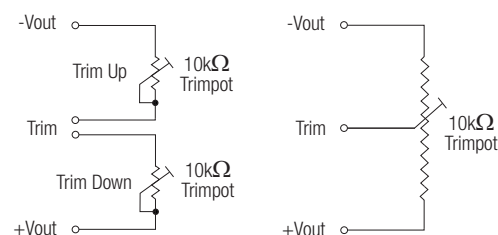
Weight	Ribbed Case	26g
	Baseplate Case	43g
Packing Quantity	Ribbed Case	5 pcs per Tube
	Baseplate Case	Single packed
Safety Standards	certified UL-60950-1, 1st Edition	
Thermal Cycling	complies with MIL-STD-810F	
Vibration	10-55Hz, 12G, 30 Min. along X, Y and Z	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		2195 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation.
For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPP20-2405S, RPP20-4805D-B.
Pos. logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the bottom plate is pressed firmly into place into the aluminium case. The hydraulic press can leave tooling marks and deformations to both the case and plate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

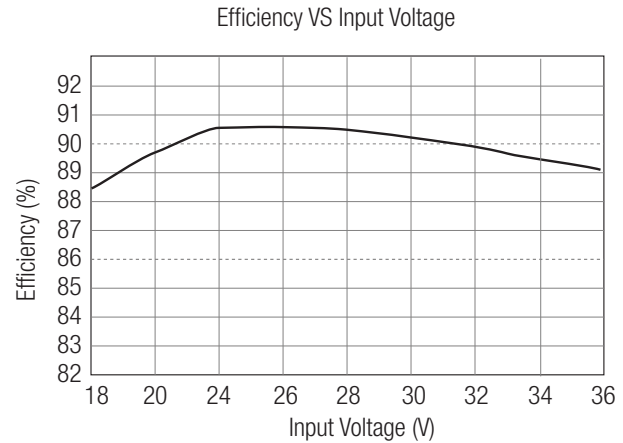
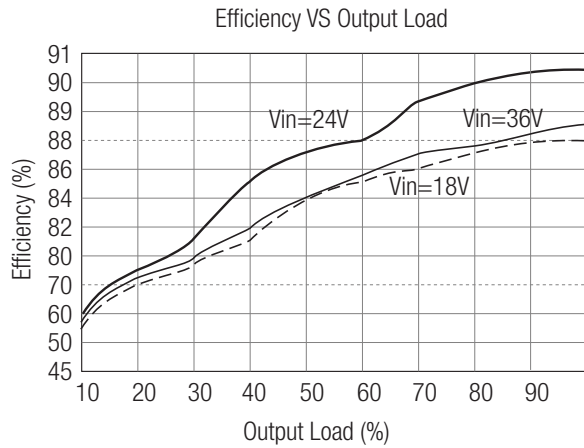
External Output Trimming

Refer To Application Notes for recommended resistor Values



Typical Characteristics

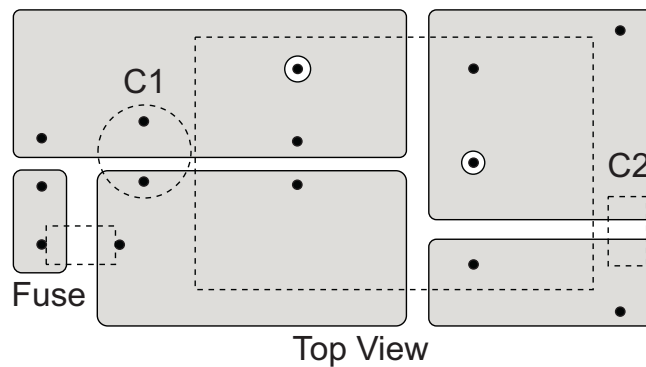
RPP20-2405S



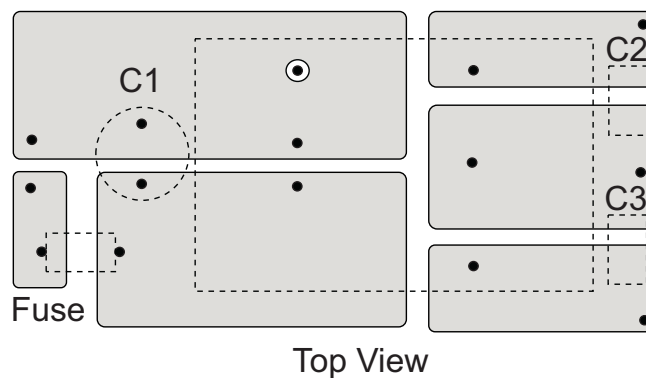
Recommended PCB Layout

Ribbed Case

Single Output



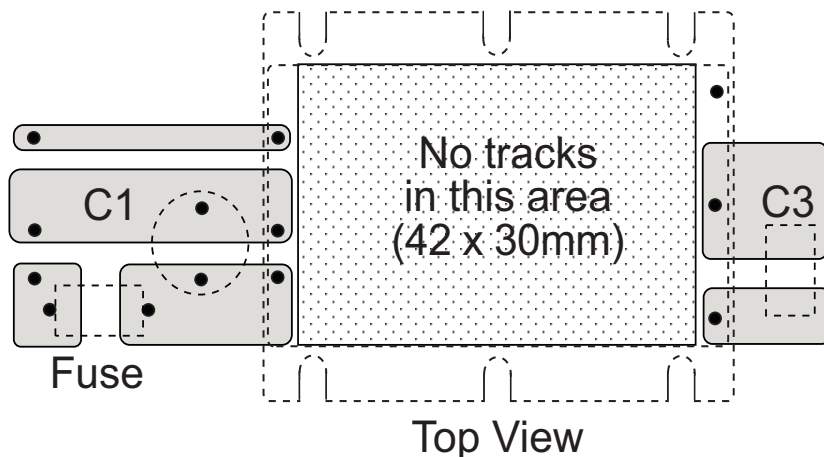
Dual Output



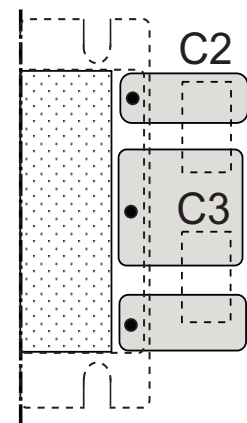
Recommended PCB Layout

Baseplate Case- suggested PCB layout

Single Output



Dual Output



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

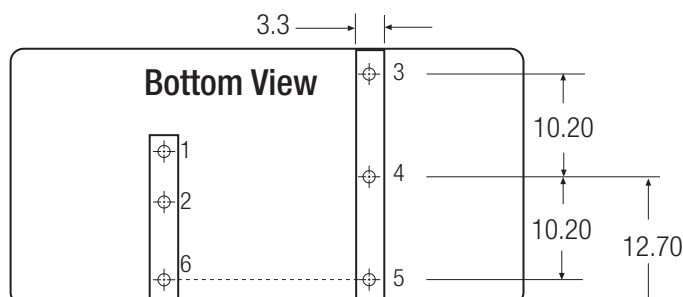
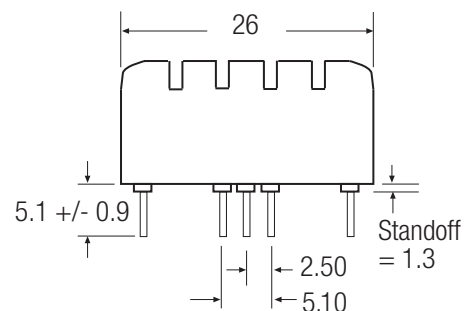
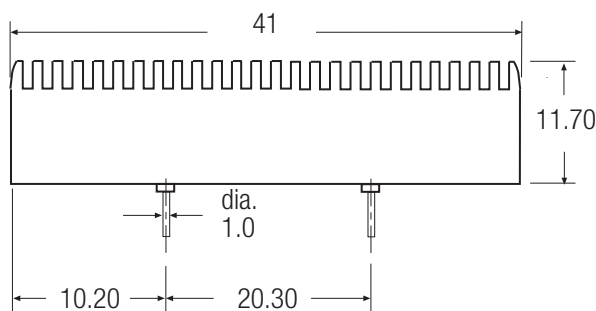
Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no suffix)

3rd angle projection



Pin Connections

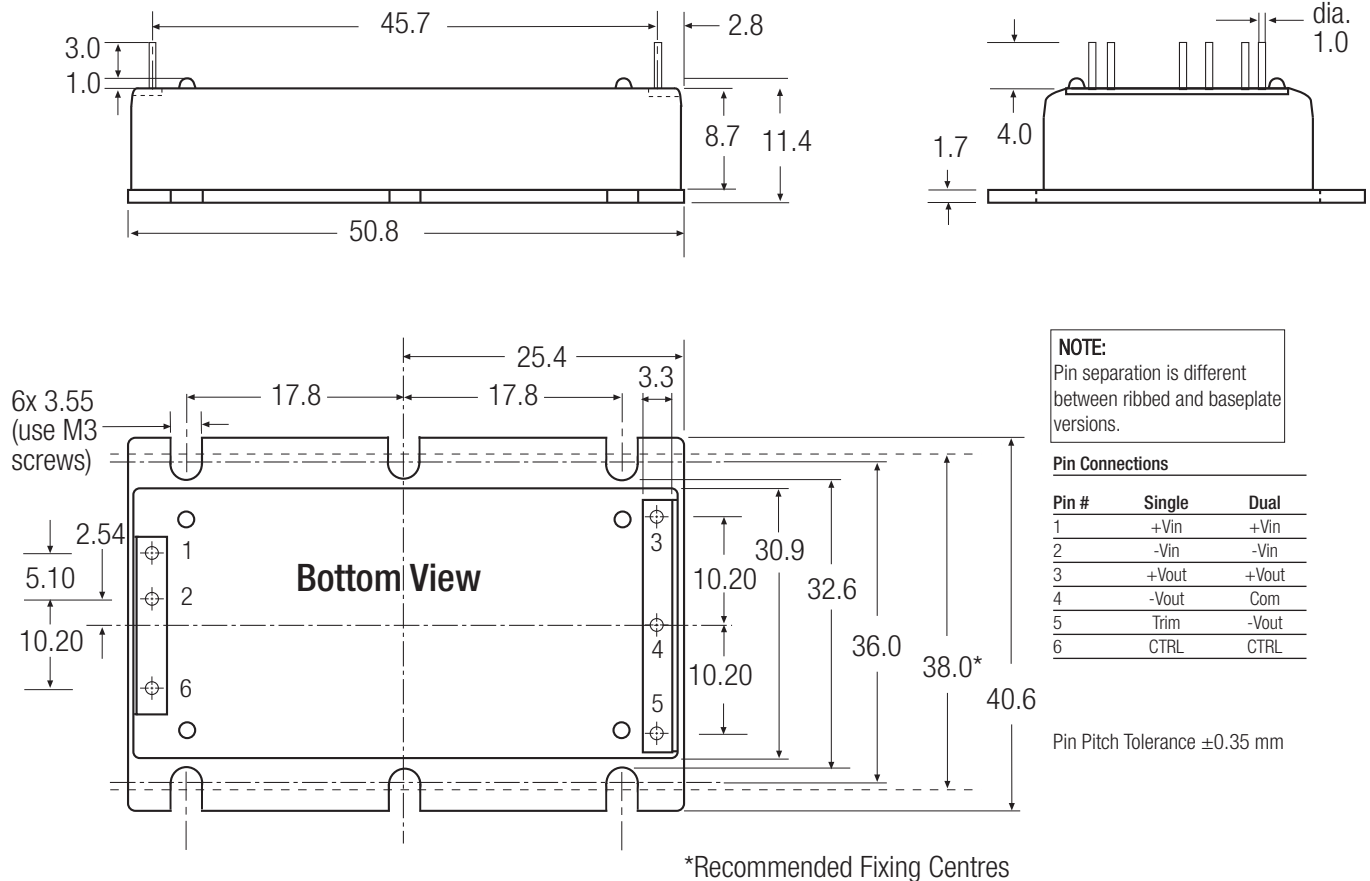
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Com
5	-Vout	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

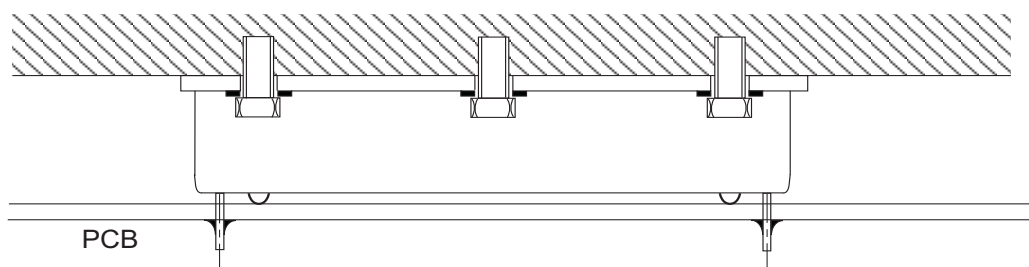
Package Style and Pinning (mm)

Baseplate Case (-B suffix)

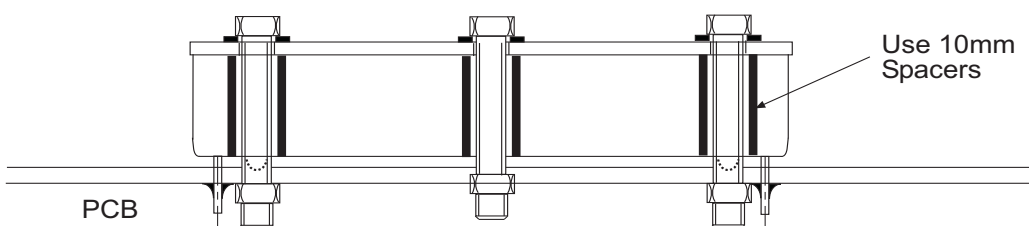
3rd angle projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 97°C Ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- UL Certified
- Built-in FCC/EN55022 Class B Filter
- 4:1 Wide Input Voltage Range
- Six Sided Shielded Enclosure
- Ribbed or Baseplate Case Styles
- Efficiency to >89%
- 2kVDC Isolation
- Low Quiescent Current

Description

The RPP20-W series 4:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP20-W is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 24V and 48V 4:1 Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Operating Temp
RPP20-243.3SW**	9-36	3.3	6000	59/955	87.2%	93°C
RPP20-2405SW**	9-36	5	4000	65/946	88.1%	95°C
RPP20-2412SW**	9-36	12	1666	23/946	88.1%	95°C
RPP20-2415SW**	9-36	15	1333	25/931	89.5%	97°C
RPP20-2424SW**	9-36	24	830	25/931	89.5%	97°C
RPP20-483.3SW**	18-75	3.3	6000	28/465	89.6%	97°C
RPP20-4805SW**	18-75	5	4000	33/465	89.6%	97°C
RPP20-4812SW**	18-75	12	1666	13/470	88.6%	96°C
RPP20-4815SW**	18-75	15	1333	12/466	89.3%	97°C
RPP20-4824SW**	18-75	24	830	12/466	89.3%	97°C
RPP20-2412DW**	9-36	±12	±833	28/930	89.6%	97°C
RPP20-2415DW**	9-36	±15	±666	24/946	88.0%	95°C
RPP20-2424DW**	9-36	±24	±416	24/946	88.0%	95°C
RPP20-4812DW**	18-75	±12	±833	16/472	88.2%	95°C
RPP20-4815DW**	18-75	±15	±666	13/466	89.4%	97°C
RPP20-4824DW**	18-75	±24	±416	13/466	89.4%	97°C

** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

SUFFIX INFORMATION

none = Standard Ribbed Case

-B = Baseplate Case

Derating graphs are valid only for the shown part number.

Please contact Technical Support for more information:

info@recom-development.at

POWERLINE+

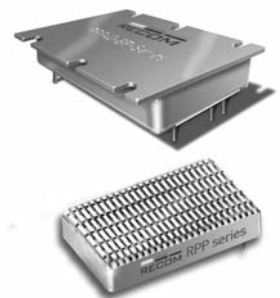
DC/DC-Converter

with 3 year Warranty

RECOM

20 Watt

4:1 Single & Dual Output

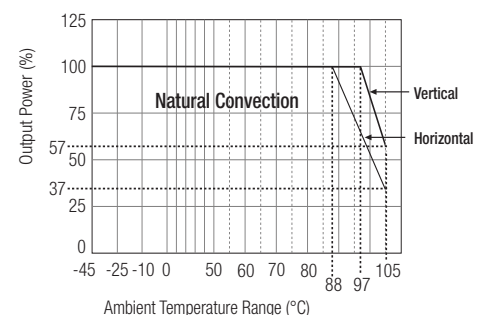


UL-60950-1 Certified
E224736

RPP20-W

Derating Graph (Ambient Temperature)

RPP20-2405SW



* ICE Technology

ICE (Innovation in Converter Excellence)

uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Under Voltage Lockout	24V input	DC-DC ON (min.) 8.5VDC
		DC-DC OFF (max.) 8VDC
	48V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	20mA _{p-p}
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	20W max.	
Output Voltage Accuracy	50% Load and nominal Vin	±1.5%
Voltage Adjustability	Single Output only	±5%
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Cross Regulation (10% <> 100% Load)	Dual Outputs only	3% typ. / 5% max.
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across outputs)	3.3V	100mV _{p-p} typ.
	All others	40mV-75mV _{p-p} typ.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	800µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Power Limit, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 1600VDC/1 minute, Flash tested at 2000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	1500pF max.	
Operating Frequency	260kHz ± 40kHz	
Operating Temperature Range	Ambient, Free Convection	-45°C to +97°C (without derating)
		-45°C to +105°C (with derating)
Maximum Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	
Thermal Impedance (Natural convection)	Ribbed Case: Vertical	7.5°C/Watt
	Ribbed Case: Horizontal	11.5°C/Watt
Relative Humidity	5% to 95% RH	
Case Material ⁽⁷⁾	Aluminium	
Potting Material	Silicone (UL94-V0)	

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

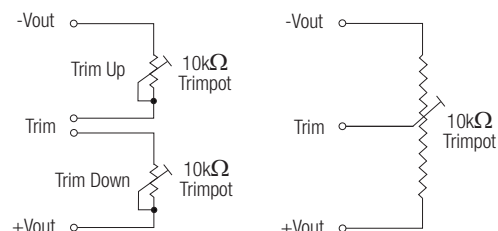
Weight	Ribbed Case	26g
	Baseplate Case	43g
Packing Quantity	Ribbed Case	5 pcs per Tube
	Baseplate Case	Single packed
Safety Standards	certified UL-60950-1, 1st Edition	
Thermal Cycling	complies with MIL-STD-810F	
Vibration	10-55Hz, 12G, 30 Min. along X, Y and Z	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		2195 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation.
For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPP20-2405SW, RPP20-4805DW-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

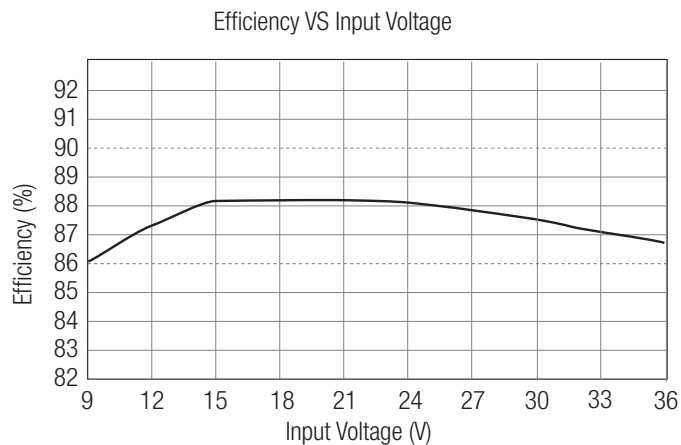
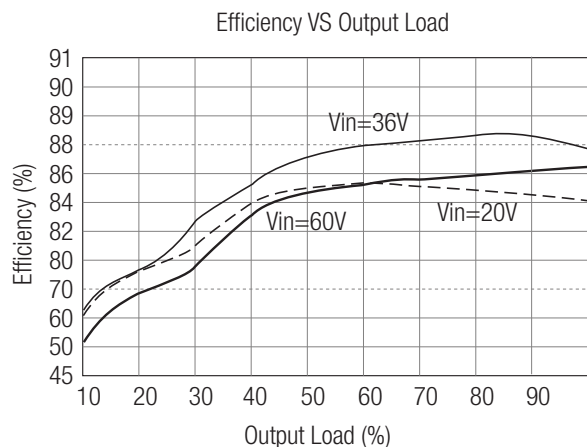
External Output Trimming

Refer To Application Notes for recommended resistor Values



Typical Characteristics

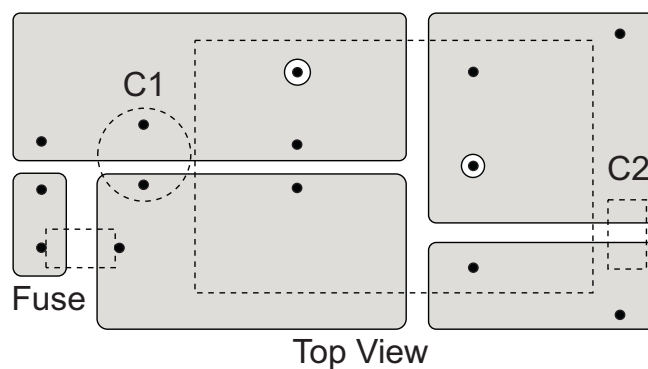
RPP20-2405SW



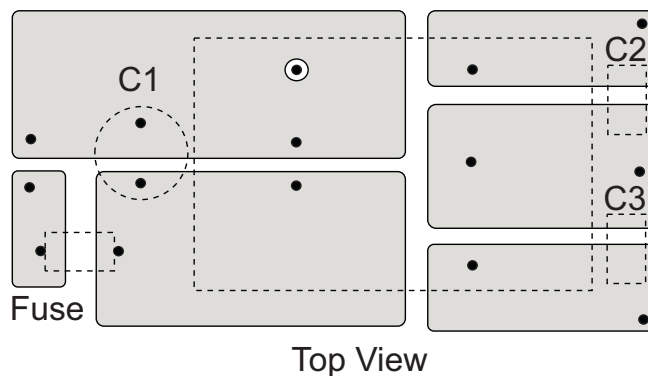
Recommended PCB Layout

Ribbed Case

Single Output

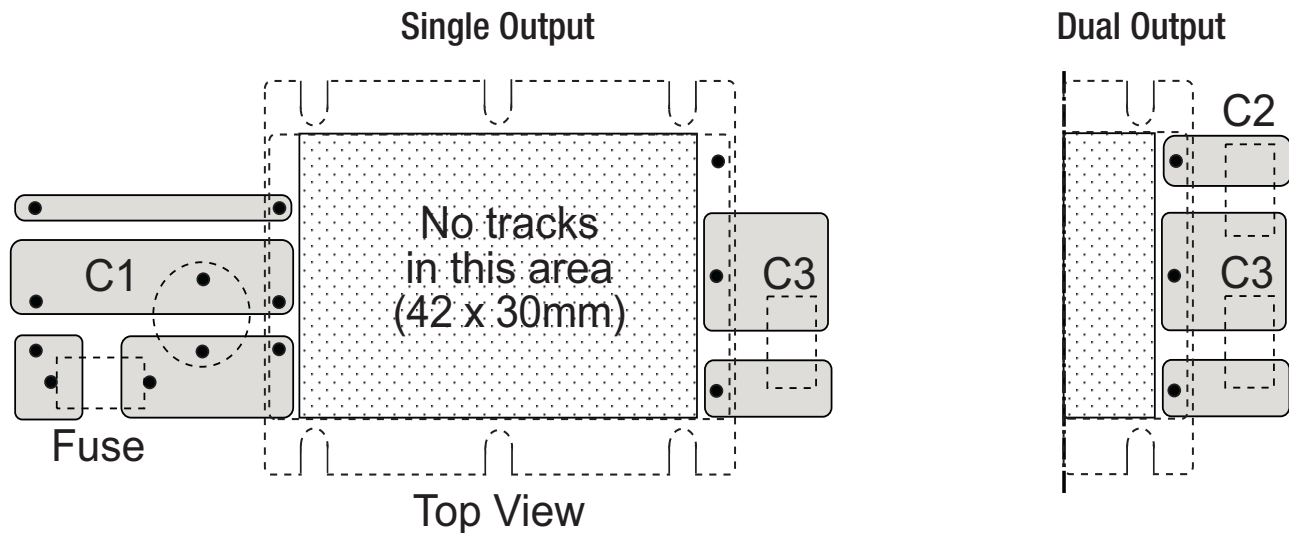


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

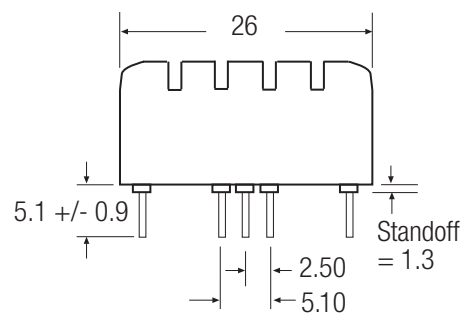
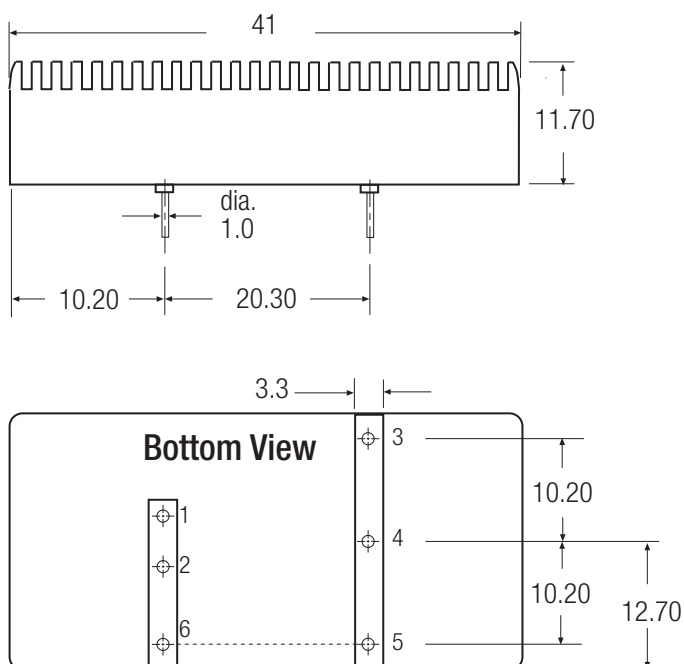
Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no suffix)



Pin Connections

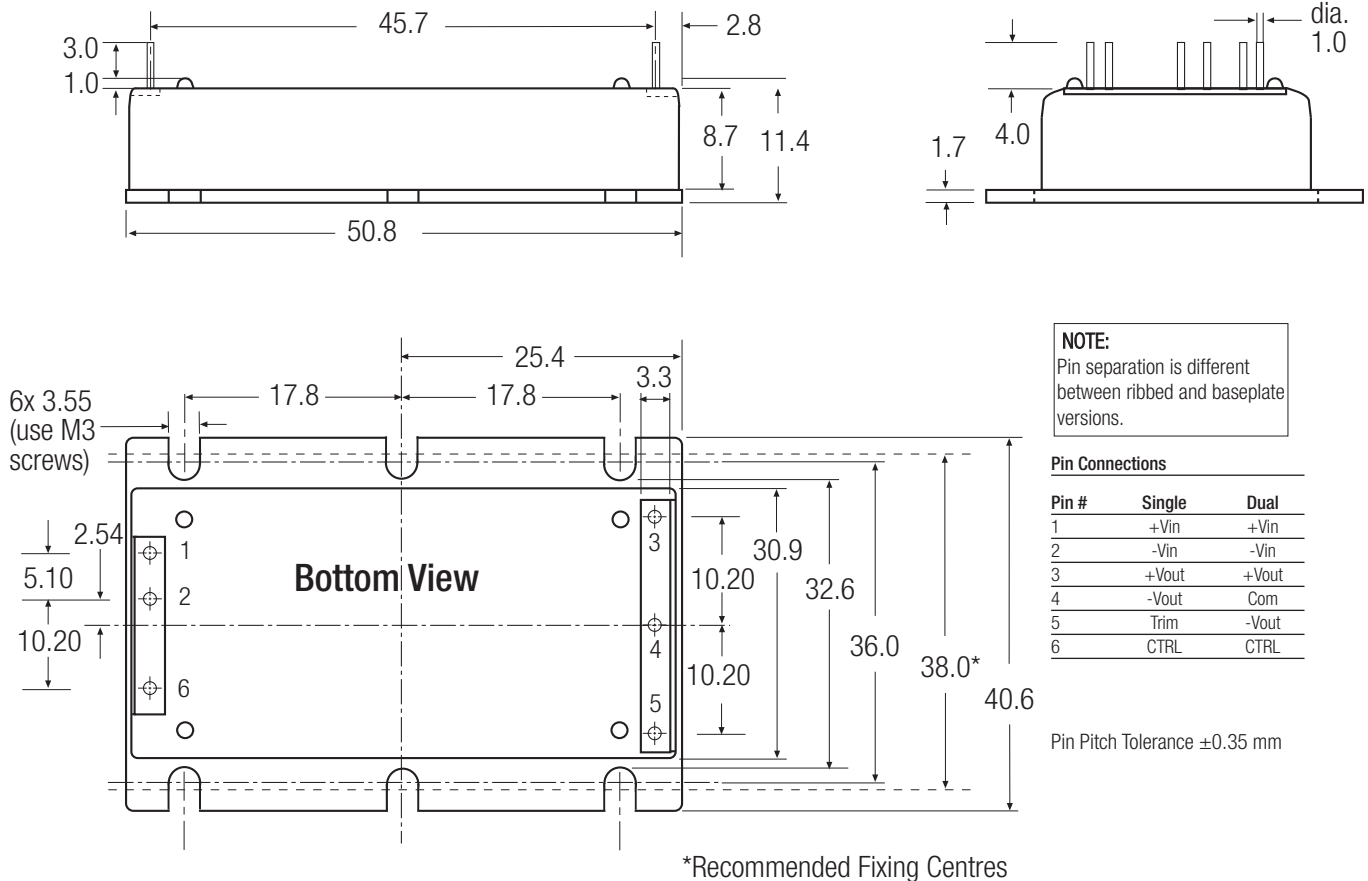
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Com
5	-Vout	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

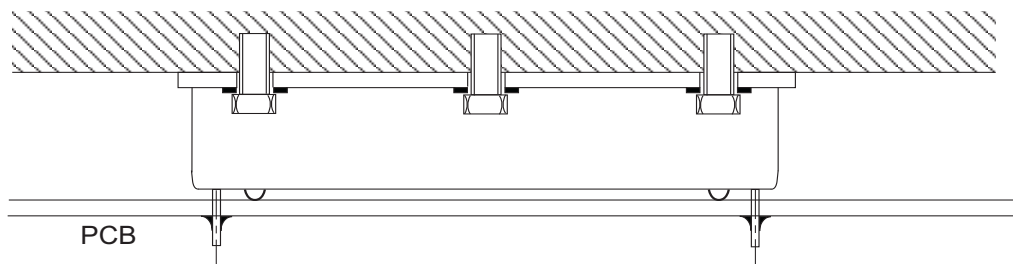
Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

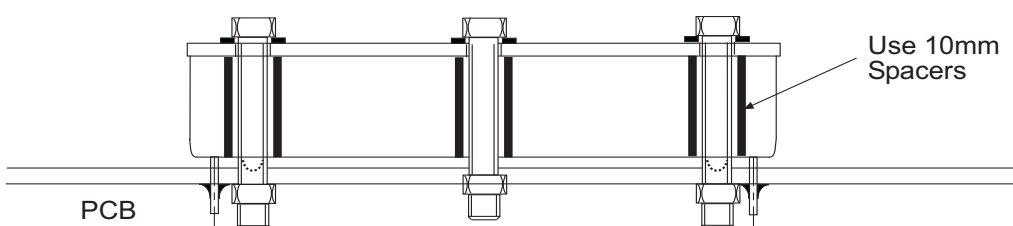
3rd angle projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 96°C ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 2:1 Wide Input Voltage Range
- Six Sided Shielded Enclosure
- Ribbed or Baseplate Case Styles
- Efficiency to 92%
- 3kVDC Isolation
- Low Quiescent Current

Description

The RPP30 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP30 is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 12V, 24V and 48V Input Types

Part Number	Input VDC	Output Range VDC	Output Voltage mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ Current	Max ⁽³⁾ Operating Temp
RPP30-123.3S	9-18	3.3	8500	78/2666	87.5%	86°C
RPP30-1205S	9-18	5	6000	109/2768	90.3%	91°C
RPP30-1212S	9-18	12	2500	26/2784	89.8%	89°C
RPP30-1215S	9-18	15	2000	31/2775	90.1%	91°C
RPP30-1224S	9-18	24	1250	31/2775	90.1%	91°C
RPP30-243.3S	18-36	3.3	8000	59/1394	89.7%	89°C
RPP30-2405S	18-36	5	6000	62/1372	91.1%	93°C
RPP30-2412S	18-36	12	2500	18/1400	90.4%	91°C
RPP30-2415S	18-36	15	2000	18/1380	91.4%	94°C
RPP30-2424S	18-36	24	1250	18/1380	91.4%	94°C
RPP30-483.3S	36-75	3.3	8000	24/697	89.6%	89°C
RPP30-4805S	36-75	5	6000	37/680	92.0%	96°C
RPP30-4812S	36-75	12	2500	11/687	91.0%	94°C
RPP30-4815S	36-75	15	2000	12/682	91.6%	94°C
RPP30-4824S	36-75	24	1250	12/682	91.6%	94°C
RPP30-1212D	9-18	±12	±1250	29/2790	89.6%	89°C
RPP30-1215D	9-18	±15	±1000	33/2784	89.8%	89°C
RPP30-1224D	9-18	±24	±625	33/2784	89.8%	89°C
RPP30-2412D	18-36	±12	±1250	20/1300	88.4%	86°C
RPP30-2415D	18-36	±15	±1000	10/1392	89.8%	89°C
RPP30-2424D	18-36	±24	±625	10/1384	90.3%	91°C
RPP30-4812D	36-75	±12	±1250	11/647	88.8%	87°C
RPP30-4815D	36-75	±15	±1000	12/689	90.7%	94°C
RPP30-4824D	36-75	±24	±625	26/622	90.7%	94°C

** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

**SUFFIX INFORMATION

none = Standard Ribbed Case
-B = Baseplate Case

Derating graphs are valid only for the shown part numbers.
Please contact Technical Support for more information
info@recom-development.at

POWERLINE+

DC/DC-Converter

with 3 year Warranty

RECOM

30 Watt

2:1 Single & Dual Output

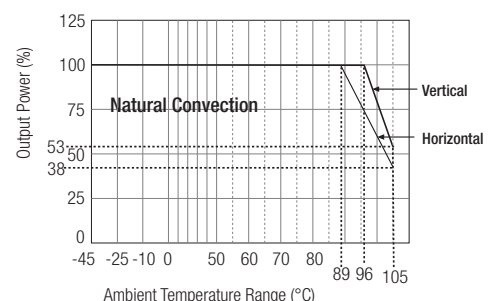


UL-60950-1 Certified
E224736

RPP30

Derating Graph (Ambient Temperature)

RPP30-4805S



* ICE Technology

ICE (Innovation in Converter Excellence)
uses state-of-the-art techniques to
minimise internal power dissipation and
to increase the internal temperature
limits to extend the ambient operating
temperature range to the maximum.
Refer to Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	12V nominal input	9-18VDC
	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	12V input	DC-DC ON (min.) 8.5VDC
		DC-DC OFF (max.) 8VDC
	24V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
	48V input	DC-DC ON (min.) 35VDC
		DC-DC OFF (max.) 34VDC
Input Filter	Common Mode EMCType	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	12V, 24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	30mA _{p-p}
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	DC-DC ON	Open or 3.0V < Vr < 5.5V
	DC-DC OFF	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	30W max.	
Output Voltage Accuracy	50% Load and nominal Vin	±1.5%
Voltage Adjustability	Single Output only	±10%
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Cross Regulation (10% <> 100% Load)	Dual Outputs only	3% typ./ 5% max.
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across outputs)	3.3V, 5V	60mV _{p-p} typ.
	All others	25mV-45mV _{p-p} max.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	800µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Power Limit, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 2250VDC/1 minute, Flash tested at 3000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	3000pF max.	
Operating Frequency	260kHz ± 40kHz	
Operating Temperature Range	Ambient, Free Convection	-45°C to +96°C max (without derating)
		-45°C to +105°C max (with derating)
Maximum Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	
Thermal Impedance (Natural convection)	Ribbed Case: Vertical	7.3°C/Watt
	Ribbed Case: Horizontal	10°C/Watt
Relative Humidity	5% to 95% RH	
Case Material ⁽⁷⁾	Aluminium	
Potting Material	Silicone (UL94-V0)	

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

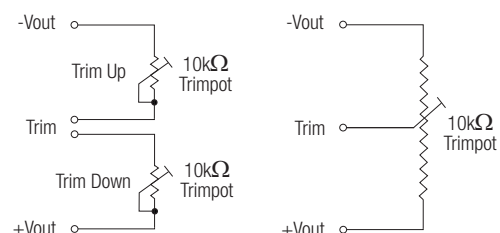
Weight	Ribbed Case	39g
	Baseplate Case	43g
Packing Quantity	Ribbed Case	4 pcs per Tube
	Baseplate Case	Single packed
Safety Standards	certified UL-60950-1, 1st Edition	
Thermal Cycling	complies with MIL-STD-810F	
Vibration	10-55Hz, 12G, 30 Min. along X, Y and Z	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		2195 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation.
For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally
ON/OFF control is standard with positive logic: e.g. RPP30-2405S, RPP30-4805D-B
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

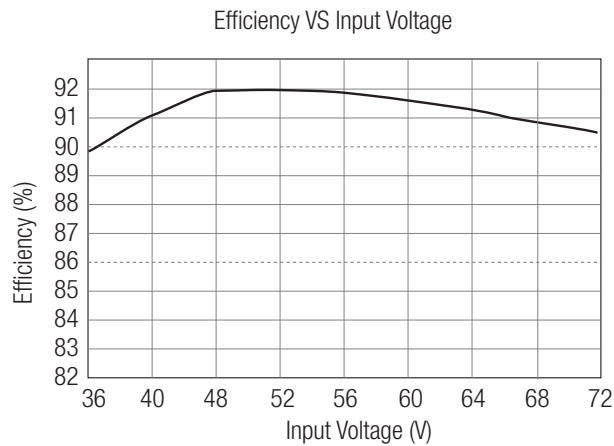
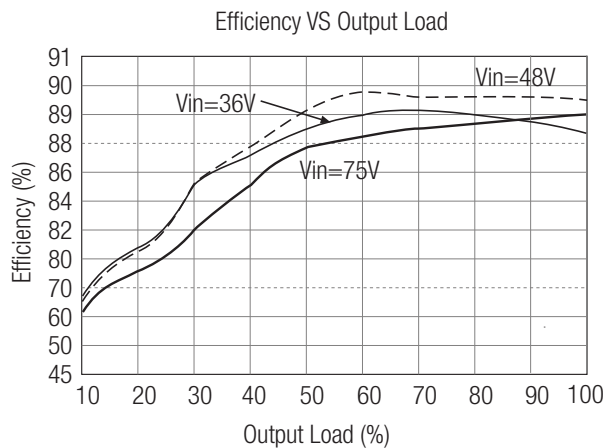
External Output Trimming

Refer to Application Notes for suggested resistor values



Typical Characteristics

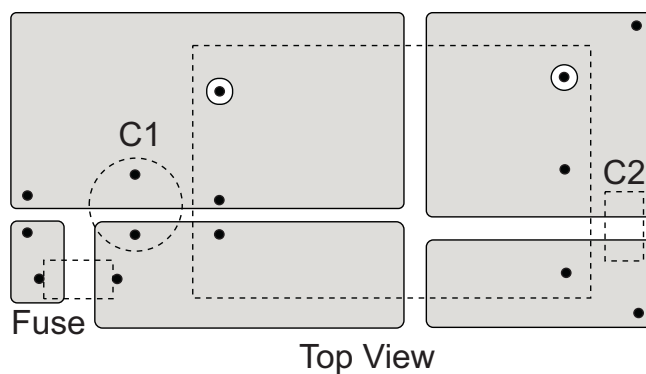
RPP30-4805S



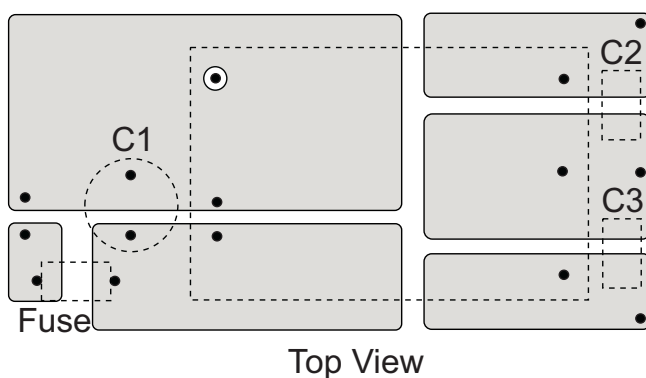
Recommended PCB Layout

Ribbed Case

Single Output

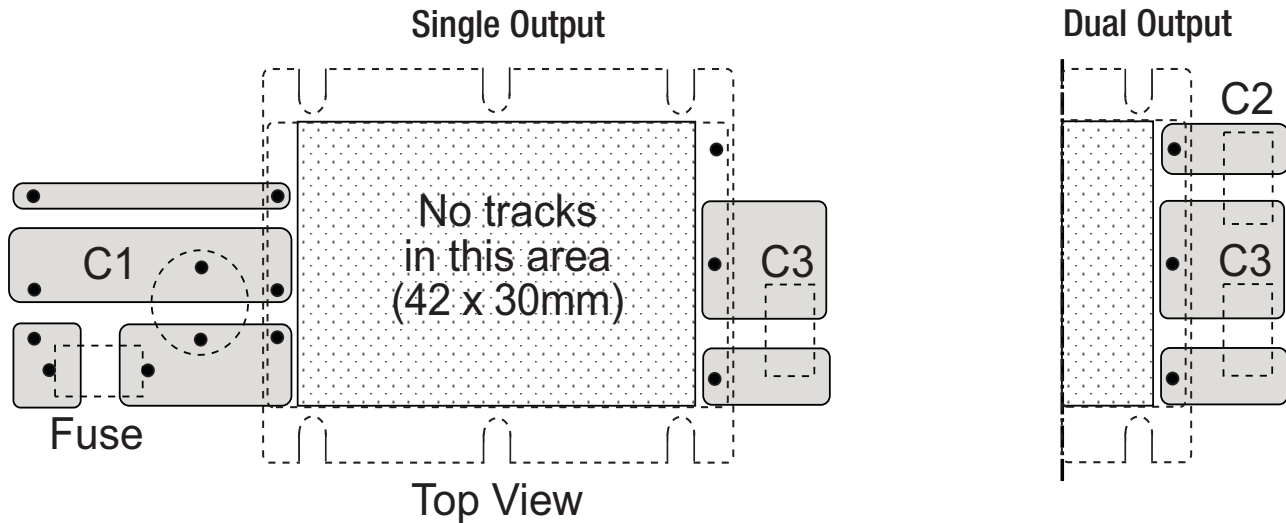


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

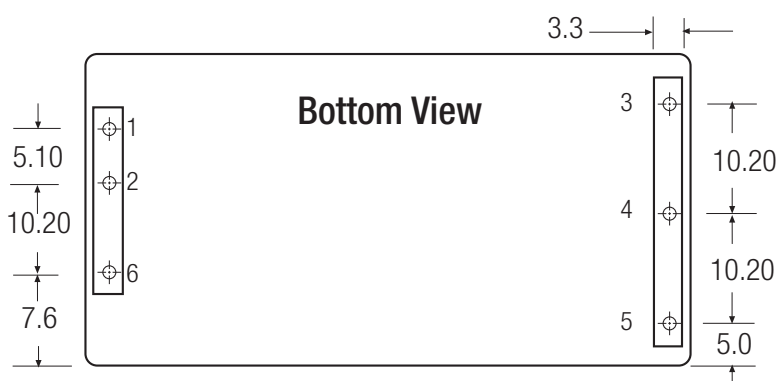
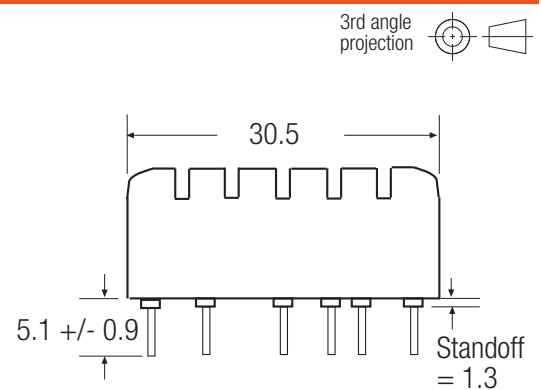
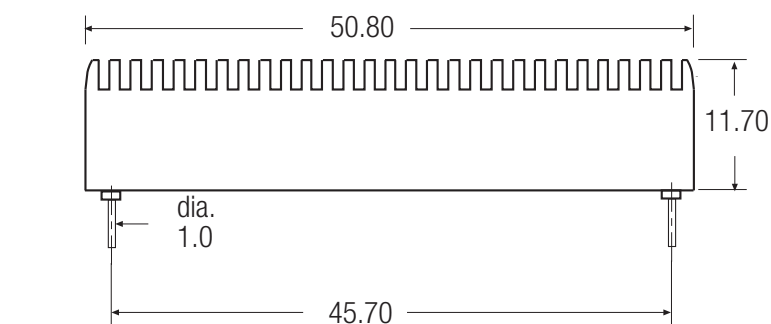
Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no Suffix)



Pin Connections

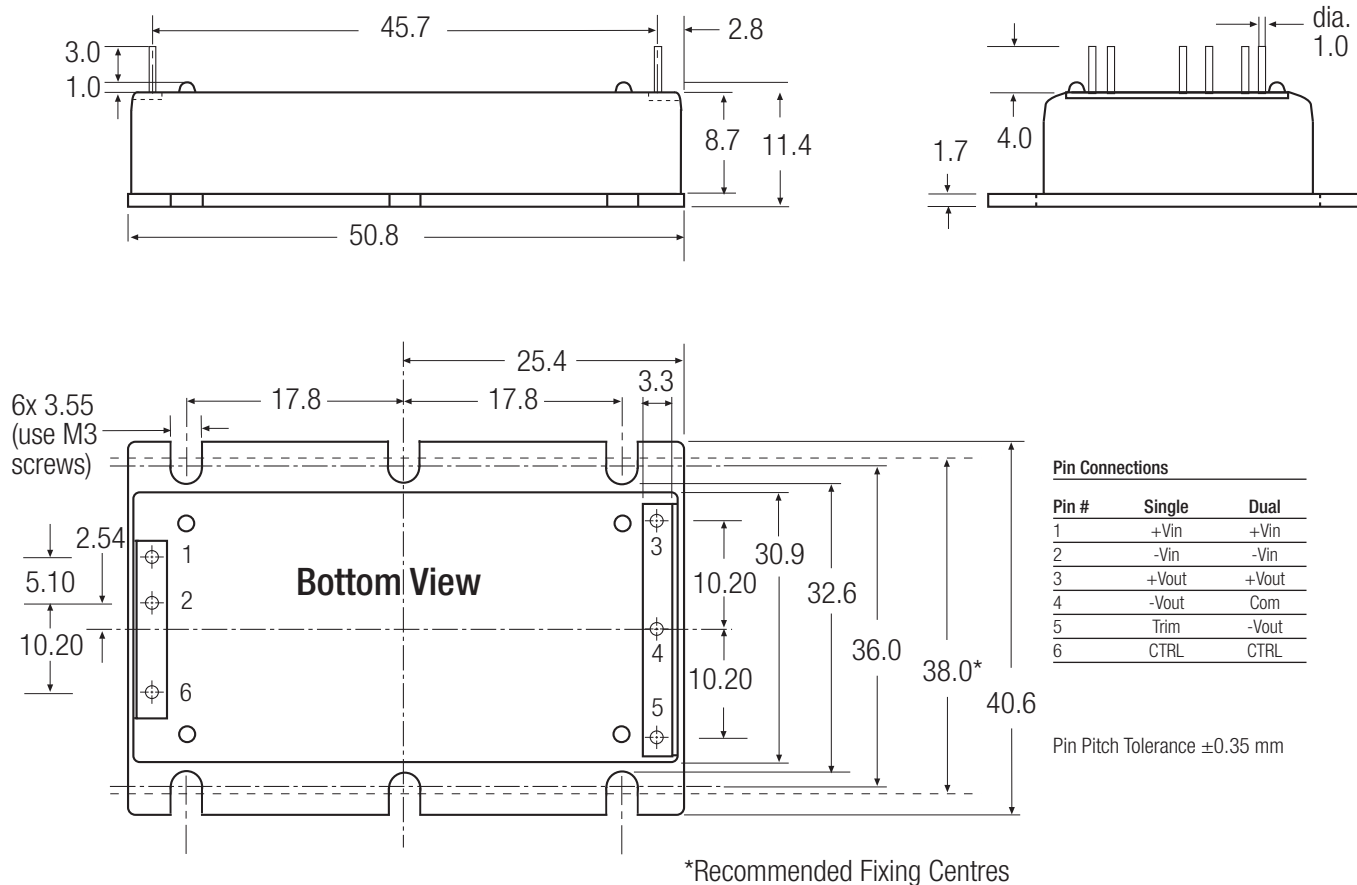
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

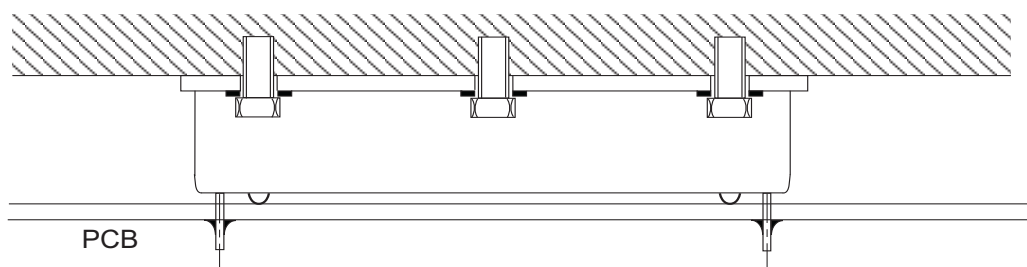
Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

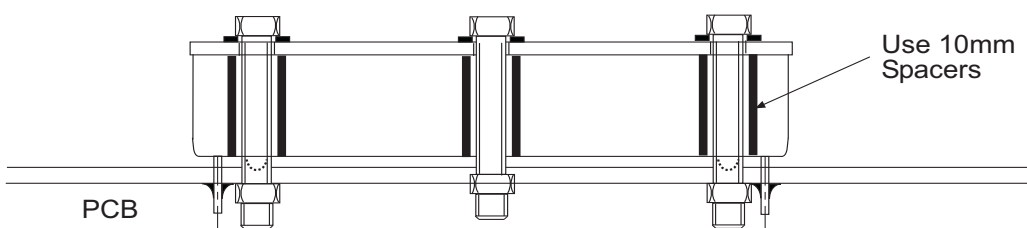
3rd angle
projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 90°C ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 4:1 Wide Input Voltage Range
- Six Sided Shielded Enclosure
- Ribbed or Baseplate Case Styles
- Efficiency to >89%
- 3kVDC Isolation
- Low Quiescent Current

Description

The RPP30-W series 4:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP30-W is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 24V and 48V 4:1 Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current mA	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Ambient Temp
RPP30-243.3SW	9-36	3.3	8400	57/1326	87.1%	85°C
RPP30-2405SW	9-36	5	6000	62/1397	89.5%	89°C
RPP30-2412SW	9-36	12	2500	27/1420	88.0%	85°C
RPP30-2415SW	9-36	15	2000	31/1436	89.7%	90°C
RPP30-2424SW	9-36	24	1250	31/1436	89.7%	90°C
RPP30-483.3SW	18-75	3.3	9000	46/704	87.6%	84°C
RPP30-4805SW	18-75	5	6000	38/710	89.7%	90°C
RPP30-4812SW	18-75	12	2500	15/727	87.8%	85°C
RPP30-4815SW	18-75	15	2000	19/718	89.3%	89°C
RPP30-4824SW	18-75	24	1250	19/718	89.3%	89°C
RPP30-2412DW	9-36	±12	±1250	32/1453	89.2%	89°C
RPP30-2415DW	9-36	±15	±1000	30/1436	87.2%	85°C
RPP30-2424DW	9-36	±24	±625	30/1436	87.2%	85°C
RPP30-4812DW	18-75	±12	±1250	18/727	87.5%	85°C
RPP30-4815DW	18-75	±15	±1000	20/718	89.1%	89°C
RPP30-4824DW	18-75	±24	±625	20/718	89.1%	89°C

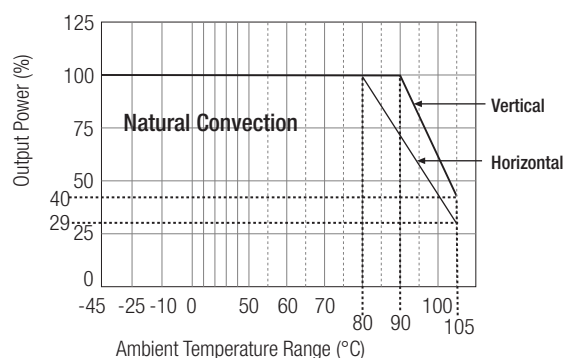
** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

Derating Graph (Ambient Temperature)

RPP30-4805SW

Derating graphs are valid only for the shown part number. Please contact Technical Support for more information:
info@recom-development.at



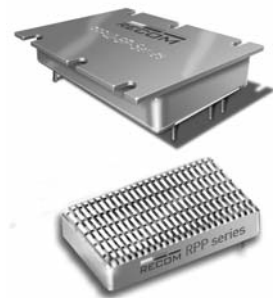
* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

POWERLINE+
DC/DC-Converter
with 3 year Warranty

RECOM

30 Watt
4:1 Single & Dual Output



UL-60950-1 Certified
E224736

RPP30-W

SUFFIX INFORMATION

none = Standard Ribbed Case
-B = Baseplate Case

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Under Voltage Lockout	24V input	DC-DC ON (min.) 8.5VDC
		DC-DC OFF (max.) 8VDC
	48V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	30mAp-p
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	30W max.	
Output Voltage Accuracy	50% Load and nominal Vin	±1.5%
Voltage Adjustability	Single Output only	±5%
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Cross Regulation (10% <= 100% Load)	Dual Outputs only	3% typ./ 5% max.
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across outputs)	3.3V, 5V	80mVp-p typ.
	All others	27mV-60mVp-p max
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	800µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Power Limit, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal +20%	
Isolation Voltage	Rated at 2250VDC/1 minute, Flash tested at 3000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	3000pF max.	
Operating Frequency	300kHz ± 30kHz	
Operating Temperature Range	Ambient, Free Convection	-45°C to +90°C max (without derating)
		-45°C to +105°C max (with derating)
Maximum Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	
Thermal Impedance (Natural convection)	Ribbed Case: Vertical	7.3°C/Watt
	Ribbed Case: Horizontal	10°C/Watt
Relative Humidity	5% to 95% RH	
Case Material ⁽⁷⁾	Aluminium	
Potting Material	Silicone (UL94-V0)	
Weight	Ribbed Case	39g
	Baseplate Case	43g

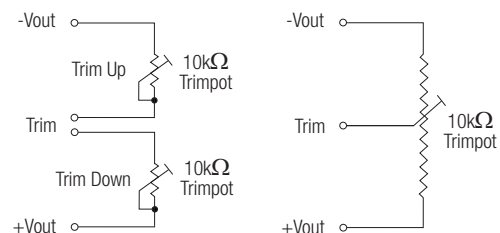
Specifications (typical at nominal input and 25°C unless otherwise noted)

Packing Quantity	Ribbed Case Baseplate Case	4 pcs per Tube Single packed
Safety Standards	certified UL-60950-1, 1st Edition	
Thermal Cycling	complies with MIL-STD-810F	
Vibration	10-55Hz, 12G, 30 Min. along X, Y and Z	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		2195 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation.
For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPP30-2405SW, RPP30-4805DW-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

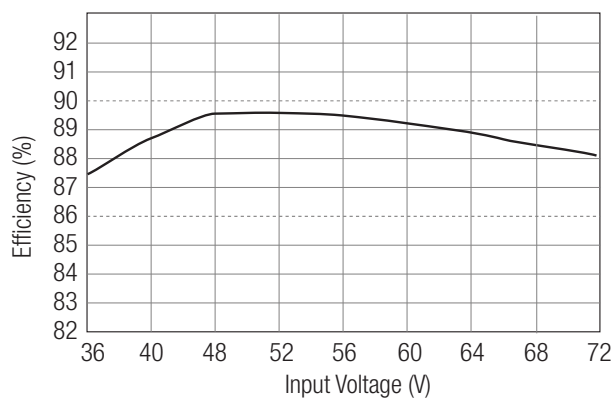
External Output Trimming



Typical Characteristics

RPP30-4805SW

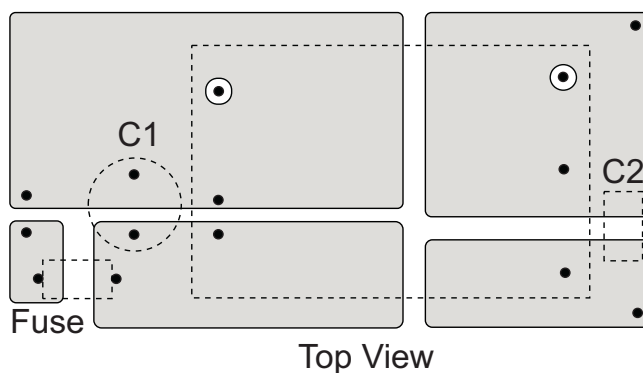
Efficiency VS Input Voltage



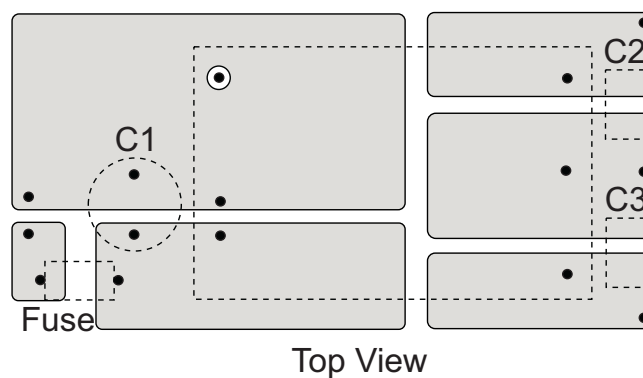
Recommended PCB Layout

Ribbed Case

Single Output

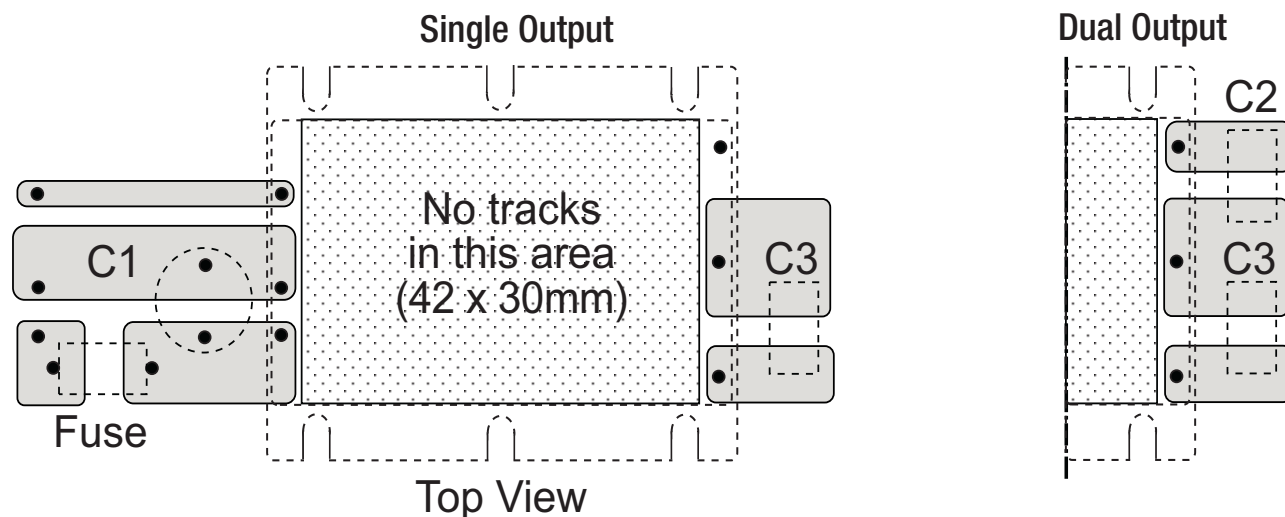


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

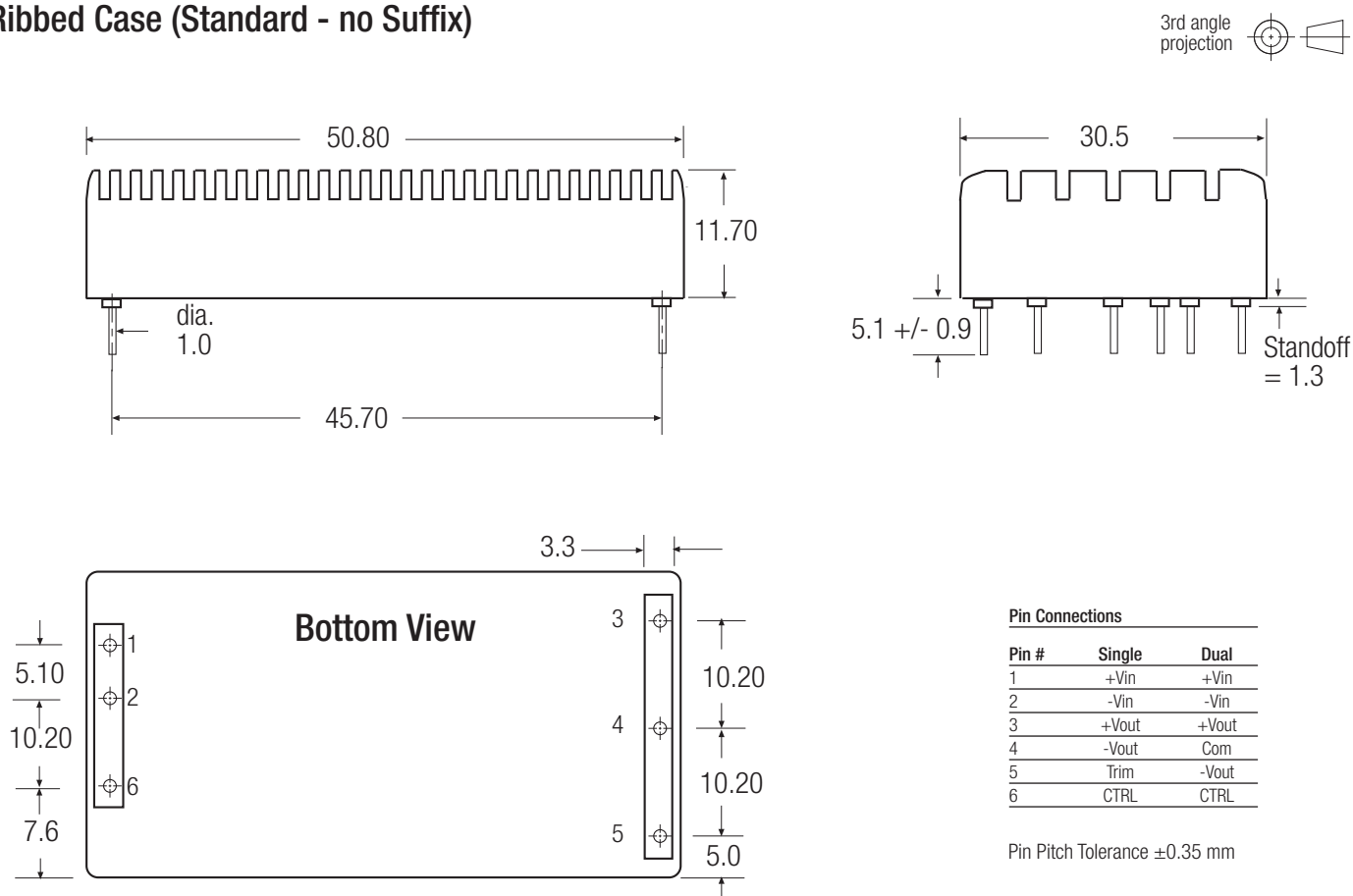
Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

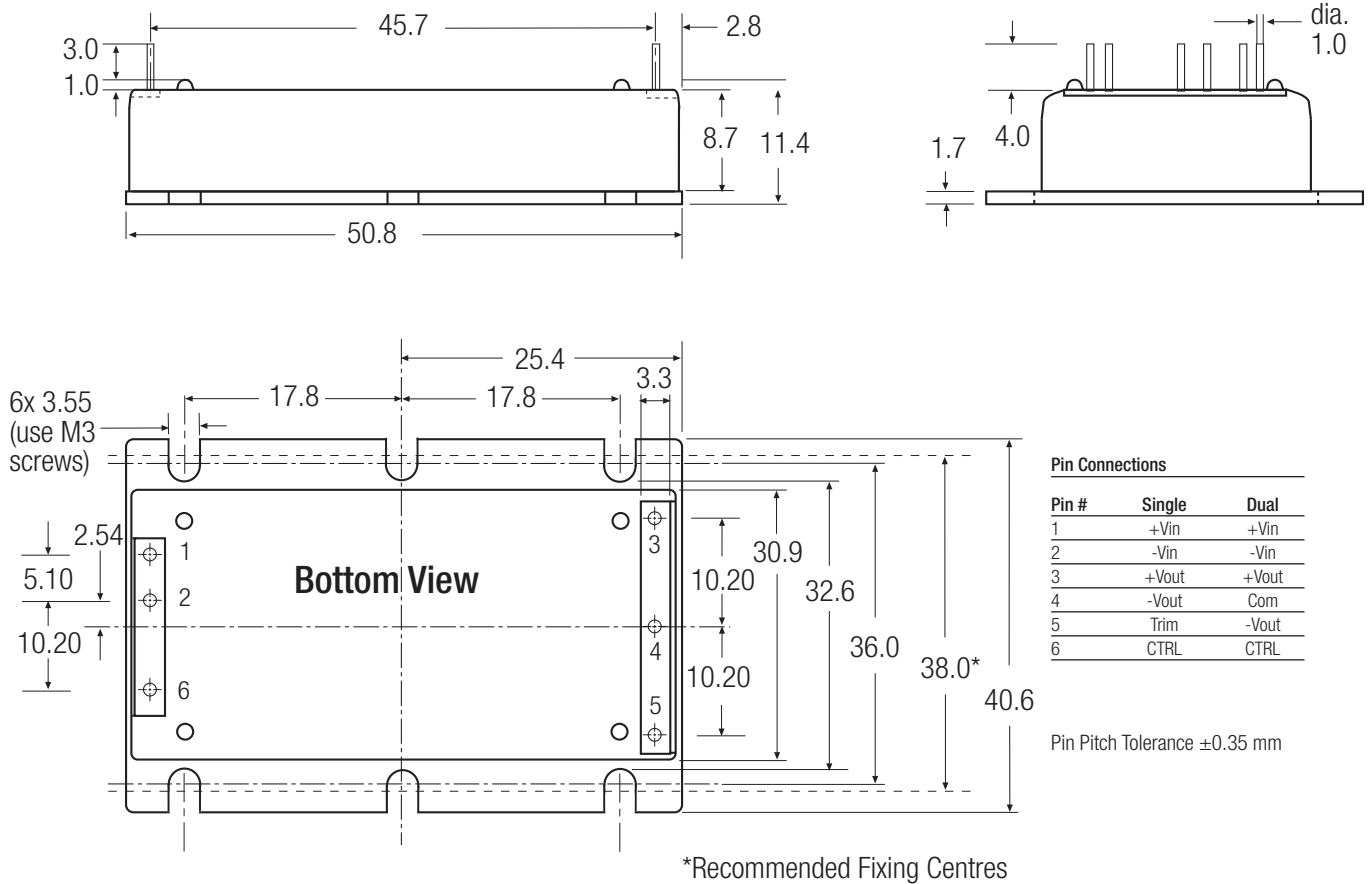
Ribbed Case (Standard - no Suffix)



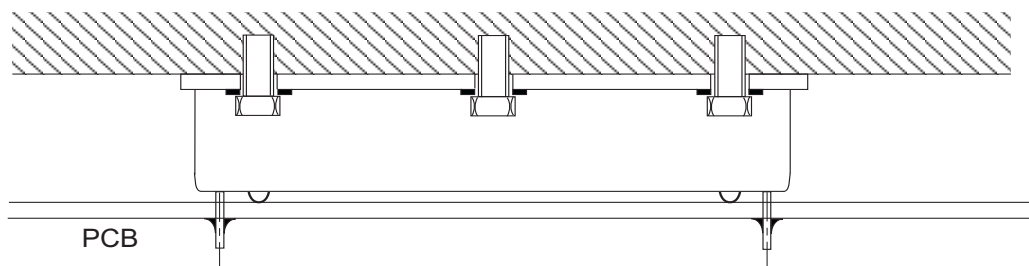
Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

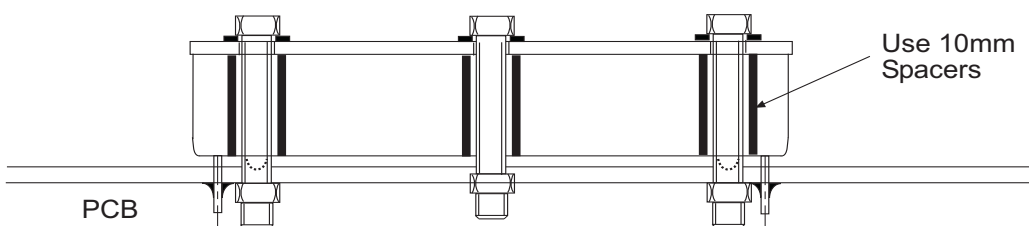
3rd angle projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 94°C ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 2:1 Wide Input Voltage Range
- 40 Watts Output Power
- Ribbed or Baseplate Case Styles
- Efficiency to 92%
- 3kVDC Isolation
- Low Quiescent Current

Description

The RPP40 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is very compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP40 is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current A	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Operating Temp
RPP40-243.3S	18-36	3.3	12	58/1885	88.4%	77°C
RPP40-2405S	18-36	5	8	60/1831	91.0%	86°C
RPP40-2412S	18-36	12	3.33	100/1875	87.8%	75°C
RPP40-2415S	18-36	15	2.67	100/1870	89.5%	81°C
RPP40-2424S	18-36	24	1.67	100/1870	89.5%	81°C
RPP40-483.3S	36-75	3.3	12	42/923	90.2%	84°C
RPP40-4805S	36-75	5	8	37/906	92.0%	89°C
RPP40-4812S	36-75	12	3.33	5/930	88.9%	78°C
RPP40-4815S	36-75	15	2.67	5/930	89.7%	81°C
RPP40-4824S	36-75	24	1.67	5/930	89.7%	81°C
RPP40-2412D	18-36	±12	±1.67	100/1870	88.4%	86°C
RPP40-2415D	18-36	±15	±1.33	100/1870	89.8%	89°C
RPP40-2424D	18-36	±24	±0.84	100/1870	89.8%	91°C
RPP40-4812D	36-75	±12	±1.67	5/930	88.8%	87°C
RPP40-4815D	36-75	±15	±1.33	5/930	89.7%	94°C
RPP40-4824D	36-75	±24	±0.84	5/930	89.7%	94°C

** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

SUFFIX INFORMATION

none = Standard Ribbed Case
-B = Baseplate Case

POWERLINE+
DC/DC-Converter
with 3 year Warranty

RECOM

40 Watt 2:1 Single & Dual Output



**UL-60950-1 Certified
E224736**

RPP40

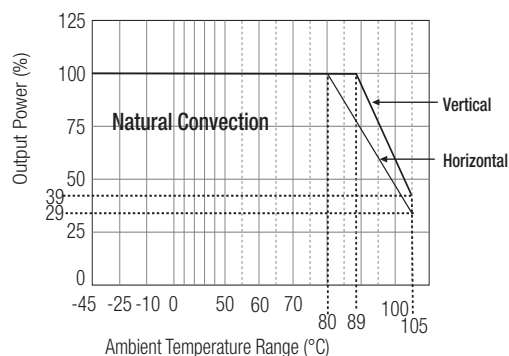
* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

Derating Graph (Ambient Temperature)

RPP40-4805S

Derating graphs are valid only for the shown part numbers. Please contact Technical Support for more information info@recom-development.at



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Under Voltage Lockout	24V input	DC-DC ON (min.) 17.5VDC DC-DC OFF (max.) 17VDC
	48V input	DC-DC ON (min.) 35VDC DC-DC OFF (max.) 34VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	30mAp-p
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	50W max.	
Output Voltage Accuracy	10% Load and nominal Vin	±1%
Voltage Adjustability	±10%	
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across output)	3.3V, 5V	60mVp-p typ.
	All others	40mVp-p typ.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	200µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Power Limit, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 2250VDC/1 minute, Flash tested at 3000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	3000pF max.	
Operating Frequency	260kHz ± 40kHz Maximum	
Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	

Specifications (typical at nominal input and 25°C unless otherwise noted)

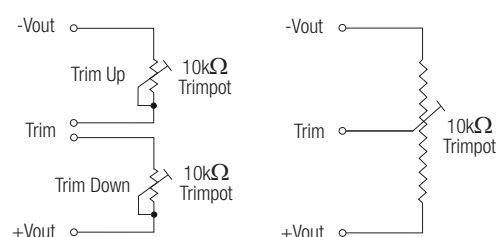
RPP40 Operating Temperature Range	Ambient, Free Convection	-45°C to +87°C max (without derating)
Thermal Impedance	Ribbed Case: Vertical	7.3°C/Watt
(Natural convection)	Ribbed Case: Horizontal	10°C/Watt
Relative Humidity		5% to 95% RH
Case Material ⁽⁷⁾		Aluminium
Potting Material		Silicone (UL94-V0)
Weight	Ribbed Case	39g
	Baseplate Case	43g
Packing Quantity	Ribbed Case	4 pcs per Tube
	Baseplate Case	Single packed
Safety Standards		certified UL-60950-1, 1st Edition
Thermal Cycling		complies with MIL-STD-810F
Vibration		10-55Hz, 12G, 30 Min. along X, Y and Z
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		1989 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values for ribbed case at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation. For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPP40-2405S
Positive logic: 0= OFF; 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

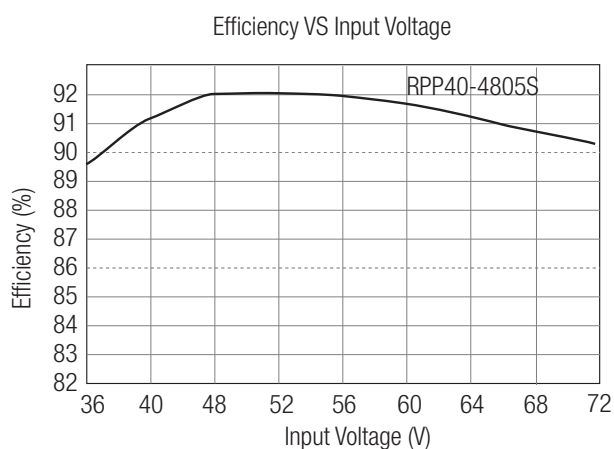
External Output Trimming

Refer to Application Notes for suggested Resistor Values



Typical Characteristics

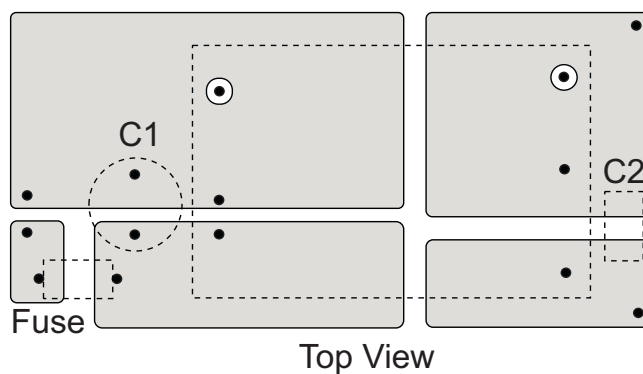
RPP40-4805S



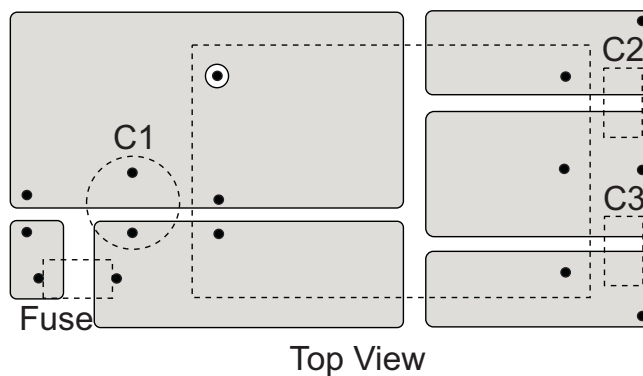
Recommended PCB Layout

Ribbed Case

Single Output

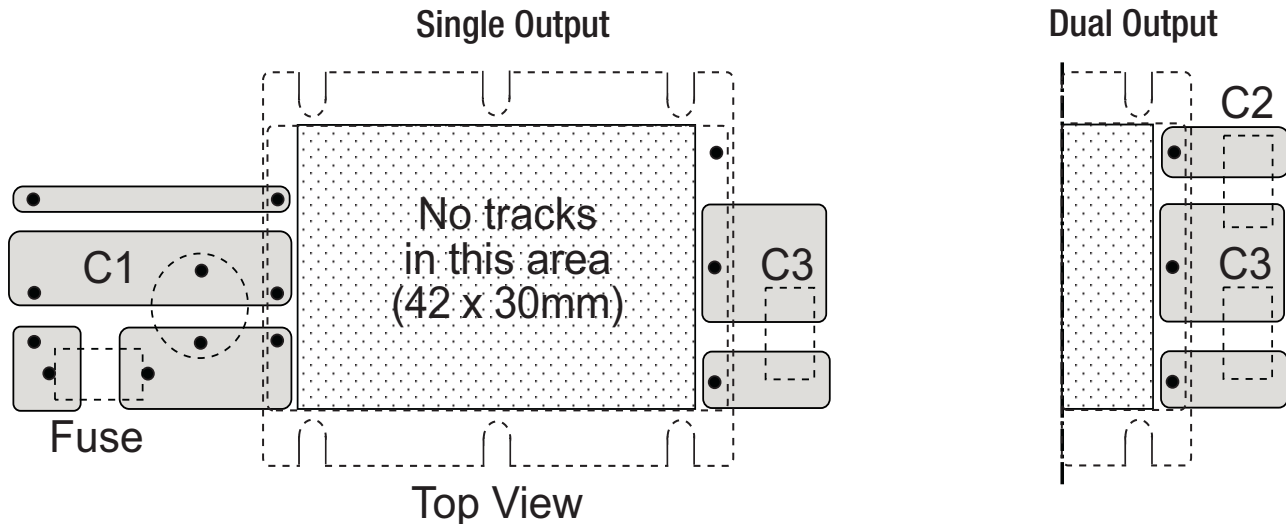


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

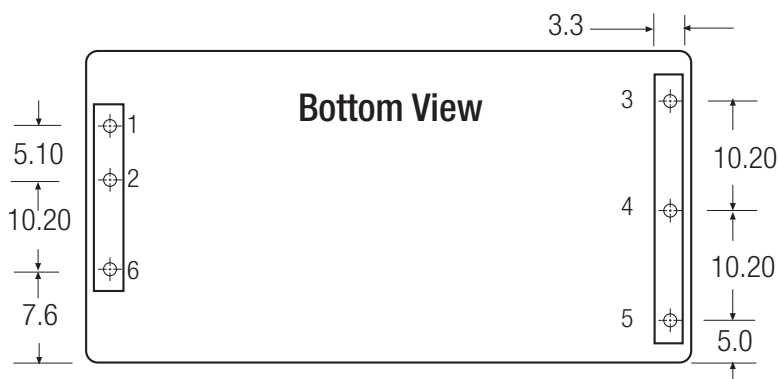
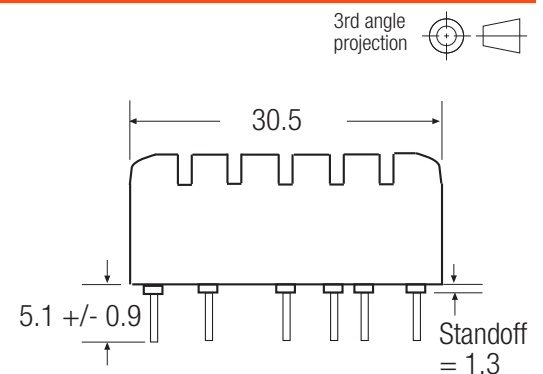
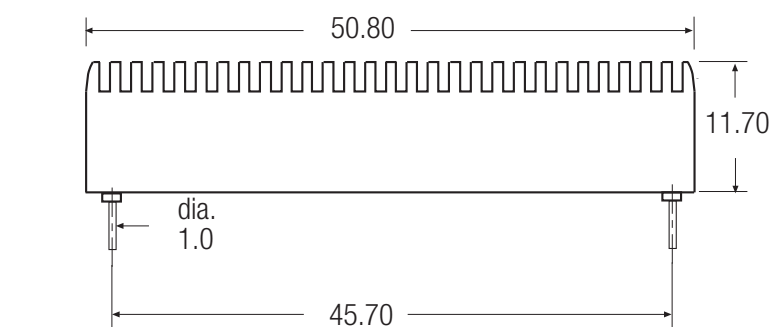
Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no Suffix)



Pin Connections

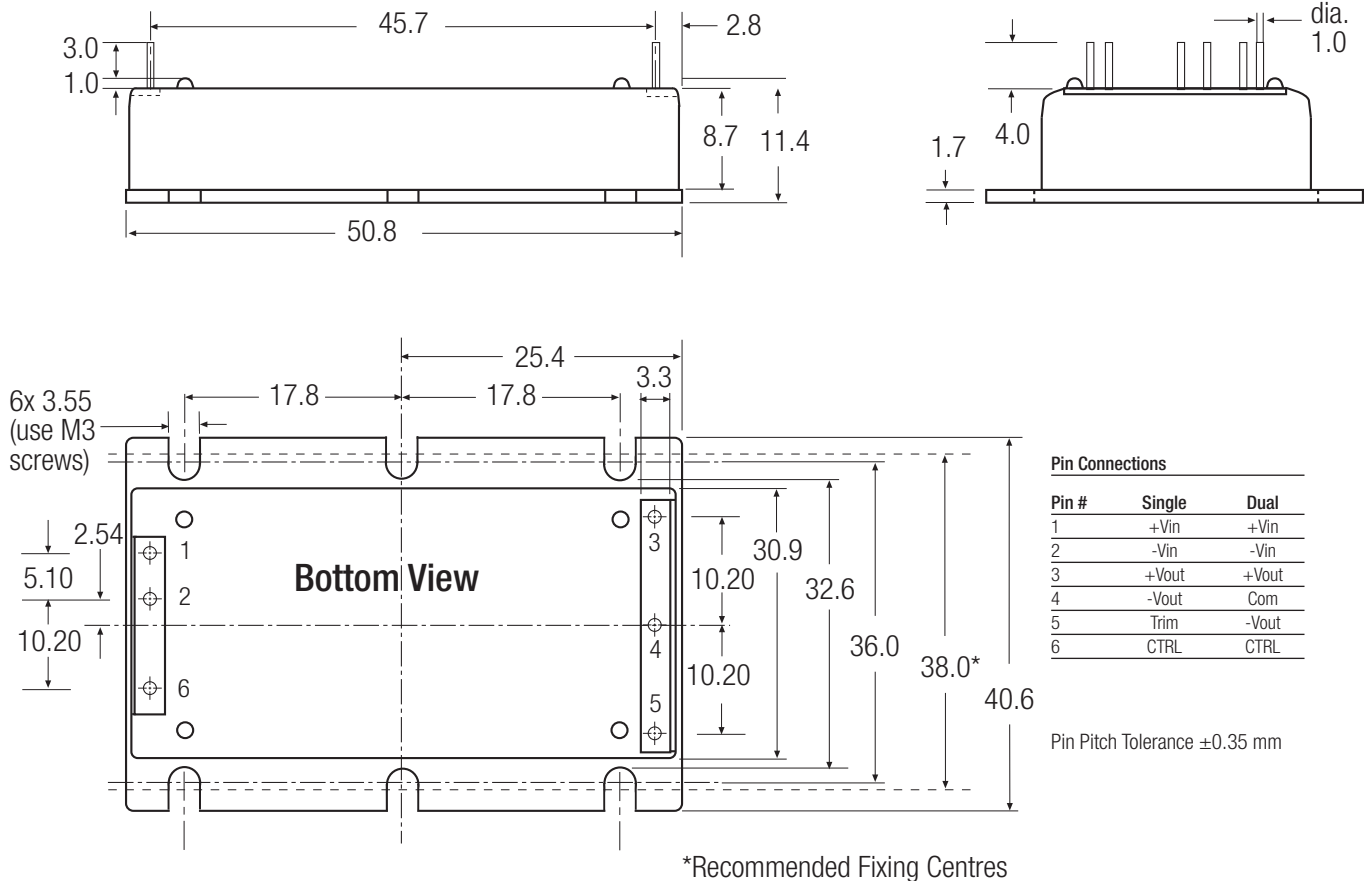
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

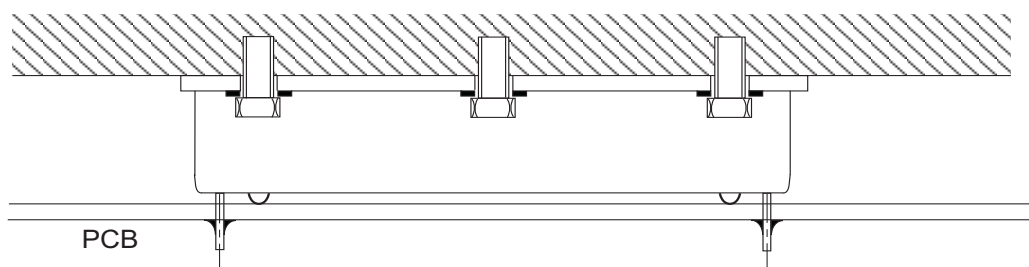
Typical Characteristics

Baseplate Case (-B Suffix)

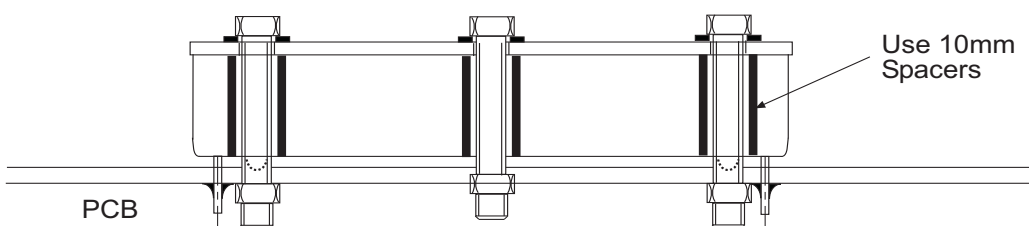
3rd angle
projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 89°C Ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 4:1 Wide Input Voltage Range
- 40 Watts Output Power
- Ribbed or Baseplate Case Styles
- Efficiency to >89%
- 3kVDC Isolation
- Low Quiescent Current

Description

The RPP40-W series 4:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is very compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP40-W is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current A	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Operating Temp
RPP40-243.3SW	9-36	3.3	12	58/1896	87.0%	60°C
RPP40-2405SW	9-36	5	8	60/1894	88.0%	66°C
RPP40-2412SW	9-36	12	3.33	100/1894	87.9%	75°C
RPP40-2415SW	9-36	15	2.67	100/1885	88.5%	77°C
RPP40-2424SW	9-36	24	1.67	100/1885	88.5%	77°C
RPP40-483.3SW	18-75	3.3	12	42/946	87.2%	62°C
RPP40-4805SW	18-75	5	8	37/941	88.5%	77°C
RPP40-4812SW	18-75	12	3.33	5/938	88.8%	78°C
RPP40-4815SW	18-75	15	2.67	5/939	88.7%	78°C
RPP40-4824SW	18-75	24	1.67	5/939	88.7%	78°C
RPP40-2412DW	9-36	±12	±1.67	32/1453	89.2%	89°C
RPP40-2415DW	9-36	±15	±1.33	30/1436	87.2%	85°C
RPP40-2424DW	9-36	±24	±0.84	30/1436	87.2%	85°C
RPP40-4812DW	18-75	±12	±1.67	18/727	87.5%	85°C
RPP40-4815DW	18-75	±15	±1.33	20/718	89.1%	89°C
RPP40-4824DW	18-75	±24	±0.84	20/718	89.1%	89°C

** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

SUFFIX INFORMATION

none = Standard Ribbed Case

-B = Baseplate Case

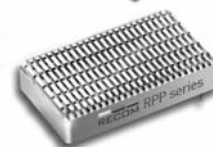
POWERLINE+

DC/DC-Converter

with 3 year Warranty

RECOM

40 Watt 4:1 Single & Dual Output



UL-60950-1 Certified
E224736

RPP40-W

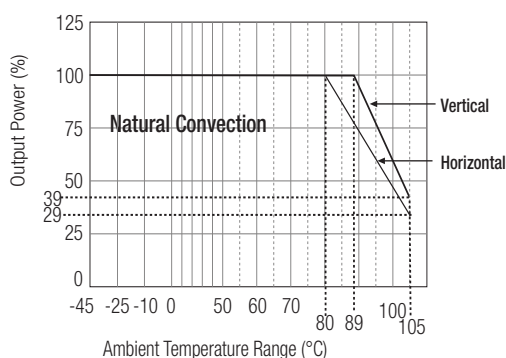
* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

Derating Graph (Ambient Temperature)

RPP40-4805SW

Derating graphs are valid only
for the shown part numbers.
Please contact Technical
Support for more information
info@recom-development.at



Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
Under Voltage Lockout	24V input	DC-DC ON (min.) 8.5VDC
		DC-DC OFF (max.) 8VDC
	48V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	30mA _{p-p}
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	50W max.	
Output Voltage Accuracy	10% Load and nominal Vin	±1%
Voltage Adjustability	±10%	
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across output)	3.3V, 5V	60mV _{p-p} typ.
	All others	40mV _{p-p} typ.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	200µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Hiccup, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 2250VDC/1 minute, Flash tested at 3000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	3000pF max.	
Operating Frequency	260kHz ± 40kHz Maximum	
Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	

Specifications (typical at nominal input and 25°C unless otherwise noted)

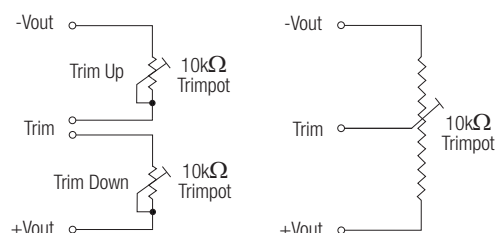
RPP40 Operating Temperature Range	Ambient, Free Convection	-45°C to +87°C max (without derating)
Thermal Impedance (Natural convection)	Ribbed Case: Vertical Ribbed Case: Horizontal	7.3°C/Watt 10°C/Watt
Relative Humidity		5% to 95% RH
Case Material ⁽⁷⁾		Aluminium
Potting Material		Silicone (UL94-V0)
Weight	Ribbed Case Baseplate Case	39g 43g
Packing Quantity	Ribbed Case Baseplate Case	4 pcs per Tube Single packed
Safety Standards		certified UL-60950-1, 1st Edition
Thermal Cycling		complies with MIL-STD-810F
Vibration		10-55Hz, 12G, 30 Min. along X, Y and Z
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁵⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾		1989 x 10 ³ hours

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values for ribbed case at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation. For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPP40-2405SW
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.

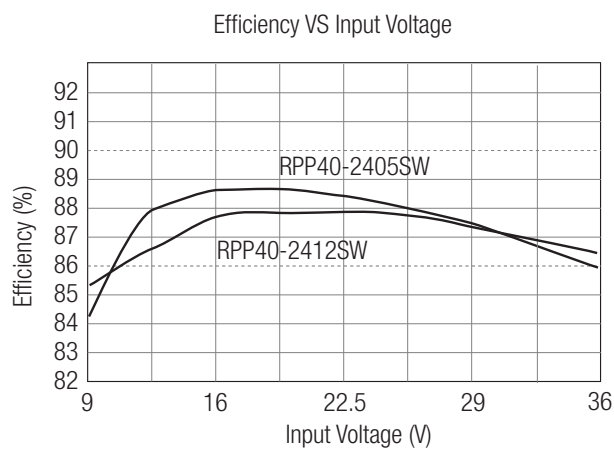
External Output Trimming

Refer to Application Notes for suggested Resistor Values



Typical Characteristics

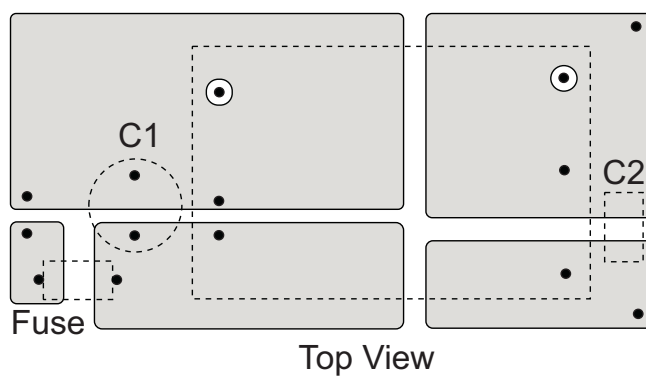
RPP40-2405SW / RPP40-2412SW



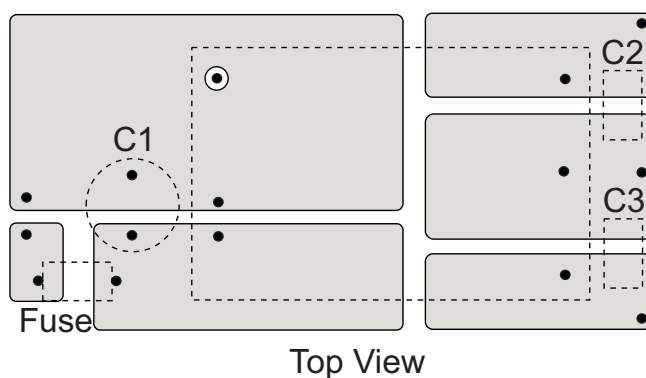
Recommended PCB Layout

Ribbed Case

Single Output

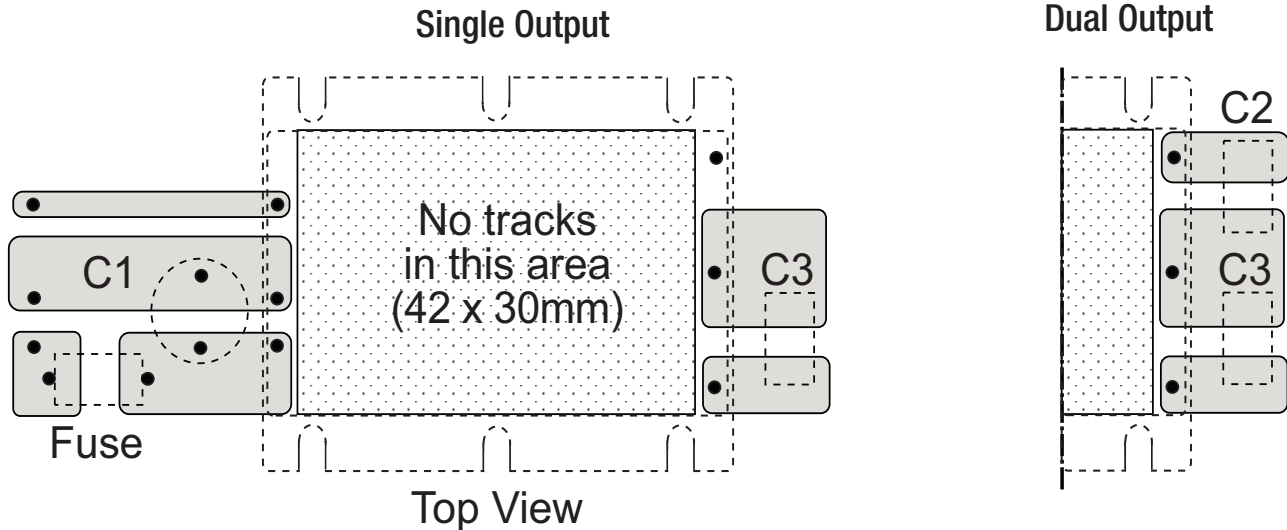


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

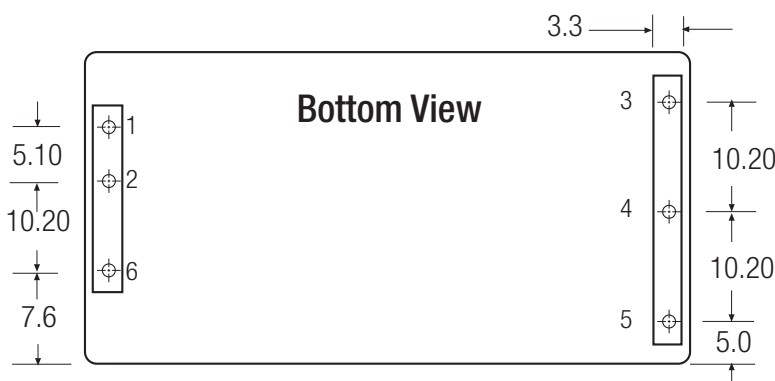
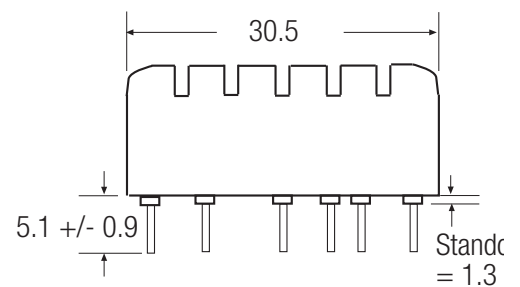
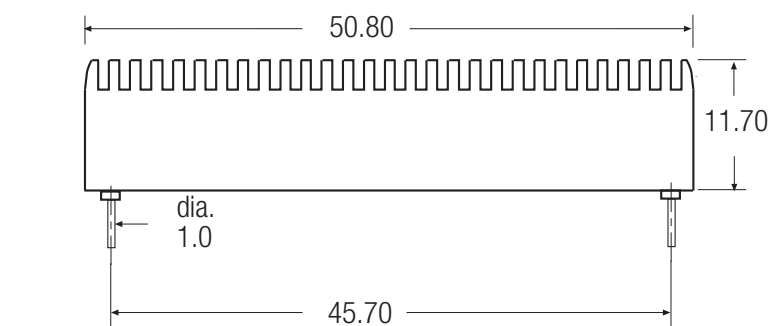
Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no Suffix)

3rd angle projection



Pin Connections

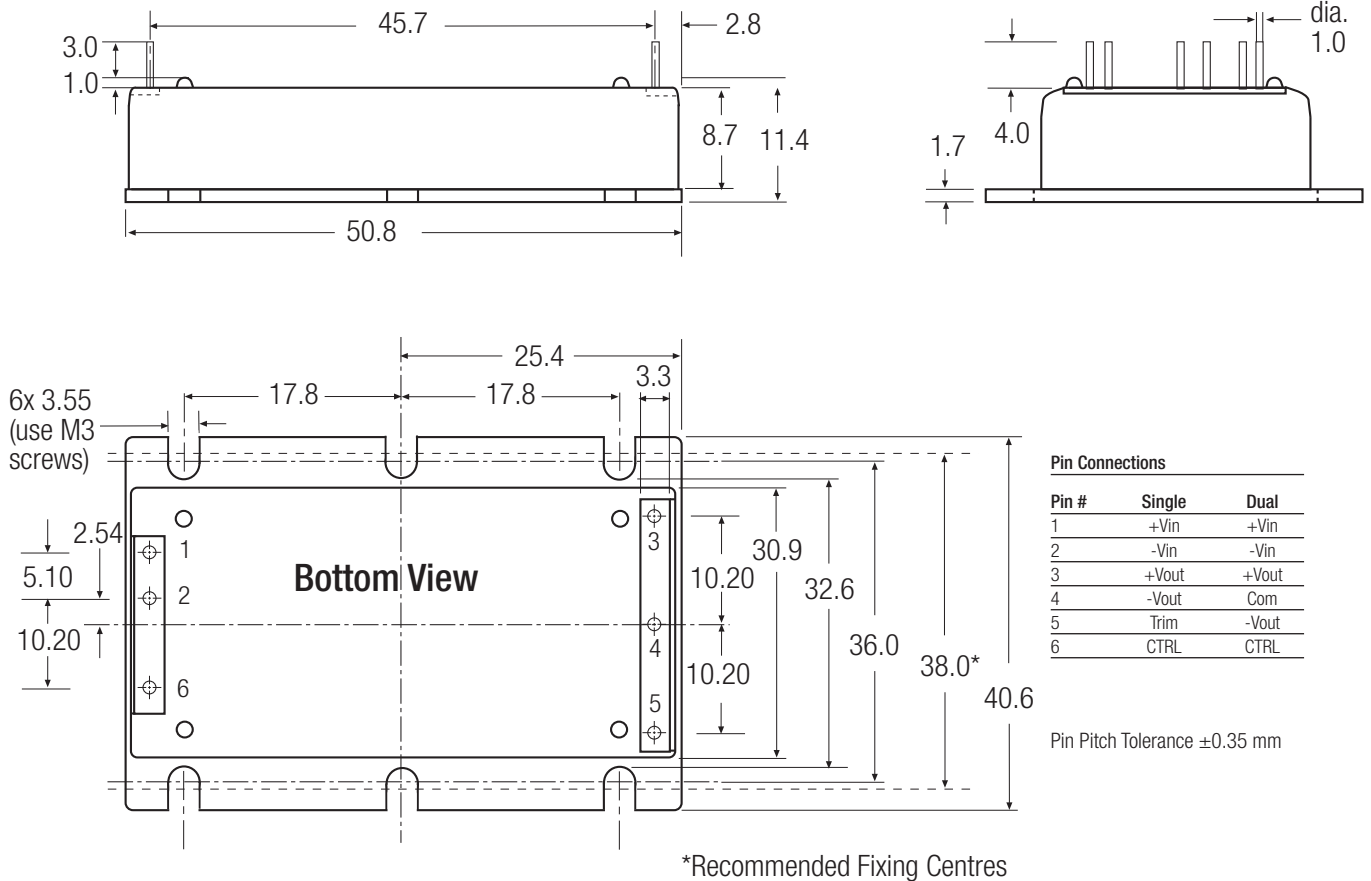
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

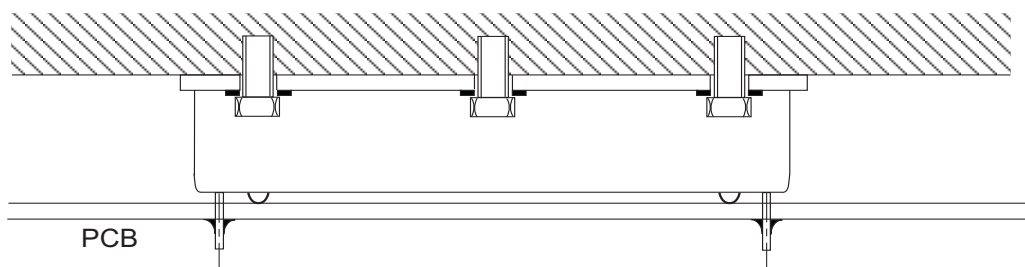
Typical Characteristics

Baseplate Case (-B Suffix)

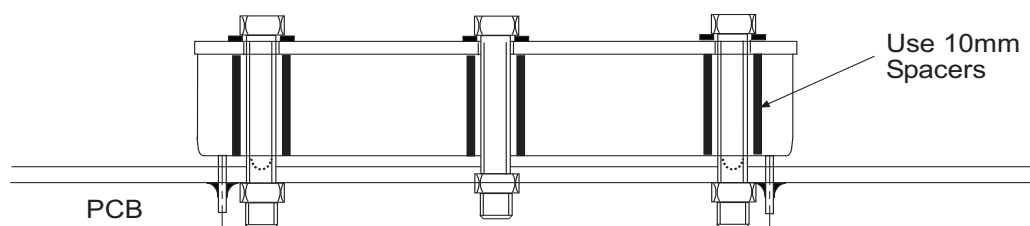
3rd angle
projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



Features

ICE Technology*

- Up to 81°C ambient, no derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- Built-in FCC/EN55022 Class B Filter
- 2:1 Wide Input Voltage Range
- 50 Watts Output Power
- Ribbed or Baseplate Case Styles
- Efficiency to >91%
- 3kVDC Isolation
- Low Quiescent Current

Description

The RPP50 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +120°C is required. Although the case size is very compact, the converter contains a built-in filter EN55022 Class B / FCC Level B without the need for any external components. The RPP50 is available in two case styles: the high operating temperature ribbed case and the baseplate case for high vibration or bulkhead-mounting applications. They are UL-60950-1 certified.

Selection Guide 24V and 48V Input Types

Part Number	Input Range VDC	Output Voltage VDC	Output Current A	Input ⁽¹⁾ Current mA	Efficiency ⁽²⁾ (Typ.)	Max ⁽³⁾ Operating Temp
RPP50-243.3S	18-36	3.3	15	58/2405	86.6%	58°C
RPP50-2405S	18-36	5	10	60/2315	90.0%	74°C
RPP50-2412S	18-36	12	4.16	18/2370	88.3%	66°C
RPP50-2415S	18-36	15	3.33	18/2315	90.0%	74°C
RPP50-2424S	18-36	24	2.10	18/2315	90.0%	74°C
RPP50-483.3S	36-75	3.3	15	42/1177	88.6%	68°C
RPP50-4805S	36-75	5	10	37/1140	91.4%	81°C
RPP50-4812S	36-75	12	4.16	11/1165	89.4%	72°C
RPP50-4815S	36-75	15	3.33	11/1141	91.2%	81°C
RPP50-4824S	36-75	24	2.10	11/1141	91.2%	81°C

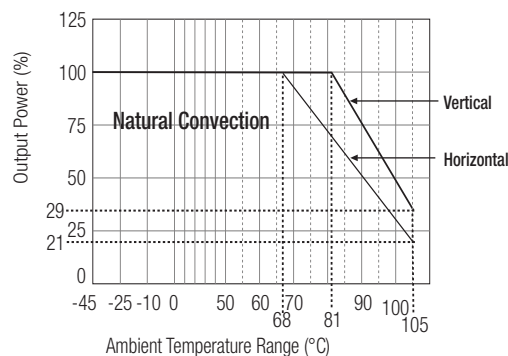
** add suffix for case options

For other CTRL logic or case style options please contact RECOM for availability.

Derating Graph (Ambient Temperature)

RPP50-4805S

Derating graphs are valid only for the shown part numbers. Please contact Technical Support for more information info@recom-development.at



POWERLINE+

DC/DC-Converter

with 3 year Warranty

RECOM

50 Watt 2:1 Single Output



**UL-60950-1 Certified
E224736**

RPP50-S

SUFFIX INFORMATION

none = Standard Ribbed Case
-B = Baseplate Case

* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum. Refer to Application Notes

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range	24V nominal input	18-36VDC
	48V nominal input	36-75VDC
Under Voltage Lockout	24V input	DC-DC ON (min.) 17.5VDC
		DC-DC OFF (max.) 17VDC
	48V input	DC-DC ON (min.) 35VDC
		DC-DC OFF (max.) 34VDC
Input Filter	Common Mode EMC Filter	
Input Voltage Variation dv/dt (Complies with ETS300 132 part 4.4)	5V/ms max	
Input Surge Voltage (100 ms max.)	24V Input	50VDC
	48V Input	100VDC
Input Reflected Ripple	nominal Vin and full load	30mA _{p-p}
Start Up Time	nominal Vin and constant resistor load	2ms typ., 5ms max.
Remote ON/OFF ⁽⁴⁾	Logic High	Open or 3.0V < Vr < 5.5V
	Logic Low	Short or 0V < Vr < 1.2V
Remote OFF input current	Nominal input	2mA typ.
Output Power	50W max.	
Output Voltage Accuracy	10% Load and nominal Vin	±1%
Voltage Adjustability	±10%	
Minimum Load	0%	
Line Regulation	low line, high line at full load	±0.3%
Load Regulation	10% to 100% full load	±0.5%
Ripple and Noise (20MHz bandwidth limited) (measured with 1µF capacitor across output)	3.3V, 5V	60mV _{p-p} typ.
	All others	40mV _{p-p} typ.
Temperature Coefficient	±0.04%/°C max.	
Transient Response	25% load step change	200µs
Over Load Protection	% of full load at nominal Vin	120% typ.
Short Circuit Protection	Hiccup, automatic recovery	
Output Over Voltage Protection (refer to block diagram in Application Notes)	Converter shutdown if Vout > Vout nominal + 20%	
Isolation Voltage	Rated at 2250VDC/1 minute, Flash tested at 3000VDC/1 second	
Isolation Resistance	10MΩ min.	
Isolation Capacitance (refer to block diagram in Application Notes)	3000pF max.	
Operating Frequency	260kHz ± 40kHz Maximum	
Case Temperature	+120°C	
Storage Temperature Range	-55°C to +125°C	
Over Temperature Protection (refer to block diagram in Application Notes)	internal thermistor	
RPP50 Operating Temperature Range	Ambient, Free Convection	-45°C to +81°C max (without derating)
Thermal Impedance (Natural convection)	Ribbed Case: Vertical	7.3°C/Watt
	Ribbed Case: Horizontal	10°C/Watt
Relative Humidity	5% to 95% RH	
Case Material ⁽⁷⁾	Aluminium	
Potting Material	Silicone (UL94-V0)	
Weight	Ribbed Case	39g
	Baseplate Case	43g
Packing Quantity	Ribbed Case	4 pcs per Tube
	Baseplate Case	Single packed

Specifications (typical at nominal input and 25°C unless otherwise noted)

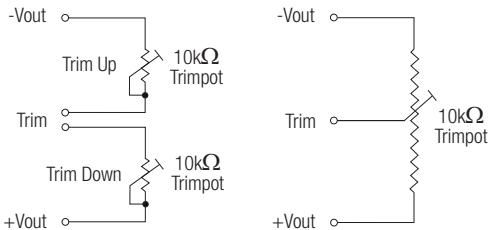
Safety Standards	certified UL-60950-1, 1st Edition	
Thermal Cycling	complies with MIL-STD-810F	
Vibration	10-55Hz, 12G, 30 Min. along X, Y and Z	
Conducted Emissions	EN55022	Class B
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Perf. Criteria B
Radiated Immunity	EN61000-4-3	Perf. Criteria A
Fast Transient ⁽⁵⁾	EN61000-4-4	Perf. Criteria B
Surge ⁽⁶⁾	EN61000-4-5	Perf. Criteria B
Conducted Immunity	EN61000-4-6	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 ⁽⁶⁾	1989 x 10 ³ hours	

Notes :

1. Typical values at nominal input voltage and no load/full load.
2. Typical values at nominal input voltage and full load.
3. Typical values for ribbed case at nominal input voltage and full load in vertical orientation and with Eurocard-sized PCB ground planes to assist in heat dissipation. For horizontal orientation, reduce the maximum temperatures by 10°C.
4. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g.RPP50-4805S.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
5. Requires an external 100µF low ESR capacitor to meet EN61000-4-4 and EN61000-4-5
6. Case I: 50% Stress, Temperature at 50°C (Ground Benign).
7. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing.The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour varations are cosmetic only and do not affect the operation or performance of the converters.

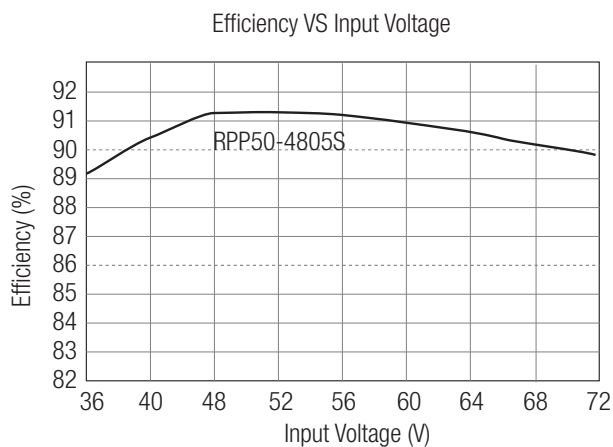
RPP50

External Output Trimming
Refer to Application Notes for
suggested Resistor Values



Typical Characteristics

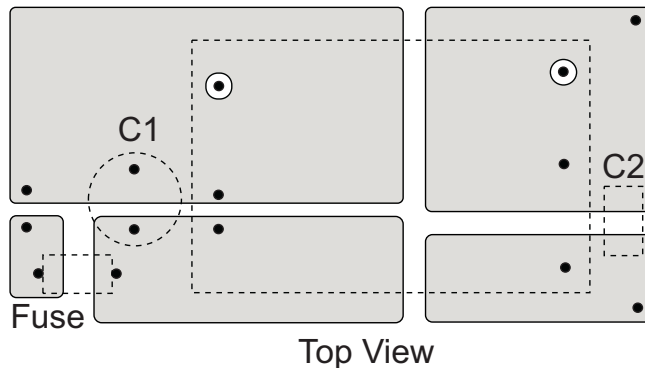
RPP50-4805S



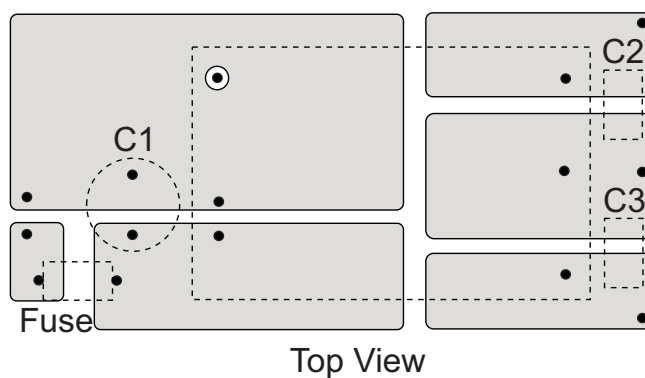
Recommended PCB Layout

Ribbed Case

Single Output

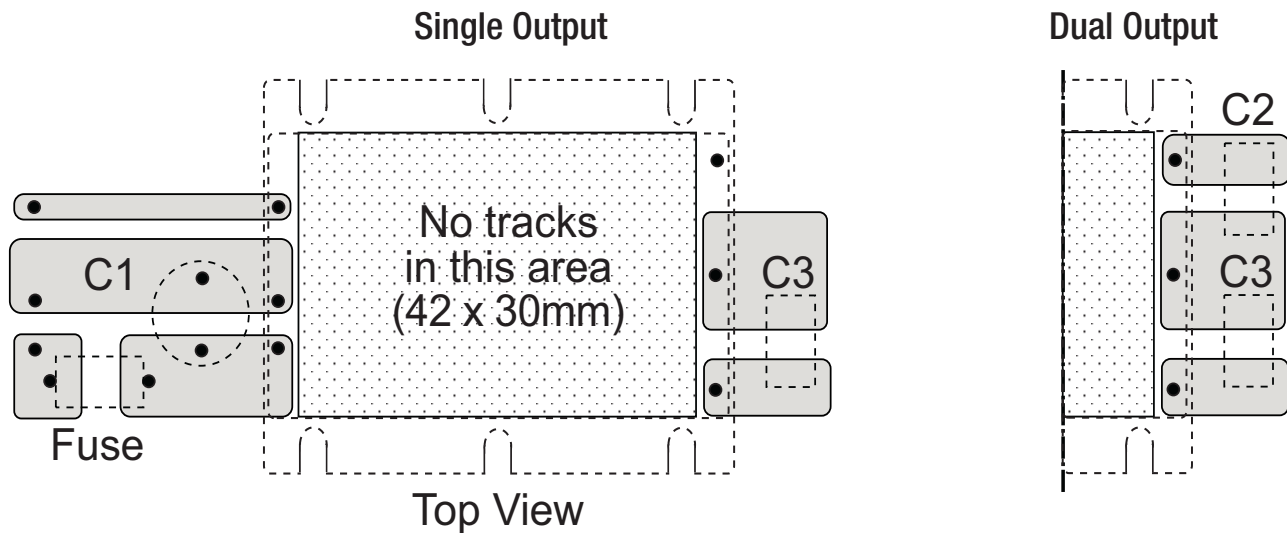


Dual Output



Recommended PCB Layout

Baseplate Case- suggested PCB layout



Input Fuse is recommended. Recommended fuse rating = double maximum input current, time delay type.

Input Capacitor, C1, is required to meet EN61000 Surge and Fast Transient, otherwise it is not required for normal operation.

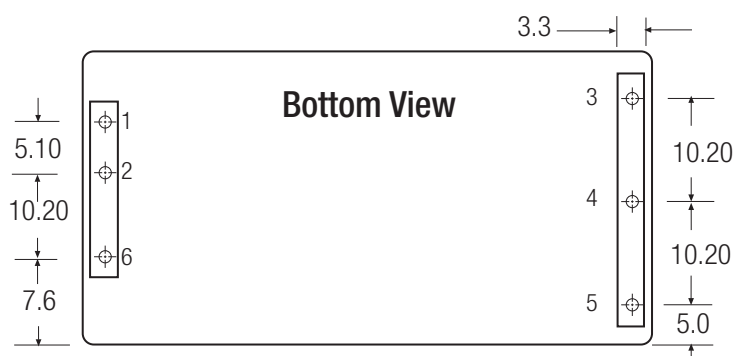
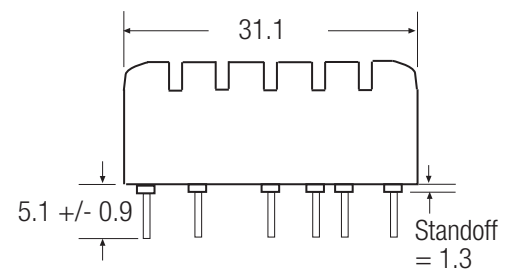
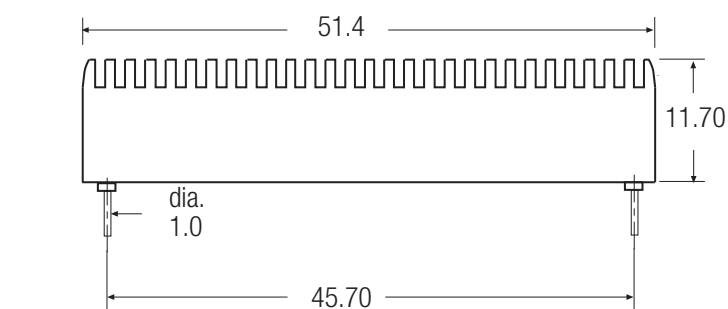
Output Capacitors C2/C3 are recommended, but not required for normal operation. Typical capacitor values are 1µF MLCC

To ensure optimum thermal performance, use large areas of copper on the PCB to assist with heat dissipation and mount the converter vertically.

Package Style and Pinning (mm)

Ribbed Case (Standard - no Suffix)

3rd angle projection



Pin Connections

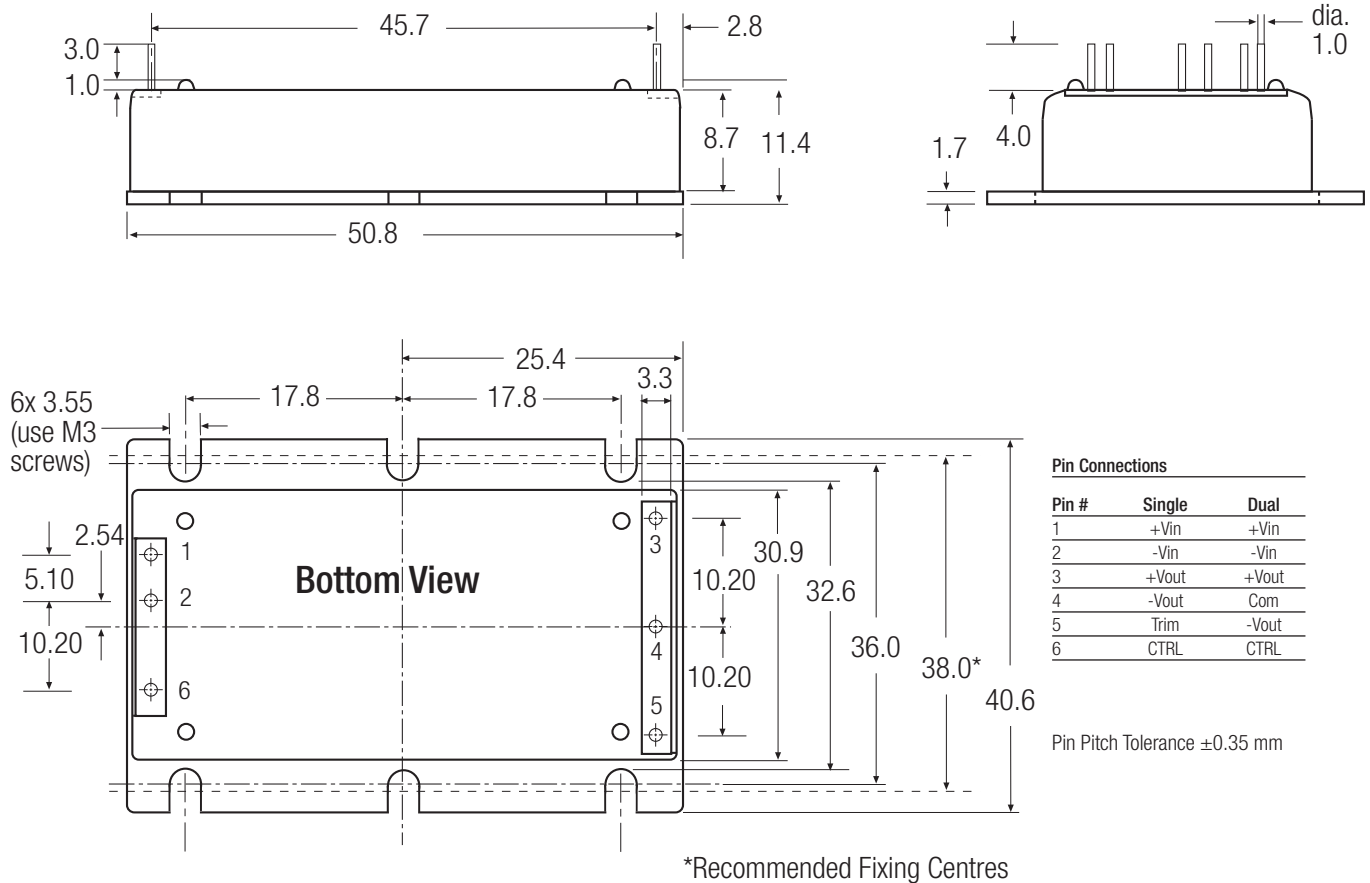
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

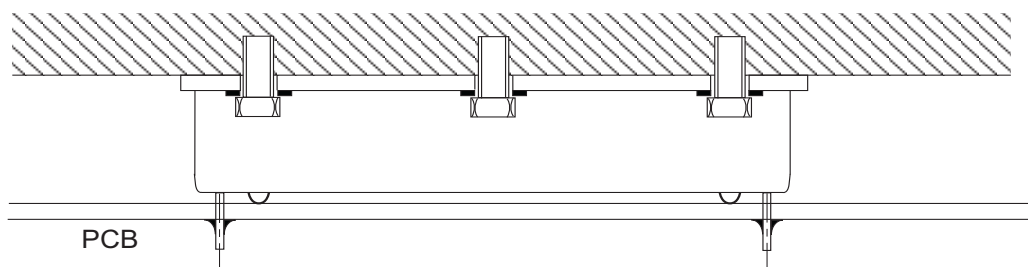
Typical Characteristics

Baseplate Case (-B Suffix)

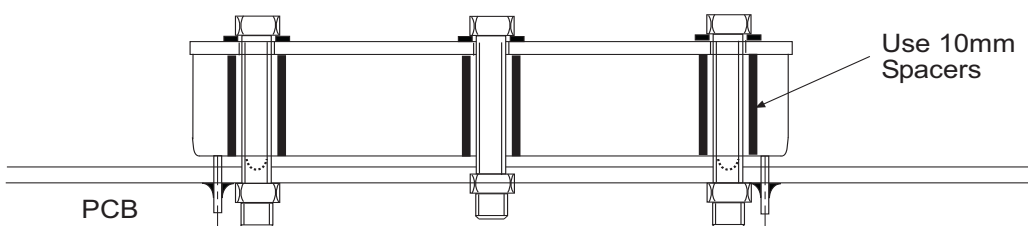
3rd angle projection



Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead



Baseplate Case Fixing - Anti Vibration Mounting onto PCB



ICE Technology

I.C.E Technology

ICE (Innovation in Converter Excellence) Technology uses a combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

The exact details of this technology must remain secret, but the following brief resume describes the main features of this technological breakthrough:

Minimising internal heat dissipation

The difference between the input power and the output power is the internal power dissipation which generates heat within the converter.

If the converter is inefficient at converting power, then adding external heat sinks, base-plates or fans are remedies that cure the symptoms rather than address the illness.

First and foremost, the converter must have the highest possible efficiency over the entire input voltage range and load conditions. Most power converters are designed to be most efficient at 25°C, full load and nominal input voltage and thus offer a compromise performance when lightly loaded or operated at the maximum ambient temperature.

ICE Technology uses state-of-the-art techniques to improve power conversion efficiency by approximately 2% compared to standard converters. A two per cent improvement may not sound much, but the difference between a converter with 88% efficiency and one with 90% efficiency is a 17% reduction in the dissipated power. In addition, when lightly loaded, the converters enter a power saving mode and draw only a few milliamps from the supply.

Maximising heat transfer

The rate of heat transfer between a hot body and its cooler surroundings is given by Fourier's Law:

$$q = -k \cdot \Delta T$$

where

q = rate of heat transfer

k = thermal conductivity

and ΔT = temperature difference

If k can be made larger, then the rate of heat transfer can still match or exceed the rate of heat generation at lower temperature differences ΔT and the converter will have an extended operating temperature range.

Techniques to improve thermal conductivity

ICE Technology splits the thermal conductivity problem into two areas and attacks each area separately using different techniques.

Firstly, the internal heat transfer to the case is maximised by a combination of novel converter construction and clever thermal design.

ICE converters use a construction where the hottest components (the switching FET, the transformer and the synchronous rectification FETs) are placed closest to the case wall. This method of construction makes the manufacture of the converter more difficult, but this lack of compromise reduces greatly the internal thermal impedance.

Secondly, the rate of transfer of heat to the surroundings is improved by a novel case construction which incorporates a built-in heat sink. The case is also made from thick aircraft grade aluminium rather than thin nickel-plated copper to provide a better thermal junction between the case and the high thermal conductivity silicone potting material used inside the converter.

Maximising high temperature performance

The final technique used in the construction of ICE Technology converters is to use high temperature internal components. The maximum operating temperature of a converter is dependent on the lowest maximum permissible operating temperature of any the components used. If the capacitors are rated up to +85°C and the FETs are rated at +160°C, then the limiting factor is the capacitor temperature of +85°C.

The temperature of the ferrite core used in the transformer is also an important limiting factor. If the transformer core temperature exceeds the Curie temperature of the ferrite, then the transformer rapidly loses performance.

ICE Technology converter uses high temperature grade components to permit a case temperature of +115°C maximum. This allows operation at up to +85°C ambient without the need for fans to blow air over the converter.



Electromagnetic Compatibility

Although high temperature performance is a significant feature of ICE Technology design, it does not end there.

ICE Technology also addresses the need for electromagnetic compatibility by incorporating a built-in EN55022 Class B grade filter inside the converter. The converter has been designed from the ground up to meet EMC requirements rather than a conventional design process where first the converter is optimised for performance and then an external filter is added to combat the conducted interference.

By including the filter on the main PCB of the converter, the track path lengths and impedances between the filter and the noise-generating components are reduced to the minimum and consequently smaller value filter components can be used that fit into the compact case dimensions of the Powerline+ converters without compromising on filter performance.

Safety and Protection

ICE Technology converters are fully protected from output short circuits, overload, output over-voltage and over-temperature. In addition, they feature under-voltage lockout that will automatically disable the converter if the input voltage falls below the minimum level.

The output is current limited which means that temporary overloads can occur without the converter shutting down. When overloaded, the output voltage will decrease to keep the maximum power constant. For the 40W and 50W converters, if the overload is too high, the converter will go into hiccup short circuit protection mode. In this mode, the converter will attempt to reconnect power every 10-20 milliseconds.

Output overvoltage protection is monitored by a separate and independent feedback circuit and an internal thermistor sensor is used to protect the converter against overheating.

Powerline Plus Output Trim Tables



Output Voltage Trimming:

Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors.

No general equation can be given for calculating the trim resistors, but the

following trimtables give typical values for choosing these trimming resistors.

If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

RPPxx-xx3.3S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,333	3,366	3,399	3,432	3,465	3,498	3,531	3,564	3,597	3,63	Volts
R _U =	72.8	34.4	21.2	14.4	9.9	7.2	5.3	3.88	2.74	1.84	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,267	3,234	3,201	3,168	3,135	3,102	3,069	3,036	3,003	2,97	Volts
R _D =	101.3	36.2	21.0	13.65	9.2	6.0	4.12	2.56	1.34	0.87	KOhms

RPPxx-xx05S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	5,05	5,1	5,15	5,2	5,25	5,3	5,35	5,4	5,45	5,5	Volts
R _U =	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	4,95	4,9	4,85	4,8	4,75	4,7	4,65	4,6	4,55	4,5	Volts
R _D =	127.6	55.8	33.0	20.2	14.2	9.46	5.97	3.6	1.77	0.28	KOhms

RPPxx-xx12S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12,12	12,24	12,36	12,48	12,6	12,72	12,84	12,96	13,08	13,2	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11,88	11,76	11,64	11,52	11,4	11,28	11,16	11,04	10,92	10,8	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

RPPxx-xx15S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15,15	15,3	15,45	15,6	15,75	15,9	16,05	16,2	16,35	16,5	Volts
R _U =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	14,85	14,7	14,55	14,4	14,25	14,1	13,95	13,8	13,65	13,5	Volts
R _D =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms

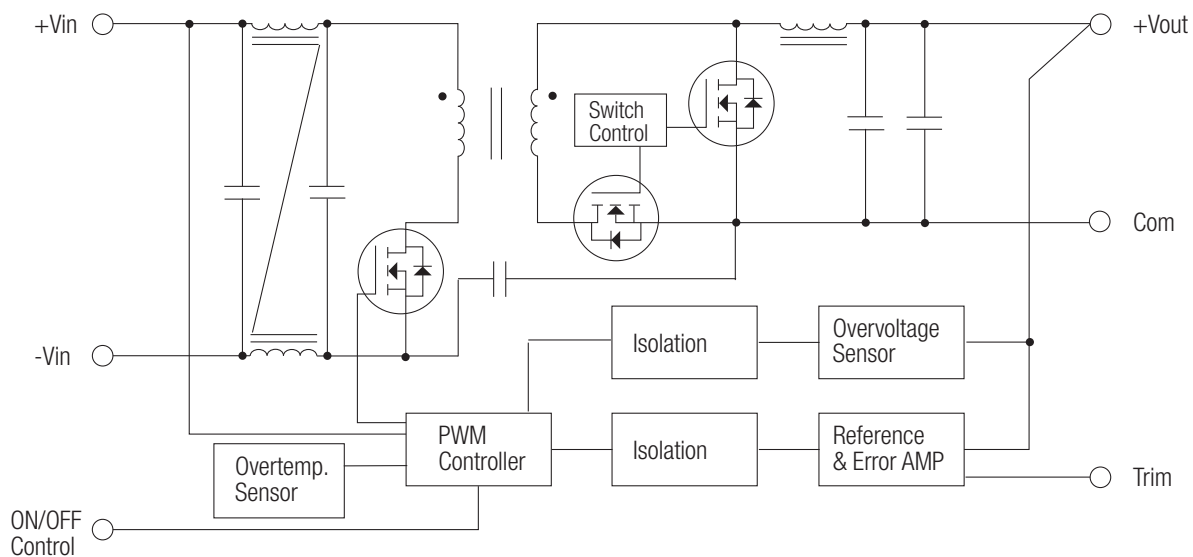
Powerline Plus Output Trim Tables

RPPxx-xx24S (all types)

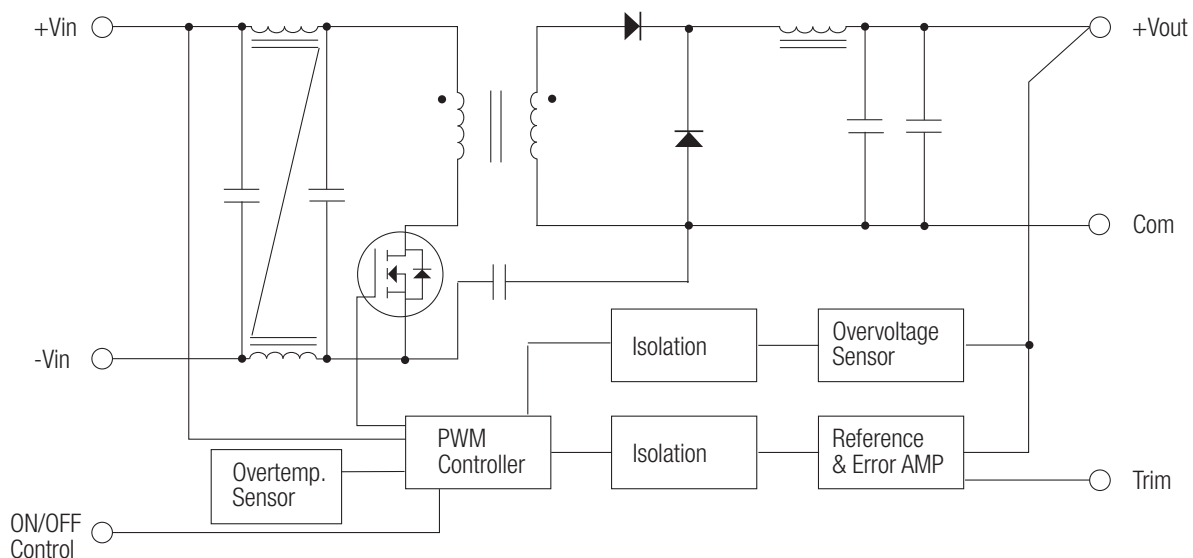
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	24,24	24,48	24,72	24,96	25,20	25,44	24,68	25,92	26,16	26,4	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	23,76	23,52	23,28	23,04	22,80	22,56	22,32	22,08	21,84	21,6	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

Block Diagrams

Single Output - 3.3V and 5V Outputs

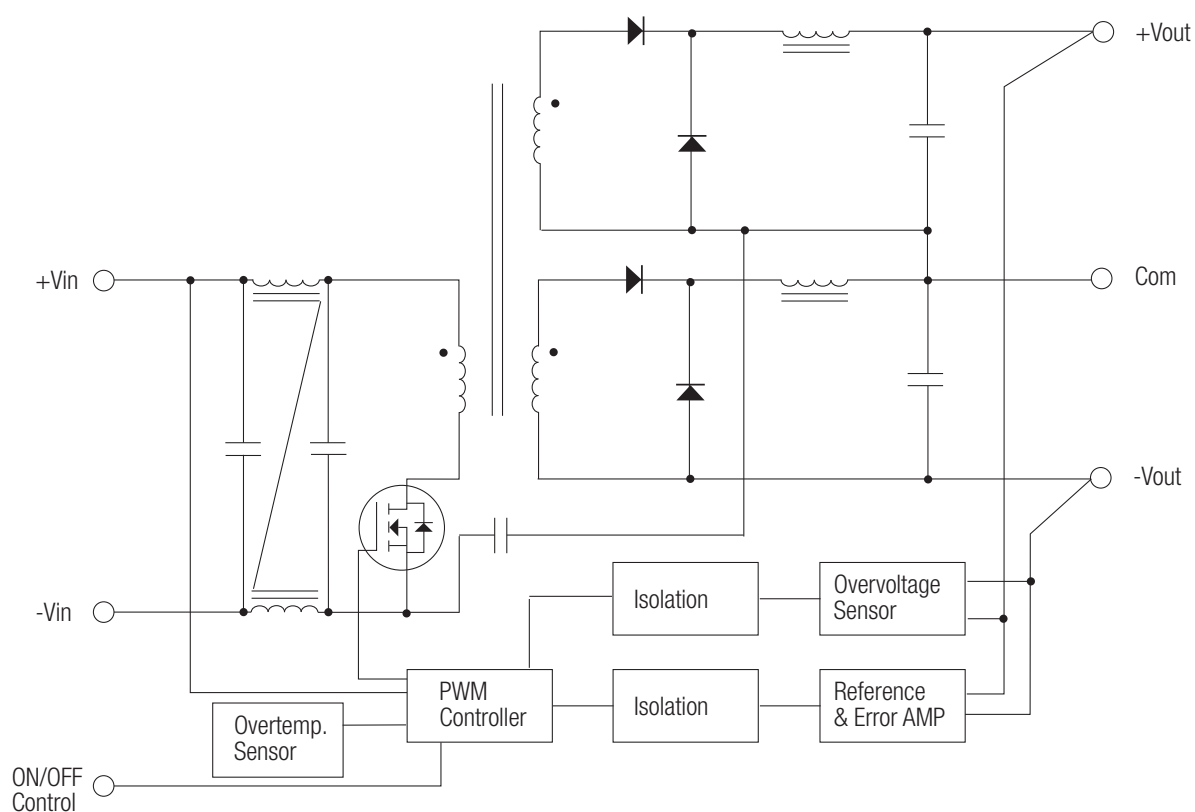


Single Output - all other outputs



Block Diagrams

Dual Output



POWERLINE PLUS - CONTENTS

The POWERLINE PLUS RAILWAY uses ICE Technology. A combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

RECOM - Green high-efficiency power solutions. SAVE ENERGY. NOW.



Introduction

The RPR series DC/DC converters are designed for railway rolling stock applications.

Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide operating temperature range of -45°C to +85°C. Although the case size is very compact, the converter contains a built-in Class A EMI filter, so few external components are required.

The RPR series is available in two case styles: a low profile flat top case, a ribbed case with a built-in heatsink and the baseplate case for high vibration or bulkhead-mounting applications.

They are EN 50155 and EN 50121-3-2 compliant.

Regulated DC/DC Converters

Series (**)	Isolation (kVDC)	Power (Watts)	Input Voltages (VDC)	Output Voltages (VDC)	Case Options	Outputs	Page No.
RPR20	1.6	20	12-36, 25-75, 40-160	3.3, 5, 12, 15, 24 ±12, ±15, ±24	Baseplate	Single and Dual	RPR-1
RPR30	1.6	30	12-36, 25-75, 40-160	3.3, 5, 12, 15, 24 ±12, ±15, ±24	Baseplate	Single and Dual	RPR-11
RPR40	1.6	40	12-36, 25-75, 40-160	3.3, 5, 12, 15, 24 ±12, ±15, ±24	Baseplate	Single and Dual	RPR-22
RPR50	1.6	50	12-36, 25-75, 40-160	3.3, 5, 12, 15, 24 ±12, ±15, ±24	Baseplate	Single	RPR-33

Features

ICE Technology*

- T2 Temperature Range without Derating
- 120°C Maximum Case Temperature
- -45°C Minimum Operating Temperature
- EN 50155 Certified
- EN 50121-3-2 Certified
- CE Marked
- 24, 48 and 110VDC Input Ranges
- Six Sided Shielded Enclosure
- Baseplate Case Style
- Efficiency to >89%
- Low Quiescent Current

Description

The RPR20 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide case temperature range of -45°C to +120°C. The RPR20 has a baseplate case for high vibration or bulkhead mounting applications. It is EN 50155 and EN 50121-3-2 certified.

Selection Guide 24V, 48V and 110V Input Types

Part Number	Nominal Input VDC	Nom. Input Range VDC	Lockout Voltage VDC	Output Voltage VDC	Output Current mA
RPR20-243.3S-B	24	12-36	8	3.3	6000
RPR20-2405S-B	24	12-36	8	5	4000
RPR20-2412S-B	24	12-36	8	12	1666
RPR20-2415S-B	24	12-36	8	15	1333
RPR20-2424S-B	24	12-36	8	24	830
RPR20-483.3S-B	48	25-75	17	3.3	6000
RPR20-4805S-B	48	25-75	17	5	4000
RPR20-4812S-B	48	25-75	17	12	1666
RPR20-4815S-B	48	25-75	17	15	1333
RPR20-4824S-B	48	25-75	17	24	830
RPR20-1103.3S-B	110	40-160	36	3.3	6000
RPR20-11005S-B	110	40-160	36	5	4000
RPR20-11012S-B	110	40-160	36	12	1666
RPR20-11015S-B	110	40-160	36	15	1333
RPR20-11024S-B	110	40-160	36	24	830
RPR20-2412D-B	24	12-36	8	±12	±833
RPR20-2415D-B	24	12-36	8	±15	±666
RPR20-2424D-B	24	12-36	8	±24	±416
RPR20-4812D-B	48	25-75	17	±12	±833
RPR20-4815D-B	48	25-75	17	±15	±666
RPR20-4824D-B	48	25-75	17	±24	±416
RPR20-11012D-B	110	40-160	36	±12	±833
RPR20-11015D-B	110	40-160	36	±15	±666
RPR20-11024D-B	110	40-160	36	±24	±416

For other CTRL logic or case style options please contact RECOM for availability.

POWERLINE+

Railway-Converter

with 5 year Warranty

RECOM

20 Watt

Single & Dual Output



EN-50155 Certified
EN-60950-1 Certified

RPR20

* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

Refer to Application Notes

Railway Input Voltage Requirements

Nominal Input Voltage	EN50155			NF F 01-510			RPR20		
	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)
24V	16.8~30V	14.4V	33.6V	18~34V	12V	40V	12~36V	9V	40V
48V	33.6~60V	28.8V	67.2V				25~75V	18V	80V
72V	50.4~90V	43.2V	100.8V	50~90V	36V	115V	40~160V	36V	176V
96V	67.2~120V	57.6V	134.4V				40~160V	36V	176V
110V	77~137.5V	66V	154V	77~137V	55V	176V	40~160V	36V	176V

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (continuous)		complies with EN50155 and NFF 01-510 (Un=24V)		12-36VDC	
		complies with EN50155 and NFF 01-510 (Un=48V)		25-75VDC	
		complies with EN50155 and NFF 01-510 (Un=72V, 96V &110V)		40-160VDC	
Low Transient operating voltage (100ms)		complies with EN50155 and NFF 01-510		Un x 0.5	
High Transient operating voltage (1 second)		complies with EN50155 and NFF 01-510		Un x 1.6	
Allowed Input Ripple		complies with EN50155		15%	
Input Reflected Ripple		nominal Vin and full load		20mA _{p-p}	
Supply Interruption (Perf. Criteria B)		according to EN50155, 5.1.1.2		Class S2	
		according to EN50155, 5.1.3		Class C2	
Start Up Time		nominal Vin and constant resistive load		2ms typ., 5ms max.	
Remote ON/OFF ⁽¹⁾		Logic High		Open or 8V < Vr < 60V	
		Logic Low		Short or 0V < Vr < 1.2V	
Remote OFF input current		Nominal input		2mA typ.	
Output Voltage Accuracy		50% Load and nominal Vin		±1.5%	
Voltage Adjustability		Single Output only		±10%	
Minimum Load				0%	
Line Regulation		low line, high line at full load		±0.3%	
Load Regulation		10% to 100% full load		±0.5%	
Cross Regulation (10% <> 100% Load)		Dual Outputs only		3% typ. / 5% max.	
Ripple and Noise (20MHz bandwidth limited)		(measured with 1µF capacitor across outputs)		1% Vout typ. / 3% max.	
Temperature Coefficient				±0.04%/°C max.	
Transient Response		25% load step change		800µs	
Over Load Protection		% of full load at nominal Vin		120% typ.	
Short Circuit Protection		Power Limit, automatic recovery			
Output Over Voltage Protection		Single Output		Converter shutdown if Vout > Vout nominal + 20%	
		Dual Output		Converter shutdown if Vout > Vout nominal + 10%	
Isolation Voltage		According to EN50155 12.2.9.2		1500VAC/1 minute	
Isolation Resistance		According to EN50155 12.2.9.1		10MΩ min.	
Isolation Capacitance				1500pF max.	
Operating Frequency				260kHz ± 40kHz	
Operating Temperature Range		(T2)	complies with EN50155: 4.1.2 and EN50125-1 when mounted on a heatsink (see notes)		-45°C to +85°C
(Ambient Air, Free Convection)		(Tx)			-45°C to +100°C
Maximum Case Temperature				+120°C	
Over Temperature Protection				Internal thermistor	
Storage Temperature Range				-55°C to +125°C	
Relative Humidity				5% to 95% RH	
Case Material ⁽²⁾				Aluminium	

continued on next page

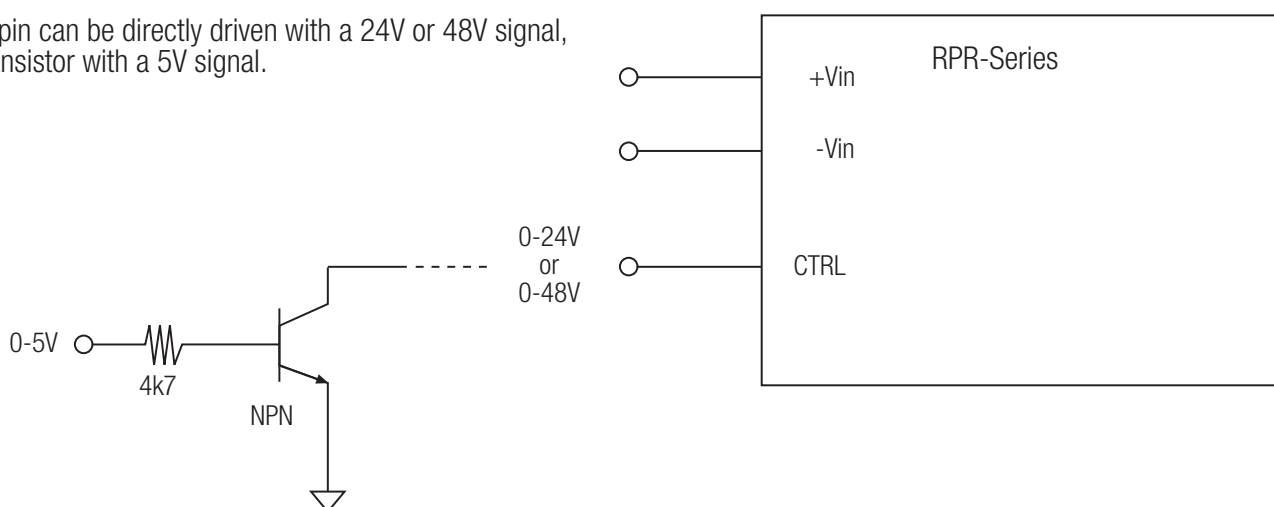
Specifications (typical at nominal input and 25°C unless otherwise noted)

Weight	43g	
Packing Quantity	Single packed	
Safety Standards	CE Marked	certified to EN-60950-1, 1st Edition
Thermal Performance	Cold	-40°C /16 Hours
	Dry Heat, Operating	-40°C/+85°C/ 5 Cycles
complies to EN50155: 12.2.3/4/5	Damp Heat,Cyclic	+25°C/+55°C, 95%RH / 2 x 24 Hours
Vibration, Shock & Bump (complies with EN61373, Category 1 Class B)	Vibration	5-150Hz, X:0.7m/s², Y:0.45m/s², Z:1m/s², 30 mins
	Shock	5g/30ms/18 shocks
Input Filter	Built-in Pi Filter	
Conducted Emissions	EN50121-3-2***	Class A
Radiated Emissions	EN50121-3-2***	Class A
ESD	EN50121-3-2***	Perf. Criteria B
Radiated Immunity	EN50121-3-2***	Perf. Criteria A
Fast Transient	EN50121-3-2***	Perf. Criteria A
Surge	EN50121-3-2***	Perf. Criteria B
Conducted Immunity	EN50121-3-2***	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 Case I: 50% Stress, Temperature at 50°C (Ground Benign)		2195 x 10 ³ hours

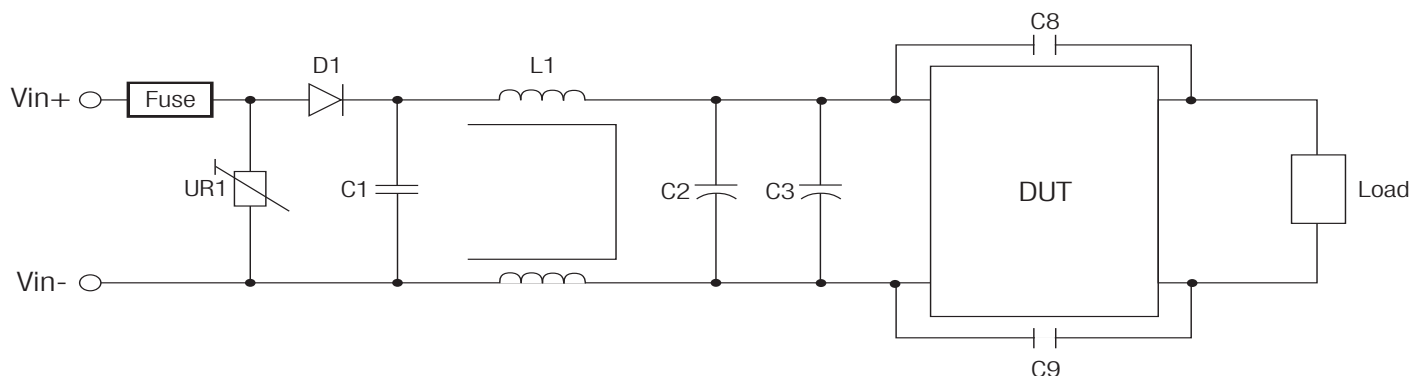
***with filter circuit

Typical Control Pin Application Circuit

The CTRL pin can be directly driven with a 24V or 48V signal, or via a transistor with a 5V signal.



EN50155 / NF F 01-510 Input Filter



Table

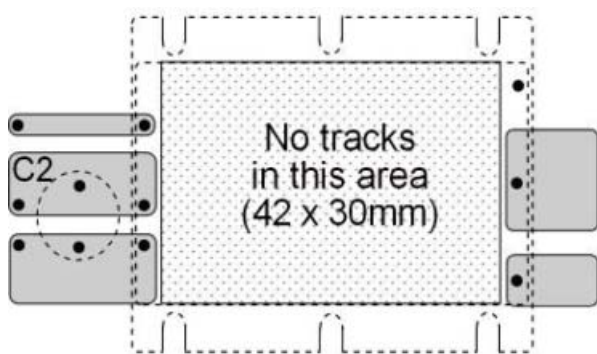
Module	Standard	UR1	D1	C1	L1	C2	C3	C8,C9
24V	EN50155	MOV 14D361K	100V/6A	6,8μF/50V	550μH±20%	330μF/ 50VDC	330μF/ 50VDC	4,7nF/3kV
48V	EN50155	MOV 14D361K	200V/3A	220nF/100V	550μH±20%	330μF/ 100VDC	330μF/ 100VDC	4,7nF/3kV
110V	EN50155	MOV 14D361K	300V/3A	470nF/250V	1200μH±20%	330μF/ 250VDC	330μF/ 250VDC	4,7nF/3kV

Notes :

1. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPR20-4805D-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
2. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.
3. The converter is supplied with a protective adhesive tape to keep the top surface clean. The tape is heat resistant and the converter can be soldered into place without removing the tape. The tape should be removed just before final installation.
4. The RPR series are optionally available with a ribbed heatsink case style. They will then meet Tx requirements without an external heat-sink. Please contact your RECOM supplier for more information.

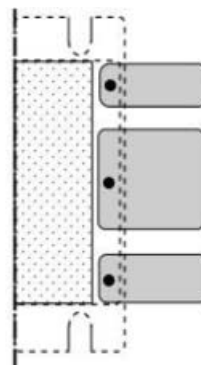
Baseplate Case- suggested PCB layout

Single Output



Top View

Dual Output



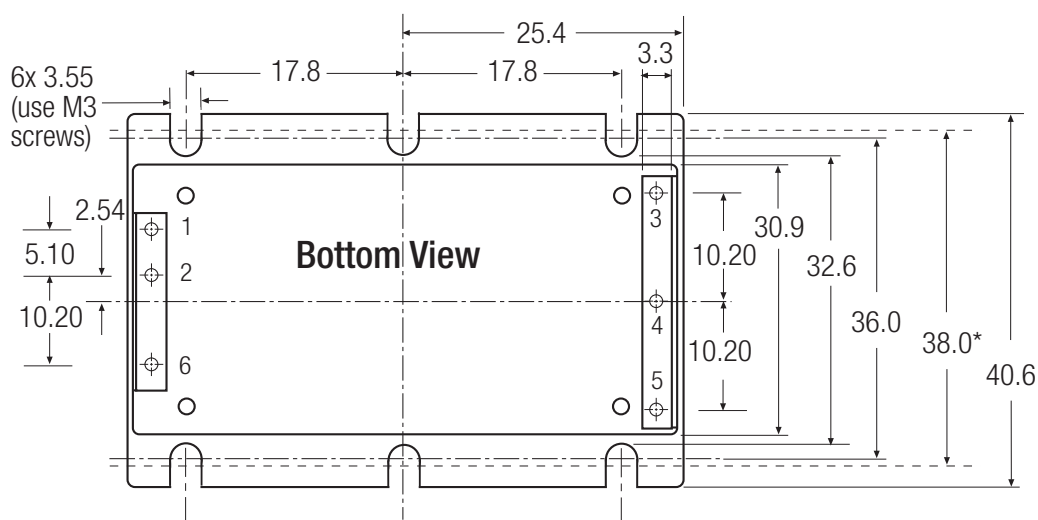
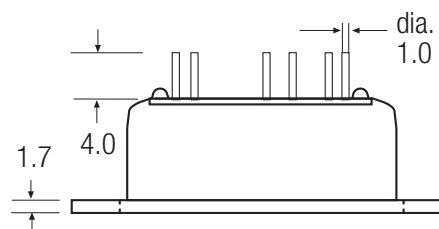
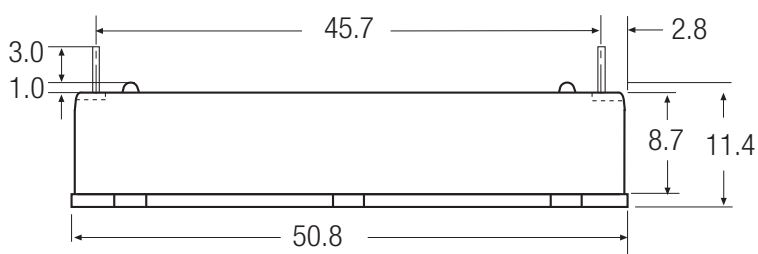
Input Fuse is recommended.
Recommended fuse rating =
double maximum input current,
time delay type.

To ensure optimum thermal
performance, use large areas
of copper on the PCB to assist
with heat dissipation and
mount the converter vertically.

Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

3rd angle
projection



Bottom View

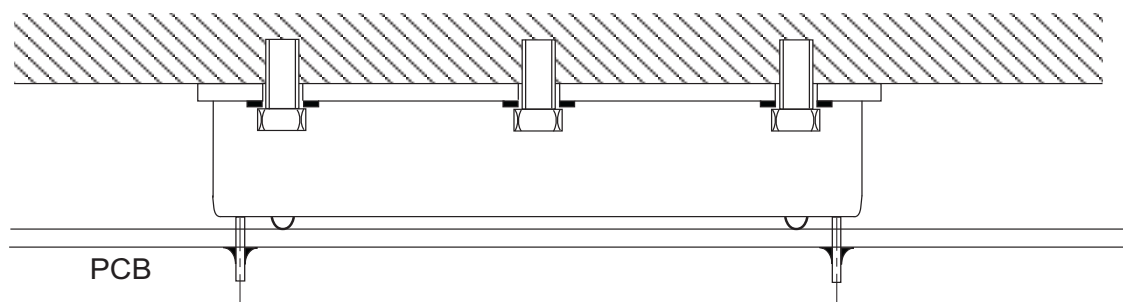
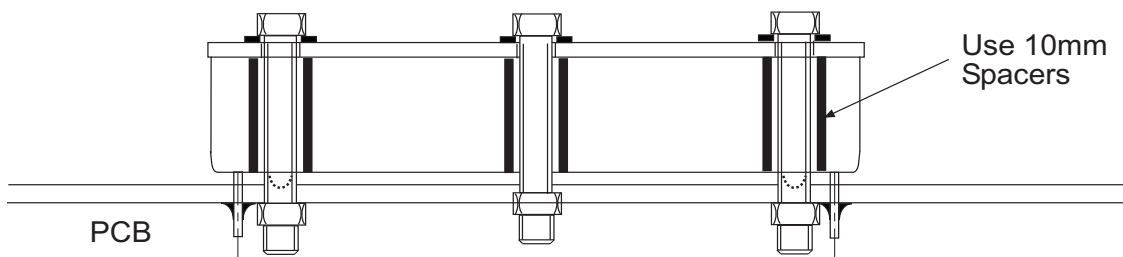
NOTE: Single output pinout
is different for the
-B version!

Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

*Recommended Fixing Centres

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead**Baseplate Case Fixing - Anti Vibration Mounting onto PCB**

I.C.E Technology

ICE (Innovation in Converter Excellence) Technology uses a combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

The exact details of this technology must remain secret, but the following brief resume describes the main features of this technological breakthrough:

Minimising internal heat dissipation

The difference between the input power and the output power is the internal power dissipation which generates heat within the converter.

If the converter is inefficient at converting power, then adding external heat sinks, base-plates or fans are remedies that cure the symptoms rather than address the illness.

First and foremost, the converter must have the highest possible efficiency over the entire input voltage range and load conditions. Most power converters are designed to be most efficient at 25°C, full load and nominal input voltage and thus offer a compromise performance when lightly loaded or operated at the maximum ambient temperature.

ICE Technology uses state-of-the-art techniques to improve power conversion efficiency by approximately 2% compared to standard converters. A two per cent improvement may not sound much, but the difference between a converter with 88% efficiency and one with 90% efficiency is a 17% reduction in the dissipated power. In addition, when lightly loaded, the converters enter a power saving mode and draw only a few milliamps from the supply.

Maximising heat transfer

The rate of heat transfer between a hot body and its cooler surroundings is given by Fourier's Law:

$$q = -k \cdot \Delta T$$

where

q = rate of heat transfer

k = thermal conductivity

and ΔT = temperature difference

If k can be made larger, then the rate of heat transfer can still match or exceed the rate of heat generation at lower temperature differences ΔT and the converter will have an extended operating temperature range.

Techniques to improve thermal conductivity

ICE Technology splits the thermal conductivity problem into two areas and attacks each area separately using different techniques.

Firstly, the internal heat transfer to the case is maximised by a combination of novel converter construction and clever thermal design.

ICE converters use a construction where the hottest components (the switching FET, the transformer and the synchronous rectification FETs) are placed closest to the case wall. This method of construction makes the manufacture of the converter more difficult, but this lack of compromise reduces greatly the internal thermal impedance.

Secondly, the rate of transfer of heat to the surroundings is improved by a novel case construction which incorporates a built-in heat sink. The case is also made from thick aircraft grade aluminium rather than thin nickel-plated copper to provide a better thermal junction between the case and the high thermal conductivity silicone potting material used inside the converter.

Maximising high temperature performance

The final technique used in the construction of ICE Technology converters is to use high temperature internal components. The maximum operating temperature of a converter is dependent on the lowest maximum permissible operating temperature of any the components used. If the capacitors are rated up to +85°C and the FETs are rated at +160°C, then the limiting factor is the capacitor temperature of +85°C.

The temperature of the ferrite core used in the transformer is also an important limiting factor. If the transformer core temperature exceeds the Curie temperature of the ferrite, then the transformer rapidly loses performance.

ICE Technology converter uses high temperature grade components to permit a case temperature of +115°C maximum. This allows operation at up to +85°C ambient without the need for fans to blow air over the converter.



Electromagnetic Compatibility

Although high temperature performance is a significant feature of ICE Technology design, it does not end there.

ICE Technology also addresses the need for electromagnetic compatibility by incorporating a built-in EN55022 Class B grade filter inside the converter. The converter has been designed from the ground up to meet EMC requirements rather than a conventional design process where first the converter is optimised for performance and then an external filter is added to combat the conducted interference.

By including the filter on the main PCB of the converter, the track path lengths and impedances between the filter and the noise-generating components are reduced to the minimum and consequently smaller value filter components can be used that fit into the compact case dimensions of the Powerline+ converters without compromising on filter performance.

Safety and Protection

ICE Technology converters are fully protected from output short circuits, overload, output over-voltage and over-temperature. In addition, they feature under-voltage lockout that will automatically disable the converter if the input voltage falls below the minimum level.

The output is current limited which means that temporary overloads can occur without the converter shutting down. When overloaded, the output voltage will decrease to keep the maximum power constant. For the 40W and 50W converters, if the overload is too high, the converter will go into hiccup short circuit protection mode. In this mode, the converter will attempt to reconnect power every 10-20 milliseconds.

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POWERLINE+ Application Notes

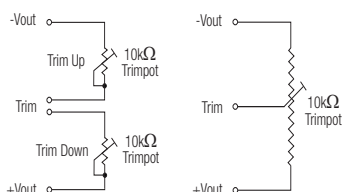
DC/DC-Converter

Trim Tables

Powerline Plus Output Trim Tables

RECOM

Output Voltage Trimming:



Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors.

No general equation can be given for calculating the trim resistors, but the

following trimtables give typical values for choosing these trimming resistors.

If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

RPRxx-xx3.3S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,333	3,366	3,399	3,432	3,465	3,498	3,531	3,564	3,597	3,63	Volts
R _U =	72.8	34.4	21.2	14.4	9.9	7.2	5.3	3.88	2.74	1.84	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,267	3,234	3,201	3,168	3,135	3,102	3,069	3,036	3,003	2,97	Volts
R _D =	101.3	36.2	21.0	13.65	9.2	6.0	4.12	2.56	1.34	0.87	KOhms

RPRxx-xx05S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	5,05	5,1	5,15	5,2	5,25	5,3	5,35	5,4	5,45	5,5	Volts
R _U =	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	4,95	4,9	4,85	4,8	4,75	4,7	4,65	4,6	4,55	4,5	Volts
R _D =	127.6	55.8	33.0	20.2	14.2	9.46	5.97	3.6	1.77	0.28	KOhms

RPRxx-xx12S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12,12	12,24	12,36	12,48	12,6	12,72	12,84	12,96	13,08	13,2	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11,88	11,76	11,64	11,52	11,4	11,28	11,16	11,04	10,92	10,8	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

RPRxx-xx15S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15,15	15,3	15,45	15,6	15,75	15,9	16,05	16,2	16,35	16,5	Volts
R _U =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	14,85	14,7	14,55	14,4	14,25	14,1	13,95	13,8	13,65	13,5	Volts
R _D =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms

DC/DC-Converter

Block Diagrams

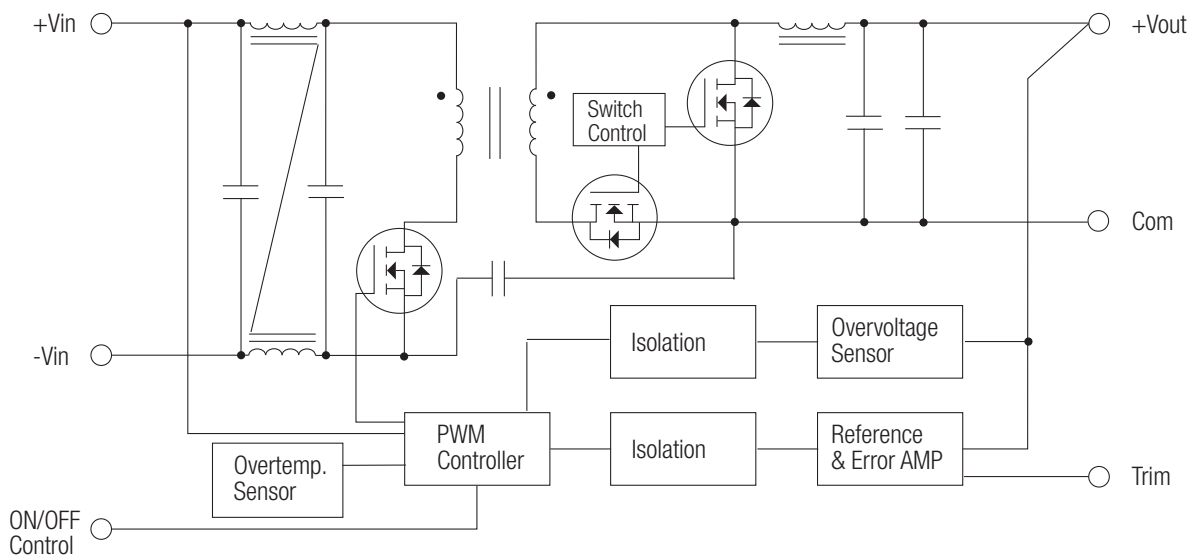
Powerline Plus Output Trim Tables

RPRxx-xx24S (all types)

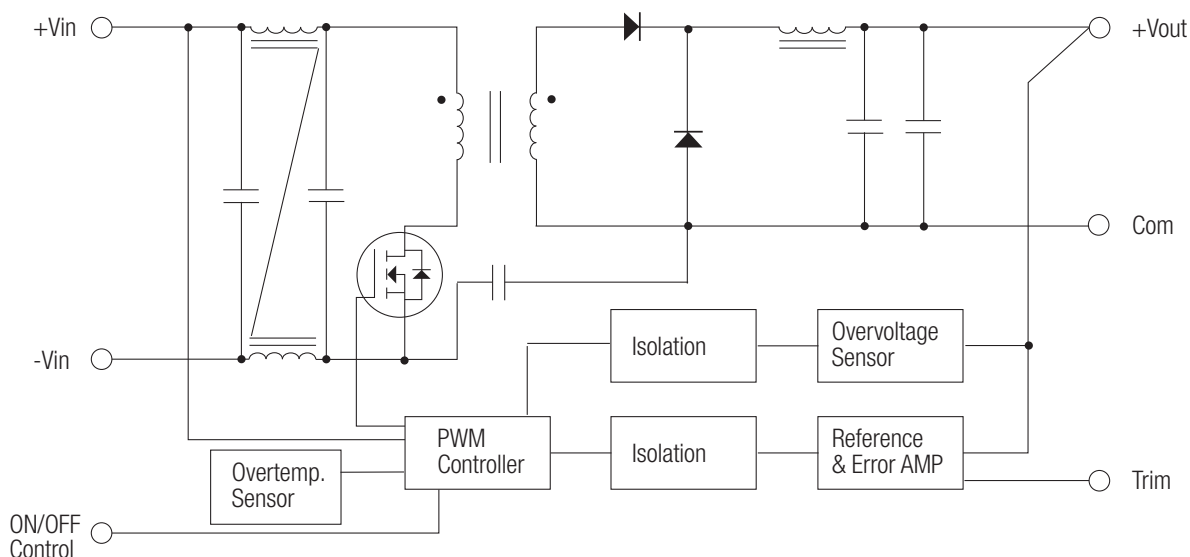
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	24,24	24,48	24,72	24,96	25,20	25,44	24,68	25,92	26,16	26,4	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	23,76	23,52	23,28	23,04	22,80	22,56	22,32	22,08	21,84	21,6	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

Block Diagrams

Single Output - 3.3V and 5V Outputs



Single Output - all other outputs



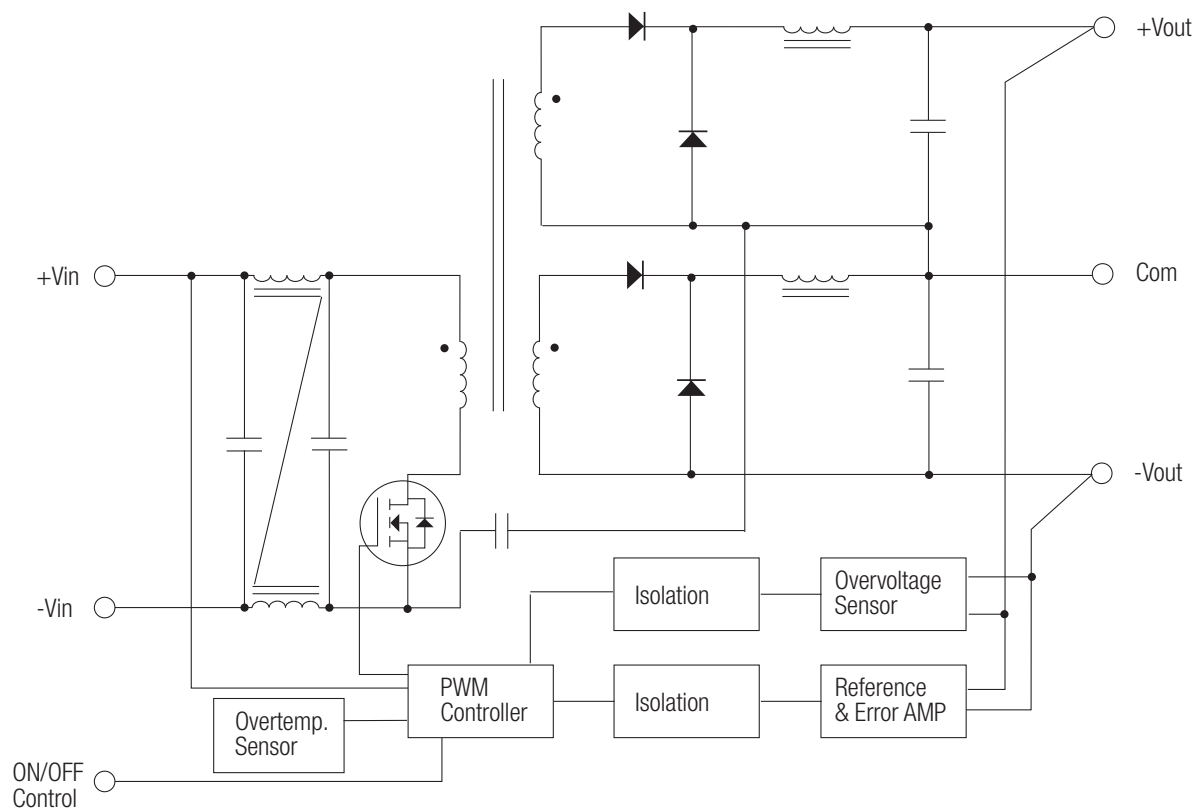
POWERLINE+ Application Notes

DC/DC-Converter

Block Diagrams

Block Diagrams

Dual Output



Features

ICE Technology*

- T2 Temperature Range without Derating
- 120°C Maximum Case Temperature
- -45°C Minimum Operating Temperature
- EN 50155 Certified
- EN 50121-3-2 Certified
- CE Marked
- 24, 48 and 110VDC Input Ranges
- Six Sided Shielded Enclosure
- Baseplate Case Styles
- Efficiency to >89%
- Low Quiescent Current

Description

The RPR30 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide operating temperature range of -45°C to +120°C. The RPR30 has a baseplate case for high vibration or bulkhead-mounting applications. It is EN 50155 and EN 50121-3-2 certified.

Selection Guide 24V, 48V and 110V Input Types

Part Number	Nominal Input VDC	Nom. Input Range VDC	Lockout Voltage VDC	Output Voltage VDC	Output Current mA
RPR30-243.3S-B	24	12-36	8	3.3	9100
RPR30-2405S-B	24	12-36	8	5	6000
RPR30-2412S-B	24	12-36	8	12	2500
RPR30-2415S-B	24	12-36	8	15	2000
RPR30-2424S-B	24	12-36	8	24	1250
RPR30-483.3S-B	48	25-75	17	3.3	9100
RPR30-4805S-B	48	25-75	17	5	6000
RPR30-4812S-B	48	25-75	17	12	2500
RPR30-4815S-B	48	25-75	17	15	2000
RPR30-4824S-B	48	25-75	17	24	1250
RPR30-1103.3S-B	110	40-160	36	3.3	9100
RPR30-11005S-B	110	40-160	36	5	6000
RPR30-11012S-B	110	40-160	36	12	2500
RPR30-11015S-B	110	40-160	36	15	2000
RPR30-11024S-B	110	40-160	36	24	1250
RPR30-2412D-B	24	12-36	8	±12	±1250
RPR30-2415D-B	24	12-36	8	±15	±1000
RPR30-2424D-B	24	12-36	8	±24	±620
RPR30-4812D-B	48	25-75	17	±12	±1250
RPR30-4815D-B	48	25-75	17	±15	±1000
RPR30-4824D-B	48	25-75	17	±24	±620
RPR30-11012D-B	110	40-160	36	±12	±1250
RPR30-11015D-B	110	40-160	36	±15	±1000
RPR30-11024D-B	110	40-160	36	±24	±620

For other CTRL logic or case style options please contact RECOM for availability.

POWERLINE+

Railway-Converter

with 5 year Warranty

RECOM

30 Watt Single & Dual Output



EN-50155 Certified
EN-60950 Certified

RPR30

* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

Refer to Application Notes

Railway Input Voltage Requirements

Nominal Input Voltage	EN50155			NF F 01-510			RPR30		
	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)
24V	16.8~30V	14.4V	33.6V	18~34V	12V	40V	12~36V	9V	40V
48V	33.6~60V	28.8V	67.2V				25~75V	18V	80V
72V	50.4~90V	43.2V	100.8V	50~90V	36V	115V	40~160V	36V	176V
96V	67.2~120V	57.6V	134.4V				40~160V	36V	176V
110V	77~137.5V	66V	154V	77~137V	55V	176V	40~160V	36V	176V

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (continuous)		complies with EN50155 and NFF 01-510 (Un=24V)		12-36VDC
		complies with EN50155 and NFF 01-510 (Un=48V)		25-75VDC
		complies with EN50155 and NFF 01-510 (Un=72V, 96V &110V)		40-160VDC
Low Transient operating voltage (100ms)		complies with EN50155 and NFF 01-510		Un x 0.5
High Transient operating voltage (1 second)		complies with EN50155 and NFF 01-510		Un x 1.6
Allowed Input Ripple		complies with EN50155		15%
Input Reflected Ripple		nominal Vin and full load		20mA _{p-p}
Supply Interruption (Perf. Criteria B)		according to EN50155, 5.1.1.2		Class S2
		according to EN50155, 5.1.3		Class C2
Start Up Time		nominal Vin and constant resistive load		2ms typ., 5ms max.
Remote ON/OFF ⁽¹⁾		Logic High		Open or 8V < Vr < 60V
		Logic Low		Short or 0V < Vr < 1.2V
Remote OFF input current		Nominal input		2mA typ.
Output Voltage Accuracy		50% Load and nominal Vin		±1.5%
Voltage Adjustability		Single Output only		±10%
Minimum Load				0%
Line Regulation		low line, high line at full load		±0.3%
Load Regulation		10% to 100% full load		±0.5%
Cross Regulation (10% <> 100% Load)		Dual Outputs only		3% typ. / 5% max.
Ripple and Noise (20MHz bandwidth limited)		(measured with 1µF capacitor across outputs)		1% Vout typ. / 3% max.
Temperature Coefficient				±0.04%/°C max.
Transient Response		25% load step change		800µs
Over Load Protection		% of full load at nominal Vin		120% typ.
Short Circuit Protection				Power Limit, automatic recovery
Output Over Voltage Protection		Single Output		Converter shutdown if Vout > Vout nominal + 20%
		Dual Output		Converter shutdown if Vout > Vout nominal + 10%
Isolation Voltage		According to EN50155 12.2.9.2		Tested at 1500VAC/1 minute
Isolation Resistance		According to EN50155 12.2.9.1		10MΩ min.
Isolation Capacitance				1500pF max.
Operating Frequency				260kHz ± 40kHz
Operating Temperature Range (Ambient Air, Free Convection)	(T2)	complies with EN50155: 4.1.2 and EN50125-1 with derating		-45°C to +85°C
	(Tx)			-45°C to +100°C
Maximum Case Temperature				+120°C
Over Temperature Protection				Internal thermistor
Storage Temperature Range				-55°C to +125°C
Relative Humidity				5% to 95% RH
Case Material ⁽²⁾				Aluminium

continued on next page

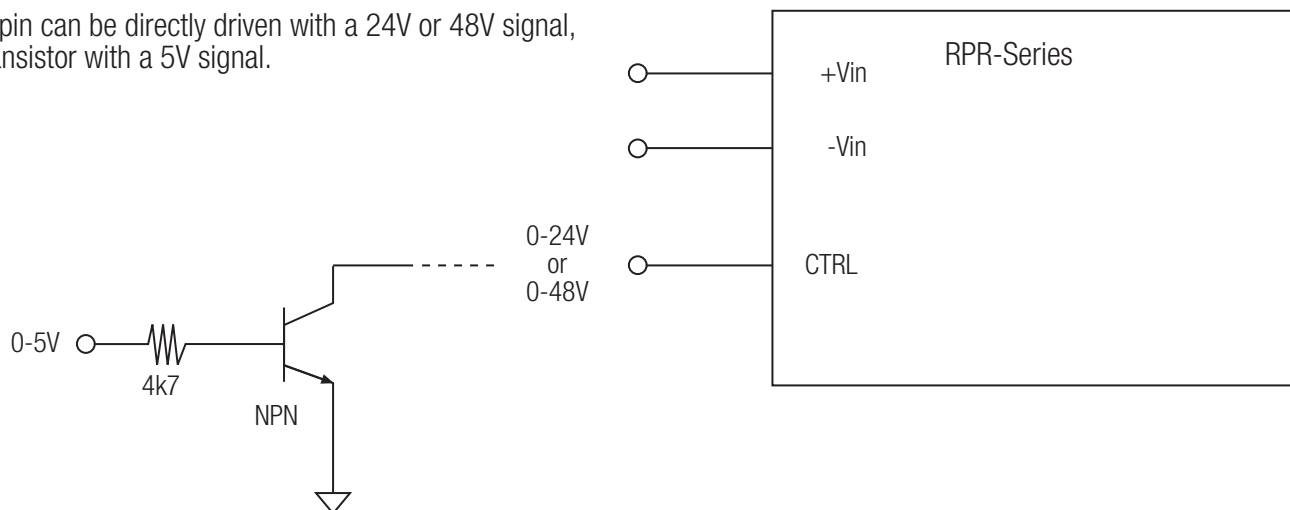
Specifications (typical at nominal input and 25°C unless otherwise noted)

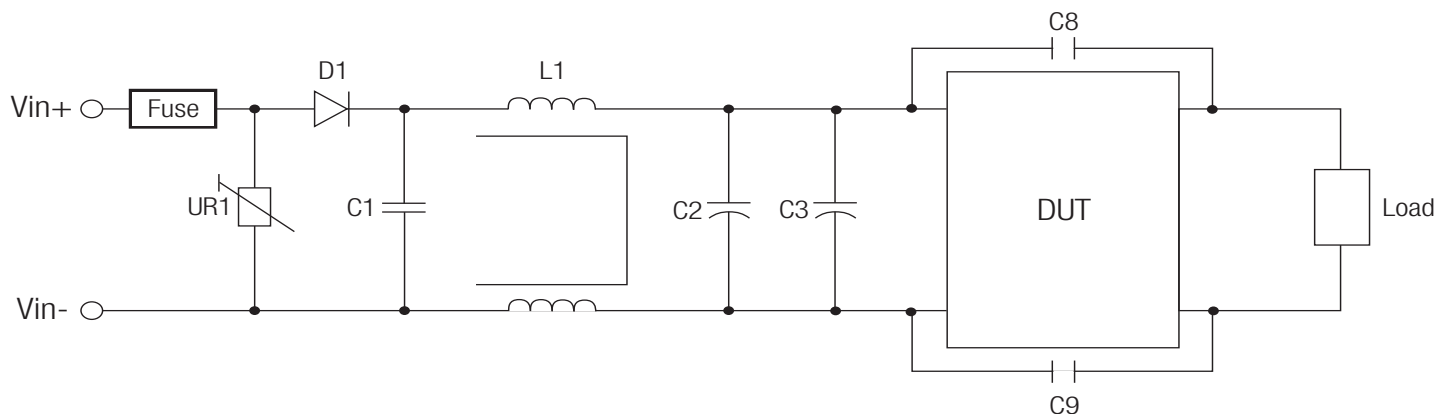
Weight	43g	
Packing Quantity	Single packed	
Safety Standards	CE Marked	certified to EN-60950-1, 1st Edition
Thermal Performance	Cold	-40°C /16 Hours
	Dry Heat, Operating	-40°C/+85°C/ 5 Cycles
complies to EN50155: 12.2.3/4/5	Damp Heat,Cyclic	+25°C/+55°C, 95%RH / 2 x 24 Hours
Vibration, Shock & Bump (complies with EN61373, Category 1 Class B)	Vibration	5-150Hz, X:0.7m/s², Y:0.45m/s², Z:1m/s², 30 mins
	Shock	5g/30ms/18 shocks
Input Filter	Built-in Pi Filter	
Conducted Emissions	EN50121-3-2***	Class A
Radiated Emissions	EN50121-3-2***	Class A
ESD	EN50121-3-2***	Perf. Criteria B
Radiated Immunity	EN50121-3-2***	Perf. Criteria A
Fast Transient	EN50121-3-2***	Perf. Criteria A
Surge	EN50121-3-2***	Perf. Criteria B
Conducted Immunity	EN50121-3-2***	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 Case I: 50% Stress, Temperature at 50°C (Ground Benign)		2195 x 10³ hours

***with filter circuit

Typical Control Pin Application Circuit

The CTRL pin can be directly driven with a 24V or 48V signal, or via a transistor with a 5V signal.





Table

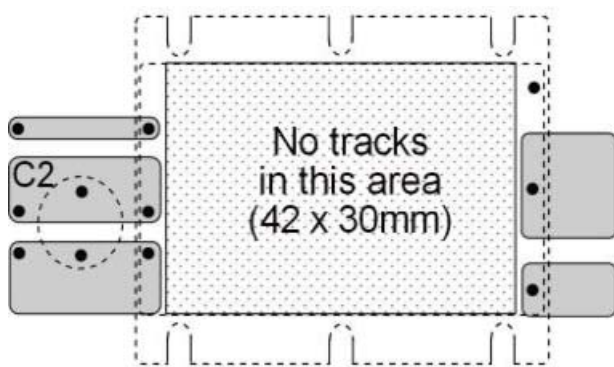
Module	Standard	UR1	D1	C1	L1	C2	C3	C8,C9
24V	EN50155	MOV 14D361K	100V/6A	6,8μF/50V	550μH±20%	330μF/ 50VDC	330μF/ 50VDC	4,7nF/3kV
48V	EN50155	MOV 14D361K	200V/3A	220nF/100V	550μH±20%	330μF/ 100VDC	330μF/ 100VDC	4,7nF/3kV
110V	EN50155	MOV 14D361K	300V/3A	470nF/250V	1200μH±20%	330μF/ 250VDC	330μF/ 250VDC	4,7nF/3kV

Notes :

- The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPR20-2405S, RPR20-4805D-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
- To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.
- The converter is supplied with a protective adhesive tape to keep the top surface clean. The tape is heat resistant and the converter can be soldered into place without removing the tape. The tape should be removed just before final installation.
- The RPR series are optionally available with a ribbed heatsink case style. They will then meet Tx requirements without an external heat-sink. Please contact your RECOM supplier for more information.

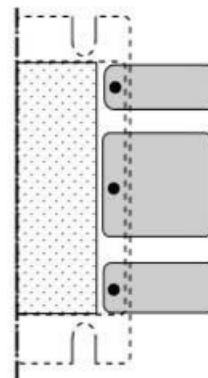
Baseplate Case- suggested PCB layout

Single Output



Top View

Dual Output



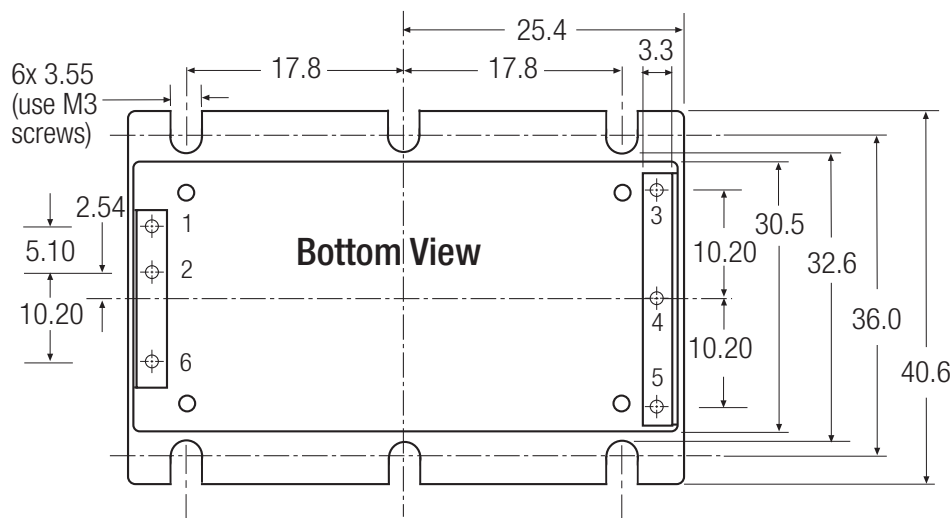
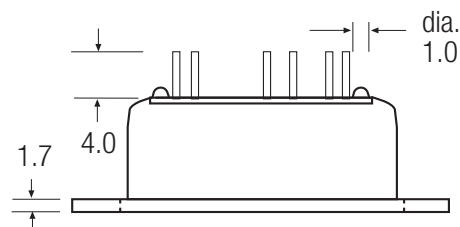
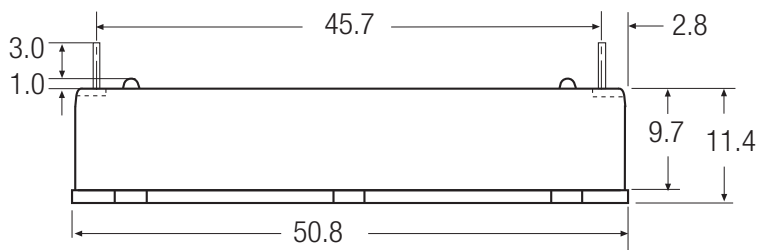
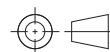
Input Fuse is recommended.
Recommended fuse rating =
double maximum input current,
time delay type.

To ensure optimum thermal
performance, use large areas
of copper on the PCB to assist
with heat dissipation and
mount the converter vertically.

Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

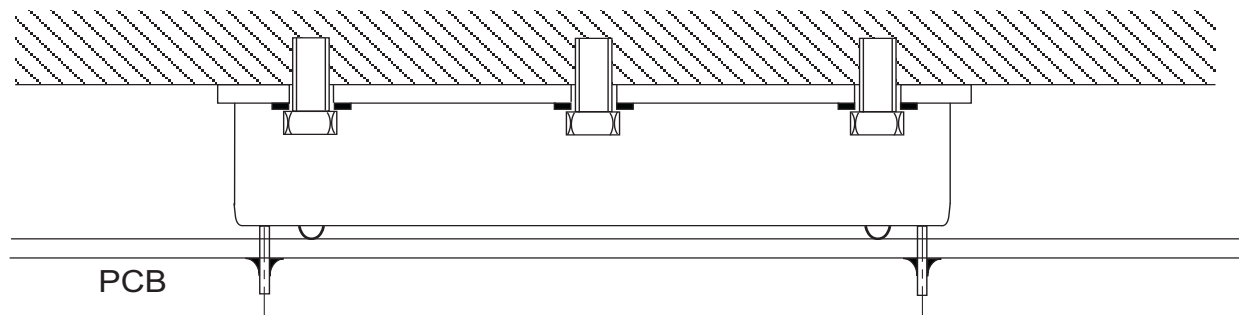
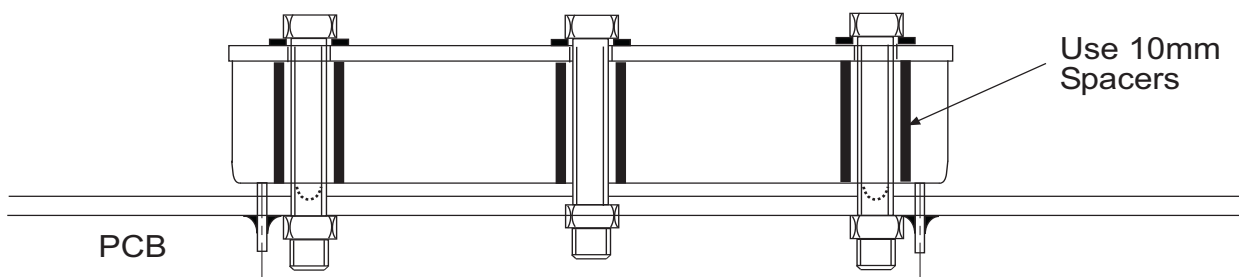
3rd angle
projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead**Baseplate Case Fixing - Anti Vibration Mounting onto PCB**

POWERLINE+ Application Notes

DC/DC-Converter

ICE Technology

ICE Technology

I.C.E Technology

ICE (Innovation in Converter Excellence) Technology uses a combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

The exact details of this technology must remain secret, but the following brief resume describes the main features of this technological breakthrough:

Minimising internal heat dissipation

The difference between the input power and the output power is the internal power dissipation which generates heat within the converter.

If the converter is inefficient at converting power, then adding external heat sinks, base-plates or fans are remedies that cure the symptoms rather than address the illness.

First and foremost, the converter must have the highest possible efficiency over the entire input voltage range and load conditions. Most power converters are designed to be most efficient at 25°C, full load and nominal input voltage and thus offer a compromise performance when lightly loaded or operated at the maximum ambient temperature.

ICE Technology uses state-of-the-art techniques to improve power conversion efficiency by approximately 2% compared to standard converters. A two per cent improvement may not sound much, but the difference between a converter with 88% efficiency and one with 90% efficiency is a 17% reduction in the dissipated power. In addition, when lightly loaded, the converters enter a power saving mode and draw only a few milliamps from the supply.

Maximising heat transfer

The rate of heat transfer between a hot body and its cooler surroundings is given by Fourier's Law:

$$q = -k \cdot \Delta T$$

where

q = rate of heat transfer

k = thermal conductivity

and ΔT = temperature difference

If k can be made larger, then the rate of heat transfer can still match or exceed the rate of heat generation at lower temperature differences ΔT and the converter will have an extended operating temperature range.

Techniques to improve thermal conductivity

ICE Technology splits the thermal conductivity problem into two areas and attacks each area separately using different techniques.

Firstly, the internal heat transfer to the case is maximised by a combination of novel converter construction and clever thermal design.

ICE converters use a construction where the hottest components (the switching FET, the transformer and the synchronous rectification FETs) are placed closest to the case wall. This method of construction makes the manufacture of the converter more difficult, but this lack of compromise reduces greatly the internal thermal impedance.

Secondly, the rate of transfer of heat to the surroundings is improved by a novel case construction which incorporates a built-in heat sink. The case is also made from thick aircraft grade aluminium rather than thin nickel-plated copper to provide a better thermal junction between the case and the high thermal conductivity silicone potting material used inside the converter.

Maximising high temperature performance

The final technique used in the construction of ICE Technology converters is to use high temperature internal components. The maximum operating temperature of a converter is dependent on the lowest maximum permissible operating temperature of any the components used. If the capacitors are rated up to +85°C and the FETs are rated at +160°C, then the limiting factor is the capacitor temperature of +85°C.

The temperature of the ferrite core used in the transformer is also an important limiting factor. If the transformer core temperature exceeds the Curie temperature of the ferrite, then the transformer rapidly loses performance.

ICE Technology converter uses high temperature grade components to permit a case temperature of +115°C maximum. This allows operation at up to +85°C ambient without the need for fans to blow air over the converter.



Electromagnetic Compatibility

Although high temperature performance is a significant feature of ICE Technology design, it does not end there.

ICE Technology also addresses the need for electromagnetic compatibility by incorporating a built-in EN55022 Class B grade filter inside the converter. The converter has been designed from the ground up to meet EMC requirements rather than a conventional design process where first the converter is optimised for performance and then an external filter is added to combat the conducted interference.

By including the filter on the main PCB of the converter, the track path lengths and impedances between the filter and the noise-generating components are reduced to the minimum and consequently smaller value filter components can be used that fit into the compact case dimensions of the Powerline+ converters without compromising on filter performance.

Safety and Protection

ICE Technology converters are fully protected from output short circuits, overload, output over-voltage and over-temperature. In addition, they feature under-voltage lockout that will automatically disable the converter if the input voltage falls below the minimum level.

The output is current limited which means that temporary overloads can occur without the converter shutting down. When overloaded, the output voltage will decrease to keep the maximum power constant. For the 40W and 50W converters, if the overload is too high, the converter will go into hiccup short circuit protection mode. In this mode, the converter will attempt to reconnect power every 10-20 milliseconds.

Output overvoltage protection is monitored by a separate and independent feedback circuit and an internal thermistor sensor is used to protect the converter against overheating.

POWERLINE+ Application Notes

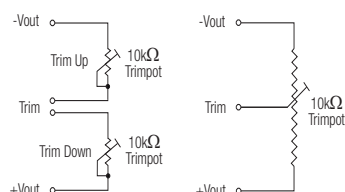
DC/DC-Converter

Trim Tables

Powerline Plus Output Trim Tables

RECOM

Output Voltage Trimming:



Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors.

No general equation can be given for calculating the trim resistors, but the

following trimtables give typical values for choosing these trimming resistors.

If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

RPRxx-xx3.3S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,333	3,366	3,399	3,432	3,465	3,498	3,531	3,564	3,597	3,63	Volts
R _U =	72.8	34.4	21.2	14.4	9.9	7.2	5.3	3.88	2.74	1.84	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,267	3,234	3,201	3,168	3,135	3,102	3,069	3,036	3,003	2,97	Volts
R _D =	101.3	36.2	21.0	13.65	9.2	6.0	4.12	2.56	1.34	0.87	KOhms

RPRxx-xx05S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	5,05	5,1	5,15	5,2	5,25	5,3	5,35	5,4	5,45	5,5	Volts
R _U =	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	4,95	4,9	4,85	4,8	4,75	4,7	4,65	4,6	4,55	4,5	Volts
R _D =	127.6	55.8	33.0	20.2	14.2	9.46	5.97	3.6	1.77	0.28	KOhms

RPRxx-xx12S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12,12	12,24	12,36	12,48	12,6	12,72	12,84	12,96	13,08	13,2	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11,88	11,76	11,64	11,52	11,4	11,28	11,16	11,04	10,92	10,8	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

RPRxx-xx15S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15,15	15,3	15,45	15,6	15,75	15,9	16,05	16,2	16,35	16,5	Volts
R _U =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	14,85	14,7	14,55	14,4	14,25	14,1	13,95	13,8	13,65	13,5	Volts
R _D =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms

DC/DC-Converter

Block Diagrams

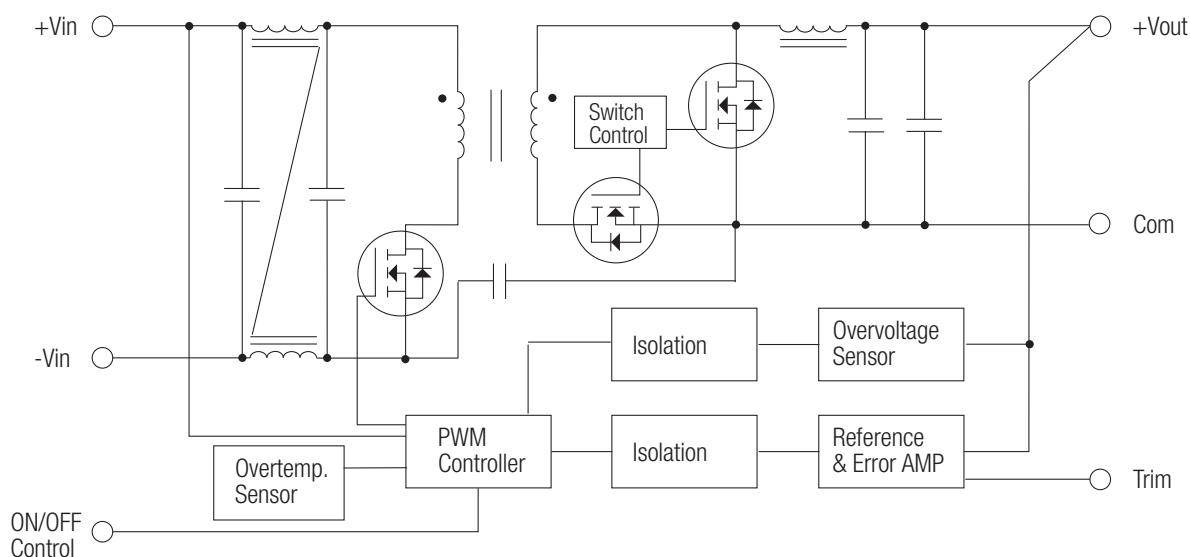
Powerline Plus Output Trim Tables

RPRxx-xx24S (all types)

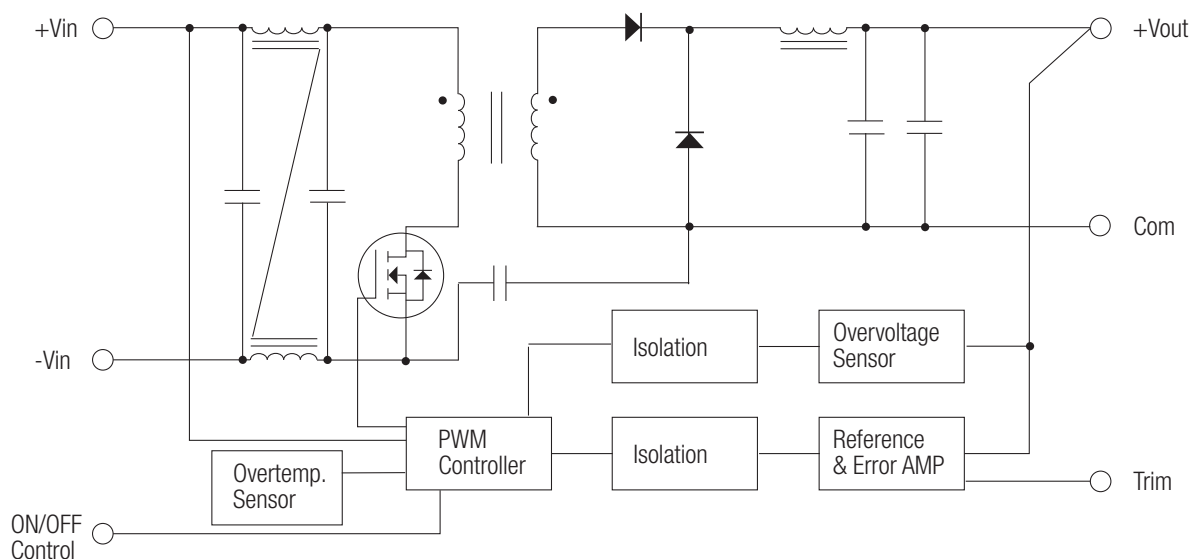
Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	24,24	24,48	24,72	24,96	25,20	25,44	24,68	25,92	26,16	26,4	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	23,76	23,52	23,28	23,04	22,80	22,56	22,32	22,08	21,84	21,6	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

Block Diagrams

Single Output - 3.3V and 5V Outputs



Single Output - all other outputs



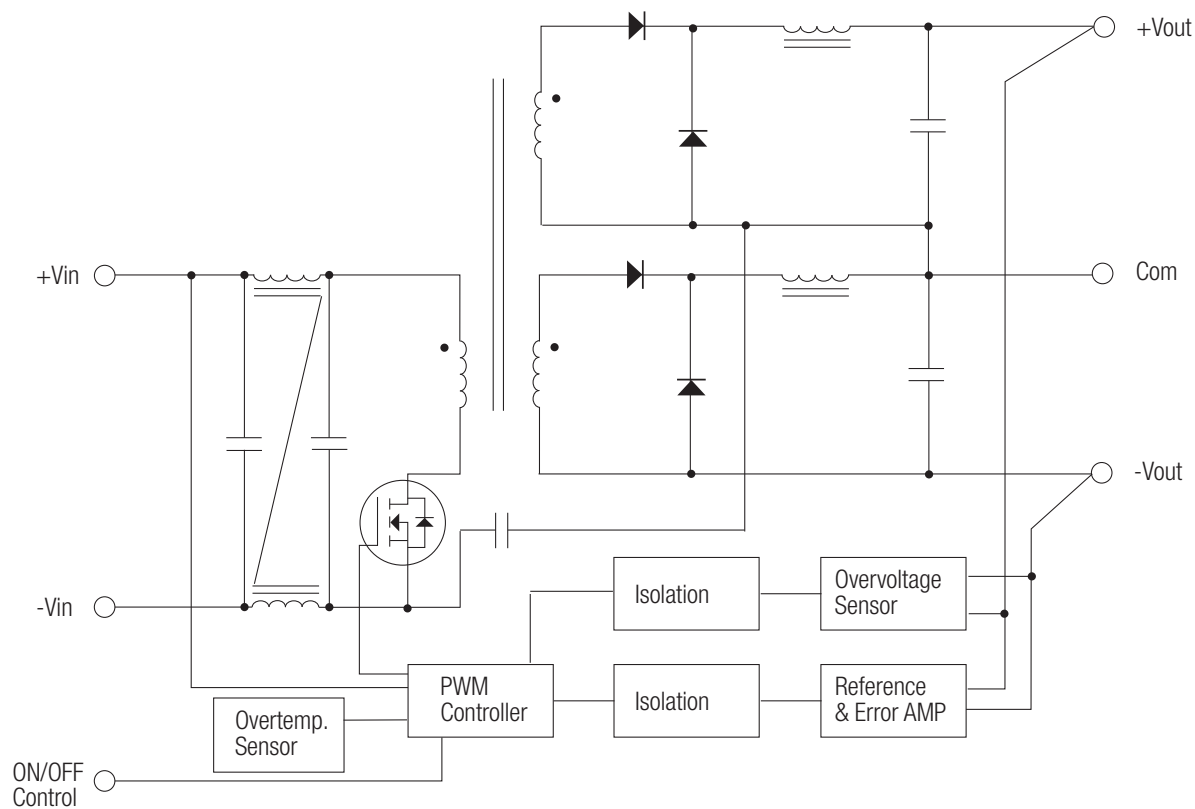
POWERLINE+ Application Notes

DC/DC-Converter

Block Diagrams

Block Diagrams

Dual Output



Features

ICE Technology*

- T2 Temperature Range without Derating
- 120°C Maximum Case Temperature
- -45°C Minimum Operating Temperature
- EN 50155 Certified
- EN 50121-3-2 Certified
- CE Marked
- 24, 48 and 110VDC Input Ranges
- Six Sided Shielded Enclosure
- Baseplate Case Style
- Efficiency to >89%
- Low Quiescent Current

Description

The RPR40 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide operating temperature range of -45°C to +120°C. The RPR40 is available has a baseplate case for high vibration or bulkhead-mounting applications. It is EN 50155 and EN 50121-3-2 compliant.

Selection Guide 24V, 48V and 110V Input Types

Part Number	Nominal Input VDC	Nom. Input Range VDC	Lockout Voltage VDC	Output Voltage VDC	Output Current mA
RPR40-243.3S-B	24	12-36	8	3.3	12100
RPR40-2405S-B	24	12-36	8	5	8000
RPR40-2412S-B	24	12-36	8	12	3300
RPR40-2415S-B	24	12-36	8	15	2670
RPR40-2424S-B	24	12-36	8	24	1670
RPR40-483.3S-B	48	25-75	17	3.3	12100
RPR40-4805S-B	48	25-75	17	5	8000
RPR40-4812S-B	48	25-75	17	12	3300
RPR40-4815S-B	48	25-75	17	15	2670
RPR40-4824S-B	48	25-75	17	24	1670
RPR40-1103.3S-B	110	40-160	36	3.3	12100
RPR40-11005S-B	110	40-160	36	5	8000
RPR40-11012S-B	110	40-160	36	12	3300
RPR40-11015S-B	110	40-160	36	15	2670
RPR40-11024S-B	110	40-160	36	24	1670
RPR40-2412D-B	24	12-36	8	±12	±1670
RPR40-2415D-B	24	12-36	8	±15	±1330
RPR40-2424D-B	24	12-36	8	±24	±830
RPR40-4812D-B	48	25-75	17	±12	±1670
RPR40-4815D-B	48	25-75	17	±15	±1330
RPR40-4824D-B	48	25-75	17	±24	±830
RPR40-11012D-B	110	40-160	36	±12	±1330
RPR40-11015D-B	110	40-160	36	±15	±1330
RPR40-11024D-B	110	40-160	36	±24	±830

For other CTRL logic or case styles please contact RECOM for availability.

POWERLINE+

Railway-Converter

with 5 year Warranty

RECOM

40 Watt Single & Dual Output



EN-50155 Certified
EN-60950 Certified

RPR40

* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

Refer to Application Notes

Railway Input Voltage Requirements

Nominal Input Voltage	EN50155			NF F 01-510			RPR40		
	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)
24V	16.8~30V	14.4V	33.6V	18~34V	12V	40V	12~36V	9V	40V
48V	33.6~60V	28.8V	67.2V				25~75V	18V	80V
72V	50.4~90V	43.2V	100.8V	50~90V	36V	115V	40~160V	36V	176V
96V	67.2~120V	57.6V	134.4V				40~160V	36V	176V
110V	77~137.5V	66V	154V	77~137V	55V	176V	40~160V	36V	176V

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (continuous)		complies with EN50155 and NFF 01-510 (Un=24V)		12-36VDC
		complies with EN50155 and NFF 01-510 (Un=48V)		25-75VDC
		complies with EN50155 and NFF 01-510 (Un=72V, 96V &110V)		40-160VDC
Low Transient operating voltage (100ms)		complies with EN50155 and NFF 01-510		Un x 0.5
High Transient operating voltage (1 second)		complies with EN50155 and NFF 01-510		Un x 1.6
Allowed Input Ripple		complies with EN50155		15%
Input Reflected Ripple		nominal Vin and full load		20mA _{p-p}
Supply Interruption (Perf. Criteria B)		according to EN50155, 5.1.1.2		Class S2
		according to EN50155, 5.1.3		Class C2
Start Up Time		nominal Vin and constant resistive load		2ms typ., 5ms max.
Remote ON/OFF ⁽¹⁾		Logic High		Open or 8V < Vr < 60V
		Logic Low		Short or 0V < Vr < 1.2V
Remote OFF input current		Nominal input		2mA typ.
Output Voltage Accuracy		50% Load and nominal Vin		±1.5%
Voltage Adjustability		Single Output only		±10%
Minimum Load				0%
Line Regulation		low line, high line at full load		±0.3%
Load Regulation		10% to 100% full load		±0.5%
Cross Regulation (10% <> 100% Load)		Dual Outputs only		3% typ. / 5% max.
Ripple and Noise (20MHz bandwidth limited)		(measured with 1µF capacitor across outputs)		1% Vout typ. / 3% max.
Temperature Coefficient				±0.04%/°C max.
Transient Response		25% load step change		800µs
Over Load Protection		% of full load at nominal Vin		120% typ.
Short Circuit Protection				Hiccup, automatic recovery
Output Over Voltage Protection		Single Output		Converter shutdown if Vout > Vout nominal + 20%
		Dual Output		Converter shutdown if Vout > Vout nominal + 10%
Isolation Voltage		According to EN50155 12.2.9.2		Tested at 1500VAC/1 minute
Isolation Resistance		According to EN50155 12.2.9.1		10MΩ min.
Isolation Capacitance				1500pF max.
Operating Frequency				260kHz ± 40kHz
Operating Temperature Range (Ambient Air, Free Convection)	(T2)	complies with EN50155: 4.1.2 and EN50125-1 with derating		-45°C to +85°C
	(Tx)			-45°C to +100°C
Maximum Case Temperature				+120°C
Over Temperature Protection				Internal thermistor
Storage Temperature Range				-55°C to +125°C
Relative Humidity				5% to 95% RH
Case Material ⁽²⁾				Aluminium

continued on next page

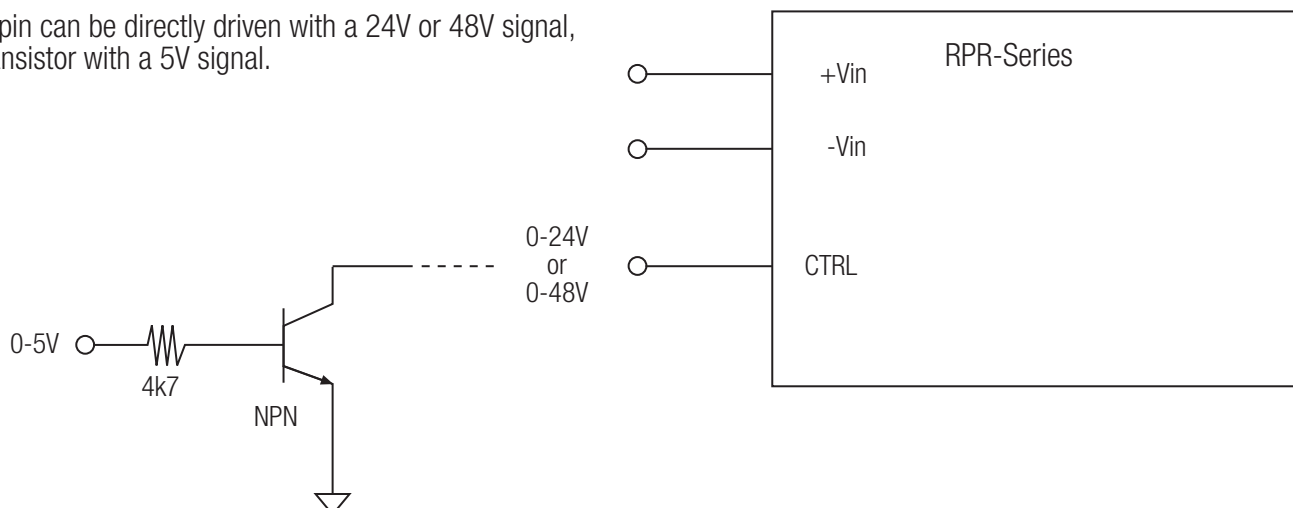
Specifications (typical at nominal input and 25°C unless otherwise noted)

Weight	43g	
Packing Quantity	Single packed	
Safety Standards	CE Marked	certified to EN-60950-1, 1st Edition
Thermal Performance	Cold	-40°C /16 Hours
	Dry Heat, Operating	-40°C/+85°C/ 5 Cycles
complies to EN50155: 12.2.3/4/5	Damp Heat,Cyclic	+25°C/+55°C, 95%RH / 2 x 24 Hours
Vibration, Shock & Bump (complies with EN61373, Category 1 Class B)	Vibration	5-150Hz, X:0.7m/s², Y:0.45m/s², Z:1m/s², 30 mins
	Shock	5g/30ms/18 shocks
Input Filter	Built-in Pi Filter	
Conducted Emissions	EN50121-3-2***	Class A
Radiated Emissions	EN50121-3-2***	Class A
ESD	EN50121-3-2***	Perf. Criteria B
Radiated Immunity	EN50121-3-2***	Perf. Criteria A
Fast Transient	EN50121-3-2***	Perf. Criteria A
Surge	EN50121-3-2***	Perf. Criteria B
Conducted Immunity	EN50121-3-2***	Perf. Criteria A
MTBF calculated according to BELLCORE TR-NWT-000332 Case I: 50% Stress, Temperature at 50°C (Ground Benign)		2195 x 10³ hours

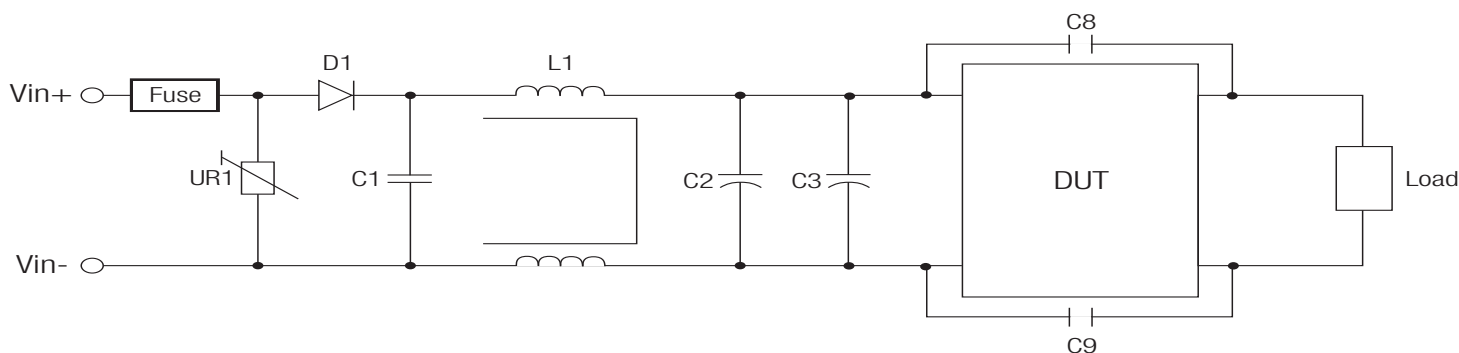
***with filter circuit

Typical Control Pin Application Circuit

The CTRL pin can be directly driven with a 24V or 48V signal, or via a transistor with a 5V signal.



EN50155 / NF F 01-510 Input Filter



Table

Module	Standard	UR1	D1	C1	L1	C2	C3	C8,C9
24V	EN50155	MOV 14D361K	100V/6A	6,8μF/50V	550μH±20%	330μF/ 50VDC	330μF/ 50VDC	4,7nF/3kV
48V	EN50155	MOV 14D361K	200V/3A	220nF/100V	550μH±20%	330μF/ 100VDC	330μF/ 100VDC	4,7nF/3kV
110V	EN50155	MOV 14D361K	300V/3A	470nF/250V	1200μH±20%	330μF/ 250VDC	330μF/ 250VDC	4,7nF/3kV

Notes :

- The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPR20-2405S, RPR20-4805D-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
- To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.
- The converter is supplied with a protective adhesive tape to keep the top surface clean. The tape is heat resistant and the converter can be soldered into place without removing the tape. The tape should be removed just before final installation.
- The RPR series are optionally available with a ribbed heatsink case style. They will then meet Tx requirements without an external heat-sink. Please contact your RECOM supplier for more information.

POWERLINE+

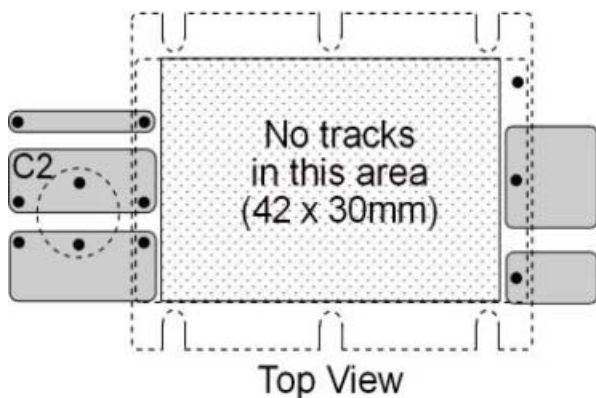
DC/DC-Converter

Recommended PCB Layout

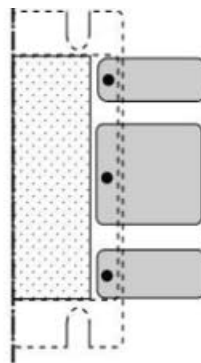
RPR40-S_D Series

Baseplate Case- suggested PCB layout

Single Output



Dual Output



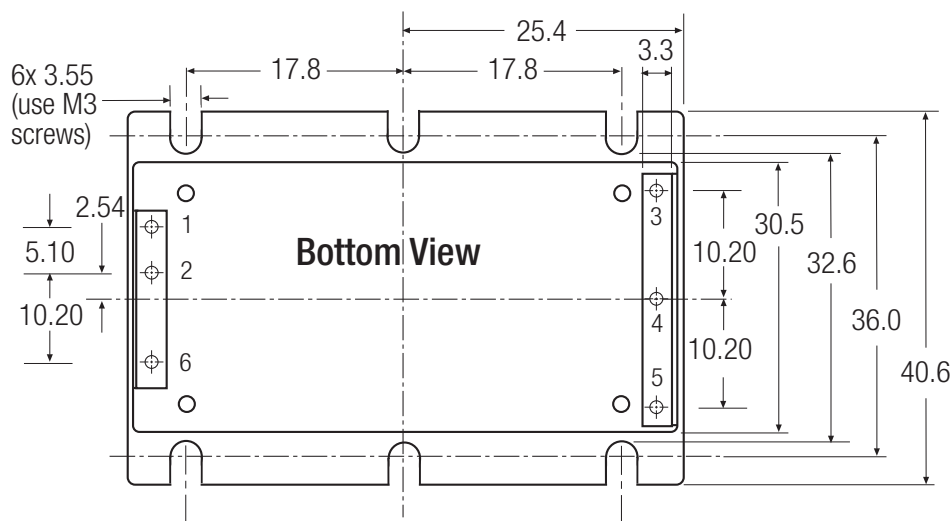
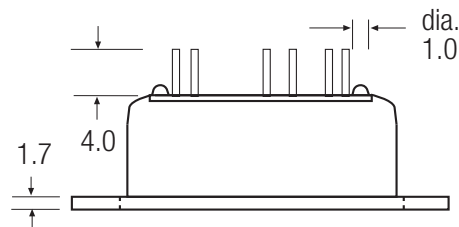
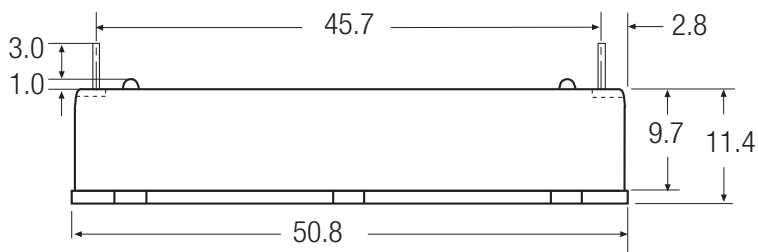
Input Fuse is recommended.
Recommended fuse rating =
double maximum input current,
time delay type.

To ensure optimum thermal
performance, use large areas
of copper on the PCB to assist
with heat dissipation and
mount the converter vertically.

Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

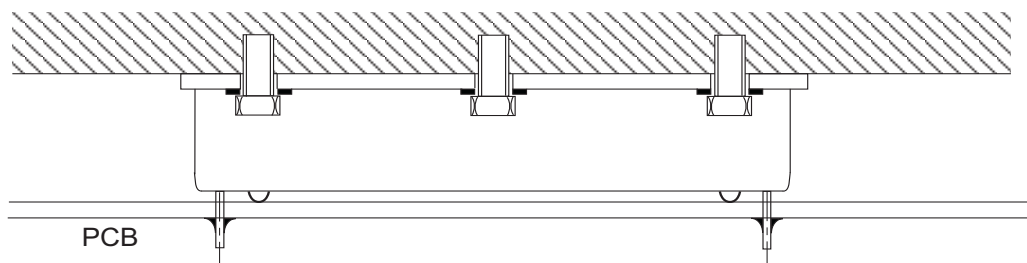
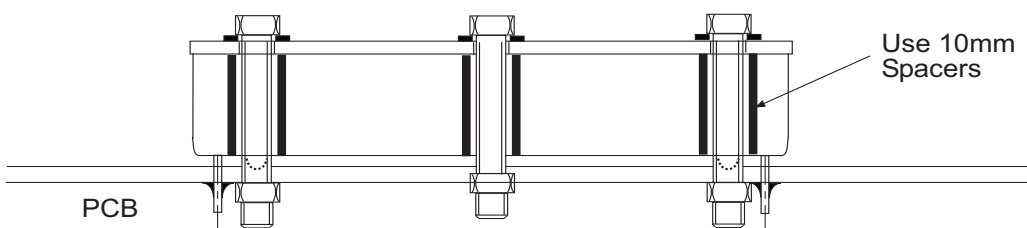
3rd angle
projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead**Baseplate Case Fixing - Anti Vibration Mounting onto PCB**

POWERLINE+ Application Notes

DC/DC-Converter

ICE Technology

ICE Technology

I.C.E Technology

ICE (Innovation in Converter Excellence) Technology uses a combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

The exact details of this technology must remain secret, but the following brief resume describes the main features of this technological breakthrough:

Minimising internal heat dissipation

The difference between the input power and the output power is the internal power dissipation which generates heat within the converter.

If the converter is inefficient at converting power, then adding external heat sinks, base-plates or fans are remedies that cure the symptoms rather than address the illness.

First and foremost, the converter must have the highest possible efficiency over the entire input voltage range and load conditions. Most power converters are designed to be most efficient at 25°C, full load and nominal input voltage and thus offer a compromise performance when lightly loaded or operated at the maximum ambient temperature.

ICE Technology uses state-of-the-art techniques to improve power conversion efficiency by approximately 2% compared to standard converters. A two per cent improvement may not sound much, but the difference between a converter with 88% efficiency and one with 90% efficiency is a 17% reduction in the dissipated power. In addition, when lightly loaded, the converters enter a power saving mode and draw only a few milliamps from the supply.

Maximising heat transfer

The rate of heat transfer between a hot body and its cooler surroundings is given by Fourier's Law:

$$q = -k \cdot \Delta T$$

where

q = rate of heat transfer

k = thermal conductivity

and ΔT = temperature difference

If k can be made larger, then the rate of heat transfer can still match or exceed the rate of heat generation at lower temperature differences ΔT and the converter will have an extended operating temperature range.

Techniques to improve thermal conductivity

ICE Technology splits the thermal conductivity problem into two areas and attacks each area separately using different techniques.

Firstly, the internal heat transfer to the case is maximised by a combination of novel converter construction and clever thermal design.

ICE converters use a construction where the hottest components (the switching FET, the transformer and the synchronous rectification FETs) are placed closest to the case wall. This method of construction makes the manufacture of the converter more difficult, but this lack of compromise reduces greatly the internal thermal impedance.

Secondly, the rate of transfer of heat to the surroundings is improved by a novel case construction which incorporates a built-in heat sink. The case is also made from thick aircraft grade aluminium rather than thin nickel-plated copper to provide a better thermal junction between the case and the high thermal conductivity silicone potting material used inside the converter.

Maximising high temperature performance

The final technique used in the construction of ICE Technology converters is to use high temperature internal components. The maximum operating temperature of a converter is dependent on the lowest maximum permissible operating temperature of any the components used. If the capacitors are rated up to +85°C and the FETs are rated at +160°C, then the limiting factor is the capacitor temperature of +85°C.

The temperature of the ferrite core used in the transformer is also an important limiting factor. If the transformer core temperature exceeds the Curie temperature of the ferrite, then the transformer rapidly loses performance.

ICE Technology converter uses high temperature grade components to permit a case temperature of +115°C maximum. This allows operation at up to +85°C ambient without the need for fans to blow air over the converter.



Electromagnetic Compatibility

Although high temperature performance is a significant feature of ICE Technology design, it does not end there.

ICE Technology also addresses the need for electromagnetic compatibility by incorporating a built-in EN55022 Class B grade filter inside the converter. The converter has been designed from the ground up to meet EMC requirements rather than a conventional design process where first the converter is optimised for performance and then an external filter is added to combat the conducted interference.

By including the filter on the main PCB of the converter, the track path lengths and impedances between the filter and the noise-generating components are reduced to the minimum and consequently smaller value filter components can be used that fit into the compact case dimensions of the Powerline+ converters without compromising on filter performance.

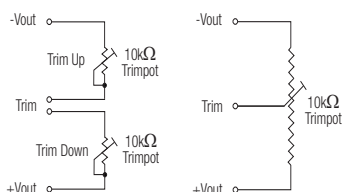
Safety and Protection

ICE Technology converters are fully protected from output short circuits, overload, output over-voltage and over-temperature. In addition, they feature under-voltage lockout that will automatically disable the converter if the input voltage falls below the minimum level.

The output is current limited which means that temporary overloads can occur without the converter shutting down. When overloaded, the output voltage will decrease to keep the maximum power constant. For the 40W and 50W converters, if the overload is too high, the converter will go into hiccup short circuit protection mode. In this mode, the converter will attempt to reconnect power every 10-20 milliseconds.

Output overvoltage protection is monitored by a separate and independent feedback circuit and an internal thermistor sensor is used to protect the converter against overheating.

Output Voltage Trimming:



Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the

following trimtables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

RPRxx-xx3.3S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,333	3,366	3,399	3,432	3,465	3,498	3,531	3,564	3,597	3,63	Volts
R _U =	72.8	34.4	21.2	14.4	9.9	7.2	5.3	3.88	2.74	1.84	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,267	3,234	3,201	3,168	3,135	3,102	3,069	3,036	3,003	2,97	Volts
R _D =	101.3	36.2	21.0	13.65	9.2	6.0	4.12	2.56	1.34	0.87	KOhms

RPRxx-xx05S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	5,05	5,1	5,15	5,2	5,25	5,3	5,35	5,4	5,45	5,5	Volts
R _U =	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	4,95	4,9	4,85	4,8	4,75	4,7	4,65	4,6	4,55	4,5	Volts
R _D =	127.6	55.8	33.0	20.2	14.2	9.46	5.97	3.6	1.77	0.28	KOhms

RPRxx-xx12S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12,12	12,24	12,36	12,48	12,6	12,72	12,84	12,96	13,08	13,2	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11,88	11,76	11,64	11,52	11,4	11,28	11,16	11,04	10,92	10,8	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

RPRxx-xx15S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15,15	15,3	15,45	15,6	15,75	15,9	16,05	16,2	16,35	16,5	Volts
R _U =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	14,85	14,7	14,55	14,4	14,25	14,1	13,95	13,8	13,65	13,5	Volts
R _D =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms

POWERLINE+ Application Notes

DC/DC-Converter

Block Diagrams

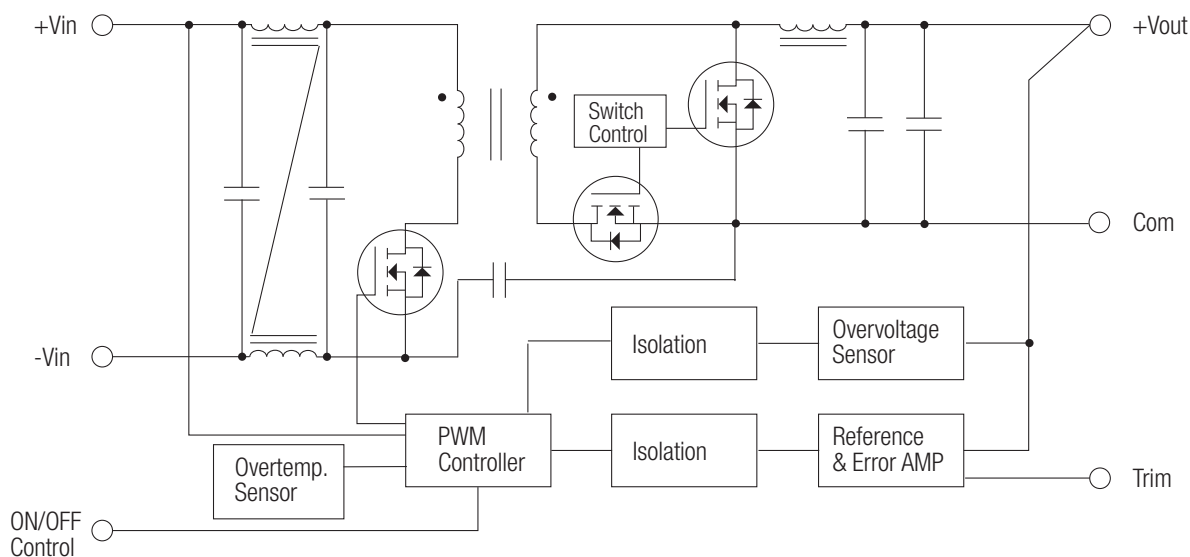
Powerline Plus Output Trim Tables

RPRxx-xx24S (all types)

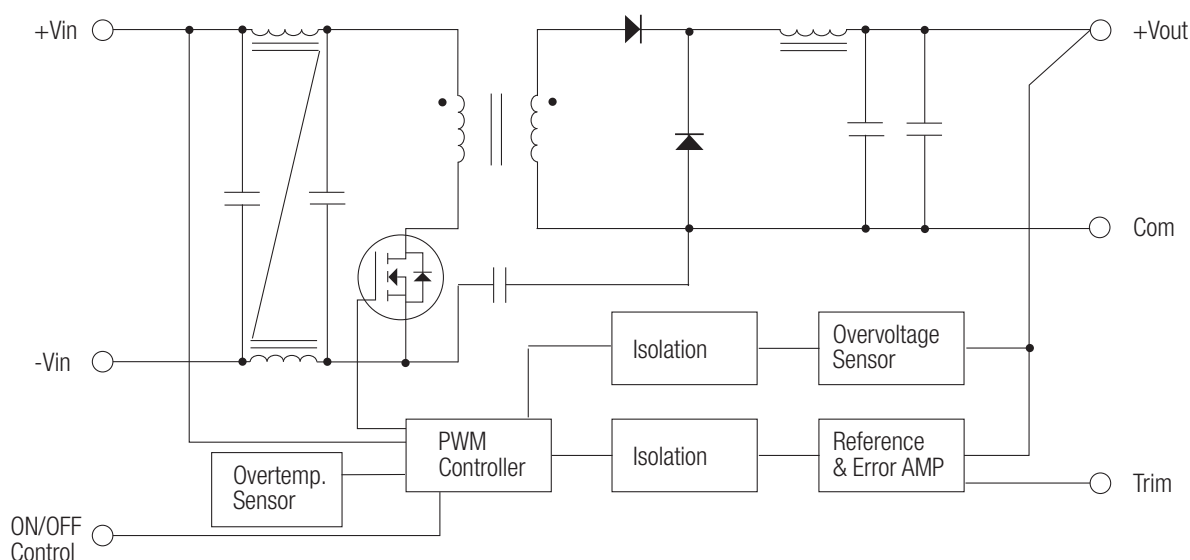
Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	24,24	24,48	24,72	24,96	25,20	25,44	24,68	25,92	26,16	26,4	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	23,76	23,52	23,28	23,04	22,80	22,56	22,32	22,08	21,84	21,6	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

Block Diagrams

Single Output - 3.3V and 5V Outputs



Single Output - all other outputs



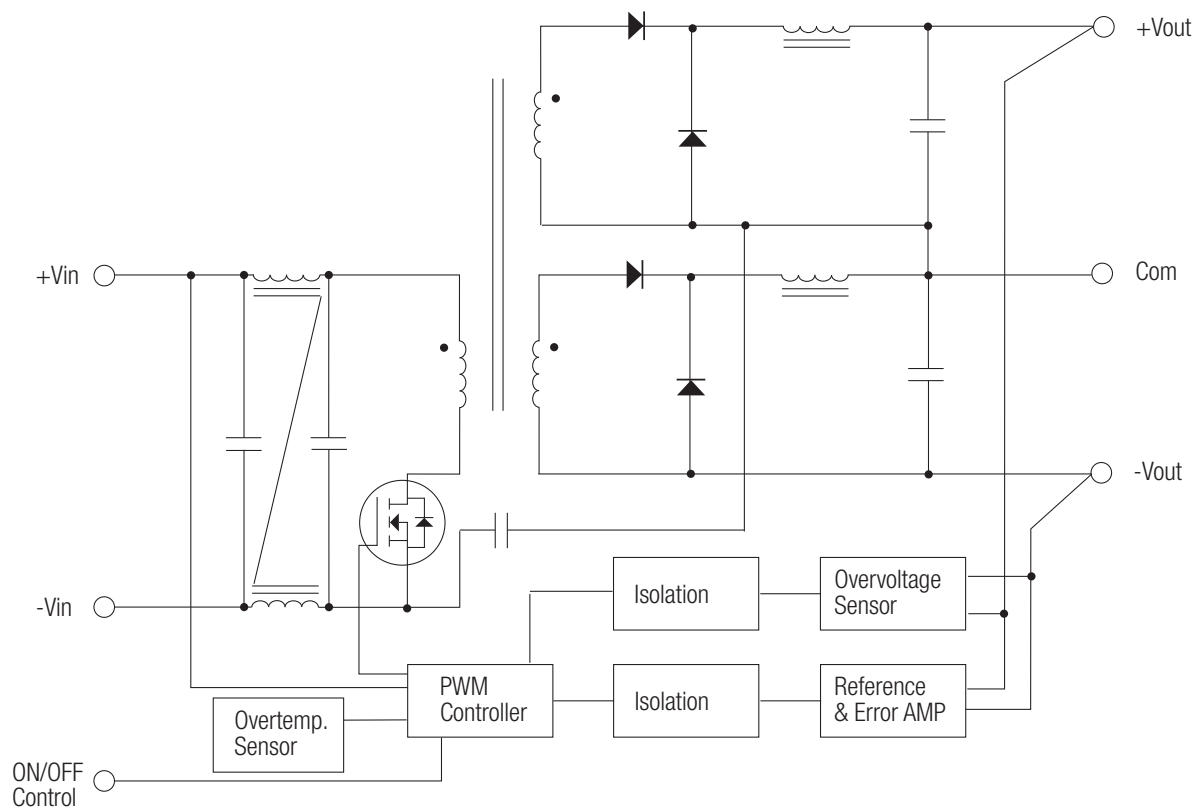
POWERLINE+ Application Notes

DC/DC-Converter

Block Diagrams

Block Diagrams

Dual Output



Features

ICE Technology*

- T2 Temperature Range without Derating
- 120°C Maximum Case Temperature
- -45°C Minimum Temp.
- EN 50155 Certified
- EN 50121-3-2 Certified
- CE Marked
- 24, 48 and 110VDC Input Ranges
- Six Sided Shielded Enclosure
- Baseplate Case Style
- Efficiency to >89%
- Low Quiescent Current

Description

The RPR50 series DC/DC converters are designed for railway rolling stock applications. Besides covering all the input voltages from 24VDC up to 110VDC, the converters have a very wide operating temperature range of -45°C to +120°C. The RPR50 has a baseplate case for high vibration or bulkhead-mounting applications. It is EN 50155 and EN 50121-3-2 compliant.

Selection Guide 24V, 48V and 110V Input Types

Part Number	Nominal Input VDC	Nom. Input Range VDC	Lockout Voltage VDC	Output Voltage VDC	Output Current mA
RPR50-243.3S-B	24	12-36	8	3.3	15000
RPR50-2405S-B	24	12-36	8	5	10000
RPR50-2412S-B	24	12-36	8	12	4100
RPR50-2415S-B	24	12-36	8	15	3300
RPR50-2424S-B	24	12-36	8	24	2100
RPR50-483.3S-B	48	25-75	17	3.3	15000
RPR50-4805S-B	48	25-75	17	5	10000
RPR50-4812S-B	48	25-75	17	12	4100
RPR50-4815S-B	48	25-75	17	15	3300
RPR50-4824S-B	48	25-75	17	24	2100
RPR50-1103.3S-B	110	40-160	36	3.3	15000
RPR50-11005S-B	110	40-160	36	5	10000
RPR50-11012S-B	110	40-160	36	12	4100
RPR50-11015S-B	110	40-160	36	15	3300
RPR50-11024S-B	110	40-160	36	24	2100
RPR50-2412D-B	24	12-36	8	±12	±2100
RPR50-2415D-B	24	12-36	8	±15	±1650
RPR50-2424D-B	24	12-36	8	±24	±1050
RPR50-4812D-B	48	25-75	17	±12	±2100
RPR50-4815D-B	48	25-75	17	±15	±1650
RPR50-4824D-B	48	25-75	17	±24	±1050
RPR50-11012D-B	110	40-160	36	±12	±2100
RPR50-11015D-B	110	40-160	36	±15	±1650
RPR50-11024D-B	110	40-160	36	±24	±1050

For other CTRL logic or case style options please contact RECOM for availability.

POWERLINE+

Railway-Converter

with 5 year Warranty

RECOM

50 Watt

Single & Dual Output



EN-50155 Certified
EN-60950 Certified

RPR50

* ICE Technology

ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

Refer to Application Notes

Railway Input Voltage Requirements

Nominal Input Voltage	EN50155			NF F 01-510			RPR50		
	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)	Input Range	Min. Input (0.1s)	Max Input (1s)
24V	16.8~30V	14.4V	33.6V	18~34V	12V	40V	12~36V	9V	40V
48V	33.6~60V	28.8V	67.2V				25~75V	18V	80V
72V	50.4~90V	43.2V	100.8V	50~90V	36V	115V	40~160V	36V	176V
96V	67.2~120V	57.6V	134.4V				40~160V	36V	176V
110V	77~137.5V	66V	154V	77~137V	55V	176V	40~160V	36V	176V

Specifications (typical at nominal input and 25°C unless otherwise noted)

Input Voltage Range (continuous)		complies with EN50155 and NFF 01-510 (Un=24V)		12-36VDC
		complies with EN50155 and NFF 01-510 (Un=48V)		25-75VDC
		complies with EN50155 and NFF 01-510 (Un=72V, 96V &110V)		40-160VDC
Low Transient operating voltage (100ms)		complies with EN50155 and NFF 01-510		Un x 0.5
High Transient operating voltage (1 second)		complies with EN50155 and NFF 01-510		Un x 1.6
Allowed Input Ripple		complies with EN50155		15%
Input Reflected Ripple		nominal Vin and full load		20mA _{p-p}
Supply Interruption (Perf. Criteria B)		according to EN50155, 5.1.1.2		Class S2
		according to EN50155, 5.1.3		Class C2
Start Up Time		nominal Vin and constant resistive load		2ms typ., 5ms max.
Remote ON/OFF ⁽¹⁾		Logic High		Open or 8V < Vr < 60V
		Logic Low		Short or 0V < Vr < 1.2V
Remote OFF input current		Nominal input		2mA typ.
Output Voltage Accuracy		50% Load and nominal Vin		±1.5%
Voltage Adjustability		Single Output only		±10%
Minimum Load				0%
Line Regulation		low line, high line at full load		±0.3%
Load Regulation		10% to 100% full load		±0.5%
Cross Regulation (10% <> 100% Load)		Dual Outputs only		3% typ. / 5% max.
Ripple and Noise (20MHz bandwidth limited)		(measured with 1µF capacitor across outputs)		1% Vout typ. / 3% max.
Temperature Coefficient				±0.04%/°C max.
Transient Response		25% load step change		800µs
Over Load Protection		% of full load at nominal Vin		120% typ.
Short Circuit Protection				Hiccup, automatic recovery
Output Over Voltage Protection		Single Output		Converter shutdown if Vout > Vout nominal + 20%
		Dual Output		Converter shutdown if Vout > Vout nominal + 10%
Isolation Voltage		According to EN50155 12.2.9.2		Tested at 1500VAC/1 minute
Isolation Resistance		According to EN50155 12.2.9.1		10MΩ min.
Isolation Capacitance				1500pF max.
Operating Frequency				260kHz ± 40kHz
Operating Temperature Range (Ambient Air, Free Convection)	(T2)	complies with EN50155: 4.1.2 and EN50125-1 with derating		-45°C to +85°C
	(Tx)			-45°C to +100°C
Maximum Case Temperature				+120°C
Over Temperature Protection				Internal thermistor
Storage Temperature Range				-55°C to +125°C
Relative Humidity				5% to 95% RH
Case Material ⁽²⁾				Aluminium

continued on next page

Specifications (typical at nominal input and 25°C unless otherwise noted)

Weight	43g	
Packing Quantity	Single packed	
Safety Standards	CE Marked	certified to EN-60950-1, 1st Edition
Thermal Performance	Cold	-40°C /16 Hours
	Dry Heat, Operating	-40°C/+85°C/ 5 Cycles
complies to EN50155: 12.2.3/4/5	Damp Heat,Cyclic	+25°C/+55°C, 95%RH / 2 x 24 Hours
Vibration, Shock & Bump (complies with EN61373, Category 1 Class B)	Vibration	5-150Hz, X:0.7m/s², Y:0.45m/s², Z:1m/s², 30 mins
	Shock	5g/30ms/18 shocks
Input Filter	Built-in Pi Filter	
Conducted Emissions	EN50121-3-2***	Class A
Radiated Emissions	EN50121-3-2***	Class A
ESD	EN50121-3-2***	Perf. Criteria B
Radiated Immunity	EN50121-3-2***	Perf. Criteria A
Fast Transient	EN50121-3-2***	Perf. Criteria A
Surge	EN50121-3-2***	Perf. Criteria B
Conducted Immunity	EN50121-3-2***	Perf. Criteria A

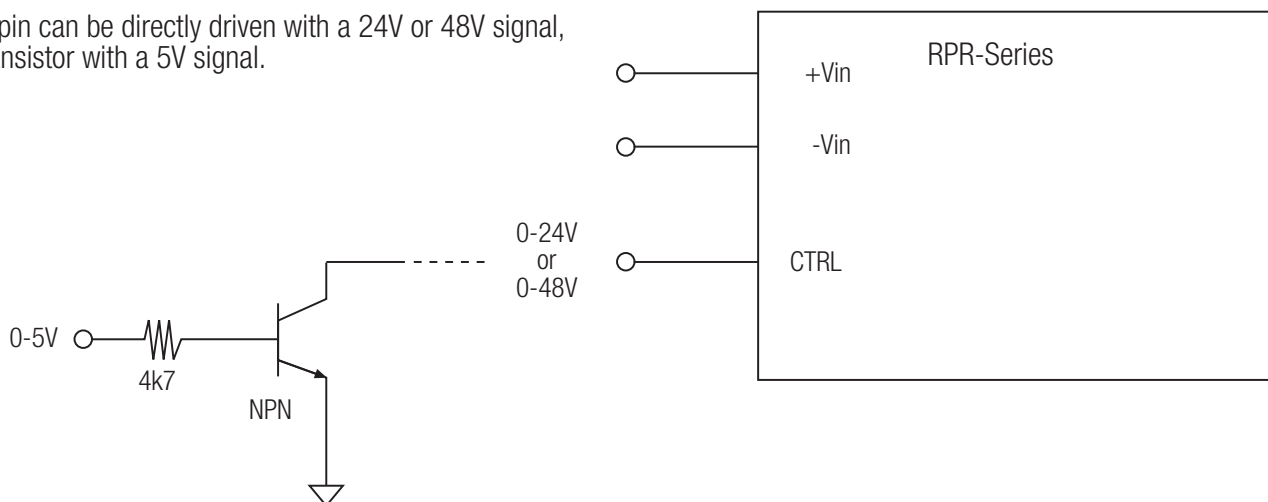
MTBF calculated according to BELLCORE TR-NWT-000332 Case I: 50% Stress, Temperature at 50°C (Ground Benign)

2195 x 10³ hours

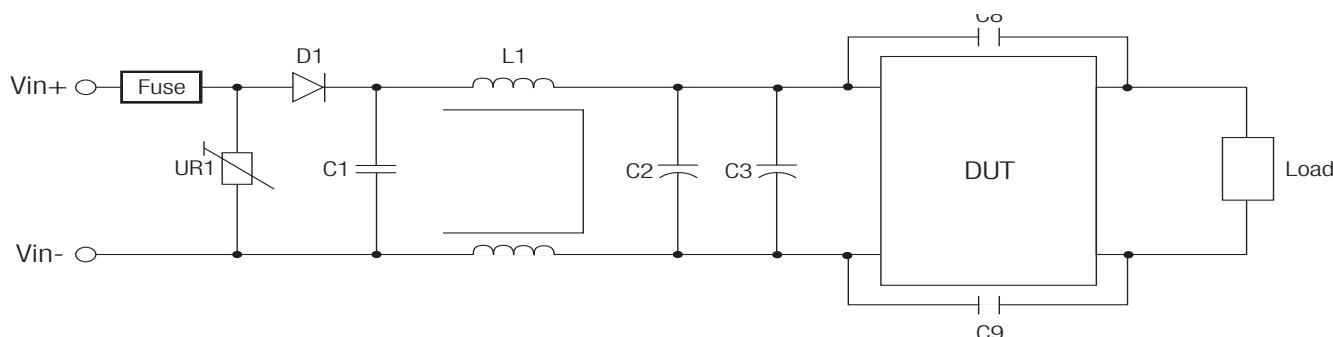
***with filter circuit

Typical Control Pin Application Circuit

The CTRL pin can be directly driven with a 24V or 48V signal, or via a transistor with a 5V signal.



EN50155 / NF F 01-510 Input Filter



Table

Module	Standard	UR1	D1	C1	L1	C2	C3	C8,C9
24V	EN50155	MOV 14D361K	100V/6A	6,8μF/50V	550μH±20%	330μF/ 50VDC	330μF/ 50VDC	4,7nF/3kV
48V	EN50155	MOV 14D361K	200V/3A	220nF/100V	550μH±20%	330μF/ 100VDC	330μF/ 100VDC	4,7nF/3kV
110V	EN50155	MOV 14D361K	300V/3A	470nF/250V	1200μH±20%	330μF/ 250VDC	330μF/ 250VDC	4,7nF/3kV

Notes :

1. The ON/OFF pin voltage is referenced to negative input. The pin is pulled high internally.
ON/OFF control is standard with positive logic: e.g. RPR20-2405S, RPR20-4805D-B.
Positive logic: 0= OFF, 1 = ON. The converter will be ON if the CTRL is left open.
2. To ensure a good all-round electrical contact, the baseplate is pressed firmly into place within the aluminium housing. The hydraulic press can leave tooling marks and deformations to both the housing and baseplate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour variations are cosmetic only and do not affect the operation or performance of the converters.
3. The converter is supplied with a protective adhesive tape to keep the top surface clean. The tape is heat resistant and the converter can be soldered into place without removing the tape. The tape should be removed just before final installation.
4. The RPR series are optionally available with a ribbed heatsink case style. They will then meet Tx requirements without an external heat-sink. Please contact your RECOM supplier for more information.

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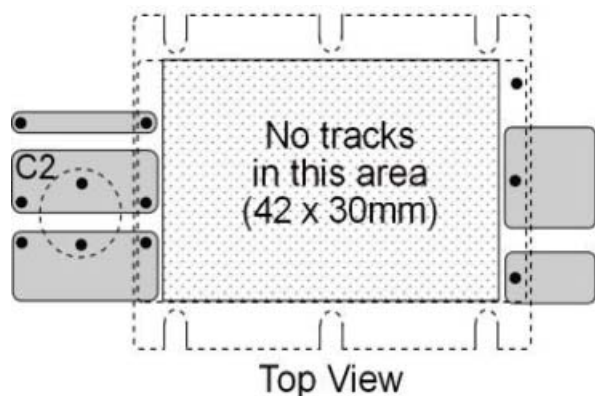
DC/DC-Converter

Recommended PCB Layout

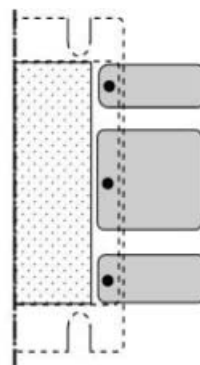
RPR50-S_D Series

Baseplate Case- suggested PCB layout

Single Output



Dual Output



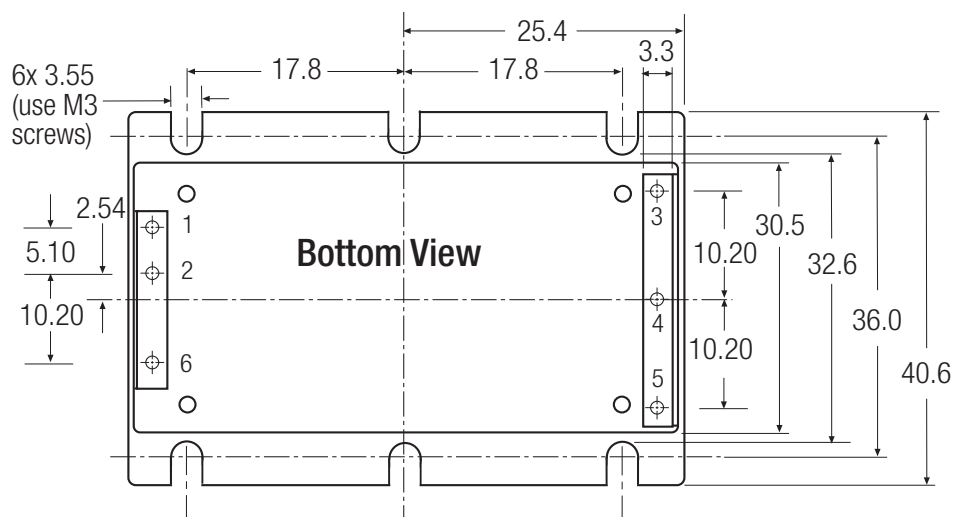
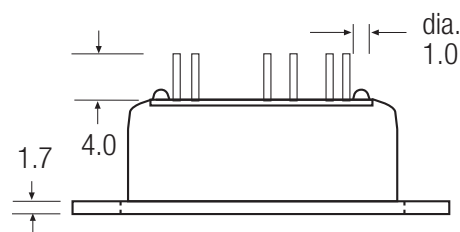
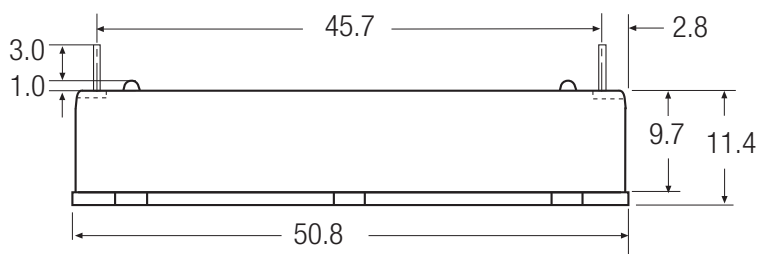
Input Fuse is recommended.
Recommended fuse rating =
double maximum input current,
time delay type.

To ensure optimum thermal
performance, use large areas
of copper on the PCB to assist
with heat dissipation and
mount the converter vertically.

Package Style and Pinning (mm)

Baseplate Case (-B Suffix)

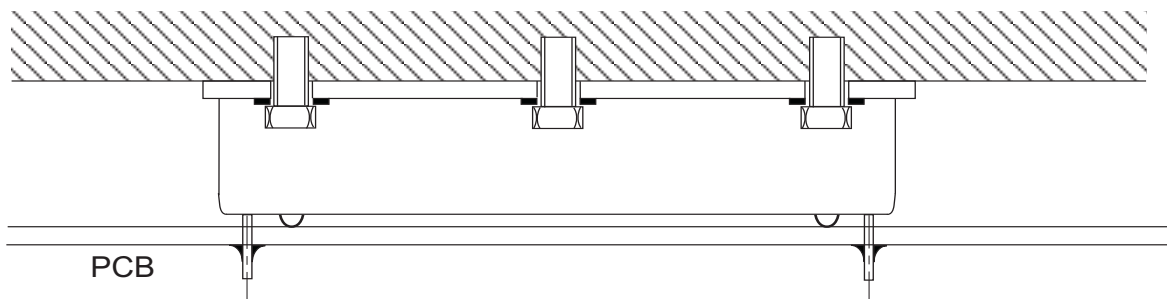
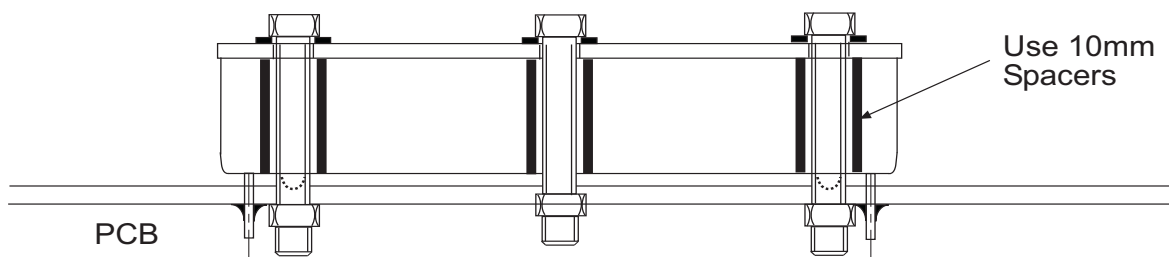
3rd angle
projection



Pin Connections

Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	-Vout	Com
5	Trim	-Vout
6	CTRL	CTRL

Pin Pitch Tolerance ± 0.35 mm

Baseplate Case Fixing - Mounting onto Heatsink/Bulkhead**Baseplate Case Fixing - Anti Vibration Mounting onto PCB**

I.C.E Technology

ICE (Innovation in Converter Excellence) Technology uses a combination of techniques to minimise internal heat dissipation and maximise the heat transfer to ambient to create a new converter series which offers high end performance at a price which is significantly lower than conventional specialist converters.

The exact details of this technology must remain secret, but the following brief resume describes the main features of this technological breakthrough:

Minimising internal heat dissipation

The difference between the input power and the output power is the internal power dissipation which generates heat within the converter.

If the converter is inefficient at converting power, then adding external heat sinks, base-plates or fans are remedies that cure the symptoms rather than address the illness.

First and foremost, the converter must have the highest possible efficiency over the entire input voltage range and load conditions. Most power converters are designed to be most efficient at 25°C, full load and nominal input voltage and thus offer a compromise performance when lightly loaded or operated at the maximum ambient temperature.

ICE Technology uses state-of-the-art techniques to improve power conversion efficiency by approximately 2% compared to standard converters. A two per cent improvement may not sound much, but the difference between a converter with 88% efficiency and one with 90% efficiency is a 17% reduction in the dissipated power. In addition, when lightly loaded, the converters enter a power saving mode and draw only a few milliamps from the supply.

Maximising heat transfer

The rate of heat transfer between a hot body and its cooler surroundings is given by Fourier's Law:

$$q = -k \cdot \Delta T$$

where

q = rate of heat transfer

k = thermal conductivity

and ΔT = temperature difference

If k can be made larger, then the rate of heat transfer can still match or exceed the rate of heat generation at lower temperature differences ΔT and the converter will have an extended operating temperature range.

Techniques to improve thermal conductivity

ICE Technology splits the thermal conductivity problem into two areas and attacks each area separately using different techniques.

Firstly, the internal heat transfer to the case is maximised by a combination of novel converter construction and clever thermal design.

ICE converters use a construction where the hottest components (the switching FET, the transformer and the synchronous rectification FETs) are placed closest to the case wall. This method of construction makes the manufacture of the converter more difficult, but this lack of compromise reduces greatly the internal thermal impedance.

Secondly, the rate of transfer of heat to the surroundings is improved by a novel case construction which incorporates a built-in heat sink. The case is also made from thick aircraft grade aluminium rather than thin nickel-plated copper to provide a better thermal junction between the case and the high thermal conductivity silicone potting material used inside the converter.

Maximising high temperature performance

The final technique used in the construction of ICE Technology converters is to use high temperature internal components. The maximum operating temperature of a converter is dependent on the lowest maximum permissible operating temperature of any the components used. If the capacitors are rated up to +85°C and the FETs are rated at +160°C, then the limiting factor is the capacitor temperature of +85°C.

The temperature of the ferrite core used in the transformer is also an important limiting factor. If the transformer core temperature exceeds the Curie temperature of the ferrite, then the transformer rapidly loses performance.

ICE Technology converter uses high temperature grade components to permit a case temperature of +115°C maximum. This allows operation at up to +85°C ambient without the need for fans to blow air over the converter.



Electromagnetic Compatibility

Although high temperature performance is a significant feature of ICE Technology design, it does not end there.

ICE Technology also addresses the need for electromagnetic compatibility by incorporating a built-in EN55022 Class B grade filter inside the converter. The converter has been designed from the ground up to meet EMC requirements rather than a conventional design process where first the converter is optimised for performance and then an external filter is added to combat the conducted interference.

By including the filter on the main PCB of the converter, the track path lengths and impedances between the filter and the noise-generating components are reduced to the minimum and consequently smaller value filter components can be used that fit into the compact case dimensions of the Powerline+ converters without compromising on filter performance.

Safety and Protection

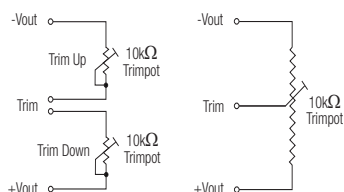
ICE Technology converters are fully protected from output short circuits, overload, output over-voltage and over-temperature. In addition, they feature under-voltage lockout that will automatically disable the converter if the input voltage falls below the minimum level.

The output is current limited which means that temporary overloads can occur without the converter shutting down. When overloaded, the output voltage will decrease to keep the maximum power constant. For the 40W and 50W converters, if the overload is too high, the converter will go into hiccup short circuit protection mode. In this mode, the converter will attempt to reconnect power every 10-20 milliseconds.

Output overvoltage protection is monitored by a separate and independent feedback circuit and an internal thermistor sensor is used to protect the converter against overheating.



Output Voltage Trimming:



Single output Powerline Plus converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the

following trimtables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

RPRxx-xx3.3S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,333	3,366	3,399	3,432	3,465	3,498	3,531	3,564	3,597	3,63	Volts
R _U =	72.8	34.4	21.2	14.4	9.9	7.2	5.3	3.88	2.74	1.84	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	3,267	3,234	3,201	3,168	3,135	3,102	3,069	3,036	3,003	2,97	Volts
R _D =	101.3	36.2	21.0	13.65	9.2	6.0	4.12	2.56	1.34	0.87	KOhms

RPRxx-xx05S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	5,05	5,1	5,15	5,2	5,25	5,3	5,35	5,4	5,45	5,5	Volts
R _U =	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	4,95	4,9	4,85	4,8	4,75	4,7	4,65	4,6	4,55	4,5	Volts
R _D =	127.6	55.8	33.0	20.2	14.2	9.46	5.97	3.6	1.77	0.28	KOhms

RPRxx-xx12S (all types)

Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	12,12	12,24	12,36	12,48	12,6	12,72	12,84	12,96	13,08	13,2	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	11,88	11,76	11,64	11,52	11,4	11,28	11,16	11,04	10,92	10,8	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

RPRxx-xx15S (all types)

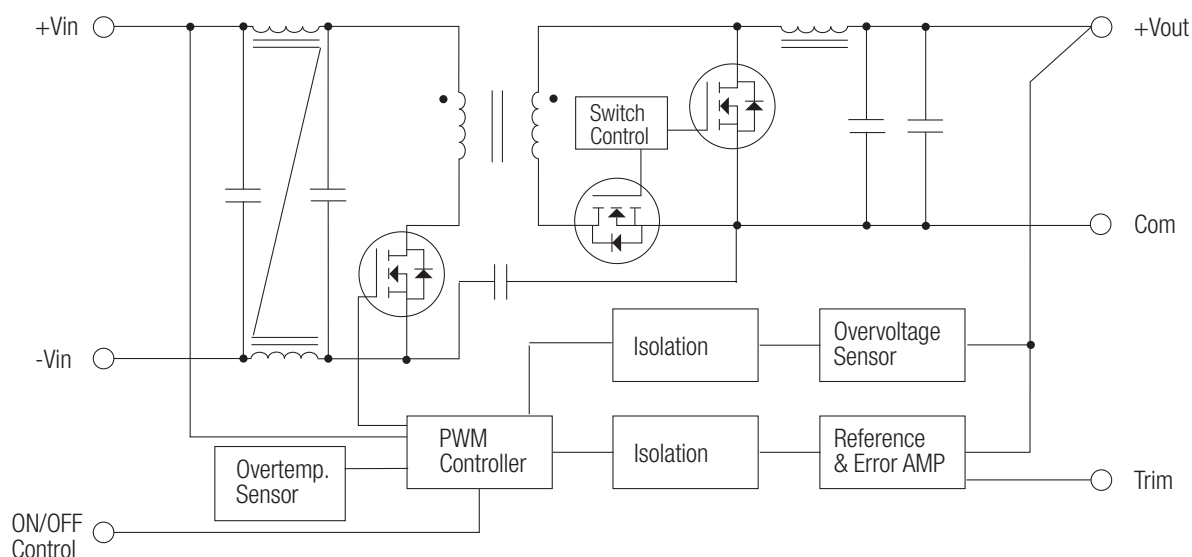
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout =	15,15	15,3	15,45	15,6	15,75	15,9	16,05	16,2	16,35	16,5	Volts
R _U =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout =	14,85	14,7	14,55	14,4	14,25	14,1	13,95	13,8	13,65	13,5	Volts
R _D =	337	150	87	56.2	37.5	24.7	16	9.4	4.16	0	KOhms

RPRxx-xx24S (all types)

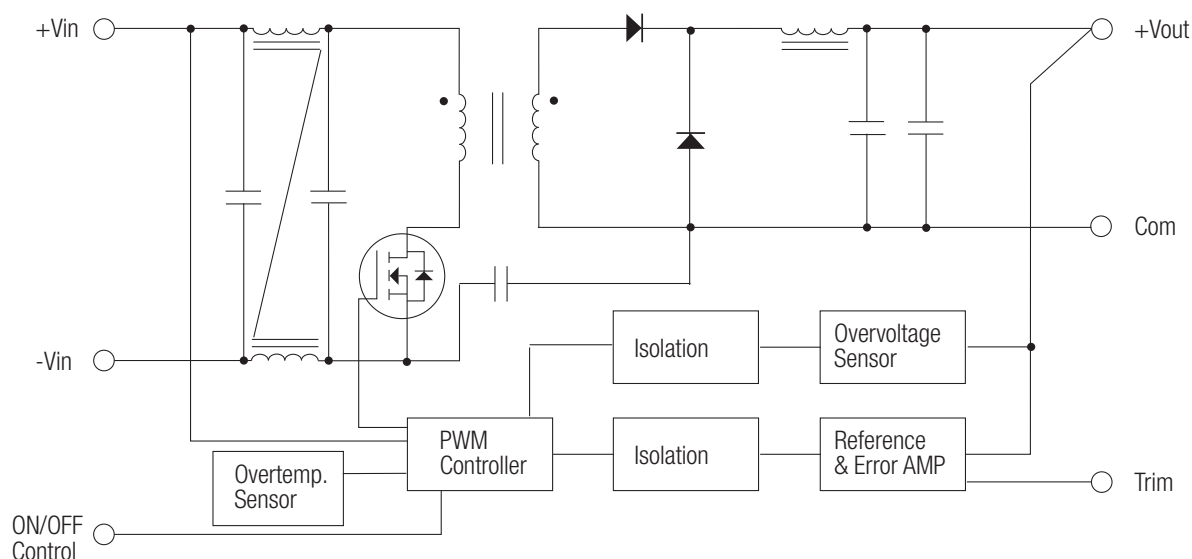
Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	24,24	24,48	24,72	24,96	25,20	25,44	24,68	25,92	26,16	26,4	Volts
R _U =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms
Trim down	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	23,76	23,52	23,28	23,04	22,80	22,56	22,32	22,08	21,84	21,6	Volts
R _D =	270	120	70	45.2	30.1	19.8	12.8	7.52	3.31	0	KOhms

Block Diagrams

Single Output - 3.3V and 5V Outputs



Single Output - all other outputs



POWERLINE+ Application Notes

DC/DC-Converter

Block Diagrams

Block Diagrams

Dual Output

