

Susumu Group Companies

Thin Film Products



Thin Film Power

The Art of Combination
Components

Rev.2009

Susumu World Group Companies



About the Susumu Group

Susumu was established in 1964 as a pioneer to mass produce thin film components for general purposes. For forty years Susumu has been continuously supplying thin film resistors to computer, telecommunication, peripheral, test equipment, automotive, and multimedia consumers. Recently chip inductors and current sensors were added to our long list of thin film products in order to meet the demand for higher speed, higher frequency, digital and the expanding wireless markets. All products are original in the field of electronic components, derived from our innovative thin film core technology. This core technology allow us to develop miniaturized, reliable, precision, and lower power consumption packages with affordable prices.



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Thin Film Technology was established in 1987 in North Mankato, Minnesota, U.S.A. by Susumu for providing thin film resistors to the computer industry. Since then, TFT has developed transmission line delay lines for high speed applications in an ISO 9001 certified factory. These compact, high accuracy delay lines provide high speed timing solutions for microprocessor, automated test equipment, and telecommunications systems. TFT has expanded these popular delay lines into surface mount and chip style packages. TFT is also responsible for expanding thin film component applications in North America by promoting it's sister companies' products, including chip resistors, arrays, attenuators, and inductors. TFT's mission is to provide superior thin film components to every PC board of our customers, hence, thin film on board.

YDS is the most senior member in the Susumu Group. Established in 1940 in Yokohama, Japan. Their first product was a precision carbon film resistor. Gradually, YDS expanded the carbon film technology into attenuators and rotary variable attenuators. In 1975 their technology migrated to thin film. Now YDS concentrates on thin film components for high frequency applications: thin film based chip resistors, chip networks, chip attenuators, SMT temperature variable attenuators, power resistors and power attenuators. YDS is committed to continuously provide thin film value to world wide customers.

Cyntec is the youngest in the Susumu group, established in 1991 as a joint venture between Susumu Co. and Delta Electronics inc. in Taiwan. Cyntec currently concentrates on two product lines including a thin film platinum temperature sensor and thin film chip arrays in an ISO 9002 and QS9000 certified factory, serving the automotive and information technology markets. Cyntec's mission is to develop , market, and produce environmentally friendly high precision electronic components from the view point of energy savings and pollution control.

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thin film components for high-frequency

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On Environment

Thin Film products by Susumu is environmentally friendly by nature.

■ Completely lead free: Our thin film products do not contain any lead even in the areas that are not restricted by RoHS. Some products are halogen free.

The lead free products are designated as **Completely lead free** in the catalogue.

Typical RG/RM construction and composition

Structure	weight % of each structure						Composition of RoHS restricted materials					
	RG1005	RG1608	RG2012	RG3216	RM2012	RM3216	Heavy metals				PBB	PBBE
							Cadmium and its compounds	Lead and its compounds	Mercury and its compounds	Hexavalent chromium		
Substrate	83.2	87	87.6	89.5	87.8	92.86	<1ppm	<1ppm	<5ppm	<1ppm	not detected	not detected
Resistor	0.02	0.02	0.02	0.02	0.02	0.02	not detected	not detected	not detected	not detected	not detected	not detected
Inner electrode	0.65	0.13	0.11	0.15	0.15	0.1	not detected	not detected	not detected	not detected	not detected	not detected
Mid electrode	8.33	5.82	5.58	4.83	5.87	2.96	not detected	not detected	not detected	not detected	not detected	not detected
Outer electrode (Sn100%)	5.45	3.81	3.66	3.16	3.84	1.94	not detected	not detected	not detected	not detected	not detected	not detected
Protective coating	A						not detected	not detected	not detected	not detected	not detected	not detected
	B	2.35	2.88	2.67	2.06	1.95	<2ppm	<2ppm	<2ppm	<2ppm	<5ppm	<5ppm
	C						<5ppm	<10ppm	<1ppm	<6ppm	not detected	not detected
Marking ink	—	0.34	0.36	0.28	0.37	0.25	<2ppm	7ppm	<2ppm	<2ppm	<2ppm	not detected
Weight	0.72mg	2.07mg	4.12mg	8.26mg	4.11mg	7.96mg						

■ Products' extremely long life contributes to conserving resources.

Extremely long life products: RG series (page 8), RM series (page 10)

- Thin film resistors are high precision and very reliable by nature. New RG series boasts 8 times longer life compared to our conventional thin film resistors. Under normal usage (normal temp. and humidity), the expected resistance drift is less than 0.1% after 116 years

Comparison to our conventional product

Product series	Type	Judgment Criteria	Years
RG series	Highly reliable thin film chip resistor	0.1% resistance drift	over 116 years
RR series	Thin film chip resistor		14 years

Test Condition: 85°C, 85%RH, 10% rated voltage bias, 90 min. on/30min. off

■ Thin film enables us to make components smaller, contributing conserving resources.

Example 1: RL series

Power	Conventional type	RL	area %
0.1W	1.6×0.8	0.6×0.3	14%
1W	6.4×3.2	3.7×2.0	36%
2W	11.5×7.0	7.5×2.0	19%

Comparison to our conventional product (unit: mm)

Example 2: RGH series

Power	Conventional type	RGH	area %
1/8W	1.6×0.8	1.0×0.5	39%
1/4W	3.2×1.6	2.0×1.25	48%

Comparison to our conventional product (unit: mm)

SSM Group Companies, as a whole group, strive to create environmentally friendly components.

SSM Group ISO14001 certification status

Company Name	Facilities	Certification date	Certifying body	Cert. #
Susumu Co., Ltd.	Obama Factory	2000.12.15	JQA	EM1184
	Headquarter, Sales offices			
Yokohama Denshi Seiko Co., Ltd.	Niigata Factory	2001.03.09	JQA	EM1388
Thin Film Technology Corp.	Mankato facility	2000.03.24	UL	A8561
Cynotec Co., Ltd.	Hsin-Chu (Taiwan)	2002.08.26	UL	A8561
	Suzhou (China)	2003.10.22	UKAS	140858

RoHS compliant products

All our products are RoHS compliant. RoHS compliant products are designated as **RoHS compliant** in the catalogue.

〈How to order and distinguish lead free and halogen free products〉

All of our products are available lead free and some are available halogen free. Lead free or halogen free products' part numbers are different on some products and the same on other products.

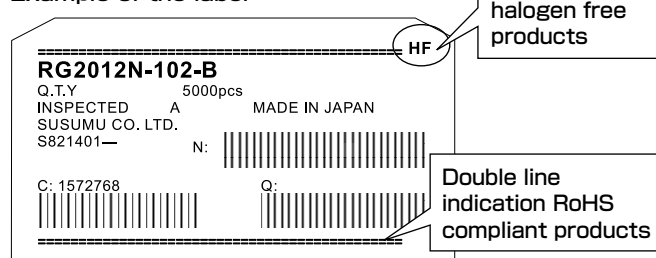
〈Ordering〉

- ① If the part-number is available lead free only, or if the part-number has lead free designation, use these part numbers to order.
- ② If the products do not have specific designation for lead or halogen free, please add remarks that say clearly that you are ordering lead free or halogen free products.
*Please contact our sales office for halogen free products.

〈Identification〉

A double line runs through the bottom of the label of all lead free terminal products. The designator "HF" appears at the top right corner of the label for all halogen free products.

Example of the label

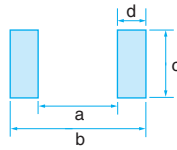


halogen free products.					Terminal lead free			Halogen free		
Page		sub category	RoHS compliant	Completely lead free	Lead free only	Specific part #	Differentiation	Halogen free	Both offered	Differentiation
8	RG series		○	○	○	—	—	○	○	HF on label
10	RM series		○	○	○	—	—	○	○	HF on label
12	RGH series		○	○	○	—	—	○	○	HF on label
13	RR series	RR0510	○	○	○		double lined label	○		
		other	○	○	○		double lined label	○	○	HF on label
14	CP series		○	○	○		specific part #			
14	RRS series		○	○	○		—	○		
15,39	RN series		○	○	○		double lined label			
15	RA series		○	○	○	—	—			
16	RT series		○	○	○		double lined label	○		
17	RP series,	RP1005	○	○	○		double lined label			
	RPH series	other	○	○	○		double lined label	○	○	HF on label
18,19,20,22	RL series	RL0603, RL0510, RL1632, RL3264	○		○		double lined label			
		other	○		○		double lined label	○	○	HF on label
18	PRL series		○		○	—	—			
20	RL-3264 series		○	○	○	○	specific part #	○	○	specific part #
21	KRL series		○	○	○	—	—	○		
23,24	PCMC (B) , PS, PW series		○	○	○	—	—	○		
25,26	RS series	RS2N,4N,8M	○		○		Internal part #	○	○	Internal part #
		RS064R,062R	○		○		Internal part #	○	○	specific part #
		RS8A	○		○	○	Internal part #			
27	PFR series,	PFR05,GFR05	○		○		Internal part #	○	○	Internal part #
	GFR series	PFR03	○		○		Internal part #	○	○	specific part #
28	RF series		○	○	○		double lined label	○		
29	SA series		○	○	○		—	○		
30	HPL series		○	○	○		double lined label	○		
	TFL series		○	○	○		double lined label			
31	HTC series		○	○	○		double lined label	○		
32,33,34	TLF,TBF,TBL,TBB,TDP series		○	○	○	—	—	○		
35	FL*B series		○	○	○		specific part #			
36	EF2A series		○	○	○		specific part #			
37	P*V series		○		○		double lined label			
38	PAT series	RAT1010	○		○	○	specific part #			
		other	○	○	○		double lined label			
39	PS series		○	○	○		—			
40	CL,GL series		○	○	○	○	specific part #			
41	DS series		○		○		—			
42	DL series		○		—	○	specific part #			

Design Supportive Data

Recommended land pattern (Dimension: mm)

Recommended land pattern A



Series	a	b	c	d	Page
RP1005, RL0510	0.5	1.9	0.7	—	17, 19
RP1608, RL0816, RPH1608	0.7	3	1.6	—	17, 19
RP2012, RL1220	1	4	2.4	—	17, 19
RL3720	1.2	4.0*	4.2	—	18
RL3720W	1.2	4.0*	7.9	—	18
RL7520W	1.2	4.0*	15.8	—	18
KRL1220	1.2	2.7	1.5	—	21
KRL1632	(5~7m)	1	4	1.9	21
	(8m~)	2.4			
KRL3264	(5~7m)	2.9	7.4	3.5	21
	(8m~)	4.4			
KRL2012	(1m)	0.1	2	2.2	21
	(2m)	0.4			
	(3m~)	0.6			
KRL3216	(1m)	0.4	2.4	3.4	21
	(2m)	0.8			
	(3m~)	1			
KRL6432	(1m)	0.9	4.2	6.6	21
	(2m~)	2.2			
KRL7638	(1m)	1.1	4.6	7.8	21
	(2m~)	2.6			
KRL9045	(1m)	1.3	5.1	9.2	21
	(2m~)	3.1			
KRL11050	(1m)	1.5	5.6	11.2	21
	(2m~)	3.6			
PRL0816	0.4	—	2	1	18
PRL1220	0.55	—	2.5	1.2	18
PRL1632	0.7	—	4	1.4	18
PRL3264	1.6	—	7.5	2	18
RL1632	1.1	4.7	1.7	1.8	19
RL3264	2.3	7.9	3.6	2.8	19
RL1632H	(1~4m)	—	4.14	2.97	20
	(5m~)	1.4	5.2	1.78	20
RL-3264-6C	—	8	4	2	20
RL-3264-9V	(1~4m)	—	7.37	3.68	20
	(5~6m)	—	7.4	3.68	20
	(7~11m)	—	7.36	3.68	20

*27mm, if heat dissipation is considered.

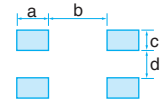
Series	a	b	c	d	Page
RN732X	1.2	—	1.2	0.6	13
RR1632	2.4	—	1.6	0.6	13
RR2632	2.4	—	2.6	0.6	13
PFR (GFR) 03	0.3	1	0.3~0.7	—	27
PFR (GFR) 05	0.5	1.5	0.4~0.8	—	27
EF2A51A	0.46	1.22	0.55	0.38	36

Series	a	b	c	d	Page
PCAA031 (B) T	1.1	3.5	1.3	—	24
PCAA041B	1.6	4.5	1.7	—	24
PCMC042T	2.2	5.2	2.5	—	24
PCMC053T	3	7	2.5	—	24
PCMC (B) 063T	3.7	7.4	3.5	—	23
PCMC (B) 104T	4.5	11.5	4	—	23
PCMC133E	8	14.5	5	—	23
PCMC135T	8	14.5	5	—	23

Chip Size	a	b	c	d
06*03	0.28	0.76	0.34	—
1.0*0.5	0.5	1.6	0.6	—
1.6*0.8	1	3	1.2	—
2.0*1.25	1.2	4	1.65	—
3.2*1.6	2.2	5	2	—

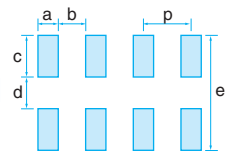
Series	Page	Series	Page
RG Series	8	RT Series	16
RGH Series	12	TFL Series	30
RR Series (except RR1632, RR2632)	13	HPL Series	30
RRS Series	14	HTC Series	31

Recommended land pattern B



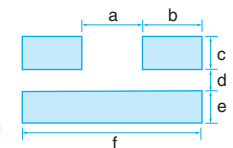
Series	a	b	c	d	Page
RM2012	0.6	0.8	0.5	0.6	10
RM3216	1.1	1.2	0.7	0.8	10
RN1632B (C)	1.2	1	0.8	0.8	15
RL1632L4	1	2.2	1.1	0.5	22
RL2550L4	3.4	2.6	1.8	0.7	22
RL3264L4	4.2	2.2	2.4	0.8	22

Recommended land pattern C

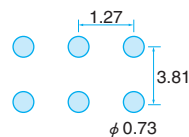


Series	a	b	c	d	e	p	Page
RS064R	0.2	—	—	0.3	0.9	0.4	25
RS064R (K)	0.2	—	—	0.3	0.9	0.5	25
RS4N	0.25	—	—	0.5	1.5~2.0	0.5	25
RA1632	0.25~0.3	0.5~0.55	0.9	0.6	—	—	15
RS062R (2 electrodes on one side)	0.3	—	—	0.3	0.9	0.5	25
RS2N (2 electrodes on one side)	0.25	—	—	0.5	1.8	0.65	25
RS8A (5 electrodes on one side)	0.3	—	—	1	3.6	0.635	26
RS8M (8 electrodes on one side)	0.25	—	—	1	3.6	0.5	26

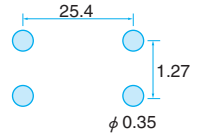
Recommended land pattern D



Series	a	b	c	d	e	f	Page
PAT0510S	0.18	0.21	0.35	0.37	0.35	0.6	38
PAT0816	0.5	0.6	0.4	0.3	0.4	1.7	38
PAT1220	0.7	0.8	0.7	0.5	0.7	2.3	38
PAT1632	1.0	1.2	0.8	0.65	0.8	3.4	38
PXV1220S	0.7	0.3	0.7	0.5	0.7	2.3	37
PBV1632S	1.0	1.2	0.8	0.65	0.8	3.4	37
RN1632A	1.0	1.2	0.8	0.65	0.8	3.4	15

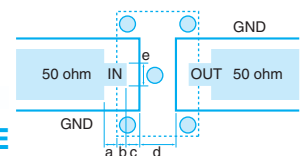


Series	Page
FL Series	35



Series	Page
CL1L5	40
CL2LA	40

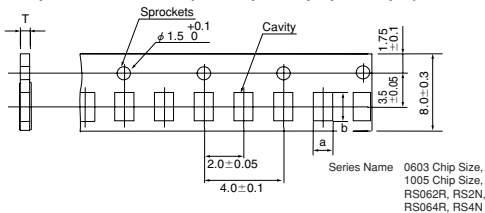
Recommended land pattern E



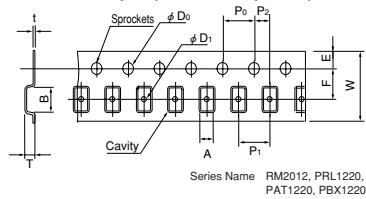
Series	a	b	c	d	e	Page
TBF-0510	0.2	0.15	0.3	1.1	0.3	33
TBF-1608	0.2	0.15	0.125	0.25	0.4	33
TBF-2012	0.2	0.15	0.3	0.35	0.3	33

Tape Specification (Dimension: mm)

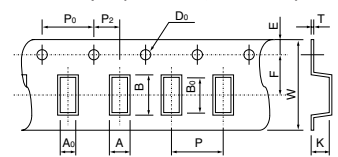
Tape dimensions (2mm pitch paper tape)



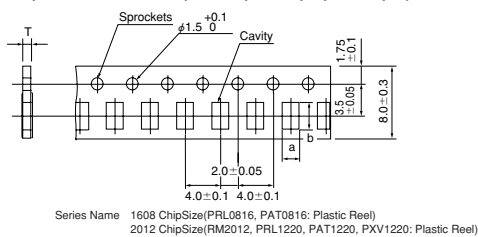
Plastic Tape (2012 ChipSize)



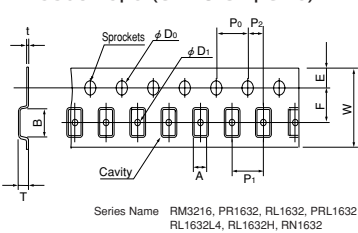
Plastic Tape (RL3720, RL7520)



Tape dimensions (4mm pitch paper tape)



Plastic Tape (3216 ChipSize)

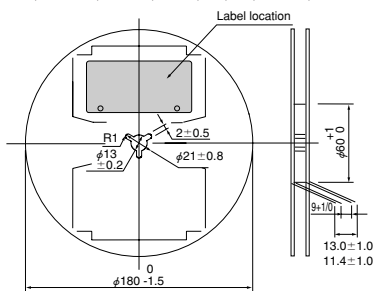


Code	Dimension Specification	
	2012	3216
A	1.6±0.2	2.0±0.2
B	2.4±0.2	3.6±0.2
W	8.0±0.3	8.0±0.3
F	3.5±0.05	3.5±0.05
E	1.75±0.1	1.75±0.1
P ₀	4.0±0.1	4.0±0.1
P ₁	4.0±0.1	4.0±0.1
P ₂	2.0±0.05	2.0±0.05
D ₀	1.55±0.05	1.55±0.05
D ₁	—	1.05±0.05
T	≤1.5	≤1.5
t	≤0.3	≤0.3

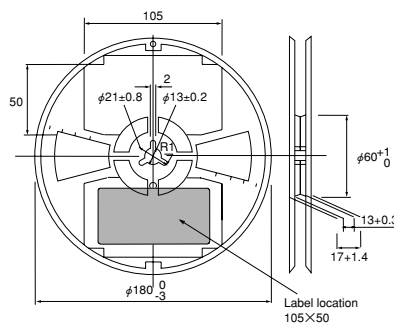
Code	Dimension Specification	
	RL3720	RL7520
A	2.6±0.2	2.6±0.2
A ₀	2.4±0.1	2.4±0.1
B	4.45±0.2	8.2±0.2
B ₀	4.25±0.2	8.0±0.2
E	1.75±0.1	1.75±0.1
F	5.5±0.05	7.5±0.1
W	12.0±0.2	16.0±0.3
D ₀	1.55±0.05	1.55±0.05
K	0.7±0.1	0.7±0.1
T	0.3±0.05	0.3±0.05
P ₀	4.0±0.1	4.0±0.1
P ₁	4.0±0.1	4.0±0.1
P ₂	2.0±0.05	2.0±0.1

Reel Specification (Dimension: mm)

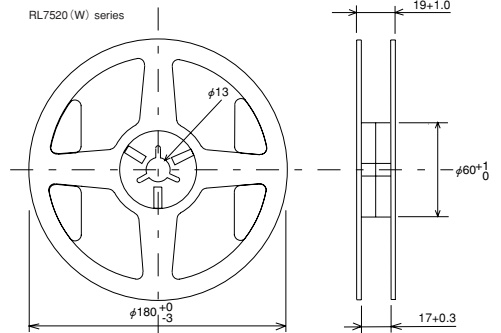
RG series, RGH series, RM series, RR series, TFL series, HPL series, RT series, HTC series, RP series, RL0510, 0816, 1220, RS series, PAT series



RL3720 (W) series



RL7520 (W) series



Power Derating

●Rated Power

The maximum load power is calculated by multiplying the rated power with the ratio derived from the power derating curve

<Rated voltage>

The rated voltage is the corresponding voltage of DC or AC (commercially used frequency) current to the rated power given by:

$$E = \sqrt{R \times P}$$

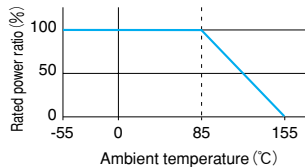
E: Rated voltage (V)
P: Rated power (W)
R: Rated resistance (Ω)

<Rated current>

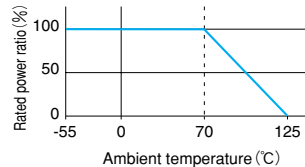
The DC current that increases the temperature by 20°C by inductance. If the ambient temperature exceeds 70°C, the current should be derated according to the power derating curve below.

$$(\text{Power}) = (\text{Current})^2 \times (\text{Resistance})$$

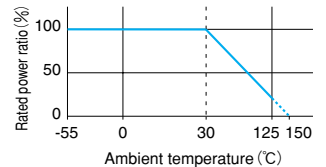
RG, RM, RGH series



RR series, RRS series, RT series, RN-RA series, PFR-GFR series, RS series, RL0510-0816-1220-3720-3720W, PRL series, RAT1010, P#V series, PS series, BL-CL-GL series, HPL0603-0510, TFL0510-0816

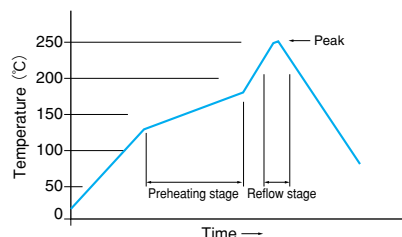


RL7520W



Recommended Reflow

●Recommended reflow temperature profile

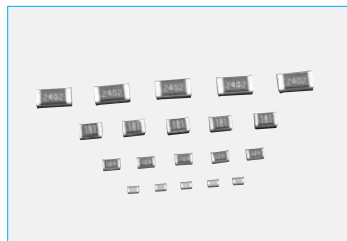


●Part's surface temperature

Pre-heat	130~180°C	60~90sec.
reflow	Over 220°C	30~90sec.
peak temperature	240~250°C	within 10sec.

●Solder composition : Sn-Ag-Cu solder

●Repetition : up to 2 times (Cooling between the two reflow is required.)



RG series, ultra-precision & ultra-reliability metal film chip resistors



Tight resistance tolerance of $\pm 0.02\%$ and temperature coefficient of resistance of $\pm 5\text{ppm}/^\circ\text{C}$ are achieved. Under high temperature and humid condition of 85°C and $85\%\text{RH}$, and at 155°C (duration:10000 hours for both tests), superior reliability of only less than $\pm 0.1\%$ of change in resistance value is realized.

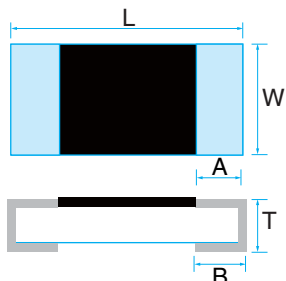
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RG1005 (0402)	RG1608 (0603)	RG2012 (0805)	RG3216 (1206)
L	1.0 ± 0.05	1.6 ± 0.2	2.0 ± 0.2	3.2 ± 0.2
W	0.5 ± 0.05	0.8 ± 0.2	1.25 ± 0.2	1.6 ± 0.2
A	0.25 ± 0.10	0.3 ± 0.2	0.4 ± 0.2	0.5 ± 0.25
B	0.25 ± 0.05	0.3 ± 0.2	0.4 ± 0.2	0.5 ± 0.2
T	0.35 ± 0.05	0.4 ± 0.1	0.4 ± 0.1	0.4 ± 0.1

(unit : mm)

Electrical

Type		RG1005				RG1608					
Power	general	1/16W				1/10W					
	Ultra-reliability	1/32W				1/16W					
Tolerance %(code)		± 0.5(D)	±0.05(W),±0.1(B) ±0.25(C),±0.5(D)	±0.02(P),±0.05(W), ±0.1(B), ±0.25(C),±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)	± 0.5(D)	±0.05(W),±0.1(B) ±0.25(C),±0.5(D)	±0.02(P),±0.05(W), ±0.1(B), ±0.25(C),±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)	± 0.1(B) ± 0.5(D)	± 0.5(D)
Resistance Range(Ω)		10~46.4	47~97.6	100~2.94k	3k~100k	10~46.4	47~97.6	100~4.99k	5.1k~270k	274~332k	340~360k
TCR ppm /°C(code)		±100 (R)	±10 (N) ±25 (P)	±10 (N) ±25 (P)	±10 (N) ±25 (P)	±50 (Q)	±10 (N) ±25 (P)	±10 (N) ±25 (P)	±10 (N) ±25 (P)	±25 (P)	±25 (P)
Max Operating Voltage		25V				75V					
Resistance Value		E-24, E-96									
Operating Temp. Range		-55°C~155°C									
Package		1,000pcs/reel (T1:P,W,B), 5,000pcs/reel (T5:W,B), 10,000pcs/reel (T10:W,B,C,D)				1,000pcs/reel (T1:P,W,B), 5,000pcs/reel(T5:W,B,C,D)					

Type		RG2012					RG3216			
Power	general	1/8W					1/4W			
	Ultra-reliability	1/10W					1/8W			
Tolerance %(code)		±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)	±0.02(P),±0.05(W), ±0.1(B), ±0.25(C),±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)	±0.1(B) ±0.5(D)	±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)	±0.02(P),±0.05(W), ±0.1(B), ±0.25(C),±0.5(D)	±0.05(W),±0.1(B), ±0.25(C),±0.5(D)
Resistance Range(Ω)		10~46.4	47~97.6	100~10k	10.2k~475k	487k~1M	10~46.4	47~97.6	100~33.2k	34k~1M
TCR ppm /°C(code)		±50 (Q)	±10 (N) ±25 (P)	±5 (V) ±10 (N) ±25 (P)	±10 (N) ±25 (P)	±25 (P)	±50 (Q)	±10 (N) ±25 (P)	±5 (V) ±10 (N) ±25 (P)	±10 (N) ±25 (P)
Max Operating Voltage		100V					150V			
Resistance Value		E-24, E-96								
Operating Temp. Range		-55°C~155°C								
Package		1,000pcs/reel (T1:P,W,B), 5,000pcs/reel(T5:W,B,C,D)					1,000pcs/reel (T1), 5,000pcs/reel(T5)			

- Please contact us for Resistance tolerance $\pm 0.01\%$.
- Please contact us for RG3225 series with power of 1/2W
- The stability (reliability) characteristics differ depending on the rated power.

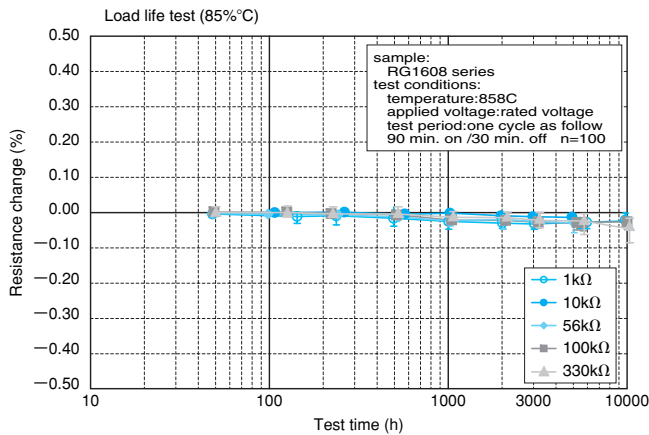
Reliability

Item	Test Method	Specification		Typical
		Ultra-reliability	general	Ultra-reliability
Short time overload	Applied voltage: $2.5 \times$ rated voltage or $2 \times$ maximum operating voltage which ever is less test duration: 5 seconds	$\pm (0.05\%)$	$\pm (0.05\%)$	$\pm (0.01\%)$
Load Life	Test Temperature: 85°C Applied voltage: rated voltage Test period: repeat 1000 cycle as follow: 90 min. on/30 min. off cycled	$\pm (0.1\%)$	$\pm (0.25\%)$	$\pm (0.01\%)$
Moisture load life	Test condition: $85^\circ\text{C}85\%\text{RH}$ Applied power: 1/10 rated Power Test period: repeat 1000 cycle as follow: 90 min. on/30 min. off cycled	$\pm (0.1\%)$	$\pm (0.25\%)$	$\pm (0.05\%)$
Temperature cycle	Repeat 1000 cycle as follow: -55°C (30 min.)/Room Tem.(2 min.)/ $+125^\circ\text{C}$ (30 min.)/Room Tem.(2 min.)	$\pm (0.1\%)$		$\pm (0.01\%)$
High temperature exposure	$+155^\circ\text{C}$ for 1000 hours with no load	$\pm (0.1\%)$		$\pm (0.01\%)$

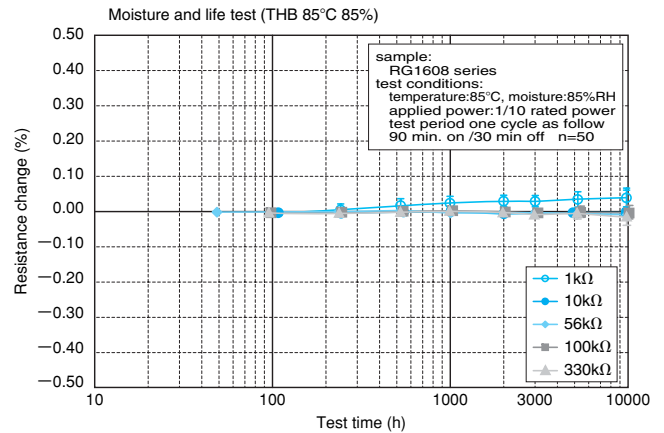


The result of each reliability test for 10000 hours

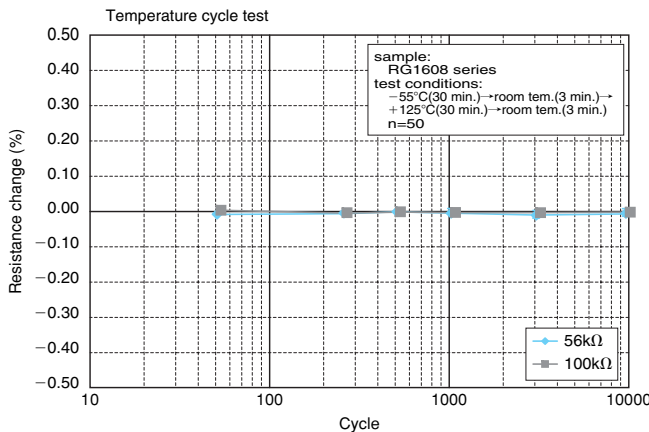
Load life test



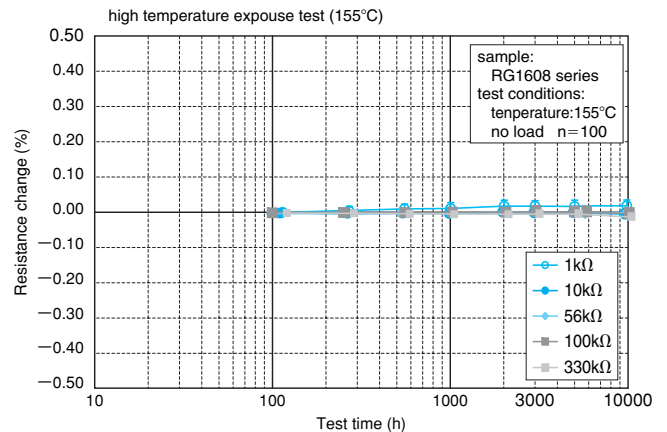
Moisture and life test



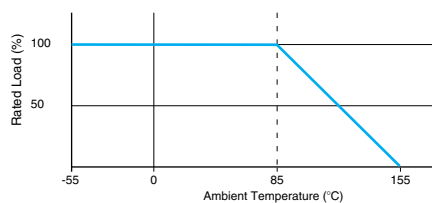
Temperature cycle test



High temperature exposure test



CHARACTERISTIC of Power Temperature Derating Curve



PART NUMBER

RG 1608 N - 102 - B - T5

Package (T1,T5,T10)

Resistance Tolerance

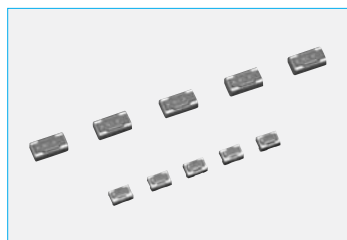
Resistance

(E-24: in a 3 digit number,
E-96: in a 4 digit number 4 digits for all RG3216)

Temperature Coefficient of Resistance

Dimensions

Part Code



RM series, ultra-precision & ultra-reliability metal film chip network resistors



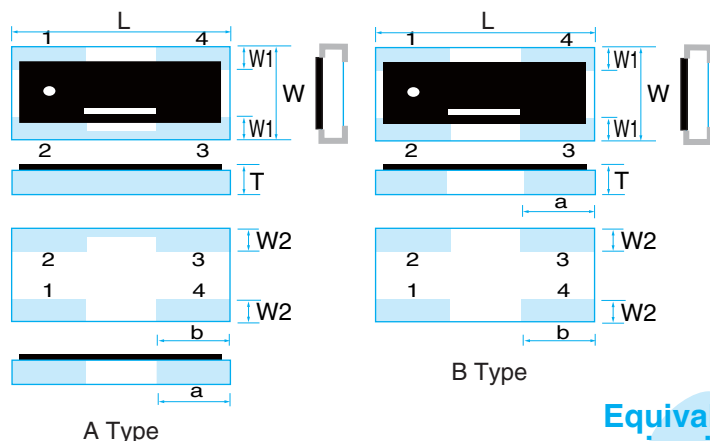
Tight tracking resistance tolerance of $\pm 0.01\%$ and tracking temperature coefficient of resistance of $\pm 1\text{ppm}/^\circ\text{C}$ are achieved. Under high temperature and humid condition of 85°C and $85\%\text{RH}$, and at 155°C (duration:10000 hours for both tests), superior reliability of only less than $\pm 0.1\%$ of change in resistance value is realized.

RoHS compliant

Completely lead free

SPECIFICATIONS

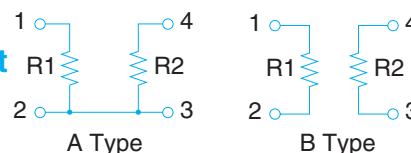
Mechanical



Dimension (Inch Size)	RM2012 (0805)	RM3216 (1206)
L	2.0 ± 0.2	3.2 ± 0.2
W	1.25 ± 0.2	1.6 ± 0.2
W1	0.4 ± 0.2	0.4 ± 0.25
W2	0.35 ± 0.2	0.4 ± 0.2
a	0.5 ± 0.2	1.0 ± 0.25
b	0.6 ± 0.2	1.0 ± 0.2
T	0.4 ± 0.1	0.4 ± 0.1

(unit : mm)

Equivalent circuits



Electrical

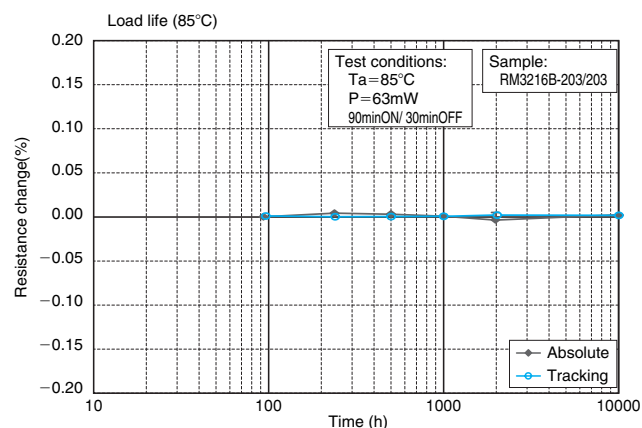
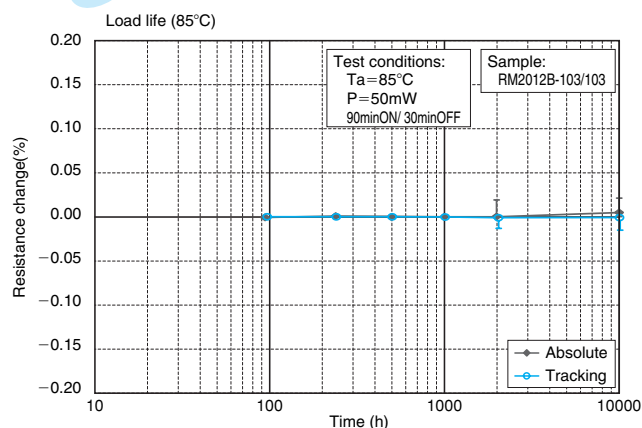
Type	RM 2012		RM 3216	
Power	0.05W/element,0.1W/package		0.063W/element,0.125W/package	
Resistance Range (Ω)	100~100kΩ		100~330kΩ	
Absolute Tol. %(code)	±0.1(B),±0.5(D) (100≤R<2kΩ)	±0.05(W),0.1(B),±0.5(D) (2kΩ≤R≤100kΩ)	±0.1(B),±0.5(D) (100≤R<2kΩ)	±0.05(W),0.1(B),±0.5(D) (2kΩ≤R≤330kΩ)
Tracking Tol. %(code)	±0.01(L),±0.02(P),±0.05(W) (ratio=1) ±0.02(P),±0.05(W) (1<ratio≤10) ±0.05(W) (100≥ratio>10)		±0.01(L),±0.02(P),±0.05(W) (ratio=1) ±0.02(P),±0.05(W) (1<ratio≤10) ±0.05(W) (100≥ratio>10)	
Absolute TCR ppm/°C(code)	±25(P) (100≤R<300Ω)	±10(N),±25(P) (300≤R≤100kΩ)	±25(P) (100≤R<300Ω)	±10(N),±25(P) (300≤R≤330kΩ)
Tracking TCR ppm/°C(code)	±1(X), ±5(V) (ratio=1) ±2(W),±5(V) (1<ratio≤3) ±5(V) (100≥ratio>3)		±1(X), ±5(V) (ratio=1) ±2(W),±5(V) (1<ratio≤3) ±5(V) (100≥ratio>3)	
Max Operating Voltage	25V		50V	
Package	500pcs/reel(05), 1.000pcs/reel(10), 5.000pcs/reel(50)			

- Please contact us for TCR $\pm 5\text{ppm}/^\circ\text{C}$ for 300Ω or more in RM2012, RM3216
- Please contact us for other variety than these sizes and customized specifications.

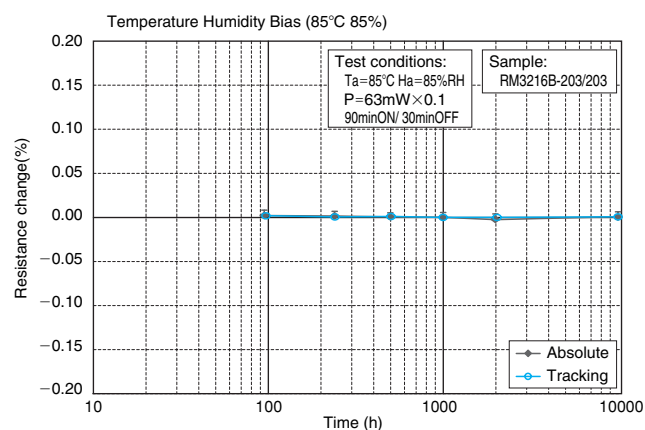
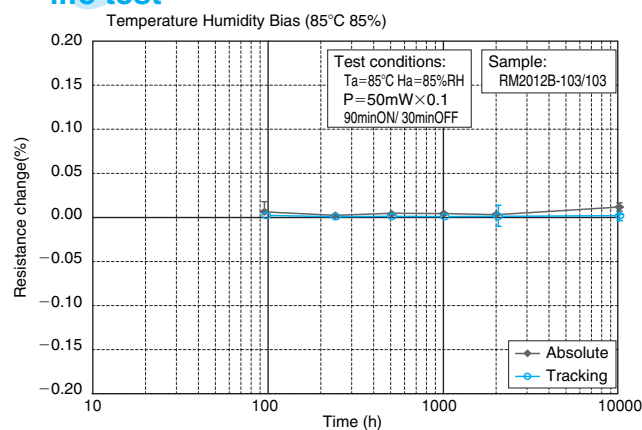
<Standard combination of resistance values>

Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)
1 : 1	1k	1k	1 : 5	1k	5k	1 : 20	1k	20k
	10k	10k		2k	10k		2k	40k
	100k	100k		10k	50k		5k	100k
1 : 2	1k	2k	1 : 6	1k	6k	1 : 25	1k	25k
	10k	20k		10k	60k		2k	50k
	100k	200k		1k	9k	1 : 50	1k	50k
1 : 3	1k	3k	1 : 9	1k	9k		2k	100k
	10k	30k		10k	10k	1 : 100	1k	100k
	100k	300k		2k	20k		2k	200k
1 : 4	1k	4k	1 : 10	10k	100k			
	10k	40k						

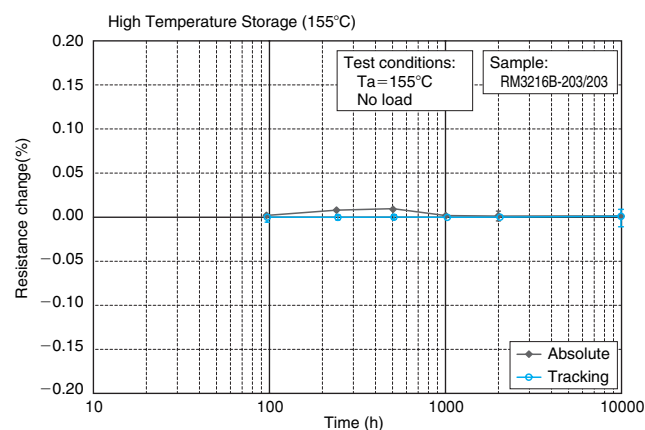
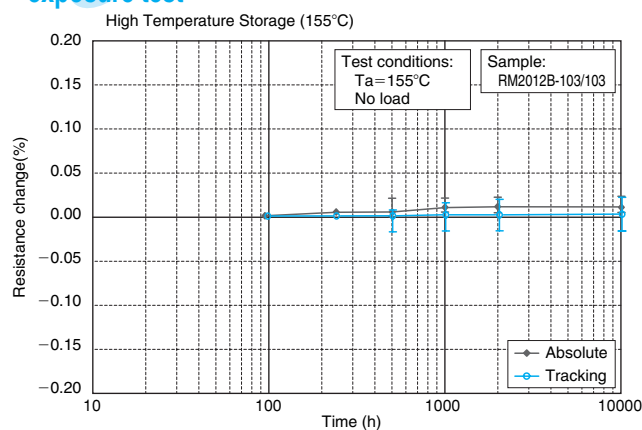
Load life test



Moisture and life test



High temperature exposure test



PART NUMBER

RM 2012 A - */** - P W X L 10**

— Package (05=500pcs, 10=1,000pcs, 50=5,000pcs)

Tracking Resistance Tolerance

Tracking Temperature Coefficient of Resistance

Resistance Tolerance

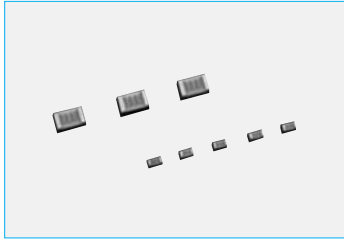
Temperature Coefficient of Resistance

Resistance

Circuit

Dimensions

Part Code



RGH series, high-power and high-precision metal film chip resistors



NEW Resistors with high power in small size are realized as 1/6W for 1.6×0.8mm(0603), 1/4W for 2.0×1.25mm(0805) size and 1/8W for 1.0×0.5mm(0402) size. Tight resistance tolerance of $\pm 0.1\%$ and temperature coefficient of resistance of $\pm 25\text{ppm}/^\circ\text{C}$ are achieved. Operating temperature range: $-55\sim 155^\circ\text{C}$

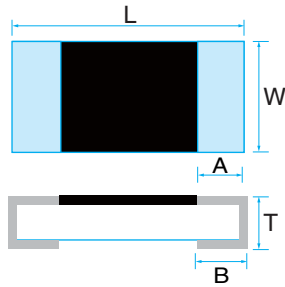
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RGH1005-2B (0402)	RGH1608-2C (0603) NEW	RGH2012-2E (0805)
L	1.0 ± 0.05	1.6 ± 0.2	2.0 ± 0.2
W	0.5 ± 0.05	0.8 ± 0.2	1.25 ± 0.2
A	0.2 ± 0.10	0.3 ± 0.2	0.4 ± 0.2
B	0.25 ± 0.05	0.3 ± 0.2	0.4 ± 0.2
T	0.35 ± 0.05	0.4 ± 0.1	0.4 ± 0.1

(unit : mm)

Electrical

Type	RGH1005-2B	RGH1608-2C NEW	RGH2012-2E
Power	1/8W	1/6W	1/4W
Tolerance % (code)	$\pm 0.1\%(B), \pm 0.5\%(D)$	$\pm 0.5\%(D), \pm 0.1\%(B)$	$\pm 0.1\%(B), \pm 0.5\%(D)$
Resistance range (Ω)	47~100k	47~360k	47~470k
TCR ppm/ $^\circ\text{C}$ (code)	$\pm 25\text{ppm}/^\circ\text{C}(P)$	$\pm 25\text{ppm}/^\circ\text{C}(P)$	$\pm 25\text{ppm}/^\circ\text{C}(P)$
Max Operating Voltage	75V	100V	125V
Resistance value	E-24, E-96	E-24, E-96	E-24, E-96
Operating Temp. Range	$-55\sim 155^\circ\text{C}$	$-55\sim 155^\circ\text{C}$	$-55\sim 155^\circ\text{C}$
Package	10,000pcs/reel	5,000pcs/reel	5,000pcs/reel

· RGH1608 with 1/5W power consumption are available to meet your needs.



PART NUMBER

RGH 1005 - 2B - P - 102 - B

Resistance Tolerance

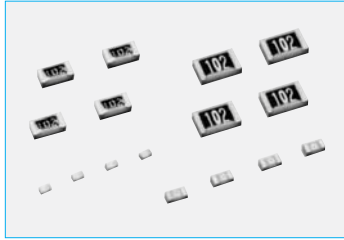
Resistance(E-24:in a 3 digit,E-96:in a 4 digit)

Temperature coefficient of resistance

Power(2B for 1/8W, 2C for 1/6W, 2E for 1/4W)

Dimension

Part Code



RR series, high-precision metal film chip resistors



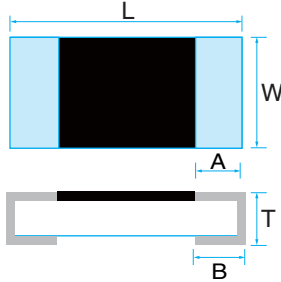
Thin Film Technology has achieved high performance chip resistors with low price and reliable supply. The parts offer excellent performance and tolerance in TCR, current noise, linearity, for high frequency circuit applications. Precise dimensions minimize errors during mounting. Tight tolerance allow for cost saving due to circuit simplification and elimination of trim pots for adjustment.

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RR0306 (0201)	RR0510 (0402)	RR0816 (0603)	RR1220 RN73 (0805)	RR1632 (1206)	RR2632 (1210)
L	0.60±0.05	1.00±0.05	1.60±0.20	2.00±0.20	3.20±0.20	3.20±0.20
W	0.30±0.05	0.50±0.05	0.80±0.20	1.25±0.20	1.60±0.20	2.60±0.20
A	0.12±0.05	0.20±0.10	0.30±0.20	0.40±0.20	0.50±0.20	0.50±0.20
B	0.12±0.05	0.25±0.05	0.30±0.20	0.40±0.20	0.45±0.20	0.45±0.20
T	0.23±0.03	0.35±0.05	0.40±0.10	0.40±0.10	0.40±0.10	0.40±0.10

(unit : mm)

Electrical

Type	RR0306	RR0510	RR0816	RR1220	RN73	RR1632			RR2632		
Power	1/20W	1/16W	1/16W	1/10W	1/10W	1/8W			1/4W		
Tolerance %(code)	±1.0% (F)	±0.5% (D)	±0.5% (D)	±0.5% (D)	±0.1% (B)	±0.5% (D)	±0.1% (B)		±0.5% (D)	±0.1% (B)	
Resistance Range (Ω)	10~30 33~22k	10~97.6 100~100k	10~97.6 100~360k	10~97.6 100~1M	511~100k 100~100k	10~49.9 51~1M	100~200k 100~200k	51~1M	10~49.9 51~2M	100~330k 100~330k	51~2M
TCR ppm /°C(code)	±100 (R)	±25 (P)	±100 (R)	±25 (P)	±50 (Q)	±25 (P)	±50 (Q)	±25 (P)	±5 (V)	±10 (N)	±25 (P)
Resistance Value	E-24	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96	E-24/E-96
Operating Temp. Range	-55°C ~ +125°C										
Max Operating Voltage	15V	25V	75V	100V	100V	150V	150V		200V	200V	
Package	5,000 pcs/reel	10,000 pcs/reel	5,000 pcs/reel	5,000 pcs/reel	1,000(T1)· 5,000(T5)pcs/reel	1,000(T1)· 5,000(T5)reel	1,000(T1)· 5,000(T5)pcs/reel		1,000(T1)· 5,000(T5)reel	1,000(T1)· 5,000(T5)pcs/reel	

· Contact us also for RL0816-JMP jumper resistor whose dimensions are the same as those of RR0816.

PART NUMBER

RR 0816 P - 102 - D - (M) - (T5) - (*)**

To be added as for E-96 series value of RR0816 as 3 letters code

Taping quantity unit

RR1632,RR2632:"T1" to be added for 1000pcs/reel

"T5" to be added for 5000pcs/reel

RR0306,RR0510,RR0816,RR1220: No marking

"M" to be added as for E-96 series value of RR1220

Resistance Tolerance

Resistance value

RR0306,RR0510,RR0816,RR1220:3 digits for E-24 series

RR0306,RR0510,RR0816,RR1220:4 digits for E-96 series

RR1632,RR2632:4 digits for all values

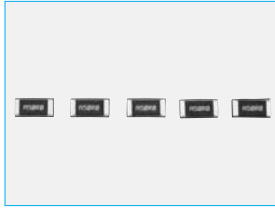
Power Rating

Temperature Coefficient of Resistance

Dimensions

Part Code

RN73 N 2X 1001 B (-T1)



Chip Power Resistor CP series



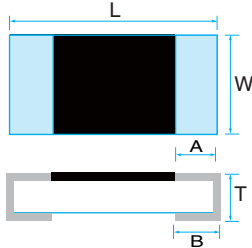
16W rated power possible depending on customer's board type.
Resistance tolerance $\pm 1\%$, TCR $\pm 25\text{ppm}/^\circ\text{C}$
Operating temperature: $55\sim 155^\circ\text{C}$

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical

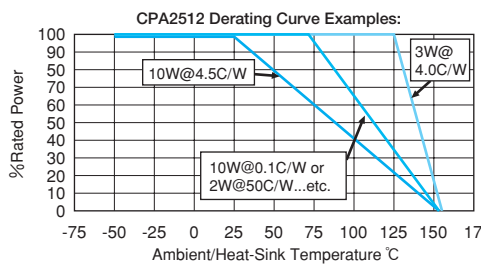


Dimension (mm)	CPA2512
L	6.3 ± 0.2
W	3.2 ± 0.2
T	0.7 ± 0.1
A	0.9 ± 0.2
B	2.0 ± 0.2

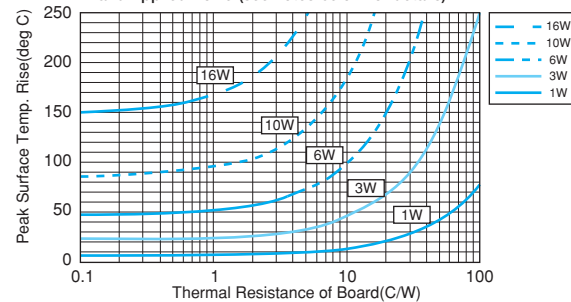
Electrical

Type	CPA2512
Power	16W
Resistance Range(Ω)	$3.3\sim 120$
Tolerance % (code)	$\pm 1.0\text{(F)}$
TCR ppm / $^\circ\text{C}$ (code)	$3.3\Omega\sim 22\Omega : \pm 50\text{(Q)}$ $> 22\Omega : \pm 25\text{(E)}$
Operating Temp. Range	$-55\sim 155^\circ\text{C}$
Package	1,000pcs/reel (T10) 5,000pcs/reel (T50)

Power rating and other characteristics vary depending on customer boards' thermal conductivity/resistivity.



Peak Surface Temperature Rise of CPA2512*##S per Board Thermal Resistance and Applied Power(see notes below for details)



PART NUMBER

Dimensions — **CP A 2512 * **** F S - T10** — Package (T10:1000pcs/reel, T50:5000pcs/reel)
Material designator: (A) Alumina — Standard products (S)
Part Code — Tolerance: $\pm 1.0\text{(F)}$
Resistance value
Temperature Coefficient of Resistance: $\pm 25\text{(E)}\pm 50\text{(Q)}$



RRS series, audio metal thin film chip resistors



Thin film realizes excellent dynamic range and sound quality

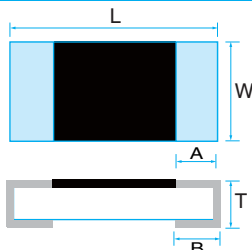
- Minimal current noise
- Special materials and structure using thin film produce "comfort" sound.

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



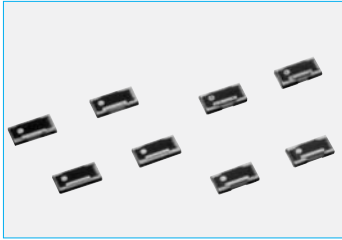
Dimension (Inch Size)	RRS2012 (0805)	RRS1608 (0603)
L	2.00 ± 0.20	1.60 ± 0.20
W	1.25 ± 0.20	0.80 ± 0.20
A	0.40 ± 0.20	0.30 ± 0.20
B	0.40 ± 0.20	0.30 ± 0.20
T	0.40 ± 0.10	0.40 ± 0.10

Electrical

Type	RRS2012	RRS1608
Power	1/10W	1/16W
Tolerance % (code)	$\pm 0.5\%\text{(D)}, \pm 0.1\%\text{(B)}$	$\pm 0.5\%\text{(D)}$
Resistance Range(Ω)	$100\sim 1\text{M}$	$100\sim 360\text{k}$
TCR ppm / $^\circ\text{C}$ (code)	$\pm 25\text{(P)}$	$\pm 25\text{(P)}$
Resistance Value	E-24	E-24
Max Operating Voltage	100V	75V
Package	5,000pcs/reel	5,000pcs/reel

PART NUMBER

Dimensions — **RRS 2012 P - 102 - B** — Resistance Tolerance
Part Code — Resistance
Temperature Coefficient of Resistance



RN series, RA series, ultra-precision chip network resistors



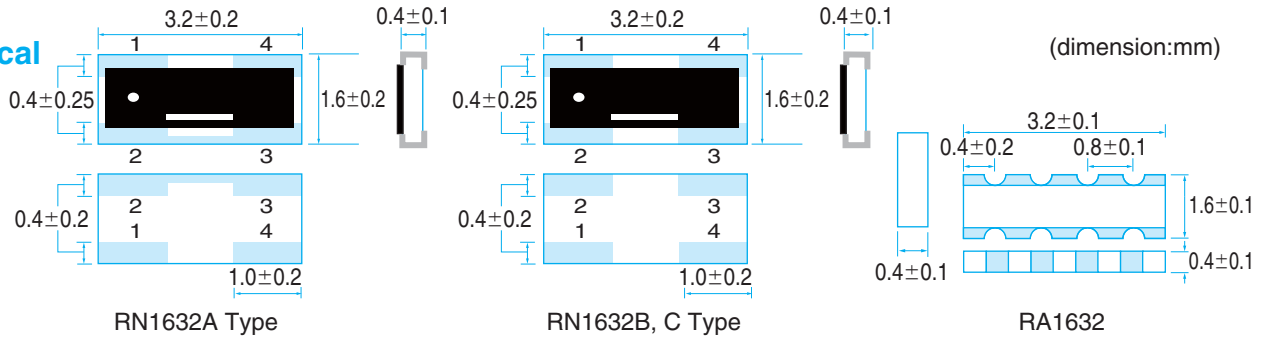
These 1206 chip resistor networks are available with either 2 or 3 resistors, and offer better performance than SIP networks. The surface mount package allow for less parasitic capacitance/inductance and even lower noise performance. Typical application: Voltage dividers.

RoHS compliant

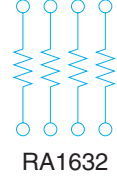
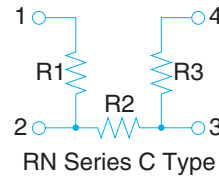
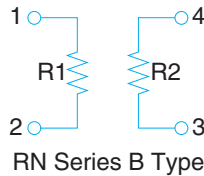
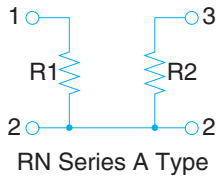
Completely lead free

SPECIFICATIONS

Mechanical



Circuits



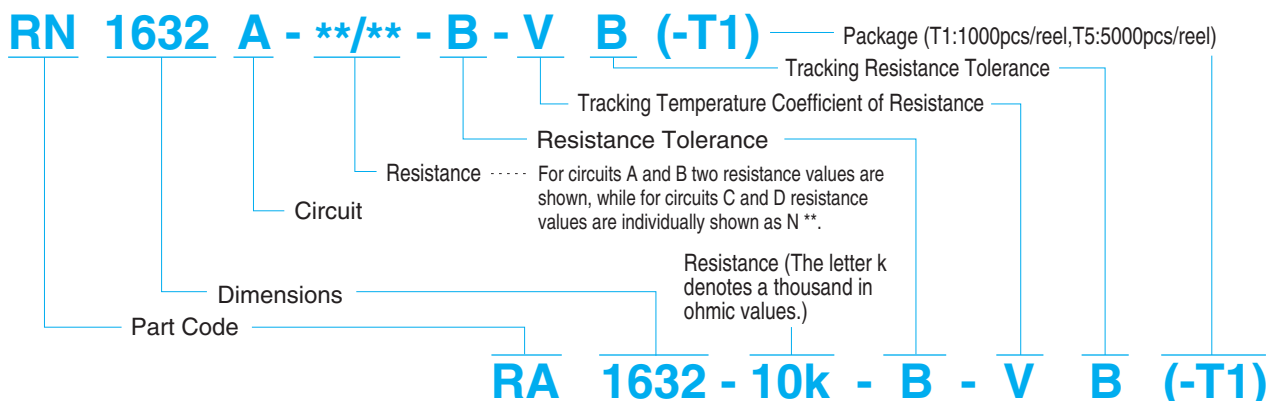
Electrical

Type	RN1632A	RN1632B	RN1632C	RA1632
Resistance Range(Ω)	50~200k	100~200k	100~33k	50~100k
Absolute Tol. %(code)	±0.5%(D), ±0.1%(B)	±0.5%(D), ±0.1%(B)	±0.5%(D), ±0.1%(B)	±0.5%(D), ±0.1%(B)
Tracking Tol. %(code)	±0.2%(C), ±0.1%(B)	±0.2%(C), ±0.1%(B)	±0.2%(C), ±0.1%(B)	±0.2%(C), ±0.1%(B)
Absolute TCR ppm /°C(code)	±25ppm/°C	±25ppm/°C	±25ppm/°C	±25ppm/°C
Tracking TCR ppm /°C(code)	±10ppm/°C(N), ±5ppm/°C(V)	±10ppm/°C(N), ±5ppm/°C(V)	±10ppm/°C(N), ±5ppm/°C(V)	±10ppm/°C(N), ±5ppm/°C(V)
Power Rating	63mW/element	63mW/element	42mW/element	30mW/element, 120mW/package
Operating Temp. Range	-55°C~+125°C			
Package	1,000(T1),5,000(T5)pcs/reel			

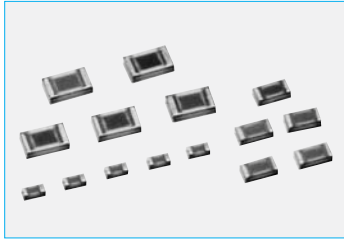
· 2.0×1.25mm size chip resistor for RN series A and B type is available.

· Certain combinations of resistance values may incur initial costs.
· Contact us for mixed resistance values in a package for RA1632.

PART NUMBER



· The specification of a different resistance value or a specific-purpose circuit will assign an individual part code.



RT series, high-precision trimmable chip resistors



A one-step trimmable thin film component for in-circuit resistor tuning. This component has excellent temperature characteristics, exhibits excellent performance in circuit noise and the third harmonic distortion, and needs no moisture proofing treatment after trimming.(Patent1921853)

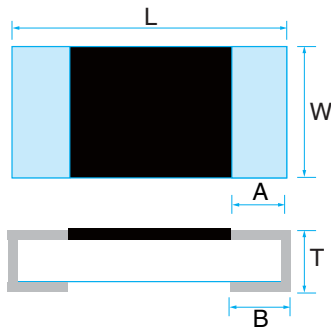
NEW First in the market 0201 trimmable chip resistor

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RT0603 (0201)	RT0510 (0402)	RT0816 (0603)	RT1220 (0805)
L	0.60±0.05	1.00±0.07	1.60±0.20	2.00±0.20
W	0.30±0.03	0.50±0.07	0.80±0.20	1.25±0.20
A	0.12±0.05	0.20±0.10	0.30±0.20	0.40±0.20
B	0.15±0.05	0.25±0.20	0.30±0.20	0.40±0.20
T	0.25±0.03	0.35±0.05	0.40±0.10	0.40±0.10

(unit : mm)

Equivalent circuit



Electrical

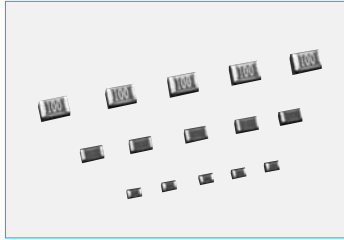
Type	RT0603			RT0510			RT0816					RT1220							
Initial resistance value(Ω)	150	330	1.5k	100	270	1.5k	100	330	1k	3.3k	10k	33	100	330	1k	3.3k	10k	33k	100k
Upper resistance limit(Ω)	1.0k	1.9k	10k	820	2.1k	10k	2.7k	8.0k	8.8k	37k	40k	4.7k	8.2k	15k	15k	100k	120k	120k	220k
TCR ppm /°C(code)	±25 (P)		±100 (R)	±25 (P)		±100 (R)	±25 (P)			±100 (R)		±50 (Q)	±25 (P)			±100 (R)			
Resistance Tolerance (code)	±20% (M)			±20% (M)			±20% (M)					±20% (M)							
Power	1/20W			1/16W			1/16W					1/10W							
Max Operating Voltage	15V			25V			75V					100V							
Max Applied Voltage	30V			50V			150V					200V							
Package	15,000pcs/reel			10,000pcs/reel			5,000pcs/reel					5,000pcs/reel							

· The RT0510 type with 50Ω initial resistance value is also available.

PART NUMBER

RT 0816 P - 102 - M

Resistance Tolerance
Resistance
Temperature Coefficient of Resistance
Dimensions
Part Code



RP series, RPH series, high-power metal film chip resistors



Resistors with high power in small size are realized as 1/3W for 2.0×1.25mm(0805) size, 1/5W for 1.6×0.8mm(0603) size and 1/6W for 1.0×0.5mm(0402 size).
A tight resistance tolerance at ±1% is achieved.

NEW RPH1608 resistors with more high power are realized as 1/4W for 1.6×0.8mm(0603) size.

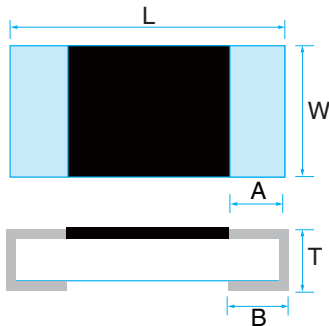
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RP1005 (0402)		RP1608 RPH1608 (0603)	RP2012 (0805)
	Single side structure	Double sides structure $R \leq 0.16\Omega$		
L	1.0 ± 0.05		1.6 ± 0.20	2.0 ± 0.2
W	0.5 ± 0.05		0.8 ± 0.10	1.25 ± 0.2
A	0.15 ± 0.10		0.2 ± 0.15	0.4 ± 0.2
B	0.25 ± 0.10	0.15 ± 0.10	0.25 ± 0.20	0.4 ± 0.2
T	0.35 ± 0.10	$0.35 \pm 0.15 / -0.10$	0.45 ± 0.10	0.4 ± 0.1

(unit : mm)

Electrical

Type	RP1005	RP1608	RPH1608 NEW	RP2012	
Power	1/6W	1/5W	1/4W	1/3W	
Tolerance %(code)	±1 (F), ±2 (G), ±5 (J)	±1 (F), ±2 (G), ±5 (J)	±1 (F), ±2 (G), ±5 (J)	±1 (F), ±2 (G), ±5 (J)	
Resistance Range (Ω)	0.1~47	0.1~68	0.01~0.082	0.1~10	11~100
TCR ppm /°C(code)	0 ~+200 (S)	0 ~+200 (S)	0 ~+350 (T)	0 ~+350 (T)	0 ~+200 (S)
Resistance Value	E-24	E-24	E-12	E-24	
Max Operating Voltage for an element	$\sqrt{P \cdot R}$	$\sqrt{P \cdot R}$		$\sqrt{P \cdot R}$	
Operating Temp. Rating	-40~125°C	-40~125°C		-40~125°C	
Package	10,000pcs/reel	5,000pcs/reel	5,000pcs/reel	5,000pcs/reel	

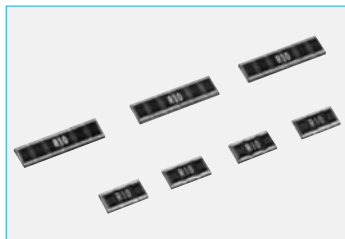
- Please contact us for specific resistance to surge voltage.
- Please contact us for 0.1Ω or lower(TCR 0 ~ +350ppm/°C) resistance value in RP1005,RP1608,RP2012.



PART NUMBER

RP 1608 S - 102 - F

- Resistance Tolerance
- Resistance
- Temperature Coefficient of Resistance
- Dimensions
- Part Code



RL series, PRL series ^{NEW} low resistance value chip resistors with long-side electrodes for high-precision current detection.



Excellent performance in resistance tolerance, noise, long term stability and heat dissipation. Our unique structure enables further miniaturization. This low resistance value chip resistor is useful in many current sensing applications. We offer 1/2, 1, 2 watt power handling thin film resistors.

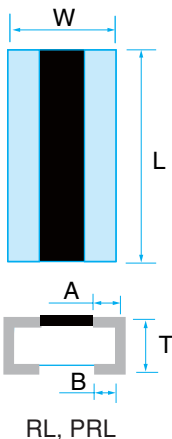
^{NEW} PRL1632 are realized as 1W for 3.2×1.6mm(1206)

Very low resistance and low ELS, supplying ripple free signals.

RoHS compliant

SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RL3720 (1508)	RL3720W (1508)	RL7520W (3008)
L	3.75±0.30	3.75±0.30	7.50±0.30
W	2.00±0.20	2.00±0.20	2.00±0.20
A	0.40±0.20	0.40±0.20	0.40±0.20
B	0.40±0.20	0.40±0.20	0.40±0.20
T	0.40±0.10	0.45+0.15/-0.10	0.45+0.15/-0.10

(unit : mm)

Dimension (Inch Size)	PRL0816 (0603)	PRL1220 (0805)	PRL1632 (1206)	PRL3264 (2512)
L	1.6±0.2	2.0±0.2	3.2±0.2	6.4±0.2
W	0.8±0.2	1.25±0.2	1.6±0.2	3.2±0.2
B	0.2±0.1	0.35±0.15	0.45±0.15	0.9±0.15
T	0.4±0.1	0.5±0.1	0.5±0.1	0.5±0.1

(unit : mm)

Electrical

Type	RL3720			RL3720W				RL7520W			
Power	1/2W			1W				2W			
Tolerance %(code)	±1%(F) ±2%(G)			NEW	±1%(F) ±2%(G)			±1%(F) ±2%(G)			
Resistance Range (Ω)	0.01~0.018	0.022~0.068	0.1~2.2		0.001~0.004	0.005~0.009	0.010~0.091	0.1~1.0	0.001~0.004	0.005~0.009	0.010~0.091
TCR ppm /°C(code)	0~350(T)	0~200(S) 0~350(T)	0~100(R)	0~350(T)	0~200(S) 0~350(T)		0~50(Q) 0~100(R) 0~200(S)	0~200(S) 0~800(T)	0~200(S) 0~420(T)	0~100(R) 0~350(T)	0~50(Q) 0~100(R) 0~200(S)
Resistance Value	E-6			—		E-24		—		E-24	
Package	4000pcs/reel										

Type	PRL0816		PRL1220			PRL1632		PRL3264			
Power	1/3W		2/3W			1W		2W			
Tolerance %(code)	±1%(F)	±0.5%(D) ±1%(F)	±2%(G)	±1%(F) ±2%(G)	±0.5%(D) ±1%(F)±2%(G)	±1%(F) ±2%(G)	±0.5%(D) ±1%(F)±2%(G)	±5%(J)	±2%(G)	±1%(F) ±2%(G)	±0.5%(D) ±1%(F)±2%(G)
Resistance Range (Ω)	10m~39m,25m	43m~100m,50m	7m~9m	10m~43m	47m~100m	5m~9m	10m~100m,25m	3m~4m	5m~9m	10m~43mΩ,25m	47m~100m,50m
TCR ppm /°C(code)	15mΩ≥ : 0~350ppm/°C 18m~27mΩ : 0~200ppm/°C 33m~68mΩ : ±100ppm/°C 75m~100mΩ : ±50ppm/°C		7m~9mΩ : 0~350ppm/°C 10m~18mΩ : 0~200ppm/°C 20m~51mΩ : ±100ppm/°C 56m~100mΩ : ±50ppm/°C					9mΩ≥ : 0~350ppm/°C 10m~18mΩ : 0~200ppm/°C 20m~51mΩ : ±100ppm/°C 56m~100mΩ : ±50ppm/°C			
Resistance Value	E-24										
Package	1,000pcs/reel(T1) 5,000pcs/reel(T5)										

· PRL series with resistance value more than 100m ohm are also available.

PART NUMBER

RL 3720W T - R10 - F - (T1) — Taping Quantity Unit:PRL:T1(1000pcs) T5(5000pcs)

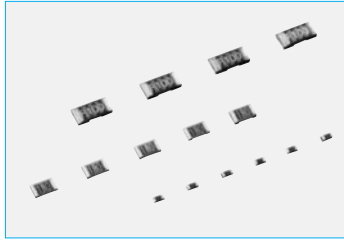
Resistance Tolerance

Resistance Value:RLseries:3 digits, PRL series :4 digits

Temperature Coefficient of Resistace:To be added as for RLseries

Dimensions

Part Code



RL series, low resistance value chip resistors with short-side electrodes for high-precision current detection.



These thin film low resistance value chip resistors are offered in international standard sizes. They exhibit excellent performance in resistance, noise performance, surface heat distribution and a lower surface temperature. Useful in many current sensing applications. Available in 1/10, 1/8, 1/4, 1/2 and 1 watt package.

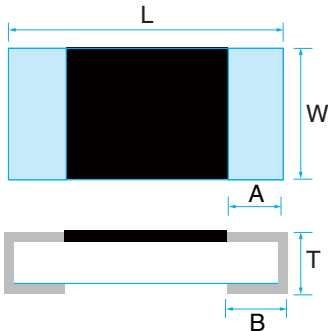
NEW Smallest in the market 0201 low resistance value chip resistor.

RoHS compliant



SPECIFICATIONS

Mechanical



Dimension(Inch Size)	RL0603 (0201)	RL0510 (0402)		RL0816 (0603)	
		Single side structure	Double sides structure $R \leq 0.20\Omega$	Single side structure	Double sides structure $R \leq 0.082\Omega$
L	0.60 ± 0.05	1.00 ± 0.05		1.60 ± 0.10	
W	0.30 ± 0.03	0.50 ± 0.05		0.80 ± 0.10	
A	0.12 ± 0.05	0.15 ± 0.10		0.20 ± 0.15	
B	0.15 ± 0.05	0.25 ± 0.10	0.15 ± 0.10	0.25 ± 0.20	0.20 ± 0.15
T	$0.28 + 0.03 / - 0.05$	0.35 ± 0.10	$0.35 + 0.15 / - 0.10$	0.45 ± 0.10	$0.45 + 0.15 / - 0.10$

(unit : mm)

Dimension(Inch Size)	RL1220 (0805)	RL1632 (1206)	RL3264 (2512)
	Single side structure	Double sides structure $R \leq 0.082\Omega$	
L	2.00 ± 0.20	3.20 ± 0.20	6.40 ± 0.20
W	1.25 ± 0.20	1.60 ± 0.20	3.20 ± 0.20
A	0.40 ± 0.20	—	—
B	0.40 ± 0.20	1.00 ± 0.15	2.00 ± 0.15
T	0.40 ± 0.10	0.50 ± 0.15	0.50 ± 0.15

(unit : mm)

Type	RL0603	RL0510	RL0816		RL1220		
Power	1/10W	1/8W	1/8W		1/4W		
Tolerance %(code)	$\pm 2\%$ (G) $\pm 5\%$ (J)	$\pm 1\%$ (F) $\pm 2\%$ (G)	$\pm 1\%$ (F) $\pm 2\%$ (G)	$\pm 1\%$ (F)	$\pm 1\%$ (F) $\pm 2\%$ (G)		
Resistance Range(Ω)	0.1~4.7	0.05~4.7	0.02~0.091	0.1~6.8	0.01~0.039	0.043~0.091	0.1~10
TCR ppm / $^{\circ}\text{C}$ (code)	0~200(S)		0~200(S)	0~100(R) 0~200(S)	0~350(T)	0~200(S) 0~350(T)	0~100(R) 0~200(S)
Resistance Value	E-24						
Package	10,000pcs/reel			5,000pcs/reel			

· Please contact us for tolerance $\pm 1\%$ in RL0603.

· Please contact us for tolerance $\pm 0.5\%$ for 0.1 Ω or more in RL0816, as well as $\pm 0.5\%$ for 0.047 Ω or more in RL1220.

Type	RL1632						RL3264			
Power	1/2W						1W			
Tolerance %(code)	±2%(G)		±1%(F) ±2%(G)		±0.5%(D) ±1.0%(F)		±2%(G)		±1%(F) ±2%(G)	
Resistance Range(Ω)	0.01~0.016	0.018~0.024	0.027~0.03	0.033~0.051	0.056~0.47	0.51~4.7	0.01~0.015	0.018~0.022	0.027	0.033~0.047 0.056~0.47
TCR ppm /°C(code)	0~+500 (T)	0~+350 (T)	0~+200 (S)	±100 (R)			0~+500 (T)	0~+350 (T)	0~+200 (S)	±100 (R)
Resistance Value	E-24, 0.05Ω						E-12			
Package	5,000pcs/reel						5,000pcs/reel			



PART NUMBER

RL 1220 S - 1R0 - F

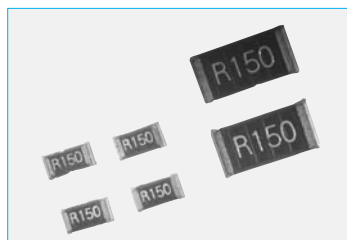
Resistance Tolerance

Resistance
(1R0=1.0 Ω , R0**=less than 0.091 Ω)
RL1632 series and RL3264 series :
4 digits

Temperature Coefficient of Resistance

Dimensions

Part Code



Fixed metal foil *Foil type RL series,
low resistance value chip resistors
for high-precision current detection.*



Operations temperature, $-55\sim 170^{\circ}\text{C}$ high stability.
Tight resistance tolerance of $\pm 1\%$, and TCR of $\pm 50\text{ppm}$.

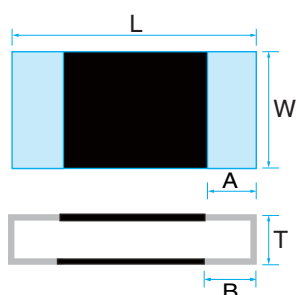


SPECIFICATIONS

RoHS compliant

Completely lead free

Mechanical



Dimension (Inch Size)	RL1632H (1206)	RL-3264-6 (2512)	RL-3264-6C (2512)	RL-3264-9V (2512)
L	$3.20\pm 0.33(1\text{-}4\text{m}\Omega)$ $3.20\pm 0.20(5\text{-}150\text{m}\Omega)$	6.35 ± 0.25	6.35 ± 0.25	6.35 ± 0.25
W	$1.60\pm 0.33(1\text{-}4\text{m}\Omega)$ $1.60\pm 0.20(5\text{-}150\text{m}\Omega)$	3.20 ± 0.20	3.20 ± 0.20	3.18 ± 0.25
A	—	$2.50\pm 0.15(1\text{m}\Omega)$ $1.90\pm 0.15(2\text{m}\Omega)$	$1.00\pm 0.25(\geq 6\text{m}\Omega)$	$2.21\pm 0.25(1\text{-}4\text{m}\Omega)$ $1.19\pm 0.25(5\text{-}6\text{m}\Omega)$ $0.76\pm 0.25(7\text{-}11\text{m}\Omega)$
B	$1.25\pm 0.20(1\text{m}\Omega)$ $0.50\pm 0.20(2\text{-}4\text{m}\Omega)$ $0.50\pm 0.15(5\text{-}150\text{m}\Omega)$	—	—	—
T	$0.65\pm 0.15(1\text{-}2\text{m}\Omega)$ $0.50\pm 0.15(3\text{-}4\text{m}\Omega)$ $0.80\pm 0.15(5\text{-}150\text{m}\Omega)$	$0.70\pm 0.15(1\text{m}\Omega)$ $0.65\pm 0.15(2\text{m}\Omega)$	$1.05\pm 0.15(3\text{-}5\text{m}\Omega)$ $0.80\pm 0.15(\geq 6\text{m}\Omega)$	$1.30\pm 0.25(1\text{m}\Omega)$ $1.20\pm 0.25(2\text{-}4\text{m}\Omega)$ $1.00\pm 0.25(5\text{-}11\text{m}\Omega)$

(unit : mm)

Electrical

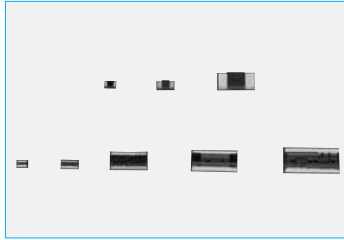
Type	RL1632H					RL-3264-6		RL-3264-6C		RL-3264-9V		
Power	1/2W					1W				2W		
Tolerance %(code)	±5%(J)	±2%(G) ±5%(J)	±1%(F) ±5%(J)			±2%(G) ±5%(J)		±1%(F) ±5%(J)		±1%(F) ±5%(J)		
Resistance Range(mΩ)	1	2	3~4	5~10	11~150	1	2	3~10	11~100	1~2	3~4	5~11
TCR ppm /°C	±275		±150	±100	±50	±200	±100	±50		±275	±150	±50
Resistance Value	1mΩ step				E-24	1mΩ step			E-24		1mΩ step	
Package	2,000pcs/reel					2,000pcs/reel				2,000pcs/reel		
Operating Temp. Range	-55~170℃					-55~170℃				-55~170℃		



PART NUMBER

RL 3264 - 6 - R002 - F N

- Given to the RoHS compliant products
- Resistance Tolerance
- Resistance
- Power: H (1/2W), 6(1W), 9(2W)
- Dimensions
- Part Code



Precision current sensing low resistance chip resistors Metal foil, long-side terminal/ short-side terminal, face down. KRL series



Two types are available: for high temperature application (up to 170°C) and for low thermal emf application. Excellent TCRs: $\pm 150\text{ppm}/^\circ\text{C}$ for 1m Ω , $\pm 100\text{ppm}/^\circ\text{C}$ for 2m Ω , $\pm 50\text{ppm}/^\circ\text{C}$ for 3m Ω . Face down mounting offers accurate sensing. Depending on customers' applications, we offer long-side terminal type and short-side terminal type ranging from 1/3W to 5W power rating. Protective coating used is halogen free showing our commitment to environment.

RoHS compliant

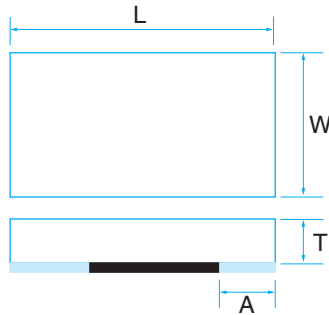
Completely lead free



SPECIFICATIONS

Mechanical

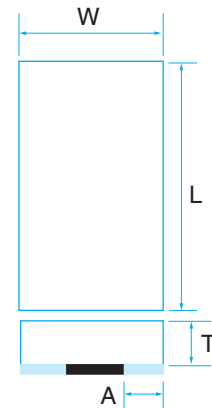
Short-side terminal



Dimensions (mm)	KRL1220	KRL1632	KRL3264
L	2.0 ± 0.20	3.2 ± 0.20	6.3 ± 0.20
W	1.25 ± 0.20	1.6 ± 0.20	3.1 ± 0.20
T	0.5 ± 0.20	0.5 ± 0.20	0.5 ± 0.20
A (5.0~7.0m Ω)	0.4 ± 0.20	1.10 ± 0.20	1.90 ± 0.20
A (8.0m Ω ~)		0.4 ± 0.20	1.0 ± 0.20

Mechanical

Long-side terminal



Dimensions (mm)	KRL2012	KRL3216	KRL6432	KRL7638	KRL9045	KRL11050
L	2.0 ± 0.20	3.2 ± 0.20	6.3 ± 0.20	7.6 ± 0.20	8.9 ± 0.20	11.0 ± 0.20
W	1.25 ± 0.20	1.6 ± 0.20	3.1 ± 0.20	3.8 ± 0.20	4.5 ± 0.20	5.0 ± 0.20
T	0.5 ± 0.20	0.5 ± 0.20	0.5 ± 0.20	0.5 ± 0.20	0.5 ± 0.20	0.5 ± 0.20
A (1m Ω)	0.55 ± 0.20	0.60 ± 0.20	1.20 ± 0.20	1.35 ± 0.20	1.60 ± 0.20	1.80 ± 0.20
A (2m Ω)	0.40 ± 0.20	0.40 ± 0.20	0.50 ± 0.20	0.60 ± 0.20	0.70 ± 0.20	0.80 ± 0.20
A (3m Ω ~)	0.30 ± 0.20	0.30 ± 0.20				

Electrical

Type	KRL1220	KRL1632	KRL3264
Power	0.3W	0.5W	1.0W
Resistance Range(Ω)	10m~100m	5m~100m	
Tolerance % (code)	5~9m : ±2.0 (G) 10m~ : ±1.0 (F)		
TCR ppm /°C	5~9m : ±100 10m~ : ±50		
Operating Temp. Range	C : -55~170°C M : -55~155°C		

· Contact our sales office for wrap around terminal ERL series.

Electrical

Type	KRL2012	KRL3216	KRL6432	KRL7638	KRL9045	KRL11050
Power	0.66W	1.0W	2.0W	3.0W	4.0W	5.0W
Resistance Range(Ω)	1m~50m		1m~100m			
Tolerance % (code)	1m : ±5.0 (J) 2m : ±2.0 (G) 3m~ : ±1.0 (F)					
TCR ppm /°C	1m : ±150 2m : ±100 3m~ : ±50					
Operating Temp. Range	C : -55~170°C M : -55~155°C					



PART NUMBER

KRL 6432 - C - R010 - F - T1

Package
(T1:1000pcs/reel, T5:5000pcs/reel)

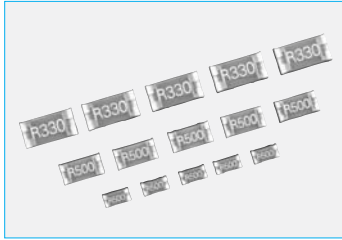
Resistance Tolerance

Resistance Value

Operating Temperature :
C (high temperature application)
M (low thermal emf application)

Dimensions

Part Code



High-precision current-detection elements

RL-L series: four-terminal type

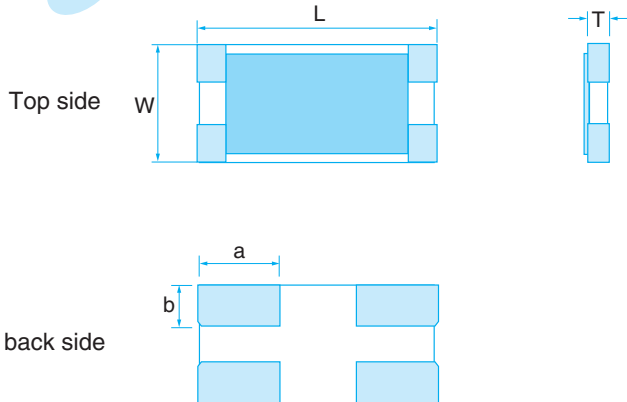


Newly released: A four-terminal structure with separate voltage- and current-terminals assures high-precision TCR of 50ppm/°C and 0.5% tolerance.

RoHS compliant

SPECIFICATIONS

Mechanical



Dimension (Inch Size)	RL1632L4 (1206)	RL2550L4 (2010)	RL3264L4 (2512)
L	3.2±0.2	5.0±0.2	6.4±0.2
W	1.6±0.2	2.5±0.2	3.2±0.2
a	1.0±0.2	1.7±0.2	2.1±0.2
b	0.55±0.2	0.9±0.2	1.2±0.2
T	0.5±0.15	0.5±0.15	0.5±0.15

(unit : mm)

Equivalent circuit



V=Voltage Terminal
I=Current Terminal

Electrical

Type	RL1632L4	RL2550L4	RL3264L4		
Power	1/2W	3/4W	1W		
Tolerance %(code)	±0.5%(D) ±1%(F)				
Resistance Range (Ω)	10~500m		3~5m	6~500m	
TCR ppm /°C(code)	±50ppm/°C		±100ppm/°C	±50ppm/°C	
Terminal Resistance (Ω)	10~47m	50~500m	3~8m	10~47m	50~500m
	5 M or less	20 M or less	1 M or less	5 M or less	20 M or less
Resistance Value (Ω)	E-12 series 50, 500m		E-12 series 3, 4, 5, 6, 7, 8, 50, 500m		
Package	1,000(T1)pcs/reel, 5,000(T5)pcs/reel				

· Contact us for even lower resistance values.

PART NUMBER

RL 1632 L4 - R033 - F - T1(T5)

Package
(T1:1000pcs/reel, T5:5000pcs/reel)
Resistance Tolerance
Current-detection Resistance Values
Number of Terminals
Dimensions
Part Code



Power Choke Coil

PCMC series, PCMB series



- Small size of 7.3mm×6.6mm and low tap of 3.0mm max
- Excellent loss characteristics and high saturation current

Applications

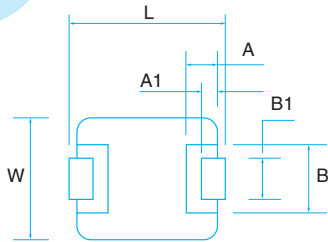
- High speed drive DC/DC inverter for server, router etc.
- CPU power for note PC and desktop PC

RoHS compliant

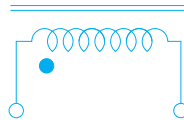
Completely lead free

SPECIFICATIONS

Mechanical



Equivalent circuit



Dimension (Inch Size)	PCMC063	PCMC103		PCMC104		PCMC105T	PCMC133	PCMC135
		103T	103E	104T	104E			
L	7.3max.	11.5±0.35		11.5max.		11.15±0.35	13.8max.	13.8max.
W	6.6±0.2	10±0.3		10±0.2		10±0.3	12.6±0.2	12.6±0.2
T	3.0max.	2.8±0.2	3.3±0.2	4.0max.	4.5max.	4.8±0.2	3.5max.	5.0max.
A	2.0±0.1	2.5±0.1		2.5±0.1		2.5±0.1	2.5±0.1	2.5±0.1
A1	1.3±0.3	2.0±0.5		2.0±0.5		2.0±0.5	2.0±0.5	2.0±0.5
B	3.6±0.2	5.0±0.2		5.0±0.2		5.0±0.2	6.0±0.2	6.0±0.2
B1	3.0±0.3	3.0±0.2		3.0±0.2		3.0±0.2	4.0±0.3	4.0±0.3

(unit : mm)

Electrical

063 type

PCMC063T-***MN	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMC063T-R10MN	0.10	1.5	1.7	32.5	60.0
PCMC063T-R20MN	0.20	2.4	3.0	24.0	41.0
PCMC063T-R22MN	0.22	2.5	2.8	23.0	40.0
PCMC063T-R33MN	0.33	3.5	3.9	20.0	30.0
PCMC063T-R47MN	0.47	4.0	4.2	17.5	26.0
PCMC063T-R68MN	0.68	5.0	5.5	15.5	25.0
PCMC063T-R82MN	0.82	6.7	8.0	13.0	24.0
PCMC063T-1R0MN	1.00	9.0	10.0	11.0	22.0
PCMC063T-1R2MN	1.20	10.0	12.0	10.0	20.0
PCMC063T-1R5MN	1.50	14.0	15.0	9.0	18.0
PCMC063T-2R2MN	2.20	18.0	20.0	8.0	14.0
PCMC063T-3R3MN	3.30	28.0	30.0	6.0	13.5
PCMC063T-4R7MN	4.70	37.0	40.0	5.5	10.0
PCMC063T-6R8MN	6.80	54.0	60.0	4.5	8.0

PCMB063T-***M*	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMB063T-8R2MS	8.20	54.0	60.0	4.5	6.0
PCMB063T-100MS	10.00	62.0	68.0	4.0	5.5
PCMB063T-1R0MT	1.00	6.7	7.5	14.0	12.0
PCMB063T-2R2MT	2.20	14.3	15.5	10.0	10.0
PCMB063T-3R3MT	3.30	22.6	24.0	8.5	8.0
PCMB063T-4R7MT	4.70	32.5	35.0	7.0	5.0

Rated current : Current that will increase temperature by 40°C
Saturating current : The current that reduces inductance by 20% (PCMC), 30% (PCMB)

Packaging : 500 piece reel for PCMC135T, PCMC133E, PCMC (B) 104, 1000 piece reel for PCMC (B) 063T

103,104,105 type

PCMC104T-***MN	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMC104T-R22MN	0.22	0.90	1.00	35.0	60.0
PCMC104T-R68MN	0.68	2.40	2.70	22.0	39.0
PCMC104T-R88MN	0.88	2.70	3.00	20.0	38.0
PCMC104T-1R5MN	1.50	3.80	4.20	16.0	33.0
PCMC104T-2R2MN	2.20	6.70	7.00	12.0	27.0

PCMB104T-***MN 103,105	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMB103T-R36MS	0.36	1.30	1.6	23.0	28.0
PCMB103T-R47MS	0.47	2.10	2.5	20.0	26.0
PCMB103T-8R2MS	8.20	35.00	45.0	5.0	8.5
PCMB103E-1R0MS	1.00	2.70	3.0	20.0	27.0
PCMB104T-R36MT	0.36	1.05	1.2	30.0	50.0
PCMB104T-R56MT	0.56	1.60	1.8	25.0	33.0
PCMB104T-1R0MT	1.00	3.00	3.3	18.0	28.0
PCMB104T-1R8MS	1.80	4.50	5.0	15.0	15.0
PCMB104T-2R0MS	2.00	5.20	5.8	14.0	14.0
PCMB104T-2R2MS	2.20	6.00	7.0	12.0	18.0
PCMB104E-2R2MS	2.20	5.80	7.0	14.0	16.0
PCMB104T-3R3MS	3.30	10.80	11.8	10.0	16.0
PCMB104E-3R3MS	3.30	11.00	13.2	11.0	14.5
PCMB104E-4R7MS	4.70	13.20	15.0	10.0	13.0
PCMB104E-6R8MS	6.80	21.50	24.0	7.5	9.5
PCMB104T-100MS	10.00	27.50	30.0	6.0	6.0
PCMB105T-R47MS	0.47	0.95	1.1	36.0	50.0

133 type

PCMC133E-***MF	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMC133E-R56MF	0.56	1.80	2.20	29	51
PCMC133E-R68MF	0.68	2.30	2.50	28	49
PCMC133E-1R0MF	1.00	3.30	3.50	24	40
PCMC133E-2R2MF	2.20	7.20	8.00	16	29

135 type

PCMC135T-***MF	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
PCMC135T-R36MF	0.36	0.77	1.10	41	75
PCMC135T-R47MF	0.47	1.10	1.30	38	65
PCMC135T-R50MF	0.50	1.20	1.50	36	55
PCMC135T-R56MF	0.56	1.20	1.50	36	55
PCMC135T-R62MF	0.62	1.50	1.70	34	54
PCMC135T-R68MF	0.68	1.50	1.70	34	54
PCMC135T-1R0MF	1.00	2.10	2.50	29	50
PCMC135T-1R5MF	1.50	3.40	4.10	23	48
PCMC135T-2R2MF	2.20	4.60	5.50	20	32
PCMC135T-3R3MF	3.30	7.70	9.20	15	32

PART NUMBER

PCMC 13** - *** M N(S,T)

Materials
: Refer to electrical characteristics table.
Inductance tolerance
M = ±20%
Inductance value
(R56=0.56μH, R68=0.68μH)
Dimensions
(063T=6.6*7.3*3.0mm,
104T=10*11.5*4.0mm,
133E=12.6*13.8*3.5mm,
135T=12.6*13.8*5.0mm)
Part Code



Small Power Choke Coil

PCMC(B) series, PW.PS series



Low DCR, small size with high current capability, high efficiency and low loss.

Applications

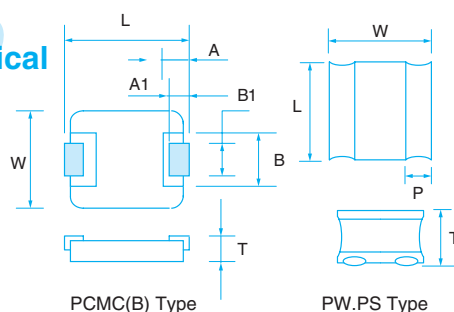
Small electronics equipment for communication, information, imaging, audio etc.

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



PCMC(B) Type

Dimension (mm)	PCMC(B)042T	PCMC053T
L	4.5max.	5.2max.
W	4.0±0.3	4.7±0.2
T	2.0max.	3.0max.
A	1.0±0.1	1.5±0.1
A1	0.8±0.3	1.0±0.3
B	2.2±0.2	1.8±0.2
B1	1.5±0.3	

PW.PS Type

Dimension (mm)	PW		PS031		PS041B
	021T Type	25201B Type	031T Type	031B Type	
L	1.9±0.2	1.95±0.1	2.9±0.2		3.8±0.2
W	1.9±0.2	2.45±0.1	2.9±0.2		3.8±0.2
P	0.4±0.2		0.75±0.2		1.0±0.2
T	1.0±0.1	1.2±0.1	1.0±0.1	1.2±0.1	1.2±0.1

Electrical

PW type

PW021T-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
R50	0.5	85	100	1.50	2.40
1R0	1.0	120	150	1.20	1.80
2R2	2.2	300	350	0.85	1.20
3R3	3.3	430	500	0.75	0.98
4R7	4.7	600	700	0.65	0.80
6R8	6.8	780	900	0.55	0.73
100	10.0	1200	1400	0.45	0.61

PW25201BT-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
R47	0.47	47	56	2.20	3.70
1R0	1.0	73	88	1.80	2.70
1R5	1.5	105	126	1.50	2.10
2R2	2.2	129	155	1.30	1.70
3R3	3.3	227	272	1.00	1.30
4R7	4.7	338	406	0.80	1.15

PCMC(B) type

PCMC042T-***MN	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
R10	0.10	4.5	5.0	11	30
R22	0.22	7.3	8.0	9	17
R47	0.47	14.0	15.5	6	11.5
1R0	1.00	32.0	36.0	3.8	8.5

PCMB042T-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
R10	0.10	3.5	4.0	12	22
R22	0.22	6.0	6.6	9	13
R47	0.47	12.5	12.0	7	9.5
1R0	1.00	24.0	27.0	4.5	7.0
1R5	1.50	38.0	46.0	4.0	6.0
2R2	2.20	52.0	58.0	3.0	5.0

PCMC053T-***MN	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
R68	0.68	11.0	12.0	8.5	14.0
1R0	1.0	13.0	14.0	7.0	11.0
1R2	1.2	15.0	16.0	6.5	11.0
1R5	1.5	18.0	20.0	6.0	10.0
2R2	2.2	29.0	35.0	5.5	9.0
3R3	3.3	32.0	38.0	5.0	7.0

PS type

PS031B-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
2R2	2.2	75	90	1.40	1.10
4R7	4.7	120	140	1.20	0.77
6R8	6.8	160	190	1.00	0.67
100	10.0	260	300	0.90	0.54

PS031T-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
2R2	2.2	90	105	1.30	1.10
3R3	3.3	130	150	1.20	0.90
4R7	4.7	170	200	1.00	0.75
6R8	6.8	200	230	0.90	0.65
100	10.0	300	340	0.80	0.52

PS041B-***MS	L0(μH) Inductance	Rdc(mΩ)		Rated current (A)	Saturation current (A)
		Typical	MAX.		
2R2	2.2	80	95	1.30	1.70
3R3	3.3	100	120	1.10	1.40
4R7	4.7	120	145	1.00	1.15
6R8	6.8	180	216	0.84	1.00

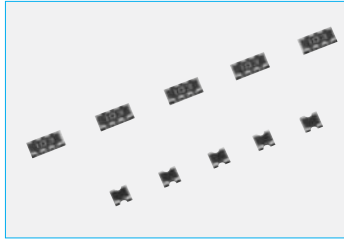
Rated current : Current that will increase temperature by 40°C
 Saturating current : The current that decreases inductance by 30%
 for PS and PW. 20% for PCMC (B)

Packaging : 2,000 piece reel for PW, PS031T(B),
 1000 piece reel for PCMC042T, PCMC053T

PART NUMBER

PS 031* - *** M (S)

Materials : Materials; refer to electrical characteristics table.
 Resistance Tolerance ±20%
 Inductance value
 Dimensions : B (2.9mm*2.9mm*1.2mm)
 : T (2.9mm*2.9mm*1.0mm)
 Part Code



RS series, micro array resistor network.

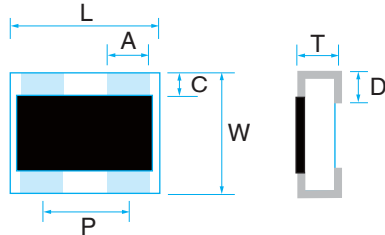


Ultra small size chip resistors array with 4 elements in 0201 size.
0603 size double-element ultra small chip resistor array, RS062R series
0603 size quadruple-element small chip resistor array with 0.5mm electrode pitch.
Environmentally friendly products: lead free glass coating and halogen free overcoating.

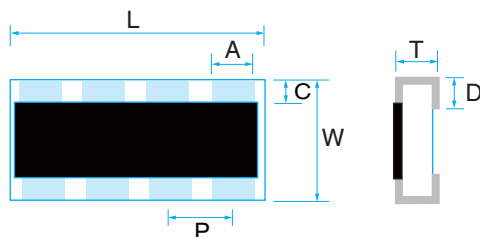
RoHS compliant

SPECIFICATIONS

Mechanical

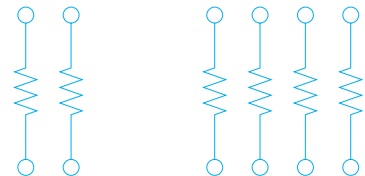


RS2N, RS062R



RS4N, RS064R (dimension:mm)

Equivalent circuit



RS2N, RS062R RS4N, RS064R, RS064R(K)

Dimension (Inch Size)	RS062R (0302)	RS2N (0404)	RS064R (0602)	RS4N (0804)
L	0.8±0.1	1.0±0.05	1.4±0.1	2.0±0.1
W	0.6±0.1	1.0±0.05	0.6±0.1	1.0±0.1
T	0.35±0.1	0.4±0.1	0.35±0.1	0.4±0.1
A	0.30±0.1	0.33±0.1	0.2±0.1	0.35±0.1
P	0.5 Typ	0.65 Typ	0.4 Typ	0.5 Typ
C	0.15±0.1	0.15±0.1	0.15±0.07	0.22±0.1
D	0.15±0.1	0.25±0.05/-0.1	0.2±0.05	0.35max.

(unit : mm)

Electrical

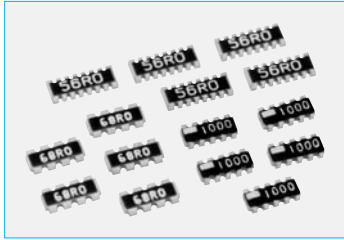
Type	RS062R	RS2N	RS064R	RS4N
Power	31mW/element	63mW/element	32mW/element	63mW/element
Resistance Range (Ω)	10~1M	10~1M	10~1M	10~1M
Tolerance %(code)	±5.0% (J)	±5.0% (J)	±5.0% (J)	±5.0% (J)
TCR ppm /°C(code)	±200ppm/°C	±250ppm/°C	±200ppm/°C	±250ppm/°C
Max Operating Voltage	12.5V	25V	12.5V	25V
Resistance Value	E-24	E-24	E-24	E-24
Package	10,000pcs/reel			

· Contact us for lead free glass coat products.

PART NUMBER

RS064R - 1001 - J - 2 N(H)

RS062R, RS064 : "RoHS" to be added for N
H : only given to RS062R and RS064
Outline Type (2=flat)
Resistance Tolerance (J=±5%, X=Jumper)
Resistance (00R0=Jumper, 1001=1kΩ)
Part Code



RS series, high-integration array resistor networks

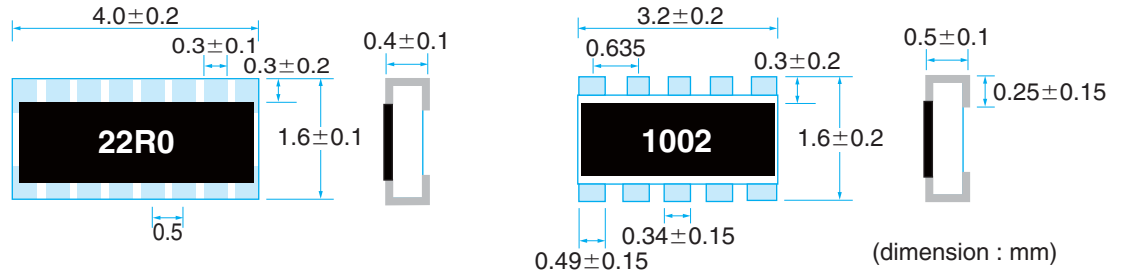


This highly integrated network contains four or eight resistance elements in one chip. Environmentally friendly products: lead free glass coating and halogen free overcoating.

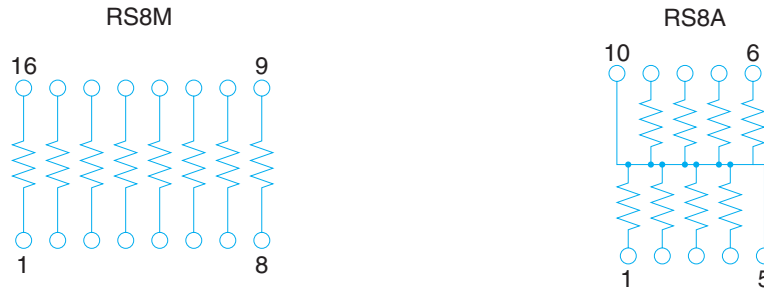
RoHS compliant

SPECIFICATIONS

Mechanical



Equivalent circuit



Electrical

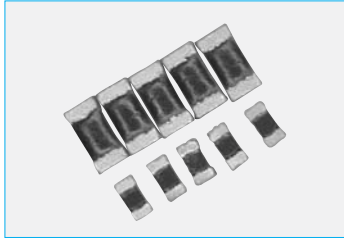
Type	RS8M	RS8A
Power	—	63mW/element
Resistance Range(Ω)	Jumper	10~47K
Tolerance % (code)	—	±5.0 (J)
TCR ppm /°C(code)	—	±250ppm
Max Operating Voltage	—	25V
Resistance Value	—	E-24
Package	4,000pcs/reel	5,000pcs/reel

· Contact us for lead free glass coat products.

PART NUMBER

RS8M - 1002 - J 2

Electrode: 1 means Flat Electrode (RS8M)
2 means □ Electrode (RS8A)
Resistance Tolerance
Resistance
Part Code



PFR/GFR series, Thick Film chip resistors



A temperature coefficient of resistance of $\pm 100\text{ppm}/^\circ\text{C}$ has been achieved for resistance value greater than $1\text{M}\Omega$.
High reliability is maintained: the electrode construction is the same as our thin film chip resistors.

NEW PFR03 series with ultra small size chip resistor.

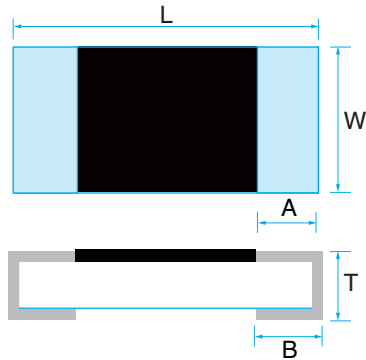
Environmentally friendly products: lead free glass coating and halogen free overcoating.

RoHS compliant



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	PFR03 (0201)	PFR05,GFR05 (0402)
L	0.60 ± 0.03	1.00 ± 0.05
W	0.30 ± 0.03	0.50 ± 0.05
A	0.10 ± 0.05	0.20 ± 0.10
B	0.15 ± 0.05	0.25 ± 0.05
T	0.23 ± 0.03	0.35 ± 0.05

(unit : mm)

Electrical

Type	PFR03						PFR05			GFR05	
Power	1/20W					Jumper	1/16W			Jumper	1/16W
Tolerance %(code)	±1%(F)		±5%(J)	±2%(G)±5%(J)		—	±0.5%(D) ±1%(F)		±1%(F)	—	±1%(F) ±5%(J)
Resistance Range(Ω)	10~91	100~1M	3.0~9.1	10~91	100~10M	50m or less	10~97.6	100~1M	1.02M~10M	50m or less	10~10M
TCR ppm /°C(code)	±300 (S)	±200 (S)	+600~ -200(S)	±300 (S)	±200 (S)	—	±100 (R)	±50 (Q)	±100 (R)	—	±200 (S)
Resistance Value	E-24/E-96		E-24			—	E-24/E-96			—	E-24/E-96
Max Operating Voltage	25V					1A	50V			—	50V
Package	15,000pcs/reel or 10,000pcs/reel						10,000pcs/reel			10,000pcs/reel	

- Please contact us for values lower in resistance than the 10Ω GFR05 series.
- Contact us for lead free glass coat products.



PART NUMBER

PFR05 R - 102 - D - (2) - (T15)

Package : PFR03 "T15" to be added for 15,000pcs/reel

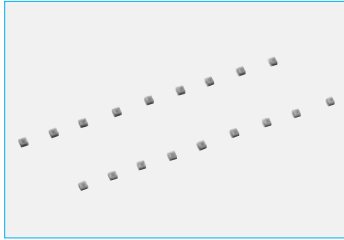
Electrode materials : 1(Pb/Sn), 2(Sn)

Resistance Tolerance J(jumper)

Resistance : E-24, E-96, jumper

Temperature Coefficient of Resistance J(jumper)

Part Code



RF series, high-precision, high-frequency chip resistors.



For wire bonding application, we have realized extremely small package size, 0.5mm×0.5mm. A reflection characteristic of -15dB is guaranteed at frequencies up to 15GHz. Ideal for transmitting/receiving applications in optical communications devices.

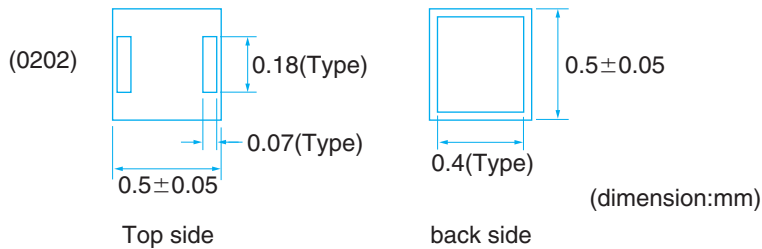
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Electrical

Type	RF0505	
Resistance (Ω)	50	100
Tolerance %(code)	±5%(J)	
TCR ppm /°C(code)	±100ppm/°C (R)	
Power Rating	1/16W	
Max rated Operating Temperature	+70°C	
Max Operating Temperature	+125°C	
Frequency characteristics	DC ~15GHz Reflection characteristic -15dB max	
Plated electrodes and bottom side	Au-plated(1.5μm thickness)	

· Other resistance values, structure of electrode are available.



PART NUMBER

RF 0505 R - 500 - J

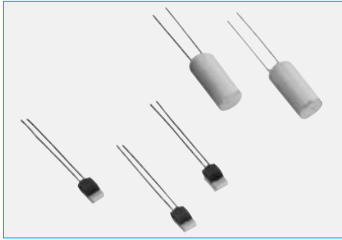
Resistance Tolerance

Resistance

Temperature Coefficient of Resistance

Dimensions

Part Code



SA series, high-precision, Pt-film thermal sensors.



Resistance tolerance of $\pm 0.06\%$ (class A). Suitable for high-precision temperature measurements up to 500°C . Available in various package for specific needs.



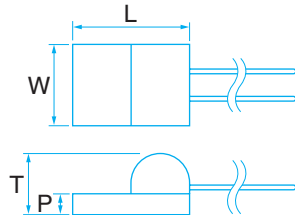
SPECIFICATIONS

RoHS compliant

Completely lead free

Mechanical

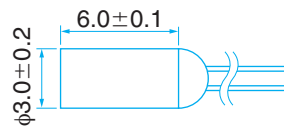
SA***□0
(glass coat)



Dimension (Inch Size)	SA101□0 (0907)	SA102□0 (1208)
L	2.40 ± 0.15	3.00 ± 0.15
W	1.70 ± 0.15	2.00 ± 0.15
P	0.40 ± 0.20	0.40 ± 0.20
T	1.25 ± 0.20	1.25 ± 0.20

(unit : mm)

SA101□1
(ceramic tube)



(dimension:mm)

Electrical

Type	SA***□0		SA101□1
Resistance (Ω)	100	1,000	100
Tolerance % (code)	$\pm 0.06\%$, $\pm 0.12\%$, $\pm 0.24\%$ (6) (0) (1)		$\pm 0.06\%$, $\pm 0.12\%$, $\pm 0.24\%$
TCR ppm/ $^{\circ}\text{C}$ (code)	3,850ppm/ $^{\circ}\text{C}$		3,850ppm/ $^{\circ}\text{C}$
TCR Tolerance	$\pm 100\text{ppm}/^{\circ}\text{C}$		$\pm 100\text{ppm}/^{\circ}\text{C}$
Response time 90% in air 1m/sec	10sec.	15sec.	30sec.
Dissipation Constant Self-heating	$2.5\text{mW}/^{\circ}\text{C}$	$2\text{mW}/^{\circ}\text{C}$	$5.0\text{mW}/^{\circ}\text{C}$
Max Applied Current	1mA		1mA
Operating Temp. Range	$-55 \sim 500^{\circ}\text{C}$		$-55 \sim 500^{\circ}\text{C}$

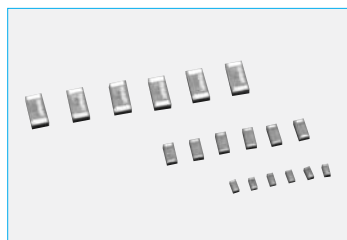
·Contact us for TO92 package (operating Temp.: $-50 \sim 150^{\circ}\text{C}$) and electric wire (operating Temp. : $-20 \sim 105^{\circ}\text{C}$)



PART NUMBER

SA 101 1 1

Dimensions
(0=glass coat, 1=ceramic tube)
Resistance Tolerance
Resistance
Part Code



HPL, TFL series, high-precision, thin-film chip inductors.



These 0805, 0402 and 0201 size chip inductors are adjustment free due to their tight tolerance. Additionally, this part also offers a high self-resonance frequency of 1 GHz and high Q value and a very excellent rated current.

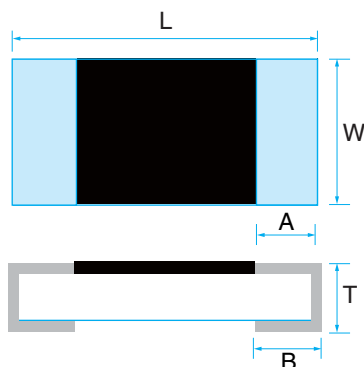
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	HPL0603 (0201)	HPL1005 (0402)	TFL0816 (0603)
L	0.60±0.05	1.00±0.10	1.60±0.10
W	0.30±0.05	0.50±0.10	0.80±0.10
A	0.07±0.05	0.15±0.10	0.30±0.20
B	0.12±0.05	0.25±0.10	0.30±0.20
T	0.28±0.05	0.40±0.10	0.45±0.10

(unit : mm)

Electrical

Type	HPL0603		HPL1005		TFL0816				
inductance value	E-24		E-24		E-12				
inductance range (nH)	1.0~5.6	6.2~27	1.0~9.1	10~39	1.0~4.7	5.6~8.2	10~27	33~68	82~100
inductance tolerance	±0.1nH, ±0.2nH	±2%	±0.1nH, ±0.2nH	±2%	±0.2nH		±2%	±2%	
Q value (at 300MHz)	10	8~10	20~15	15~13	20	15	15	*15	*10
Q value (at 800MHz) typ.	14~17	14~16	35~25	25~20	34~30		30~25	25	15
Q value (at 1.5GHz) typ.	18~25	18~20	50~30	30~25	38~35		35~30	**	
Self resonance Frequency(GHz)	10~6.0	3.5	7.0~4.0	3.5	6.0~5.0	5.0~4.0	4.0~2.0	1.5~1.0	1.0
DC resistance(Ω)	0.1~0.8	0.8~1.5	0.01~0.4	0.5~0.8	0.10~0.25	0.50	1.0~2.0	2.0~4.5	6.0~8.5
Rated Current(A)	0.5~0.2	0.2~0.15	1.8~0.34	0.3~0.24	1.0~0.6	0.40	0.3~0.2	0.2~0.14	0.12~0.1
Package	10,000pcs/reel					5,000pcs/reel			

Measured at 500MHz in case of HPL0603, at 300MHz in case of HPL1005

* Measured at 200MHz in case of 33-100nH(TFL0816)

** No measuring in case of 33-100nH(TFL0816)



PART NUMBER

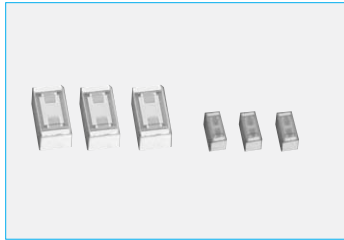
HPL 0603 - 1N0 (-E02)

Superior tolerance (Given to HPL series)

Inductance value

Dimensions

Part Code



HTC series, high-precision, thin-film chip capacitors.



Capacitance tolerance as tight as $\pm 0.035\text{pF}$, and low equivalent series resistance.
Chip sizes of 0402 and 0201 are available.
Space saving face down mounting is possible.

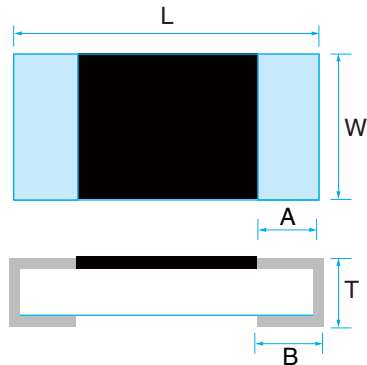
RoHS compliant

Completely lead free



SPECIFICATIONS

Mechanical



Dimension (Inch Size)	HTC0603 (0201)	HTC1005 (0402)
L	0.6 ± 0.03	1.0 ± 0.05
W	0.3 ± 0.03	0.5 ± 0.05
A	0.12 ± 0.05	0.2 ± 0.10
B	0.15 ± 0.05	0.25 ± 0.10
T	$0.28 + 0.03 / - 0.05$	0.28 ± 0.05

(unit : mm)

Electrical

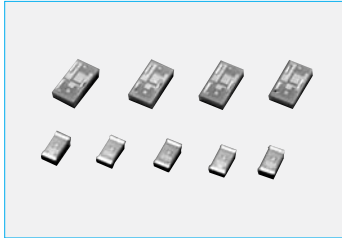
Type	HTC0603				HTC1005		
Capacitance Range (pF)	0.1~0.45	0.5~0.7	0.8~1.0	1.2~1.8	0.1~0.7	0.75~1.0	1.2~10
Capacitance Value	0.05pF step	0.1pF step		E-12	0.05pF step		E-12
Capacitance tolerance	±0.035pF		±5%		±0.035pF	±5%	
Temperature coefficient of capacitance(ppm/°C)	0±60ppm/°C						
Rated Voltage (V)	25V						
Operating Temp. Range(°C)	-40~85°C						
Package	5,000(T5), 10,000pcs						



PART NUMBER

HTC 0603 - 1E - R30 - J (-L5)

- Given to 5,000 piece reels
- Tolerance of capacitance : J($\pm 5\%$), T35($\pm 0.035\text{pF}$)
- Capacitance : R30(0.30pF)
- Rated Voltage : 1E(25V)
- Dimensions
- Part Code



Thin Film Chip LC Filter

TLF series



Low top max. 0.35mm
Excellent frequency characteristic

RoHS compliant

Completely lead free

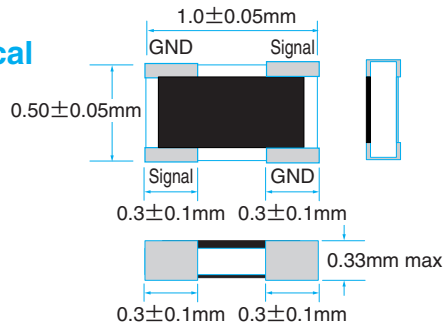


Example of application and its Characteristic

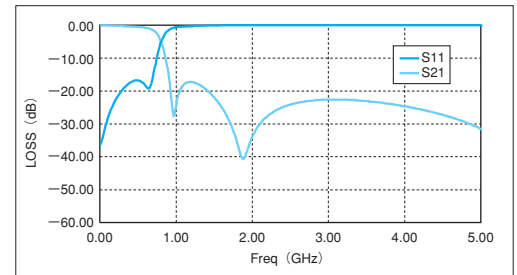
●Low Pass filter (LPF) for digital terrestrial broadcasting receiver

TLF-1005-077-***

Mechanical



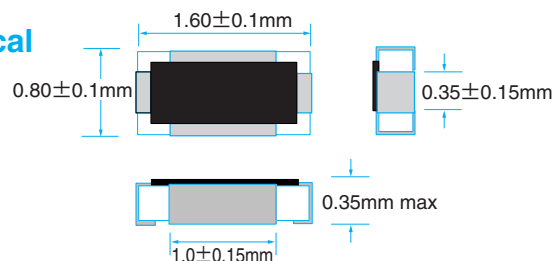
Electrical



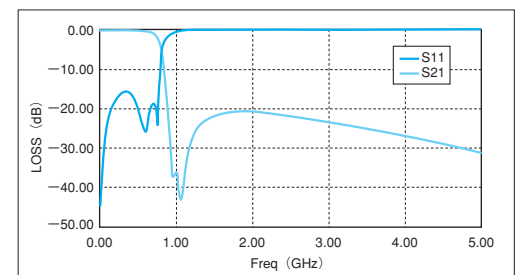
specification	Insertion Loss		Attenuation	
	470~710MHz	710~770MHz	830~840MHz	1500~7200MHz
TLF-1005-077-S2	2.0dB max	3.5dB max	6.0dB min	15.0dB min

TLF-1608-077-***

Mechanical



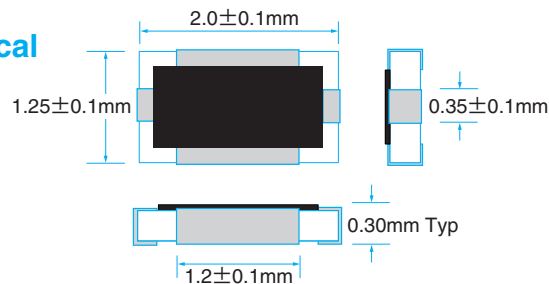
Electrical



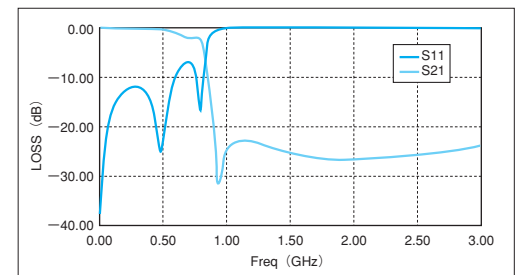
specification	Insertion Loss			Attenuation
	470~600MHz	600~710MHz	710~770MHz	890MHz~2.5GHz
Simulation	1.0dB max	1.8dB max	3.5dB max	20dB min

TLF-2012-077-***

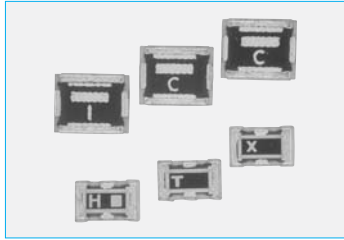
Mechanical



Electrical



specification	Insertion Loss			Attenuation
	470~570MHz	570~670MHz	670~770MHz	880MHz~2.5GHz
Simulation	1.5dB max	2.0dB max	3.5dB max	15dB min



Thin Film Chip LC Filter

W-LAN, Bluetooth (Band-Pass Filter)
TBF series

NEW

SSM
THIN FILM TECHNOLOGY

Low top max. 0.4mm and small size.
Excellent loss characteristics.

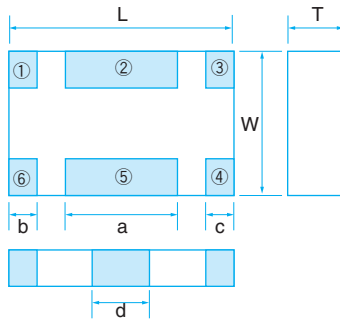
RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical

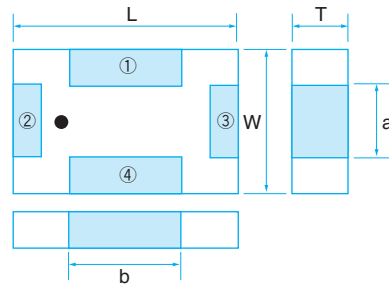
TBF-1005-245-F1



Dimension (mm)	TBF1005-245-F1
L	1.0±0.1
W	0.5±0.1
T	0.4±0.1
a	0.4±0.1
b	0.15±0.05
c	0.15±0.05
d	0.25±0.05

	F1
①	Input
②	GND
③	Output
④	Output
⑤	GND
⑥	Input

TBFseries (except "TBF-1005-245-F1")



Dimension (mm)	TBF-1005	TBF-1608	TBF-2012
L	1.0±0.15	1.6±0.1	2.0±0.1
W	0.5±0.15	0.8±0.1	1.25±0.1
T	0.5 max	0.4 max	0.4 max
a	0.2±0.1	0.4±0.1	0.35±0.1
b	0.6±0.1	1.0±0.1	1.5±0.1

	TBF-1005	TBF-1608	TBF-2012-T1
①	GND	Input	GND
②	Input	GND	Input
③	Output	GND	Output
④	GND	Output	GND

Electrical

Band-Pass Filter

Type	TBF-1005-245-F1	TBF-1005-181-F1	TBF-1608-245-R1N	TBF-2012-537-T1
Application	For Bluetooth, W-LAN	For DCS	For Bluetooth, W-LAN	For Bluetooth, W-LAN
F0 (MHz)	2450	1810	2450	5370
Band (MHz)	2400~2500	1710~1910	2400~2500	4900~5850
Insertion Loss	2.5dB at 25°C	2.7dB at 25°C	1.7dB at 25°C	2.2dB at 25°C
	2.8dB at -40~85°C	2.3dB at -40~85°C	1.9dB at -40~85°C	—
Attenuation	30.0dB at 824~960MHz	20.0dB at 855~955MHz 10.0dB at 2565~2865MHz	20.0dB at 1710~1910MHz 30.0dB at 4800~5000MHz 30.0dB at 7200~7500MHz	40.0dB at 340~1195MHz
	10.0dB at 1700~1900MHz			21.0dB at 2140~3580MHz
	30.0dB at 4800~5000MHz			25.0dB at 6855~7150MHz
	20.0dB at 7200~7500MHz			20.0dB at 8570~8930MHz
VSWR in BW	2.0 Max.			
Impedance	50Ω			
Power	500mW Max.			

PART NUMBER

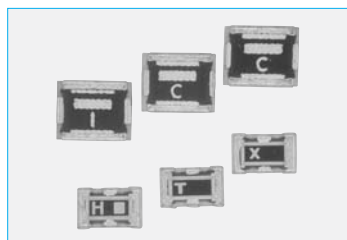
TBF 1608 - 245 - R1N

Type(see electrical characteristics table)

Center Frequency F0

Dimension

Part Code



Thin Film Chip LC Filter

W-LAN, Bluetooth, TBL series (Balun) , **NEW**
TBB series (Balance filter) , TDP series (Diplexer)



Low top max. 0.4mm and small size.
Excellent loss characteristics.

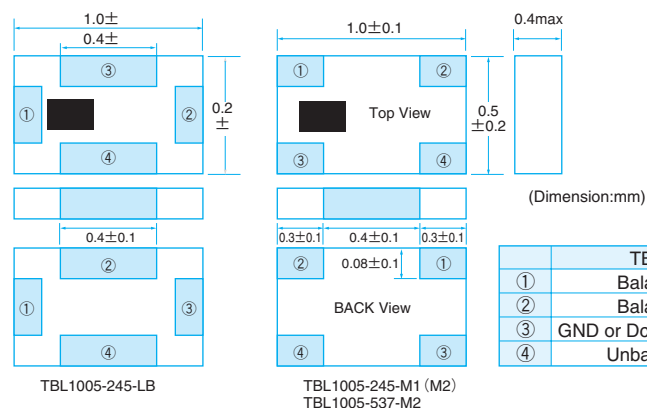
RoHS compliant

Completely lead free

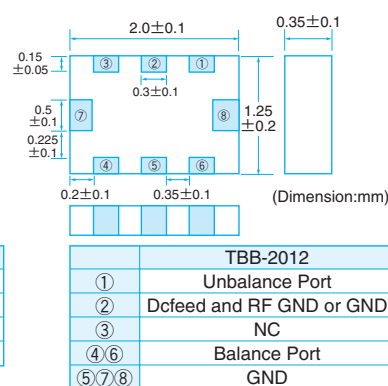
SPECIFICATIONS

Mechanical

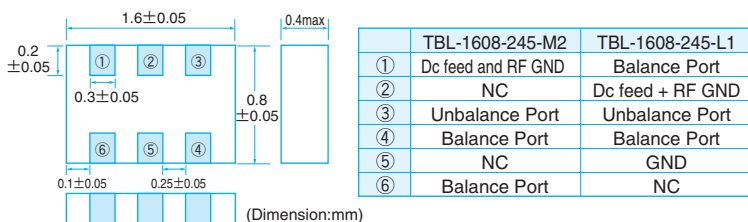
TBL1005 series



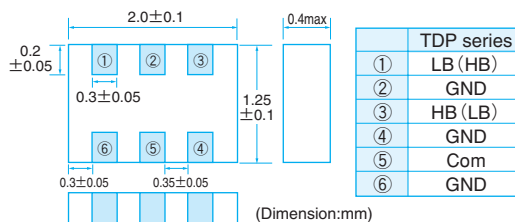
TBB2012 series



TBL1608 series



TDP series



Electrical

Balun

Type	TBL-1005-245-M1	TBL-1005-245-LB	TBL-1005-245-M2	TBL-1005-537-M2	TBL-1608-245-M2	TBL-1608-245-L1
Application	For Bluetooth, W-LAN	For Bluetooth, W-LAN	For Bluetooth, W-LAN	For W-LAN	For Bluetooth, W-LAN	For Bluetooth, W-LAN
F0 (MHz)	2450	2450	2450	5375	2450	2450
Band (MHz)	2400~2500	2400~2500	2400~2500	4900~5850	2400~2500	2400~2500
Unbalance Port Impedance	50Ω	50Ω	50Ω	50Ω	50Ω	50Ω
balance Port Impedance	50Ω	75Ω	100Ω	100Ω	100Ω	50Ω
Phase	180±10deg	180±10deg	180±10deg	180±10deg	180±10deg	180±10deg
Insertion Loss	1.2dB Max at 25°C	1.2dB Max at 25°C	1.2dB Max at 25°C	1.2dB Max at 25°C	1.0dB Max at 25°C	1.2dB Max at 25°C
VSWR in BW	2.0 Max	2.0 Max	2.0 Max	2.0 Max	2.0 Max	2.0 Max
Power	500mW Max	500mW Max	500mW Max	500mW Max	500mW Max	500mW Max

Diplexer

Type	TDP-2012-205-W2
Application	W-LAN
Pass Band	Low 2400~2500MHz High 4900~5950MHz
Insertion Loss	Low 0.5dB Max at 25°C 0.8dB Max at -40~+85°C High 0.8dB Max at 25°C 1.1dB Max at -40~+85°C
Attenuation	Low 20dB Min at 4800~6000MHz 20dB Min at 7200~7500MHz High 25dB Min at 1800~2500MHz 25dB Min at 9800~11900MHz
VSWR in BW	Low 2.0 Max. High 2.0 Max.
Impedance	50Ω

Balance filter

Type	TBB-2012-245-C2
Application	For Bluetooth, W-LAN
F0 (MHz)	2450
Band (MHz)	2400~2500
Unbalance Port Impedance	50Ω
balance Port Impedance	Conjugate match to CSR series
Phase	180±10deg
VSWR at Unbalance Port in BW	2.0 Max
Insertion Loss	3.5dB Max at 25°C
Attenuation	35.0dB at 880~960MHz 20.0dB at 1700~1880MHz 12.0dB at 1880~1990MHz 15.0dB at 4800~5000MHz
Power	500mW Max

1608 size balance filter is available upon request.

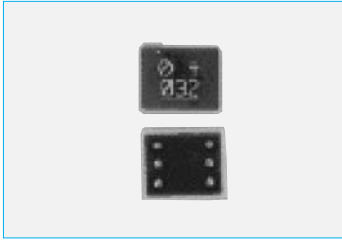


PART NUMBER

TBL - 1608 - 245 - M2

Part Code Dimension Center Frequency F0

Type(see electrical characteristics table)



Ball-Grid-Array Thin Film Low-Pass Filter

FL*B5BC series NEW



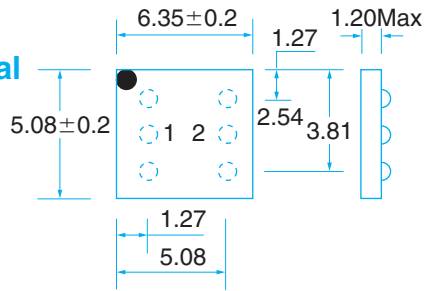
Low pass filter up to 10GHz with very low reflection.
Ball-grid-array termination for surface mount application.

RoHS compliant

Completely lead free

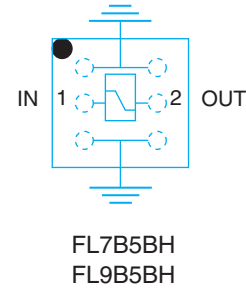
SPECIFICATIONS

Mechanical



FL7B5BH (Dimension:mm)
FL9B5BH

Equivalent circuit

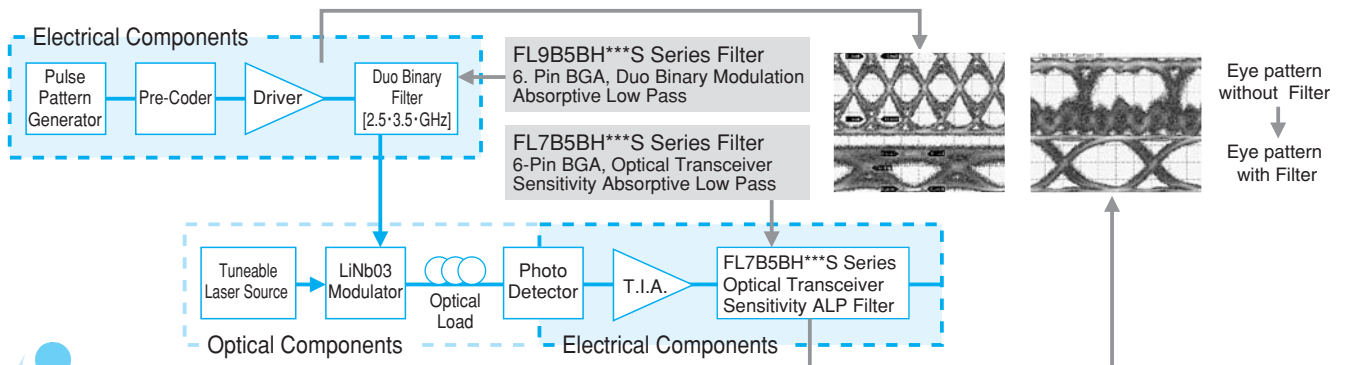


Electrical

Type	FL7B5BH	FL9B5BH
Cut Off Frequency f_0 (-3dB)	6.0GHz~10.0GHz(0.5GHz step)	2.5GHz~4.0GHz(0.25GHz step)
Attenuation(typical)	-10dB at $2f_0$	-10dB at $3f_0$
Reflection(typical)	S11 >12dB at F_0 , >10dB at $2f_0$	>15dB at F_0 , >10dB at $2f_0$
	S22 >10dB at F_0	>13dB at F_0
Rated current (A)	100m	
Operating Temp. Range	-40°C~+85°C	

Application/ Features

Transmission & reception on optical fiber communication



PART NUMBER

FL 9B 5 B H 030 S (-C)

Given to RoHS compliant products

serial code (S=Single)

Cut Off Frequency f_0 (025=2.50GHz, 028=2.75GHz, 030=3.0GHz, 033=3.25GHz, 035=3.5GHz, 038=3.75GHz, 040=4.0GHz, 060~075=7.5GHz, 080=8.0GHz, 085=8.5GHz, 090=9.0GHz, 095=9.5GHz, 100=10GHz)

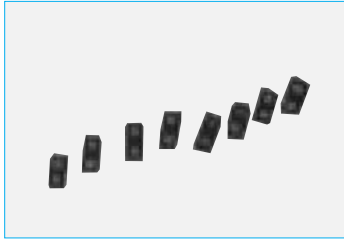
Electrode Type (H=6pin BGA)

Filter Function (B=Bessel)

Impedance (5=50Ω)

Filter order/return function (7=7th, 9=9th/B=Absorptive)

Part Code



Equalizer

EF2A51A Series Now under development



These equalizers maintain high speed data (2.5Gb/s~12.5Gb/s) attenuation level at -3dB, -6dB, -9dB, -12dB up to 10GHz.

Applications

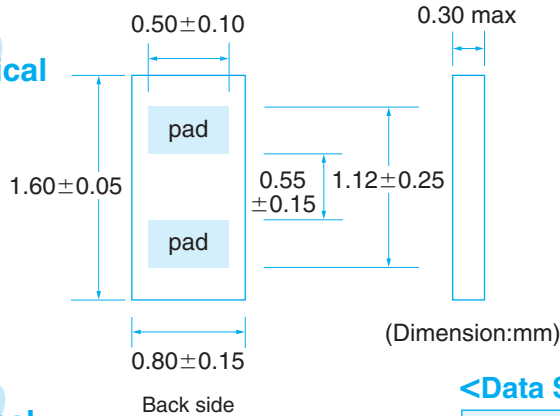
High speed communication cable, optical module, test and measurement equipment etc.

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



Equivalent circuit



Electrical

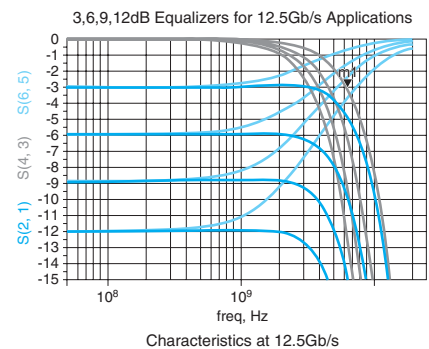
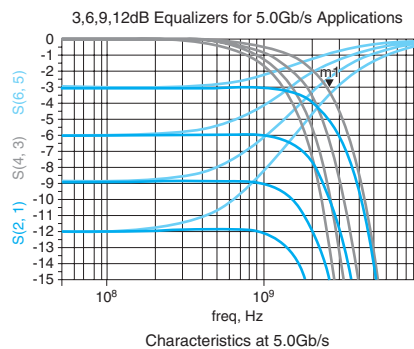
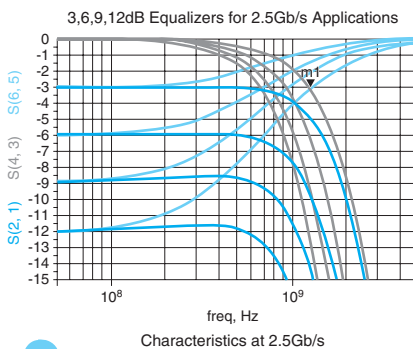
Type	EF2A51A
Attenuation (at 50MHz)	-3, -6, -9, -12dB (± 1 dB)
Band	~10GHz (-1dB max)
Impedance	50 Ω
Rated current (A)	100m
Operating temperature	-40 ~ 85°C

<Data Speed and Attenuation>

Data speed	Attenuation (dB)		
	E = 3	K = 6	Q = 9
025=2.5 Gb/s	EF2A51A025E10B	EF2A51A025K10B	EF2A51A025Q10B
031=3.125 Gb/s	EF2A51A031E10B	EF2A51A031K10B	EF2A51A031Q10B
050=5.0 Gb/s	EF2A51A050E10B	EF2A51A050K10B	EF2A51A050Q10B
063=6.25 Gb/s	EF2A51A063E10B	EF2A51A063K10B	EF2A51A063Q10B
100=10.0 Gb/s	EF2A51A100E10B	EF2A51A100K10B	—
125=12.5 Gb/s	EF2A51A125E10B	—	—

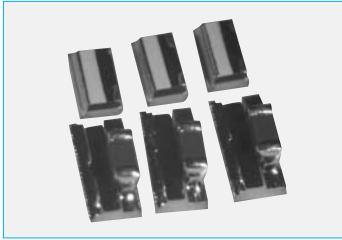
Details of specifications may be discussed for specific application

Examples of characteristics



PART NUMBER

EF2	A	5	1A	050	E	**	B	
								B=Bessel Loss Function
								Ripple characteristics (10=1dB of Max Ripple)
								Attenuation at 50MHz (E=-3dB, K=-6dB, Q=-9dB, T=-12dB)
								data speed (031=3.125Gb/s, 063=6.25Gb/s, 125=12.5Gb/s)
								Dimensions (1A=1608 package)
								Impedance (5=50 Ω)
								Circuit (A=RC shunt)
								Part Code



P*V series, thermal sensitive chip attenuators.



These thermo-variable attenuators have opposite temperature characteristics of GaAs MOSFET amplifiers and compensate the temperature caused gain fluctuation of such amplifiers.

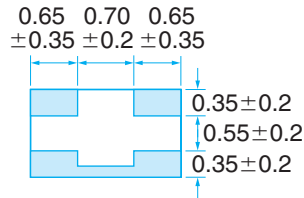
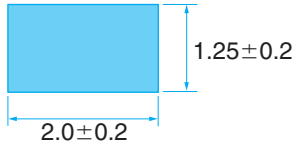
RoHS compliant



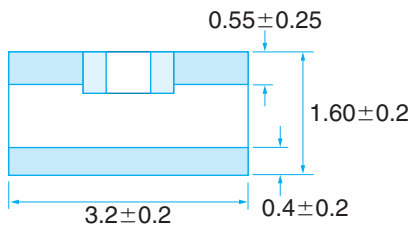
SPECIFICATIONS

Mechanical

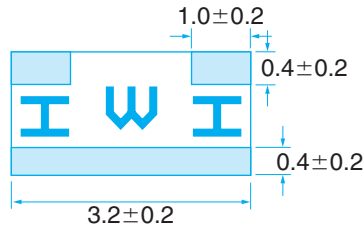
PXV1220S
(0805)



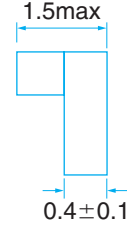
PBV1632S
(1206)



Top side

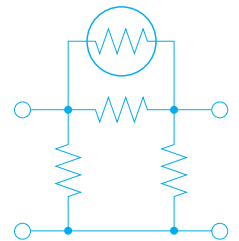


back side



(dimension:mm)

Equivalent circuit



Electrical

Type	PXV1220S	PBV1632S
Attenuation	1, 2, 3, 4, 5, 6, 7, 8, 9, 10dB	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 16dB
Attenuation tolerance	$\pm 0.5\text{dB}$ (@25°C, no load)	
Impedance	50 Ω	
VSWR	1.3 or less	
Temperature coefficient of Attenuation	ex : 6dB N1 0.0119dB/dB*°C N5 0.0041dB/dB*°C N2 0.0088dB/dB*°C N6 0.0035dB/dB*°C N3 0.0062dB/dB*°C N7 0.0026dB/dB*°C N4 0.0047dB/dB*°C N8 0.0019dB/dB*°C (N1~N8 (Nin types available for 1 to 3 dB))	
Frequency Range	DC ~3GHz	
Power Rating	63mW	100mW
Operating Temp. Range	-40°C~+100°C	
Package	100pcs/package 1,000pcs/reel	min.20pcs/package 1,000pcs/reel

· Contact us for data book in details.



PART NUMBER

PXV 1220S - 06dB N1 - T

Package(T=Tape, B=Bulk)
Temperature coefficient of Attenuation
Attenuation
Dimensions
Part Code

"Not for shipment to or sale in the United States"



PAT series, RAT series, high-precision chip attenuators



These 3042, 1632, 1220, 1010 and 0510 size chip attenuators exhibit excellent high frequency characteristics. The surface mount package is ideal for low noise, low inductance and parasitic capacitance applications. Thin film metalization provides for very stable characteristics over temperature and time.

NEW Smallest in the market

PAT0510S, Thin-film chip attenuator that is the smallest and lightest in the market.

RoHS compliant

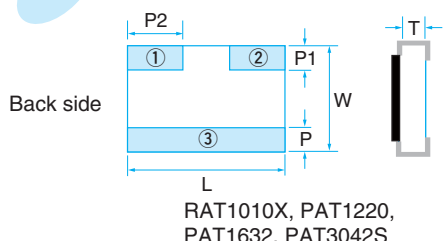
Completely lead free

RAT1010Xを除く



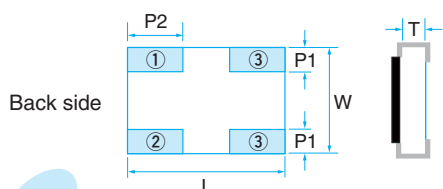
SPECIFICATIONS

Mechanical

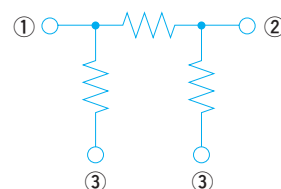


Dimension (Inch Size)	RAT1010X (0404)	PAT0510S (0402)	PAT0816 (0603)	PAT1220 (0805)	PAT1632 (1206)	PAT3042S(C) (1712)
L	1.00±0.05	1.00±0.05	1.60±0.10	2.00±0.10	3.20±0.20	4.20±0.20
W	1.00±0.05	0.50±0.05	0.80±0.10	1.25±0.10	1.60±0.20	3.00±0.20
P	0.25±0.05/-0.1	—	0.20±0.10	0.35±0.20	0.40±0.20	0.90±0.20
P1	0.25±0.05/-0.1	0.12±0.04	0.20±0.10	0.35±0.20	0.40±0.20	0.80±0.20
P2	0.33±0.10	0.27±0.05	0.50±0.10	0.60±0.20	1.00±0.20	0.50±0.20
T	0.42±0.05	0.34±0.05	0.40±0.10	0.40±0.10	0.40±0.10	0.80±0.15

(unit : mm)



Equivalent circuit



Electrical

Type	RAT1010X					PAT0510S			PAT0816			PAT1220	PAT1632		PAT3042S	
Attenuation	1~5dB	6~9dB	10dB	11~16dB	20dB	0~3dB	4~7dB	8~10dB	0~3dB	4~7dB	8~10dB	0~10dB	0~10dB	16dB	0~10dB	16, 20dB
Attenuation tolerance	±0.3dB	±0.4dB	±0.75dB	±0.8dB	±2.5dB	±0.3dB	±0.5dB	±0.7dB	±0.3dB	±0.5dB	±1.0dB	±0.3dB	±0.3dB	±0.5dB	±0.3dB	±0.5dB
Impedance	50Ω(C)					50Ω(C)			50Ω(C)			50Ω(C)		50Ω(C), 75Ω(D)		
VSWR	<1.3					<1.3			<1.3(~6GHz), <1.5(6~10GHz)			<1.3	<1.3	<1.2(50Ω), <1.3(75Ω)		
Frequency Range	~2.5GHz		~3GHz			DC ~10GHz			DC ~10GHz			DC ~3GHz		~3GHz(50Ω), ~2GHz(75Ω)		
Power Rating	40mW					32mW			63mW		100mW	125mW		250mW		
Rated Operating Temperature	—					70℃										
Operating Temp Range	-55℃~+125℃															
Package	10,000pcs/reel					10,000pcs/reel(T10)			5,000pcs/reel(T)			100pcs/package 1,000pcs/reel(T1), 5,000pcs/reel(T5)		50pcs/package 2,000pcs/reel(T2)		

- PAT0510 series of 0402 chip with BGA are also available.
- Please contact us for power rating of up to 10W.



PART NUMBER

PAT 1632 - C - 3dB - T(5)

Package T=Tape, B=Bulk, Taping Quantity Unit: 5(5000), 1(1000)

Attenuation

Rectangular Corner

Impedance

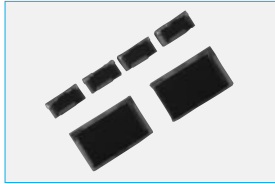
Impedance

Attenuation

Dimension, (Circuit)

Part Code

RAT 1010X - 3dB - C - B



High Precision Power Splitter

PS Series



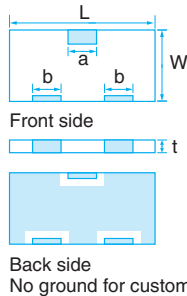
Power splitter with excellent high frequency characteristics for applications from DC~20GHz Bit error is restrained by keeping high frequency digital signal stable Offer standard type with ground and custom type designed to customer' specification.

RoHS compliant

Completely lead free

SPECIFICATIONS

Mechanical



Dimension (mm)	PS1608(G)	PS2012(G)	PS3216(G)	PS5025(G)
L	1.6±0.2	2.0±0.2	3.2±0.2	5.0±0.2
W	0.8±0.2	1.25±0.2	1.6±0.2	2.5±0.2
a	0.4±0.1	0.4±0.1	0.3±0.1	0.35±0.1
b	0.3±0.1	0.3±0.1	0.35±0.1	0.65±0.1
t	0.4±0.1	0.4±0.1	0.4±0.1	0.8±0.15

Electrical

Standard type

Type	PS1608G	PS2012G	PS3216G	PS5025G
Operating frequency	DC~20GHz	DC~17.5GHz	DC~15GHz	DC~10GHz
Insertion loss	6±0.5dB(DC~10GHz) 6±1.0dB(10GHz~20GHz)	6±0.5dB(DC~10GHz) 6±1.0dB(10GHz~17.5GHz)	6±0.5dB(DC~10GHz) 6±1.0dB(10GHz~15GHz)	6±0.5dB(DC~7.5GHz) 6±1.0dB(7.5GHz~10GHz)
Insertion loss	max.0.3dB			
Insertion loss	1.3(DC~10GHz) 1.5(10GHz~20GHz)	1.3(DC~10GHz) 1.5(10GHz~17.5GHz)	1.3(DC~10GHz) 1.5(10GHz~15GHz)	1.3(DC~7.5GHz) 1.5(7.5GHz~10GHz)
Input power	100mW	125mW	250mW	500mW
Max overload power	200mW	250mW	500mW	1000mW
Operating temperature	-40~125°C			
Package	1,000 · 5,000pcs/reel			

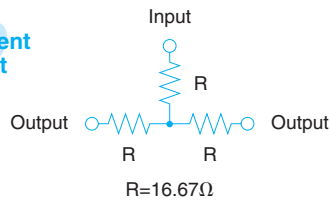
*Standard type with ground on back side can gain stable performance regardless of circuit characteristics

*Custom type without ground on back side can be designed according to specific circuit

· Please ask as for chip custom type with dimension of 1.0*0.5mm

· Simplified pattern can be realized as ground is not required on the surface of circuit

Equivalent circuit



PART NUMBER

PS 1608 G T2 - R50 - T1(T5)

Package (T1:1,000pcs/reel, T5:5,000pcs/reel)

Impedance (50Ω)

Number of output terminal (T2=2 terminals)

Type(G=standard)

Dimensions

Part Code

Positive Emitter Coupled Logic(PECL) Chip Terminators



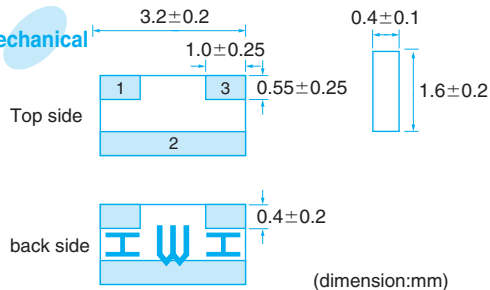
Suitable for output applications in emitter coupled logic for high-speed signal transmission. Minimized reflection permits high-speed data processing.

RoHS compliant

Completely lead free

SPECIFICATIONS

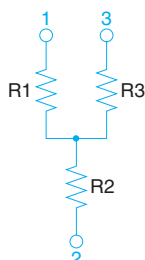
Mechanical



Electrical

Type	RN1632F
Resistance (Ω)	R1=50, R2=46.4, R3=50 ; typical
Tolerance %(code)	±1.0%(F)
TCR ppm /°C(code)	±50ppm/°C
Power Rating	42mW/element ; 125mW/package
Rated Operating Temperature	-55°C~+125°C
Package	5,000pcs/reel

Equivalent circuit



PART NUMBER

RN 1632 F - N23 - F - C

Serial Code

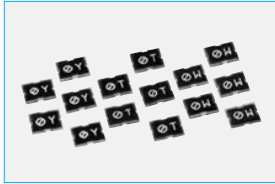
Resistance Tolerance

Code No.

Circuit

Dimensions

Part Code



CL1L, CL2L series, surface-mount thin film delay lines



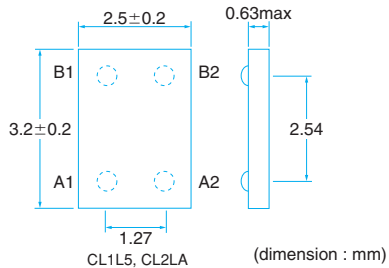
This series permits ultra-precision timing adjustment from 20 to 200 picoseconds with accuracy of $\pm$ picoseconds for ultrahigh-speed signal processing applications.
Differential delay line: CL2L

RoHS compliant

Completely lead free

SPECIFICATIONS

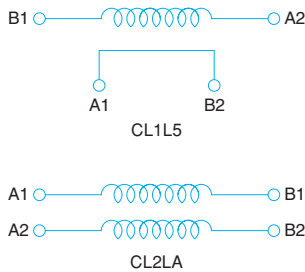
Mechanical



Electrical

Type	CL1L5	CL2LA
Time Delay	40~220ps(20ps step)	
Time Delay Tolerance	$\pm 10\%$	
Temp. coefficient of Td	$\pm 100\text{ppm}/^\circ\text{C}$	
Characteristic Impedance	$50\Omega \pm 10\%$	$100\Omega \pm 10\%$
DC Resistance	0.3 Ω (100ps or less) 3.0 Ω /ns max (100ps or more)	1.0 Ω Max.
Insertion loss	0.5dB or less (at 0.75GHz)	0.5dB or less (at 1.0GHz)
Rated Current	100mA	
Rated Current	$-40^\circ\text{C} \sim 85^\circ\text{C}$	

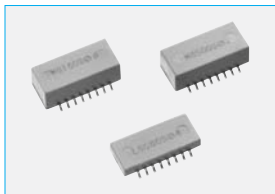
Equivalent circuit



PART NUMBER

CL 1L 5 A T 020 L T1 (-C)

Given to RoHS compliant CL2LA series products
Package(T1:100pcs, T5:500pcs, TA:1,000pcs)
Serial code (L=CL1L5A, D=CL2LA)
Time Delay (020=200ps)
Termination type (T)
Height code (A)
Impedance (5=50 Ω , A=100 Ω)
Number of elements (1L=CL1L5, 2L=CL2LA)
Part Code, Number of elements



GL1L/GL2L series, SOP (small outline package) thin film differential delay lines

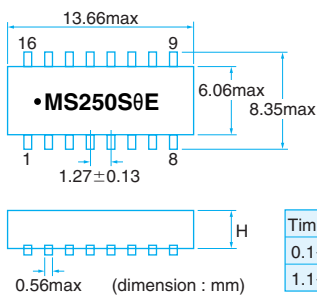


These delay lines offer the same excellent frequency performance as SIP delay lines but come in a gullwinged surface mount package. The differential SMT is useful for PECL application, and contains two identical transmission lines matched for the time delay. Featuring a stripline shielded construction, these parts offer very low EMI/RFI, and are ideal for high frequency/tight tolerance timing and deskew applications.

RoHS compliant

SPECIFICATIONS

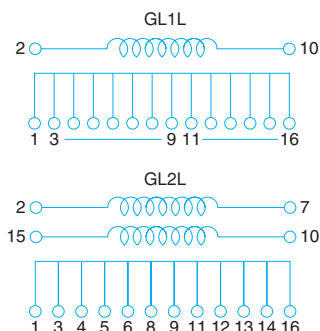
Mechanical



Electrical

Type	GL1L	GL2L
Time Delay	0.1~5.0ns(0.1ns step)	0.1~3.0ns(0.1ns step) 3.5~4.5ns(0.5ns step)
Time Delay Tolerance	$\pm 0.05\text{ns}$	$\pm 0.05\text{ns}$ (0.1~2.9ns) $-0.5/+0.1\text{ns}$ (3.0ns) $\pm 0.1\text{ns}$ (3.5~4.5ns)
Temp. coefficient of Td	$0 \sim 150\text{ppm}/^\circ\text{C}$	
Characteristic Impedance	$50 \pm 5\Omega$	
Rise/fall time	200ps/ns	
Rated Current	100mA	
Characteristic Impedance	$-25 \sim 85^\circ\text{C}$	

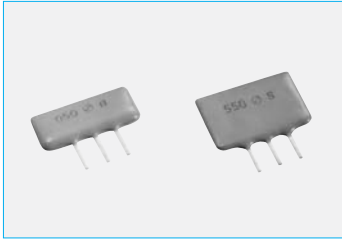
Equivalent circuit



PART NUMBER

GL1L 5 M S 250 S -T* (-C)

Given to RoHS compliant products
Package(T1:100pcs, T5:500pcs)
Circuit : S(GL1L), D(GL2L)
Time Delay : (250=2.50ns)
Lead Frame
Height code
Impedance : (5=50V)
Part Code



DS1L series, SIP thin film delay lines



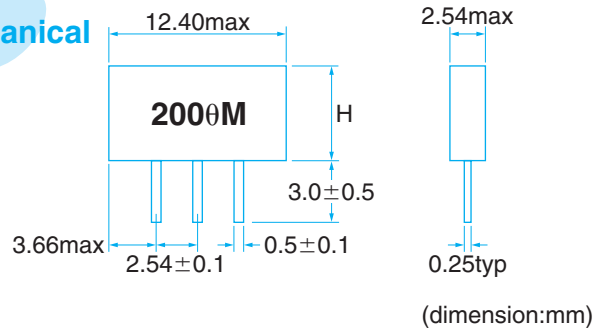
These delay lines provide timing control to 10 nanosecond in a SIP solder lead three pin package. Thin film on ceramic construction provide for high reliability and high bandwidth performance.

RoHS compliant



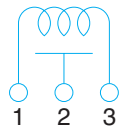
SPECIFICATIONS

Mechanical



Time Delay	H	Form
0.1~5.0ns	6.35max	D
5.5~10.0ns	9.20max	V

Equivalent circuit



Electrical

Type	DS1L
Time Delay range	0.1~2.0ns (0.10ns step)
	2.25~5.0ns (0.25ns step)
	5.5~10.0ns (0.50ns step)
Time Delay Tolerance	±0.050ns (0.10~0.20ns)
	±0.125ns (2.25~5.00ns)
	±0.250ns (5.00~10.0ns)
Characteristic Impedance	50±5 Ω

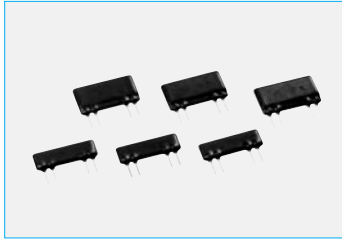
Type	DS1L
DC Resistance	1.0 Ω/ns max
Rated Current	100mA
Temp. coefficient of Td	<150ppm/°C
Insulation resistance	>100M Ω 50V
Operating temperature	-10~+85°C
Storage Temperature	-40~+125°C



PART NUMBER

DS1L 5 DJ 200 S (-C)

- Given to RoHS compliant products
- Serial code
- Time Delay(200=2.0ns)
- Lead Frame
- Impedance(5=50Ω)
- Part Code, Number of elements



DL1L series, SIP thin film delay lines



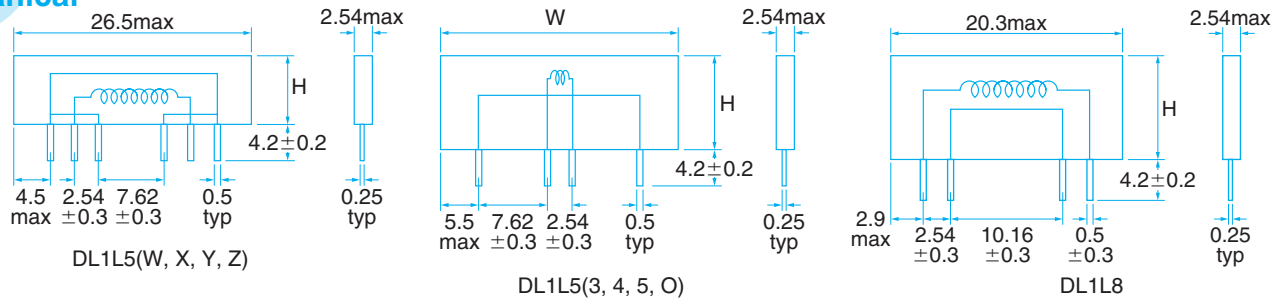
Performance to 5 GHz. For many high frequency applications, discrete, tight tolerance(± 50 picosecond) delay lines can be used to help solve your TTL, and ECL timing and clock deskew needs.

RoHS compliant

SPECIFICATIONS

Mechanical

(dimension : mm)



DL1L5(W, X, Y, Z)

Time Delay	H	Code
0.1~0.5ns	7.60max	W
0.6~2.6ns	10.10max	X
2.7~3.5ns	14.00max	Y
3.6~5.1ns	16.45max	Z

DL1L5(3, 4, 5, O)

Time Delay	H	W	Code
0.1~1.3ns	7.50max	26.50max	3
1.4~2.5ns	10.10max	26.50max	4
2.6~3.4ns	12.70max	27.90max	5
3.6~10ns	15.50max	27.90max	O

DL1L8

Time Delay	Time Delay Tolerance	H	Code
0.1~1.2ns	± 0.05 ns	7.50max	B
1.3~2.6ns	± 0.05 ns	12.00max	F
2.8ns	± 0.10 ns		
3.0~5.0ns	± 0.25 ns		

Electrical

Type	DL1L5(W, X, Y, Z)	DL1L5(3, 4, 5, O)			DL1L8
Time Delay Range	0.1~5.1ns (0.1ns step)	0.1~2.50ns (0.1ns step)	2.6~4.90ns (0.2ns step)	5.0~10.0ns (0.5ns step)	0.1~2.6ns(0.1ns step) 3.0~5.0ns(0.5ns step)
Time Delay Tolerance	±0.050ns	0.05ns	±0.100ns	±0.250ns	above table
Characteristic Impedance	50±5Ω				75±7.5Ω
Retune Loss	20dB min				20dB min
DC Resistance	0.1~0.5ns : 0.5Ωmax	0.1~1.0ns : 0.8Ωmax 1.1~10ns : 0.8Ωmax/ 1ns			0.1~1.0ns : <1.7Ω
	0.6~2.6ns : 1.0Ωmax				0.1~5.0ns : <1.7Ω/ns
	2.7~3.5ns : 2.0Ωmax				
	3.6~5.1ns : 3.0Ωmax				
Rise / fall time	1ns or less	1ns or less	2ns or less		>1ns
Rated Current	100mA				
Operating temperature	-40~+85℃				-10~+85℃

PART NUMBER

DL1L 5 X K 260 S (-C)

- Given to RoHS compliant products
- Serial code
- Time Delay(260=2.6ns)
- Lead Frame
- Height code
- Impedance(5=50 Ω ,8=75 Ω)
- Part Code

STANDARD RESISTANCE VALUES

Please refer to the following table of the standard E-Series application for resistors.

SERIES	SIGNIFICANT FIGURES														
E-6	1.00	1.50	2.20	3.30	4.70	6.80									
E-12	1.00	1.20	1.50	1.80	2.20	2.70	3.30	3.90	4.70	5.60	6.80	8.20			
E-24	1.00	1.10	1.20	1.30	1.50	1.60	1.80	2.00	2.20	2.40	2.70	3.00	3.30	3.60	3.90
	4.30	4.70	5.10	5.60	6.20	6.80	7.50	8.20	9.10						
E-96	1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.37	1.40
	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74	1.78	1.82	1.87	1.91	1.96	2.00
	2.05	2.10	2.15	2.21	2.26	2.32	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87
	2.94	3.01	3.09	3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12
	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49	5.62	5.76	5.90
	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32	7.50	7.68	7.87	8.06	8.25	8.45
	8.66	8.87	9.09	9.31	9.53	9.76									

Table for 3-character codes for resistance value (follows E96 series)

Three letter simple codes are used for E96 series RR0816 and RG1608 (*E24 is used)

Code	E96 series	Code	E96 series	Code	E96 series	Code	E96 series	Code	E96 series	Code	E96 series	Code	E96 series	Code	E96 series
01	100*	13	133	25	178	37	237	49	316	61	422	73	562	85	750*
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150*	30	200*	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130*	24	174	36	232	48	309	60	412	72	549	84	732	96	976

Multipliers Code

Code	Multipliers
A	10 ⁰
H	10 ¹
C	10 ²
D	10 ³
E	10 ⁴
F	10 ⁵
R	10 ⁻¹
S	10 ⁻²

e. g. 1780Ω:178×10¹→25H

Preferred value of resistance shall be composed by significant figures shown in the above table and multipliers including x10Ω, x100Ω, x1,000Ω, x10,000Ω, and x100,000Ω.

- specifications in this catalogue are subject to change for future improvement without prior notice
- the contents of this catalogue are current as of March 2007
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- This is Catalog Rev. 2009

Caution for mounting the product

<Caution for mounting the product>

- (1) Please be careful not to scratch the protection coating while (pre/after) mounting. Any scratches may lead to the deterioration on durability against moisture.
- (2) When soldering by soldering iron, heating should be done on a land so that the tip of soldering iron will not touch the component itself. Also, if soldering is done at high temperature, please do soldering as short time as possible (less than 3 seconds under 350°C is preferable).
- (3) Remaining flux may lead to deterioration of durability against moisture due to corrosion and occurrence of electrolyte. Specially, if high activating flux, such as chlorine related one, is used, please check its characteristics before using it.
- (4) Adherence and remaining of ionized impurity also may lead to deterioration of durability against moisture due to corrosion and occurrence of electrolyte. Please be careful of not to touch the components with sweated bare hand pre/after mounting.
- (5) High temperature and long soldering may cause the poor soldering on electrode.
- (6) In case of placing resistors in resin after mounting, please pay special attention to the selection for it. It is recommended to check durability against heat and moisture, good shock absorption, and not-containing ionized impurity.

<Environment and conditions of usage>

- (1) Usage and conditions under special environment, it is recommended to confirm the specification and reliability of products. Below conditions are considered as special environments.
 - ① Places where products are immersed in such liquids as water, salt water, oil, acid, and an organic solvent. Or, there is possibility of splash of these liquids.
 - ② Direct sunlight, exposure at outdoor, and dusty environment.
 - ③ A place where condensation is expected.
 - ④ A place where the exposure to toxic gas (sea breeze, HCl, Cl₂, SO₂, H₂S, N₂H₄, NOx, etc.) is expected.
- (2) When using the product under high temperature and high humidity
 - ① When using the product under high temperature environment, including generation of heat under consideration, please derate the maximum load in accordance with the derating curve stated on the specification.
 - ② When conducting in high moisture environment or the state of condensation, it may lead to the increase in resistance value or break.
- (3) Dissipation, Pulse loading

Please use the product under rated power. Also please set the maximum voltage under rated voltage upon pulse loading.



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