High Performance Analog IC Portfolio

Catalog

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a leap ahead in analog

Includes Package Guide

High Performance Analog Product Line-up

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Product Overview

POWER MANAGEMENT

Comparators

Part No.	Inputs	Output Type	Internal Hysteresis	Supply Current	Supply Voltage	Package
	#		mV	µA	V	
AS1970	1	Push/Pull	3	10	2.5 to 5.5	SOT23-5
AS1971	1	Open-Drain	3	10	2.5 to 5.5	SOT23-5
AS1972	2	Push/Pull	3	17	2.5 to 5.5	MSOP-8
AS1973	2	Open-Drain	3	17	2.5 to 5.5	MSOP-8
AS1974	4	Push/Pull	3	34	2.5 to 5.5	TSSOP-14
AS1975	4	Open-Drain	3	34	2.5 to 5.5	TSSOP-14
AS1976	1	Push/Pull	3	0.2	1.8 to 5.5	SOT23-5
AS1977	1	Open-Drain	3	0.2	1.8 to 5.5	SOT23-5

DC-DC Step-down Converters

Part No.	Input Voltage	Output Voltage	Output Current	Efficiency	Iq	Architecture	fmax	Enable/ SHDN	Reset/ POK	Features	Package
	V	V	mA	%	µA		kHz				
AS7620-A	3.6 to 32	1.2 to Vin	500	90	30	Hysteretic, Async	<250	✓	✓	Early Power Fail Warning, 100% Duty Cycle	4x4mm MLP-12
AS7620-B	3.6 to 32	3.3	500	90	30	Hysteretic, Async	<250	✓	✓	Early Power Fail Warning, 100% Duty Cycle	4x4mm MLP-12
AS1324	2.7 to 5.5	0.6 to Vin	600	96	20	Fixed, Sync	1500	✓	✓	Powersave Mode	TSOT23-5
AS1332	2.7 to 5.5	1.3 to 3.16	650	96	1000	Fixed, Sync	2000	✓	✓	RF PA Supply, Vcon	WL-CSP-8
AS1333	2.7 to 5.5	3.09	650	96	1000	Fixed, Sync	2000	✓	✓	RF PA Supply	WL-CSP-8
NEW AS1334	2.7 to 5.5	1.2, 1.5, 1.8, 2.5, 3.0, 3.3	650	96	1000	Fixed, Sync	2000	✓	✓		TDFN
NEW AS1339	2.7 to 5.5	0.8 to 3.75	650	95	4500*	Fixed, Sync	2000	✓		2 integrated LDOs, Shutdown	WL-CSP-16 (2x2)
AS1341	4.5 to 20	1.25 to Vin	600	96	12	Hysteretic, Async	<250	✓	✓	100% Duty Cycle	TDFN(3x3)-8

*) no load supply current

DC-DC Step-up Converters

Part No.	Input Voltage	Output Voltage	Output Current*	Efficiency	Iq	Architecture	fmax	Enable/ SHDN	Reset/ POK	Features	Package
	V	V	mA	%	µA		kHz				
AS1301	2.7 to 5.25	5.0	50	95	3000	Charge Pump	1000	✓		Inductorless	TDFN(3x3)-10 / WL-CSP-8
AS1302	2.9 to 5.15	5.0	30	90	100	Charge Pump	1200	✓		Inductorless	WL-CSP-8 (1.2x1.2) / TDFN(3x3)-10
AS1320	1.5 to 3.5	3.3	200	90	35	Hysteretic, Sync	<200	✓	✓	Shdn Batt Feedthrough	SOT23-6
AS1321	1.5 to 5.0	5.0	130	96	35	Hysteretic, Sync	<200	✓	✓	Shdn Batt Feedthrough	SOT23-6
AS1322A	0.65 to 5.0	2.5 to 5.0	315	95	30	Fixed, Sync	1200	✓		Powersave Mode	TSOT23-6
AS1322B	0.65 to 5.0	2.5 to 5.0	315	95	30	Fixed, Sync	1200	✓		Continuous Mode	TSOT23-6
AS1323-27	0.75 to 2.0	2.7	100	85	1.6	Hysteretic, Sync		✓		1.6µA Quiescent Current	TSOT23-5
AS1323-30	0.75 to 2.0	3.0	90	85	1.6	Hysteretic, Sync		✓		1.6µA Quiescent Current	TSOT23-5
AS1323-33	0.75 to 2.0	3.3	80	85	1.6	Hysteretic, Sync		✓		1.6µA Quiescent Current	TSOT23-5
AS1325-33	1.5 to 3.5	3.3	300	96	35	Hysteretic, Sync	<400	✓	✓	Shdn Batt Feedthrough	SOT23-6
AS1325-50	1.5 to 5.0	5.0	185	91	35	Hysteretic, Sync	<400	✓	✓	Shdn Batt Feedthrough	SOT23-6
AS1326	0.7 to 5.0	3.3, 2.5 to 5.0	650	96	65	Fixed, Sync	1200	✓	-	Synchronizes to External Clock	TDFN-10
AS1329	0.65 to 5.0	2.5 to 5.0	315	95	30	Fixed, Sync	1200	✓	-	Shdn Batt Feedthrough	TSOT23-6
AS1340	2.7 to 50	2.7 to 50	140**	90	30	Fixed, Async	1000	✓	✓	Output Disconnect	TDFN(3x3)-8
AS1343	0.9 to 3.6	5.5 to 42	180**	85	22	Fixed, Async	1000	✓	✓	Output Disconnect	TDFN(3x3)-10
NEW AS1344	0.9 to 3.6	5.5 to 42	100	85	22	Fixed, Async	1000	✓	✓	Softstart, Shutdown, Output Disconnect	TDFN(3x3)-10

*) at 2V Vin; if Vout is adjustable, Vout = 3.3V **) at 3.3 VIN, Vout=12V

DC-DC Buck-Boost Converters

Part No.	Input Voltage	Output Voltage	Output Current*	Efficiency	Iq	Architecture	fmax	Enable/ SHDN	Reset/ POK	Features	Package
	V	V	mA	%	µA		kHz				
NEW AS1331	1.8 to 5.5	2.5 to 3.3	300	90	22	Hysteretic, Sync	<500	✓	✓	Low Battery Detection	TDFN (3x3)-10

Product Overview

Low Dropout Regulators

Part No.	Outputs	Accuracy	Output Current**	Feature	Output Voltage	Dropout Voltage @ max Current	Supply Current	Supply Voltage	Package
	#	%	mA		V	mV	µA	V	
AS1351	2	± 1.5	200	OTP*	1.8 to 3.3	200	125	3.0 to 5.5	QFN(3x3)-12
AS1352	4	± 2.0	200	OTP*	1.8 to 3.3	200	225	3.0 to 5.5	QFN(4x4)-12 / QFN(3x3)-16
AS1353	1	± 1.0	150	Low Noise	1.5 to 3.6	60	115	2.5 to 5.5	SOT23-5
AS1356	1	± 1.0	150	Power-OK	1.5 to 3.6	60	115	2.5 to 5.5	SOT23-5
AS1357	3	± 1.5	200	OTP*	1.8 to 3.3	200	175	3.0 to 5.5	QFN(4x4)-12 / QFN(3x3)-16
AS1358	1	± 0.5	150	Ultra Low Noise, High PSRR	1.5 to 4.5	70	40	2.0 to 5.5	TSOT23-5
AS1359	1	± 0.5	300	Ultra Low Noise, High PSRR	1.5 to 4.5	140	40	2.0 to 5.5	TSOT23-5
AS1360	1	± 1.5	250	High Voltage, Low IQ	1.8, 2.5, 3.0, 3.3, 5.0	400	1.5	2.0 to 20	SOT23-3
AS1361	1	± 0.5	150	Ultra Low Noise, High PSRR, POK	1.5 to 4.5	70	40	2.0 to 5.5	TSOT23-6
AS1362	1	± 0.5	300	Ultra Low Noise, High PSRR, POK	1.5 to 4.5	140	40	2.0 to 5.5	TSOT23-6
AS1363	1	±0.75	500	Ultra Low Dropout, Ultra Low Noise	1.2 to 5.3	150	40	2.0 to 5.5	SOT23-6
AS1364	1	±0.75	1000	Ultra Low Dropout, Ultra Low Noise	1.2 to 5.3	140	35	2.0 to 5.5	TDFN(3x3)-8
NEW AS1367	1	± 1.0	150	Under Voltage Lockout, Low IQ, Low Noise	1.2 to 5.5	100	10	2.0 to 5.5	TDFN(2x2)-8
AS1369	1	±0.7	200	Micro-Sized	1.2 to 5.0	80	25	2.0 to 5.5	CS-WLP-4
AS13985	1	± 1.0	150	Ultra Low Dropout	1.2 to 5.0	45	95	2.5 to 5.5	CS-WLP-5 / SOT23-5
AS13986	2	± 1.0	150	Ultra Low Dropout	1.2 to 5.0	45	135	2.5 to 5.5	CS-WLP-8

*) One Time Programmable: The Output Voltage of each Output port can be programmed, one time, on a PCB board, (**) per output

Power Management Units

Part No.	DC-DC Step up Converters	DC-DC Step down converters	RF LDOs	Digital LDOs	Current Sinks	Charge Pump	Audio DAC	Audio ADC	Audio Features	General Purpose ADC	Charger	Customizeable Startup Sequences	Package
AS3603	45mA (Backlight)	500 mA	3x150mA, 2x75mA	2x200mA	4x160mA	5V/30mA	no	no	0.5W Stereo	10 Bit	Linear	8x	QFN48
AS3604	45mA (Backlight)	500 mA	3x200mA, 2x150mA	2x250mA	4x160mA	5V/30mA	no	no	0.5W Stereo	10 Bit	Linear	8x	QFN48
AS3650	1x General Purpose (Voltage or Current Output)	1x1.6A, 1x500mA	1x400mA, 2x150mA	3x200mA	4x40mA, 2x40mA (HV)	5V/100mA	96dB SNR	84dB SNR	2x Headphone, 1x Line In, 1x Line Out, Mic Input, Audio Mixer	10 Bit	Linear, USB	8 PROM Programmable	BGA124 8x8mm
AS3654	2x General Purpose (Voltage or Current Output)	3x500mA	1x150mA, 1x400mA	2x200mA	4x40mA, 3x40mA (HV)	5V/100mA	18Bit	no	1x Headphone, 1x Line In, 1x Line Out	10 Bit	Step-Down, USB	8x	BGA100 10x10mm
AS3656	2x General Purpose (Voltage or Current Output)	3x500mA	1x150mA, 1x400mA	2x200mA	4x40mA, 3x40mA (HV)	5V/100mA	no	no	no	10 Bit	Step-Down, USB	8x	BGA100 10x10mm
AS3658	2x General Purpose (Voltage or Current Output)	1x1.6A, 2x500mA	1x400mA, 2x150mA	4x200mA	4x40mA, 3x40mA (HV)	5V/100mA	96dB SNR	84dB SNR	2x Headphone, 1x Line Out, 1x Line In, Mic Input, Audio Mixer, Equalizer	10 Bit	Step-Down, Linear, USB	8 PROM Programmable	BGA124 8x8mm

Supervisors

Part No.	Supervised Voltages	Supervised Voltages	Supervised Voltages	Supervised Voltages	Push/Pull Active Low	Push/Pull Active High	Open-Drain	Watch-dog	Manual Reset	Supply Current	Supply Voltage	Package
	V (IN1)	V (IN2)	V (IN3)	V (IN4)						µA	V	
AS1901	2.2 to 3.1				✓					0.23	1.0 to 3.6	SOT23-3
AS1902	2.2 to 3.1					✓				0.23	1.0 to 3.6	SOT23-3
AS1903	2.2 to 3.1						✓			0.23	1.0 to 3.6	SOT23-3
AS1904	2.2 to 3.1				✓					0.15	1.0 to 3.6	SOT23-3
AS1905	2.2 to 3.1					✓				0.15	1.0 to 3.6	SOT23-3
AS1906	2.2 to 3.1						✓			0.15	1.0 to 3.6	SOT23-3
AS1907	1.6 to 2.5				✓					2.6	0.7 to 3.6	SOT23-3
AS1908	1.6 to 2.5					✓				2.6	0.7 to 3.6	SOT23-3
AS1909	1.6 to 2.5						✓			2.6	1.0 to 3.6	SOT23-3
AS1910	1.58 to 3.6	Adjustable			✓			✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1911	1.58 to 3.6	Adjustable				✓		✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1912	1.58 to 3.6	Adjustable					✓	✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1913	1.58 to 3.6	0.9 to 2.5			✓			✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1914	1.58 to 3.6	0.9 to 2.5				✓		✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1915	1.58 to 3.6	0.9 to 2.5					✓	✓	✓	5.8	1.0 to 3.6	SOT23-6
AS1916	1.58 to 3.6				✓			✓	✓	5.5	1.0 to 3.6	SOT23-5
AS1917	1.58 to 3.6					✓		✓	✓	5.5	1.0 to 3.6	SOT23-5
AS1918	1.58 to 3.6						✓	✓	✓	5.5	1.0 to 3.6	SOT23-5
AS1920-18	3	1.8	Adjustable		✓					6.5	1.0 to 3.6	SOT23-5
AS1922-18	3	1.8	Adjustable				✓			6.5	1.0 to 3.6	SOT23-5
AS1923A	5.0, Adj.	3.3, 3.0	2.5, 1.8, Adj	-5.0, 1.8, Adj			✓			55	1.0 to 5.5	SOT23-5
AS1923B	5.0, Adj.	3.3, 3.0	2.5, 1.8, Adj	-5.0, 1.8, Adj	✓					55	1.0 to 5.5	SOT23-5
AS1925	0.9, 1.2, 1.5				✓	✓			✓	3.5	0.75 to 1.8	SOT23-5
AS1926	0.9, 1.2, 1.5					✓	✓		✓	3.5	0.75 to 1.8	SOT23-5

*) This table shows the main interfaces. For more information please refer to the datasheet.

Product Overview

MOBILE ENTERTAINMENT

High Performance Microcontrollers

Part No.	MCU Core	Internal Memory	EMI	Mass Storage Interfaces	Interfaces*	General Purpose ADC	Audio Codec SNR	Audio Features	Power Management	Battery Type Support	Package
			GByte								
AS3524	32 bit ARM922TDMI 20-266MHz	320kB RAM 128kB ROM	4	Nand Flash, SLC, MLC SD/MMC Memory Stick (Pro) IDE, Ultra ATA	I²S, SPDIF, USB2 HS&OTG, SPI & UARTs, 2 wire Serial IF, Display IF, MCU IF 8,16bit, 4x 8bit GPIOs		N/A	N/A			CTBGA180 10x10mm
AS3525A	32 bit ARM922TDMI 20-266MHz	320kB RAM 128kB ROM	4	Nand Flash, SLC, MLC SD/MMC Memory Stick (Pro) IDE, Ultra ATA	I²S, SPDIF, USB2 HS&OTG, SPI & UARTs, 2 wire Serial IF, Display IF, MCU IF 8,16bit, 4x 8bit GPIOs	10 bit 16 channels	DAC: 94dB ADC: 83dB	Headphone Amp: 1x Line Out/In: 1x/2x Microphone In: 2x Audio Mix: yes Speaker Amp: yes	DCDC StepUp: 1x45mA DCDC StepDown: - LDO: 5x200mA, 1x2mA, 2x MIC Charge Pump: 1x for Core Current Sink: 1x40mA (progr.)	✓ AA, AAA Li-Ion etc	CTBGA224 13x13mm
AS3525B	32 bit ARM922TDMI 20-266MHz	320kB RAM 128kB ROM	N/A	Nand Flash, SLC, MLC SD/MMC Memory Stick (Pro) IDE, Ultra ATA	I²S, SPDIF, USB2 HS&OTG, SPI & UARTs, 2 wire Serial IF, Display IF, MCU IF 8,16bit, 4x 8bit GPIOs	10 bit 16 channels	DAC: 94dB ADC: 83dB	Headphone Amp: 1x Line Out/In: 1x/2x Microphone In: 2x Audio Mix: yes Speaker Amp: yes	DCDC StepUp: 1x45mA DCDC StepDown: - LDO: 5x200mA, 1x2mA, 2x MIC Charge Pump: 1x for Core Current Sink: 1x40mA (progr.)	✓ AA, AAA Li-Ion etc	CTBGA144 10x10mm
AS3527	32 bit ARM922TDMI 20-266MHz	320kB RAM 128kB ROM	4	Nand Flash, SLC, MLC SD/MMC Memory Stick (Pro) IDE, Ultra ATA	I²S, SPDIF, USB2 HS&OTG, SPI & UARTs, 2 wire Serial IF, Display IF, MCU IF 8,16bit, 4x 8bit GPIOs	10 bit 16 channels	DAC: 96dB ADC: 90dB	Headphone Amp: 1x Line Out/In: 2x/2x Microphone In: 2x Audio Mix: yes Speaker Amp: -	DCDC StepUp: 1x45mA, 1x500mA DCDC StepDown: 1x500mA, 2x250mA LDO: 4x200mA, 1x2mA, 2x MIC Charge Pump: 1x10mA Current Sink: 1x40mA (prog., log. Dimming)	✓ Li-Ion etc	CTBGA224 13x13mm

*) This table shows the main interfaces. For more information please refer to the datasheet.

Mobile Entertainment Players

Part No.	MCU Core	Internal Memory	Distinguishing Features	Interfaces*	Integrated Audio	Integrated Power Management	Package
AS3530	32 bit ARM926EJ up to 400 MHz	512kB RAM 128kB ROM	Multimedia Microcontroller - Low power Audio Engine Multi-Standard Audio Decoder, Audio Postprocessor - Low power Video Engine Multi-Standard Video Decoder, Alpha Blending, Scaling, Rotation, PIP , up to D1 resolution - Security Cipher Engine - LCD Controller up to 1024x768	Ext Memory 16bit & 32bit Nand Flash (SLC, MLC, iNand, LBA) 3xSD, SDIO, MMC, CE-ATA, MS-Pro 3xI2S IN/OUT, SPDIF I/O USB 2.0 HS OTG 3x SSI,3x UART, IrDa, RGB LCD, MCU LCD, CAN-Bus, GPIOs, KBS XM-AMBADT	-	-	BGA280 10x10mm
AS3531	32 bit ARM926EJ up to 266 MHz	512kB RAM 128kB ROM	Digital Audio Player - Low power Audio Engine Multi-Standard Audio Decoder, Audio Postprocessor - Low power Video Engine Multi-Standard Video Decoder, Alpha Blending, Scaling, Rotation, PIP, up to QCIF+ Resolution - Security Cipher Engine	Nand Flash (SLC, MLC, iNand, LBA) SD, SDIO, MMC, CE-ATA USB 2.0 HS OTG, SSI, UART, IrDa MCU LCD, GPIOs, KBS	✓ DAC: 100dB SNR, -85dB THD ADC: 83dB SNR 6 Channel Audio Mixer Ground noise Cancellation CAP-less Headphone Out Line-In & Line-Out	✓ various DCDC, LDOs for int. and ext. PM USB, Wall-plug Charger (e.g. Lio-Ion, AAA), LED Backlight Driver, Real Time Clock, Power On Reset, Supervisor and Watchdog 10bit, 19 channel Gen Purpose ADC	BGA124 8x8mm
AS3532	32 bit ARM926EJ up to 266 MHz	512kB RAM 128kB ROM	Digital Audio Player - Low power Audio Engine Multi-Standard Audio Decoder, Audio Postprocessor - Security Cipher Engine	Nand Flash (SLC, MLC, iNand, LBA) SD, SDIO, MMC, CE-ATA 3xI²S IN/OUT, SPDIF IO 2x PDM MIC IN, USB 2.0 HS OTG SSI, UART, IrDa, MCU LCD, GPIOs, KBS	-	-	BGA84 6x6mm
AS3536	32 bit ARM926EJ up to 400 MHz	512kB RAM 128kB ROM	Multimedia Microcontroller - Low power Audio Engine Multi-Standard Audio Decoder, Audio Postprocessor - Low power Video Engine Multi-Standard Video Decoder, Alpha Blending, Scaling, Rotation, PIP , up to D1 resolution - Security Cipher Engine - LCD Controller up to 1024x768	Ext Memory 16bit & 32bit Nand Flash (SLC, MLC, iNand, LBA) 3xSD, SDIO, MMC, CE-ATA, MS-Pro 2xI²S IN/OUT, SPDIF I/O USB 2.0 HS OTG, 3x SSI,3x UART,IrDa RGB LCD, MCU LCD, CAN-Bus, GPIOs, KBS, XM-AMBADT	✓ 10 bit DAC: 100dB SNR, -85dB THD ADC: 83dB SNR 6 Channel Audio Mixer Ground noise Cancellation CAP-less Headphone Out Line-In & Line-Out	✓ various DCDC, LDOs for int. and ext. PM USB, Wall-plug Charger (e.g. Lio-Ion, AAA) LED Backlight Driver Real Time Clock, Power On Reset Supervisor and Watchdog 10bit, 19 channel Gen Purpose ADC	CTBGA244 10x10mm

*) This table shows the main interfaces. For more information please refer to the Datasheet

Product Overview

AUDIO

Active Noise Cancellation

	Part No.	Function	Topology	Output Type	Max. Output Power	SNR, THD	ANC Performance	Supply Voltage	Package
		dB	W	dB	BTL, 1.8V, 32 Ohm	SE, 34mW, 32Ohm	mA	V	
NEW	AS3501	Receive path	Feedforward	Stereo/BTL	125mW	>100dB, <0.1%	>20dB	1.0 to 1.8	QFN24 (4x4mm)
NEW	AS3502	Receive Path	Feedback	Stereo/BTL	125mW	>100dB, <0.1%	>15dB	1.0 to 1.8	QFN32 (5x5mm)

Audio Amplifiers

Part No.	Gain	Power	PSRR	Output Type	Shutdown	Supply Current	Supply Voltage	Package
	dB	W	dB			mA	V	
AS1701	Adjustable	1.6	65	Bridged	Active High	6.8	2.7 to 5.5	MSOP-8
AS1702	Adjustable	1.8	79	Differential	Active High/Low	8	2.7 to 5.5	MSOP-10, DFN(3x3)-10
AS1703	0	1.8	79	Differential	Active High/Low	8	2.7 to 5.5	MSOP-10, DFN(3x3)-10
AS1704	3	1.8	79	Differential	Active High/Low	8	2.7 to 5.5	MSOP-10, DFN(3x3)-10
AS1705	6	1.8	79	Differential	Active High/Low	8	2.7 to 5.5	MSOP-10, DFN(3x3)-10
AS1706	Adjustable	1.6	65	Bridged	Active Low	6.8	2.7 to 5.5	MSOP-8

Audio Front-Ends

Part No.	Power Management	Main Audio Features	Audio Codec SNR	Speaker Amplifier	Main Interfaces and Control	USB Charger with Temp Supervision	Boot ROM for Start-up Sequences	RTC	Package
AS3510	DCDC StepUp: 1x150mA @ 3.6V DCDC StepDown: - LDO: 2x50mA, 1x200mA Charge: - Current Sink: -	Headphone Amp: 1x Line Out: - Line In: - Microphone In: 1x Audio Mix: yes	DAC: 91dB ADC: 83dB	✓	Gen. Purpose ADC: - I2C & I2S: yes SPDIF: - RES & WDT: RES only DRM Enabled (UID): -				BGA49 7x7mm
AS3514	DCDC StepUp: 1x150mA @ 3.6V DCDC StepDown: - LDO: 2x50mA, 1x200mA, 2x MIC Charge: - Current Sink: -	Headphone Amp: 1x Line Out: 1x Line In: 2x Microphone In: 2x Audio Mix: yes	DAC: 94dB ADC: 83dB	✓	Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: - RES & WDT: yes DRM Enabled (UID): 64bit	✓	✓ 25	✓	BGA64 7x7mm
AS3515	DCDC StepUp: 1x60mA @ 12V DCDC StepDown: - LDO: 5x200mA, 1x2mA, 2x MIC Charge Pump: 1x for Core Current Sink: 1x40mA (progr.)	Headphone Amp: 1x Line Out: 1x Line In: 2x Microphone In: 2x Audio Mix: yes	DAC: 94dB ADC: 83dB	✓	Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: - RES & WDT: yes DRM Enabled (UID): 64bit	✓	✓ 25	✓	BGA64 7x7mm
AS3517	DCDC StepUp: 1x60mA @ 12V, 1x500mA (USB) DCDC StepDown: 1x500mA, 2x250mA LDO: 4x200mA, 1x2mA, 2x MIC Charge Pump: 1x10mA (for USB OTG) Current Sink: 1x40mA (prog., log. Dimming)	Headphone Amp: 1x Line Out: 2x Line In: 2x Microphone In: 2x Audio Mix: yes	DAC: 96dB ADC: 90dB		Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: yes RES & WDT: yes DRM Enabled (UID): 64bit	✓	✓ 25	✓	BGA81 9x9mm
AS3518	DCDC StepUp: 1x60mA @ 12V DCDC StepDown: 2x250mA LDO: 4x200mA, 1x MIC Charge Pump: - Current Sink: 1x36mA (prog., log. Dimming)	Headphone Amp: 1x Line Out: 1x Line In: 3x Microphone In: 1x Audio Mix: yes	DAC: 96dB ADC: 96dB		Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: yes RES & WDT: yes DRM Enabled (UID): 64bit	✓ + Current Limitation	✓ 5	✓	BGA64 7x7mm
AS3542	DCDC StepUp: 1x60mA @ 12V DCDC StepDown: 2x250mA with DVM LDO: 3x200mA, 1x50mA, 1x MIC Charge Pump: - Current Sink: 1x36mA (prog., log. Dimming)	Headphone Amp: 1x Line In/Out: 1x Microphone In: 1x Audio Mix: yes	DAC: 96dB ADC: 85dB		Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: - RES & WDT: yes DRM Enabled (UID): 64bit	✓ + Current Limitation + Battery Switch	✓ 5 (5 voltage combinations each)		MLF56 7x7mm
AS3543	DCDC StepUp: 1x60mA @ 12V DCDC StepDown: 2x250mA with DVM LDO: 3x100mA, 1x50mA, 1x MIC Charge Pump: - Current Sink: 2x36mA (prog., log. Dimming)	Headphone Amp: 1x Line Out: 1x* Line In: 2x Microphone In: 1x Audio Mix: yes	DAC: 102/96dB ADC: 85dB		Gen. Purpose ADC: 10bit I2C & I2S: yes SPDIF: - RES & WDT: yes DRM Enabled (UID): 64bit	✓ + Current Limitation + Battery Switch	✓ 5 (25 voltage combinations each)	✓	BGA64 6x6mm

*) with ground noise cancellation

Operational Amplifiers

	Part No.	Amplifiers	Slew Rate	Gain Bandwidth	PSRR	CMRR	Shutdown	Supply Current	Supply Voltage	Package
		#	V/µs	MHz	dB	dB		mA	V	
	AS1710A	1	10	10	-85	-70	✓	1.6	2.7 to 5.5	SC70-6
	AS1710B	1	10	10	-85	-70		1.6	2.7 to 5.5	SC70-5
	AS1712A	4	10	10	-85	-70	✓	6.4	2.7 to 5.5	TQFN(3x3)-16
NEW	AS1713	1	10	10	-70	-60	✓	1.6	2.7 to 5.5	MLPD (2x2)-8

Product Overview

Phones (Feature/Basic)

Part No.	Supply Voltage	Operating Range	Temperature Range	Last Number & Memory Dialing	Tone Ringer	Handsfree Function	Package
	V	mA	°C				
AS2522B	3.0 to 5.0	15 to 150	-25 to 70	0	✓	✓	TQFP-32, Die on Foil
AS2523/24	3.0 to 5.0	15 to 150	-25 to 70	0		✓	SOIC-28, Die on Foil
AS2525	3.0 to 5.0	15 to 100	-25 to 70	29	✓	✓	TQFP-44, Die on Foil
AS2533	3.8 to 5.0	13 to 100	-25 to 70	15	✓		SOIC-28, Die on Foil
AS2534	3.8 to 5.0	13 to 100	-25 to 70	1	✓		SOIC-28, Die on Foil
AS2535	3.8 to 5.0	13 to 100	-25 to 70	12	✓		SOIC-28, Die on Foil
AS2536	3.8 to 5.0	13 to 100	-25 to 70	15	✓		SOIC-28, Die on Foil
AS2540	3.6 to 5.0	15 to 100	-15 to 60	0	✓		SOIC-28, Die on Foil

SENSORS & SENSOR INTERFACES

Linear Encoders

Part No.	Description	Resolution	Features	Output	Supply	Temp. Range	Package	Remark
					V	°C		
AS5304	Integrated Hall ICs for linear and off-axis rotary motion detection	25 µm	high speed, linear movement measurement using multi-pole magnetic strips, circular off axis movement measurement using multi-pole magnetic rings	incremental A & B quadrature outputs and index pulse that is asserted once every magnet pole pair	5.0	-40°C to +125°C	TSSOP	for linear: use magnetic strip for off-axis: use ring magnet
AS5306	Integrated Hall ICs for linear and off-axis rotary motion detection	15 µm	high speed, linear movement measurement using multi-pole magnetic strips, circular off axis movement measurement using multi-pole magnetic rings	incremental A & B quadrature outputs and index pulse that is asserted once every magnet pole pair	5.0	-40°C to +125°C	TSSOP	for linear: use magnetic strip for off-axis: use ring magnet
NEW AS5311	Integrated Hall IC for linear and off-axis rotary motion detection	0.488 µm absolute 1.95 µm incremental	high resolution, linear movement measurement using multi-pole magnetic strips, circular off-axis movement measurement using multi-pole magnetic rings	incremental A & B with index; absolute serial + PWM output	3.3 or 5.0	-40°C to +125°C	TSSOP-20	for linear: use magnetic strip for off-axis: use ring magnet

Rotary Encoders

Part No.	Resolution	Features	Supply Voltage	Temperature Range	Automotive Qualification	Package
			V	°C		
AS5030	8-bit	SSI, PWM, Low Power Modes	5.0	-40 to 125		TSSOP16
AS5035	8-bit	Quadrature A/B, Index	3.3 or 5.0	-40 to 125	✓	SSOP16
AS5040	10-bit	SSI, PWM, Quadrature A/B, Index, BLDC Commutation U,V,W	3.3 or 5.0	-40 to 125	✓	SSOP16
AS5140H	10-bit	SSI, PWM, Quadrature A/B, Index, BLDC Commutation U,V,W	3.3 or 5.0	-40 to 150	✓	SSOP16
AS5043	10-bit	SSI, Analog	3.3 or 5.0	-40 to 125		SSOP16
AS5045	12-bit	SSI, PWM	3.3 or 5.0	-40 to 125		SSOP16
AS5046	12-bit	I²C, Analog, Sin/Cos (12-bit)	3.3 or 5.0	-40 to 125		SSOP16
AS5130	8-bit	SSI, PWM, Low Power Modes, Multiturn	5.0	-40 to 125	✓	SSOP16
AS5134	8.5-bit	SSI, PWM, Quadrature A/B, Index, BLDC Commutation, Multiturn	5.0	-40 to 140	✓	SSOP20
NEW AS5163	14-bit	27V overvoltage protection, -18V reverse polarity, short circuit management, programmable characteristic output, 1-wire interface, PWM, analog, digital	5.0	-40 to 150	✓	TSSOP14

Metering Front Ends

Part No.	Current Channels	On-Chip Vref	Power Supply Monitoring	Anti Creep	Stepper Motor Output	Digital Calibration	Stepper Motor Output	Energy Pulse Output	Digital Calibration	Package
	#							Instantaneous/Average		
AS8118	1	✓	✓	✓	✓	✓	✓	Instantaneous	✓	SOIC18
AS8168	1	✓	✓	✓	✓	✓	✓	Average	✓	SOIC18

Metering SoC

Part No.	Current Channels	MCU	Flash	RAM	Anti Tampering	RTC	LCD Driver	MPIOs	Energy Pulse Output	UART	Digital Calibration	Package
	#		kB	kB			Segments	#	Instantaneous/Average	#		
AS8218	2	8051		24	✓	✓	80	9	✓	2	✓	LQFP64
AS8228	2	8051		24	✓	✓	96	12	✓	2	✓	LQFP64
AS8267	2	8051	32	1	✓	✓	80	9	✓	2	✓	LQFP64
AS8268	2	8051	32	1	✓	✓	96	12	✓	2	✓	LQFP64

Product Overview

INTERFACES

FlexRay Transceivers

	Part No.	Network	Description	Supply Voltage	Temperature Range	Package
				V	°C	
NEW	AS8220	FlexRay™	FlexRay™ Basis Transceiver	VBAT 6.5 - 50	-40 to +125	SSOP14
	AS8221	FlexRay™	FlexRay™ Standard Transceiver	VBAT 6.5 - 50	-40 to +125	SSOP20

Low Voltage Differential Signaling

Part No.	Type	Lines	Data Rate	Terminated	Failsafe Circuit	Supply Current	Supply Voltage	Package
		#	Mbps	Ohm		mA	V	
AS1150	Receiver	4	500		✓	5	3.0 to 3.6	TSSOP-16
AS1151	Receiver	4	500	107	✓	5	3.0 to 3.6	TSSOP-16
AS1152	Driver	4	500			4	3.0 to 3.6	TSSOP-16
AS1153	Receiver	1	260		✓	2.5	3.0 to 3.6	SOIC-8
AS1154	Driver	2	800			2	3.0 to 3.6	SOIC-8
AS1155	Receiver	2	260		✓	4.5	3.0 to 3.6	SOIC-8
AS1156	Driver	1	800			2	3.0 to 3.6	SOIC-8
AS1157	Receiver	1	260	107	✓	2.5	3.0 to 3.6	SOIC-8
AS1158	Receiver	2	260	107	✓	4.5	3.0 to 3.6	SOIC-8

LIGHTING MANAGEMENT

Large LCD Panel Backlighting

Part No.	Outputs	LED Current per Output	Features	Error Detection	Read-back	LED-to-LED Matching	Supply Voltage	Package
	#	mA				%	V	
AS3691	4	400	Slew rate control			0.5	From Main Supply	QFN24 or ePTSSOP24
AS3693	16	70	Slew rate control	✓		0.5	From Main Supply	epTQFP64
AS3694	12	70	3 DC/DC controller, slew rate control	✓		0.5	From Main Supply	epTQFP64

LED Drivers

	Part No.	Outputs	LED Current per Output	Features	Error Detection	Read-back	LED-to-LED Matching	Supply Voltage	Package
		#	mA				%	V	
	AS1100	64	5	Multiplexed			3	5.0	PDIP-24 / SOIC-24
	AS1101	2	80				3	2.2 to 3.6	SC70-6
	AS1102	3	40				3	2.2 to 3.6	SC70-6
	AS1103	4	40				3	2.2 to 3.6	SC70-6
	AS1104	4	40				3	2.2 to 3.6	MSOP-8
	AS1105	32	10	Multiplexed			3	5.0	SOIC-20
	AS1106	64	5	Multiplexed			3	2.7 to 5.5	PDIP-24 / SOIC-24
	AS1107	64	5	Multiplexed			3	2.7 to 5.5	PDIP-24 / SOIC-24
	AS1108	32	10	Multiplexed			3	2.7 to 5.5	PDIP-20 / SOIC-20
	AS1109	8	100		✓	✓	2	3.0 to 5.5	SOIC150-16 / SSOP150-16 / TQFN(4x4)-16
	AS1110	16	100		✓	✓	3	3.0 to 5.5	SSOP-24 / TQFN(5x5)-28
	AS1112	16	80	12-bit PWM, 6-bit DOT	✓	✓	4.5	3.0 to 5.5	TQFN(5x5)-32
	AS1113	16	50		✓	✓	3	3.0 to 5.5	SSOP-24 / TQFN(5x5)-28
NEW	AS1115	64	5	multiplexed, I²C interface	✓	✓	3	2.7 to 5.5	QSOP-24 / TQFN(4x4)-24
NEW	AS1116	64	5.5	multiplexed	✓	✓	3	2.7 to 5.5	QSOP-24 / TQFN(4x4)-24
	AS3691	4	400	Slew rate control			0.5	From Main Supply	QFN24 or ePTSSOP24

Lighting Flash LED Drivers

Part No.	Topology	Performance		LED Channels				Interfaces			Safety Features		Packages
		I_{Led} max	V_{Out} max	Curr. Sinks	Curr. Source	Flash LEDs	Indicator LED	I²C	2 pin Enable	single wire serial	TimeOut	TXMask	
AS3682	Capacitive	480 mA	5.5 V	6	Low Side	1 to 6	✓	✓	✓		✓		QFN24 4x4mm, Pitch 0.5mm
AS3683	Capacitive	1000 mA	5.5 V	6	Low Side	1 to 6	✓	✓	✓		✓		QFN24 4x4mm, Pitch 0.5mm
AS3683B	Capacitive	1000 mA	5.5 V	6	Low Side	1 to 6	✓	✓	✓		✓	✓	QFN24 4x4mm, Pitch 0.5mm
AS3685	Capacitive	700 mA	5.5 V	1	Low Side	1	Flash LED	✓	✓	✓	✓	✓	CS-WLP12 1.5x2mm, Pitch 0.5mm
AS3686	Capacitive	700 mA	5.5 V	2	Hi Side	1	✓	✓	✓	✓	✓	✓	CS-WLP12 1.5x2mm, Pitch 0.5mm

Product Overview

Lighting Management Units

Part No.	Display	Camera						Light FX	Specials	Music		Package
	Lighting	Flash	Flash Timeout	Torch	Indicator	Supply	CCD Supply/Control	Event/Dim/RGB	In-Circuit LED Test	Audio Input	Curr. Sinks	
AS3675	✓	150mA	✓	✓	✓	✓	✓	Auto	✓	✓	13	CS-WLP-30 3x2.5
AS3681	✓	400mA		✓	✓	1 x LDO	✓	I²C			11	QFN-32 5x5
AS3687	✓							Auto	✓		7	CS-WLP-20 2x2.5
AS3687XM	✓							Auto	✓	✓	6	CS-WLP-20 2x2.5
AS3688	✓	900mA	✓	✓	✓	2 x LDO	✓	Auto	✓		12	QFN-32 5x5
AS3689	✓	150mA	✓	✓	✓	1 x LDO	✓	Auto	✓		15	CS-WLP-36 3x3
AS3689XF	✓	900mA	✓	✓	✓	2 x LDO	✓	Auto	✓		15	QFN-40 5x5

RF PRODUCTS

Low Frequency

Part No.	Description	Channels	Wake-up Sensitivity	LF Carrier Frequency Range	Data Rate	Dynamic Range	RSSI Step	Package
		#	µVpp	kHz	kb/s	dB	mV	
NEW **AS3931**	3D Low Power LF Receiver	3	350	19 - 150	2.731	60	290	TSSOP-16
AS3932	Programmable 3D Low Power LF Wakeup Receiver	3	282	110 - 150	1-8	64	n.a. (digital RSSI)	TSSOP16, QFN16

RFID

Part No.	Standards	TX Modulation	Sensitivity	ISM Range	Output Power	Link frequencies supported	Datarate	Package	Temp Range
AS3990	EPC Class 1 - Gen 2, ISO 18000 6c/b	ASK-DSB, PR-ASK	-66	840-960	0	40 - 640	40 - 640	QFN 64	-40 to 85
AS3991	EPC Class 1 - Gen 2, ISO 18000 6c/b	ASK-DSB, PR-ASK	-66	840-960	20	40 - 640	40 - 640	QFN 64	-40 to 85

Ultra High Frequency

Part No.	Description	Channels	Temp. Sensor	Temp. Range	ISM Frequency range	Data Rate	Supply	Standard	Package
		#		°C			V		
AS3977	Multi-Channel Narrowband FSK/ASK Transmitter	Multi With Narrow Bandwidth	Fully Integrated	-40 to +85	300 – 1000 MHz	up to 100 kb/s	2.0 - 3.6	ETSI, FCC, ARIB	QFN-16(4x4)

DATA CONVERTERS

Analog Switches

Part No.	Lines	Type	RON	RON flatness	RON matching	On/Off time	Supply Voltage	Package
	#		Ohm	Ohm	Ohm	ns	V	
AS1741	2	SPST NO	0.8	0.18	0.08	22/14	1.6 to 3.6	MSOP-8 / SOT23-8
AS1742	2	SPST NC	0.8	0.18	0.08	22/14	1.6 to 3.6	MSOP-8 / SOT23-8
AS1743	2	SPST NO/NC	0.8	0.18	0.08	22/14	1.6 to 3.6	MSOP-8 / SOT23-8
AS1744	2	SPDT NO/NC	4	1	0.2	17/6	1.8 to 5.5	MSOP-10
AS1745	2	SPDT NC/NO	4	1	0.2	17/6	1.8 to 5.5	MSOP-10
AS1746	2	SPDT NC/NO	0.5/0.6	0.15	0.06	50/30	1.8 to 5.5	TDFN(3x3)-10 / WL-CSP-10
AS1747	2	SPDT	0.45/0.55	0.4	0.15	400/200	1.8 to 5.5	TDFN(3x3)-10
AS1748	2	SPDT, Comparator	0.85	0.4	0.15	400/200	1.8 to 5.5	TQFN(3x3)-16
AS1749	2	SPDT, Shunt	0.85	0.4	0.15	400/200	1.8 to 5.5	TDFN(3x3)-10
AS1750	2	SPDT, Shunt + Comp	0.85	0.4	0.15	400/200	1.8 to 5.5	TQFN(3x3)-16
AS1751	4	SPST NO	0.9	0.1	0.12	22/14	1.5 to 3.6	TSSOP-14 / QFN(3x3)-16
AS1752	4	SPST NC	0.9	0.1	0.12	22/14	1.5 to 3.6	TSSOP-14 / QFN(3x3)-16
AS1753	4	SPST NO/NC	0.9	0.1	0.12	22/14	1.5 to 3.6	TSSOP-14 / QFN(3x3)-16

Product Overview

Analog/Digital Converters

Part No.	Channels	Resolution	Sampling Rate	Fully Differential	Internal Reference	Supply Current	Supply Voltage	Package
	#	bit	ksps			mA @ max speed	V	
AS1520	8	10	400	✓	✓	2.8	4.5 to 5.5	TSSOP-20
AS1521	8	10	300	✓	✓	2.2	2.7 to 3.6	TSSOP-20
AS1522	4	10	400	✓	✓	2.8	4.5 to 5.5	TSSOP-16
AS1523	4	10	300	✓	✓	2.2	2.7 to 3.6	TSSOP-16
AS1524	1	12	150	✓		0.35	2.7 to 5.25	TDFN(3x3)-8
AS1525	2	12	150			0.35	2.7 to 5.25	TDFN(3x3)-8
AS1526	1	10	73		✓	1.4	2.7 to 5.25	SOIC-150-8
AS1527	1	10	73			1.0	2.7 to 5.25	SOIC-150-8
AS1528	1	10	150	✓		0.35	2.7 to 5.25	TDFN(3x3)-8
AS1529	2	10	150			0.35	2.7 to 5.25	TDFN(3x3)-8
AS1530	8	12	400	✓	✓	2.8	4.5 to 5.5	TSSOP-20
AS1531	8	12	300	✓	✓	2.2	2.7 to 3.6	TSSOP-20
AS1532	4	12	400	✓	✓	2.8	4.5 to 5.5	TSSOP-16
AS1533	4	12	300	✓	✓	2.2	2.7 to 3.6	TSSOP-16
AS1535	8	12	400	✓	✓	2.5	3.0 to 5.5	QFN(5x5)-32
AS1536	1	12	73		✓	1.4	2.7 to 5.25	SOIC-150-8
AS1538	8	12	50	✓	✓	1.1	2.75 to 5.25	TSSOP-16
AS1539	8	10	50	✓	✓	1.1	2.75 to 5.25	TSSOP-16
AS1540	4	12	50	✓	✓	1.1	2.75 to 5.25	TQFN(4x4)-16
AS1541	4	10	50	✓	✓	1.1	2.75 to 5.25	TQFN(4x4)-16
AS1542	16	12	1000	✓		2.4	2.75 to 5.25	TSSOP-28
AS1543	8	12	1000	✓		5.2	2.75 to 5.25	TQFN(4x4)-20
AS1544	4	12	1000	✓		5.2	2.75 to 5.25	TQFN(4x4)-20
AS1545	2 x 6	12	2 x 1000	✓	✓	5.2	2.7 to 5.25	TQFN(5x5)-32

D/A Converters

Part No.	Channels	Resolution	INL	DNL	Functionality	Supply Voltage	Package
	#	bit	LSB	LSB		V	
AS1504	8	8	±0.75	±0.5	Mid-Scale Reset Pin	2.7 to 5.5	SOIC-150-16
AS1505	8	8	±0.75	±0.5	Zero-Scale Setting	2.7 to 5.5	SOIC-150-16

Digital Potentiometers

Part No.	Features	Channels	Resistance	Resolution	INL	DNL	Supply Voltage	Supply Current	Package
		#	kOhm	bit	LSB	LSB	V	µA	
AS1500	Volatile	1	10	8	±2	±1	2.7 to 5.5	1	SOIC-8
AS1501	Volatile	1	20	8	±2	±1	2.7 to 5.5	1	SOIC-8
AS1502	Volatile	1	50	8	±4	±1	2.7 to 5.5	1	SOIC-8
AS1503	Volatile	1	100	8	±4	±1	2.7 to 5.5	1	SOIC-8
AS1506-10	Non-Volatile	1	10	8	0.5	0.5	2.7 to 5.5	0.2	TDFN(3x3)-8
AS1506-50	Non-Volatile	1	50	8	0.5	0.5	2.7 to 5.5	0.2	TDFN(3x3)-8
AS1506-100	Non-Volatile	1	100	8	0.5	0.5	2.7 to 5.5	0.2	TDFN(3x3)-8
AS1507-10	Non-Volatile	2	10	8	0.5	0.5	2.7 to 5.5	0.2	TQFN(3x3)-16
AS1507-50	Non-Volatile	2	50	8	0.5	0.5	2.7 to 5.5	0.2	TQFN(3x3)-16
AS1507-100	Non-Volatile	2	100	8	0.5	0.5	2.7 to 5.5	0.2	TQFN(3x3)-16

Data Acquisition Front-Ends

Part No.	Channels	Resolution	Sampling Rate	Fully Differential	Internal Reference	Supply Current	Supply Current	Supply Voltage
	#	bit	ksps			mA @ max speed	mA	V
AS8500	4	16	8	✓	✓	3	1.6	4.9 to 5.1
ASA8501	4	16	8	✓	✓	3	1.6	4.9 to 5.1

High Performance Analog IC Portfolio

Catalog

July 2009

AS1970-AS1975

General Description

The AS1970-AS1975 are single/dual/quad comparators that operate with supplies from 2.5 to 5.5V making them perfect for all 3- and 5-Volt applications. The comparators can also operate with bipolar supplies (±1.25 to ±2.75V), and require very little supply current (down to 8.5µA) with minimal propagation delay (300ns).

Low input bias current (1.0pA typ), low input offset voltage (0.5mV typ), and internal hysteresis (3mV) make these comparators ideal for low-power single-cell applications including power-management and power-monitoring systems.

The comparators are available as the standard products listed below.

Standard Products

Model	Output Type
AS1970/AS1972/AS1974	Push/Pull
AS1971/AS1973/AS1975	Open-Drain

The AS1970/AS1972/AS1974 push/pull output can sink or source current. The AS1971/AS1973/AS1975 open-drain output can be pulled beyond V_{CC} to a maximum of 5.5V > V_{EE}. These open-drain versions are ideal for logic-level translators or bipolar-to-unipolar converters. Large internal output drivers allow Rail-to-Rail output swings with loads of up to 8mA.

The AS1970/AS1971 are available in a 5-pin SOT23 package.
The AS1972/AS1973 are available in a 8-pin MSOP package.
The AS1974/AS1975 are available in a 14-pin TSSOP package.

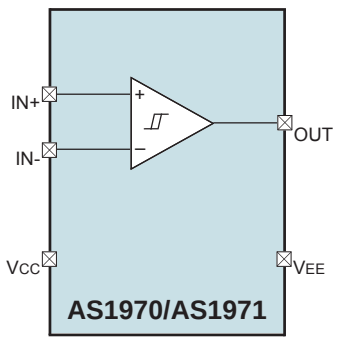
Key Features

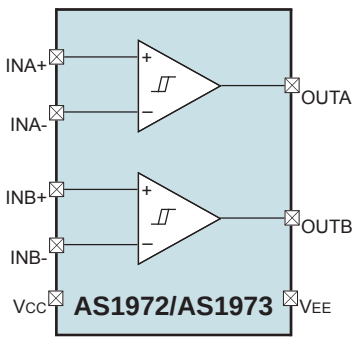
- CMOS push/pull output sinks and sources 8mA (AS1970/AS1972/AS1974)
- CMOS open-drain output voltage extends beyond V_{CC} (AS1971/AS1973/AS1975)
- Quiescent supply current: 8.5µA per comparator
- Internal hysteresis: 3mV
- 3V/5V logic-level translation
- Single-supply operation: 2.5 to 5.5V
- Common-mode input voltage range extends 250mV above the rails
- Low propagation delay: 300ns
- Minimized overall power consumption
- Supply current at 1MHz switching frequency: 80µA
- No phase reversal for overdriven inputs
- 5-pin SOT23 package – AS1970/AS1971
- 8-pin MSOP package – AS1972/AS1973
- 14-pin TSSOP package – AS1974/AS1975

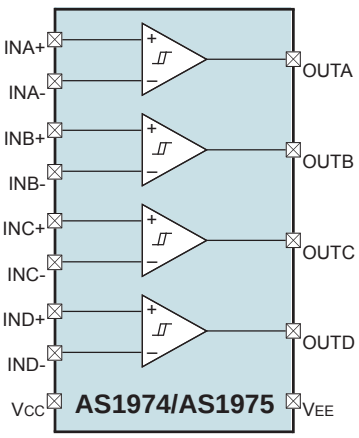
Applications

The devices are ideal for battery-powered systems, mobile communication devices, zero-crossing detectors, window comparators, level translators, threshold detectors/ discriminators, ground/supply-sensing applications, IR receivers or any other space-limited application with low power-consumption requirements.

Block Diagrams







AS1976/AS1977

200nA
Supply Current

General Description

The AS1976/AS1977 are very low-current comparators that can operate beyond the rail voltages and are guaranteed to operate down to 1.8V.

Low input bias current, current-limiting output circuitry, and ultra-small packaging make these comparators ideal for low-power 2-cell applications including powermanagement and power-monitoring systems.

The comparators are available as the standard products listed below.

Standard Products

Model	Output Type	Current
AS1976	Push/Pull	200nA
AS1977	Open-Drain	200nA

The AS1976 push/pull output can sink or source current. The AS1977 open-drain output can be pulled beyond VCC to a maximum of 3.6V > VEE. This open-drain model is ideal for use as a logic-level translator or bipolar-to-unipolar converter.

Large internal output drivers provide rail-to-rail output swings with loads up to 8mA. Both devices feature builtin battery power-management and power-monitoring circuitry.

The AS1976/AS1977 are available in a 5-pin SOT23 package.

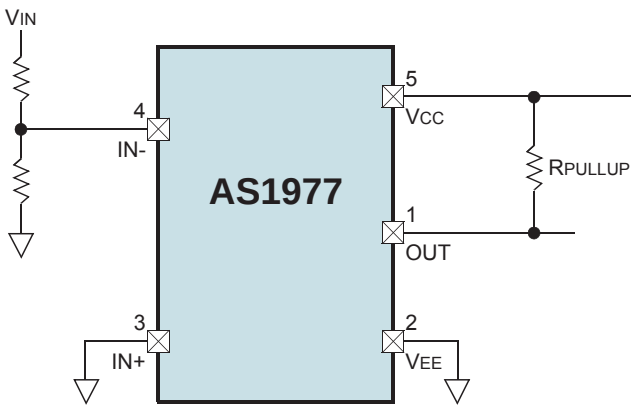
Key Features

- CMOS push/pull output sinks and sources 8mA (AS1976)
- CMOS open-drain output voltage extends beyond VCC (AS1977)
- Ultra-low supply current: 200nA
- Internal hysteresis: 3mV
- Guaranteed to operate down to +1.8V
- Input voltage range operates 200mV beyond the rails
- Crowbar current-free switching
- No phase reversal for overdriven inputs
- 5-pin SOT23 package

Applications

The devices are ideal for battery monitoring/management, mobile communication devices, laptops and PDAs, ultra-low-power systems, threshold detectors/discriminators, telemetry and remote systems, medical instruments, or any other space-limited application with low power-consumption requirements.

Application Diagram



AS7620

General Description

The AS7620 is an easy-to-use, high-efficiency, highvoltage, hysteretic step-down DC-DC converter, operating in asynchronous mode.

Its low-power architecture extends hold-up time in battery-backed and critical applications where maximum up-time over a wide input supply voltage range is needed, while still providing for high efficiencies of up to 90% during peak current demands.

Although the AS7620 is optimized for 24V applications found in industrial and medical systems, its ability to support 100% Duty Cycle makes the AS7620 ideal for applications demanding maximum up-time and soft power fail behavior. In combination with low idle current of only 30µA, on-demand switching reduces operating current at low load currents.

By selecting an appropriate inductor value, operating current can be lowered and switching frequencies tuned to certain load conditions. A pin-strapped current limit input minimizes inductor peak current and thus inductor size and cost for any given application.

The device further includes output short-circuit protection and thermal shutdown. In shutdown mode, only 1µA (typ) of current is consumed.

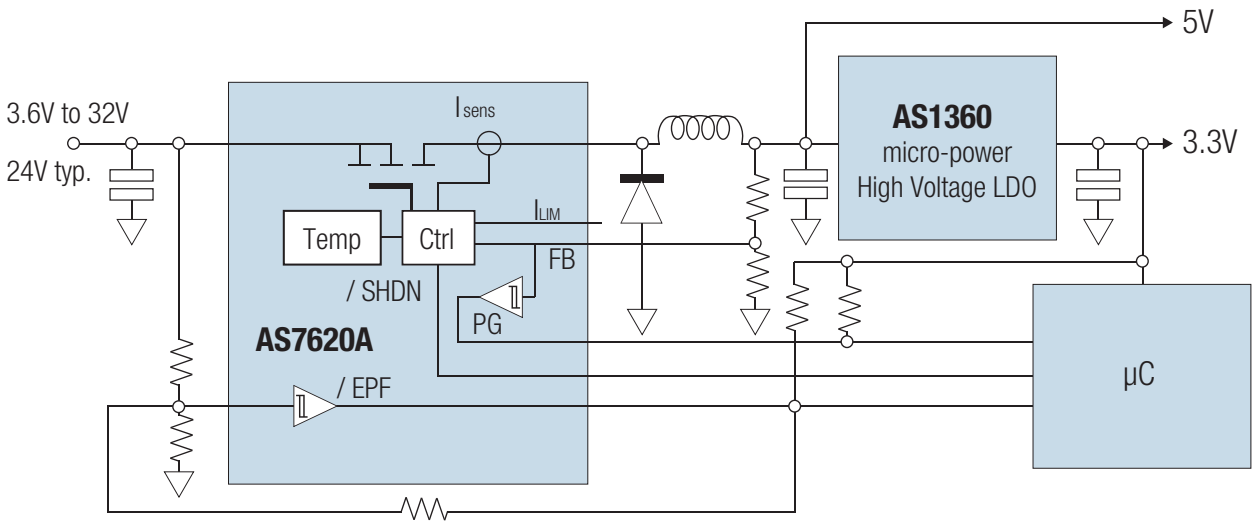
Key Features

- Integrated Power-Good / Early Power Fail Flags
- Low quiescent current
- 100% Duty Cycle
- Integrated PMOS power switch
- Pin-programmable cycle-by-cycle current limit
- Hysteretic Architecture
- Thermal Shutdown
- Resistor-programmable Early Power Fail
- Wide Supply Voltage Range, 3.6V to 32V
- Resistor-programmable Early Power Fail
- Fixed 3.3V and adjustable output (1.2V to VIN)
- Small 4x4mm 12-Lead MLPQ Enhanced Power Package
- Specified from -40ºC to +125ºC junction and 85ºC maximum ambient temperatures

Applications

The AS7620 is suitable for Industrial 24VDC applications such asPLCs, Robotics, Home Security and Building Control applications, Solid-state utility meters, Signage and LED column power, and Sensor interfaces.

Block Diagram



General Description

The AS1324 is a high-efficiency, constant-frequency synchronous buck converter available in adjustable- and fixed-voltage versions. The wide input voltage range (2.7 to 5.5V), automatic powersave mode and minimal external component requirements make the AS1324 perfect for any single Li-Ion battery-powered application.

Typical supply current with no load is 30µA and decreases to ≤1µA in shutdown mode. The highly efficient duty cycle (100%) provides low dropout operation, prolonging battery life in portable systems.

The AS1324 is available as the standard versions listed in Table 1.

Standard Versions

Model	Output Type
AS1324-AD	Adjustable via External Resistors
AS1324-12	Fixed: 1.2V
AS1324-15	Fixed: 1.5V
AS1324-18	Fixed: 1.8V

An internal synchronous switch increases efficiency and eliminates the need for an external Schottky diode. The internally fixed switching frequency (1.5MHz) allows for the use of small surface mount external components. Very low output voltages can be delivered with the internal 0.6V feedback reference voltage.

The AS1324 is available in a 5-pin TSOT-23 package.

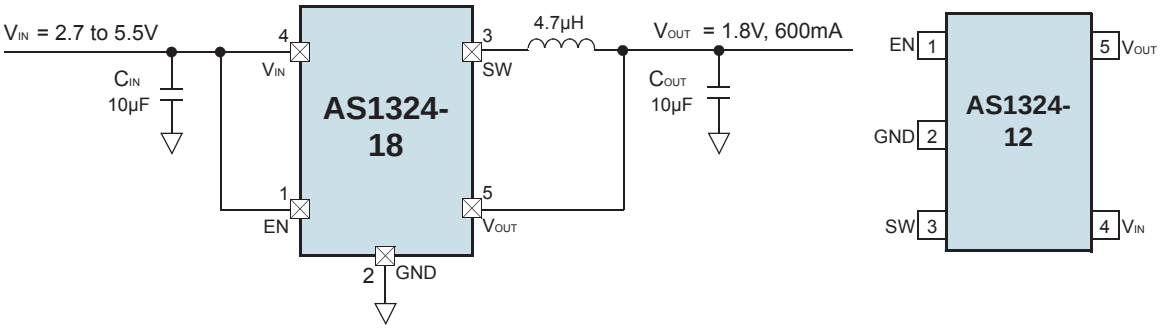
Key Features

- High Efficiency: Up to 96%
- Output Current: 600mA
- Input Voltage Range: 2.7 to 5.5V
- Constant Frequency Operation: 1.5MHz
- Variable- and Fixed-Output Voltages
- No Schottky Diode Required
- Automatic Powersave Operation
- Low Dropout Operation: 100% Duty Cycle
- Low Quiescent Current: 30µA
- Internal Reference: 0.6V
- Shutdown Mode Supply Current: ≤1µA
- Current Mode Operation for Excellent Line/Load Transient Response
- Thermal Protection
- 5-pin TSOT-23 Package

Applications

The device is ideal for mobile communication devices, laptops and PDAs, ultra-low-power systems, threshold detectors/discriminators, telemetry and remote systems, medical instruments, or any other space-limited application with low power-consumption requirements.

Block Diagram



Typical Application Diagram – High Efficiency Step-Down Converter

General Description

to power radiofrequency (RF) power amplifiers (PAs) from a single Li-Ion battery. The device also achieves high-performance in mobile phones and similar RF PA applications.

The AS1332 steps down an input voltage of 2.7V to 5.5V to output voltages ranging from 1.3V to 3.16V. Using a V_{CON} analog input, the output voltage is set for controlling power levels and efficiency of the RF PA.

The RF interferences are minimized due to the fixe-frequency PWM operation. The battery consumption is reduced to 0.01µA (typ.) during shutdown.

Because of the high switching frequencies (2 MHz) tiny surface-mount components can be used. Additional to the small size the amount is also small. Only three external components are requiered, an inductor and two ceramic capacitors.

The AS1332 is available in a 8-pin WL-CSP.

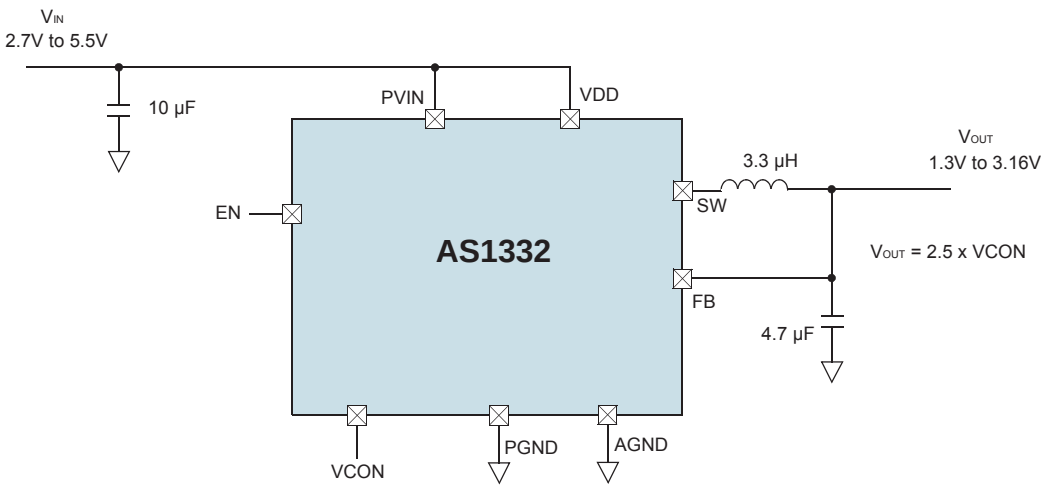
Key Features

- PWM Switching Frequency: 2MHz
- Single Lithium-Ion Cell Operation (2.7V to 5.5V)
- Dynamic Programmable Output Voltage (1.3V to 3.16V)
- Programmable output voltage range: 1.8 to 3.3V in 0.1V steps
- Maximum load capability of 650mA
- High Efficiency (96% Typ at 3.6 V_{IN}, 3.16 V_{OUT} at 400mA) from internal synchronous rectification
- Current Overload Protection
- Thermal Overload Protection
- Supply range: 3 to 5.5V
- Soft Start
- Shutdown current: ≤1µA
- 8-pin WL-CSP

Applications

The AS1332 is an ideal solution for cellular phones, hand-held radios, RF PC cards, and battery powered RF devices.

Block Diagram



Typical Application Circuit

General Description

The AS1333 is a step-down DC-DC converter designed to power portable applications from a single Li-Ion battery. The device also achieves high-performance in mobile phones and other applications requiring low dropout voltage.

The AS1333 steps down an input voltage of 3.25V to 5.5V to a fixed output voltage of 3.09V. Fixed-frequency PWM operation minimizes RF interference. Shutdown function turns the device off and reduces battery consumption to 0.01µA (typ.).

The AS1333 is available in a 8-pin lead free micro SMD package. A high switching frequency (2 MHz) allows use of tiny surface-mount components. Only three small external surface-mount components, an inductor and two ceramic capacitors are required.

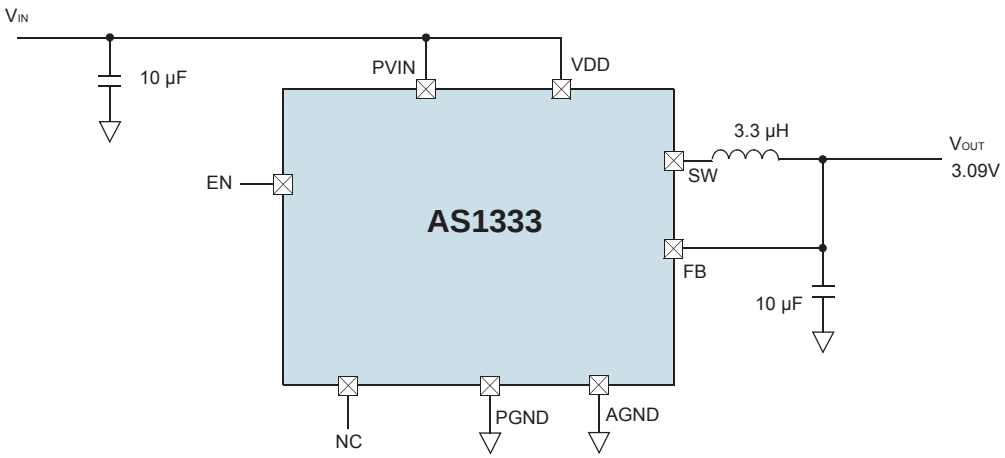
Key Features

- PWM Switching Frequency: 2MHz
- Single Lithium-Ion Cell Operation
- Fixed Output Voltage (3.09V)
- Maximum load capability of 650mA
- High Efficiency (96% Typ at 3.6 V_{IN}, 3.09 V_{OUT} at 400mA) from internal synchronous rectification
- Current Overload Protection
- Thermal Overload Protection
- Soft Start
- Low Dropout Voltage (140 mΩ Typ PFET)
- 8-pin WL-CSP

Applications

The AS1333 is an ideal solution for cellular phones, hand-held radios, RF PC cards, battery powered RF devices, and RFIC chipsets.

Block Diagram



Typical Application Circuit

AS1334

General Description

The AS1334 is a step-down DC-DC converter designed to power portable applications from a single Li-Ion battery. The device also achieves high-performance in mobile phones and other applications requiring low dropout voltage.

The AS1334 steps down an input voltage of 2.7V to 5.5V to a fixed output voltage of 1.2, 1.5, 1.8, 2.5, 3.0, 3.3V.

Fixed-frequency PWM operation minimizes RF interference. Shutdown function turns the device off and reduces battery consumption to 0.01µA (typ.).

The AS1334 is available in a TDFN(3x3) package. A high switching frequency (2 MHz) allows use of tiny surface-mount components. Only three small external surface-mount components, an inductor and two ceramic capacitors are required.

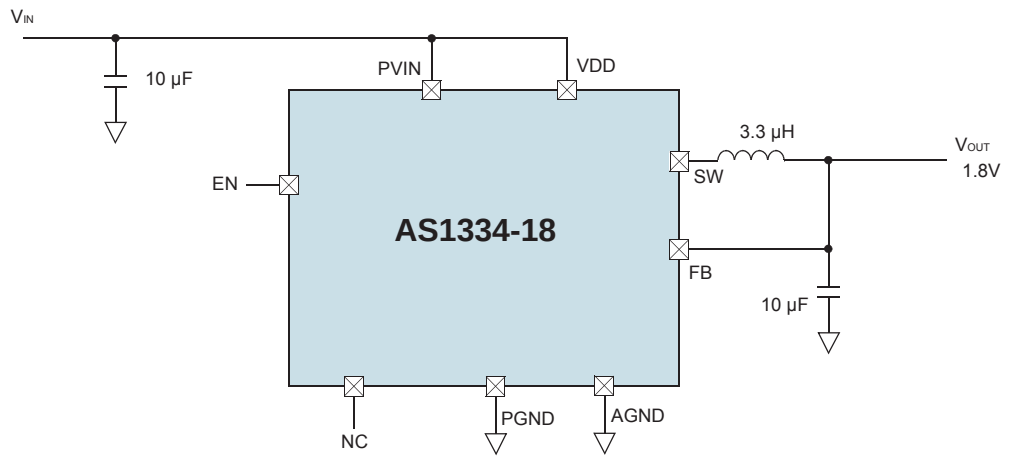
Key Features

- PWM Switching Frequency: 2MHz
- Single Lithium-Ion Cell Operation
- Fixed Output Voltage (1.2 to 3.3V)
- Maximum load capability of 650mA
- High Efficiency (96% Typ at 3.6 V_{IN}, 3.0 V_{OUT} at 400mA) from internal synchronous rectification
- Current Overload Protection
- Thermal Overload Protection
- Soft Start
- Low Dropout Voltage (140 mΩ Typ PFET)
- TDFN(3x3)

Applications

The AS1334 is an ideal solution for cellular phones, hand-held radios, RF PC cards, battery powered RF devices, and RFIC chipsets.

Block Diagram



Typical Application Circuit

General Description

The AS1339 is a high-frequency step-down converter optimized for dynamically powering the power amplifier (PA) in WCDMA or NCDMA handsets.

The device uses a 110mΩ typical bypass FET to power the PA directly from the battery during high-power transmission. The IC integrates two 10mA low-noise, low-dropout regulators (LDOs) for PA biasing.
With a switching frequency of 2MHz, the device allows optimization for smallest solution size or highest efficiency. The AS1339 supports fast switching using small ceramic 10µF input and 4.7µF output capacitors to maintain low ripple voltage.

The AS1339 uses an analog input driven by an external DAC to control the output voltage linearly for continuous PA power adjustment. The gain from REFIN to OUT is 2.5V/V. At high-duty cycle, the device automatically switches to a bypass mode, connecting the input to the output through a low-impedance MOSFET. The LDOs are designed for low-noise operation, wherein each LDO in the device is individually enabled through its own logic control interface.

The device is available in a 16-pin WLP (2x2mm) package.

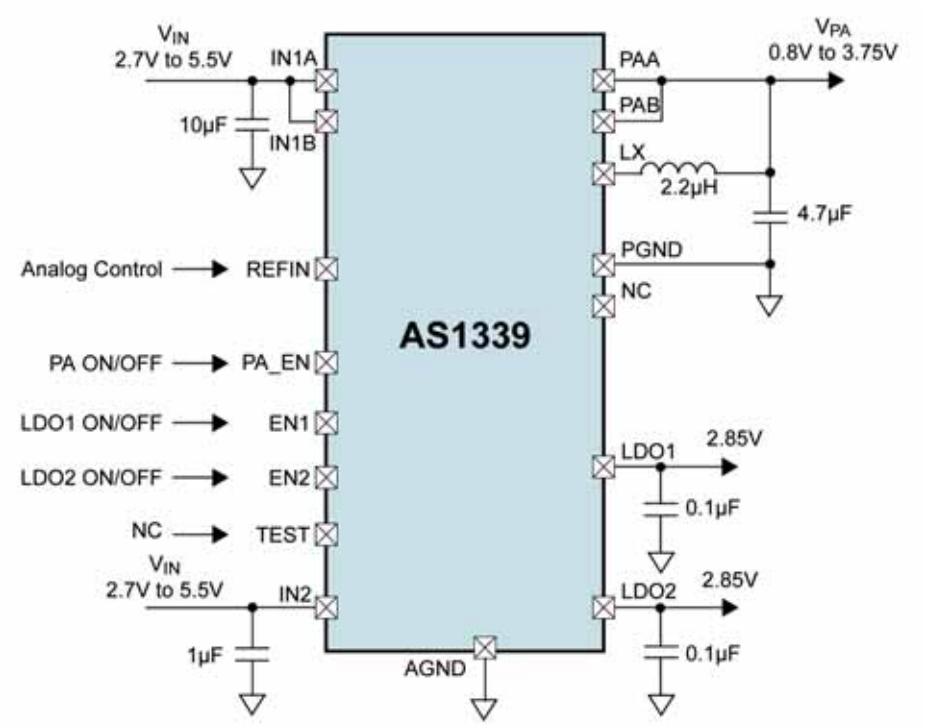
Key Features

- Fixed Switching Frequency: 2MHz
- PA Step-Down Converter
- Low Dropout Voltage
- Low Output-Voltage Ripple
- Dynamic Output Voltage Control (0.8V to 3.75V)
- 30µs Settling Time for 0.8V to 3.4V Output Voltage Change
- 650mA Output Drive Capability
- Two 10mA Low-Noise LDOs
- Low Shutdown Current
- Supply Voltage Range: 2.7V to 5.5V
- Thermal Shutdown
- 16-pin WLP (2x2mm) package

Applications

The AS1339 is ideal for WCDMA/NCDMA cellular handsets, Wireless PDAs, and Smartphones.

Block Diagram



AS1341

General Description

The AS1341 is a high-efficiency step-down converter with adjustable output voltages from 1.25V to VIN using supply voltages of up to 20V.

An integrated current-limited 0.4Ω MOSFET delivers load currents up to 1A.

The AS1341 has a low quiescent current (12µA) to improve light-load efficiency and minimize battery use, and draws only 0.8µA in shutdown mode.

High switching frequencies (up to 200kHz) allow the use of small surface-mount inductors and output capacitors.

The device is available in a TDFN-8 3x3mm pin package.

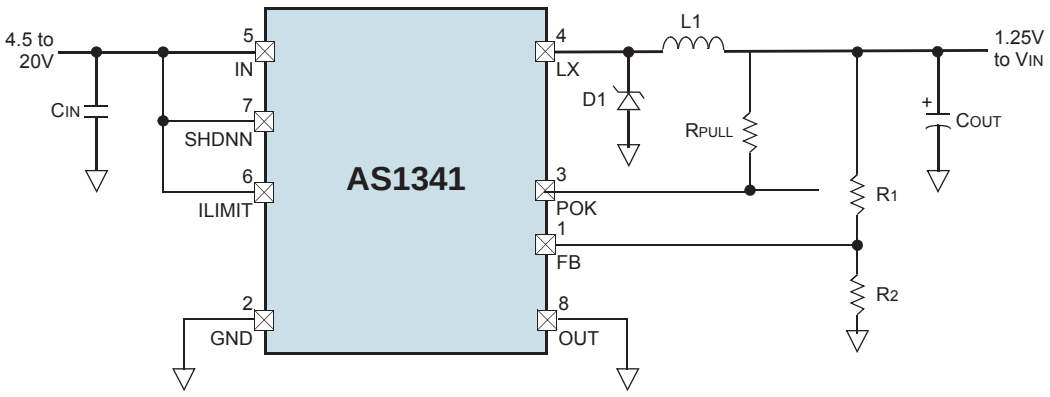
Key Features

- Output voltages: fixed 5V or adjustable between 1.25V to VIN
- Input voltage range: 4.5 to 20V
- Output current: up to 600mA
- Power OK function
- Internal 0.4Ω P-channel MOSFET
- Efficiency: up to 95%
- Quiescent supply current: 12µA
- Shutdown current: 0.8µA
- 100% Maximum duty cycle for low dropout
- Current-limited architecture
- Thermal shutdown
- TDFN-8 3x3mm package

Applications

The device is ideal for laptops, PDAs, MP3 and CD players, portable gaming systems, distributed power systems, keep-alive supplies, and any other batteryoperated, portable device.

Application Diagram



General Description

The AS1301 is a 50mA inductorless step-up converter using a double H-bridge charge-pump topology with two external flying capacitors. The AS1301 runs on a 1MHz fixed frequency and utilizes a low noise regulation scheme to allow usage together with sensitive RF circuitry from the same battery supply.

Designed to reside in portable and space limited equipment the 1MHz charge pump converts a 2.7 to 5.25V input to regulated 5V output with 5% accuracy.

The shutdown function reduces the supply current to <5µA and disconnects the load from the output. The integrated soft-start circuitry prevents current spikes being drawn from the battery during start-up.

The AS1301 is available in TDFN (3x3x0.8mm) 10-pin and WL-CSP 8-bumps packages.

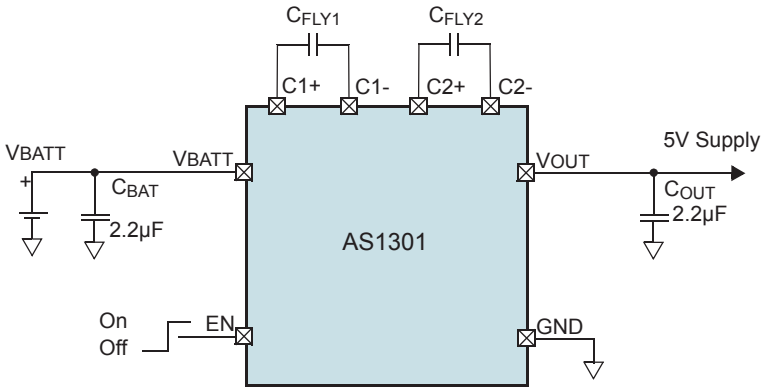
Key Features

- Up to 92% Efficiency
- 2.7 to 5.25V Input Voltage
- Regulated 5V Output
- Automatic Mode Up-Switching
- <5µA Shutdown Current
- 5V Tolerant Enable Signal
- Up to 50mA Load Current
- Overload Protection
- Output Disconnected During Shutdown
- Soft Start
- No Inductor Required
- Small External Components Required
  (C_{OUT} ≤2.2µF, C_{FLY} ≤220nF)
- Low Noise Fixed Frequency 1MHz Charge Pump:
  - 1:1 Battery Feed Through Mode
  - 2:3 Single Phase Mode
  - 1:2 Dual Phase Mode
- Package Options:
  - TDFN (3x3x0.8mm) 10-pin
  - WL-CSP 8-bumps with 0.5mm pitch

Applications

The device is ideal for triple AA cells or single Li-Ion battery cell to 5V conversion, mobile phones, portable instruments, microprocessor based systems, remote data-acquisition systems, inductorless DC-DC conversion.

Block Diagram



AS1302

General Description

The AS1302 is a 30mA inductorless boost converter using a double H-bridge charge-pump topology with two external flying capacitors.

The AS1302 charge pump features 1:2 and 2:3 operation modes as well as a 1:1 operation mode where the input is directly connected to the output.

The AS1302 runs on a 1.2MHz fixed frequency and is utilized with a low noise regulation scheme to allow usage together with sensitive RF circuitry from the same battery supply. Additionally to increase efficiency the AS1302 switches to 49kHz at light loads.

Designed to reside in portable and space limited equipment the 1.2MHz charge pump converts a 2.9V to 5.15V input to regulated 5V output with 3% accuracy.

The shutdown function reduces the supply current to <1µA and disconnects the load from the output. The integrated soft-start circuitry prevents high inrush currents being drawn from the battery during start-up.

The AS1302 includes built-in under-voltage lockout, short circuit-, and thermal protection circuitry.

The AS1302 is available in TDFN (3x3x0.8mm) 10-pin and an extremely small 1.2x1.2mm WL-CSP 8-bumps package with 0.4mm pitch.

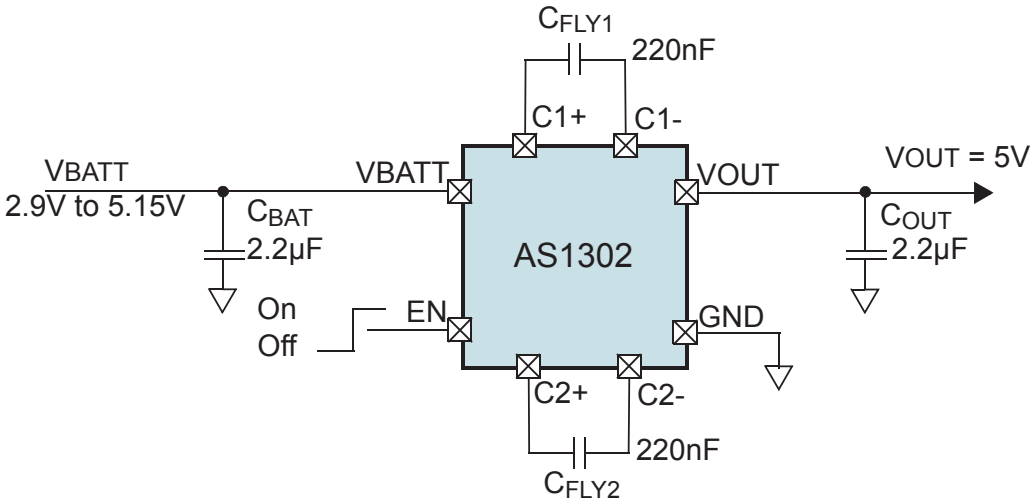
Key Features

- Up to 90% Efficiency
- 2.9V to 5.15V Input Voltage
- Regulated 5V Output
- Automatic Mode Switching
- <1µA Shutdown Current
- Startup with Full Load (within 1ms)
- Up to 30mA Load Current
- Short Circuit Protection
- Output Disconnected During Shutdown
- Soft-Start
- No Inductor Required
- Small External Components Required m(COUT =2.2µF, CFLY =220nF)
- Low Noise Fixed Frequency (1.2MHz, 49kHz)
- Charge Pump:
  - 1:1 Battery Feed Through Mode
  - 2:3 Single Phase Mode
  - 1:2 Single Phase Mode
- Package Options:
  - TDFN (3x3x0.8mm) 10-pin
  - WL-CSP 8-bumps with 0.4mm Pitch

Applications

The device is ideal for two or three AA cells or a single Li-Ion battery cell to 5V conversion, mobile phones, portable instruments, microprocessor based systems and remote data-acquisition systems.

Block Diagram



General Description

The AS1320 is a high-efficiency step-up DC-DC converter designed to generate a fixed voltage of 3.3V.

The AS1320 achieves an efficiency of up to 90%. The minimum input voltage is 1.5V, the output voltage is fixed at 3.3V, and output current is up to 200mA.

In order to save power the AS1320 features a shutdown mode, where it draws less than 1µA. In shutdown mode the battery is connected directly to the output enabling the supply of real-time-clocks.

The AS1320 provides a power-on reset output that goes high-impedance when the output reaches 90% of its regulation point.

The SHDNN trip threshold of the AS1320 can be used as an input voltage detector that disables the device when the battery voltage falls to a predetermined level.

An internal synchronous rectifier is included, thus an external transistor or Schottky diode is not required.

The AS1320 is available in a 6-pin SOT23 package.

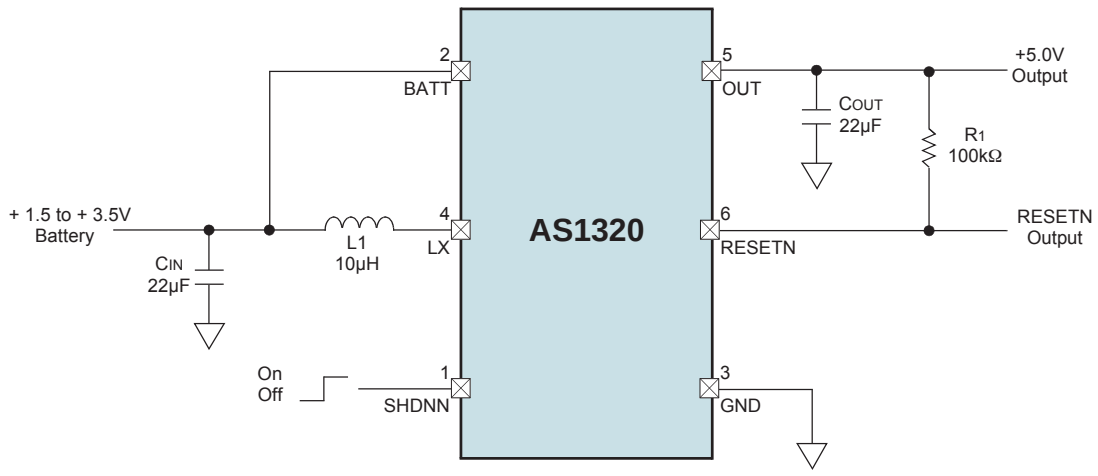
Key Features

- Fixed output voltage: 3.3V
- Output current: up to 200mA
- Internal synchronous rectifier
- Requires no external Schottky Diode or FETs
- Shutdown mode supply current: less than 1µA
- Efficiency: up to 90%
- Minimum input voltage: +1.5V
- Power on reset
- Low-battery cutoff
- Battery input connected to Pin OUT in shutdown Mode for backup power
- 6-pin SOT23 package

Applications

The AS1320 is ideal for low-power applications where ultra-small size is critical as in medical diagnostic equipment, hand-held instruments, pagers, digital cameras, remote wireless transmitters, cordless phones, and PC cards. The device is also perfect as a local 3.3V supply or as a battery backup.

Application Diagram



General Description

The AS1321 is a high-efficiency step-up DC-DC converter designed to generate a fixed voltage of 5.0V.

The AS1321 achieves an efficiency of up to 90%. The minimum input voltage is 1.5V, the output voltage is fixed at 5.0V, and output current is up to 130mA.

In order to save power the AS1321 features a shutdown mode, where it draws less than 1µA. In shutdown mode the battery is connected directly to the output enabling the supply of real-time-clocks.

The AS1321 provides a power-on reset output that goes high-impedance when the output reaches 90% of its regulation point.

The SHDNN trip threshold of the AS1321 can be used as an input voltage detector that disables the device when the battery voltage falls to a predetermined level.

An internal synchronous rectifier is included, which is parallel with the external Schottky diode.

The AS1321 is available in a 6-pin SOT23 package.

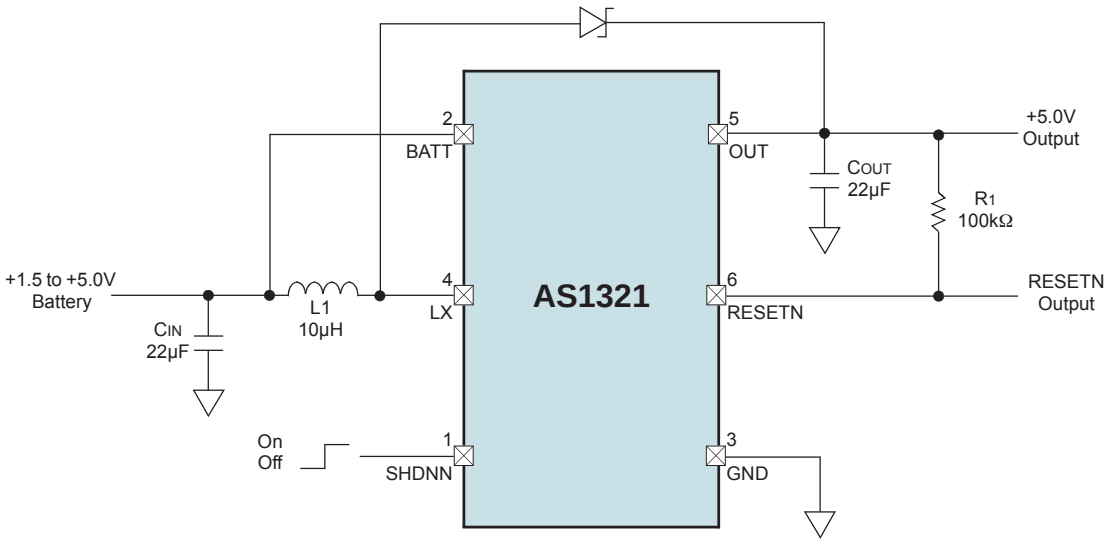
Key Features

- Fixed output voltage: 5.0V
- Output current: up to 130mA
- Internal synchronous rectifier
- Shutdown mode supply current: less than 1µA
- Efficiency: up to 96%
- Minimum input voltage: +1.5V
- Power on reset
- Low-battery cutoff
- Battery input connected to Pin OUT in shutdown mode for backup power
- 6-pin SOT23 package

Applications

The AS1321 is ideal for low-power applications where ultra-small size is critical as in medical diagnostic equipment, hand-held instruments, pagers, digital cameras, remote wireless transmitters, cordless phones, and PC cards. The device is also perfect as a local 5.0V supply or as a battery backup.

Application Diagram



AS1322

General Description

The AS1322A and the AS1322B are synchronous, fixed frequency, very high-efficiency DC-DC boost converters capable of supplying 3.3V at 150mA from a single AA supply. Compact size and minimum external parts requirements make these devices perfect for modern portable devices.

High-speed switching frequency (1.2MHz) and internally compensated PWM current mode design provide highly reliable DC-DC conversion, especially when driving white LEDs. The converters are available as the standard products listed below.

Standard Products

Model	Light Load Switching
AS1322A	Automatic Powersave Operation
AS1322B	Continous Switching

The devices contain two internal MOSFET switches: one NMOS switch and one PMOS synchronous rectifier. Anti-ringing control circuitry reduces EMI by damping the inductor in discontinuous mode, and the devices exhibit extremely low quiescent current (< 1µA) in shutdown. In shutdown mode the battery is connected to the output and VOUT is held atapproximately VIN - 0.6V.

The AS1322A is available in a 6-pin TSOT-23 package.

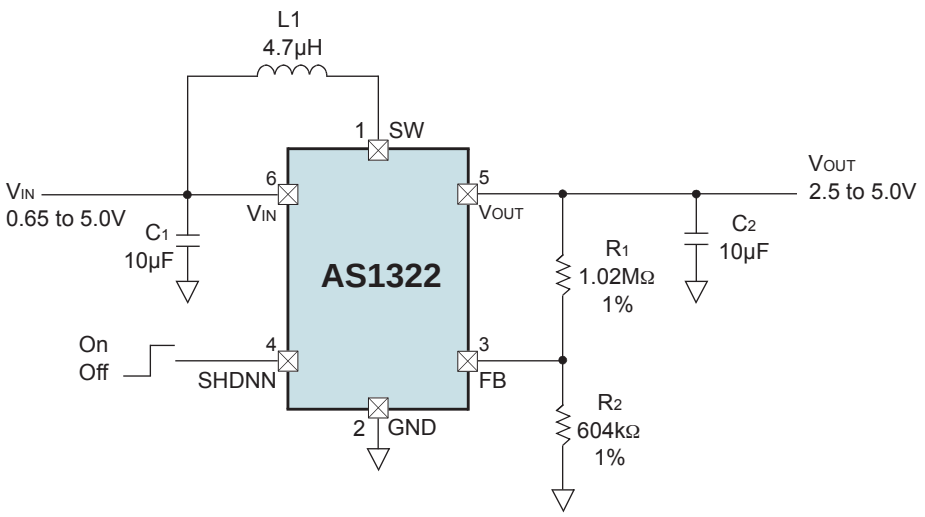
Key Features

- 95% Efficiency
- Single, dual & triple-cell or Li-Ion operation
- Delivers 160mA @ 3.3V (from single AA cell)
- Delivers 220mA @ 5.0V (from two AA cells)
- Delivers 570mA @ 3.3V (from two AA cells)
- Low start-up voltage: 0.85V
- Adjustable output range: 2.5 to 5.0V
- High-speed fixed-frequency: 1.2MHz
- Internal PMOS synchronous rectifier
- Automatic powersave operation (AS1322A)
- Continuous switching at light loads (AS1322B)
- Anti-ringing control minimizes EMI
- Logic controlled shutdown (< 1µA)
- 6-pin TSOT-23 package

Applications

The AS1322 is ideal for low-power applications where ultra-small size is critical as in medical diagnostic equipment, hand-held instruments, pagers, digital cameras, remote wireless transmitters, MP3 players, LCD bias supplies, cordless phones, GPS receivers, and PC cards.

Application Diagram



Low Iq Low Voltage Step-Up DC-DC Converter

AS1323

1.6µA
Quiescent Current

General Description

The AS1323 high-efficiency step-up DC-DC converter was designed specifically for single-cell, battery-powered devices where lowest quiescent current and high efficiency are essential.
The compact device is available in three fixed-voltage variations and is perfect for a wide variety of applications where extremely-low quiescent currents and very-small form factors are critical.

The devices are available as the standard products listed below.

Standard Products

Model	Fixed Output Voltage	Package
AS1323-27	2.7V	TSOT23-5
AS1323-30	3.0V	TSOT23-5
AS1323-33	3.3V	TSOT23-5

Integrated boot circuitry ensures start-up even with veryhigh load currents.

The true output disconnect feature completely disconnects the output from the battery during shutdown.

The device is available in a TSOT23-5 pin package.

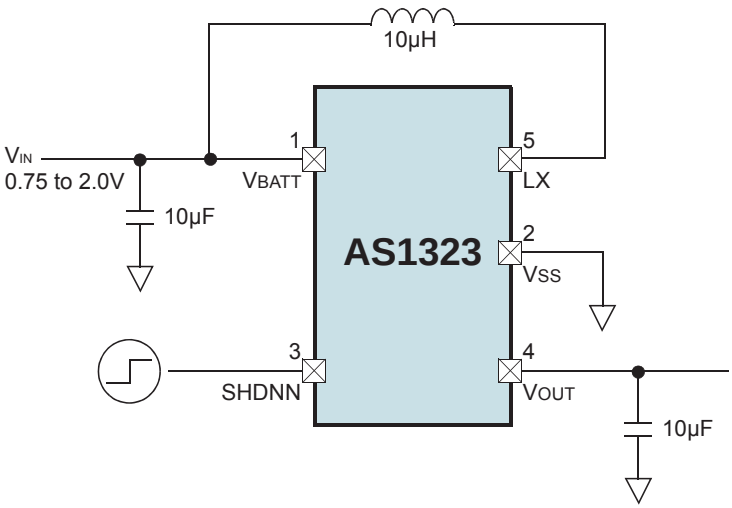
Key Features

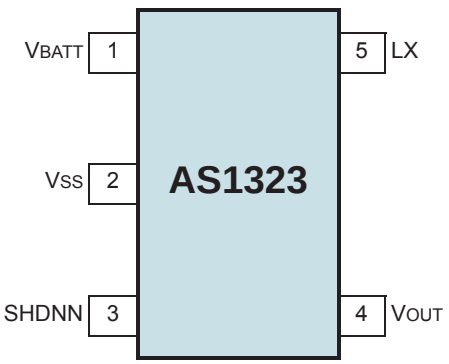
- 1.6µA quiescent current
- Input voltage range: 0.75 to 2V
- Up to 100mA output current
- Fixed output voltages: 2.7, 3.0 and 3.3V
- Shutdown current: 0.1µA
- Output voltage accuracy: ±3%
- Efficiency: up to 85%
- No external diode or FETs needed
- Output disconnect in shutdown
- Guaranteed 0.95V start-up voltage
- TSOT23-5 package

Applications

The devices are ideal for single-cell portable devices including mobile phones, MP3 players, PDAs, remote controls, personal medical devices, wireless transmitters and receivers, and any other battery-operated, portable device.

Application Diagram





General Description

The AS1325 is a high-efficiency step-up DC-DC converter designed to generate a fixed output voltage of 3.3V or 5V.

The AS1325 achieves an efficiency of up to 96% and the minimum input voltage is 1.5V. The AS1325-BSTT-33 delivers up to 300mA output current at the fixed output voltage of 3.3V. With the fixed output voltage of 5V the AS1325-BSST-50 supplies up to 185mA output current.

In order to save power the AS1325 features a shutdown mode, where it draws less than 1µA. In shutdown mode the battery is connected directly to the output enabling the supply of real-time-clocks.

The AS1325 provides a power-on-reset output that goes high-impedance when the output reaches 90% of its regulation point.

The SHDNN trip threshold of the AS1325 can be used as an input voltage detector that disables the device when the battery voltage falls to a predetermined level.

An internal synchronous rectifier is included.

The AS1325 is available in a 6-pin SOT23 package.

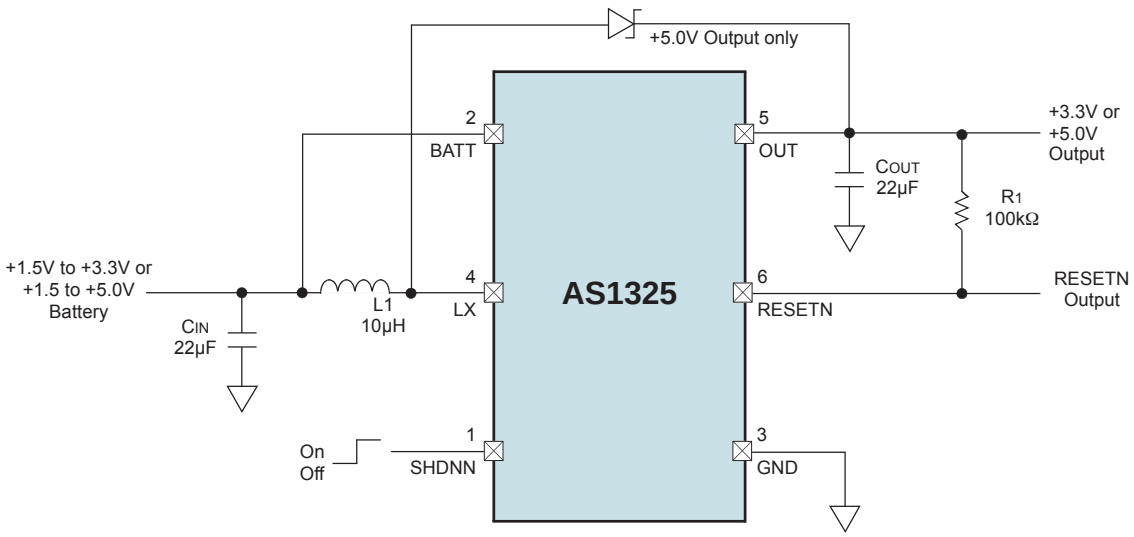
Key Features

- Fixed output voltage: 3.3V (AS1325-BSTT-33) or 5V (AS1325-BSST-50)
- Output current: up to 300mA (AS1325-BSTT-33) and up to 185mA (AS1325-BSST-50)
- Internal synchronous rectifier
- Shutdown mode supply current: less than 1µA
- Efficiency: up to 96%
- Minimum input voltage: +1.5V
- Accurate shutdown low-battery cutoff threshold
- Battery input connected to Pin OUT in shutdown mode for backup power
- Anti-ringing control minimizes EMI
- Ripple reduction at light loads
- 6-pin SOT23 package

Applications

The AS1325 is ideal for low-power applications where ultra-small size is critical as in medical diagnostic equipment, hand-held instruments, pagers, digital cameras, remote wireless transmitters, cordless phones, and PC cards. The device is also perfect as a local supply or as a battery backup.

Application Diagram



High Current 0.8A DC-DC Step-Up Converter

AS1326

800mA
Output Current

General Description

The AS1326A/AS1326B are high-efficiency, high current, DC-DC step-up converters specifically designed for battery-powered wireless applications. Low quiescent supply current (65µA), high operating frequency (1MHz), and minimal external component requirements make these devices perfect for small hand-held applications.

Standard Products

Model	Input Signal Activation
AS1326A	Logic-Low On
AS1326B	Logic-High On

Both devices use synchronous-rectified pulse-width modulation (PWM) boost technology to generate 2.5 to 5.5V outputs from a wide range of inputs, such as 1 to 3 alkaline/NiCd/NiMH cells or a single lithium-ion (Li+) cell. Automatic powersave operation significantly improves efficiency at light-loads.

Continuous switching mode is available for applications requiring constant-frequency operation at all load currents. PWM operation can also be synchronized to an external clock to protect sensitive frequency bands in communications equipment.

Analog soft-start and adjustable current limit permit optimization of efficiency, external component size, and output voltage ripple.
The AS1326A/AS1326B are available in a 10-pin TDFN 3x3 package.

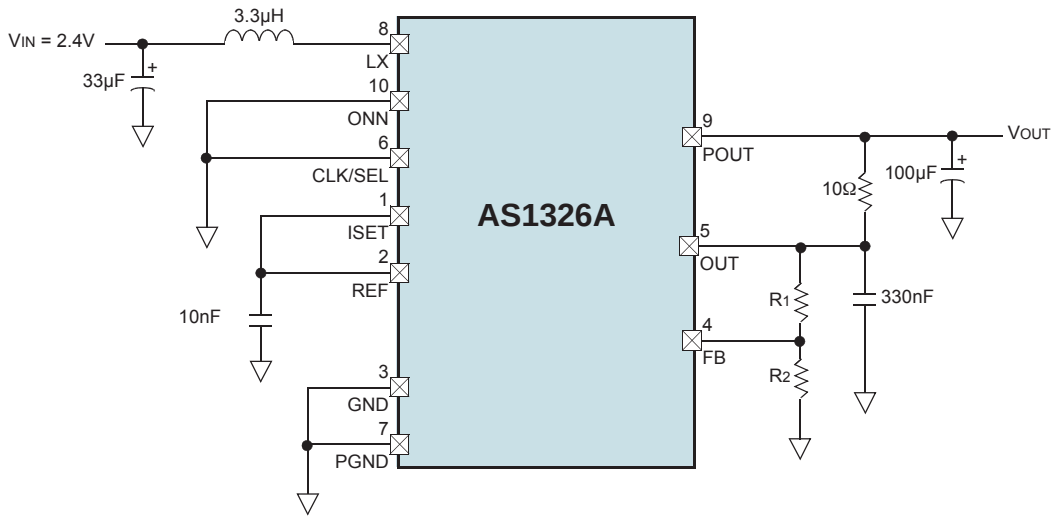
Key Features

- Up to 800mA output
- Constant-frequency (1MHz) operation
- Up to 96% efficiency
- Input range: 0.7 to 5.0V
- Fixed output: 3.3V
- Adjustable output: 2.5 to 5.0V
- PWM synchronous-rectified technology
- Logic-controlled shutdown: 0.1µA
- Synchronizable switching frequency (0.5 to 1.2MHz)
- Adjustable current limit
- Adjustable soft-start
- 10-pin TDFN 3x3 package

Applications

The devices are ideal for digital cordless phones. mobile phones, wireless handsets, hand-held instruments, PDAs, two-way pagers, and any battery-operated equipment.

Application Diagram



General Description

The AS1329A, AS1329B and the AS1329C are synchronous, fixed frequency, very high-efficiency DC-DC boost converters capable of supplying 3.3V at 160mA from a single AA-supply. Compact size and minimum external parts requirements make these devices perfect for modern portable devices.

High-speed switching frequency (1.2MHz) and internally compensated PWM current mode design provide highlyreliable DC-DC conversion, especially when driving white LEDs.

The converters are available as the standard products listed below.

Standard Products

Model	Light Load Switching
AS1329A	Medium Load Automatic Powersave Operation
AS1329B	Light Load Automatic Powersave Operation
AS1329C	Continuous Switching

The devices contain two internal MOSFET switches: one NMOS switch and one PMOS synchronous rectifier.

Anti-ringing control circuitry reduces EMI by damping the inductor in discontinuous mode, and the devices exhibit extremely low quiescent current (< 1µA) in shutdown.

In shutdown mode the battery is connected directly to the output enabling the supply of real-time-clocks.

The AS1329 is available in a 6-pin TSOT-23 package.

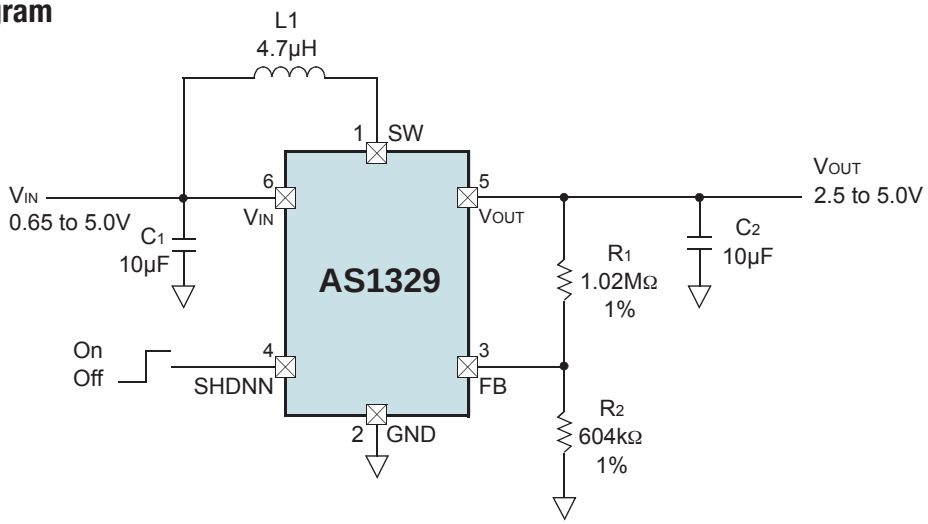
Key Features

- 95% Efficiency
- Single, dual & triple-cell or Li-Ion operation
- Delivers 160mA @ 3.3V (from single AA cell)
- Delivers 220mA @ 5.0V (from two AA cells)
- Delivers 570mA @ 3.3V (from two AA cells)
- Low start-up voltage: 0.85V
- Adjustable output range: 2.5 to 5.0V
- High-speed fixed-frequency: 1.2MHz
- Battery feedthrough
- Internal PMOS synchronous rectifier
- Automatic powersave operation (AS1329A&B)
- Continuous switching at light loads (AS1329C)
- Anti-ringing control minimizes EMI
- Logic controlled shutdown (< 1µA)
- 6-pin TSOT-23 package

Applications

The AS1329 is ideal for low-power applications where ultra-small size is critical as in medical diagnostic equipment, hand-held instruments, pagers, digital cameras, remote wireless transmitters, MP3 players, LCD bias supplies, cordless phones, GPS receivers, and PC cards.

Application Diagram



General Description

The AS1340 step-up converter contains a fully integrated 1.4A switch in a tiny TDFN-8 3x3mm package. The device operates from a 2.7 to 5.5V supply, and can boost voltages up to 50V output. The output voltage can easily be adjusted by an external resistor divider.

The AS1340 uses an unique control scheme providing the highest efficiency over a wide range of load conditions. An internal 1.4A MOSFET reduces external component count, and a fixed high switching frequency (1MHz) allows for tiny surface-mount components. The AS1340 also features power-OK circuitry which monitors the output voltage.

Additionally the AS1340 features a low quiescent supply current and a shutdown mode to save power. During shutdown an output disconnect switch separates the input from the output.

The AS1340 is ideal for LCD or OLED panels with low current requirements and can also be used in a wide range of other applications.

The device is available in a low-profile TDFN-8 3x3mm package.

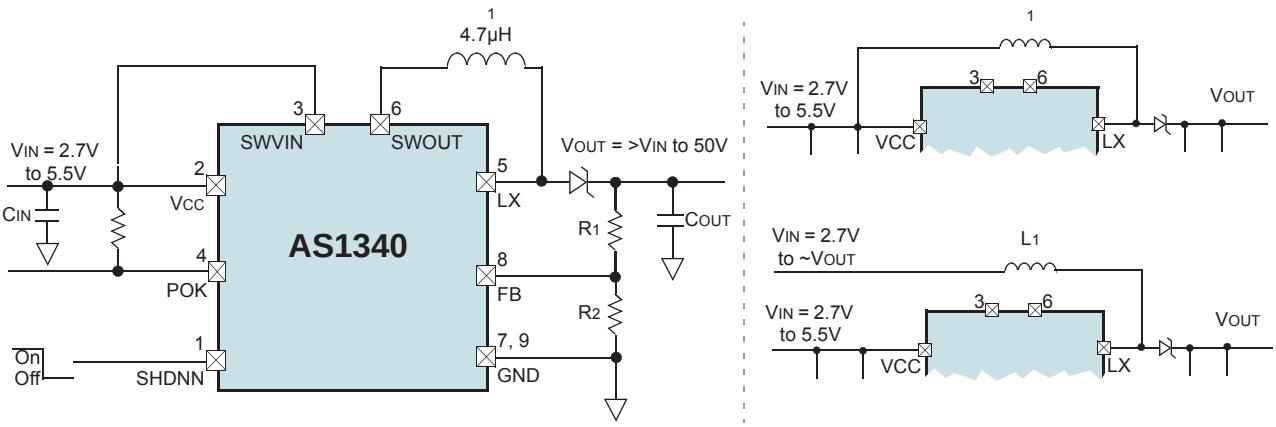
Key Features

- 2.7V to 50V Adjustable Output Voltage
- 2.7V to 50V Input Voltage Range
- 2.7V to 5.5V Supply Voltage Range
- High Output Currents:
  - · 100mA @ 12V from 3.3V VIN
  - · 50mA @ 24V from 3.3V VIN
  - · 30mA @ 36V from 3.3V VIN
- Efficiency: Up to 90%
- Switching Frequency: 1MHz
- Output Disconnect
- Power-OK Output
- Quiescent Current: 30µA
- Shutdown Current: 0.1µA
- TDFN-8 3x3mm Package

Applications

The device is ideal for OLED display power supply, LCD bias generators, mobile/cordless phones, palmtop computers, PDAs and organizers, handy terminals or any other portable, battery-powered device.

Block Diagram



General Description

The AS1343 boost converter contains a 1.4A internal switch in a tiny TDFN-10 3x3mm package. The device operates from a 0.9V to 3.6V supply, and can boost voltages up to 42V output.

The output voltage can easily be adjusted by an external resistor divider.

The AS1343 uses a unique control scheme providing the highest efficiency over a wide range of load conditions. An internal 1.4A MOSFET reduces external component count, and a fixed high switching frequency (1MHz) allows for tiny surface-mount components.

The AS1343 also features power-OK circuitry which monitors the output voltage.

Additionally the AS1343 features a low quiescent supply current and a shutdown mode to save power. During shutdown an output disconnect switch separates the input from the output.

The AS1343 is ideal for LCD or OLED panels with low current requirements and can also be used in a wide range of other applications.

The device is available in a low-profile TDFN-10 3x3mm package.

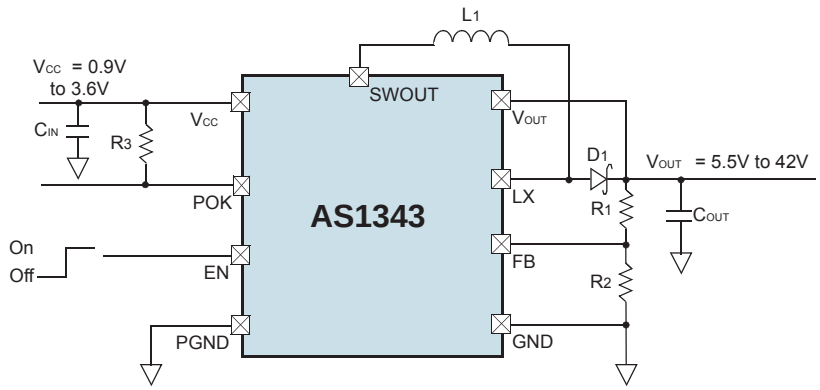
Key Features

- 5.5V to 42V Adjustable Output Voltage
- 0.9V to 3.6V Supply Voltage Range
- High Output Currents:
  - 30mA @ 12V V_{OUT}, from 1.5V V_{CC}
  - 40mA @ 24V V_{OUT}, from 2.5V V_{CC}
- Efficiency: Up to 85%
- Switching Frequency: 1MHz
- Output Disconnect Function
- Power-OK Output
- Quiescent Current: 22µA
- Shutdown Current: 0.1µA
- TDFN-10 3x3mm Package

Applications

The device is ideal for OLED display power supply, LCD bias generators, mobile/cordless phones, palmtop computers, PDAs and organizers, handy terminals, driving LEDs or any other portable, battery-powered device.

Block Diagram



Typical Application Diagram

AS1344

General Description

The AS1344 boost converter contains a 1.4A internal switch in a tiny TDFN-10 3x3mm package.

The device operates from a 0.9V to 3.6V supply, and can boost voltages up to 42V output. The output voltage can easily be adjusted by an external resistor divider.

The AS1344 uses a unique control scheme providing the highest efficiency over a wide range of load conditions. An internal 1.4A MOSFET reduces external component count, and a fixed high switching frequency (1MHz) allows for tiny surface-mount components.

The AS1344 also features power-OK circuitry which monitors the output voltage. The device also offers a Softstart function which limits the current during startup. The current during startup can be easely adjusted with the value of RV. For RV = 0Ω, there is no softstart.

Additionally the AS1344 features a low quiescent supply current and a shutdown mode to save power. During shutdown an output disconnect switch separates the input from the output.

The AS1344 is ideal for LCD or OLED panels with low current requirements and can also be used in a wide range of other applications. The device is available in a low-profile TDFN-10 3x3mm package.

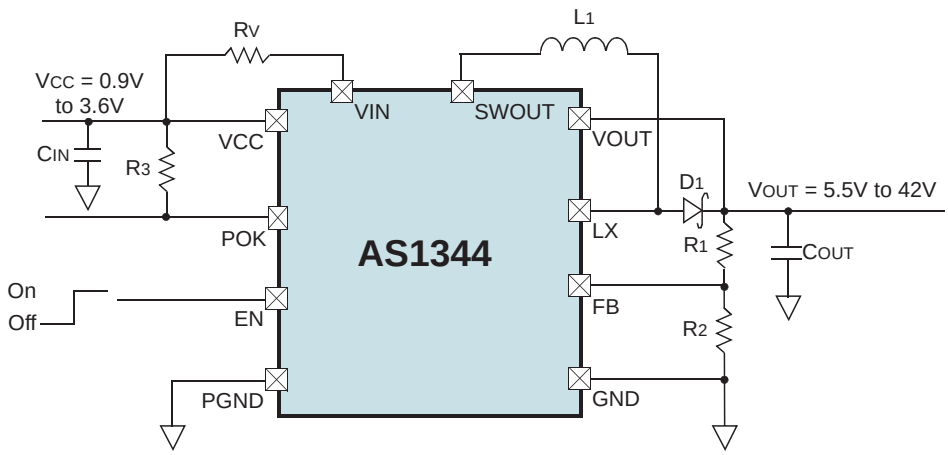
Key Features

- 5.5V to 42V Adjustable Output Voltage
- 0.9V to 3.6V Supply Voltage Range
- High Output Current:
- 30mA @ 12V VOUT, from 1.5V VCC
- Efficiency: Up to 85%
- Switching Frequency: 1MHz
- Output Disconnect Function
- Softstart Function with adjustable Current Limit
- Output Discharge Function
- Power-OK Output
- Quiescent Current: 22µA
- Shutdown Current: 0.1µA
- TDFN-10 3x3mm Package

Applications

The device is ideal for OLED display power supply, LCD bias generators, mobile/cordless phones, palmtop computers, PDAs and organizers, handy terminals, driving LEDs or any other portable, battery-powered device.

Block Diagram



AS1331

General Description

This special device is a synchronous buck-boost DC/DC converter which can handle input voltages above, below, or equal to the output voltage. Due to the internal structure of the AS1331 which is working continuously through all operation modes this device is ideal for dual or triple cell alkaline/NiCad/NiMH as well as single cell Li-Ion battery applications.

Because of the implemented Power Save Mode, the solution footprint and the component count is minimized and also over a wide range of load currents a high conversion efficiency is provided.

The device includes two N-channel MOSFET switches and two P-channel switches. Also following features are implemented: a quiescent current of typically 22µA (ideal for battery power applications), a shutdown current less than 1µA, current limiting, thermal shutdown and output disconnect.

The AS1331 is available in a 10-pin 3x3mm TDFN package with fixed and adjustable output voltage.

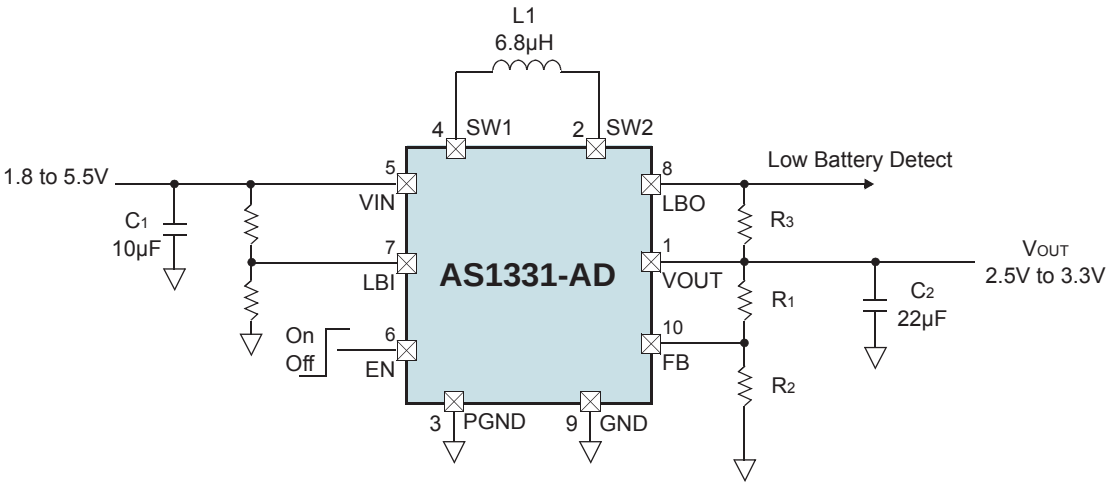
Key Features

- Input Voltage Range: 1.8V to 5.5V
- Output Voltages:
  · Fixed: 2.5V, 3.0V, 3.3V
  · Adjustable: 2.5V to 3.3V
- Output Current: 300mA @ 3.3V
- Up to 90% efficiency
- Power Good
- Output Disconnection in Shutdown
- Automatic transition between Buck and Boost mode
- Ultra Low Quiescent Current: 22µA,
  Shutdown Current <1µA (Active Low)
- Short-Circuit Protection
- Low Battery detection
- Over Temperature Protection
- 10-pin 3x3mm TDFN package

Applications

The AS1331 is an ideal solution for handheld computers, handheld instruments, portable music players and PDAs. Two and three cell Alkaline, NiCd or NiMH or single cell Li battery powered products.

Block Diagram



Dual 200mA LDO with Programmable Output Voltage

AS1351

One Time Programmable

General Description

The AS1351 is a high-performance dual CMOS low-dropout voltage regulator in a single 3x3 package. The efficient set of programmable power supplies is optimized to deliver the best compromise between quiescent current and regulator performance for mobile phones, PDAs, MP3 players, and other battery powered devices.

The one-time-programmable (OTP) function provides greater design flexibility by allowing for independent programming of the output voltage for each regulator onsite. The OTP function allows for fast prototyping, as well as full-production in the field. Factory trimmed versions are also available.

Stability is guaranteed with ceramic output capacitors of only 1µF (±20% – X5R) up to 4.7µF (±20% – X5R). The low equivalent series resistance (ESR) of these capacitors ensures low output impedance at high frequencies.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The low-noise performance allows direct connection of noise sensitive circuits without additional filtering networks.

The AS1351 is available in a 12-pin QFN 3x3 package or in a wafer bumping package.

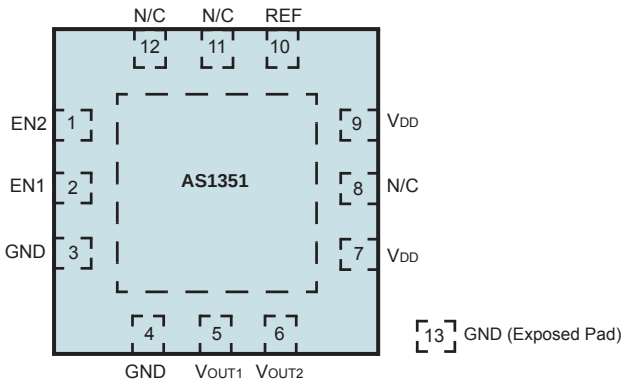
Key Features

- 2 independent voltage regulators with shutdown
- Output current: 200mA each LDO
- One time programmable output voltage (user- or factory-trimmed)
- Programmable output voltage range: 1.8 to 3.3V in 0.1V steps
- Accuracy: ±1.5%
- PSRR: 70dB @ 1kHz, 40dB @ 100kHz
- Line regulation: ±2mV
- Load regulation: ±0.6mV
- Supply range: 3 to 5.5V
- 0.2V dropout voltage @ 200mA
- Shutdown current: ≤1µA
- Supply current without load: 125µA (typ)
- Softstart for low inrush current
- Stable with low ESR ceramic capacitors from 1 to 4.7µF
- Low noise: 40µVRMS @ 10Hz to 100kHz bandwidth
- Thermal protection
- Over-current protection
- Temperature range: -40 to +85°C
- 12-pin QFN 3x3 package

Applications

The AS1351 is ideal for cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held battery-powered device.

Pinout Assignments (Top View)



AS1352

One Time Programmable

General Description

The AS1352 is a high-performance quad CMOS lowdropout voltage regulator in a single QFN package. The efficient set of programmable power supplies is optimized to deliver the best compromise between quiescent current and regulator performance for mobile phones, PDAs, MP3 players, and other battery powered devices.

The one-time-programmable (OTP) function provides greater design flexibility by allowing for independent programming of the output voltage for each regulator onsite. The OTP function allows for fast prototyping, as well as full-production in the field. Factory trimmed versions are also available.

Stability is guaranteed with ceramic output capacitors of only 1µF (±20% – X5R) up to 4.7µF (±20% – X5R). The low equivalent series resistance (ESR) of these capacitors ensures low output impedance at high frequencies.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The low-noise performance allows direct connection of noise sensitive circuits without additional filtering networks.

The AS1352 is available in a 12-pin QFN 4x4 package or a 16-pin QFN 3x3 package.

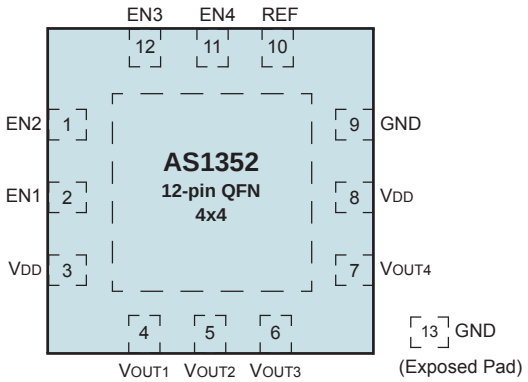
Key Features

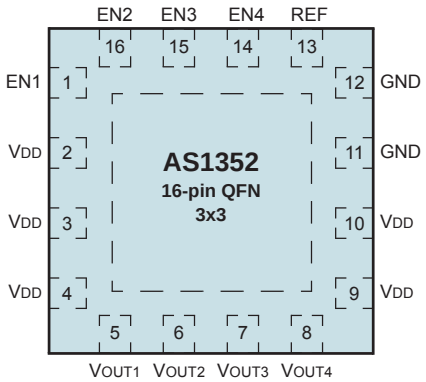
- 4 independent voltage regulators with shutdown
- Output current: 200mA each LDO
- One time programmable output voltage (user- or factory-trimmed)
- Programmable output voltage range: 1.8 to 3.3V in 0.1V steps
- Accuracy: ±2%
- PSRR: 70dB @ 1kHz, 40dB @ 100kHz
- Line regulation: ±2mV
- Load regulation: ±0.6mV
- Supply range: 3 to 5.5V
- 0.2V dropout voltage @ 200mA
- Shutdown current: ≤1µA
- Supply current without load: 225µA (typ)
- Softstart for low inrush current
- Stable with low ESR ceramic capacitors from 1 to 4.7µF
- Low noise: 40µVRMS @ 10Hz to 100kHz bandwidth
- Thermal protection
- Over-current protection
- Temperature range: -40 to +85°C
- 12-pin QFN 4x4 and 16-pin QFN 3x3 packages

Applications

The AS1352 is ideal for cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held battery-powered device.

Pinout Assignments (Top View)





Linear Low-Dropout 150mA Voltage Regulators

AS1353/AS1356

Reverse Battery Protection

General Description

The AS1353/AS1356 are high-performance, fixed-voltage linear LDOs designed for use with capacitors of 1 to 10µF. The devices can deliver superior performance even under low dropout conditions when the power transistor operates in linear mode.

The integrated P-channel MOSFET output allows the devices to maintain a low supply-current at loads of up to 150mA. A shutdown mode includes logic-controlled circuitry, which reduces shutdown current to less than 1µA (max).

Integrated over-temperature and over-current protection circuitry switches the devices off in case of thermal overload or output short-circuit conditions.

The AS1353/AS1356 are optimized for low equivalent series resistance (ESR) output capacitors. Additionally, all devices contain reversed battery protection which disconnects the internal circuitry and parasitic diodes if the battery is connected incorrectly.

The AS1356 also features power-OK circuitry, which can be used to monitor output regulation.

All devices also feature an integrated error amplifier and built-in 1.25V reference, and output current is limited (380mA typ) via the on-chip current limiting circuitry.

Multiple output voltages are available as standard products: 3.6, 3.3, 3.0, 2.7, 2.5, or 1.5V. All devices are available in a 5-pin SOT23 package.

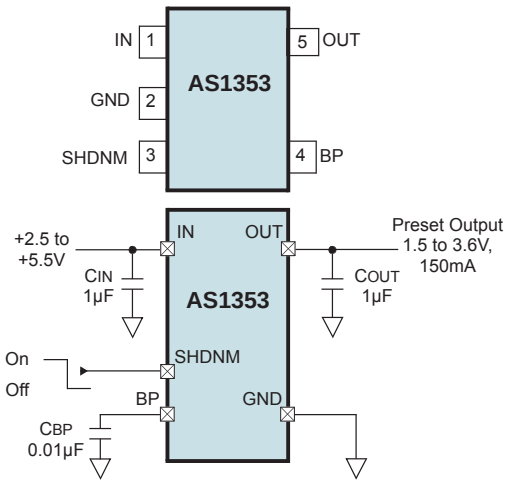
Key Features

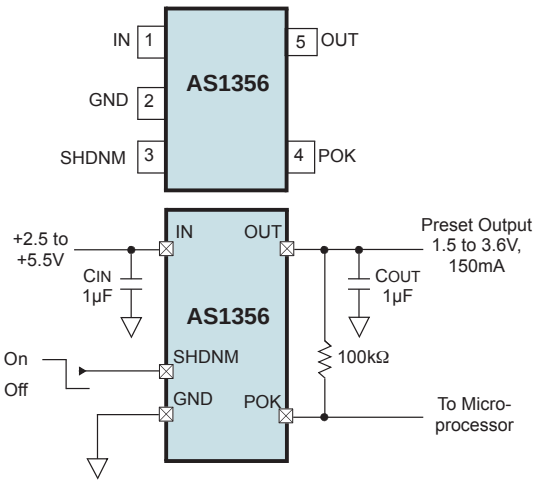
- Ultra-low dropout voltage: 40mV @ 100mA load
- Output voltage range: +1.5 to +3.6V (100mV steps)
- Max output current: 150mA
- Output voltage accuracy: ±1%
- Low shutdown current: 1µA
- High PSRR: 60dB @ 100Hz
- Integrated overtemperature/overcurrent protection
- Reverse-battery protection
- Power-OK output (AS1356 only)
- Minimal external components required
- Operating temperature range: -40 to +85°C
- 5-pin SOT23 package

Applications

The devices are ideal for powering cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held and/or battery-powered device.

Pinout Assignments (Top View)





AS1357

One Time Programmable

General Description

The AS1357 is a high-performance triple CMOS lowdropout voltage regulator in a single QFN package. The efficient set of programmable power supplies is optimized to deliver the best compromise between quiescent current and regulator performance for mobile phones, PDAs, MP3 players, and other battery powered devices.

The one-time-programmable (OTP) function provides greater design flexibility by allowing for independent programming of the output voltage for each regulator onsite. The OTP function allows for fast prototyping, as well as full-production in the field. Factory trimmed versions are also available.

Stability is guaranteed with ceramic output capacitors of only 1µF (±20% – X5R) up to 4.7µF (±20% – X5R). The low equivalent series resistance (ESR) of these capacitors ensures low output impedance at high frequencies.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The low-noise performance allows direct connection of noise sensitive circuits without additional filtering networks.

The AS1357 is available in a 12-pin QFN 4x4 package or a 16-pin QFN 3x3 package.

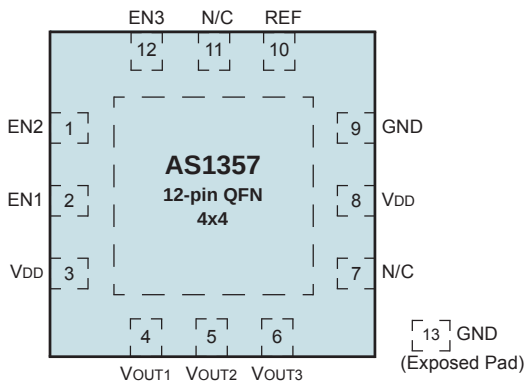
Key Features

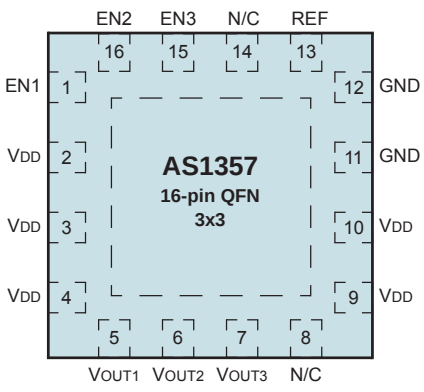
- 3 independent voltage regulators with shutdown
- Output current: 200mA each LDO
- One time programmable output voltage (user- or factory-trimmed)
- Programmable output voltage range: 1.8 to 3.3V in 0.1V steps
- Accuracy: ±1.5%
- PSRR: 70dB @ 1kHz, 40dB @ 100kHz
- Line regulation: ±2mV
- Load regulation: ±0.6mV
- Supply range: 3 to 5.5V
- 0.2V dropout voltage @ 200mA
- Shutdown current: ≤1µA
- Supply current without load: 175µA (typ)
- Softstart for low inrush current
- Stable with low ESR ceramic capacitors from 1 to 4.7µF
- Low noise: 40µVRMS @ 10Hz to 100kHz bandwidth
- Thermal protection
- Over-current protection
- Temperature range: -40 to +85°C
- 12-pin QFN 4x4 and 16-pin QFN 3x3 packages

Applications

The AS1357 is ideal for cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held battery-powered device.

Pinout Assignments (Top View)





300/150mA, Low-Noise, Low-Dropout, High-PSRR Linear Voltage Regulators

AS1358/59

Ultra Low Noise High PSRR

General Description

The AS1358/AS1359 are ultra-low-noise, low-dropout linear regulators specifically designed to deliver up to 150/300mA continuous output current, and can achieve a low 140mV dropout for 300mA load current. The LDOs are designed and optimized to work with low-cost, smallcapacitance ceramic capacitors.

The devices are available as the standard products listed below.

Standard Products

Model	Load Current	Output Voltage
AS1358	150mA	Preset -1.5 to 4.5V
AS1359	300mA	Preset -1.5 to 4.5V

An integrated P-channel MOSFET pass transistor allows the devices to maintain extremely low ground current (40µA).

The AS1358/AS1359 uses an advanced architecture to achieve ultra-low output voltage noise of 9µVRMS and power-supply rejection-ratio of better than 80dB up to 10kHz.

The AS1358/AS1359 requires only 1µF output capacitor for stability at any load. When the LDO is disabled, current consumption drops to below 200µnA.

The devices are available in a TSOT23 5-pin package.

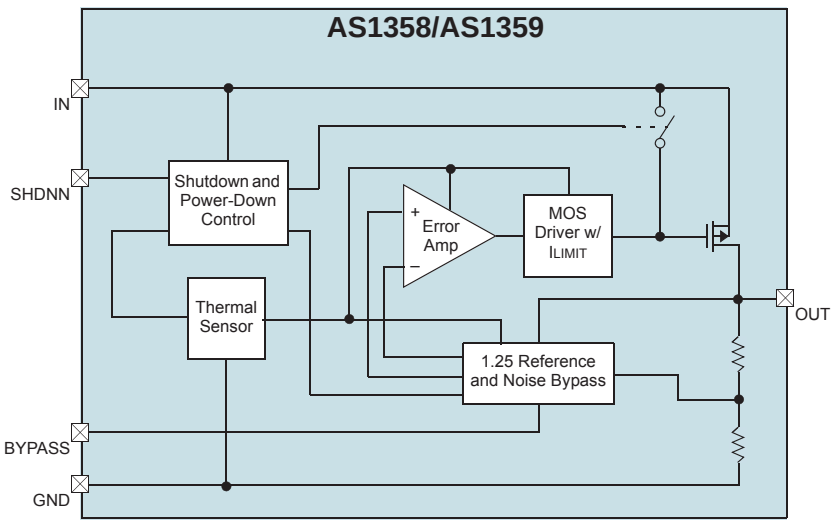
Key Features

- Preset output voltages: 1.5 to 4.5V in 50mV steps
- Output noise: 9µVRMS @ 100Hz to 100kHz
- Power-supply rejection ratio: 92dB @ 1kHz
- Low dropout: 140mV @ 300mA load
- Stable with 1µF ceramic capacitor for any load
- Guaranteed 150/300mA output
- 1.25V internal reference
- Extremely-low ground current: 40µA
- Excellent load/line transient
- Overcurrent and thermal protection
- TSOT23 5-pin package

Applications

The devices are ideal for mobile phones, wireless phones, PDAs, handheld computers, mobile phone base stations, Bluetooth portable radios and accessories, wireless LANs, digital cameras, personal audio devices, and any other portable, battery-powered application.

Block Diagram



AS1360

1.5µA Quiescent Current 20V LDO

General Description

The AS1360 low-power, positive voltage regulator was designed to deliver up to 250mA while consuming only 1.5µA of quiescent current. The device is available in fixed output voltages of 1.8, 2.5, 3.0, 3.3, and 5.0V.

The device features integrated short-circuit and overcurrent protection.

The wide input voltage range, low-dropout voltage, and high-accuracy output voltage makes the device perfectly suited for 2- and 3-cell battery-powered and portable applications.

The low dropout voltage (650mV) prolongs battery life and allows high current in small applications when operated with minimum input-to-output voltage differentials.

The device features very stable output voltage (using only 1µF tantalum or aluminum-electrolytic capacitors), strict output voltage regulation tolerances (±0.5%), and excellent line-regulation.

The AS1360 is available in a 3-pin SOT23 package.

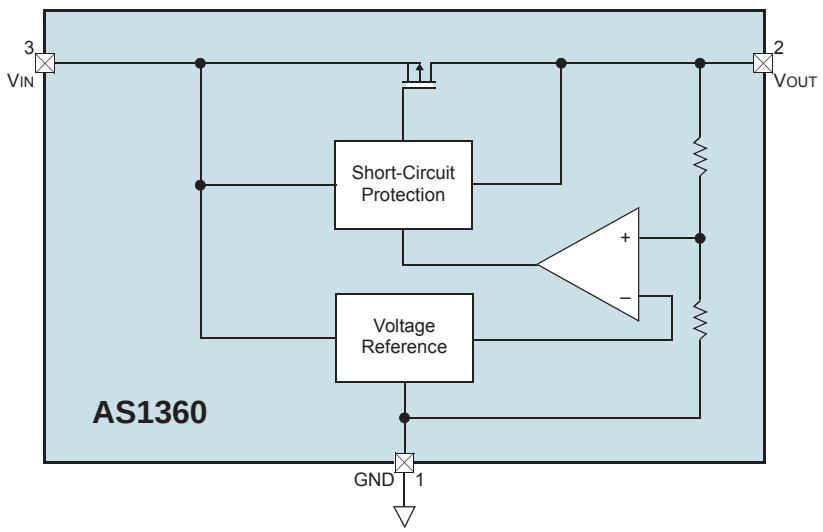
Key Features

- Low quiescent current: 1.5µA
- Input voltage range: up to 20V
- Low dropout voltage
  - 250mV @ 100mA
  - 400mV @ 200mA
- Fixed output voltages: 1.8, 2.5, 3.0, 3.3, 5.0V
- High output current: 250mA (V_{OUT} = 5.0V)
- High-accuracy output voltage: ±1.5%
- Exceptional line regulation: 0.1%/V
- Low temperature drift: ±100ppm/°C
- Integrated short-circuit and overcurrent protection
- 3-pin SOT23 package

Applications

The device is ideal for mobile phones, PDAs, digital cameras, smart battery packs, battery-powered alarms, solar-powered instruments, intelligent instruments, CO2 and smoke detectors, CPU power supplies, and any battery-powered application.

Block Diagram



300/150mA, Low-Noise, Low-Dropout, High-PSRR Linear Voltage Regulators with POK

AS1361/62

Ultra Low Noise High PSRR

General Description

The AS1361/AS1362 are ultra-low-noise, low-dropout linear regulators specifically designed to deliver up to 150/300mA continuous output current, and can achieve a low 140mV dropout for 300mA load current. The LDOs are designed and optimized to work with low-cost, smallcapacitance ceramic capacitors.

The devices are available as the standard products listed in Table 1.

Standard Products

Model	Load Current	Output Voltage
AS1361	150mA	Preset -1.5 to 4.5V
AS1362	300mA	Preset -1.5 to 4.5V

An integrated P-channel MOSFET pass transistor allows the devices to maintain extremely low ground current (40µA).

The AS1361/AS1362 uses an advanced architecture to achieve ultra-low output voltage noise of 9µVRMS and power-supply rejection-ratio better then 80dB up to 10kHz.

The AS1361/AS1362 requires only 1µF output capacitor for stability at any load. When the LDO is disabled, current consumption drops to below 200µnA.

The devices are available in a TSOT23 6-pin package.

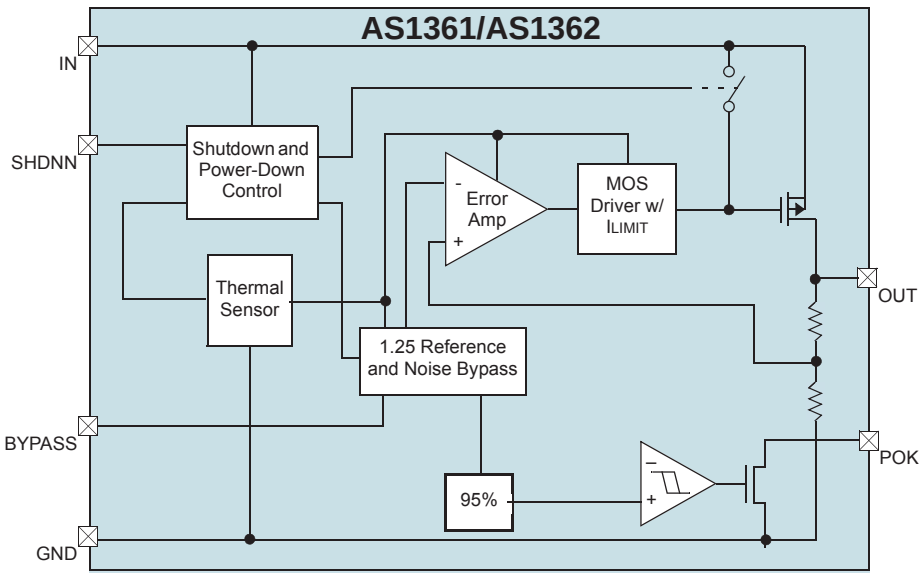
Key Features

- Preset output voltages: 1.5 to 4.5V in 50mV steps
- Output noise: 9µVRMS @ 100Hz to 100kHz
- Power-supply rejection ratio: 92dB @ 1kHz
- Low dropout: 140mV @ 300mA load
- Stable with 1µF ceramic capacitor for any load
- Guaranteed 150/300mA output
- 1.25V internal reference
- Extremely-low ground current: 40µA
- Excellent load/line transient
- Overcurrent and thermal protection
- TSOT23 6-pin package

Applications

The devices are ideal for mobile phones, wireless phones, PDAs, handheld computers, mobile phone base stations, Bluetooth portable radios and accessories, wireless LANs, digital cameras, personal audio devices, and any other portable, battery-powered application.

Block Diagram



General Description

The AS1363 is a low-dropout linear regulator that operates from a +2.0 to +5.5V supply and delivers a guaranteed 500mA load current with low 150mV dropout.

The device is aviable in two versions. One version has a high-accuracy output with a preset voltage (1.5, 1.8, 3.0, 3.3, or 4.5V). This voltage is internally trimmed and also offers a Bypass pin. With an capacitor connected to this Bypass pin, the PSRR and the Noise performance is improved.

At the other version the output voltage is user-adjustable (1.2V to 5.3V) and offers an SET pin for setting the output voltage.

A low supply current (65µA typ.) at maximum load is making the device ideal for portable battery-operated equipment.

Other features are included such as an active-low opendrain reset output that indicates when the output is out of regulation, a low-current (30nA typ.) shutdown mode, an integrated short-circuit and a thermal shutdown protection.

The AS1363 is available in a 6-pin SOT23 package.

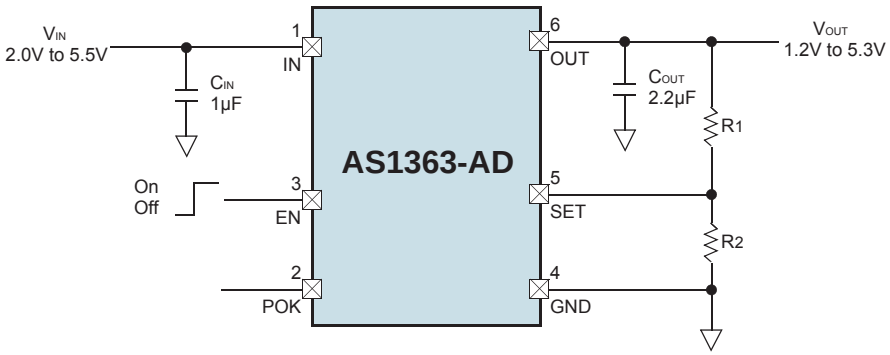
Key Features

- Guaranteed Output Current: 500mA
- Low Dropout: 150mV @ 500mA
- Output Voltage Accuracy: ±0.75% @ 25°C
- Fixed Output Voltage: 1.5, 1.8, 3.0, 3.3, 4.5V
- User-Adjustable Output Voltage: 1.2V to 5.3V
- Power OK Output
- Low Quiescent Current: 40µA
- Low Shutdown Current: 30nA
- Thermal Overload Protection
- Output Current Limit
- 6-pin SOT23 Package

Applications

The device is ideal for laptops, PDAs, portable audio devices, mobile phones, cordless phones, and any other battery-operated portable device.

Block Diagram



Typical Application Circuit

1A, Low-Dropout Linear Voltage Regulator

AS1364

General Description

The AS1364 is a low-dropout linear regulator (LDO) designed to operate from 2V to 5.5V input, that delivers a wide range of highly accurate (±0.75%) factorytrimmed output voltages as well as adjustable output voltages (using an external resistor-divider network).

The ultra-low dropout device requires only 140mV dropout voltage while delivering a guaranteed 1A load current and is therefore perfectly suited for battery-operated portable applications.

Additionally the AS1364 offers extremly low 10µVRMS (100Hz to 100kHz) or 45µVRMS (10Hz to 1MHz) output voltage noise.

Standard Products

Model	Output Type	BYP	SET
AS1364-AD	Adjustable	No	Yes
AS1364-_ _	Fixed	Yes	No

The device features an internal PMOS pass transistor (for a low supply current of only 35µA), reset output, a low-power shutdown mode, and protection from shortcircuit and thermal-overload conditions.

The AS1364 is available in an 8-pin TDFN 3x3mm package.

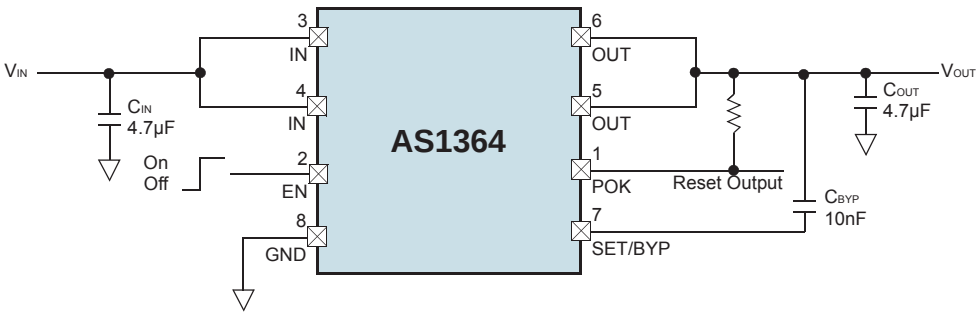
Key Features

- Guaranteed Output Current: 1A
- Low Dropout: 140mV @ 1A
- Output Voltage Accuracy: Up to ±0.75%
- 2.0 to 5.5V Input Voltage
- Fixed V_{OUT}: 1.2 to 5.0V
- Adjustable V_{OUT}: 1.2 to 5.3V
- Low Ground Current: 35µA
- Low Shutdown Current: 10nA
- Low Output Noise: 45µVRMS (from 10Hz to 1MHz)
- Thermal Overload Protection
- Output Current Limit
- 8-pin TDFN 3x3mm Package

Applications

The device is ideal for laptops, PDAs, portable audio devices, mobile phones, cordless phones, and any other battery-operated portable device.

Block Diagram



Typical Application Diagram

General Description

The AS1367 is a precise, low noise, high speed, low dropout regulator with adaptive operation. Features included are high ripple rejection and low dropout voltage, a reference voltage source, an error amplifier and a current limiter.

The AS1367 provides high speed operation, low power consumption and high efficiency by automatically switching between a light load and a heavy load mode depending upon the output current level.
The EN function enables the output to be turned off, while the electric charge at the output capacitor is discharged via the internal auto-discharge resistance, and as a result the VOUT pin quickly returns to the GNDlevel.

Furthermore a Bypass Pin is included to reduce noise. The device features integrate short-circuit and over current protection. Under-Voltage lockout prevents erratic operation when the input voltage is slowly decaying. Thermal Protection shuts down the device when die temperature reaches 150°C. This is a useful protection when the device is under sustained short circuit conditions.

The device is available in a 8-pin TDFN 2x2 package.

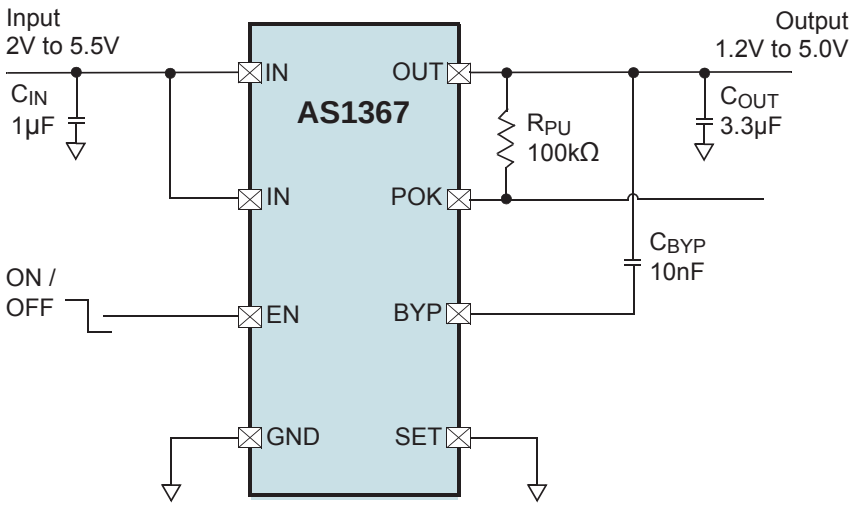
Key Features

- Low Dropout Voltage: 100mV @ 100mA load
- Operating Input Voltage Range: 2.0V to 5.5V
- Output Voltage Range: 1.2V to 5.0V (50mV steps)
- Max. Output Current: 150mA
- Low Shutdown Current: 100nA
- High PSRR: 60dB @ 100kHz
- Integrated Overtemperature/Overcurrent Protection
- Under-Voltage Lockout Feature
- Chip Enable Input
- Power-OK
- Low Quiescent Current: 10µA
- Low Output Noise: 15µV @ 100kHz Bandwidth
- Operating Temperature Range: -40°C to +85°C
- 8-pin TDFN 2x2 Package

Applications

The AS1367 is ideal for cellular phones, cordless phones, wireless communication equipment, portable games, cameras, video recorders, portable audio-video equipment and personal digital assistants.

Block Diagram



200mA Ultra-Compact Low Dropout Regulator
AS1369

General Description

The AS1369 is an ultra compact high-performance low dropout 200mA voltage regulator designed for use with very-low ESR output capacitors. The device delivers superior performance in all specifications critical to battery-powered designs, and is perfectly suited for mobile phones, PDAs, MP3 players and other battery powered devices.

The AS1369 is working with small input and output capacitors of only 0.47µF offering PSRR of 72dB typical and a noise level of 30µVRMS. Typical quiescent current is around 25µA while in shutdown the AS1369 requires less than 0.1µA current. Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The AS1369 offers excellent low-noise performance requiring no external bypass capacitance. Multiple output voltage options between 1.2 and 5.0V in 100mV steps are available and the the minimum input voltage is as low as 2.0V (depending on the output voltage version), so the component can be used with upcoming battery technologies.

The AS1369 is available in a 4-bump WL-CSP package.

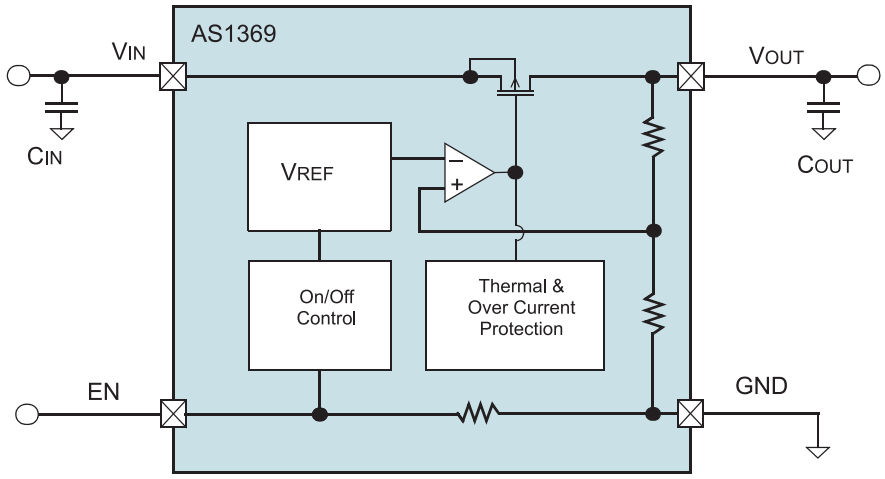
Key Features

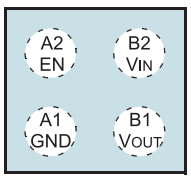
- Low Dropout Voltage: typ. 40mV @ 100mA
- 200mA High Maximum Load Current
- 2.0 to 5.5V Input Voltage
- 1.2 to 5.0V Output Voltage (in 100mV steps)
- High Accuracy: ±2% Over Temperature
- Thermal and Over Current Protection
- 25µA Quiescent Current
- <0.1µA Standby Current
- High PSRR: 72dB @ 1kHz
- No Noise Bypass Capacitor Required
- Low Noise: 30µVRMS
- Enable Pin
- Package: 4-bump WL-CSP 0.5mm pitch

Applications

The device is ideal for mobile communication, battery powered systems and any electronic equipment.

Block Diagram





(WLP; Top Through View)

AS13985

General Description

The AS13985 is a high-performance low-dropout 150mA voltage regulator designed for use with very-low ESR output capacitors. The device can deliver superior performance in all specifications critical to battery-powered designs, and is perfectly suited for mobile phones, PDAs, MP3 players, and other battery powered devices.

Stability is guaranteed with a ceramic output capacitor of from 1 to 22µF. The low equivalent series resistance (5Ω) of these capacitors ensures low output impedance at high frequencies.

Automatic sleep mode requires less than 1µA quiescent current when pin EN is pulled low.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

A 10nF bypass capacitor can be added to reduce output noise to 30µV. The low-noise performance allows direct connection of noise sensitive circuits without additional filtering networks.

Multiple output voltage options are available as standard products. The AS13985 is available in a 5-bump WL-CSP or a 5-pin SOT23 package.

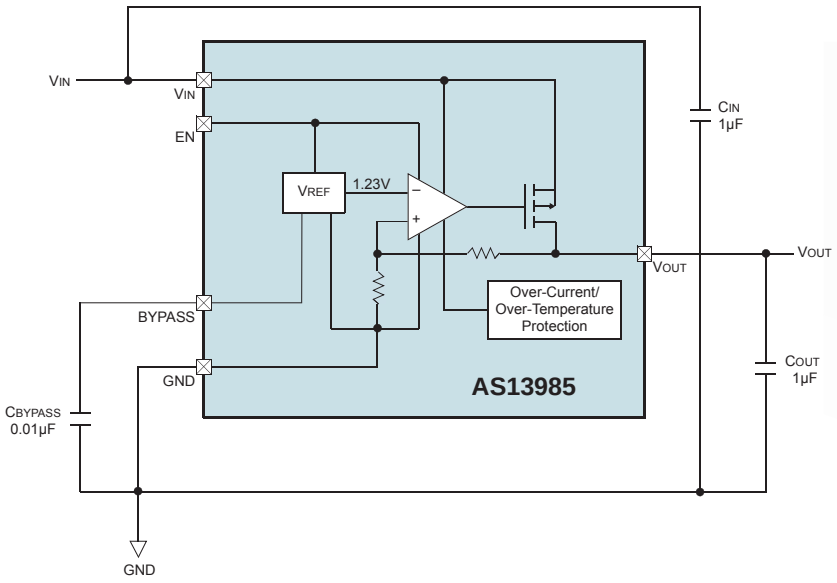
Key Features

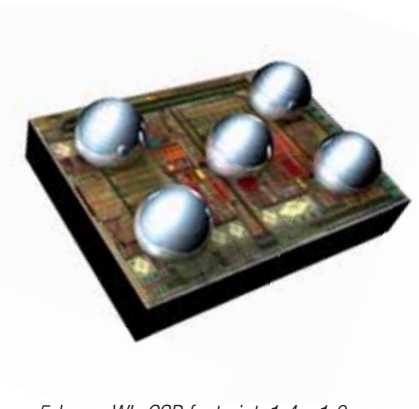
- Ultra-low dropout voltage: (45mV @ 150mA, 0.3mV @ 1mA)
- Supply range: 2.5 to 5.5V
- Output voltage range: 1.2 to 5.0V (in 25mV steps)
- Output current: 150mA (guaranteed)
- Stable with low-ESR output capacitor
- Integrated over-temperature/over-current protection
- Low GND pin current (only 95µA)
- Output voltage accuracy: 1%
- Minimal external components required
- High peak-current capability
- Low shutdown current: ≤1µA
- Operating temperature junction range: -40 to +125°C
- 5-bump WL-CSP and 5-pin SOT23 package

Applications

The AS13985 is ideal for powering cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held battery-powered device.

Application & Package Diagrams





5-bump WL-CSP footprint: 1.4 x 1.0mm

Dual 150mA Ultra-Low Dropout Low-Noise LDO

AS13986

General Description

The AS13986 dual low-dropout regulator provides up to 150mA at each output using a 2.5 to 5.5V input voltage. The ultra-low drop-out voltage, low quiescent current, and low noise make the AS13986 perfect for low-power, battery-operated applications.

Regulator ground current increases only slightly in dropout, extending the battery life in low-power applications.

The device features excellent power supply rejection (55dB at 1KHz and 50dB at 10KHz). The high power supply rejection is maintained down to low input voltage levels used in battery operated devices.

Integrated shutdown logic control function is available for each output. In cases where the device is used as a local regulator it is possible to some of the circuitry into standby mode, thus decreasing total power consumption.

The AS13986 was specifically designed to work with low-ESR ceramic capacitors.

The AS13986 is available in a 8-bump WL-CSP.

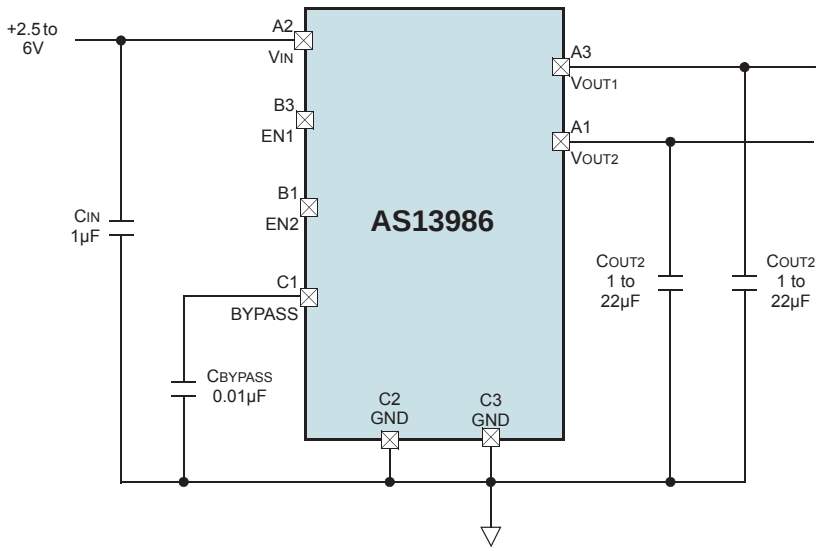
Key Features

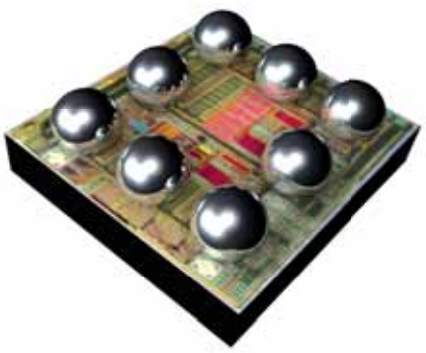
- Input voltage: 2.5 to 5.5V
- Dual output voltages: 1.2 to 5.0V (in 50mV steps)
- Ultra-low dropout voltage: 45mV @ 150mA load, 0.3mV @ 1mA load
- Very low quiescent current: 135µA @ no load, 255µA @ 150mA load, 2µA @ off mode
- Guaranteed output current up to 150mA
- Fast turn-on time: 120µs
- Logic-controlled shutdown
- Up to 1% output voltage accuracy
- Integrated current-limit and thermal overload protection
- Output low-noise voltage: 30µVRMS (10Hz to 100kHz)
- Supply voltage rejection: 55dB @ 1kHz, 50dB @ 10kHz
- Stable with low-ESR ceramic capacitors
- Temperature range: -40 to +125°C
- 8-bump WL-CSP

Applications

The device is ideal for powering cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other hand-held battery-powered device.

Application & Package Diagrams





8-bump WL-CSP footprint: 1.55 x 1.55mm

General Description

The AS3603 is a highly-integrated CMOS power management device designed specifically for portable devices such as any mobile phone standard, PDAs, CD players, digital cameras and other devices powered by 1-cell lithium-based or 3- to 4-cell nickel-based batteries.

The device incorporates low dropout regulators (LDOs), DC/DC converters, a complete battery charger, and an audio power amplifier onto one DIE.

The linear analog LDOs feature extremely high performance regarding:
- Noise – typ 30µVRMS from 100Hz to 100kHz
- Line/Load Regulation ≤ 1mV static and < 10mV transient
- Power Supply Rejection ≥ 70dB @ 1kHz

The integrated Step Down DC/DC Converter does not require an external Schottky diode yet provides very high efficiency (up to 95%) throughout the whole operating range. It can be either used as a stand-alone device or as a pre-regulator for LDOs to increase overall device efficiency.

A Step Up DC/DC Converter is included to supply power for white LEDs together with programmable current sources to control LED brightness.

A low-distortion audio power amplifier (1 Watt @ 8Ω) supports handsfree mobile phone operation and HiFi ringtones.

The device also features a chemistry-independent battery charger including fuel gauge circuitry, automatic trickle charging, programmable constant current, constant voltage and pulse charging.

The AS3603 is controlled via a serial interface and integrates all necessary system specific functions such as Reset, Watchdog, and Power-On Detection.

Regulator output voltages are programmable by software. Eight preset startup timings can be selected by an external resistor.

This data sheet is applicable for device versions:
- AS3603-Jxx-x
- AS3603-Hxx-x

Key Features

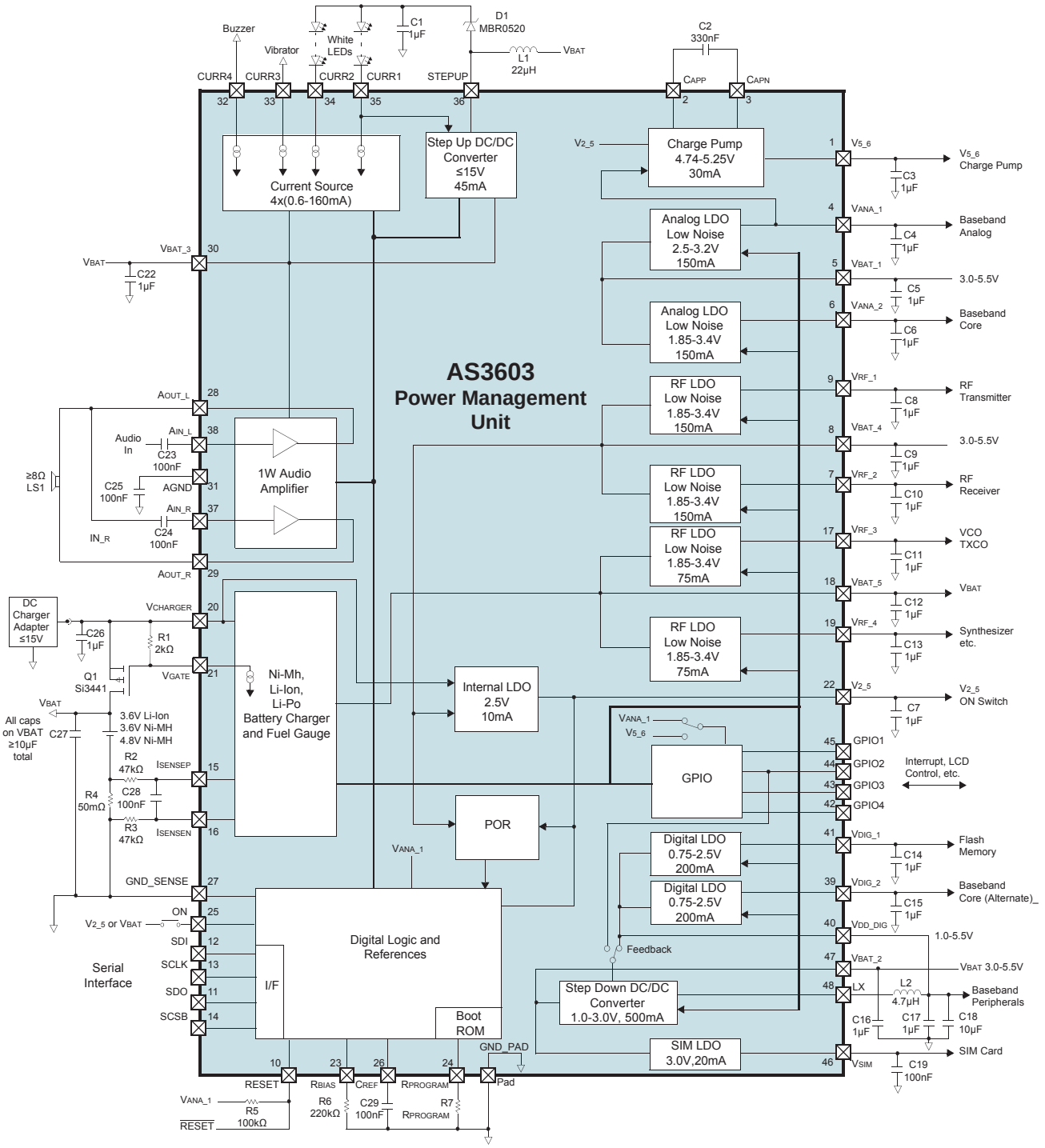
- Ten programmable high performance LDOs
  - Two digital low-power LDOs (0.75 to 2.5V, 200mA)
  - Three RF low-noise LDOs (1.85 to 3.4V, 150mA)
  - Two RF low-noise LDOs (1.85 to 3.4V, 75mA)
  - One SIM low-power LDO (3.0V, 20mA)
  - One periphery low-noise LDO (2.5 to 3.2V, 150mA)
  - One low-power LDO (2.5V, 10mA)
- Programmable high efficiency DC/DC converters
  - Step down: 1.0 to 3.0V, up to 500mA
  - Step up: 15V, 45mA, (for white LEDs)
- Stereo audio power amplifier
  - 0.5W @ 4Ω - stereo
  - 1W @ 8Ω - bridged
  - Digital volume control, 3dB steps
  - Click- and pop-less start-up and power-down
- Complete chemistry-independent battery charger
  - Integrated fuel gauge
  - Automatic trickle charging
  - Programmable constant current charging
  - Programmable constant voltage charging
  - Programmable pulse charging
  - Safety functions (low battery shutdown)
  - Operation without battery
  - No-battery detection
- Four 8-bit programmable current sources (0.625mA to 160mA) support:
  - Buzzer
  - Vibrator
  - LEDs
- Wide battery supply range 3.0 to 5.5V
- Four general purpose switches (1Ω and 2Ω)
- Four programmable general purpose I/O pins
- On-chip bandgap tuning for high accuracy (±1%)
- Integrated programmable watchdog (7.5 to 1900ms)
- Programmable reset (10 to 110ms)
- Shutdown current typ 7µA (2.5V always on)
- Overcurrent and thermal protection
- 0.35µ CMOS solution
- 48-pin, 6x6mm QFN package (0.4mm pitch)
- 48-pin, 7x7mm QFN package (0.5mm pitch)
- 2.1 Watt power dissipation @ TAMBIENT = 70ºC

Applications

Multi-standard power management for mobile phones, PDAs, and 1-cell Li+ or 3 to 4-cell Ni-Mh powered devices.

Block Diagram

Option: audio amplifier in differential mode, step down DC/DC Converter as pre-regulator for digital LDOs



General Description

The AS3604 is based on the architecture of the AS3603. It has additional functions like momentary power loss detection, a synchronous DC/DC buck converter, charger resume operation and increased driving capability of the LDOs.

Key Features

The AS3604 features all the functions of the AS3603 with the following additions:

- Momentary power loss detection
  - · Detect a short interruption (<200ms) of the battery supply (e.g. due to a dropped phone)

- Ten programmable high performance LDOs
  - · Two digital low-power LDOs (0.75 to 2.5V, 200mA; 250mA up to 1.4V)
  - · Three RF low-noise LDOs (1.85 to 3.4V, 200mA)
  - · Two RF low-noise LDOs (1.85 to 3.4V, 150mA)
  - · One SIM low-power LDO (3.0V, 20mA)
  - · One periphery low-noise LDO (2.5 to 3.2V, 200mA)
  - · One low-power LDO (2.5V, 10mA)

- Programmable high efficiency DC/DC converters
  - · Step-down: 0.8V-3.4V, up to 500mA with 2.2MHz operating frequency and small external coil (2.2uH)
  - · Step up: 15V, 45mA, (for white LEDs)

- Stereo audio power amplifier
  - · 0.5W @ 4 -stereo
  - · 1W @ 8 -bridged
  - · Digital volume control, 3dB steps
  - · Click- and pop-less start-up and power-down

- Complete chemistry-independent battery charger
  - · Integrated fuel gauge
  - · Automatic trickle charging
  - · Programmable constant current charging
  - · Programmable constant voltage charging
  - · Programmable pulse charging
  - · Safety functions (low battery shutdown)
  - · Operation without battery
  - · No-battery detection
  - · Can regulate the current through the battery or from the charger
  - · Charger input overvoltage protection (6V)
  - · Shutdown even with connected charger
  - · Charger resume operation
  - · Charger interrupts (inserted, removed, overvoltage, resume)

- Four 8-bit programmable current sources (0.625mA to 160mA) support:
  - · Buzzer
  - · Vibrator
  - · LEDs

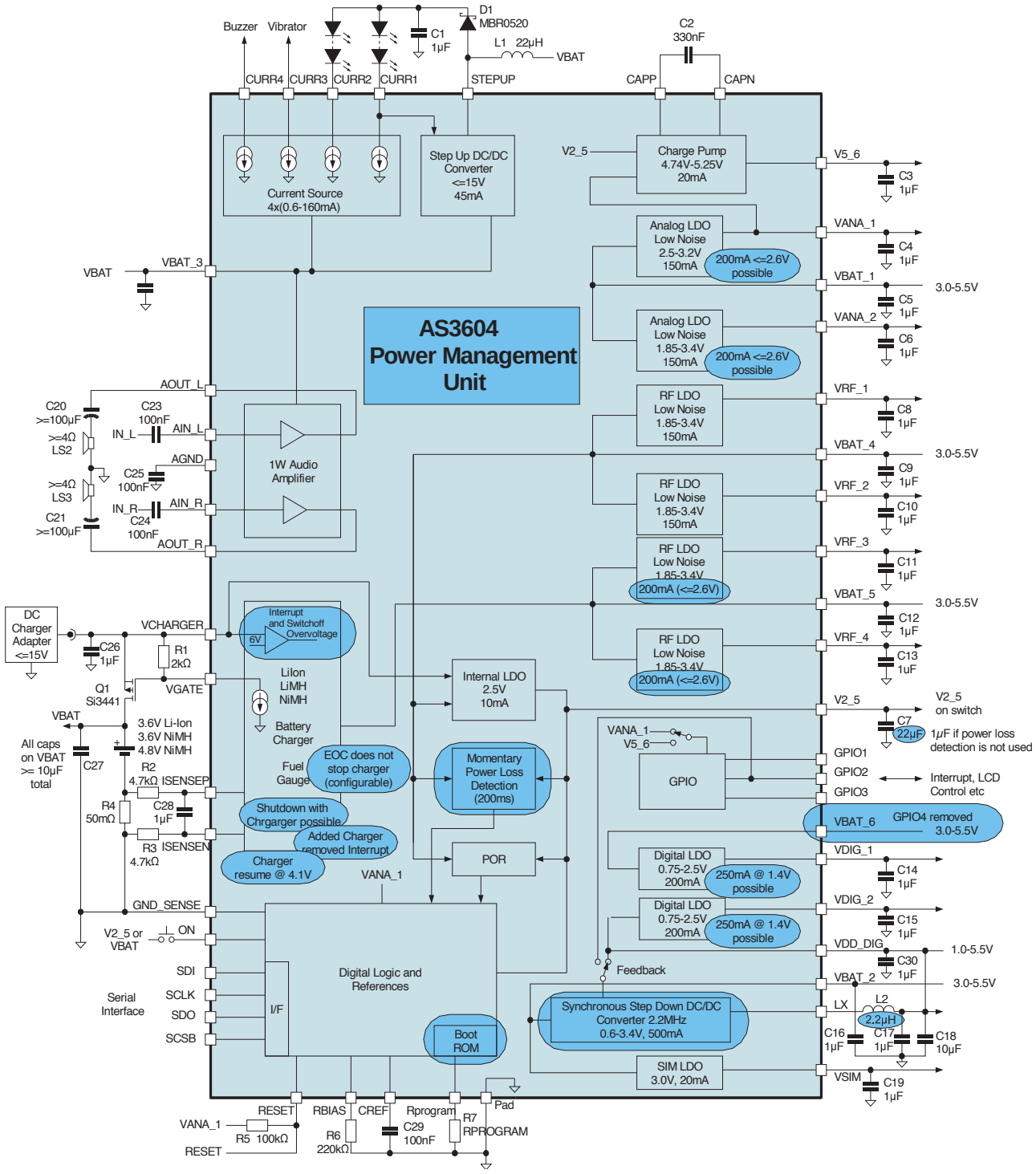
- Wide battery supply range 3.0 to 5.5V
- Four general purpose switches (1Ω and 2Ω)
- Three programmable general purpose I/O pins
- On-chip bandgap tuning for high accuracy (±1%)
- Integrated programmable watchdog (7.5 to 1900ms)
- Programmable reset (10 to 110ms)
- Shutdown current typ 7µA (2.5V always on)
- Overcurrent and thermal protection
- 0.35µ CMOS solution
- 48-pin, 6x6mm QFN package (0.4mm pitch)
- 2.1 Watt power dissipation @ TAMBIENT = 70ºC
- Almost pin compatible to AS3603 (only one pin changed)

Applications

Multi-standard power management for mobile phones, PDAs, and 1-cell Li+ or 3 to 4-cell Ni-MH powered devices.

Block Diagram

Differences to the AS3603 marked with blue



General Description

The AS3650 is highly integrated power and audio management unit. The AS3650 is designed to include sophisticated audio features like high performance audio DAC and ADC. It has several analog and digital audio interface which are explained in detail in the following sections. The AS3650 is an integrated solution for power supply generation and monitoring, battery management including charging.

Key Features

System Control
- Serial Control Interface
- On/Off Control Module with Boot-ROM / GPIO
- Reset Generation for system controller
- Programmable Interrupt Controller and Watchdog
- Low power off mode (9µA; 2.5V LDO on)
- 88 bit unique ID or Boot fuse array
- Reset with long ON-Keypress (5s, SW-Interuptable)
- Touchscreen Interface (10 bit, interrupt)

Supply Voltage Generation
- 2 RF Programmable Low Noise LDOs (250mA) (1 LDO can be a current controlled switch for hotplug (200mA +/-40%))
- 1 RF Programmable Low Noise LDO (400mA)
- 3 Programmable Dig. Low Power LDOs (200mA)
- 1 General Purpose PWM DC/DC step-up converter with two programmable current sinks (e.g. for white led); for current mode feedback is automatically selected (DCDC_CURR1,2)
- 2 General Purpose high efficiency DC/DC step-down converter (DCDC 1 support DVM)
- 1 Low noise charge pump with 5V output voltage
- 1 Ultra Low Power 2.5V LDO (always on)

Current sinks
- 4 programmable(8-bit) from 0.15mA to 38.25mA (+/-5%) optional useable as GPIOs
- 2 programmable high voltage (15V) (8-bit) from 0.15mA to 38.25mA (+/-5%)
- internal PWM generator (extended time range) (can control DCDC_CURR1,2)

10-bit 40µs Successive Approximation ADC
- Two external Inputs (ADC_IN1, ADC_IN2)

Battery Management
- High Current (1.0A) Linear Charger with external pass transistor (no step down charger)
- 0.1 Ω Battery switch for start-up and trickle charge
- Integrated USB charger up to 880mA (can be used as wall adapter charger); current accuracy 440-500mA for USB specification, in-circuit trimmable (+/-1.2% trimsteps)
- Autonomous Battery Temperature Supervision (0°C-45°C or 0°C- 50°C) for 10k and 100k NTC
- Fuel Gauge
- Charging Timeout (1h-8h in 30min steps)
- Charging in Stand-by mode
- Completely Autonomous (no SW)

Power Management Features
- Wide Battery Supply Range 3.0…5.5V
- On-Chip Bandgap Tuning for High Accuracy (±1%)
- Thermal and Current Protection (int. sensor)
- Standby Mode exit by interrupt e.g.Onkey

Audio
- 94dB Audio DAC, 16-48kHz sampling rate
- Two Digital Audio Inputs (2 x I^2S interface)
- 2.9V low Noise LDO for Audio DAC
- Two Headphone Amplifier Output with GND separation
- I^2S master mode with programmable sample rate (controlled by internal PLL)
- GND Buffer for Headphone Amplifier
- Line/ Headphone outputs with GND separation
- Audio ADC, 82dB SNR with 16ksps
- Microphone Bias Supply and Amplifier (mono)
- Audio Mixer and Gain Stages
- PCM Interface

Real Time Clock (RTC)
- Alarm and Time function
- Repeated Wakeup (every second or minute)
- 32kHz output
- Backup Battery Charger and Switchover

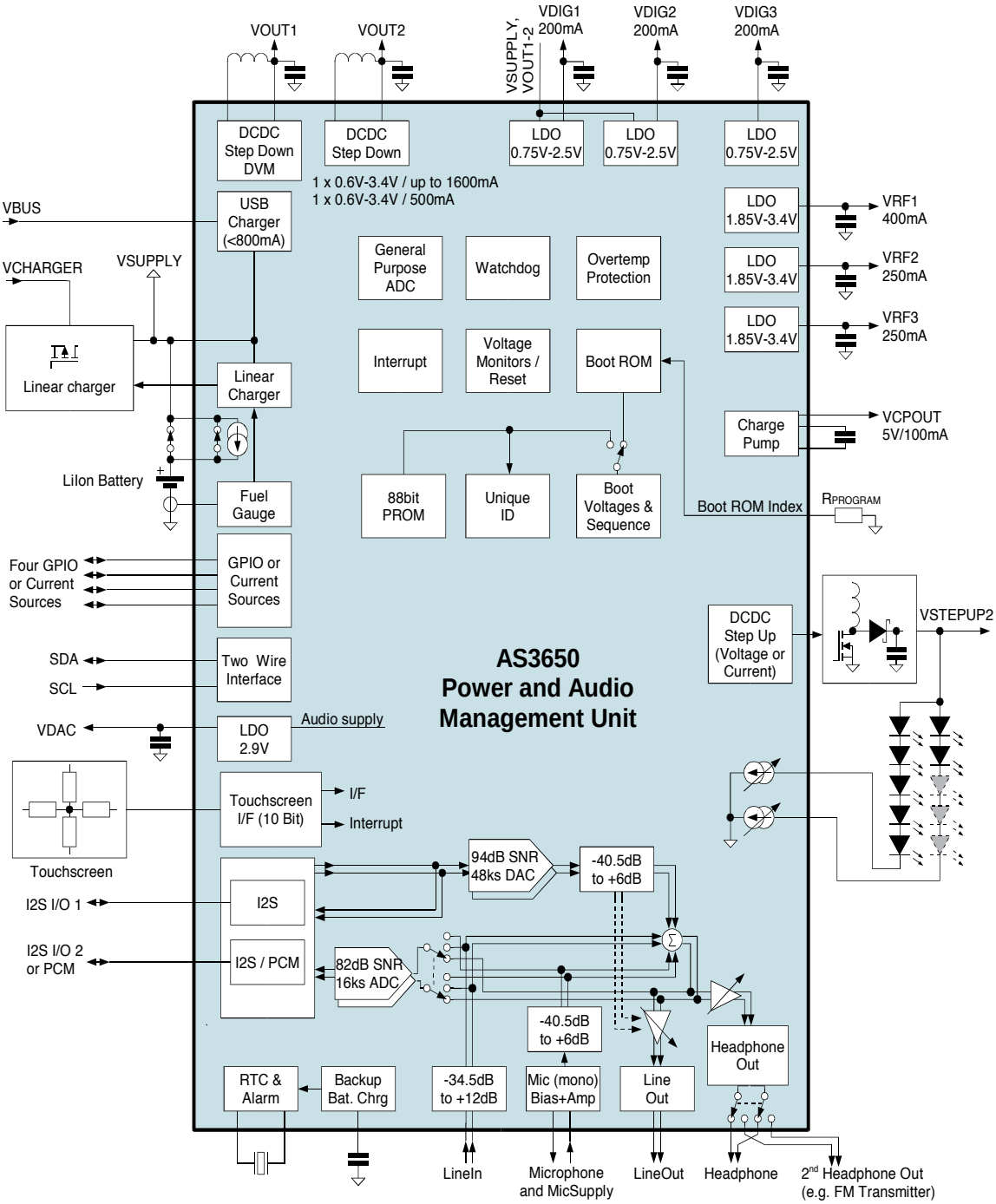
Programmable System clock
- 1.6 MHz to 2.3 MHz with 100 kHz steps

Package
- BGA124 8x8mm, 0.5mm pitch (can be assembled without microvia boards)

Applications

Portable Media Players, Navigation Devices

Block Diagram



General Description

The AS3654 is a highly integrated solution for power supply generation and monitoring, battery management including charging. It is controlled via a serial control interface and integrates all necessary system specific functions such as clock, reset and interrupt generation, voltage and temperature monitoring.

Key Features

- System control
  - Serial control interface
  - On/off control module
  - Reset generation for system controller
  - Programmable interrupt controller
  - Watchdog
  - Low power off mode (9µA; 2.5V LDO on)

- System control supply voltage generation
  - 1 RF programmable low noise LDOs (400mA)
  - 1 RF programmable low noise LDOs (150mA)
  - 2 RF programmable low noise LDOs (150mA)
  - 2 programmable digital low power LDOs (200mA)
  - 2 general purpose PWM DC/DC step-up converters with two programmable current sinks (e.g. for white LED)
  - 3 general purpose high efficiency DC/DC step down converters
  - 1 Low noise charge pump with 5V output voltage
  - 1 Ultra low power 2.5V LDO (always on)

- Current sinks
  - 4 programmable (6-bit) from 0.625 to 40mA optional useable as GPIOs
  - 3 programmable high voltage (15V) (6-bit) from 0.625 to 40mA
  - Internal PWM generator

-10-bit successive approximation ADC
  - 40µs conversation time

- Battery management
  - Full featured chemistry independent step down charger with included gas gauge and current limitation
  - 0.2Ω battery switch for start-up during trickle charging
  - Integrated USB charger up to 400mA

- Power management features
  - Wide battery supply range 3.0…5.5V
  - On-chip bandgap tuning for high accuracy (±1%)
  - Current protection
  - Thermal protection with internal temperature sensor

- Audio
  - 18-bit audio DAC
  - Two digital audio inputs (I^2S interface)
  - 2.9V low noise LDO for audio DAC
  - Headphone amplifier output with GND separation
  - GND buffer for headphone amplifier
  - Line/ headphone output with GND separation

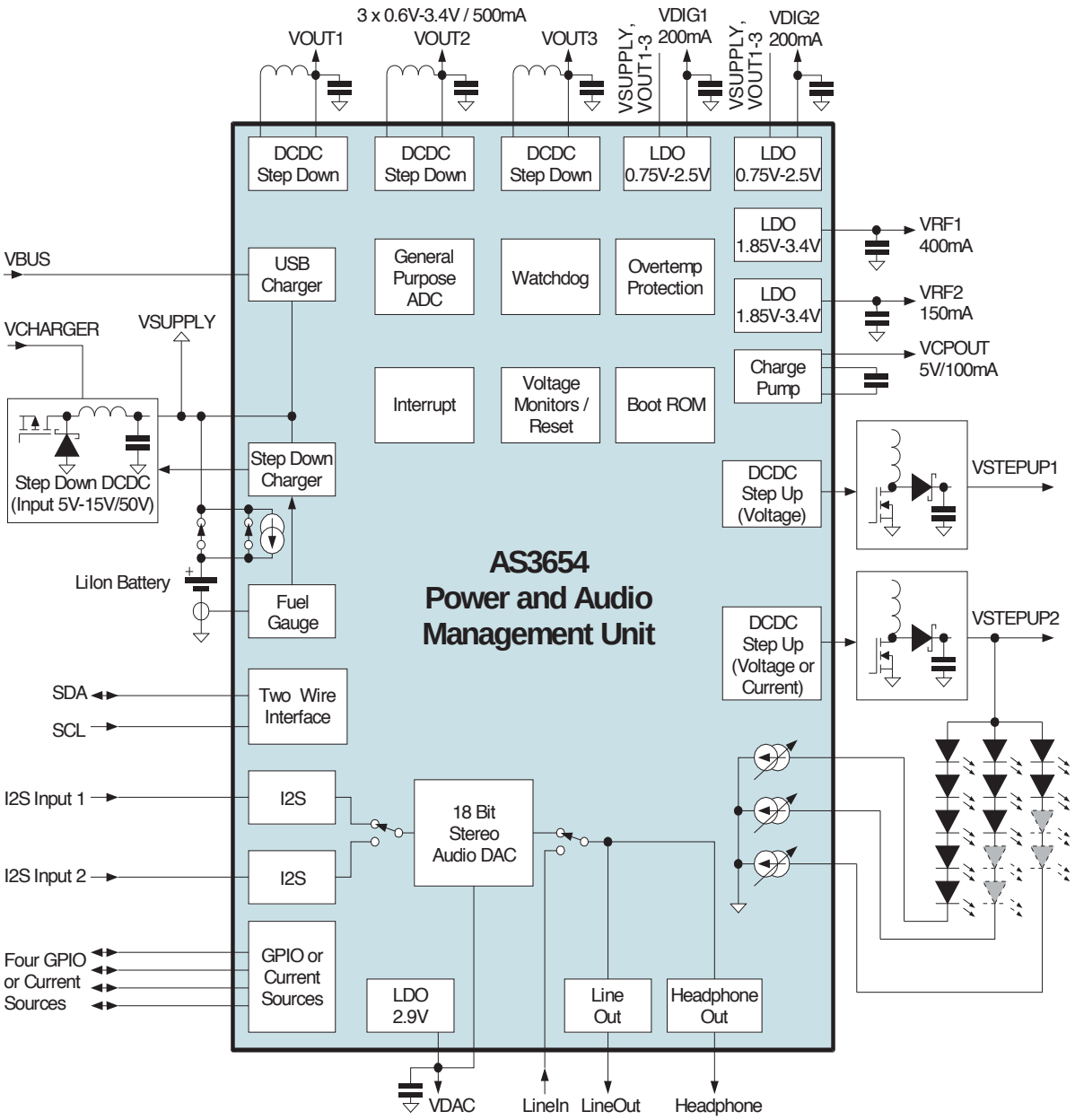
- Programmable system clock
  - 1.6 MHz to 2.3 MHz with 100 kHz steps

- Package
  - BGA100 9x9mm, 0.8mm pitch

Applications

- Power management Unit
- 1 Cell Li+ or 3 Cell NiMH powered devices
- Car battery powered systems with and without internal battery

Block Diagram



General Description

The AS3656 is a highly integrated solution for power supply generation and monitoring, battery management including charging. It is controlled via a serial control interface and integrates all necessary system specific functions such as clock, reset and interrupt generation, voltage and temperature monitoring.

Key Features

- System control
  - · Serial control interface
  - · On/off control module
  - · Reset generation for system controller
  - · Programmable interrupt controller
  - · Watchdog
  - · Low power off mode (9µA; 2.5V LDO on)

- Supply voltage generation
  - · 1 RF programmable low noise LDOs (400mA)
  - · 1 RF programmable low noise LDOs (150mA)
  - - 2 RF programmable low noise LDOs (150mA)
  - · 2 programmable digital low power LDOs (200mA)
  - · 2 general purpose PWM DC/DC step-up converters with two programmable current sinks (e.g. for white LED)
  - · 3 general purpose high efficiency DC/DC step-down converters
  - · 1 low noise charge pump with 5V output voltage
  - · 1 ultra low power 2.5V LDO (always on)

- Current sinks
  - · 4 programmable (6-bit) from 0.625 to 40mA optional useable as GPIOs
  - · 3 programmable high voltage (15V) (6-bit) from 0.625 to 40mA
  - · Internal PWM generator

- 10-bit successive approximation ADC
  - · 40µs conversation time

- Battery management
  - · Full featured chemistry independent step down charger with included gas gauge and current limitation
  - · 0.2Ω battery switch for start-up during trickle charging
  - · Integrated USB charger up to 400mA

- Power management features
  - · Wide battery supply range 3.0…5.5V
  - · On-chip bandgap tuning for high accuracy (±1%)
  - · Current protection
  - · Thermal protection with internal temperature sensor

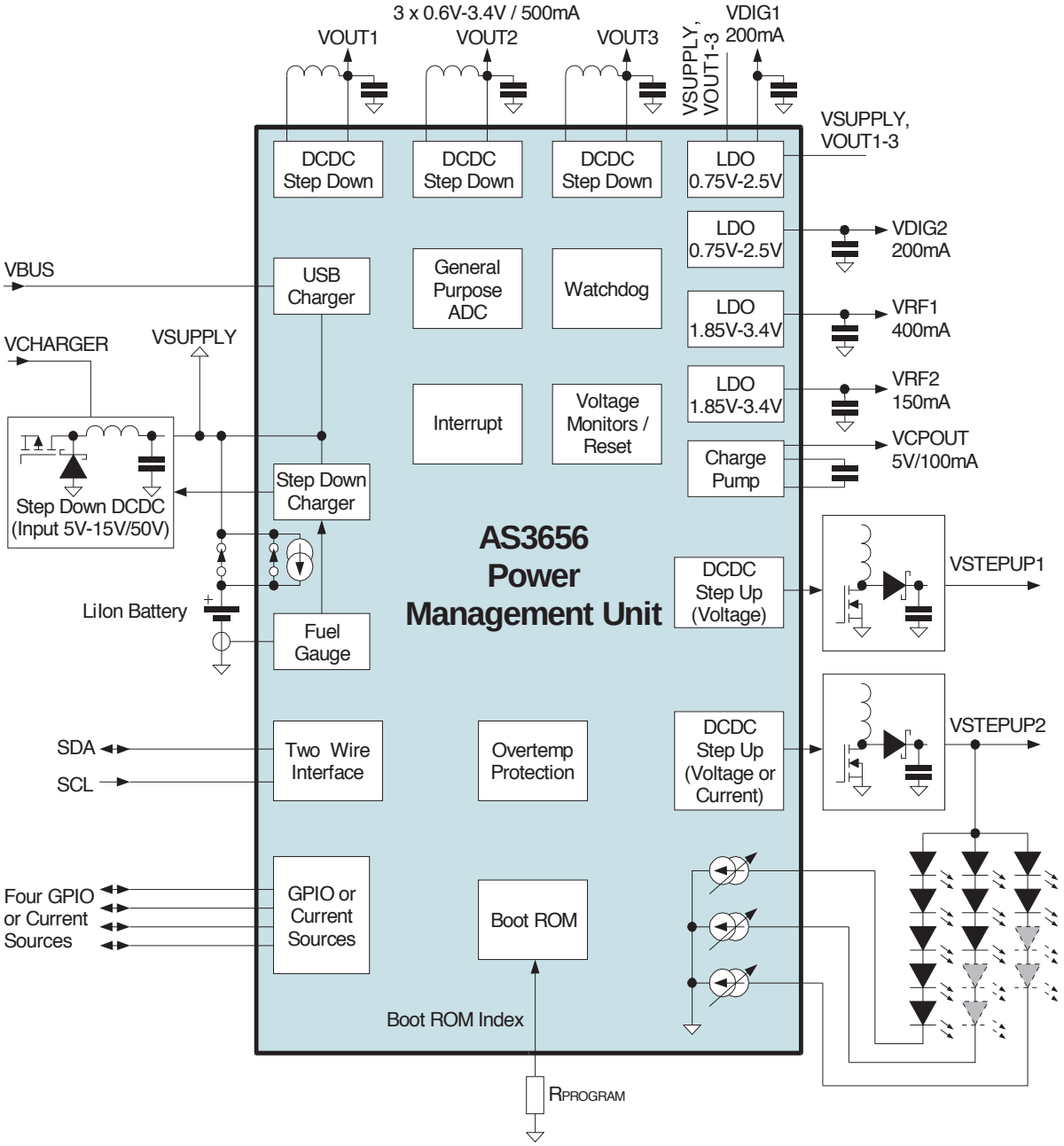
- Programmable system clock
  - · 1.6 MHz to 2.3 MHz with 100 kHz steps

- Package
  - · BGA100 9x9mm, 0.8mm pitch

Applications

- Power management unit
- 1 Cell Li+ or 3 Cell NiMH powered devices
- Car battery powered systems with and without internal battery

Block Diagram



General Description

The AS3658 is highly integrated power and audio management unit. The AS3658 is designed to include sophisticated audio features like high performance audio DAC and ADC. It has several analog and digital audio interface which are explained in detail in the following sections. The AS3658 is an integrated solution for power supply generation and monitoring, battery management including charging.

Key Features

System Control
- Serial Control Interface
- On/Off Control Module with Boot-ROM / GPIO
- Reset Generation for system controller
- Programmable Interrupt Controller and Watchdog
- Low power off mode (9µA; 2.5V LDO on)
- 88 bit unique ID or Boot fuse array
- Reset with long ON-Keypress (SW-Interruptible)
- Touchscreen Interface (10 bit, interrupt)

Supply Voltage Generation
- 2 RF Programmable Low Noise LDOs (250mA) (1 LDO can be a current controlled switch for hotplug (200mA ± 40%))
- 1 RF Programmable Low Noise LDO (400mA)
- 4 Programmable Dig. Low Power LDOs(200mA)
- 2 General Purpose PWM DC/DC step-up converter with three programmable current sinks (e.g. for white led); for current mode feedback is automatically selected (DCDC_CURR1,2,3)
- 3 General Purpose high efficiency DC/DC step-down converter (DCDC 1 support DVM)
- 1 Low noise charge pump with 5V output voltage
- 1 Ultra Low Power 2.5V LDO (always on)

Current sinks
- 4 programmable(8-bit) from 0.15mA to 38.25mA (±5%) optional usable as GPIOs
- 3 programmable high voltage (15V) (8-bit) from 0.15mA to 38.25mA (±5%)
- internal PWM generator (extended time range) (can control DCDC_CURR1,2,3)

10-bit 40µs Successive Approximation ADC
- Two external Inputs (ADC_IN1, ADC_IN2)

Battery Management
- Full featured chemistry independent step down charger with Gas Gauge and Current limitation
- High Current (1.0A) Linear Charger with external pass transistor (no step down charger)
- 0.1 Ω Battery switch for start-up and trickle charge
- Integrated USB charger up to 880mA (can be used as wall adapter charger); current accuracy 440-500mA for USB specification, in-circuit trimmable (±1.2% trimsteps)
- Autonomous Battery Temperature Supervision (0ºC-45ºC or 0ºC- 50ºC) for 10k and 100k NTC
- Charging Timeout (1h-8h in 30min steps)
- Charging in Standby mode
- Completely Autonomous (no SW)

Power Management Features
- Wide Battery Supply Range 3.0…5.5V
- On-Chip Bandgap Tuning for High Accuracy (±1%)
- Thermal and Current Protection (int. sensor)
- Standby Mode exit by interrupt e.g. Onkey/RTC

Audio
- 94dB Audio DAC, 16-48kHz sampling rate
- Two Digital Audio Inputs (2 x I^2S interface)
- 2.9V low Noise LDO for Audio DAC
- Two Headphone Amplifier Output with GND separation
- Two I^2S Inputs and one I^2S Output
- I^2S master mode with programmable sample rate (controlled by internal PLL)
- GND Buffer for Headphone Amplifier
- Line/ Headphone outputs with GND separation
- Audio ADC, 82dB SNR with 16ksps
- Microphone Bias Supply and Amplifier (mono)
- 5 Band Adjustable Audio Equalizer (± 12dB in 3dB gain steps)
- SPDIF Output
- Audio Mixer and Gain Stages
- PCM Interface

Real Time Clock (RTC)
- Alarm and Time function
- Repeated Wakeup (every second or minute)
- 32kHz output
- Backup Battery Charger and Switchover

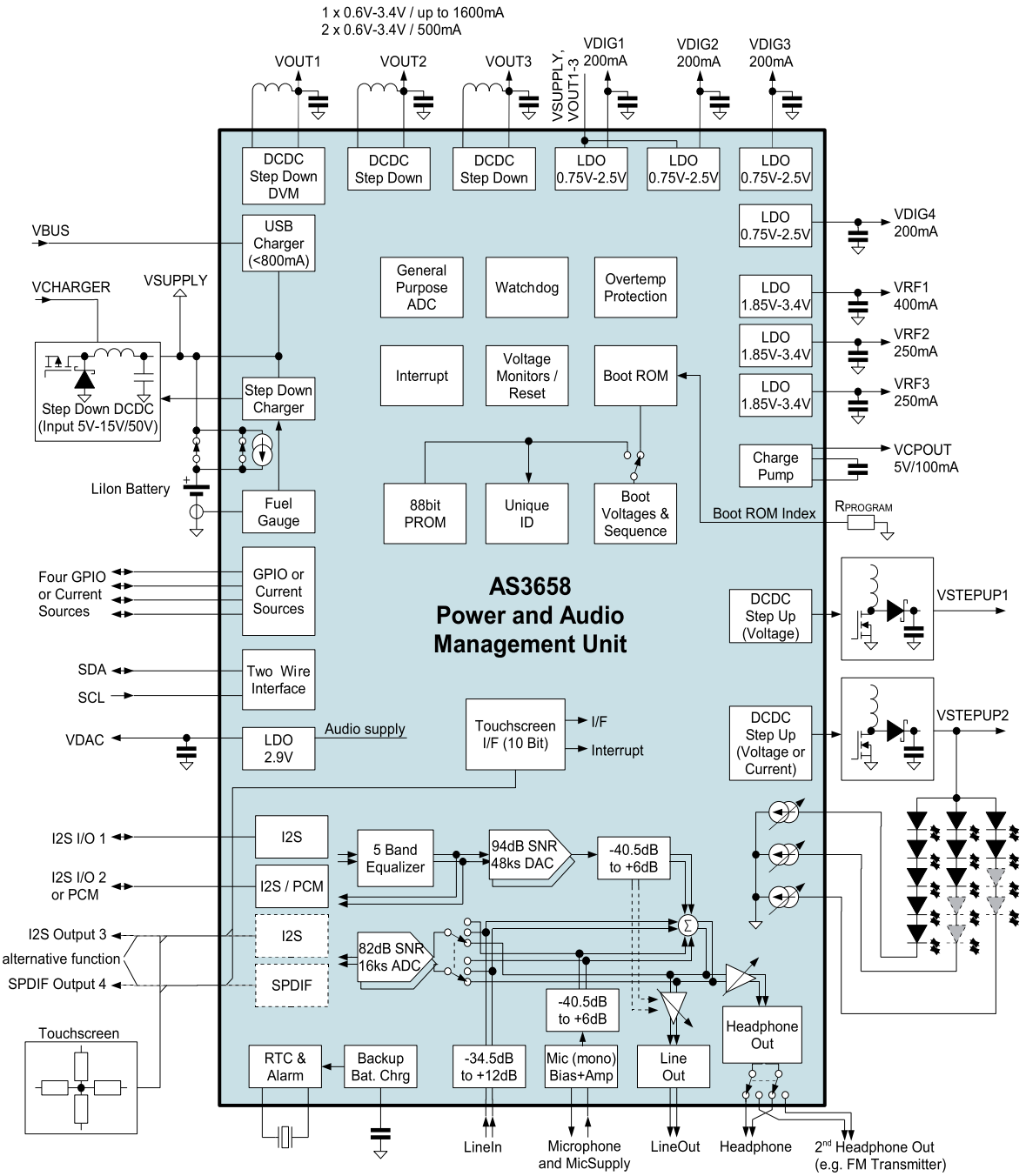
Programmable System clock
- 1.6 MHz to 2.3 MHz with 100 kHz steps

Package
- BGA124 8x8mm, 0.5mm pitch (can be assembled without micro via boards)

Applications

The AS3658 is ideal for PDA, PMP, GPS-Navigation Systems and 1 Cell Li+ or 3 Cell NiMH powered devices.

Block Diagram



General Description

The AS1901/2/3 family is an ultra low-power supervisory circuit device.

The device can be used to monitor the supply voltage of digital systems and microprocessors and initiate a reset when the voltage goes below a predefined threshold. The duration of the reset is 5/20/100/500ms (typ.) after the supply voltage has risen above the threshold.

The AS1901/2/3 exhibit excellent reliability and can reduce application costs by eliminating all external components.

Standard Products

Model	Output Type	Reset Type
AS1901	Push/Pull	Active-Low
AS1902	Push/Pull	Active-High
AS1903	Open-Drain	Active-Low

All devices operate down to a voltage of 1V. The reset thresholds are factory-trimmable between 2.2V and 3.08V in steps of approximately 100mV.

Each device of AS1901/2/3 family is offered with four time-out periods of 5/20/100/500ms. The extremely low current consumption of only 230nA (typ) at 3.3V makes the device ideal for use in portable applications.

All devices are available in a 3-pin SOT23 package.

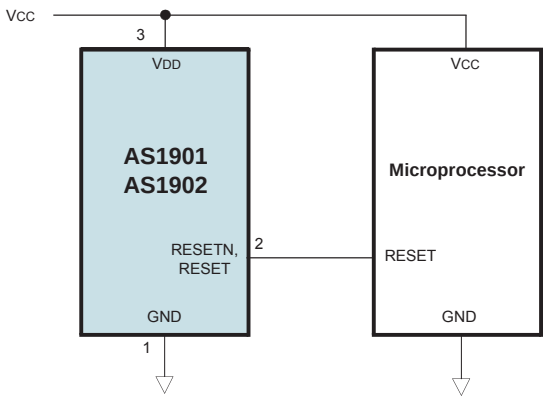
Key Features

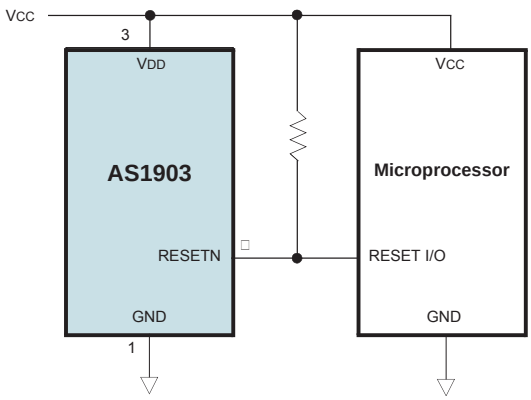
- Low 230nA (typ) supply current
- Precision monitoring of 2.5, 3, and 3.3V power supplies
- Supply voltage range: 1.0 to 3.6V
- Reset threshold range: 2.2 to 3.1V
- Available in 3 versions:
  - AS1901 push pull RESETN
  - AS1902 push pull reset
  - AS1903 open drain RESETN
- 4 time-out periods ranging from 5 to 500ms
- Temperature range: -40 to +85°C
- Detection voltage accuracy ± 1.5%
- 3-pin SOT23 package

Applications

- Computers
- Intelligent instruments
- Controllers
- Critical microprocessor and microcontroller power monitoring
- Portable/battery-powered equipment
- Automotive

Application Diagrams





150nA Low Power µP Supervisory Circuits

AS1904/AS1905/AS1906

World's Lowest Power Consumption!

General Description

The AS1904/5/6 family is an ultra low-power supervisory circuit device.

The device can be used to monitor the supply voltage of digital systems and microprocessors and initiate a reset when the voltage goes below a predefined threshold. The duration of the reset is 5/20/100/500ms (typ.) after the supply voltage has risen above the threshold.

The devices exhibit excellent reliability and can reduce application costs by eliminating all external components.

Standard Products

Model	Output Type	Reset Type
AS1904	Push/Pull	Active-Low
AS1905	Push/Pull	Active-High
AS1906	Open-Drain	Active-Low

All devices operate down to a voltage of 1V. The reset thresholds are factory-trimmable between 2.2V and 3.08V in steps of approximately 100mV.

Each device of the AS1904/5/6 family is offered with four time-out periods of 5/20/100/500ms. The extremely low current consumption of only 150nA (typ) at 3.3V makes the device ideal for use in portable applications.

All devices are available in a 3-pin SOT23 package.

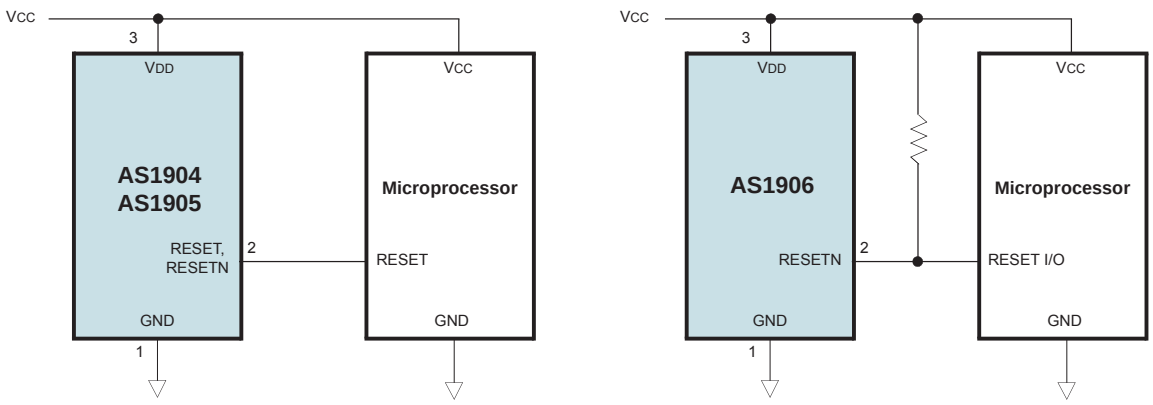
Key Features

- Ultra low 150nA (typical) supply current
- Precision monitoring of 2.5, 3, and 3.3V power supplies
- Supply voltage range 1.0 to 3.6V
- Reset threshold available from 2.2 to 3.1V
- Available in three versions
  - · AS1904 push-pull RESETN
  - · AS1905 push-pull RESET
  - · AS1906 open drain RESETN
  - · 4 time-out periods ranging from 5 to 500ms
- Temperature range: -40 to +85°C
- Detection voltage accuracy ± 1.5%
- 3-pin SOT23 package

Applications

- Computers
- Intelligent instruments
- Controllers
- Critical microprocessor and microcontroller power monitoring
- Portable/battery-powered equipment
- Automotive

Application Diagrams



General Description

The AS1907/AS1908/AS1909 microprocessor supervisory circuits are ideal for monitoring the supply voltage of digital systems and microprocessors.

The devices are designed to initiate a reset if the supply voltage goes below a predefined threshold. The duration of the reset is either 1.5, 30, or 150ms (typ.) after the supply voltage has risen above the pre-set threshold.

The devices are available as the standard products listed below.

Standard Products

Model	Output Type	Reset Type
AS1907	Push/Pull	Active-Low
AS1908	Push/Pull	Active-High
AS1909	Open-Drain	Active-Low

The reset thresholds are factory-set between 1.6 and 2.5V in steps of approximately 100mV. The devices exhibit excellent reliability, and can reduce system costs by eliminating the need for external components.

The extremely low current consumption makes the devices ideal for use in portable applications. The integrated reset comparator was specifically designed to ignore fast transients on Vcc.

The devices are available in a 3-pin SOT23 package.

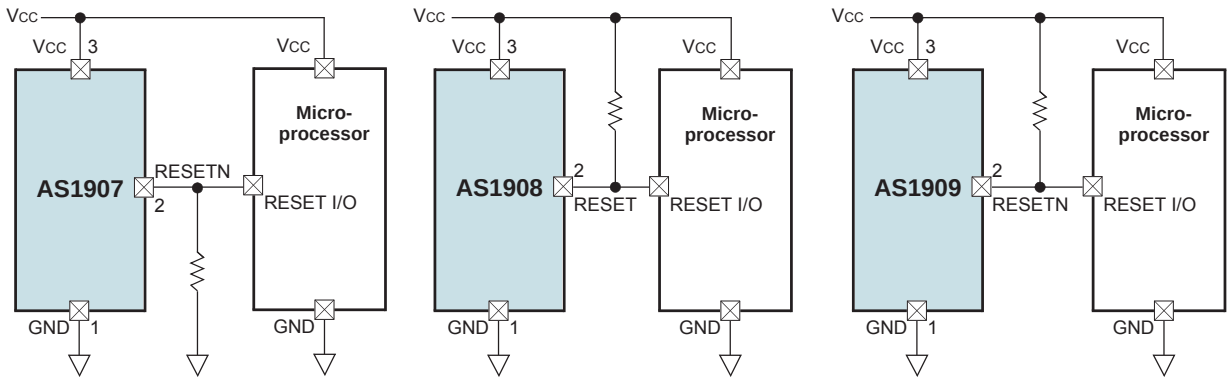
Key Features

- Reset threshold range: 1.6 to 2.5V (~100mV increments)
- RESET/RESETN:
  - Valid to Vcc = 0.7V (AS1907 and AS1908)
  - Valid to Vcc = 1.0V (AS1909)
- Reset pulse widths: 1, 20, and 100ms
- Supply voltage range: +0.7 to +3.6V
- Supply current range: 2.6 to 7.0µA
- Power supply transient immunity
- Requires no external components
- Operating temperature range: -40 to +125°C
- 3-pin SOT23 package

Applications

The devices are ideal for use in cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, hard drives, and any other application where power supply supervisory control is required.

Application Diagrams



AS1910-AS1915

General Description

The AS1910-AS1915 microprocessor supervisory circuits were designed to generate a reset when one of the two monitored supply voltages falls below a factorytrimmed threshold, and to maintain the reset for a minimum timeout period when both supplies are above their reset thresholds. Guaranteed to be in the correct state for Vcc higher than +1.0V, these devices are ideal for multiple-voltage systems with strict monitoring requirements.

The AS1913/AS1914/AS1915 feature factory-trimmed thresholds to monitor a primary voltage between 1.8 and 3.6V, and a secondary voltage between 0.9 and 2.5V.

For the AS1910/AS1911/AS1912, a secondary monitoring voltage can be user-adjusted via an external resistordivider down to 0.6V.

The devices are available with the reset output types listed below.

Standard Products

Model	Reset Output Type
AS1910/AS1913	Active-Low Push/Pull
AS1911/AS1914	Active-High Push/Pull
AS1912/AS1915	Active-Low Open-Drain

The AS1910-AS1915 include a manual-reset input for systems that never fully power down the microprocessor. Additionally, these devices feature a watchdog timer to help ensure that the processor is operating within proper code boundaries.

The AS1910-AS1915 devices are available in a 6-pin SOT23 package.

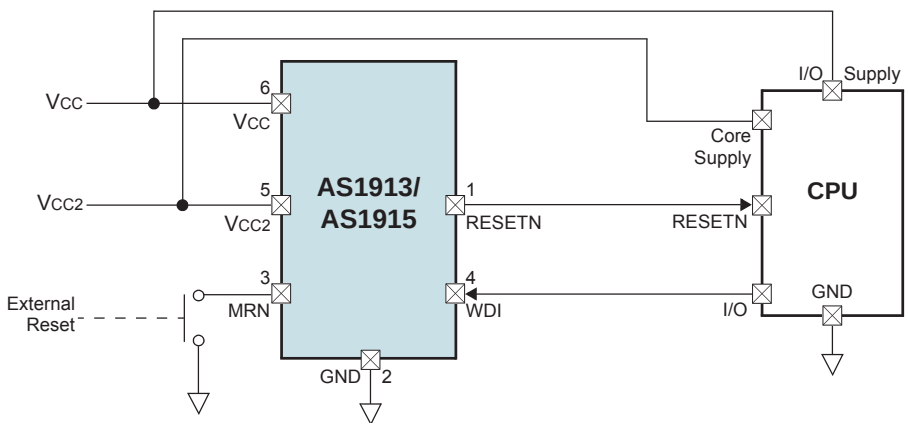
Key Features

- Primary Vcc supervisory range: +1.8 to +3.6V
- Secondary Vcc supervisory range: +0.9 to +2.5V (AS1913/AS1914/AS1915)
- User-adjustable threshold down to +0.63V (AS1910/AS1911/AS1912)
- Guaranteed reset valid down to Vcc = +1.0V
- Reset timeout delay: 215ms
- Manual reset input
- Three reset output types
  - Active-high push/pull
  - Active-low push/pull
  - Active-low open-drain
- Watchdog timeout period: 1.5s
- Immune to fast negative Vcc transients
- Operating temperature range: -40 to +125°C
- External components not required
- 6-pin SOT23 package

Applications

The devices are ideal for portable and battery-powered systems, embedded controllers, intelligent instruments, automotive systems, critical CPU monitoring, and any multi-supply application.

Application Diagram



AS1916/AS1917/AS1918

General Description

The AS1916-AS1918 microprocessor supervisory circuits were designed to generate a reset when the monitored supply voltage falls below a factory-trimmed threshold. The reset remains asserted for a minimum timeout period after the supply voltage stabilizes.

Guaranteed to be in the correct state for Vcc higher than +1.0V, these devices are ideal for portable and batterypowered systems with strict monitoring requirements.

The devices feature factory-trimmed thresholds to monitor a supply voltage between 1.8 and 3.6V.

The devices are available with the reset output types listed below.

Standard Products

Model	Reset Output Type
AS1916	Active-Low Push/Pull
AS1917	Active-High Push/Pull
AS1918	Active-Low Open-Drain

The AS1916-AS1918 include a manual-reset input for systems that never fully power down the microprocessor. Additionally, these devices feature a watchdog timer to help ensure that the processor is operating within proper code boundaries.

The AS1916-AS1918 are available in a 5-pin SOT23 package.

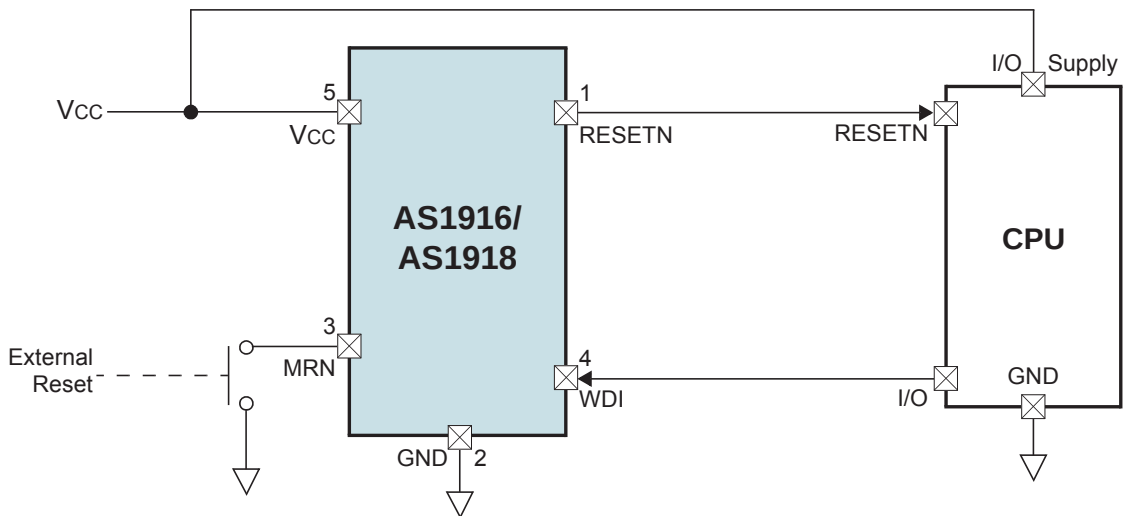
Key Features

- Vcc supervisory range: +1.8 to +3.6V
- Guaranteed reset valid down to Vcc = +1.0V
- Reset timeout delay: 215ms
- Manual reset input
- Three reset output types
  - · Active-low push/pull (AS1916)
  - · Active-high push/pull (AS1917)
  - · Active-low open-drain (AS1918)
- Watchdog timeout period: 1.5s
- Immune to fast negative Vcc transients
- External components not required
- Operating temperature range: -40 to +125°C
- 5-pin SOT23 package

Applications

The devices are ideal for portable and battery-powered systems, embedded controllers, intelligent instruments, automotive systems, and critical CPU monitoring applications.

Application Diagram



AS1920/AS1922

General Description

The AS1920 and AS1922 microprocessor supervisory circuits were designed to generate a reset when one or more of the three monitored supply voltages falls below a pre-defined trip threshold.

These very-low-current (6.2µA typ.) devices maintain reset for a minimum timeout period after all supplies are stabilized. Guaranteed to be in the correct state for V_{CC} higher than +1.0V, these devices are perfect for multiple-voltage systems with low current requirements and strict monitoring requirements.

The devices are available as the standard products listed below.

Standard Products

Model	Output Type	3 Supervisory Voltages
AS1920-18	Push/Pull	3V, 1.8V, Adjustable
AS1922-18	Open-Drain	3V, 1.8V, Adjustable

All devices monitor primary and secondary factory-set voltages. Additionally, a third monitoring voltage can be selected via an external resistor divider.

The AS1920 has an active-low push/pull reset output, where as the AS1922 has an active-low open-drain reset output.

The AS1920 and AS1922 are available in a 5-pin SOT23 package.

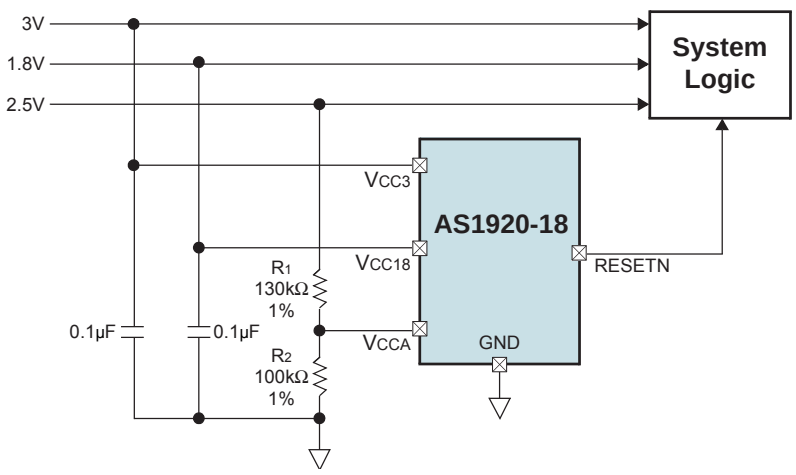
Key Features

- Simultaneous triple-voltage monitoring
- Threshold accuracy over temperature: ±1.5%
- Very low supply current: 6.2µA
- Reset time delay: 200ms
- Power supply transient immunity
- Guaranteed reset for $V_{CC3} \geq 1V$ or $V_{CC18} \geq 1V$
- Active-low push/pull reset output (AS1920)
- Active-low open-drain reset output (AS1922)
- 5-pin SOT23 package

Applications

The devices are ideal for personal computers, laptops, notebooks, battery-powered systems, embedded controllers, intelligent instruments, automotive systems, critical CPU monitoring, and any multi-supply monitoring application.

Application Diagram



General Description

The AS1923 microprocessor supervisory circuit was designed to monitor up to four system supply voltages without the need for external components, and asserts a single reset if any of the monitored supply voltages drops below its reset threshold.

The AS1923 features an active-low reset output that is asserted when any of the 4 monitored voltages are below their respective reset threshold. The reset output is open-drain with a weak internal pullup (10µA) to IN2. Reset remains low for a specified reset timeout period (120ms min) after all voltages have stabilized. The output is valid as long as the IN1 or IN2 input voltage remains >1V.

Minimal external component requirements, small size, and wide temperature range (-40 to +85°C) greatly improves reliability compared to individual supervisory circuits or discrete components.

A wide range of factory-trimmed threshold voltages are available to accommodate many different supply voltages/tolerances with minimal external component requirements. Factory-trimmed options are available for monitoring +5.0, +3.3, +3.0, +2.5, +1.8, and -5.0V supplies with -5% and/or -10% tolerances. The device is also available with one or two user-adjustable threshold options (via external resistor-divider network) if non-standard voltage thresholds are required.

The AS1923 is available in an 6-pin SOT23 package.

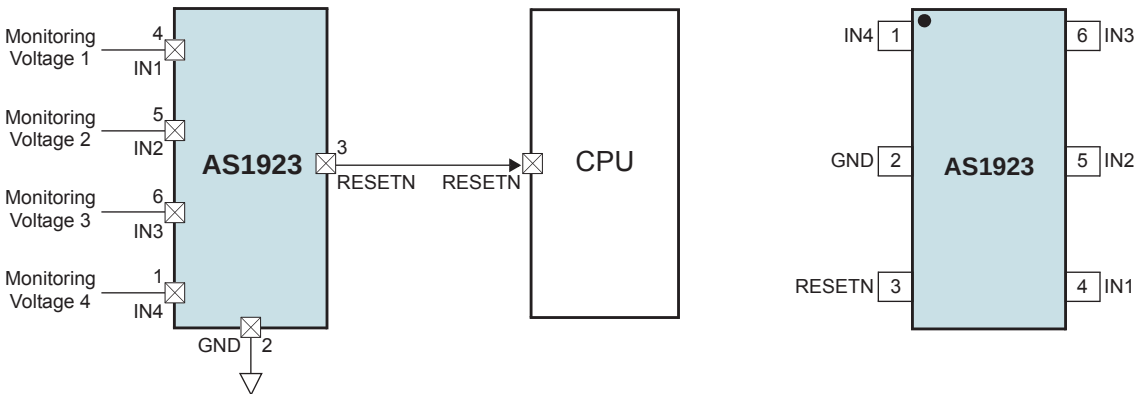
Key Features

- Simultaneous quad-voltage monitoring
- Precision factory-trimmed reset threshold
  +5.0, +3.3, +3.0, +2.5, +1.8, and -5.0V
- User-adjustable voltage monitoring threshold options
- Low supply current: 55µA
- Open-drain (AS1923A)
- 10µA current source pullup (AS1923B)
- Reset timeout period: 120ms
- Reset valid to IN1 = 1V or IN2 = 1V
- Immune to fast INx transients
- External components not required
- Guaranteed performance:
  Operating temperature range = -40 to +85°C
- 6-pin SOT23 package

Applications

The device is ideal for portable and battery-powered systems, embedded controllers, intelligent instruments, automotive systems, critical CPU monitoring, and any multi-supply application.

Application Diagrams



AS1925/AS1926

General Description

The AS1925/AS1926 microprocessor supervisory circuits were designed to assert a single reset if the monitored supply voltage drops below its reset threshold or if the manual reset is activated. The reset remains asserted for a fixed timeout delay after Vcc has risen above the reset threshold and the manual reset is deasserted.

Their small size, excellent circuit reliability, and low supply current (3.5µA) make the AS1925/AS1926 a very low cost solution by eliminating external components and adjustments when used with low-voltage (+0.9 to +1.5V) systems.

The devices are available as the standard products listed below.

Standard Products

Model	Reset Output Type
AS1925	Active-Low Push/Pull, Active-High Push/Pull
AS1926	Active-High Push/Pull, Active-Low Open-Drain

The active-low open-drain reset output requires a pullup resistor that can be connected to a voltage from 0 to Vcc. The reset comparator was specifically designed to ignore fast Vcc transients.

The devices are available in a 5-pin SOT23 package.

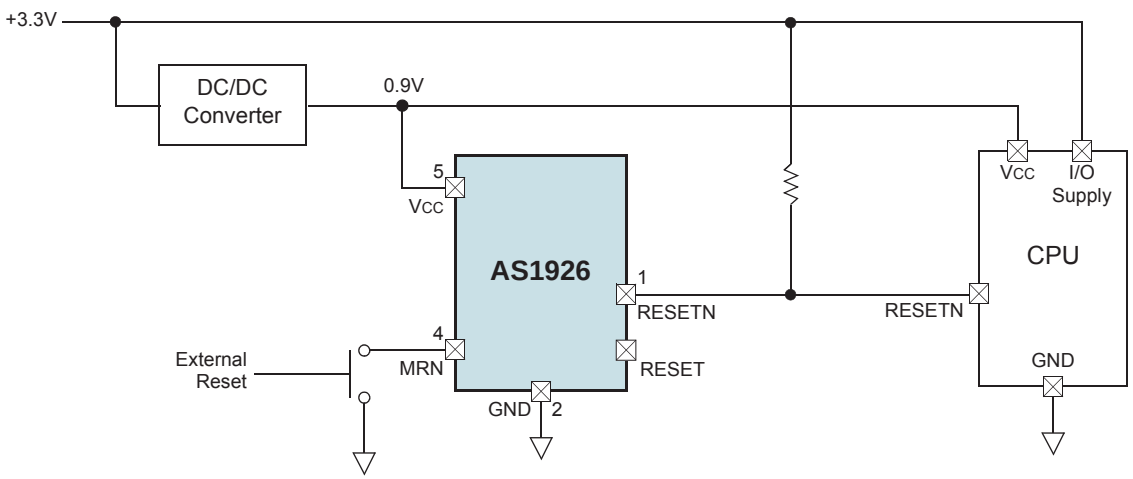
Key Features

- Factory-trimmed reset thresholds for monitoring supplies from 0.9 to 1.5V
- Low power consumption: 3.5µA
- Reset threshold accuracy over temperature: ±2.5%
- Four timeout periods: 1.5ms, 30ms, 210ms, and 1.68s
- Three reset output types:
  - Active-low push/pull
  - Active-high push/pull
  - Active low open-drain
- Guaranteed reset valid to Vcc = 0.55V (active-low)
- Manual reset input
- Immune to fast Vcc transients
- 5-pin SOT23 package

Applications

The device is ideal for portable and battery-powered systems, embedded controllers, intelligent instruments, automotive systems, telecommunications equipment, networking equipment, computer workstations and servers, critical CPU monitoring applications, and any low-voltage application.

Application Diagram



General Description

The AS3524 implements a highly flexible and fully integrated digital audio processor system combining strong calculating power and high performance interfaces commonly used within audio player systems.

Using advanced 0.13µm process technology and large on chip RAM leads to outstanding low power consumption of 0.3 mW/MHz for the ARM922T microcontroller core and 0.6 mW/MHz for the overall system measured with a typical MP3 player SW application. Based on a powerful ARM9TDMI capable of performing up to 200MIPS it is suited to run MP3, AAC, WMA, OGG… decoders and encoders and, in addition, it can perform extensive user interfaces, motion graphics support, video playback and much more.

The AS3524 SOC (system-on-a-Chip) features dedicated high speed interfaces for ATA IDE, USB2.0 HS-OTG and SDRAM ensuring maximum performance for download, upload, and playback.
Furthermore interfaces for NAND flashes, MMC/SD cards and Memory Stick ensure most flexible system design possibilities. Hardware support for parallel interfaces lower the CPU load serving complex and/or colour user interfaces.

Additional serial high-speed data and control interfaces guarantee the connection to other peripherals and or processors in the system. Two independently programmable PLLs generate the required frequencies for audio playback/recording, for the processor core and for the USB interface at the same time.

Key Features

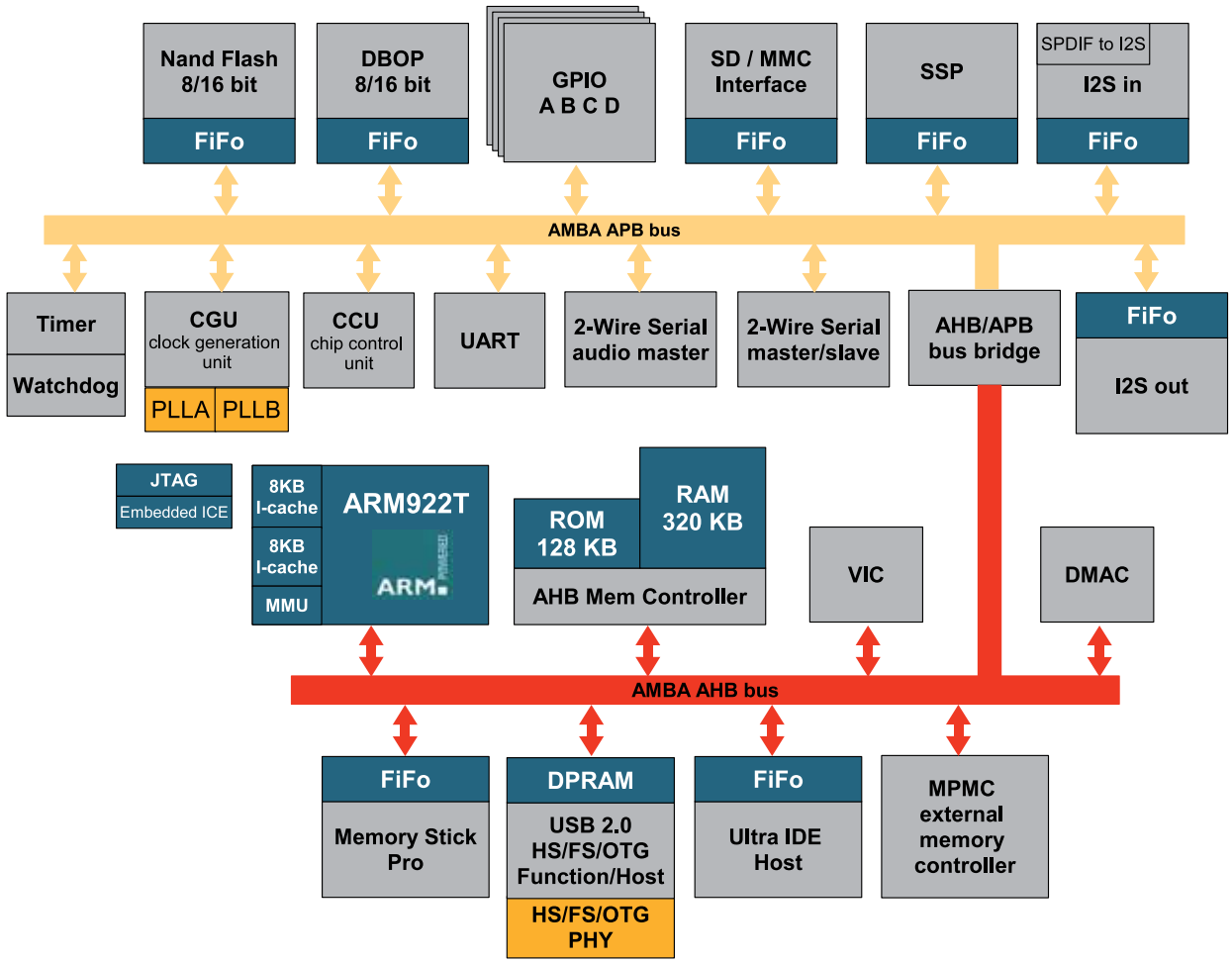
Digital Core

- Embedded 32-bit RISC controller
  - · ARM922TDMI RISC CPU
  - · 2.5mbit on-chip ram
  - · 1mbit on chip ROM
  - · Clock speed max. 250MHz (200MIPS)
  - · Standard JTAG interface
- USB 2.0 HS & OTG interface
  - · Up to 480mbit/s transfer speed
  - · USB 2.0 HS/FS physical inlcuding OTG support
  - · USB 2.0 HS/FS digital core including OTG host
  - · Dedicated dual port buffer ram
  - · DMA bus master functionality
- IDE host controller
  - · Supporting ultra ATA 33/66/100/133 modes
  - · Programmable IO and multi-word DMA capability
  - · Dedicated dual port buffer ram
  - · DMA bus master functionality
- External memory controller
  - · Dynamic memory interface
  - · Asynchronous static memory
  - · DMA bus master functionality
- DMA controller
  - · Single master DMA controller
  - · 2 DMA channels possible at the same time
  - · 16 DMA requests supported
- Interrupt controller
  - · Support for 32 standard interrupts
  - · Support for 16 vectored IRQ interrupts
- Audio subsystem interface
  - · Dedicated 2 wire serial control master
  - · I^2S input and output with dual port buffer ram
- NAND flash interface
  - · 8 snd 16-bit flash support
  - · 3, 4 & 5 Byte address support
  - · Hardware ECC
- MMC/SD interface
  - · MMC/SD card host for multiple card support
  - · 4 data line support for sd cards- MS / MS pro interface
  - - Dedicated dual port buffer ram
- MS / MS pro interface
  - · Dedicated dual port buffer ram
- Display interface
  - · Serial and parallel controller supported
  - · On-chip hardware acceleration
- Synchronous serial interface
  - · Master and slave operation
  - · 8 and 16 bit support
  - · Several protocol standards supported
- I^2S interface
  - · Input multiplexed with audio subsystem
  - · Selectable SPDIF input conversion
  - · Dedicated dual port buffer ram
- 2-wire serial control interface
  - · Master and slave operation
  - · Standard and fast mode support
- General purpose IO interface
  - · 4x 8-bit ports

Applications

- Portable digital audio player and recorder
- Portable digital media player
- PDA
- Smartphone

Block Diagram



AS3525

General Description

This highly flexible and fully integrated audio processor system (AS3525) combines strong calculating power, high performance audio features with system power management options for battery powered devices.

Using advanced 0.13µm process technology and large on chip RAM leads to outstanding low power consumption of as low as 58mW for a complete flash-player during MP3 playback.

Based on a powerful ARM9TDMI capable of performing up to 200MIPS it is suited to run MP3, AAC, WMA, OGG... decoders and encoders and, in addition, it can perform extensive user interfaces, motion graphics support, video playback and much more.

The AS3525 SOC (system-on-a-Chip) features dedicated high speed interfaces for ATA IDE, USB2.0 HS-OTG and SDRAM ensuring maximum performance for download, upload, and playback.

Furthermore interfaces for NAND flashes, MMC/SD cards and Memory Stick ensure most flexible system design possibilities. Hardware support for parallel interfaces lower the CPU load serving complex and/or colour user interfaces.

Additional serial high-speed data and control interfaces guarantee the connection to other peripherals and or processors in the system.

Two independently programmable PLLs generate the required frequencies for audio playback/recording, for the processor core and for the USB interface at the same time. An additional external clock input eliminates the use of external crystals when used in multi-processor systems like mobile phones.

It has a variety of audio inputs and outputs to directly connect electret microphones, and auxiliary signal sources via a 10-channel mixer to a 16Ω/32Ω headset, 4Ω speaker or auxiliary audio peripherals.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player with flash or hard-disk memory are supplied by the AS3525. The different regulated supply voltages are fully programmable. The power management block generates 10 different supply voltages out of a single battery supply. CPU, NAND flash, SRAM, memory cards, LCD, LCD backlight and USB-OTG can be powered. When operating from a single cell (AA or AAA) battery the AS3525 can use a DC/DC booster to generate the needed system supply.

The AS3525 has an independent 32kHz real time clock (RTC) on chip, which allows a complete power down of the system CPU and peripherals.

AS3525 also contains a charger for Li-Io battery supply.

The single supply voltage may vary from 1.0V to 5.5V.

Key Features

Digital Core

- Embedded 32-bit RISC controller
  - · ARM922TDMI RISC CPU
  - · 2.5Mbit on-chip RAM
  - · 1Mbit on chip ROM
  - · Clock speed max. 250MHz (200MIPS)
  - · Standard JTAG interface
- USB 2.0 HS & OTG interface
  - · Up to 480Mbit/s transfer speed
  - · USB 2.0 HS/FS physical inlcuding OTG support
  - · USB 2.0 HS/FS digital core including OTG host
  - · Dedicated dual port buffer RAM
  - · DMA bus master functionality
- IDE host controller
  - · Supporting Ultra ATA 33/66/100/133 modes
  - · Programmable IO and Multi-word DMA capability
  - · Dedicated dual port buffer RAM
  - · DMA bus master functionality
- External memory controller
  - · Dynamic memory interface
  - · Asynchronous static memory
  - · DMA bus master functionality
- DMA controller
  - · Single Master DMA controller
  - · 2 DMA channels possible at the same time
  - · 16 DMA requests supported
- Interrupt controller
  - · Support for 32 standard interrupts
  - · Support for 16 vectored IRQ interrupts
- Audio subsystem interface
  - · Dedicated 2-wire serial control master
  - · I²S input and output with dual port buffer RAM
- NAND flash interface
  - · 8 and 16-bit flash support
  - · 3, 4 & 5 byte address support
  - · Hardware ECC
- MMC/SD interface
  - · MMC/SD card host for multiple card support
  - · 4 data line support for SD cards
- MS / MS Pro interface
  - · Dedicated dual port buffer RAM
- Display interface
  - · Serial and parallel controller supported
  - · On chip hardware acceleration
- Synchronous serial interface
  - · Master and slave operation
  - · 8 and 16-bit support
  - · Several protocol standards supported
- I²S interface
  - · Input multiplexed with audio subsystem
  - · selectable SPDIF input conversion
  - · Dedicated dual port buffer RAM

AS3525

- 2-wire serial control interface
  - · Master and slave operation
  - · Standard and fast mode support
- General purpose IO interface
  - · 4x 8-bit ports

Audio

- Multi-bit sigma delta converters
  - · DAC: 18-bit with 94dB SNR ('A' weighted)
  - · ADC: 14-bit with 82dB SNR ('A' weighted)
  - · Sampling frequency: 8-48kHz
  - · 32 gain steps @ 1.5dB and MUTE
- 2 line inputs
  - · stereo, 2x mono or mono differential inputs
  - · 32 gain steps @ 1.5dB and MUTE
- 2 microphone inputs
  - · differential inputs
  - · 3 gain presets (28/34/40 dB) and OFF with AGC
  - · 32 gain steps @ 1.5dB and MUTE
  - · microphone detection with about 50µA
  - · supply for electret microphone max 1mA
  - · remote control by switch
- Line output
  - · max 1Vp @ 10kΩ in single ended stereo mode
  - · >32Ω in mono differential mode to drive earpieces
  - · 32 gain steps @ 1.5dB and MUTE
- Stereo headphone audio amplifier
  - · 2x 60mW @ 16Ω driver capacity
  - · 32 gain steps @ 1.5dB and MUTE
  - · Click- and pop-less start-up and power down
  - · Headphone and over-current detection
  - · Phantom ground eliminates large capacitors
- Stereo speaker audio amplifier
  - · 2x 500mW @ 4Ω driver capacity
  - · 32 gain steps @ 1.5dB and MUTE
  - · Click- and pop-less start-up and power down
  - · Over-current detection
- 10 channel audio mixer
  - · mixes Line inputs, Mic inputs and DAC output
  - · separate selectable source for right and left channel
  - · possibility to select AGC to prevent clipping

Power Management

- Voltage generation
  - · Step up for system supply (3.0V-3.6V, 150mA)
  - · Charge-pump for CPUcore (1.05V-1.2V, 50mA)
  - · Charge pump for USB OTG (5V, 10mA)
  - · LDO for digital supply (2.9V, 200mA)
  - · LDO for analog supply (2.9V, 200mA)
  - · LDO for IO supply (2.94 or 3.11V, 200mA)
  - · LDO for peripherals (1.7V-3.3V, 200mA)
  - · LDO for USB Transceiver (3.26V, 200mA)
  - · LDO for RTC (1.0V-2.5V, 2mA)
- 25V back-light step-up converter
  - · For driving up to 6 white LEDs in series to achieve a uniform illumination
  - · Current programmable up to 40mA (1.25mA steps)
- Li-Io battery charger
  - · Automatic 50mA trickle charging
  - · Prog. constant current charging (50 – 400mA)
  - · Prog. constant voltage charging (3.9 – 4.25V)

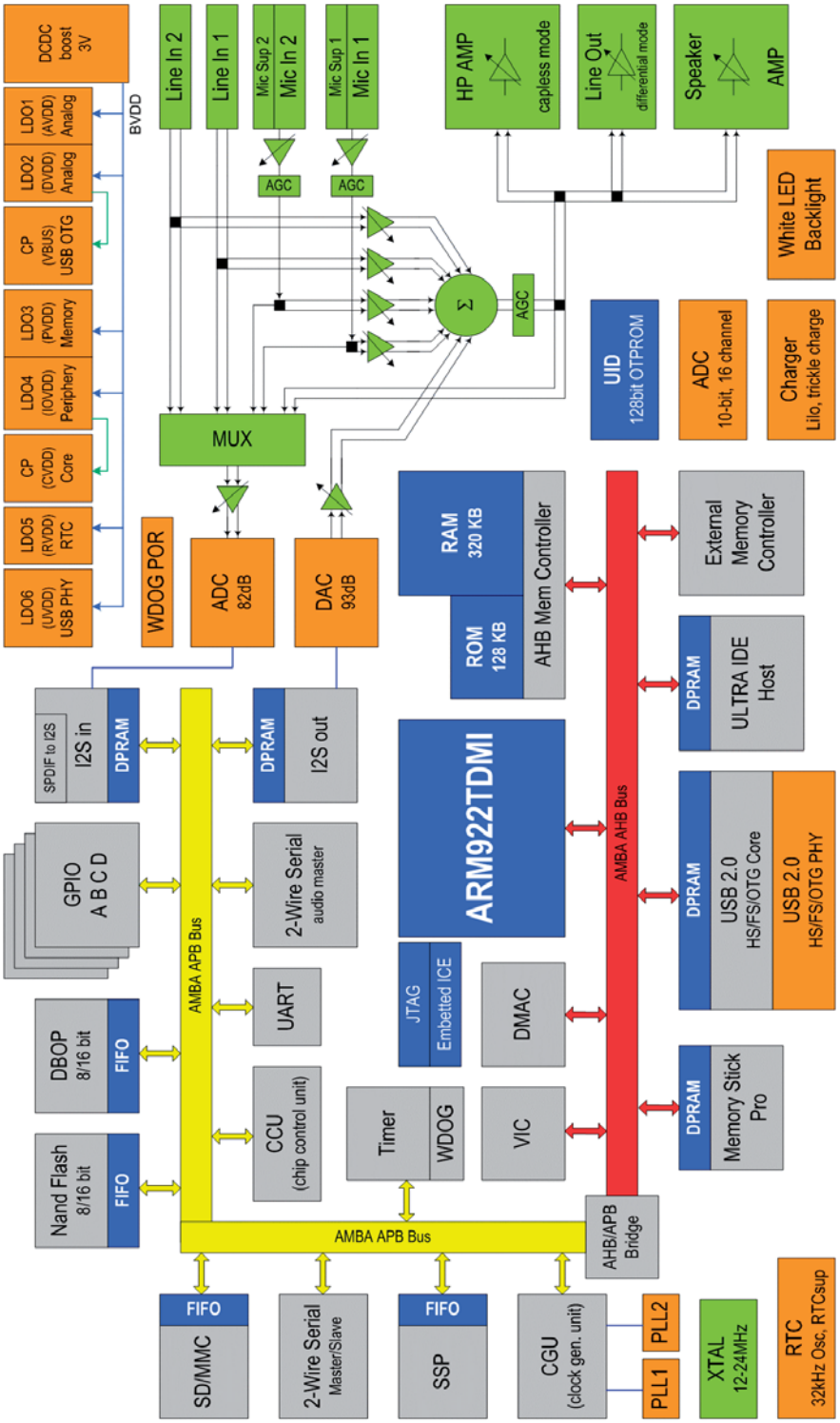
System

- RTC
  - · Ultra low power 32kHz oscillator
  - · 32-bit RTC second counter
  - · Selectable alarm (seconds or minutes)
  - · Trimmable oscillator
- Oscillator
  - · Low power 12-24MHz oscillator
  - · Generating main system clock
- Supervisor
  - · Automatic battery monitoring with interrupt generation and selectable warning level
  - · Automatic temperature supervision with interrupt generation and selectable warning and shutdown levels
- General purpose ADC
  - · 10-bit resolution
  - · 16 inputs analog multiplexer
- UID
  - · Unique Identification Number in OTP ROM for DRM support
- General
  - · Reset pin, watchdog
  - · 10sec emergency shut-down
  - · Wide battery supply range 1V – 5.5V
  - · MP3 playback with 58mW
- Packages:
  - · AS3525-A: CTBGA224 13x13mm, 0.8mm pitch
  - · AS3525-B: CTBGA144 10x10mm, 0.8mmpitch
  - · (in preparation: CTBGA132 9x9, 0.5mm pitch)

Applications

- Portable digital audio player and recorder
- Portable digital media player
- PDA
- Smartphone

Block Diagram



High Performance Single-Chip Solution with Enhanced Power Management for Mobile Entertainment

AS3527

General Description

This highly flexible and fully integrated audio processor system (AS3527) combines strong calculating power, high performance audio features with system power management options for battery powered devices. Using advanced process technology and large on chip RAM unique power management techniques leads to outstanding system level low power consumption of 52mW for a complete flash-player during MP3 playback.

Based on a powerful ARM9TDMI capable of performing up to 200MIPS it is suited to run MP3, AAC, WMA, OGG… decoders and encoders and, in addition, it can perform advanced user interfaces, motion graphics support, video playback and much more. The AS3527 SOC (system-on-a-Chip) features dedicated high speed interfaces for ATA IDE, USB2.0 HS-OTG and SDRAM ensuring maximum performance for download, upload, and playback.
Furthermore interfaces for NAND flashes, MMC/SD cards and Memory Stick ensure most flexible system design possibilities. Hardware support for parallel interfaces lower the CPU load serving complex and/or colour user interfaces.

Additional SPI, Fast UARTs and configurable serial high-speed data and control interfaces enable the addition of a number of connectivity options, radio broADCast and communication front-fnds:
- Satellite radio (XM-Radio, HD-Radio, Sirius, DAB)
- BT2.0 radio front-ends or complete chip sets
- WiFi chip sets
- Comm receivers (i.e. GSM, etc)
- GPS radio or complete chip set

Two independently programmable PLLs generate the required frequencies for audio playback/recording, for the processor core and for the USB interface at the same time. An additional external clock input eliminates the use of external crystals when used in multiprocessor systems like mobile phones.
It has a variety of audio inputs and outputs to directly connect electret microphones, and auxiliary signal sources via a 10-channel mixer to a headset 16Ω/32Ω or auxiliary audio peripherals. Selectable mixer bypasses lower the power consumption for simple playback operations and enlarger the system design flexibility. Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player with flash or hard-disk memory are supplied by the AS3527. The different regulated supply voltages are fully programmable. The power management block generates 11 different supply voltages out of a single battery supply. CPU, NAND flash, SRAM, memory cards, harddisk, LCD, LCD back-light, USB-HOST and USB-OTG can be powered.

The AS3527 has an independent 32kHz real time clock (RTC) on chip, which allows a complete power down of the system CPU and peripherals. AS3527 also contains a charger for Li-Io batteries. The single supply voltage may vary from 3.0V to 5.5V.

Key Features

Digital Core

- Embedded 32-bit RISC controller
  - ARM922TDMI RISC CPU
  - 2.5Mbit on-chip RAM
  - 1Mbit on chip ROM
  - Clock speed max. 250MHz (200MIPS)
  - Standard JTAG interface
- USB 2.0 HS & OTG interface
  - Up to 480Mbit/s transfer speed
  - USB 2.0 HS/FS physical inlcuding OTG support
  - USB 2.0 HS/FS digital core including OTG host
  - Dedicated dual port buffer RAM
  - DMA bus master functionality
- IDE host controller
  - Supporting Ultra ATA 33/66/100/133 modes
  - Programmable IO and multi-word DMA capability
  - Dedicated dual port buffer RAM
  - DMA bus master functionality
- External memory controller
  - Dynamic memory interface
  - Asynchronous static memory
  - DMA bus master functionality
- DMA controller
  - Single master DMA controller
  - 2 DMA channels possible at the same time
  - 16 DMA requests supported
- Interrupt controller
  - Support for 32 standard interrupts
  - Support for 16 vectored IRQ interrupts
- Audio subsystem interface
  - Dedicated 2 wire serial control master
  - I^2S input and output with dual port buffer RAM
- NAND flash interface
  - 8 and 16-bit flash support
  - 3, 4 & 5 byte address support
  - Hardware ECC
- MMC/SD interface
  - MMC/SD Card host for multiple card support
  - 4 data line support for SD cards
- MS / MS Pro interface
  - Dedicated dual port buffer RAM
- Display interface
  - Serial and parallel controller supported
  - FiFo buffered
  - Programmable timing
- Synchronous serial interface
  - Master and slave operation
  - 8 and 16-bit support
  - Several protocol standards supported
- I^2S interface
  - Input multiplexed with audio subsystem
  - selectable SPDIF input conversion
  - Dedicated dual port buffer RAM

- 2-wire serial control interface
  - · Master and slave operation
  - · Standard and fast mode support
- General purpose IO interface
  - · 4x 8-bit ports
- Multiple boot options
  - · Selection of internal ROM or external boot device
  - · Internal boot loader supporting boot from external
- NorFlash, NandFlash, IDE, SPI host
  - · Internal USB boot loader with USB promer supporting initial factory programming and firmware update

Audio

- Multi-bit sigma delta converters
  - · DAC: 18bit with 94dB SNR ('A' weighted)
  - · ADC: 20bit with 90dB SNR ('A' weighted)
  - · Sampling Frequency: 8-48kHz
  - · 32 gain steps @ 1.5dB and MUTE
- 2 Line inputs
  - · stereo, 2x mono or mono differential inputs
  - · 32 gain steps @ 1.5dB and MUTE
- 2 microphone inputs
  - · differential inputs
  - · 3 gain presets (28/34/40 dB) and OFF with AGC
  - · 32 gain steps @ 1.5dB and MUTE
  - · Microphone detection with about 50µA
  - · Supply for electret microphone max 1mA
  - · Voice activation and remote control by switch
- 2 line outputs
  - · Max 1Vp @ 10kΩ in single ended stereo mode
  - · >32Ω in mono differential mode to drive ear-pieces
  - · Mixer bypass
  - · 32 gain steps @ 1.5dB and MUTE
- Stereo headphone audio amplifier
  - · 2x 60mW @ 16Ω driver capacity
  - · 32 gain steps @ 1.5dB and MUTE
  - · Click- and pop-less start-up and power down
  - · Headphone and over-current detection
  - · Phantom ground eliminates large capacitors
  - · Mixer bypass
- 10 channel audio mixer
  - · Mixes Line inputs, Mic inputs and DAC output
  - · Separate selectable source for right and left channel
  - · Possibility to select AGC to prevent clipping

Power Management

- Li-Io battery charger
  - · Automatic 50mA trickle charging
  - · Prog. constant current charging (50 – 400mA)
  - · Prog. constant voltage charging (3.9 – 4.25V)
- Voltage generation
  - · Step down for harddisk (0.65V-3.4V, 500mA)
  - · Step down for CPUcore (1.05V-1.2V, 250mA)
  - · Step down for peripheral (0.65V-3.4V, 250mA)
  - · Charge pump for USB OTG (5V, 10mA)
  - · Step up for USB HOST/OTG (5V, 500mA)
  - · LDO for digital supply (2.9V, 200mA)
  - · LDO for analog supply (2.9V, 200mA)
  - · LDO for peripherals (1.2V-3.5V, 200mA)
  - · LDO for USB transceiver (3.26V, 200mA)
  - · LDO for RTC (1.0V-2.5V, 2mA)
- 25V back-light step-up converter
  - · For driving up to 6 white LEDs in series to achieve a uniform illumination
  - · Current programmable up to 40mA (1.25mA steps)
  - · Dimming with selectable timing

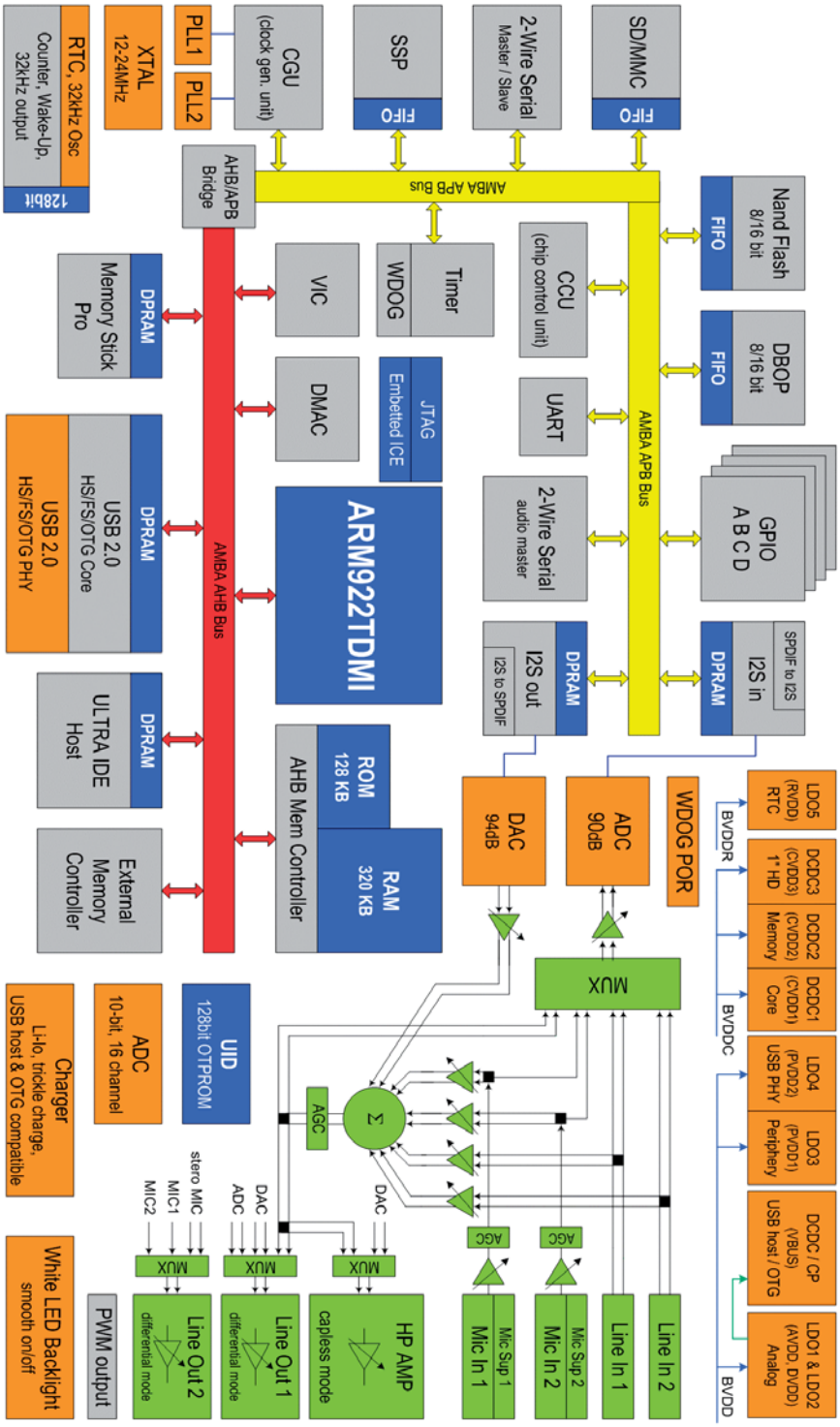
System

- RTC
  - · Ultra low power 32kHz oscillator
  - · 32-bit RTC second counter, 96 days auto wake-up
  - · Selectable alarm (seconds or minutes)
  - · Trimmable oscillator
  - · 128-bit free SRAM for random settings
  - · 32kHz clock output to peripherals
- Oscillator
  - · Low power 12-24MHz Oscillator
  - · Generating main system clock
- Supervisor
  - · Automatic battery monitoring with interrupt generation and selectable warning level
  - · Automatic temp supervision with interrupt generation and selectable warning and shutdown levels
  - · Power rail monitoring
- General purpose ADC
  - · 10-bit resolution
  - · 21 inputs analog multiplexer
- UID
  - · Unique identification number in OTP ROM for DRM
- General
  - · Reset pin, watchdog, power good pin
  - · PWM output
  - · Hibernation modes
  - · 5sec and 10sec emergency shut-down
  - · Wide battery supply range 3V – 5.5V
  - · MP3 playback with 52mW
- Packages:
  - · AS3527-A: CTBGA224 13x13mm, 0.8mm pitch)

Applications

- Portable digital audio player and recorder
- Portable digital media player
- PDA
- Smartphone

Block Diagram



General Description

The AS3530 is austriamicrosystems' digital system for its new generation mobile entertainment platform. It's highly flexible architecture allows single chip solutions for high performance power optimised audio and video products with minimum count of external components.

The device can be configured in two ways: for pure audio products the video decoder and parts of the main memory can be configured into power down. For video applications the video decoder hardware will be enabled and the speed of the system will be scaled to the actual demanded video decoder complexity and resolution. All video decoder features for H.263/MPEG-4/H.264 and VC-1 are implemented in a dedicated video hardware accelerator for minimal power consumption and also ultra low main processor load.

Using low power deep submicron technology gives outstanding performance in terms of power consumption and utmost integration densities for embedded on-chip RAM and ROM areas.

The AS3530 is intended as microcontroller chip including all digital function blocks necessary for a portable audio or video player. These function blocks include onchip RAM and ROM memories, interface blocks for data transfer and storage like USB, IDE, NandFlash, MMC, SD, SDIO, CE-ATA, hardware acceleration for video decoding, clock generation and digital power optimisation functions.

Based on the ARM926-EJ with large on-chip instruction and data caches and integrated MMU, the system gives full support for all kinds of operating systems from simple RTOS implementations up to Symbian OS, micro Linux and Windows CE.

For all audio input/output and power management it is intended that the chip is used in combination with austriamicrosystems audio AFE products (e.g. AS3514/ AS3515/AS3517/AS3518/AS3519).

For the chip family MCM derivatives with integrated AFE and integrated mobile SDRAM are planned as future products.

austriamicrosystems provides a total system solution reference design including all necessary software blocks for low level HW drivers, device IO functions and a dedicated reference application with common audio and video features.

austriamicrosystems runs a comprehensive software partnership program which allows authorised software partners to provide variety of audio or video extensions, applications or total solutions based on austriamicrosystems powerful portable multimedia platform.

Key Features

Basic System

ARM926-EJ RISC Controller

- 32/16 bit RISC architecture
- 16-bit Thumb instruction set
- ARMv5TEJ extended DSP instruction set and single cycle MAC
- Memory Management Unit
- Embedded ICE JTAG debug interface
- 16KB Instruction + 16KB Data Cache
- Up to 400 MHz clock speed
- Power consumption: 0.265 mW/MHz including caches at typical conditions
- 32/16 bit RISC architecture

Memory

- 512 KByte embedded SRAM connected to AHB1
- 128 KByte ROM (128KB bootrom + 32KB GF-table)
- 32 KByte embedded SRAM connected to AHB2 as buffer memory within AHB2 bus domain
- External memory controller supporting
- Support for 16/32 bit data width
- Synchronous/asynchronous SRAM/Flash interface
- SDR DRAM (single data rate DRAM)
- Supports 2 static and 2 dynamic external memory devices
- Support three IO voltage levels: 1.8/2.5/3.3 V
- Pads with programmable drive strength
- 133 MHz max external memory clock frequency

AMBA Bus

- Two AHB bus segments
  - · AHB1 with all Core/Memory high performance elements running up to 150 MHz
  - · AHB2 with all peripheral interface blocks running at max. 100 MHz bus speed
- AHB bus bridge between AHB1 and AHB2
  - · Synchronous 1:1 mode
  - · Asynchronous mode
- AHB interconnect matrix for high throughput
  - · AHB to APB bridge
  - · Connected to AHB2

DMA controller

One DMA controller located in each of AHB1 and AHB2 bus domain

- DMA1 in AHB1 bus domain
  - · 8 simultaneously opened DMA channels
  - · 16 DMA requests
- DMA2 in AHB2 bus domain
  - · 8 simultaneously opened DMA channels
  - · 32 DMA requests

Interrupt Controller (VIC)

- Support for 32 non-vectored interrupts
- Support for 32 vectored interrupts

PWM outputs
- Four PWM output channels
- Each channel can run independently or synchronized
- Period, pulse width and phase defined by 8-bit registers (phase only in synchronized mode)
- Two independent rotary decoders with programmable glitch filter
- Programmable count direction
- Programmable interrupt on zero count
- Zero count can stop PWM modulators

Timer and Watchdog
- Two independent timer blocks (A+B) with two 32 bit counters each
- Two timer trigger event inputs
- Watchdog

Chip Control Unit
- Two independent 1 GHz PLL generators (PLLA, PLLB)
- Internal 24 MHz oscillator
- Optional usage of external oscillator
- Four programmable clock outputs
- Chip version number
- Control of IO multiplexing
- Universal spare registers
- Clock gating / block enables
- JTAG disable bit

Keyscan Controller
- Configurable 1x4 to 4x4 or 1x8 to 8x8 matrix
- Low power mode
- Interrupt generation

RTC
- Integrated ultra low power 32 KHz oscillator
- Separated power supply
- Wakeup can be triggered by RTC
- Suspend mode with all clocks stopped, resume by RTC timer

IMON
- Intelligent hardware monitor for bus and system profiling for continuous system monitoring and power optimisation
- Very flexible selection of input events
- Monitoring averaging or peak conditions
- Scalable counters
- Programmable interrupt generation

OTP
- 256 Bit one-time-programmable memory
- Contains unique ID

Interfaces

Audio Interface
- Two I²S input interfaces
  - · FiFo (32x48) buffered
  - · DMA support
  - · 14/24 bit modes
  - · SPDIF input bridge
- Two I²S output interfaces
  - · FiFo (128x48) buffered
  - · DMA support
  - · 16/18/24 bit modes
  - · SPDIF output bridge
- Synchronous I²SIN to I²SOUT streaming mode

USB 2.0 HS & OTG Interface
- Up to 480Mbit/s transfer speed
- USB 2.0 HS/FS physical including OTG support
- USB 2.0 HS/FS digital core including OTG host
- Dedicated dual port buffer RAM
- DMA bus master functionality
- Total of seven endpoints (1xCONTROL, 3xIN, 3xOUT)

IDE Host Controller
- Supporting Ultra ATA 33/66/100 modes
- Programmable IO and Multi-word DMA capability
- Dedicated dual port buffer RAM
- DMA bus master functionality

NandFlash Interface
- 8 and 16 bit flash support
- 3, 4 & 5 byte address support
- DMA support
- Basic hardware ECC for SLC
- Extended BCH error correction for MLC (correction of up to 8 errors within 512 byte)
- Caching of ECC data for 2K/4K/8K page sizes to write ECC data to spare region

MMC/SD Interface
- Mobile Storage controller supporting various standards
  - · SD card according to SD Phys. Layer Spec V2.0
  - · SDHC card according to SD Phys. Layer Spec V2.0
  - · SDIO interface according to SD spec part E1, SDIO Spec V2.0
  - · Multimedia Card according to MMC Spec V4.2 including MMCplus and MMC Mobile
  - · Consumer Electronics Advanced Transport Architecture (CE-ATA version 1.2)
- Other Features
  - · Integrated 2048 byte FiFo
  - · Separate clock for bus interface and card interface
  - · 1, 4 or 8 bit data width for MMC card IF
  - · 1, 4 bit data width for SD card IF
  - · AMBA AHB bus interface

Memory Stick Interface
- Memory Stick and Memory Stick Pro support
- 20 MHz serial, 40 MHz parallel clock

Synchronous Serial Interface
- Three independent SSI interfaces
- Master/slave
- TX/RX FiFo buffering (16 byte)
- DMA support
- 8/16 bit support

2-wire Control Interfaces
- Three independent I²C interfaces
- Master/slave function
- FiFo buffering (16 byte)
- DMA support
- Max. 400 KHz speed

UART
- Three independent UART interfaces
- Baud rates up to 2 Mbit/s
- Internal RX/TX FiFo buffering (64 byte)
- DMA support
- IrDA SIR Encoder/Decoder

General Purpose IO
- Most of the PINs configurable as GPIO
- Configurable drive strength
- Configurable pull-down function
- Each GPIO PIN can be used as programmable interrupt source

Generic Infrared Interface
- Modulated or digital transmit and receive
- Independent transmit and receive FiFo buffers (16 entries each)
- Direct interrupts for transmit and receive FiFo level monitoring

CAN Bus
- ISO011898 CAN specification V2.0B compatible
- 11-bit and 29-bit identifiers
- Bit rates from 125 Kbit/s to 1 Mbit/s
- Total of 8 transmit and receive buffers
- 3 identifier filters

XM Satellite ready
- Integrated XM DT interface
- LVDS interface
- Uses internal PLLB for generation of 45.1584 MHz clock

Display Interface

Two display output interfaces are available: either DBOP for simple small resolution displays or full RGB/LCD controller IF for high resolution displays

DBOP
- Configurable interface for different types of uController
- System interfaces (Intel 80xx or Motorola 68xx style)
- FiFo buffer (128x32) and DMA support
- 8 or 16 bit modes

LCD Controller
- FiFo input data buffer (dual 16x64)
- Supports single and dual panel mono STN
- Supports single and dual panel color STN
- Supports TFT color displays
- Wide range of programmable resolutions: 320x200, 320x240, 640x200, 640x240, 640x480, 800x600, 1024x768
- 1/2/4/8 bpp palettized color for STN or TFT
- 16 bpp true color STN or TFT mode
- 24 bpp true color TFT
- TFT modes with 12 bpp direct 4:4:4 RGB, 16 bpp direct 5:5:5, 16bpp direct 6:6:6 and 16bpp direct 5:6:5 (both with common intensity bit), 24 bpp direct 8:8:8
- Hardware cursor support for single panel displays
- Programmable parameters for all key parameters (frequency, timings, resolution, bpp, color modes, …)

Video Output

CCIR-656 compatible pixel output port to support an external PAL/NTSC video encoder
- 27 MHz data rate
- 8 bit parallel data IF with YCrCb 4:2:2 encoding

Audio Engine

Audio Accelerator
- Ultra low power accelerator for decoding of MP3, WMA and AAC.
- Includes ten-band equalizer with 64 steps (-20 ÷ 20 db gain) and 32-step volume control

MP3 features
- 9 MHz clock frequency for MP3 decoding with 320 kbit/s input bit rate / 48 KHz audio sampling rate
- Supports MPEG-1 layer III and MPEG-2 layer III (ISO11172-3 and ISO13818-3) formats
- Support for constant and variable bit rate from 8 to 320 kbps

WMA features
- WMA V8 and V9 compatible WMA decoder
- Support of bit rates from 5kbps up to 382 kbps

AAC features
- AAC with support of CBR and VBR

Audio Post-Processor

For flexible audio signal processing an internal audio matrix is available together with a audio mixer, equalizer and sample rate converter.
- 5 band graphic equalizer
- I²SIN input sample rate conversion for audio mixing with signals running on other sampling rate
- Audio mute
- L/R channel swap
- Gain attenuation
- Llimiter modes

Security Engine
- AES ciphering supporting 128 bit keys with ECB, CBC and CTR block cipher modes
- DES and 3-DES ciphering supporting ECB and CBC block cipher modes
- RC-4 ciphering supporting 40 bit and 128 bit key expansion modes
- All cipher modes support both encrypt and decrypt operations
- SHA-1 and MD-5 hashing algorithm with support for HMAC mode (key sizes of 1 to 64 byte)
- Power optimized True Random Number Generator (TRNG) supporting initial seeding and 32 bit random word every 128 clock cycles

Video Engine

The video engine consists of a video accelerator and of an independent video postprocessor. Features of the video postprocessor can be used independently of the chosen video decoding algorithm (running either in the video accelerator or in software).

- Minimum power consumption of HW video engine
- < 18mW for H.264 PAL/NTSC resolution
- Video Accelerator
- MPEG 4 simple profile, Levels 0 - 5
- H.263 profile 0, Levels 10 - 70
- H.264 / AVC Baseline, Levels 1 - 3.1
- VC-1 (Windows Media Video 9) main profile, levels Low, Mid and High
- JPEG Baseline DCT, sequential
- Video resolutions (for MPEG-4/H.263/H.264/VC-1)
  - · Up to 720x576 at 25 fps (PAL/DVD) or
  - · Up to 720x480 at 30fps (NTSC)
- Ultra low CPU load < 3MHz

Video Post-Processor

- Integrated colour space conversion YCbCr to RGB
- Proprietary scaling algorithms for better quality on handset resolutions
- Image rotation
- Cropping function for viewing large images on small displays in original size
- Masking feature for easy user interface implementation
- Alpha blending support for two variable sized regions
- Picture-in-picture support

Extended system features

Boot Options

The chip contains an on-chip ROM Bootloader that supports booting from various kinds of external flash devices. During boot, the application firmware is loaded from the external flash device into the RAM. In addition to this boot functionality, also the firmware programming and firmware update is supported.

- NandFlash
- External static Flash (MPMC)
- Serial NOR Flash
- IDE
- SD/MMC/SDIO/CE-ATA
- Bootloader concept with 1st/2nd level loader for initial firmware programming and firmware update
- Secured firmware update mechanism

Modes of operation

- Normal operation
- Hibernation mode (clock stopped)

Power Consumption

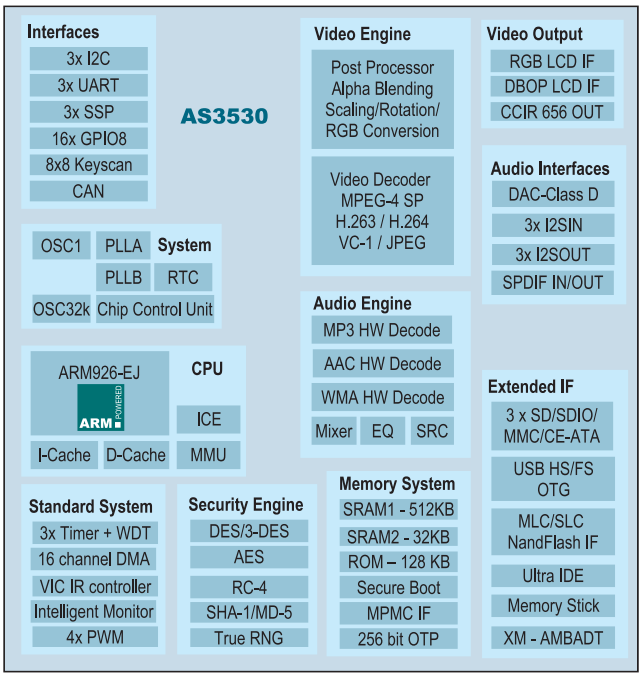
Playback use case: MP3 / AAC / WMA playback 128kbit/s, 44.1 KHz, output level 150 mVrms, no external memory. Depending on output quality, following power consumption values are achieved. Standby use case: clock stopped, only voltage generation for keeping memory content is on, system will wake up by timer interrupt.

Audio Playback, 92 dB SNR (1)	9 mW
H.264 Video Decode QVGA (2)	37 mW
H.264 Video Decode D1 (2)	88 mW
Standby	0.5 mW

Packaging

Single chip CTBGA 10x10 mm with 0.5 mm ball pitch, 280 Balls.

Block Diagram



General Description

The AS3531 is austriamicrosystems' new generation SoC for portable digital audio products. Its highly flexible architecture allows single chip solutions for high performance and ultra low power audio products with minimum count of external components.

Using low power process technologies with ultra low leakage currents provides an outstanding performance in terms of power consumption and utmost integration densities for embedded on-chip RAM and ROM areas.

The AS3531 integrates a powerfull Audio Engine that enables lowest possible system clock rates for audio decoding. This audio engine supports all common audio decoding standards: MP3, AAC+ and WMA. Together with the audio postprocessor this enables devices with less than 15 mW power consumption for typical audio playback use cases.

The AS3531 contains all digital functions together with the audio analog front-end (AFE) and all necessary power management blocks. These function blocks include on-chip RAM and ROM memories, interface blocks for data transfer and storage like USB, NandFlash, MMC, SD, SDIO, CE-ATA, GPIO, SSP, clock generation and digital power optimisation functions.

austriamicrosystems provides a total system solution reference design including all necessary software blocks for low level HW drivers, device IO functions and a dedicated reference application with a feature rich set of audio functions.

The AS3531 contains an ultra low power stereo audio codec. It allows playback in higher than CD quality and recording in FM quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16 /32 headsets and auxiliary signal sources via a 3-channel mixer.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player are supplied by the included AFE. The different regulated supply voltages are programmable via the serial control interface.

The AFE also contains a Li- Ion battery charger. The single supply voltage may vary from 2.7V to 5.5V. The AFE has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

Key Features

Basic System

ARM926-EJ RISC Controller
- 32/16 bit RISC architecture
- 16-bit Thumb instruction set
- ARMv5TEJ extended DSP instruction set and single cycle MAC
- Memory Management Unit
- Embedded ICE JTAG debug interface
- 16KB Instruction + 16KB Data Cache
- Up to 250 MHz clock speed
- Power consumption: 0.265 mW/MHz including caches at typical conditions
- 32/16 bit RISC architecture

Memory
- 512 KByte embedded SRAM connected to AHB1
- 128 KByte ROM (128KB bootrom + 32KB GF-table)
- 32 KByte embedded SRAM connected to AHB2 as buffer memory within AHB2 bus domain

AMBA Bus
- Two AHB bus segments
  - · AHB1 with all Core/Memory high performance elements running up to 150 MHz
  - · AHB2 with all peripheral interface blocks running at max. 100 MHz bus speed
- AHB bus bridge between AHB1 and AHB2
  - · Synchronous 1:1 mode
  - · Asynchronous mode
- AHB interconnect matrix for high throughput
  - · AHB to APB bridge
  - · Connected to AHB2

DMA controller

One DMA controller located in each of AHB1 and AHB2 bus domain
- DMA1 in AHB1 bus domain
  - · 8 simultaneously opened DMA channels
  - · 16 DMA requests
- DMA2 in AHB2 bus domain
  - · 8 simultaneously opened DMA channels
  - · 32 DMA requests

Interrupt Controller (VIC)
- Support for 32 non-vectored interrupts
- Support for 32 vectored interrupts

Timer and Watchdog
- Two independent timer blocks (A+B) with two 32 bit counters each
- Two timer trigger event inputs
- Watchdog

Chip Control Unit
- Two independent 1 GHz PLL generators (PLLA, PLLB)
- Internal 24 MHz oscillator
- Optional usage of external oscillator
- Four programmable clock outputs
- Chip version number

- Control of IO multiplexing
- Universal spare registers
- Clock gating / block enables
- JTAG disable bit

Keyscan Controller
- Up to 16 keys in a 4x4 matrix
- Low power mode
- Interrupt generation

IMON
- Intelligent hardware monitor for bus and system profiling for continuous system monitoring and power optimisation.
- Very flexible selection of input events
- Monitoring averaging or peak conditions
- Scalable counters
- Programmable interrupt generation

OTP
- 256 Bit one-time-programmable memory
- contains unique ID

Interfaces

USB 2.0 HS & OTG Interface
- Up to 480Mbit/s transfer speed
- USB 2.0 HS/FS physical including OTG support
- USB 2.0 HS/FS digital core including OTG host
- Dedicated dual port buffer RAM
- DMA bus master functionality
- Total of seven endpoints (1xCONTROL, 3xIN, 3xOUT)

NandFlash Interface
- 8 and 16 bit flash support
- 3, 4 & 5 byte address support
- DMA support
- Basic hardware ECC for SLC
- Extended BCH error correction for MLC (correction of up to 8 errors within 512 byte)
- Caching of ECC data for 2K/4K/8K page sizes to write ECC data to spare region

MMC/SD Interface
- Mobile Storage controller supporting various standards
  - SD card according to SD Phys. Layer Spec V2.0
  - SDHC card according to SD Phys. Layer Spec V2.0
  - SDIO interface according to SD spec part E1, SDIO Spec V2.0
  - Multimedia Card according to MMC Spec V4.2 including MMCplus and MMC Mobile
  - Consumer Electronics Advanced Transport Architecture (CE-ATA version 1.2)
- Other Features
  - Integrated 2048 byte FiFo
  - Separate clock for bus interface and card interface
  - 1, 4 or 8 bit data width for MMC card IF
  - 1, 4 bit data width for SD card IF
  - AMBA AHB bus interface

Synchronous Serial Interface
- Master/slave
- TX/RX FiFo buffering (16 byte)
- DMA support
- 8/16 bit support

I²C Control Interfaces
- Master/slave function
- FiFo buffering (16 byte)
- DMA support
- Max. 400 KHz speed

UART
- Baud rates up to 2 Mbit/s
- Internal RX/TX FiFo buffering (64 byte)
- DMA support
- IrDA SIR Encoder/Decoder

General Purpose IO
- Most of the PINs configurable as GPIO
- Configurable drive strength
- Configurable pull-down function
- Each GPIO PIN can be used as programmable interrupt source

Display Interface

The DBOP (data block output port) interface is perfectly suited for all display types with uController style interfaces.

DBOP
- Configurable interface for different types of uController
- System interfaces (Intel 80xx or Motorola 68xx style)
- FiFo buffer (128x32) and DMA support
- 8 or 16 bit modes

Audio Engine

Audio Accelerator
- Ultra low power accelerator for decoding of MP3, WMA and AAC.
- Includes ten-band equalizer with 64 steps (-20 ÷ 20 db gain) and 32-step volume control

MP3 features
- 9 MHz clock frequency for MP3 decoding with 320 kbit/s input bit rate / 48 KHz audio sampling rate
- Supports MPEG-1 layer III and MPEG-2 layer III (ISO11172-3 and ISO13818-3) formats
- Support for constant and variable bit rate from 8 to 320 kbps

WMA features
- WMA V8 and V9 compatible WMA decoder
- support of bit rates from 5kbps up to 382 kbps

AAC features
- AAC with support of CBR and VBR

Audio Post-Processor

For flexible audio signal processing an internal audio matrix is available together with a audio mixer, equalizer and sample rate converter.
- 5 band graphic equalizer
- I²SIN input sample rate conversion for audio mixing with signals running on other sampling rate

- Audio mute
- L/R channel swap
- Gain attenuation
- Limiter modes

Security Engine

- AES ciphering supporting 128 bit keys with ECB, CBC and CTR block cipher modes
- DES and 3-DES ciphering supporting ECB and CBC block cipher modes
- RC-4 ciphering supporting 40 bit and 128 bit key expansion modes
- All cipher modes support both encrypt and decrypt operations
- SHA-1 and MD-5 hashing algorithm with support for HMAC mode (key sizes of 1 to 64 byte)
- Power optimized True Random Number Generator (TRNG) supporting initial seeding and 32 bit random word every 128 clock cycles

Extended system features

Boot Options

The chip contains an on-chip ROM Bootloader that supports booting from various kinds of external flash devices. During boot, the application firmware is loaded from the external flash device into the RAM. In addition to this boot functionality, also the firmware programming and firmware update is supported.

- NandFlash
- SD/MMC/SDIO/CE-ATA
- Bootloader concept with 1st/2nd level loader for initial firmware programming and firmware update
- Secured firmware update mechanism

Modes of operation

- Normal operation
- Hibernation mode (clock stopped)

Audio Front-End Features

Audio Features

- Audio power consumption:
  - 5mW: 96dB DAC to Headphone @ 1.8V, 32
  - 7mW: 100dB DAC to Headphone @ 2.9V, 32
- Sigma Delta DAC
  - 96dB SNR (‚A' weighted) @ 1.8V
  - 100dB SNR (‚A' weighted) @ 2.9V
  - 8-48kHz sampling frequency
- Sigma Delta ADC
  - 83dB SNR (‚A' weighted) @ 1.8V
  - 8-24kHz sampling frequency
- Microphone Input
  - 3 gain pre-setting (28dB/34dB/40dB) and AGC
  - 32 gain steps @1.5dB and MUTE
  - Supply for electret microphone
  - Microphone detection
  - Remote control by switch
- Line Input
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - Stereo or 2x mono
- Audio Mixer
  - 6 channel input/output mixer with AGC
  - Mixes line inputs and microphones with DAC
  - Left and right channels independent
- Line Output
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 1Vp @10k
  - Ground noise cancellation
- High Efficiency Headphone Amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x12mW @16 driver capability@ 1.8V supply
  - THD -74dB @16 ; 1.8V
  - 2x40mW @16 driver capability@ 2.9V supply
  - THD -77dB @16 ; 2.9V
  - Headphone and over-current detection
  - Phantom ground eliminates large capacitors
  - Ground noise cancellation

Power Management

- Voltage Generation
  - Step down for CPU core (1.2V typ, 250mA)
  - Step down for peripheral (0.65V-3.4V, 250mA)
  - LDO1 for AFE audio supply (1.7V, 50mA)
  - LDO2 for AFE IO/audio supply (2.7V, 200mA)
  - LDO3 for peripherals (1.2V-3.5V, 100/200mA)
  - LDO4 for peripherals (1.2V-3.5V, 100/200mA)
  - VBUS comparator
  - Separate input for LDO3
  - Power supply supervision
  - 5sec and 10sec emergency shut-down
- Backlight Driver
  - Step up for backlight (15V (25V))
  - Current control mode (1.1-36mA)
  - Voltage control mode
  - Automatic dimming
  - Over-voltage protection
- Battery Charger
  - Automatic trickle charge (55mA)
  - Prog. constant current charging (55-460mA)
  - Prog. constant voltage charging (3.9V-4.25V)
  - Current limitation for USB mode
  - Integrated battery switch

AS3531

General AFE Features

- Supervisor
  - · Automatic battery monitoring with interrupt generation and selectable warning level
  - · Automatic temperature monitoring with interrupt generation and selectable warning and shutdown levels
- Real Time Clock
  - · Ultra low power 32kHz oscillator
  - · 32bit RTC sec counter, 96 days auto wake-up
  - · Selectable alarm (seconds or minutes)
  - · 128bit free SRAM for random settings
  - · 32kHz clock output to peripheral
  - · Voltage generation
  - · Trimmable oscillator
  - · <1µA total power consumption
- General Purpose ADC
  - · 10bit resolution
  - · 19 inputs analog multiplexer
- Interfaces
  - · 2 wire serial control interface
  - · Reset pin with selectable delay, power good pin
  - · 64bit unique ID (OTP)
  - · 23 different interrupts

Power Consumption

Playback use case: MP3 / AAC / WMA playback 128kbit/s, 44.1 KHz, output level 150 mVrms, no external memory. Depending on output quality, following power consumption values are achieved.
Standby use case: clock stopped, only voltage generation for keeping memory content is on, system will wake up by timer interrupt.

Playback, 100 dB SNR	16.5 mW
Playback, 94 dB SNR	14.1 mW
Playback, 92 dB SNR (1)	10.6 mW
Standby	1.4 mW

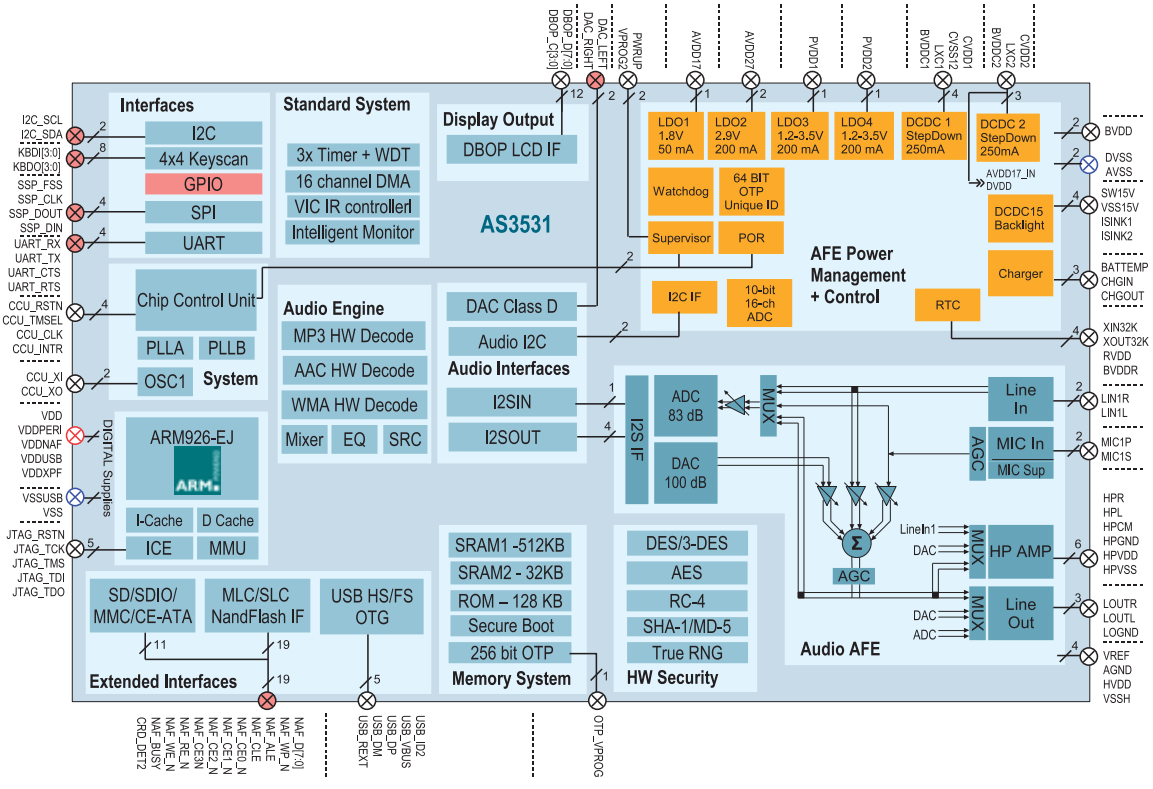
Packaging

Single chip CTBGA 124 with 0.5 mm ball pitch, 8x8 mm.

Applications

Portable digital Audio players

- · With ultra low power consumption
- · With optional recording capability
- · With up to 16 key user interface
- · Supporting internal and external non-volatile memory
- · With colour LCD display interface
- · With support for Microsoft WMDRMv10 or other DRM systems



General Description

The AS3532 is a high definition audio player at ultra low power consumption for new generation music phones. The music player subsystem core is based on a new Audio Engine and Audio Post-Processor which act as co-processors to an ARM central programmable unit.

The Audio Engine, in a fully hardwired context, executes the decompression and playback of most popular compressed audio formats, like MP3, WMA and AAC for the least amount of power consumption with 0 (zero) CPU load.

The Audio Post-Processor implements an Asynchronous Sample Rate Converter (ASRC) with near transparent quality, multi-channel mixer with limiting function, 10 Bands Graphics Equalizer and it supports 192KHz sample rates at 24 Bits Dynamic Range for High Definition Audio processing.

Three sets of I^2S outputs can independently control stereo speakers, subwoofer and headphone or line outputs, these can also be utilized as multi-channel audio outputs.

The AS3532 audio subsystem includes a stereo PDM digital microphone input therefore completing all the audio requirements for new generation Mobile Phones.

Interfaces included in the AS3532 can support either Peer Mode to a Baseband Phone IC or „Black Box" companion Music Sub-system. In the later case it provides direct support for latest generation removable and embedded Flash Memory types with 4/8/16-Bit hardware ECC for MLC NAND Flashes, for iNAND, LBA NAND, moviNAND, oneNAND and removable card formats like SD2.0, MMC+, CE-ATA, MS PRO, CF.

The AS3532 is complemented by a comprehensive software suite that has matured over three generation of products delivered in the Multimedia Player market. The on chip 512Kbytes buffer memory allows single chip support of all key audio formats, compressed, lossless and high definition, polyphonic sequenced content, wavetable synthesizer, 3D positional sound, virtualizer engines and other digital audio effects. The SDK has passed the stringent test criteria of the Certified for Windows Vista program for downloadable DRM protected content.

Key Features

Basic System

ARM926-EJ RISC Controller
- 32/16 bit RISC architecture
- 16-bit Thumb instruction set
- ARMv5TEJ extended DSP instruction set and single cycle MAC
- Memory Management Unit
- Embedded ICE JTAG debug interface
- 16KB Instruction + 16KB Data Cache
- Up to 250 MHz clock speed
- Power consumption: 0.265 mW/MHz including caches at typical conditions
- 32/16 bit RISC architecture

Memory
- 512 KByte embedded SRAM connected to AHB1
- 128 KByte ROM (128KB bootrom + 32KB GF-table)
- 32 KByte embedded SRAM connected to AHB2 as buffer memory within AHB2 bus domain

AMBA Bus
- Two AHB bus segments
  - · AHB1 with all Core/Memory high performance elements running up to 150 MHz
  - · AHB2 with all peripheral interface blocks running at max. 100 MHz bus speed
- AHB bus bridge between AHB1 and AHB2
  - · synchronous 1:1 mode
  - · asynchronous mode
- AHB interconnect matrix for high throughput
  - · AHB to APB bridge
  - · connected to AHB2

DMA controller

One DMA controller located in each of AHB1 and AHB2 bus domain
- DMA1 in AHB1 bus domain
  - · 8 simultaneously opened DMA channels
  - · 16 DMA requests
- DMA2 in AHB2 bus domain
  - · 8 simultaneously opened DMA channels
  - · 32 DMA requests

Interrupt Controller (VIC)
- Support for 32 non-vectored interrupts
- Support for 32 vectored interrupts

Timer and Watchdog
- Two independent timer blocks (A+B) with two 32 bit counters each
- Two timer trigger event inputs
- Watchdog

Chip Control Unit
- Two independent 1 GHz PLL generators (PLLA, PLLB)
- Internal 24 MHz oscillator
- Optional usage of external oscillator
- Four programmable clock outputs
- Chip version number
- Control of IO multiplexing
- Universal spare registers
- Clock gating / block enables
- JTAG disable bit

Keyscan Controller
- Up to 16 keys in a 4x4 matrix
- Low power mode
- Interrupt generation

IMON
- Intelligent hardware monitor for bus and system profiling for continuous system monitoring and power optimisation.
- Very flexible selection of input events
- Monitoring averaging or peak conditions
- Scalable counters
- Programmable interrupt generation

OTP
- 256 Bit one-time-programmable memory
- Contains unique ID

RTC
- Integrated ultra low power 32 KHz oscillator
- Separated power supply
- Wakeup can be triggered by RTC
- Suspend mode with all clocks stopped, resume by RTC timer

Interfaces

USB 2.0 HS & OTG Interface
- Up to 480Mbit/s transfer speed
- USB 2.0 HS/FS physical including OTG support
- USB 2.0 HS/FS digital core including OTG host
- Dedicated dual port buffer RAM
- DMA bus master functionality
- Total of seven endpoints (1xCONTROL, 3xIN, 3xOUT)

NandFlash Interface
- 8 and 16 bit flash support
- 3, 4 & 5 byte address support
- DMA support
- Basic hardware ECC for SLC
- Extended BCH error correction for MLC (correction of up to 8 errors within 512 byte)
- Caching of ECC data for 2K/4K/8K page sizes to write ECC data to spare region

MMC/SD Interface
- Mobile Storage controller supporting various standards
  - SD card according to SD Phys. Layer Spec V2.0
  - SDHC card according to SD Phys. Layer Spec V2.0
  - SDIO interface according to SD spec part E1, SDIO Spec V2.0
  - Multimedia Card according to MMC Spec V4.2 including MMCplus and MMC Mobile
  - Consumer Electronics Advanced Transport Architecture (CE-ATA version 1.2)
- Other Features
  - Integrated 2048 byte FiFo
  - Separate clock for bus interface and card interface
  - 1, 4 or 8 bit data width for MMC card IF
  - 1, 4 bit data width for SD card IF
  - AMBA AHB bus interface

Synchronous Serial Interface
- Master/slave
- TX/RX FiFo buffering (16 byte)
- DMA support
- 8/16 bit support

I²C Control Interfaces
- Master/slave function
- FiFo buffering (16 byte)
- DMA support
- Max. 400 KHz speed

UART
- Baud rates up to 2 Mbit/s
- Internal RX/TX FiFo buffering (64 byte)
- DMA support
- IrDA SIR Encoder/Decoder

General Purpose IO
- Most of the PINs configurable as GPIO
- Configurable drive strength
- Configurable pull-down function
- Each GPIO PIN can be used as programmable interrupt source

Audio Interfaces
- Three I²S stereo input interfaces
  - FiFo (32x48) buffered
  - DMA support
  - Up to 24 bit input width
- SPDIF input interface
- Three I²S stereo output interfaces
  - FiFo (128x48) buffered
  - DMA support
  - Up to 24 bit output width
- SPDIF output bridge
- PDM stereo digital microphone input

Audio Engine

Audio Accelerator

- Ultra low power accelerator for decoding of MP3, WMA and AAC.
- Includes ten-band equalizer with 64 steps (-20 ÷ 20 db gain) and 32-step volume control

MP3 features

- 9 MHz clock frequency for MP3 decoding with 320 kbit/s input bit rate / 48 KHz audio sampling rate
- Supports MPEG-1 layer III and MPEG-2 layer III (ISO11172-3 and ISO13818-3) formats
- Support for constant and variable bit rate from 8 to 320 kbps

WMA features

- WMA V8 and V9 compatible WMA decoder
- Support of bit rates from 5kbps up to 382 kbps

AAC features

- AAC with support of CBR and VBR

Audio Post-Processor

For flexible audio signal processing an internal audio matrix is available together with a audio mixer, equalizer and sample rate converter.

- Input and output matrix for flexible routing of I²S inputs / SPDIF input / MIC input / I²S outputs / SPDIF output.
- 3-input stereo mixer stage
- 5 band graphic equalizer
- Audio mute
- L/R channel swap
- Gain attenuation
- Limiter modes
- On-the-fly channel switching and option changes without any audio disturbances
- Asynchronous fully digital stereo sample rate conversion for audio mixing with signals running on other sampling rate
- Asynchronous rate conversion
- Ratios from 7:1 up to 1:7
- Input/output sample rates from 8 KHz to 192 KHz
- Lower than -120 dB THD+N for common conversion rates
- Greater than 131 dB dynamic range for common conversion rates

Extended system features

Boot Options

The chip contains an on-chip ROM Bootloader that supports booting from either the SSP host port or from various kinds of external flash devices. Optional the device supports also firmware programming and firmware update through the USB interface.

- SPI slave boot mode
- NandFlash
- SD/MMC/SDIO/CE-ATA
- Bootloader concept with 1st/2nd level loader for initial firmware programming and firmware update
- Secured firmware update mechanism

Modes of operation

- Normal operation
- Hibernation mode (clock stopped)

Power Consumption

Playback use case: MP3 / AAC / WMA playback 128kbit/s, 44.1 KHz, output level 150 mVrms, no external memory. Depending on output quality, following power consumption values are achieved.
Standby use case: clock stopped, only voltage generation for keeping memory content is on, system will wakeup by timer interrupt.

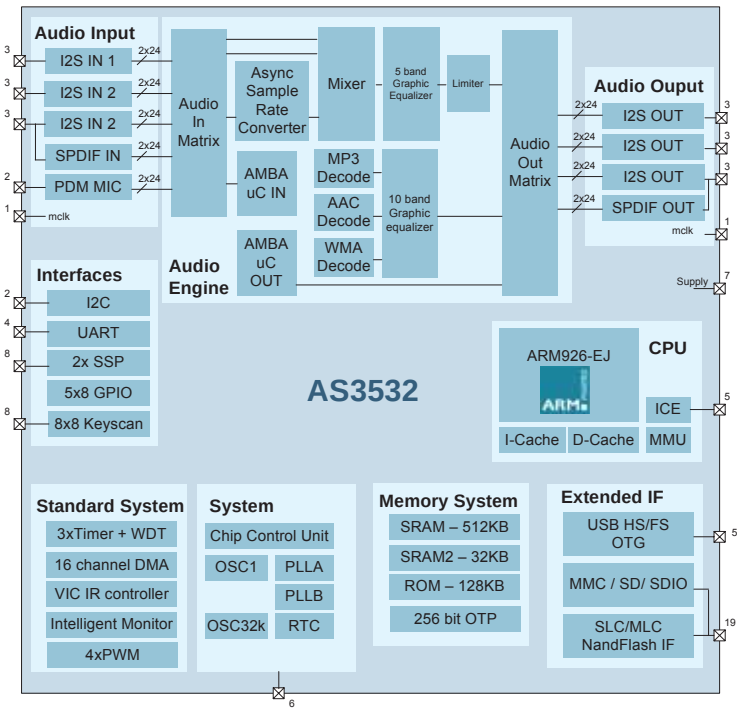
Playback of compressed audio formats (MP3, AAC, WMA)	5 mW
Standby	1 mW

Packaging

Single chip CTBGA 84 with 0.5 mm ball pitch, 6x6 mm.

Applications

Digital audio processor for music phones working with highest precision audio processing and optional also supporting various digital I/O functions.



AS3536

General Description

The AS3536 is austriamicrosystems´ third generation mobile entertainment platform digital audio/video processor. Its highly flexible architecture allows single chip solutions for high performance power optimised audio and video products with minimum count of external components.

For video applications the integrated video decoder hardware will provide high efficient video decoding at very low clock rates and the speed of the system can be scaled to the actual demanded video decoder complexity and resolution. All video decoder features for H.263/ MPEG-4/H.264 and VC-1 are implemented in a dedicated video hardware accelerator for minimal power consumption.

Using low power deep submicron technology gives outstanding performance in terms of power consumption and utmost integration densities for embedded on-chip RAM and ROM areas.

The AS3536 is intended as a microcontroller chip including all digital function blocks necessary for a portable audio or video player. These function blocks include onchip RAM and ROM memories, interface blocks for data transfer and storage like USB, IDE, NandFlash, MMC, SD, SDIO, CE-ATA.

Based on the ARM926-EJ with large on-chip instruction and data caches and integrated MMU, the system gives full support for all kinds of operating systems from simple RTOS implementations up to Symbian OS, micro Linux and Windows CE.

The AS3536 contains an ultra low power stereo audio codec. It allows playback in higher than CD quality and recording in FM quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16 /32 headsets and auxiliary signal sources via a 3-channel mixer.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player are supplied by the included AFE.

The AFE also contains a Li-Ion battery charger. The single supply voltage may vary from 2.7V to 5.5V. The AFE has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

austriamicrosystems provides a total system solution reference design including all necessary software blocks for low level HW drivers, device IO functions and a dedicated reference application with common audio and video features.

Key Features

Basic System

ARM926-EJ RISC Controller

- 32/16 bit RISC architecture
- 16-bit Thumb instruction set
- ARMv5TEJ extended DSP instruction set and single cycle MAC
- Memory Management Unit
- Embedded ICE JTAG debug interface
- 16KB Instruction + 16KB Data Cache
- Up to 250 MHz clock speed
- Power consumption: 0.265 mW/MHz including caches at typical conditions
- 32/16 bit RISC architecture

Memory

- 512 KByte embedded SRAM connected to AHB1
- 128 KByte ROM (128KB bootrom + 32KB GF-table)
- 32 KByte embedded SRAM connected to AHB2 as buffer memory within AHB2 bus domain
- External memory controller supporting
- Support for 16/32 bit data width
- Synchronous/asynchronous SRAM/Flash interface
- SDR DRAM (single data rate DRAM)
- Supports 2 static and 2 dynamic external memory devices
- Support three IO voltage levels: 1.8/2.5/3.3 V
- Pads with programmable drive strength
- 133 MHz max external memory clock frequency

AMBA Bus

- two AHB bus segments
  - · AHB1 with all Core/Memory high performance elements running up to 150 MHz
  - · AHB2 with all peripheral interface blocks running at max. 100 MHz bus speed
- AHB bus bridge between AHB1 and AHB2
  - · Synchronous 1:1 mode
  - · Asynchronous mode
- AHB interconnect matrix for high throughput
  - · AHB to APB bridge
  - · Connected to AHB2

DMA controller

One DMA controller located in each of AHB1 and AHB2 bus domain

- DMA1 in AHB1 bus domain
  - · 8 simultaneously opened DMA channels
  - · 16 DMA requests
- DMA2 in AHB2 bus domain
  - · 8 simultaneously opened DMA channels
  - · 32 DMA requests

Interrupt Controller (VIC)

- Support for 32 non-vectored interrupts
- Support for 32 vectored interrupts

PWM outputs
- Four PWM output channels
- Each channel can run independently or synchronized
- Period, pulse width and phase defined by 8-bit registers (phase only in synchronized mode)
- Two independent rotary decoders with programmable glitch filter
- Programmable count direction
- Programmable interrupt on zero count
- Zero count can stop PWM modulators

Timer and Watchdog
- Two independent timer blocks (A+B) with two 32 bit counters each
- Two timer trigger event inputs
- Watchdog

Chip Control Unit
- Two independent 1 GHz PLL generators (PLLA, PLLB)
- Internal 24 MHz oscillator
- Optional usage of external oscillator
- Four programmable clock outputs
- Chip version number
- Control of IO multiplexing
- Universal spare registers
- Clock gating / block enables
- JTAG disable bit

Keyscan Controller
- Configurable 1x4 to 4x4 or 1x8 to 8x8 matrix
- Low power mode
- Interrupt generation

IMON
- Intelligent hardware monitor for bus and system profiling for continuous system monitoring and power optimization.
- Very flexible selection of input events
- Monitoring averaging or peak conditions
- Scalable counters
- Programmable interrupt generation

OTP
- 256 Bit one-time-programmable memory
- Contains unique ID

RTC
- Integrated ultra low power 32 KHz oscillator
- Separated power supply
- Wakeup can be triggered by RTC
- Suspend mode with all clocks stopped, resume by RTC timer

Interfaces

Audio Interface
- I^2S input interface
  - FiFo (32x48) buffered
  - DMA support
  - 14/24 bit modes
  - SPDIF input bridge
- I^2S output interface
  - FiFo (128x48) buffered
  - DMA support
  - 16/18/24 bit modes
  - SPDIF output bridge
- Synchronous I^2SIN to I^2SOUT streaming mode

USB 2.0 HS & OTG Interface
- Up to 480Mbit/s transfer speed
- USB 2.0 HS/FS physical including OTG support
- USB 2.0 HS/FS digital core including OTG host
- Dedicated dual port buffer RAM
- DMA bus master functionality
- Total of seven endpoints (1xCONTROL, 3xIN, 3xOUT)

IDE Host Controller
- Supporting Ultra ATA 33/66/100 modes
- Programmable IO and Multi-word DMA capability
- Dedicated dual port buffer RAM
- DMA bus master functionality

NandFlash Interface
- 8 and 16 bit flash support
- 3, 4 & 5 byte address support
- DMA support
- Basic hardware ECC for SLC
- Extended BCH error correction for MLC (correction of up to 8 errors within 512 byte)
- Caching of ECC data for 2K/4K/8K page sizes to write ECC data to spare region

MMC/SD Interface
- Mobile Storage controller supporting various standards
  - SD card according to SD Phys. Layer Spec V2.0
  - SDHC card according to SD Phys. Layer Spec V2.0
  - SDIO interface according to SD spec part E1, SDIO Spec V2.0
  - Multimedia Card according to MMC Spec V4.2 including MMCplus and MMC Mobile
  - Consumer Electronics Advanced Transport Architecture (CE-ATA version 1.2)
- Other Features
  - Integrated 2048 byte FiFo
  - Separate clock for bus interface and card interface
  - 1, 4 or 8 bit data width for MMC card IF
  - 1, 4 bit data width for SD card IF
  - AMBA AHB bus interface

Memory Stick Interface
- Memory Stick and Memory Stick Pro support
- 20 MHz serial, 40 MHz parallel clock

Synchronous Serial Interface
- Three independent SSI interfaces
- Master/slave
- TX/RX FiFo buffering (16 byte)
- DMA support
- 8/16 bit support

2-wire Control Interfaces
- Three independent I²C interfaces
- Master/slave function
- FiFo buffering (16 byte)
- DMA support
- max. 400 KHz speed

UART
- Three independent UART interfaces
- Baud rates up to 2 Mbit/s
- Internal RX/TX FiFo buffering (64 byte)
- DMA support
- IrDA SIR Encoder/Decoder

General Purpose IO
- Most of the PINs configurable as GPIO
- Configurable drive strength
- Configurable pull-down function
- Each GPIO PIN can be used as programmable interrupt source

Generic Infrared Interface
- Modulated or digital transmit and receive
- Independent transmit and receive FiFo buffers (16 entries each)
- Direct interrupts for transmit and receive FiFo level monitoring

CAN Bus
- ISO011898 CAN specification V2.0B compatible
- 11-bit and 29-bit identifiers
- Bit rates from 125 Kbit/s to 1 Mbit/s
- Total of 8 transmit and receive buffers
- 3 identifier filters

XM Satellite ready
- Integrated XM DT interface
- LVDS interface
- Uses internal PLLB for generation of 45.1584 MHz clock

Display Interface

Two display output interfaces are available: either DBOP for simple small resolution displays or full RGB/LCD controller IF for high resolution displays

DBOP
- Configurable interface for different types of uController
- System interfaces (Intel 80xx or Motorola 68xx style)
- FiFo buffer (128x32) and DMA support
- 8 or 16 bit modes

LCD Controller
- FiFo input data buffer (dual 16x64)
- Supports single and dual panel mono STN
- Supports single and dual panel color STN
- Supports TFT color displays
- Wide range of programmable resolutions: 320x200, 320x240, 640x200, 640x240, 640x480, 800x600, 1024x768
- 1/2/4/8 bpp palettized color for STN or TFT
- 16 bpp true color STN or TFT mode
- 24 bpp true color TFT
- TFT modes with 12 bpp direct 4:4:4 RGB, 16 bpp direct 5:5:5, 16bpp direct 6:6:6 and 16bpp direct 5:6:5 (both with common intensity bit), 24 bpp direct 8:8:8
- Hardware cursor support for single panel displays
- Programmable parameters for all key parameters (frequency, timings, resolution, bpp, color modes, …)

Audio Engine

Audio Accelerator
- Ultra low power accelerator for decoding of MP3, WMA and AAC.
- Includes ten-band equalizer with 64 steps (-20 ÷ 20 db gain) and 32-step volume control

MP3 features
- 9 MHz clock frequency for MP3 decoding with 320 kbit/s input bit rate / 48 KHz audio sampling rate
- Supports MPEG-1 layer III and MPEG-2 layer III (ISO11172-3 and ISO13818-3) formats
- support for constant and variable bit rate from 8 to 320 kbps

WMA features
- WMA V8 and V9 compatible WMA decoder
- Support of bit rates from 5kbps up to 382 kbps

AAC features
- AAC with support of CBR and VBR

Audio Post-Processor

For flexible audio signal processing an internal audio matrix is available together with a audio mixer, equalizer and sample rate converter.
- 5 band graphic equalizer
- I²SIN input sample rate conversion for audio mixing with signals running on other sampling rate
- Audio mute
- L/R channel swap
- Gain attenuation
- Limiter modes

Security Engine
- AES ciphering supporting 128 bit keys with ECB, CBC and CTR block cipher modes
- DES and 3-DES ciphering supporting ECB and CBC block cipher modes
- RC-4 ciphering supporting 40 bit and 128 bit key expansion modes

- All cipher modes support both encrypt and decrypt operations
- SHA-1 and MD-5 hashing algorithm with support for HMAC mode (key sizes of 1 to 64 byte)
- Power optimized True Random Number Generator (TRNG) supporting initial seeding and 32 bit random word every 128 clock cycles

Video Engine

The video engine consists of a video accelerator and of an independent video postprocessor. Features of the video postprocessor can be used independently of the chosen video decoding algorithm (running either in the video accelerator or in software).

- Minimum power consumption of HW video engine
- < 18mW for H.264 PAL/NTSC resolution
- Video Accelerator
- MPEG 4 simple profile, Levels 0 - 5
- H.263 profile 0, Levels 10 - 70
- H.264 / AVC Baseline, Levels 1 - 3.1
- VC-1 (Windows Media Video 9) main profile, levels Low, Mid and High
- JPEG Baseline DCT, sequential
- Video resolutions (for MPEG-4/H.263/H.264/VC-1)
  - · Up to 720x576 at 25 fps (PAL/DVD) or
  - · Up to 720x480 at 30fps (NTSC)
- Ultra low CPU load < 3MHz

Video Post-Processor

- Integrated colour space conversion YCbCr to RGB
- Proprietary scaling algorithms for better quality on handset resolutions
- Image rotation
- Cropping function for viewing large images on small displays in original size
- Masking feature for easy user interface implementation
- Alpha blending support for two variable sized regions
- Picture-in-picture support

Extended system features

Boot Options

The chip contains an on-chip ROM Bootloader that supports booting from various kinds of external flash devices. During boot, the application firmware is loaded from the external flash device into the RAM. In addition to this boot functionality, also the firmware programming and firmware update is supported.

- NandFlash
- External static Flash (MPMC)
- Serial NOR Flash
- IDE
- SD/MMC/SDIO/CE-ATA
- Bootloader concept with 1st/2nd level loader for initial firmware programming and firmware update
- Secured firmware update mechanism

Modes of operation

- Normal operation
- Hibernation mode (clock stopped)

Audio Front-End Features

Audio Features

- Audio power consumption:
  - · 5mW: 96dB DAC to Headphone @ 1.8V, 32
  - · 7mW: 100dB DAC to Headphone @ 2.9V, 32
- Sigma Delta DAC
  - · 96dB SNR (‚A' weighted) @ 1.8V
  - · 100dB SNR (‚A' weighted) @ 2.9V
  - · 8-48kHz sampling frequency
- Sigma Delta ADC
  - · 83dB SNR (‚A' weighted) @ 1.8V
  - · 8-24kHz sampling frequency
- Microphone Input
  - · 3 gain pre-setting (28dB/34dB/40dB) and AGC
  - · 32 gain steps @1.5dB and MUTE
  - · Supply for electret microphone
  - · Microphone detection
  - · Remote control by switch
- Line Input
  - · Volume control via serial interface
  - · 32 steps @1.5dB and MUTE
  - · Stereo or 2x mono
- Audio Mixer
  - · 6 channel input/output mixer with AGC
  - · Mixes line inputs and microphones with DAC
  - · Left and right channels independent
- Line Output
  - · Volume control via serial interface
  - · 32 steps @1.5dB and MUTE
  - · 1Vp @10k
  - · Ground noise cancellation
- High Efficiency Headphone Amplifier
  - · Volume control via serial interface
  - · 32 steps @1.5dB and MUTE
  - · 2x12mW @16 driver capability@ 1.8V supply
  - · THD -74dB @16 ; 1.8V
  - · 2x40mW @16 driver capability@ 2.9V supply
  - · THD -77dB @16 ; 2.9V
  - · Headphone and over-current detection
  - · Phantom ground eliminates large capacitors
  - · Ground noise cancellation

Power Management

- Voltage Generation
  - · Step down for CPU core (1.2V typ, 250mA)
  - · Step down for peripheral (0.65V-3.4V, 250mA)
  - · LDO1 for AFE audio supply (1.7V, 50mA)
  - · LDO2 for AFE IO/audio supply (2.7V, 200mA)
  - · LDO3 for peripherals (1.2V-3.5V, 100/200mA)
  - · LDO4 for peripherals (1.2V-3.5V, 100/200mA)
  - · VBUS comparator
  - · Separate input for LDO3
  - · Power supply supervision
  - · 5sec and 10sec emergency shut-down
- Backlight Driver
  - · Step up for backlight (15V (25V))
  - · Current control mode (1.1-36mA)
  - · Voltage control mode
  - · Automatic dimming
  - · Over-voltage protection
- Battery Charger
  - · Automatic trickle charge (55mA)
  - · Prog. constant current charging (55-460mA)
  - · Prog. constant voltage charging (3.9V-4.25V)
  - · Current limitation for USB mode

General AFE Features

- Supervisor
  - · Automatic battery monitoring with interrupt generation and selectable warning level
  - · Automatic temperature monitoring with interrupt generation and selectable warning and shutdown levels
- Real Time Clock
  - · Ultra low power 32kHz oscillator
  - · 32bit RTC sec counter, 96 days auto wake-up
  - · Selectable alarm (seconds or minutes)
  - · 128bit free SRAM for random settings
  - · 32kHz clock output to peripheral
  - · Voltage generation
  - · Trimmable oscillator
  - · <1µA total power consumption
- General Purpose ADC
  - · 10bit resolution
  - · 19 inputs analog multiplexer
- Interfaces
  - · 2 wire serial control interface
  - · Reset pin with selectable delay, power good pin
  - · 64bit unique ID (OTP)
  - · 23 different interrupts

Power Consumption

Playback use case: MP3 / AAC / WMA playback 128kbit/s, 44.1 KHz, output level 150 mVrms, no external memory. Depending on output quality, following power consumption values are achieved.
Standby use case: clock stopped, only voltage generation for keeping memory content is on, system will wakeup by timer interrupt.

Audio Playback, 100 dB SNR	16.5 mW
Audio Playback, 94 dB SNR	14.1 mW
Audio Playback, 92 dB SNR[1]	10.6 mW
H.264 Video Decode QVGA[2]	56 mW
H.264 Video Decode D1	120 mW
Standby	1.4 mW

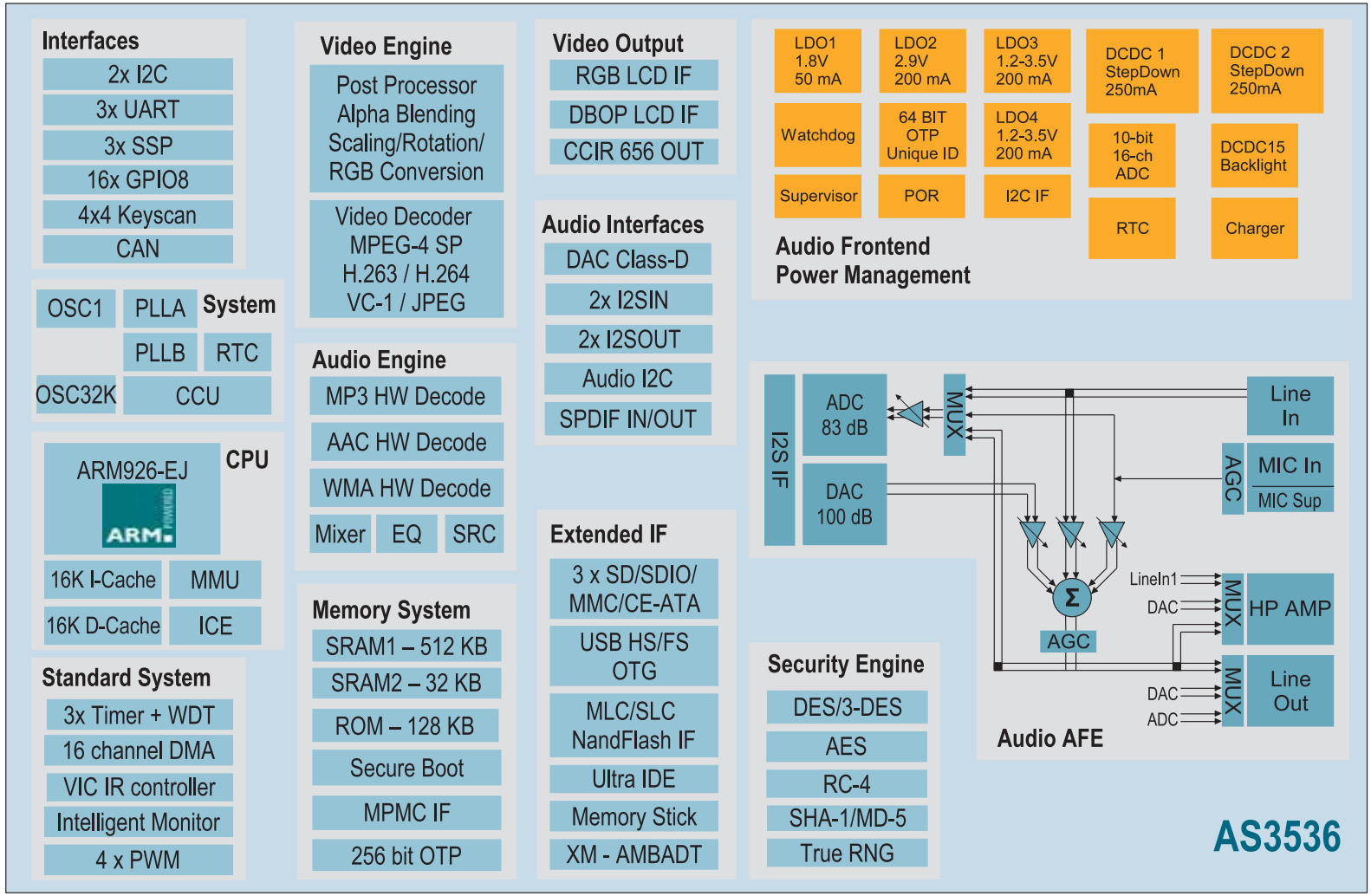
1) Class-D Headphone output amplifier
2) System power consumption, includes power consumption for external mobile SDRAM memory. Display and display backlight power consumption is not included.

Packaging

Single chip CTBGA 10x10 mm with 0.5 mm ball pitch, 280 Balls.

Applications

Portable Multimedia Players with ultra low power consumption


Interfaces
2x I2C
3x UART
3x SSP
16x GPIO8
4x4 Keyscan
CAN
OSC1
PLLA
System
PLLB
RTC
OSC32K
CCU
ARM926-EJ
CPU
ARM
16K I-Cache
MMU
16K D-Cache
ICE
Standard System
3x Timer + WDT
16 channel DMA
VIC IR controller
Intelligent Monitor
4 x PWM
Video Engine
Post Processor
Alpha Blending
Scaling/Rotation/
RGB Conversion
Video Decoder
MPEG-4 SP
H.263 / H.264
VC-1 / JPEG
Audio Engine
MP3 HW Decode
AAC HW Decode
WMA HW Decode
Mixer
EQ
SRC
Memory System
SRAM1 – 512 KB
SRAM2 – 32 KB
ROM – 128 KB
Secure Boot
MPMC IF
256 bit OTP
Video Output
RGB LCD IF
DBOP LCD IF
CCIR 656 OUT
Audio Interfaces
DAC Class-D
2x I2SIN
2x I2SOUT
Audio I2C
SPDIF IN/OUT
Extended IF
3 x SD/SDIO/
MMC/CE-ATA
USB HS/FS
OTG
MLC/SLC
NandFlash IF
Ultra IDE
Memory Stick
XM - AMBADT
LDO1
1.8V
50 mA
LDO2
2.9V
200 mA
LDO3
1.2-3.5V
200 mA
DCDC 1
StepDown
250mA
DCDC 2
StepDown
250mA
Watchdog
64 BIT
OTP
Unique ID
LDO4
1.2-3.5V
200 mA
10-bit
16-ch
ADC
DCDC15
Backlight
Supervisor
POR
I2C IF
RTC
Charger
Audio Frontend
Power Management
I2S IF
ADC
83 dB
DAC
100 dB
MUX
Line
In
AGC
MIC In
MIC Sup
LineIn1
DAC
Σ
AGC
MUX
HP AMP
DAC
ADC
MUX
Line
Out
Audio AFE
Security Engine
DES/3-DES
AES
RC-4
SHA-1/MD-5
True RNG
AS3536

AS3501/02

General Description

The AS3501/2 combine a high quality (0.1% THD, >100dB SNR), true ground, audio headphone amplifier with all the necessary circuitry to enable superior performance Active Noise Cancellation, all at very low power consumption. The AS3501 is ideally suited for feed-forward topology, whereas AS3502 is better suited for feedback topology.

The device contains an OTP-ROM to store calibration settings for the noise cancelling microphones, removing the need for the manually trimmed pots typically used. The OTP can also be used to store device configuration settings, allowing flexibility and differentiation for a broad end-product portfolio. The device is designed to operate in both stand-alone mode, ideal for accessories, and embedded mode targeting MP3 players and other portable multimedia equipment.

The AS3501/2 also contains a monitor mode, allowing the user to attenuate Line-in, while amplifying the ambient noise. This is typically used to hear announcements in airports, without the need to remove the headset.

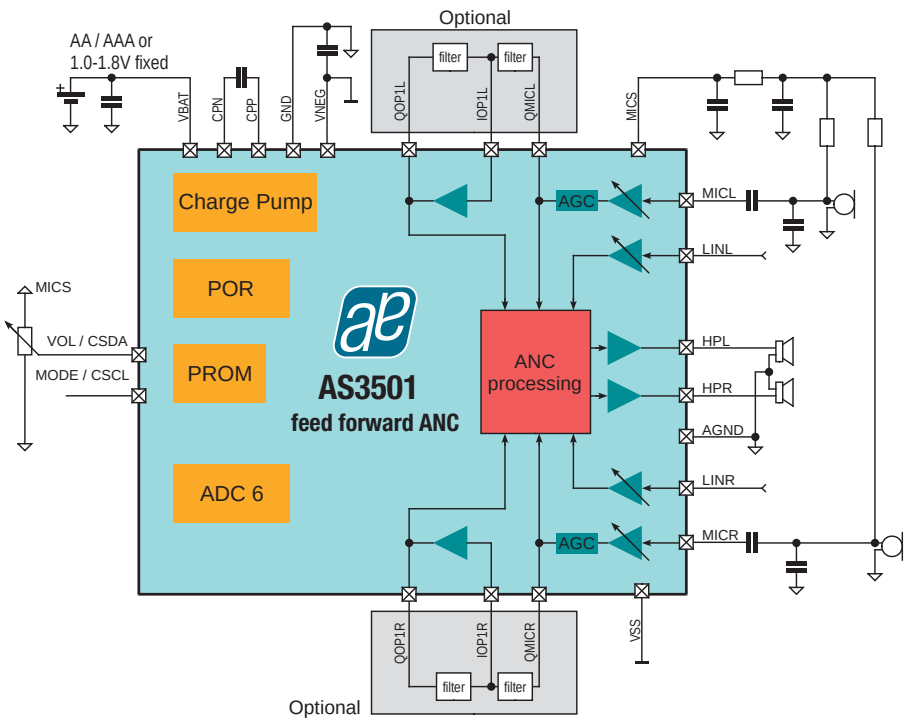
Typically powered directly off an AAA battery, the AS3501/2 tolerates 1.0V to 1.8V supply, and contains the necessary charge pumps to enable true ground operation, as well as providing a supply voltage for the microphones.

Key Features

- ANC processing
  - · Feed-forward and feedback topology
  - · Calibration and confi guration programmable on production line without manual intervention
  - · Typically up to 20dB noise reduction depending on headset
- High performance true ground headphone amplifier
  - · 2x34mW, THD <0.1% @ 16 with 1.5V supply, SNR >100dB
  - · Click and pop less start-up/shutdown
- Line-in gain programmable or user adjustable
- 2-wire serial control
- Low quiescent current of 0.6µA (typ.)
- Single cell (AA/AAA) or 1.0 - 1.8V supply
- Short circuit protection
- High PSRR, 80dB at 1kHz and 217Hz
- Package:
- · AS3501: 4x4mm QFN24 0.5mm pitch
- · AS3502: 5x5mm QFN32 0.5mm pitch

Applications

- Headsets (over-ear, on-ear and in-ear)
- Hands-free kits
- Mobile phones
- Portable media players
- Portable DVD players



AS1702/AS1703/AS1704/AS1705

General Description

The AS1702-AS1705 are single-channel differential audio power-amplifiers designed to drive 4 and 8Ω loads. The integrated gain circuitry of these amplifiers and their small size make them ideal for 2.7- to 5V-powered portable audio devices.

The differential input design improves noise rejection and provides common-mode rejection. A bridge-tied load (BTL) design minimizes external component count, while providing high-fidelity audio power amplification.

The devices deliver 1.8W continuous average power per Channel to a 4Ω load with less than 1% total harmonic distortion (plus noise), while operating from a single 2.7 to 5V supply.

For reduced component designs, the devices are available with different gain levels as shown below.

Standard Products

Model	Gain
AS1702	Adjustable (via external components)
AS1703	AV = 0dB
AS1704	AV = 3dB
AS1705	AV = 6dB

Integrated shutdown circuitry disables the bias generator and amplifiers, and reduces quiescent current consumption to less than 100nA. The shutdown input can be set active-high or active-low. All devices contain clickand-pop suppression circuitry that reduces audible clicks and pops during power-up and shutdown.

The devices are available in a 10-pin MSOP package and a 10-pin DFN package.

Key Features

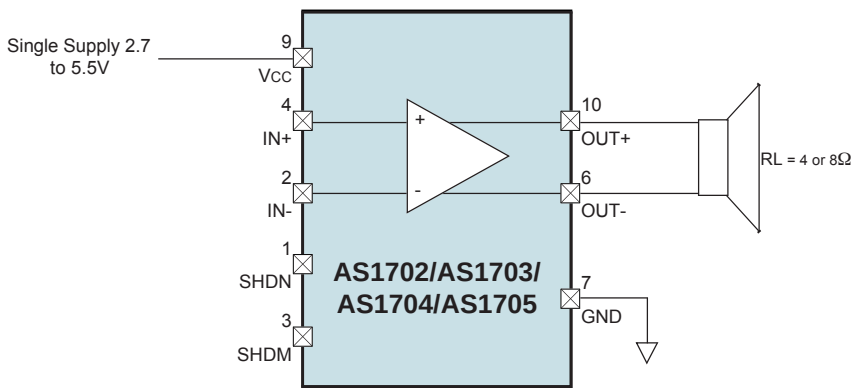
- 2.7 to 5.5V (V_{CC}) single-supply operation
- THD+N: 1.8W into 4Ω at 1% (per channel)
- Differential input
- Adjustable gain option (AS1702)
- Internal fixed gain to reduce external component count (AS1703, AS1704, AS1705)
- <100nA low-power shutdown mode
- Click and pop suppression
- Operating temperature range: -40 to +85°C
- Package types
  - 10-pin MSOP
  - 10-pin DFN (3x3mm)

Applications

The devices are ideal as audio front-ends for battery powered audio devices such as MP3 and CD players, mobile phones, PDAs, portable DVD players, and any other hand-held battery-powered device.

Block Diagram

Simplified Block Diagram



General Description

The AS1701 and AS1706 are 1.6W bridged audio power amplifiers that provide excellent circuit reliability, providing a very low-cost solution by eliminating external components when used with 2.7 to 5.5V-powered circuits.

The devices have superb total harmonic distortion (THD) at high-power output and excellent power supply rejection with 4- and 8Ω-loads.

Integrated over-temperature and over-current protection circuitry switch the devices off in case of an output short-circuit. A digital input allows the devices to automatically switch into shutdown mode. Click- and popsuppression circuitry reduces audible clicks and pops during power-up and shutdown. The gain (AV) of the devices is controlled using external resistors.

The AS1701/AS1706 are available in an 8-pin MSOP package.

Device	Shutdown
AS1701	Active-High
AS1706	Active-Low

Key Features

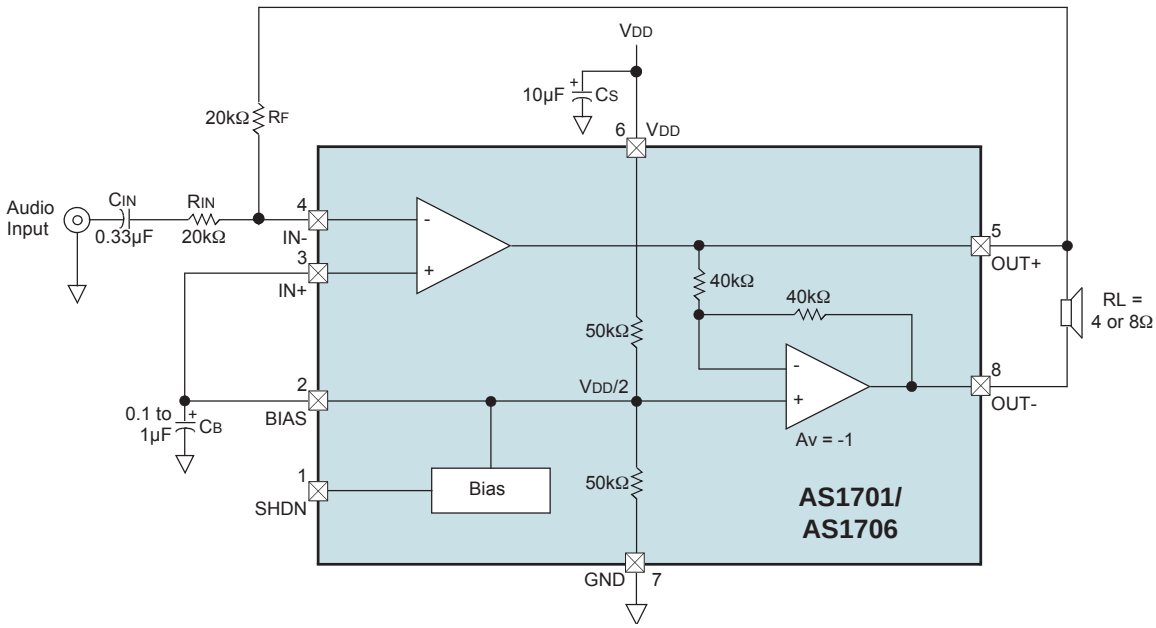
- 2.7 to 5.5V (V_{CC}) single-supply operation
- Very high PSRR: greater than 65dB @ 217Hz
- THD+Noise: 1.6W into 4Ω at 1%
- No output coupling capacitors required
- External gain configuration capability
- Low-power shutdown mode: 10nA
- Click and pop suppression
- Over-temperature and over-current protection
- Operating temperature range: -40 to +85°C
- 8-pin MSOP package

Applications

The AS1701/AS1706 are ideal as audio front-ends for battery powered audio devices such as MP3 and CD players, mobile phones, PDAs, portable DVD players, and any other hand-held battery-powered device.

Block Diagram

Typical configuration block diagram



AS3510

General Description

The AS3510 combines high flexibility and outstanding performance for analog audio front-end solutions. This codec-chip contains a high performance 18 bit digital to analog converter.

The dynamic range exceeds 95dB for best audio quality, for multi media applications (audio playback) within battery or line operated equipment. An additional audio power amplifier can directly drive external headphones or small 4Ω speakers with a power of up to half a watt. The power-up is click- and pop-less due to a smooth start-up circuitry.

The overall distortion level is always below 0.02%. The microphone input amplifier contains an automatic gain control (AGC) with a dynamic range of 40dB to generate an amplified and compressed signal for the ADC, which provides 14-bit resolution at 8kHz sampling-rate.

Furthermore all necessary power management is included such as bandgap reference and four voltage regulators. The two 2.9V regulators are used internally (analog and digital supply), but can also be used for external purposes as well. The third output is designed to supply the peripheral cells and an external digital core, and is programmable from 1.5V to 2.5V in 5 steps (default is 2.5V). They are all powered through a DC/DC-Converter, which can work down to a voltage of 1V. So the whole chip can work from a single battery cell.

The fourth regulator is only used for generating the supply voltage for the analog USB 1.1 interface circuit. It is supplied via the USB connector. The performance of the regulators is excellent (noise, line- and load-regulation) and allows the direct supply of sensitive analog circuits.

Because of the internal supply and signal filtering only few small external capacitors are required for de-coupling and stabilising and lead to very low output noise.

The current consumption is very low and makes the chip ideally for battery powered devices.

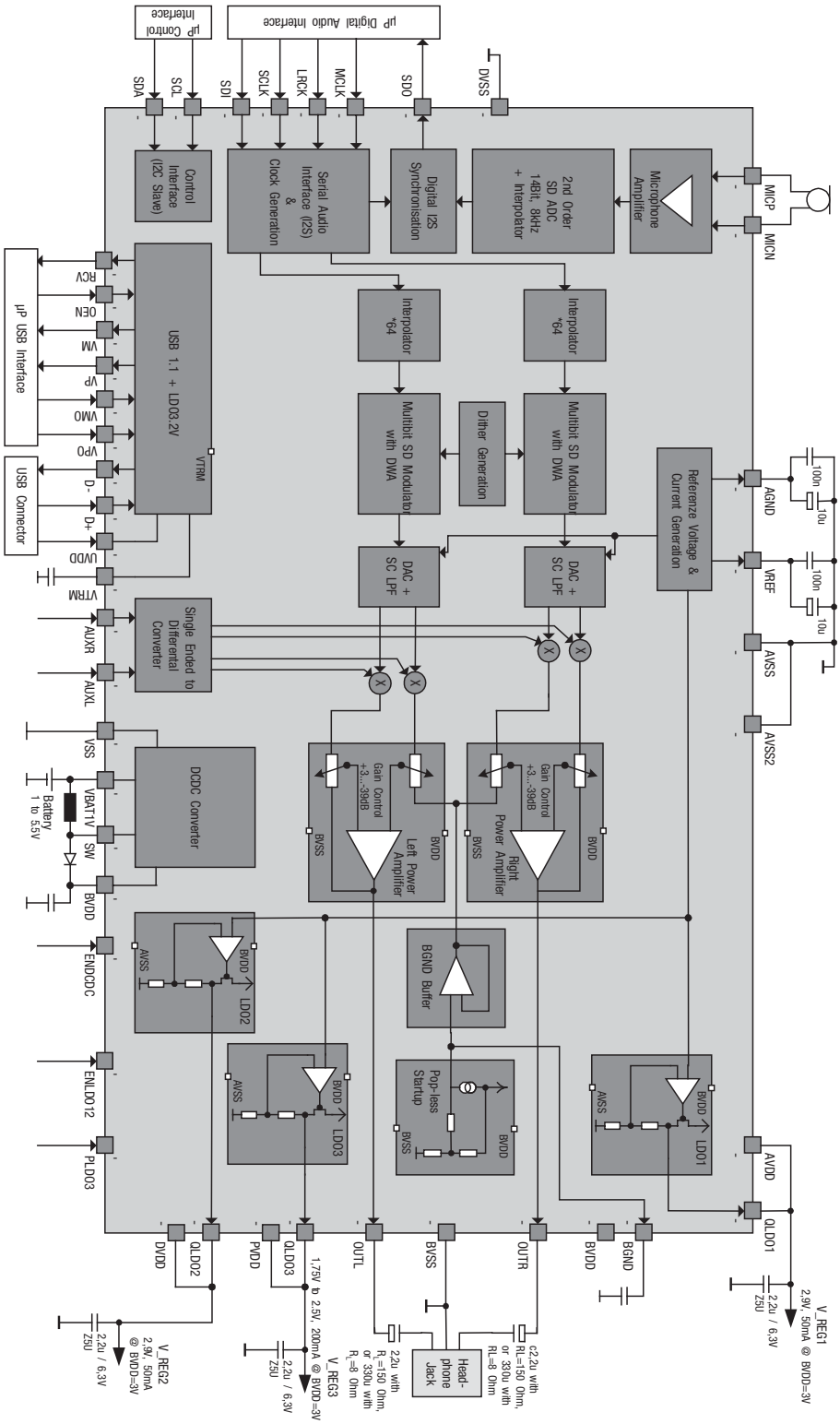
Key Features

- On-chip DC/DC Converter
  - 1.0 to 5.5V input voltage range
- 4 on-chip high performance voltage regulators
  - Digital Supply, 2.9V
  - Analog Supply, 2.9V
  - Core Supply, 1.5 to 2.5V
  - USB Transceiver Supply, 3.2V
- 18-bit stereo DAC
  - Dynamic range >95 dB
  - THD < -85dB
  - De-emphasis for 32 kHz, 44.1 kHz and 48 kHz
- Stereo power audio amplifier
  - Max. 2x 0.5W @ 4Ω
  - Analog volume control -39dB to +3dB, 3dB steps (including mute)
  - Click- and pop-less startup and power down
  - Auxiliary inputs for additional audio sources
- Microphone input
  - 14 bit ΣΔ–ADC , 8kHz sampling rate
  - Automatic gain control (AGC)
  - Low power consumption
  - Wide battery supply range 1.0V – 5.5V
  - Standard I^2S interface
  - Audio sampling rates: 8, 11.025, 12, 16, 22.05, 24, 32, 44.1, and 48 kHz
  - I^2C control interface
  - USB 1.1 front-end
  - 49-pin BGA Package

Applications

- Audio front-end for cellular phones
- Stand alone MP3 player
- CD and DVD player
- PDAs

Block Diagram



General Description

The AS3514 is a low power stereo audio codec and is designed for Portable Digital Audio Applications. It allows playback in CD quality and recording in FM-stereo quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16Ω headset, 4Ω speaker and auxiliary signal sources via a 10-channel mixer. It only consumes 22mW in playback mode.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a flash based Digital Audio Player are supplied by the AS3514. The power management block generates 9 different supply voltages out of the battery supply. CPU, NAND flash, SRAM, memory cards, LCD back-light, USB RX/TX can be powered. The different supply voltages are programmable via the serial control interface. It also contains a charger and is designed for battery supplies from 1V to 5V.

The AS3514 has an on-chip, phase locked loop (PLL) controlled, clock generator. It generates 44.1kHz, 48kHz and other sample rates defined in MP3, AAC, WMA, OGG VORBIS etc. No additional external crystal or PLL is needed. Further the AS3514 has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

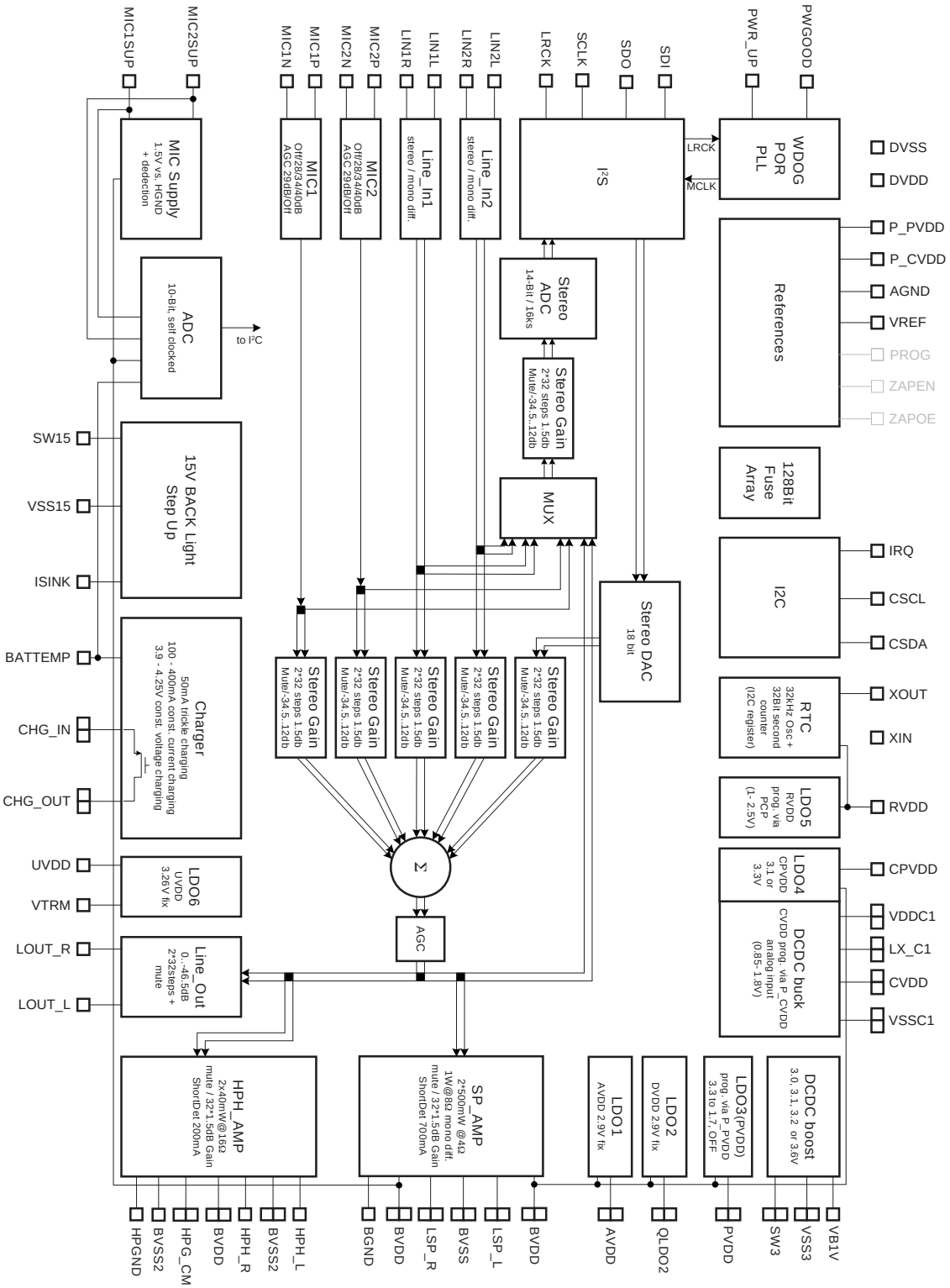
Key Features

- Multi-bit sigma delta converters
  - DAC: 18bit with 94dB SNR ('A' weighted) , 48kHz
  - ADC: 14bit with 82dB SNR ('A' weighted), 16kHz
- 2 microphone inputs
  - 3 gain pre-setting (28dB/34dB/40dB) with AGC
  - 32 gain steps @1.5dB and MUTE
  - Supply for electret microphone
  - Microphone detection
  - Remote control by switch
- 2 line inputs
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - Stereo or 2x mono or mono differential
- Line outputs
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 1Vp @ 10kΩ
- Audio mixer
  - 10 channel input/output mixer with AGC
  - Mixes line inputs and microphones with DAC
  - Left and right channels independent
- High efficiency headphone amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x40mW @16Ω driver capability
  - Headphone and over-current detection
  - Phantom ground eliminates large capacitors
- High power speaker amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x500mW @8Ω driver capability
  - Over-current detection
- Power management
  - Step up for system supply (3.0V – 3.6V)
  - Step down for CPU core (0.85V – 1.8V, 250mA)
  - Step up for backlight (15V, 38.5mA)
  - LDO for digital supply (2.9V, 200mA)
  - LDO for analogue supply (2.9V, 200mA)
  - LDO for peripherals (1.7V-3.3V, 200mA)
  - LDO for peripherals (3.1V-3.3V, 200mA)
  - LDO for RTC (1.0V-2.5V, 2mA)
  - LDO for USB 1.1 transceiver (3.26V, 10mA)
  - Battery supervision
  - 10sec emergency shut-down
- Battery charger
  - Automatic trickle charge (50mA)
  - Prog. constant current charging (100-400mA)
  - Prog. constant voltage charging (3.9V-4.25V)
- Real time clock
  - Ultra low power 32kHz oscillator
  - 32-bit RTC sec counter
  - Selectable alarm (seconds or minutes)
- General Purpose ADC
  - 10bit resolution
  - 16 inputs analogue multiplexer
- Interfaces
  - I²S digital audio interface
  - 2-wire serial control interface
  - Watchdog via serial interface
  - Power good pin
  - 128-bit unique ID (OTP)
  - 17 different interrupts
- Package CTBGA64 [7.0x7.0x1.1mm] 0.8mm pitch

Applications

- Portable digital audio player and recorder
- PDA, smartphone

Block Diagram



General Description

The AS3515 is a low power stereo audio codec and is designed for Portable Digital Audio Applications. It allows playback in CD quality and recording in FM-stereo quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16Ω headset, 4Ω speaker and auxiliary signal sources via a 10-channel mixer. It only consumes 22mW in playback mode.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a flash based Digital Audio Player are supplied by the AS3515. The power management block generates 9 different supply voltages out of the battery supply. CPU, NAND flash, SRAM, memory cards, LCD back-light, USB RX/TX can be powered. The different supply voltages are programmable via the serial control interface. It also contains a charger and is designed for battery supplies from 1V to 5V.

The AS3515 has an on-chip, phase locked loop (PLL) controlled, clock generator. It generates 44.1kHz, 48kHz and other sample rates defined in MP3, AAC, WMA, OGG VORBIS etc. No additional external crystal or PLL is needed. Further the AS3515 has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

Key Features

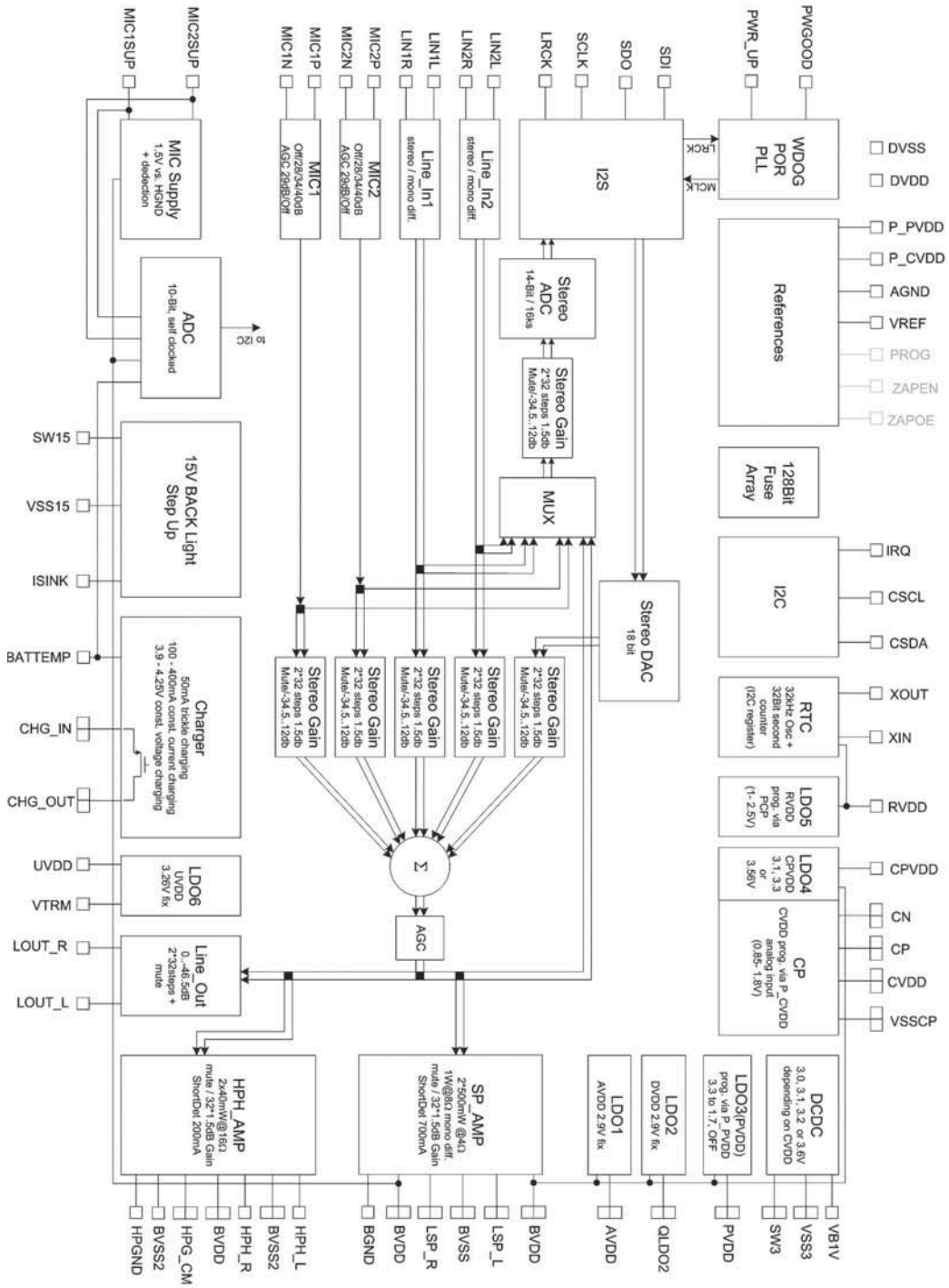
- Multi-bit sigma delta converters
  - DAC: 18bit with 94dB SNR ('A' weighted) , 48kHz
  - ADC: 14bit with 82dB SNR ('A' weighted), 16kHz
- 2 microphone inputs
  - 3 gain pre-setting (28dB/34dB/40dB) and AGC
  - 32 gain steps @ 1.5dB and MUTE
  - Supply for electret microphone
  - Microphone detection
  - Remote control by switch
- 2 line inputs
  - Volume control via serial interface
  - 32 steps @ 1.5dB and MUTE
  - Stereo or 2x mono or mono differential
- Line outputs
  - Volume control via serial interface
  - 32 steps @ 1.5dB and MUTE
  - 1Vp @ 10kΩ
- Audio mixer
  - 10 channel input/output mixer with AGC
  - Mixes line inputs and microphones with DAC
  - Left and right channels independent
- High efficiency headphone amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x40mW @16Ω driver capability
  - Headphone and over-current detection
  - Phantom ground eliminates large capacitors
- High power speaker amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x500mW @8Ω driver capability
  - Over-current detection
- Power management
  - Step up for system supply (3.0V – 3.6V)
  - Charge pump for CPU core (0.85V – 1.8V, 200mA)
  - Step up for backlight (15V, 38.5mA)
  - LDO for digital supply (2.9V, 200mA)
  - LDO for analogue supply (2.9V, 200mA)
  - LDO for peripherals (1.7V-3.3V, 200mA)
  - LDO for peripherals (3.1V-3.3V, 200mA)
  - LDO for RTC (1.0V-2.5V, 2mA)
  - LDO for USB 1.1 transceiver (3.26V, 10mA)
  - Battery supervision
  - 10sec emergency shut-down
- Battery charger
  - Automatic trickle charge (50mA)
  - Prog. constant current charging (100-400mA)
  - Prog. constant voltage charging (3.9V-4.25V)
- Real time clock
  - Ultra low power 32kHz oscillator
  - 32bit RTC sec counter
  - Selectable alarm (seconds or minutes)
- General purpose ADC
  - 10bit resolution
  - 16 inputs analogue multiplexer
- Interfaces
  - I²S digital audio interface
  - 2-wire serial control interface
  - Watchdog via serial interface
  - Power good pin
  - 128bit unique ID (OTP)
  - 17 different interrupts

- Package CTBGA64 [7.0x7.0x1.1mm] 0.8mm pitch

Applications

- Portable digital audio player and recorder
- PDA, smartphone

Block Diagram



AS3517

General Description

The AS3517 is a low power stereo audio codec and is designed for Portable Digital Audio Applications. It allows playback and recording in CD quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16Ω/32Ω headsets and auxiliary signal sources via a 10-channel mixer. It only consumes 20mW in playback mode.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player with flash or harddisk memory are supplied by the AS3517. The different regulated supply voltages are programmable via the serial control interface. The power management block generates 11 different supply voltages out of a single battery supply. CPU, NAND flash, SRAM, memory cards, harddisk, LCD, LCD backlight, USB-HOST and USBOTG can be powered. AS3517 also contains a charger. The single supply voltage may vary from 3.0V to 5.5V.

The AS3517 has an on-chip, phase locked loop (PLL) controlled, clock generator. It generates 44.1kHz, 48kHz and other sample rates defined in MP3, AAC, WMA, OGG VORBIS etc. No additional external crystal or PLL is needed in slave mode. Further the AS3517 has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

Key Features

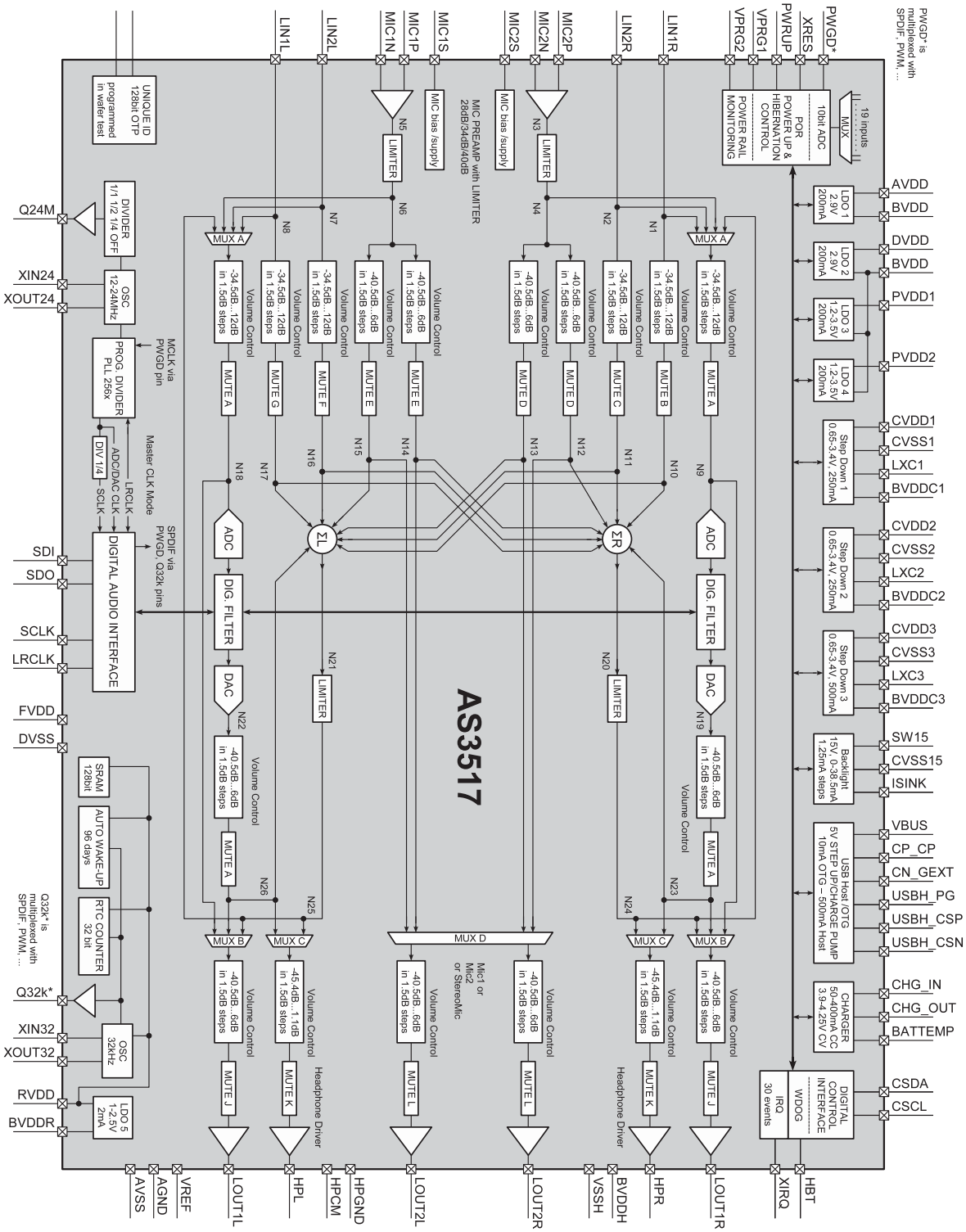
- Multi-bit sigma delta converters
  - DAC: 18bit with 94dB SNR ('A' weighted)
  - ADC: 20bit with 90dB SNR ('A' weighted)
  - Sampling Frequency: 8-48kHz
- 2 microphone inputs
  - 3 gain pre-setting (28dB/34dB/40dB) and AGC
  - 32 gain steps @1.5dB and MUTE
  - Supply for electret microphone
  - Microphone detection
  - Remote control by switch
- 2 line inputs
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - Stereo or 2x mono or mono differential
- Audio mixer
  - 10 channel input/output mixer with AGC
  - Mixes line inputs and microphones with DAC
  - Left and right channels independent
- 2 line outputs
  - Volume control via serial interface
  - 32 steps @ 1.5dB and MUTE
  - 1Vp @ 10kΩ
  - Stereo 2*5mW to 16Ω
  - Differential 10mW to 32Ω (earpiece)
- High efficiency headphone amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x60mW @16Ω driver capability
  - Headphone and over-current detection
  - Phantom ground eliminates large capacitors
- Power management
  - Step down for CPU core (0.65V-3.4V, 250mA)
  - Step down for peripheral (0.65V-3.4V, 250mA)
  - Step down for harddisk (0.65V-3.4V, 500mA)
  - Step up for backlight (15V (25V), 38mA
  - LDO for digital supply (2.9V, 200mA)
  - LDO for analog supply (2.9V, 200mA)
  - LDO for peripherals (1.2V-3.5V, 200mA)
  - LDO for peripherals (1.2V-3.5V, 200mA)
  - LDO for RTC (1.0V-2.5V, 2mA)
  - Power supply supervision
  - Hibernation modes
  - 5sec and 10sec emergency shut-down
- Battery charger
  - Automatic trickle charge (50mA)
  - Prog. constant current charging (50-460mA)
  - Prog. constant voltage charging (3.9V-4.25V)
- Real time clock
  - Ultra low power 32kHz oscillator
  - 32bit RTC sec counter, 96 days auto wake-up
  - Selectable alarm (seconds or minutes)
  - 128bit free SRAM for random settings
  - 32kHz clock output to peripheral
- Auxiliary oscillator (only for master clock mode)
  - Low power 12-24MHz oscillator
  - Master clock input/output (e.g. from/to CPU)
- General purpose ADC
  - 10-bit resolution
  - 21 inputs analog multiplexer
- Interfaces
  - I²S digital audio interface and SPDIF
  - 2 wire serial control interface
  - Reset pin, watchdog, power good pin
  - PWM output
  - 128-bit unique ID (OTP)
  - 30 different interrupts

- Package CTBGA81 [9.0x9.0x1.15mm] 0.8mm pitch

Applications

- Portable digital audio player and recorder
- PDA, smartphone

Block Diagram



AS3518

General Description

The AS3518 is a low power stereo audio codec and is designed for Portable Digital Audio Applications. It allows playback and recording in CD quality. It has a variety of audio inputs and outputs to directly connect electret microphones, 16Ω/32Ω headsets and auxiliary signal sources via a 10-channel mixer. It consumes less than 20mW in playback mode.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player are supplied by the AS3518. The different regulated supply voltages are programmable via the serial control interface. AS3518 also contains a Li-Io battery charger. The single supply voltage may vary from 1.0V to 5.5V.

The AS3518 has an on-chip, phase locked loop (PLL) which generates the needed internal CODEC master clock. I²S Frame and shift-clock has to be applied from the processor for playback and recording. Further the AS3518 has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU.

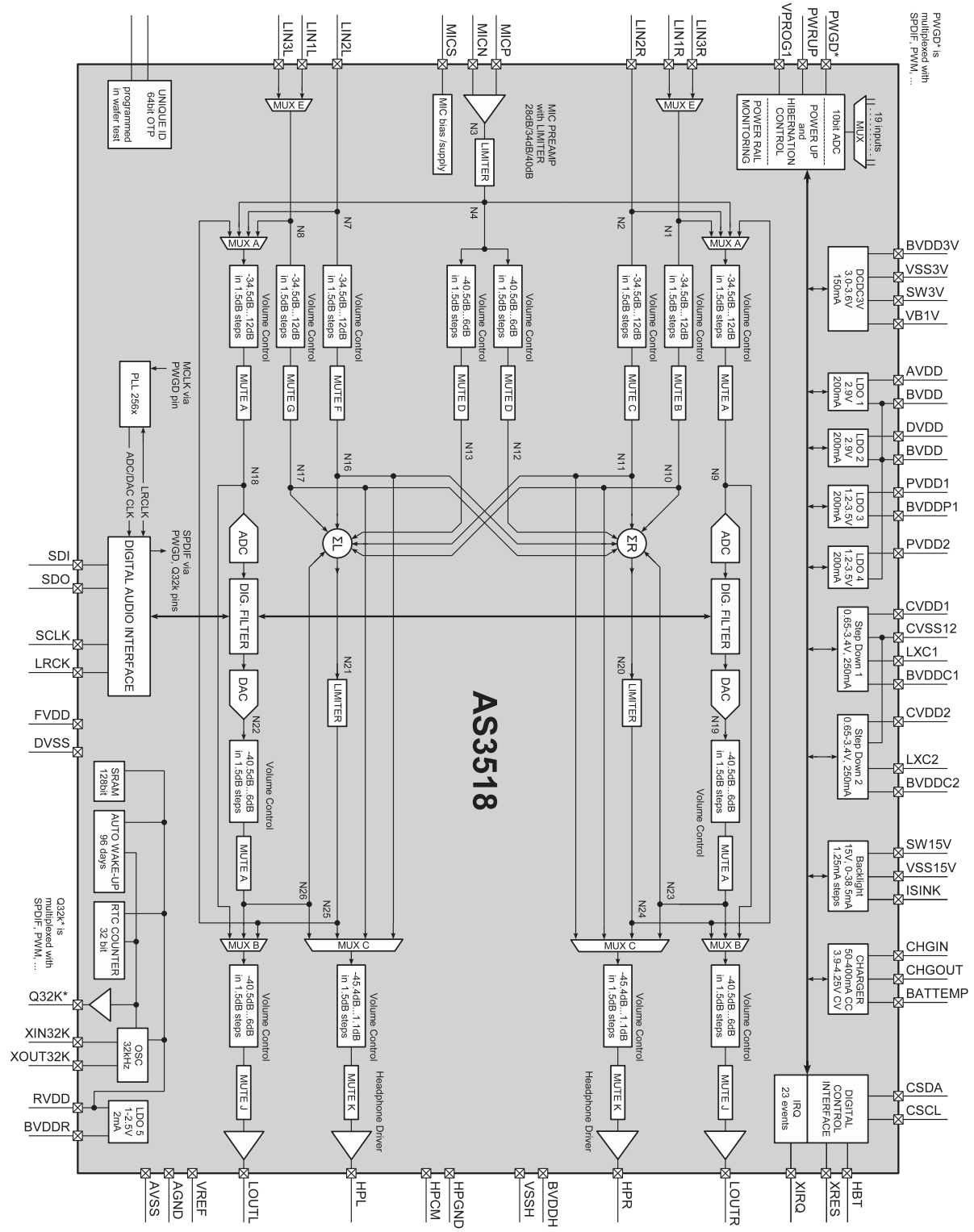
Key Features

- Multi-bit sigma delta converters
  - DAC: 18bit with 94dB SNR ('A' weighted)
  - ADC: 20bit with 90dB SNR ('A' weighted)
  - Sampling Frequency: 8-48kHz
- 1 microphone input
  - 3 gain pre-setting (28dB/34dB/40dB) and AGC
  - 32 gain steps @ 1.5dB and MUTE
  - Supply for electret microphone
  - Microphone detection
  - Remote control by switch
- 3 line inputs
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - Stereo or 2x mono or mono differential
- Audio mixer
  - 8 channel input/output mixer with AGC
  - Mixes line inputs and microphones with DAC
  - Left and right channels independent
- Line output
  - Volume control via serial interface
  - 32 steps @ 1.5dB and MUTE
  - 1Vp @ 10kΩ
  - Stereo 2*5mW @ 16Ω
  - Mono differential 10mW @32Ω (earpiece)
- High efficiency headphone amplifier
  - Volume control via serial interface
  - 32 steps @1.5dB and MUTE
  - 2x60mW @16Ω driver capability
  - Headphone and over-current detection
  - Phantom ground eliminates large capacitors
- Power management
  - Step down for CPU core (0.65V-3.4V, 250mA)
  - Step down for peripheral (0.65V-3.4V, 250mA)
  - Step up for backlight (15V (25V), 38mA), dimming, voltage control mode
  - LDO for AFE analog supply (2.9V, 200mA)
  - LDO for AFE digital supply (2.9V, 200mA)
  - LDO for peripherals (1.2V-3.5V, 200mA)
  - LDO for peripherals e.g. USB (1.2V-3.5V, 200mA)
  - Power supply supervision
  - Hibernation modes
  - 5sec and 10sec emergency shut-down
- Battery charger
  - Automatic trickle charge (50mA)
  - Prog. constant current charging (50-460mA)
  - Prog. constant voltage charging (3.9V-4.25V)
  - Current limitation for USB mode
- Real time clock
  - Ultra low power 32kHz oscillator
  - 32bit RTC sec counter, 96 days auto wake-up
  - Selectable alarm (seconds or minutes)
  - 128bit free SRAM for random settings
  - 32kHz clock output to peripheral
  - Voltage generation
  - <1µA total power consumption
- General purpose ADC
  - 10-bit resolution
  - 21 inputs analog multiplexer
- Interfaces
  - I²S digital audio interface and SPDIF
  - 2-wire serial control interface
  - Reset pin, watchdog, power good pin
  - PWM output
  - 64-bit unique ID (OTP)
  - 23 different interrupts
- Package CTBGA64 (7.0 x 7.0 x 1.1mm) 0.8mm pitch

Applications

- Portable digital audio player and recorder
- PDA, smartphone

Block Diagram



General Description

The AS3542 is an ultra low power stereo audio codec and is designed for Portable Digital Audio Applications.
It allows CD quality playback with up to 96dBA SNR and recording in FM quality. With one microphone (including pre-amplifier and supply for an electret microphone) and one line input, it allows connecting a variety of audio inputs. The different audio signals can be mixed via a 6- channel mixer and fed to either a headphone output for 16 /32 headsets or a line output. The audio outputs have also an auto fading implemented which performs the fade-in, fade-out as well as the transition between specific volume levels automatically with an selectable timing.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player are supplied by the AS3542. It features 2 DCDC converters for core and memory/ periphery supply as well as 4 LDOs. Both DCDC converter feature DVM (dynamic voltage management) with an selectable timing for the voltage stepping. The different regulated supply voltages are programmable via the serial control interface.

The step-up converter for the backlight can operate up to 15V (with an external transistor even higher) in voltage and current control mode. An internal voltage protection is limiting the output voltage in the case of external component failures. An automatic dimming function allows a logarithmic on/off of the backlight with selectable timing.

AS3542 also contains a Li-Ion battery charger with constant current, constant voltage and trickle charging. The maximum charging current is 460mA. An integrated battery switch is separating the battery during charging or whenever an external power supply is present. With this switch it is also possible to operate with no or deeply discharged batteries.

The AS3542 has an on-chip, phase locked loop (PLL) which generates the needed internal CODEC master clock. I²S Frame and shift-clock have to be applied from the processor for playback and recording.

The single supply voltage may vary from 2.7V to 5.5V

Key Features

Audio

Audio power consumption:
- 5mW: 95dB DAC to Headphone @ 1.8V, 32Ω

Sigma Delta Converters
- DAC
  - 96dB SNR (‚A' weighted) @ 1.8V
- ADC
  - 85dB SNR (‚A' weighted) @ 1.8V
- Sampling Frequency
  - DAC: 8-48kHz
  - ADC: 8-24kHz

High Efficiency Headphone Amplifier
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- 2x12mW @16 driver capability@ 1.8V supply
- THD -74dB @16Ω; 1.8V
- 2x40mW @16 driver capability@ 2.9V supply
- THD -77dB @16Ω; 2.9V
- Headphone and over-current detection

Line Output
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- 0.6Vp @10kΩ

Microphone Input
- 3 gain pre-setting (30dB/36dB/42dB) and AGC
- 2 gain steps @1.5dB and MUTE
- Supply for electret microphone
- Microphone detection
- Remote control by switch

Line Input
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- Stereo or 2x mono

Audio Mixer
- 6 channel input/output mixer with AGC
- Mixes line input and microphone with DAC
- Left and right channels independent

Power Management

Voltage Generation
- Step down for CPU core (0.61V-3.35V, 250mA)
- Step down for peripheral (0.61V-3.35V, 250mA)
- LDO1 for AFE supply (1.7V (1.65-3.2V), 50mA)
- LDO2 for AFE supply (2.7V (2.3-3.5V), 200mA)
- LDO3 for peripherals (1.2V-3.5V, 100mA)
- LDO4 for peripherals (1.2V-3.5V, 100mA)
- Separate input for LDO3
- Power supply supervision & hibernation modes
- 5sec and 10sec emergency shut-down

AS3542

Backlight Driver
- Step up for backlight (15V)
- Current control mode (1.2-36mA)
- Voltage control mode
- 1 HV current sink
- Automatic dimming
- Over-voltage protection

Battery Charger
- Automatic trickle charge (55mA)
- Prog. constant current charging (55-460mA)
- Prog. constant voltage charging (3.9V-4.25V)
- Current limitation for USB mode
- Integrated battery switch

General

Supervisor
- Automatic battery monitoring with interrupt generation and selectable warning level
- Automatic temperature monitoring with interrupt generation and selectable warning and shutdown levels

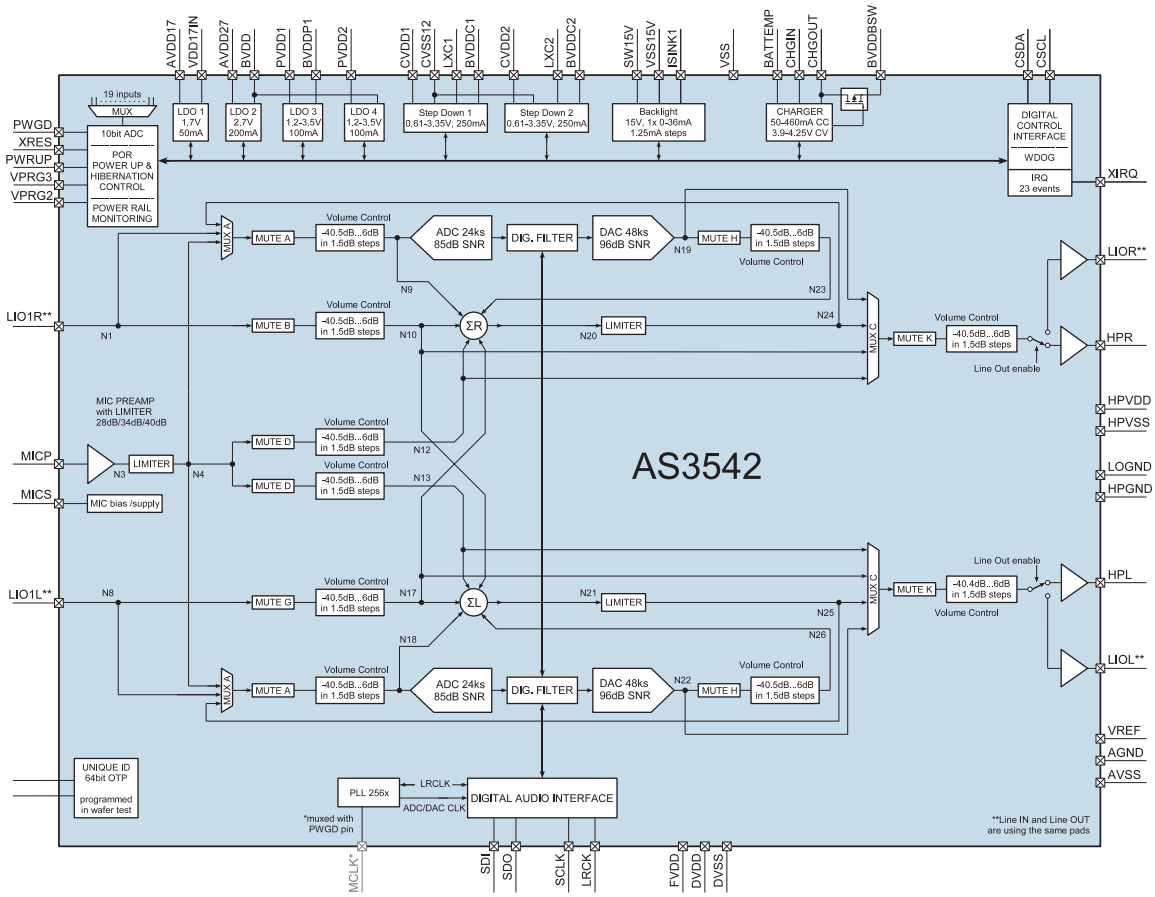
General Purpose ADC
- 10bit resolution
- 19 inputs analog multiplexer

Interfaces
- 2 wire serial control interface
- Reset pin with selectable delay, power good pin
- 64bit unique ID (OTP)
- 26 different interrupts
- Package MLF2 56 [7.0x7.0x0.85mm] 0.4mm pitch

Applications

Portable Digital Audio/Video Player and Recorder, PDA, Smartphone

Block Diagram



General Description

The AS3543 is an ultra low power stereo audio codec and is designed for Portable Digital Audio Applications.

It allows high-end quality playback with up to 100dBA SNR and recording in FM quality. With one microphone (including pre-amplifier and supply for an electret microphone) and two line inputs, it allows connecting a variety of audio inputs. The different audio signals can be mixed via a 6-channel mixer and fed to either a headphone output for 16 /32 headsets or a line output. Both outputs have a ground noise cancellation to use it e.g. in car docking stations. The audio outputs have also an auto fading implemented which performs the fade-in, fadeout as well as the transition between specific volume levels automatically with a selectable timing.

Further the device offers advanced power management functions. All necessary ICs and peripherals in a Digital Audio Player are supplied by the AS3543. It features 2 DCDC converters for core and memory/ periphery supply as well as 4 LDOs. Both DCDC converter feature DVM (dynamic voltage management) with an selectable timing for the voltage stepping. The different regulated supply voltages are programmable via the serial control interface.

The step-up converter for the backlight can operate up to 25V (with an external transistor even higher) in voltage and current control mode. An internal voltage protection is limiting the output voltage in the case of external component failures. 2 high voltage current sinks can be used to operate two , if needed also unbalanced, LED strings. An automatic dimming function allows a logarithmic on/off of the backlight with selectable timing.

AS3543 also contains a Li-Ion battery charger with constant current, constant voltage and trickle charging. The maximum charging current is 460mA. An integrated battery switch is separating the battery during charging or whenever an external power supply is present. With this switch it is also possible to operate with no or deeply discharged batteries.

The AS3543 has an on-chip, phase locked loop (PLL) which generates the needed internal CODEC master clock. I^2S Frame and shift-clock have to be applied from the processor for playback and recording.

Further the AS3543 has an independent 32kHz real time clock (RTC) on chip which allows a complete power down of the system CPU while only consuming less than 1µA. An internal switch automatically switches between the RTC backup-battery and main battery supply.

The single supply voltage may vary from 2.7V (2.4V) to 5.5V.

Key Features

Audio

Audio power consumption:
- 5mW: 96dB DAC to Headphone @ 1.8V, 32Ω
- 7mW: 100dB DAC to Headphone @ 2.9V, 32Ω

Sigma Delta Converters
- DAC
  - · 98dB SNR (‚A' weighted) @ 1.8V
  - · 102dB SNR (‚A' weighted) @ 2.9V
- ADC
  - · 83dB SNR (‚A' weighted) @ 1.8V
- Sampling Frequency
  - · DAC: 8-96kHz
  - · ADC: 8-24kHz

High Efficiency Headphone Amplifier
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- 2x12mW @16 driver capability@ 1.8V supply
- THD -74dB @16Ω; 1.8V
- 2x40mW @16 driver capability@ 2.9V supply
- THD -77dB @16Ω; 2.9V
- Headphone and over-current detection
- Phantom ground eliminates large capacitors
- Ground noise cancellation

Line Output
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- 0.6Vp @10kΩ
- Ground noise cancellation

Microphone Input
- 3 gain pre-setting (28dB/34dB/40dB) and AGC
- 2 gain steps @1.5dB and MUTE
- Supply for electret microphone
- Microphone detection
- Remote control by switch

2 Line Inputs
- Volume control via serial interface
- 32 steps @1.5dB and MUTE
- Stereo or 2x mono

Audio Mixer
- 6 channel input/output mixer with AGC
- Mixes line inputs abd microphone with DAC
- Left and right channels independent

AS3543

Power Management

Voltage Generation

- Step down for CPU core (0.61V-3.35V, 250mA)
- Step down for peripheral (0.61V-3.35V, 250mA)
- LDO1 for AFE supply (1.7V (1.65-3.2V), 50mA)
- LDO2 for AFE supply (2.7V (2.3-3.5V), 200mA)
- LDO3 for peripherals (1.2V-3.5V, 100/200mA)
- LDO4 for peripherals (1.2V-3.5V, 100/200mA)
- VBUS comparator
- Separate input for LDO3
- Power supply supervision & hibernation modes
- 5sec and 10sec emergency shut-down

Backlight Driver

- Step up for backlight (15V)
- Current control mode (1.2-36mA)
- Voltage control mode
- 2 current sinks
- Automatic dimming
- Over-voltage protection

Battery Charger

- Automatic trickle charge (55mA)
- Prog. constant current charging (55-460mA)
- Prog. constant voltage charging (3.9V-4.25V)
- Current limitation for USB mode
- Integrated battery switch

General

Supervisor

- Automatic battery monitoring with interrupt generation and selectable warning level
- Automatic temperature monitoring with interrupt generation and selectable warning and shutdown levels

Real Time Clock

- Ultra low power 32kHz oscillator
- 32bit RTC sec counter, 96 days auto wake-up
- Selectable alarm (seconds or minutes)
- 128bit free SRAM for random settings
- 32kHz clock output to peripheral
- Voltage generation
- Trimmable oscillator
- <1µA total power consumption

Auxiliary Oscillator (system clock generation)

- Low power 12-24MHz oscillator
- Clock output

General Purpose ADC

- 10bit resolution
- 19 inputs analog multiplexer

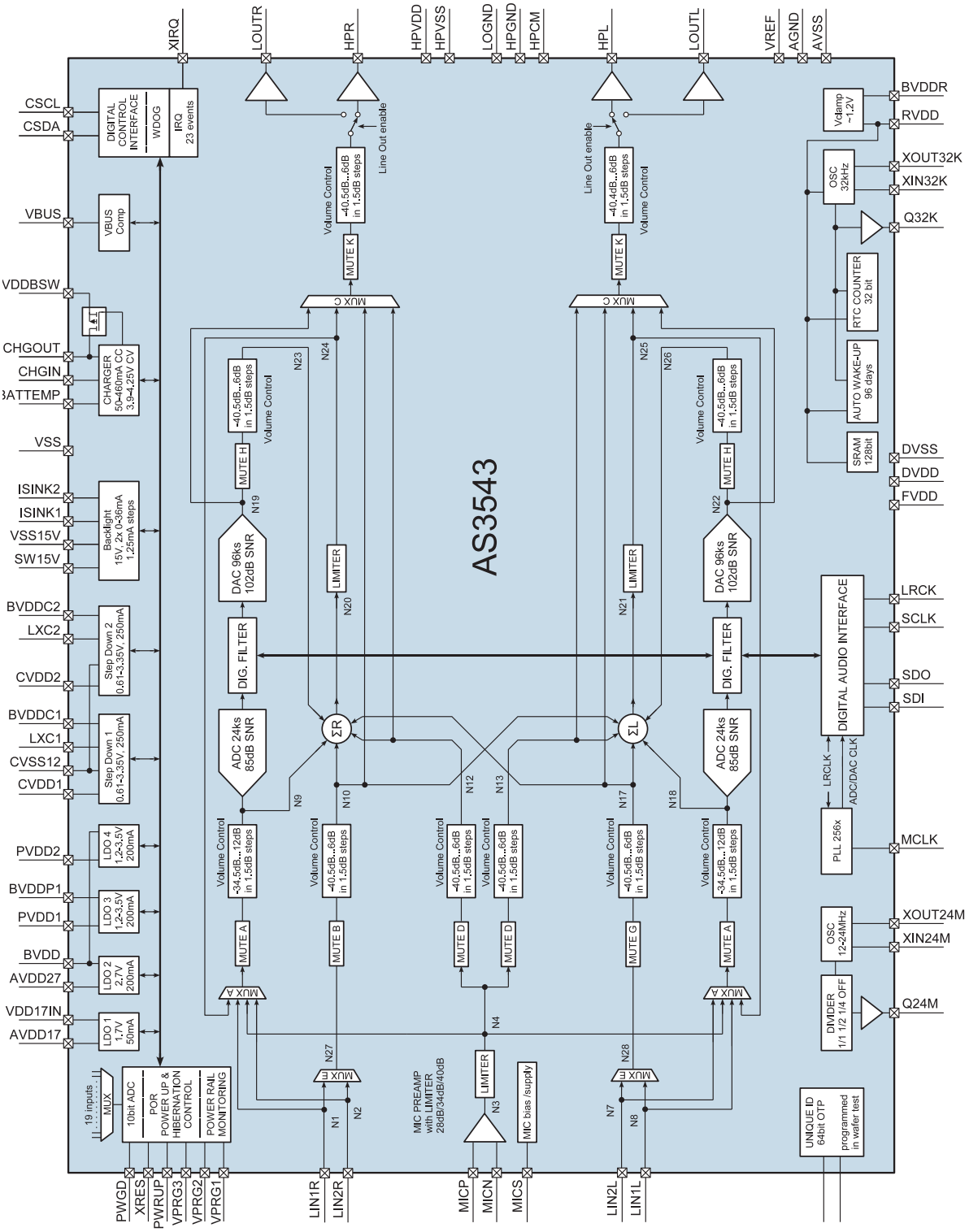
Interfaces

- 2 wire serial control interface
- Reset pin with selectable delay, power good pin
- 64bit unique ID (OTP)
- 26 different interrupts
- Package CTBGA68 [6.0x6.0x1.1mm] 0.5mm pitch

Applications

Portable Digital Audio/Video Player and Recorder, PDA, Smartphone

Block Diagram



AS1710/12

General Description

The AS1710/AS1712 are low-offset, high-output CMOS op amps that deliver 200mA of peak output current from a single supply (2.7 to 5.5V). These devices were specifically designed to drive typical headset levels (32Ω), as well as bias RF power amplifiers for wireless handset applications.

The devices are available as the standard products listed below.

Model	Functionality	Package
AS1710A	Single Op Amp w/Shutdown	SC70-6
AS1710B	Single Op Amp	SC70-5
AS1712A	Quad Op Amp w/Shutdown	TQFN-16 3x3mm

These rail-to-rail I/O, wide-bandwidth amplifiers exhibit a high slew rate of 10V/µs and a gain-bandwidth product of 10MHz.

The integrated shutdown feature (not included in B versions) drives the output low.

These devices operate over the entire automotive temperature range (-40°C to +125°C).

Key Features

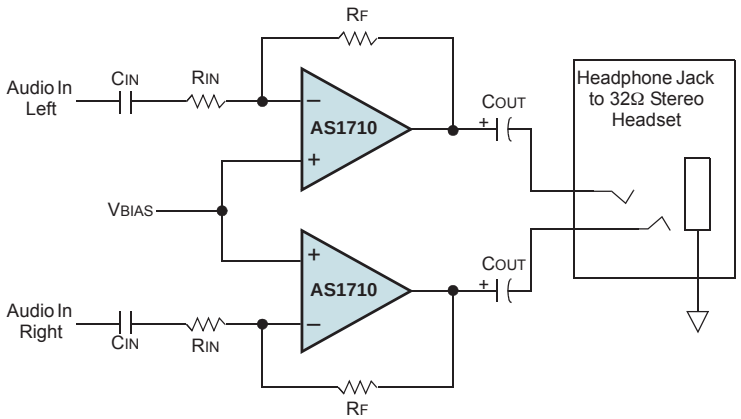
- Constant output drive capability: 50mA
- Rail-to-rail input and output
- Supply current: 1.6mA
- Single-supply operation: 2.7 to 5.5V
- Gain-bandwidth product: 10MHz
- High slew rate: 10V/µs
- Voltage gain: 100dB (RLOAD = 100kΩ)
- Power-supply rejection ratio: -85dB
- No phase reversal for overdriven inputs
- Unity-gain stable for capacitive loads: up to 100pF
- Shutdown mode (AS1710A) current: 1nA typ
- Package types:
  - SC70-6
  - SC70-5
  - TQFN-16 3x3mm

Applications

The devices are ideal for portable/battery-powered audio applications, portable headphone speaker drivers (32Ω), hands-free mobile phone kits, TFT panels, sound ports/cards, set-top boxes, biasing controls, DAC converter buffers, transformer/line drivers, motor drivers, and any other battery-operated audio device.

Block Diagram

TDFN-10 (3x3mm)



AS1713

General Description

The AS1713 is a low cost cmos difference amplifier providing extended common mode voltage range for a single rail 5V supply.

Resistor trimming during final test ensures a typical common mode rejection of 60dB. Low input bias currents, 10MHz gain bandwidth, low total harmonic distortion (THD) and a rail-to-rail output drive capability of typically 200mA (@ 5V supply) provide support for a number of signal processing applications such as audio line receivers, ground loop breakers and current sensing.

Linearity is suitable for 12bit ADC measurement. A classical single amplifier approach ensures that the differential gain is determined by a simple ratio of two internal resistors. A fixed gain of x1 is available.

Single ended input resistance is equalised (10kΩ ±10%) at each input terminal. This feature provides additional common mode rejection when long balanced input cables connect at the input.

A EN pin reduces the quiescent current of the device.

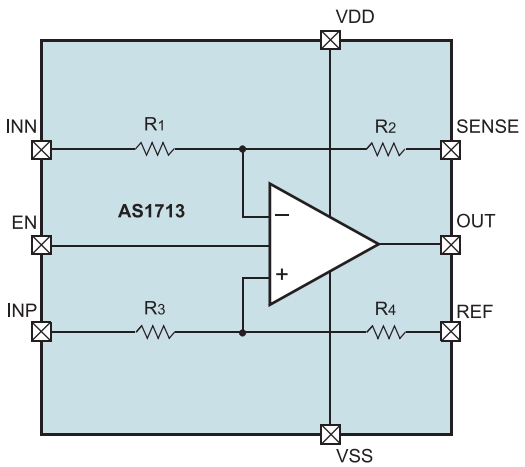
Key Features

- Constant Output Drive Capability: 50mA
- Rail-to-Rail Input and Output
- Supply Current: 1.6mA
- Single-Supply Operation: 2.7 to 5.5V
- Voltage Gain: 1
- Gain-Bandwidth Product: 10MHz
- High Slew Rate: 10V/µs
- Power-Supply Rejection Ratio: -70dB
- Common Mode Rejection Ratio: -60dB
- No Phase Reversal for Overdriven Inputs
- Unity-Gain Stable for Capacitive Loads: Up to 100pF
- Shutdown Mode Current: 1nA
- MLPD (2x2mm) 8-pin package

Applications

The device is ideal for headphone amplifiers with ground interference rejection, infotainment high drive audio line buffers with ground interference rejection, audio differential-to-single-ended conversion and instrumentation amplifier back-end.

Block Diagram



AS2522B

General Description

AS2522 is a flexible CMOS integrated circuit that incorporates DC and AC line adaptation (DC-mask and synthesized AC-impedance of 1000Ω) as well as a speech circuit with softclipping, line loss compensation and Rxvolume control for handset and handsfree operation. It shall act as an a/b-line powered device, which is controlled by a CPU via a serial interface. Furthermore the AS2522 incorporates a DTMF, FSK transmitter, single tone and ringer tone generator.

AS2522 allows to use an off-the-shelf microprocessor without special blocks and functions for telephone applications. DTMF, FSK transmitter, single tone and ringer tone generator can be controlled via the serial interface as well as the gain settings in handset and handsfree mode.

Key Features

- Line/Speech circuit, DTMF dialer, FSK transmitter and tone ringer on a 32-pin CMOS-IC
- Enhanced voice switching
- Background noise monitoring
- DTMF tone generator
- FSK Transmitter V.23, BELL202, V.21, BELL 103
- Ringer tone programmable
- Tx- and Rx-gain programmable
- Digital volume control of Rx signals
- DC characteristic programmable
- Dual softclipping in handset mode
- Tx-softclipping in handsfree mode
- Common monitor amplifier for loudhearing, handsfree and ringing
- Supply voltage generation for external circuitry
- Automatic line loss compensation (LLC)
- Real and complex impedance selectable by external components
- Side tone adaptation selectable by external components
- Unique EMC performance
- Operating range from 15mA to 100mA (down to 5mA with reduced performance)
- Few external components

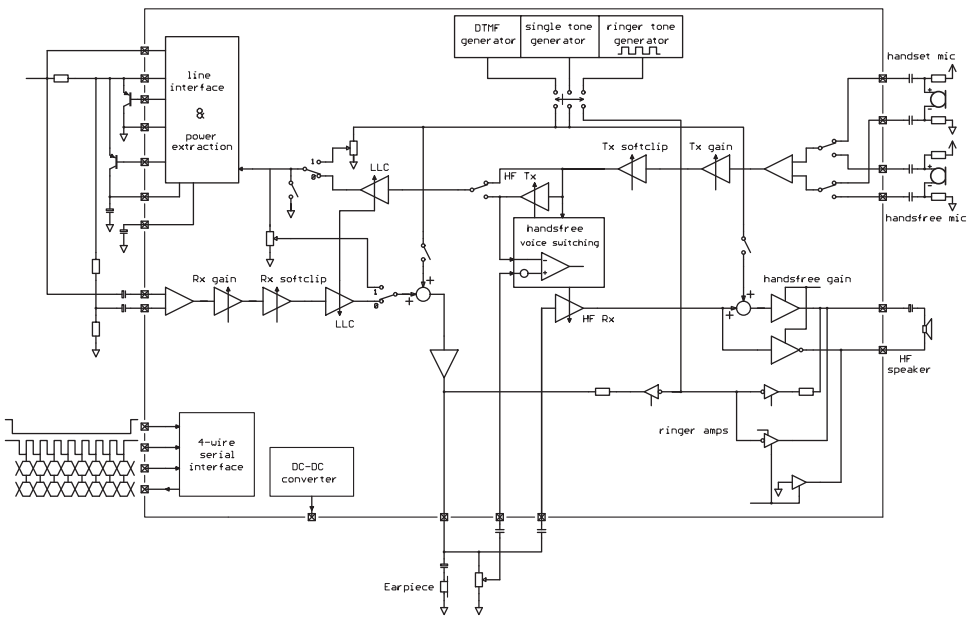
Applications

Enhanced handsfree feature phones with CallerID and extended displays.

Package

Available in 32-pin TQFP.

Block Diagram



General Description

AS2523/24 is a flexible CMOS integrated circuit that incorporates DC and AC line adaptation (DC-mask and synthesized AC-impedance of 1000Ω) as well as a speech circuit with softclipping, line loss compensation and Rxvolume control for handset and handsfree operation. It shall act as an a/b-line powered device, which is controlled by a CPU via a serial interface on AS2523 or a standard dialler via a parallel interface on AS2524 and AS2524B.

Key Features

- Line/Speakerphone circuit on a 28-pin CMOS-IC, simple inventory: same DIE for AS2523/24 and AS2523/24B
- Serial I/F on AS2523, parallel I/F on AS2524
- Enhanced voice switching
- Background noise monitoring
- Tx- and Rx-gain programmable on AS2523 only
- Digital volume control of Rx signals on AS2523 only
- DC characteristic programmable on AS2523 only
- Dual softclipping in handset mode on AS2523 only
- Dual softclipping in handsfree mode on AS2523 only
- Loudspeaker amplifier for loudhearing and handsfree
- Supply voltage generation for external circuitry
- Automatic line loss compensation on AS2523 / 24B only
- Real and complex impedance selectable by external components
- Side tone adaptation selectable by external components
- Unique EMC performance
- Operating range from 15mA to 100mA (down to 5mA with reduced performance)
- Few external components

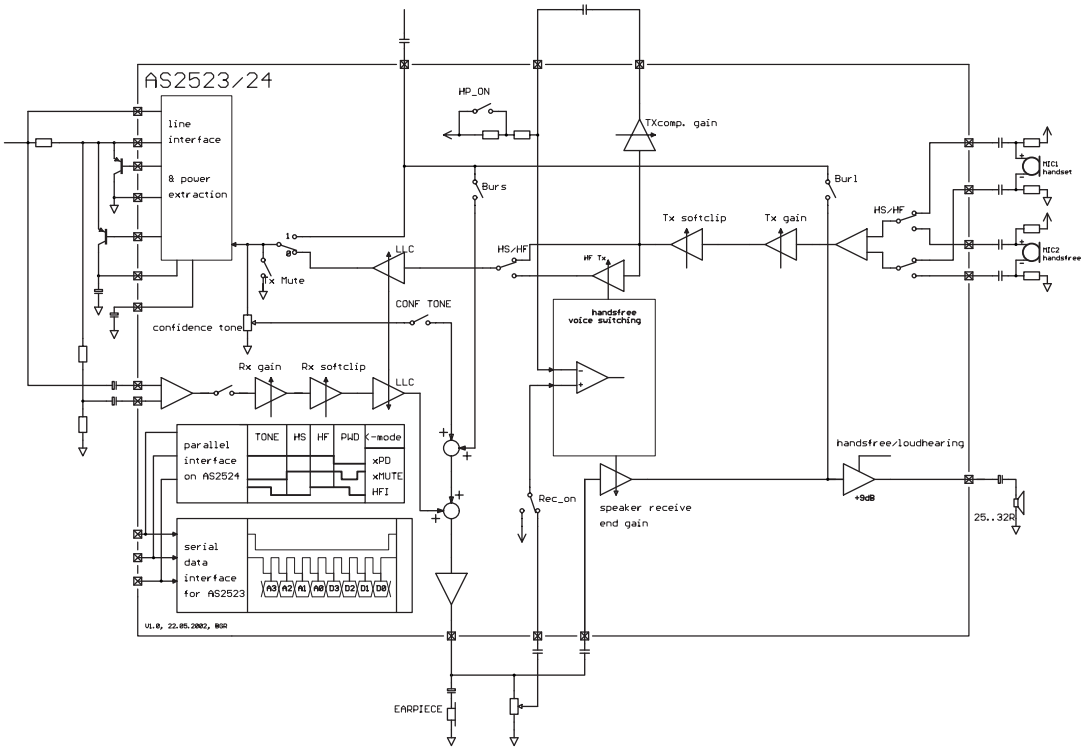
Applications

Enhanced handsfree feature phones with CallerID and extended displays. The AS2524 and AS2524B are developed to interface with common Taiwanese dialers.

Package

Available in 28-pin SOIC or DIE

Block Diagram



Single-Chip Hands Free Phone CMOS Integrated Cicuit

AS2525

General Description

The AS2525 is a very flexible CMOS mixed-mode integrated circuit for use in feature phones, answering machines and fax machines. It contains an analogue line interface and speech circuit for a/b terminals, loudhearing, handsfree, enhanced LD/MF dialler, tone ringer with DC/DC converter and serial interface to EEPROM and LCD-driver (AS2591), all in a 44 pin package. The circuit is fully line powered.

The AS2525 uses an external EEPROM for a 32 digit last number redial storage and memories for 28 numbers each containing up to 24 digits/ data.

The device provides a volume control for the earpiece and the loudspeaker. The volume can be controlled by pressing the [V-]/[V+] keys.

The versatility of the circuit is provided by programming all parameters through an external EEPROM. This allows easy adaptation to various PTT requirements worldwide.

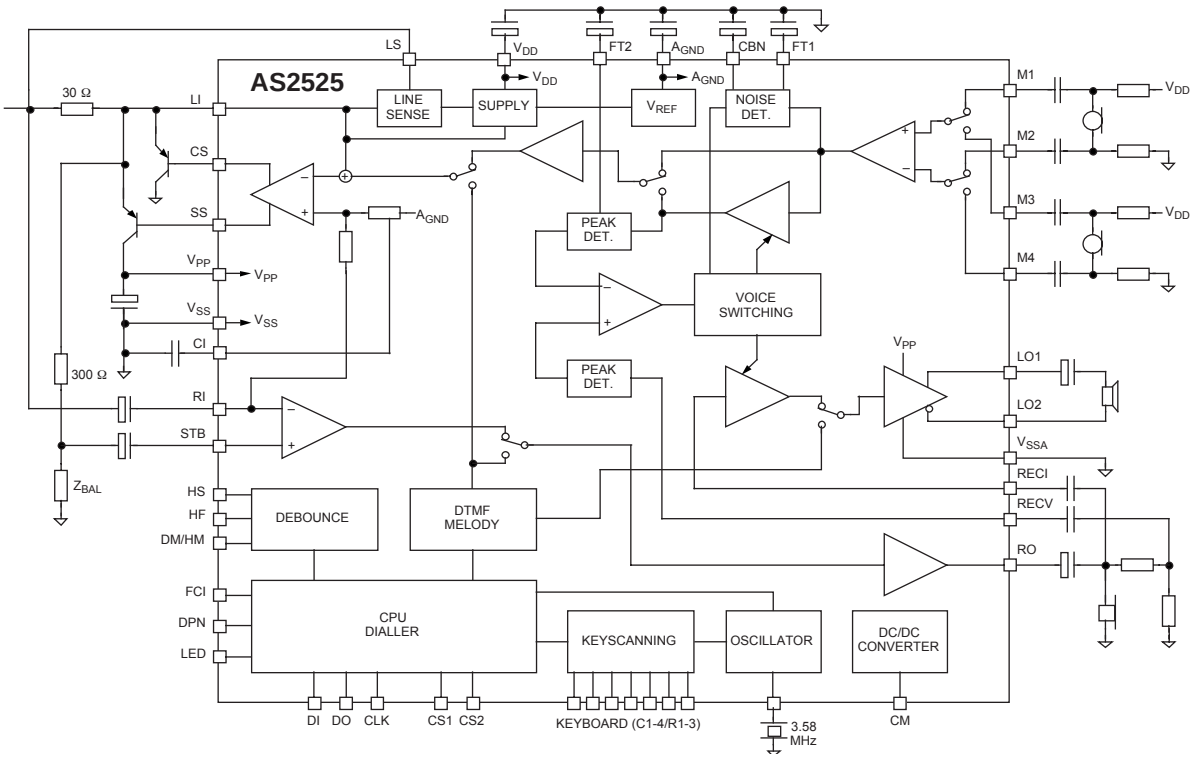
Key Features

- Line/speech handsfree circuit, LD/MF repertory dialler, and tone ringer on one 44-pin CMOS chip
- Operating range from 15 to 100mA line current (down to 5mA with slightly reduced performance)
- All significant parameters programmable with external EEPROM
- Volume control of receiver signal
- Handsfree function with enhanced voice switching
- Low noise (max. -72 dBmp)
- Unique EMC performance
- LD/MF switchable dialing with temporary MF mode
- Repertory dialing with last number redial and memory dialing (8 x 2 direct and 12 indirect)
- Call restriction with PIN code
- Serial interface for EEPROM and LCD driver
- 2-tone/3-tone ringer with ring frequency detection

Package

Available in 44-pin TQFP

Block Diagram



AS2533-36

General Description

The AS253x is a CMOS integrated circuit that contains all the functions needed to build a high performance electronic telephone set with basic features.

The AS253x incorporates a line interface, a speech circuit, a dialler and ringer. It is a real single-chip / single-DIE IC with 28 pins. It allows either package mounting or chip-on-board mounting.

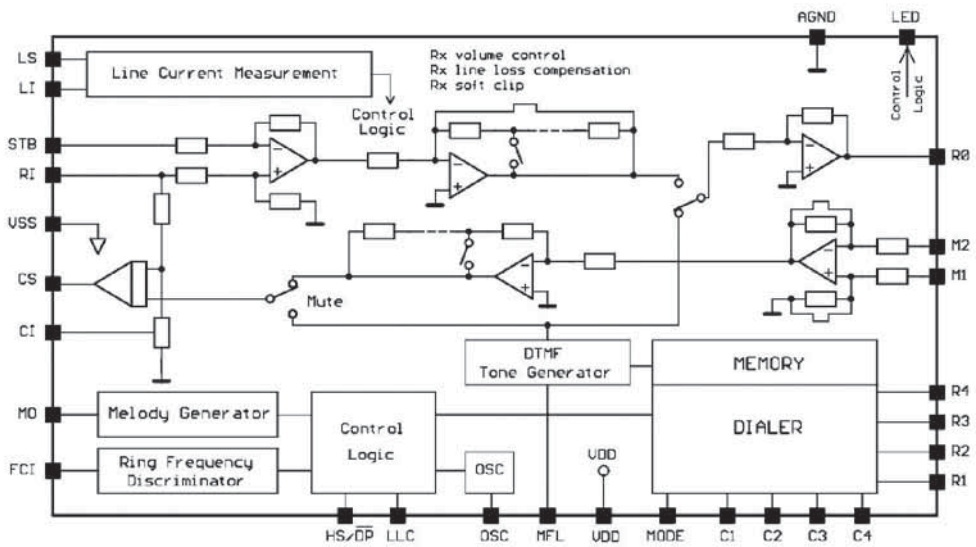
The device is available in 4 versions (pin-compatible) with different features ranging from LNR only (last number redial) to 4 direct (one-touch) memories and 10 indirect (two-touch) memories. The sliding cursor procedure makes the LNR function easy to use under various PABX systems.

The versatility of the circuit is provided by pin options and a few external components. This allows fast time-to-market and easy adaptation to different PTT requirements. A unique EMI performance has been achieved due to the consequent use of CMOS amplifiers.

Key Features

- Line interface and speech circuit
  - · Electronic Rx volume control
  - · Electronic microphone mute
  - · Microphone amplifier with symmetrical input
  - · Rx and Tx soft clipping to avoid harsh distortion
  - · Real or complex impedance (EU compliant)
  - · Stabilized supply for dialler and peripherals
  - · Automatic line loss compensation
  - · Operating range from 13 to 100 mA (down to 5mA with reduced performance)
  - · Unique EMI performance (EU compliant)
- Dialler
  - · LD/MF dialing and mixed-mode dialing
  - · 31 digit last number redial (LNR)
  - · 4 direct/10 indirect (AS2533/36), 12 direct (AS2535)
  - · Repeat dialing by busy or engaged (not AS2535)
  - · Confidence tone during memory programming and mute
  - · Notepad memory function
  - · Pause key for access pause or wait function
  - · 3 flash timings, 100 ms, 280 ms and 375/600 ms
  - · Sliding cursor protocol with comparison
- Ringer
  - · Ring frequency discrimination
  - · 3-tone melody generator
  - · Ring melody selection via keyboard
  - · Ring volume selection via keyboard
  - · Version available with fixed ring melody and ring volume
- Package
  - · SOIC 28 or DIE

Block Diagram



Remote Controlled Single-Chip-Telephone

AS2540

General Description

The AS2540 is a CMOS integrated circuit that incorporates a speech circuit (line-adaptation, 2/4-wire conversion, separate Rx- and Tx-amplifiers for handset and modem), MF dialler, ring frequency detector, ring melody generator and a two wire serial interface. It shall act as an a/b-line-powered device in order to interface a main-powered CPU to the analogue telephone line.

AS2540 can operate in a so-called mainpower mode and in a backup mode. During mainpower mode, a watchdog timer is running on AS2540, which has to be reset via the serial interface, which is connected to the CPU through opto-couplers. During backup mode (=The main-power failure or SW engine problem), AS2540 can operate as an independent basic MF dialler (digits 0-9*#)

Key Features

- Line Interface, Speech Circuit, MF Dialler and Tone Ringer on a 28-pin CMOS chip
- Programmable via 2-wire serial interface (UART 9600 baud, 8N1)
- Watch dog timer for backup mode
- Additional input for modem transmit path
- Additional output for modem receive path
- CMOS for high EMC immunity
- Low noise (max. –72 dBm)
- Operating range from 15mA to 100mA (down to 5mA with reduced performance)
- Soft clipping for handset operation to avoid harsh distortion
- Line loss compensation selectable by pin option
- Real and complex impedance selectable by external components
- Side tone adaption selectable by external components
- Ring frequency discrimination
- 3-tone ring melody generator

Applications

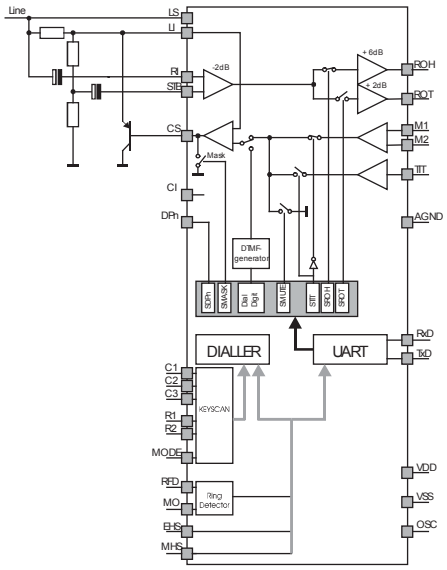
- Web telephones
- Answering machines
- Fax machines
- Base station of cordless telephones
- Hospital communication units

Package

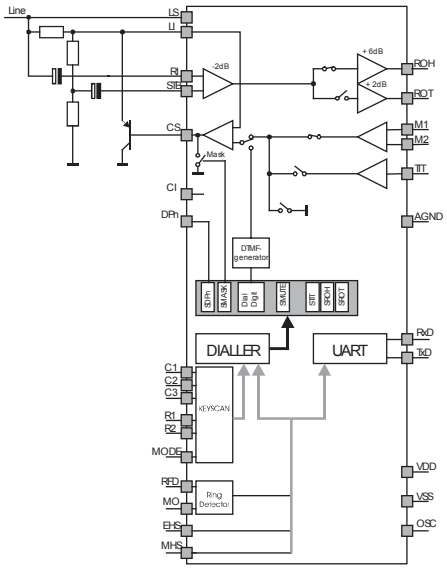
- 28-pin SOIC
- Dice-on-Foil

Block Diagram

Main Power Mode



Backup Mode



General Description

The AS5304 and AS5306 devices are high performance fixed resolution encoder options containing on-chip hall sensor elements and signal processing for measuring linear and off axis rotary motion. Due to the fixed resolutions, the AS5304 and AS5306 devices do not require any register configuration by the host controller at start up or during operation.

The AS5304 and AS5306 devices allow system designers to develop rotary encoder applications in mechanical systems where the sensor IC cannot be mounted at the end of a rotating device (e.g. at hollow shafts). Instead, the IC is mounted off-axis underneath a multi-pole single strip magnetized ring. Both devices can also be used in linear encoder applications where the IC is mounted directly underneath a single strip linear multi-pole magnet. Communication to the host controller is made using an index output and incremental A/B quadrature outputs providing 40 quadrature pulses (160 steps) per magnet pole period.

Using, for example, a 32pole-pair circular magnetic ring, the AS5304 and AS5306 can provide a resolution of 1280 pulses/rev, which is equivalent to 5120 positions/rev or 12,3 bit. The maximum speed at this configuration is 9375 rpm.

The AS5304 requires a multipole magnet with a pole pair length of 4mm and the AS5306 requires 2.4mm pole pair leng th. A pole pair consists of one magnetic north and one magnetic south pole with equal length.

The AS5304 and AS5306 are both 5V operating devices available in a small 20-pin TSSOP package and specified for an operating ambient temperature of -40° to +125°C.

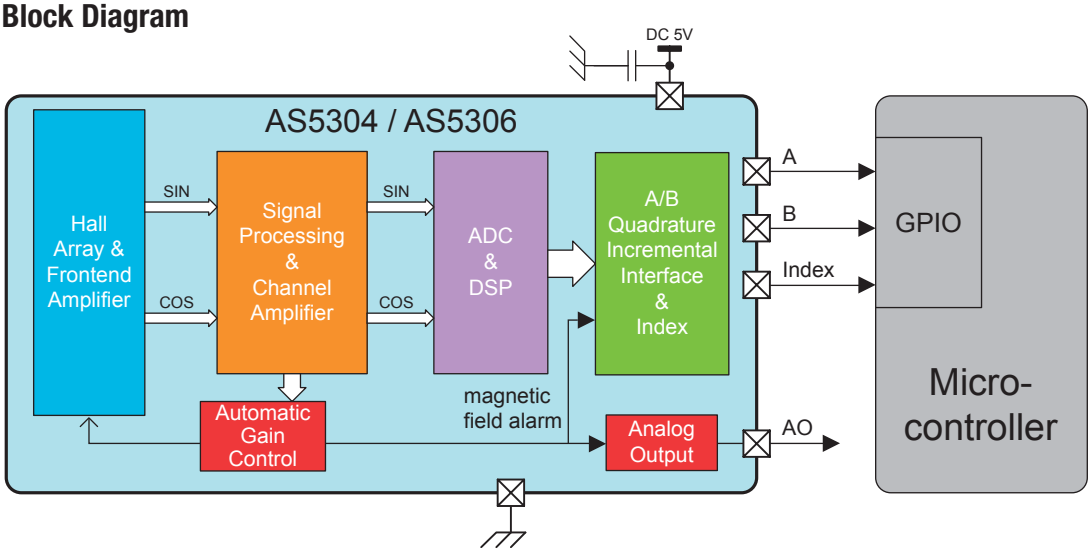
Key Features

- On-chip automatic gain and offset correction
- High sensitivity: supports as low as 5mT magnet field amplitudes
- Single track system –> lower magnet costs
- High magnet to IC air gap tolerance
- High immunity to external magnetic fields
- Magnetic field strength alarm indicator (A0 output)

Applications

Ideal for any high speed linear motion and off-axis rotation measurement in applications such as:
- Electrical motors
- Linear X-Y-stages
- Rotation knobs
- Industrial drives

Block Diagram



Integrated Hall IC for Linear and Off-Axis Rotary Motion Detection

AS5311

General Description

The AS5311 is a contactless high resolution magnetic linear encoder for accurate linear motion and off-axis rotary sensing with a resolution down to <0.5µm. It is a system-on-chip, combining integrated Hall elements, analog front end and digital signal processing on a single chip, packaged in a small 20-pin TSSOP package.

A multi-pole magnetic strip or ring with a pole length of 1.0mm is required to sense the rotational or linear motion. The magnetic strip is placed above the IC at a distance of typical 0.3mm. The absolute measurement provides instant indication of the magnet position within one pole pair with a resolution of 488 nanometers per step (12 bit over 2.0mm). This digital data is available as a serial bit stream and as a PWM signal.

Furthermore, an incremental output is available with a resolution of 1.95 µm per step. An index pulse is generated once for every pole pair (once per 2.0mm). The travelling speed in incremental mode is up to 650mm/second. An internal voltage regulator allows the AS5311 to operate at either 3.3 V or 5 V supplies.

Depending on the application the AS5311 accepts multi-pole strip magnets as well as multi-pole ring magnets, both radial and axial magnetized.

The AS5311 is available in a Pb-free TSSOP-20 package and qualified for an ambient temperature range from -40°C to +125°C.

Key Features

- Two 12-bit digital absolute outputs:
  - Serial interface
  - Pulse Width Modulated (PWM) output
- Incremental output with Index
- Extended diagnostic features for monitoring magnet placement over the chip

Benefits

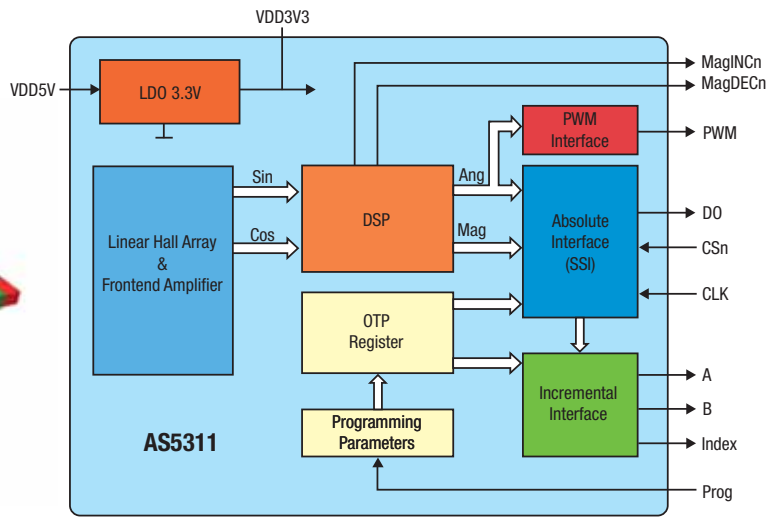
- Complete system-on-chip
- Flexible system solution provides absolute, PWM and incremental outputs simultaneously
- Ideal for applications in harsh environments due to contactless position sensing
- No calibration required
- High resolution:
  - 0.488 µm absolute
  - 1.95 µm incremental

Applications

- Micro-actuator feedback
- Servo drive feedback
- Robotics
- Replacement of optical encoders

Typical arrangement of AS5311 and magnet

Block Diagram



AS5030

General Description

The AS5030 is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360°. It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device. to measure the angle, only a simple two-pole magnet, rotating over the center of the chip is required.

The absolute angle measurement provides instant indication of the magnet's angular position with a resolution of 8-bit = 256 positions per revolution. This digital data is available as a serial bit stream and as a PWM signal.

In addition to the angle information, the strength of the magnetic field is also available as a 6-bit code. Data transmission can be configured for 1-wire (PWM), 2-wires (CLK, DIO) or 3-wires (CLK, DIO, CS).

A software programmable (OTP) zero position simplifies assembly as the zero position of the magnet does not need to be mechanically aligned. A power down mode together with fast startup- and measurement cycles allows for very low average power consumption and makes the AS5030 also suitable for battery operated equipme nt.

Key Features

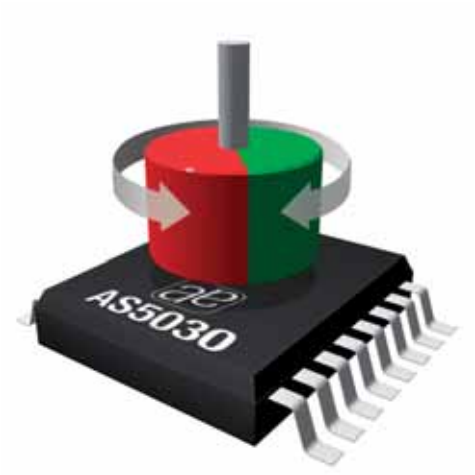
- 360° contactless angular position encoding
- Two digital 8-bit absolute outputs:
  - · Serial interface and
  - · Pulse width modulated (PWM) output
- User programmable zero position
- High speed: up to 30.000 rpm
- Direct measurement of magnetic field strength
- Serial read-out of multiple interconnected AS5030 devices using daisy chain mode
- Wide magnetic field input range: 20 – 80mT
- Wide temperature range: -40 to +125°C
- Small Pb-free package: TSSOP-16

Benefits

- Complete system-on-chip, no calibration required
- Flexible system solution provides absolute serial and PWM output – ideal for applications in harsh environments due to magnetic sensing principle
- High reliability due to non-contact sensing
- Robust system, tolerant to horizontal misalignment, airgap variations, temperature variations and external magnetic fields

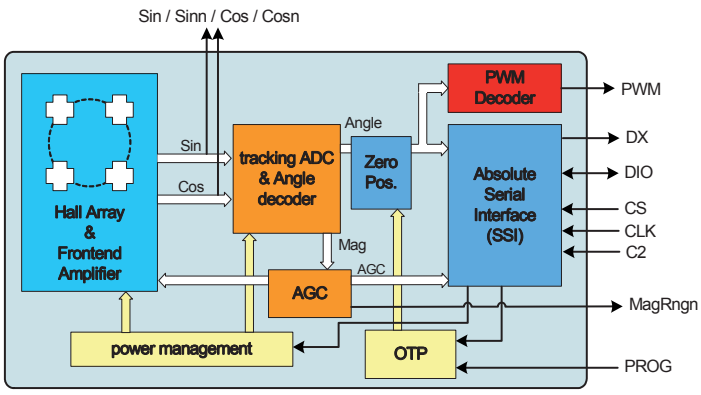
Applications

- Contactless rotary position sensing
- Rotary switches (human machine interface)
- AC/DC motor position control
- Robotics
- Battery operated equipment



Typical arrangement of AS5030 and magnet

Block Diagram



AS5035

General Description

The AS5035 is a contactless magnetic incremental encoder with 64 quadrature pulses per revolution (8-bit resolution) and index output.

Only a simple two-pole magnet, rotating over the center of the chip is required. The magnet may be placed above or below the IC.

The angular position of the magnet during assembly is not critical as the AS5035 allows for a user programmable zero-position to an accuracy of 0.35°.

Two diagnostic outputs are provided to indicate an out-of-range condition of the magnetic field as well as movement of the magnet in Z-axis. In addition, a specific combination of output states indicate a loss of power supply.

The AS5035 is available in a small 16pin SSOP package. It can be operated at either 3.3V or 5V supplies.

Key Features

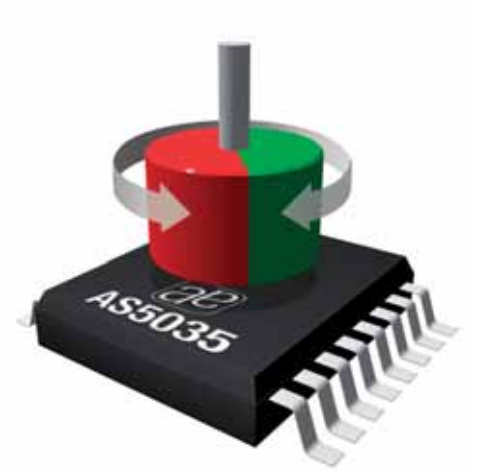
- Full turn (360°) contactless angular position encoder
- 2 quadrature A/B outputs with 64 pulses per revolution (ppr), 256 edges per revolution, 1.4° per step
- Accurate user programmable zero position
- Index output (one pulse per revolution)
- Failure detection mode for magnet placement monitoring and loss of power supply
- Wide temperature range: -40 to +125°C
- Small package: SSOP-16 (5.3mm x 6.2mm)

Benefits

- Complete system-on-chip, including analog front-end and digital signal processing
- 2-channel quadrature and index outputs provide an alternative to optical encoders
- User programmable Zero positioning by OTP allows easy assembly of magnet
- Diagnostic features for operation safety
- Ideal for applications in harsh environments due to magnetic sensing principle
- Robust system, tolerant to magnet misalignment, air gap variations, temperature variations and external magnetic stray fields

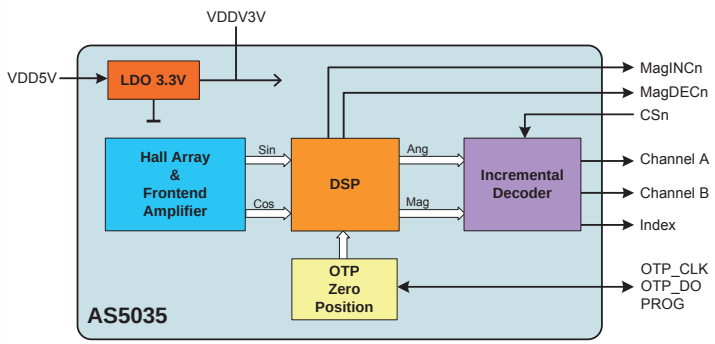
Applications

- Industrial applications:
  - Robotics
  - Replacement of optical encoders
  - Flow meters
  - Man-machine interface
- Automotive applications:
  - Power seat position sensing
  - Power mirror position sensing



Typical arrangement of AS5035 and magnet

Block Diagram



AS5040

General Description

The AS5040 is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device. It provides incremental output signals and the absolute angular position of a magnet that is placed above or below the device.

The AS5040 can be configured to specific customer requirements by programming the integrated OTP (one time programmable) register. An internal voltage regulator allows operating the AS5040 device at either 3.3V or 5V supplies.

Key Features

- Contactless high resolution encoding over a full turn of 360 degrees
- Flexible system due to user programmable incremental output modes:
- 10, 9, 8 or 7-bit user programmable resolution
- Quadrature A/B and index output signal
- Single Channel output and direction indication
- U-V-W commutation signals for brushless DC motors
- Absolute angular position mode:
- 10-bit resolution providing 1024 absolute positions per 360 degrees (step size ~ 0.35 degrees)
- Synchronous serial interface (SSI) output for absolute position data
- Pulse width modulated (PWM) output, duty cycle proportional to angle
- User programmable zero and index position
- Failure detection mode for magnet placement monitoring
- Rotational speeds up to 10.000 rpm (incremental output)
- Push button functionality detects movement of magnet in Z-axis
- Two supply voltages: 3.3V or 5V
- Wide temperature range: -40 to +125°C
- SSOP 16 package: 5.3mm x 6.2mm

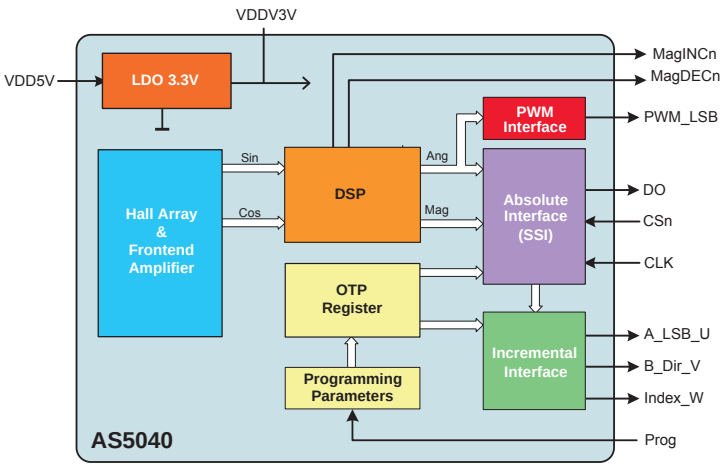
Benefits

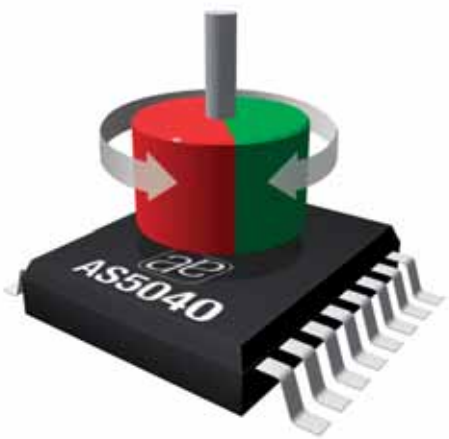
- World's smallest multiple output rotary encoder
- Tolerant to magnetic source misalignment
- Failure detection feature
- Complete system-on-chip:
  - Flexible system solution provides absolute, incremental and PWM digital outputs simultaneously
  - Minimum number of external components needed
- Serial read-out of multiple AS5040 devices using daisy chain mode feature
- Ideal for applications in harsh environments due to contactless position sensing

Applications

- Industrial applications such as:
  - Robotics
  - Motion control
  - Brushless DC motor commutation
  - Power tools
  - Office equipment: printers, scanners, copiers
- Automotive applications:
  - Steering wheel position sensing
  - Gas pedal position encoder
  - Transmission box encoder
  - Headlight position control
  - Power seat position sensing
  - Replacement of optical encoders
  - Front panel rotary switches and potentiometers

Block Diagram





Typical arrangement of AS5040 and magnet

AS5043

General Description

The AS5043 is a contactless magnetic angle encoder for accurate measurement up to 360°.

It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

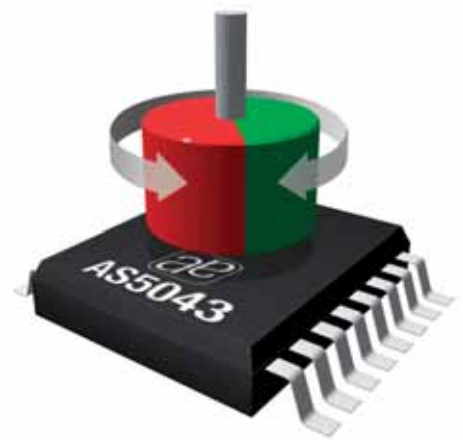
The AS5043 provides a digital 10-bit as well as a programmable analog output that is directly proportional to the angle of a magnet, rotating over the chip.

The analog output can be configured in many ways, including user programmable angular range, adjustable output voltage range, voltage or current output, etc..

An internal voltage regulator allows operation of the AS5043 from 3.3V or 5.0V supplies.

Key Features

- 360° contactless high resolution angular position encoding
- User programmable zero position
- Two 10-bit absolute outputs:
- Serial digital interface and
- Versatile analog output
    - programmable angular range up to 360°
    - programmable ratiometric output voltage range
- Failure detection mode for magnet field strength and loss of power supply
- Serial read-out of multiple interconnected AS5043 devices using daisy chain mode
- Mode input for optimizing noise vs. speed
- Alignment mode for magnet placement guidance
- Wide temperature range: -40 to +125°C
- Small package: SSOP 16 (5.3mm x 6.2mm)



Typical arrangement of AS5043 and magnet

Benefits

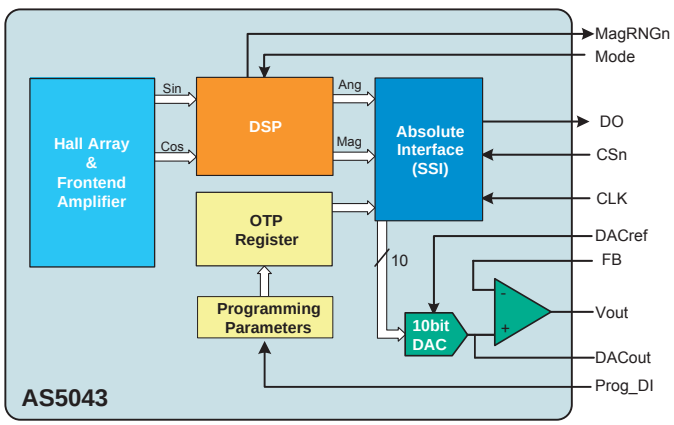
- Complete system-on-chip
- Flexible system solution provides absolute output, both digital and analog
- Angle measurement with software programmable range up to 360°
- High reliability due to non-contact magnetic sensing
- Ideal for applications in harsh environments
- Robust system, tolerant to magnet misalignment, airgap variations, temperature variations and external magnetic fields

Applications

The AS5043 is ideal for applications with an angular travel range from a few degrees up to a full turn of 360°, such as

- Industrial applications:
    - Contactless rotary position sensing
    - Robotics
    - Valve vontrols
- Automotive applications:
    - Throttle position sensors
    - Gas/brake pedal position sensing
    - Headlight position control
- Front panel rotary switches
- Replacement of potentiometers

Block Diagram



General Description

The AS5045 is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360°. It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device. to measure the angle, only a simple two-pole magnet, rotating over the center of the chip, is required. The magnet may be placed above or below the IC.

The absolute angle measurement provides instant indication of the magnet's angular position with a resolution of 0.0875° = 4096 positions per revolution. This digital data is available as a serial bit stream and as a PWM signal. The PWM pulse width is programmable for 1µs/step or 2µs/step.(244Hz or 122Hz PWM frequency).

An internal voltage regulator allows the AS5045 to operate at either 3.3V or 5V supplies.

Key Features

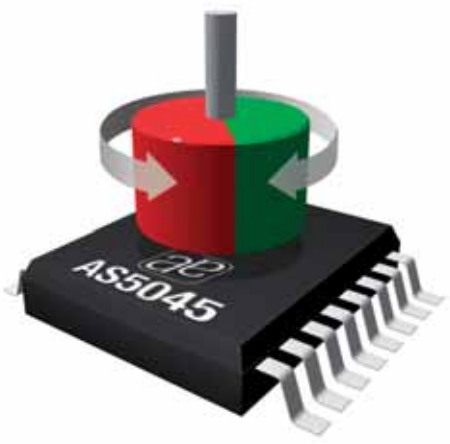
- 360° contactless high resolution angular position encoding
- Two digital 12-bit absolute outputs:
  - · Serial interface and
  - · Programmable Pulse Width Modulated (PWM) output
- User programmable zero position
- Failure detection mode for magnet placement monitoring and loss of power supply
- Push button functionality detects movement of magnet in Z-axis
- Serial read-out of multiple interconnected AS5045 devices using daisy chain mode
- Mode input for optimizing noise vs. speed
- Wide temperature range: -40 to +125°C
- Small package: SSOP-16 (5.3mm x 6.2mm)

Benefits

- Complete system-on-chip
- Flexible system solution provides absolute output, with serial data and PWM output
- Ideal for applications in harsh environments due to magnetic sensing principle
- High reliability due to non-contact sensing
- Robust system, tolerant to misalignment, airgap variations, temperature variations and external magnetic fields

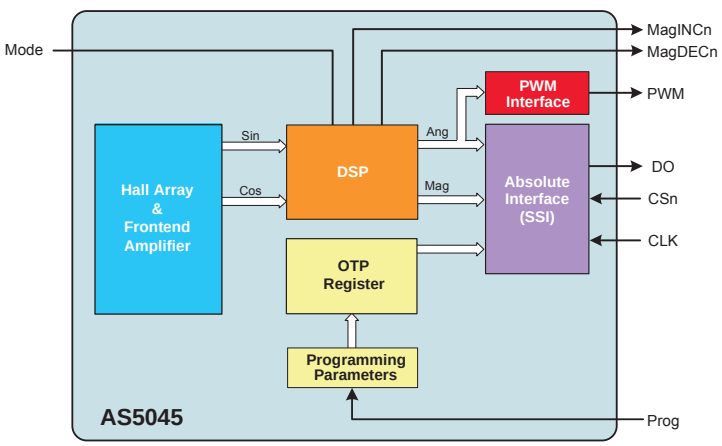
Applications

- Industrial applications:
  - · Contactless rotary position sensing
  - · Robotics
- Automotive applications:
  - · Steering wheel position sensing
  - · Gas pedal position sensing
  - · Transmission gearbox encoder
  - · Headlight position control
  - · Power seat position indicator
- Replacement of potentiometers
- Front panel rotary switches



Typical arrangement of AS5045 and magnet

Block Diagram



AS5046

General Description

The AS5046 is a contactless magnetic angle encoder for accurate measurement up to 360°. It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

The AS5046 provides a digital serial 12-bit as well as a programmable 10-bit ratiometric analog output that is directly proportional to the angle of a magnet, rotating over the chip. In addition, the serial interface enables a user configurable arrangement of the Hall array and allows access to each individual Sensor of the Hall Array.

The AS5046 also provides high resolution information of the magnetic field strength, respectively the vertical distance of the magnet, thus adding excellent state-of-health information of the overall system.
An internal voltage regulator allows operation of the AS5046 from 3.3V or 5.0V supplies.

Key Features

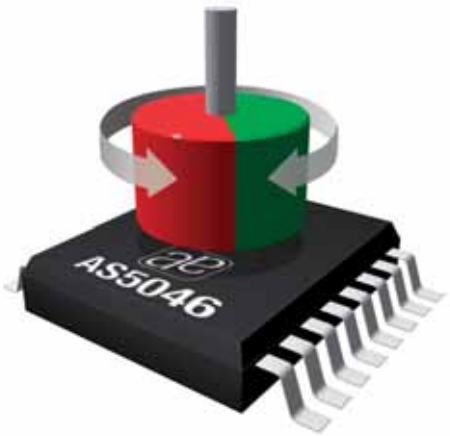
- 360° contactless high resolution angular position encoding
- User programmable zero position
- 12-bit 2-wire serial interface
- Versatile analog output
  - · Programmable angular range up to 360°
  - · Programmable ratiometric output voltage range
- High resolution magnet distance indication
  - · 256 steps within recommended range (~0.5 to 1.8mm)
  - · 256 steps over extended range (~0 to 5mm)
- Mode input for optimizing noise vs. speed
- Alignment mode for magnet placement guidance
- Wide temperature range: -40°C to +125°C
- Small package: SSOP-16 (5.3mm x 6.2mm)

Benefits

- Complete system-on-chip
- High reliability due to non-contact sensing
- Bi-directional 2-wire interface
- Programmable ratiometric analog output
- Ideal for applications in harsh environments
- Robust system, tolerant to magnet misalignment, airgap variations, temperature variations and external magnetic fields

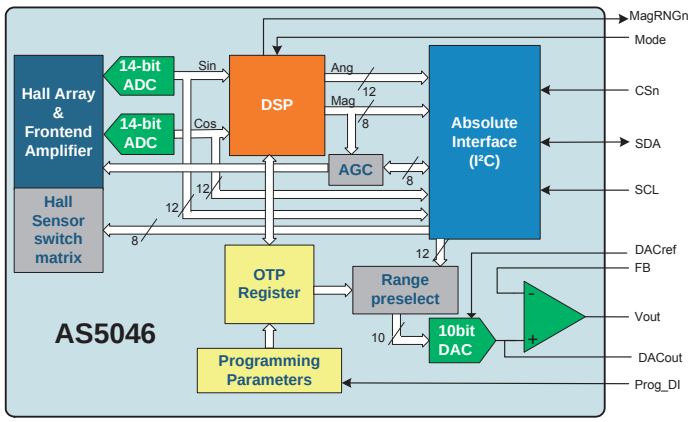
Applications

The AS5046 is ideal for applications that require high resolution, a minimum of wires between controller and sensor and where the vertical distance of the magnet is of importance:
- Remote sensors
- Rotate-and-push manual input devices
- Joysticks
- Applications with extended safety requirements regarding magnet distance



Typical arrangement of AS5046 and magnet

Block Diagram



AS5130

General Description

The AS5130 is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360°.

It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

To measure the angle, only a simple two-pole magnet, rotating over the center of the chip, is required. The magnet may be placed above or below the IC. Theabsolute angle measurement provides instant indication of the magnet's angular position with a resolution of 8 bit = 256 positions per revolution.

This digital data is available as a serial bit stream and as a PWM signal. The AS5130 can be operated in pulsed mode (Vsupply=off), which reduces the average power consumption significantly.
During Vsupply=off, the measured angle can be stored using an internal storage register supplied by a low power voltage line.
This mode allows for very low power consumption during polling of the rotary position of the magnet. The Motion detection wakes up the system, if a motion of the magnet is detected.
The multiturn counter enables the counting of the numbers of turns of the rotating magnetic field and writes it into a register.
Furthermore you can set any arbitrary position as zeroposition.
The system is tolerant to misalignment, airgap variations, temperature variations and external magnetic fields and high reliability due to non-contact sensing. The system is tolerant to misalignment, airgap variations, temperature variations and external magnetic fields and high reliability due to non-contact sensing.

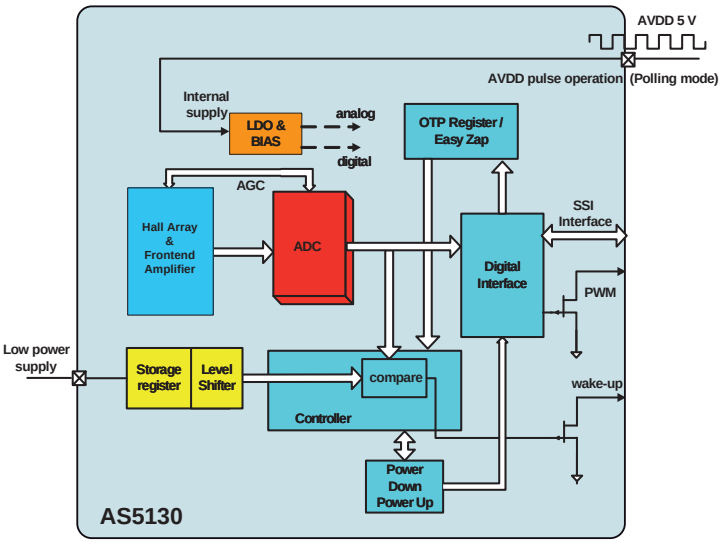
Key Features

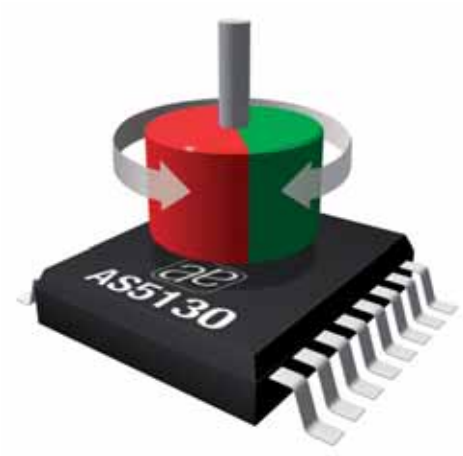
- 360°Contactless angular position encoding
- Two digital 8-bit absolute outputs:
  - · Serial interface and
  - · Pulse width modulated (PWM) output
- User programmable zero position
- High speed: up to 30000 rpm
- Failure detection mode for magnet placement monitoring and loss of power supply
- Wide temperature range: 40 to +125°C
- Multi turn counter / movement detection
- Small Pb-free package: SSOP-16 (5,3mm x 6,2mm)
- Automotive qualified to AEC-Q100, grade 1

Applications

- Ignition key position sensing
- Steering wheel position sensing
- Transmission gearbox encoder
- Front panel rotary switches
- Replacement of potentiometers

Block Diagram





Typical arrangement of AS5130 and magnet

360 Step Programmable High Speed Magnetic Rotary Encoder
AS5134

General Description

The AS5134 is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360º.

It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

To measure the angle, only a simple two-pole magnet, rotating over the center of the chip is required. The absolute angle measurement provides instant indication of the magnet's angular position with a resolution of 8.5 bit = 360 positions per revolution.

This digital data is available as a serial bit stream and as a PWM signal. In addition to the angle information, the strength of the magnetic field is also available as a 6-bit code. Data transmission can be configured for 1-wire (PWM), 2-wires (DCLK, DIO) or 3-wires (DCLK, DIO, CS).

A software programmable (OTP) zero position simplifies assembly as the zero position of the magnet does not need to be mechanically aligned. A Power Down Mode together with fast startup and measurement cycles allows for very low average power consumption.

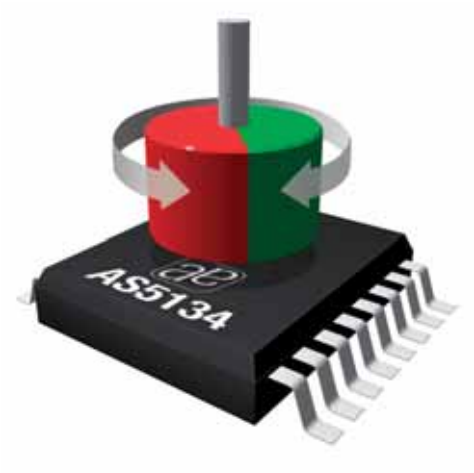
Key Features

- 360º contactless angular position encoding
- Two digital 360 step (8.5 bit) absolute outputs: Serial interface and Pulse width modulated (PWM) output
- User programmable zero position, sensitivity
- High speed: up to 30.000 rpm
- Direct measurement of magnetic field strength allows exact determination of vertical magnet distance
- Incremental Outputs ABI Quadrature: 90 ppr, step direction: 180ppr, fixed pulse width 360ppr
- BLDC Outputs UVW, selectable for 1,2,3,4,5,6 pole pairs
- Daisy-Chain mode for cascading of multiple sensors
- 9-bit multiturn counter
- Low power mode with fast startup
- Wide magnetic field input range: 20 – 80 mT
- Wide temperature range: - 40ºC to +140ºC
- Small Pb-free package: SSOP 20

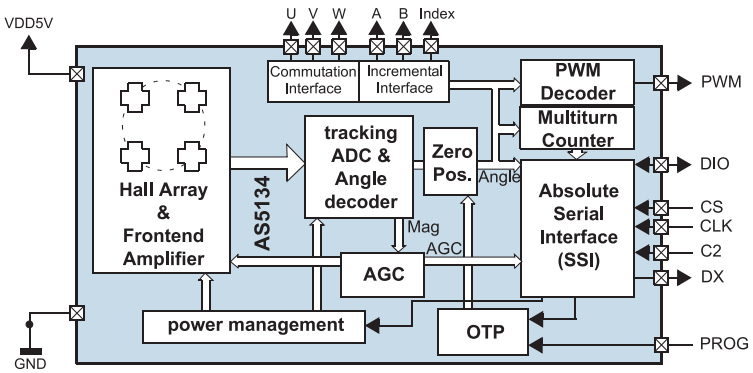
Applications

The AS5134 is suitable for contactless rotary position sensing, rotary switches (human machine interface), AC/DC motor position control and Brushless DC motor position control.

Block Diagram



Typical arrangement of AS5134 and magnet



AS5140H

150°C
Ambient Temperature

General Description

The AS5140H is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360° and over an extended ambient temperature range of -40…+150°C.

It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

To measure the angle, only a simple two-pole magnet, rotating over the center of the chip, is required. The magnet may be placed above or below the IC.

The absolute angle measurement provides instant indication of the magnet's angular position with a resolution of 0.35° = 1024 positions per revolution. This digital data is available as a serial bit stream and as a PWM signal. Furthermore, a user-programmable incremental output is available.

An internal voltage regulator allows the AS5140H to operate at either 3.3V or 5V supplies.

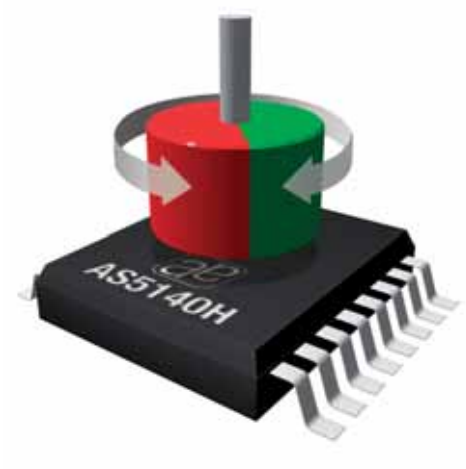
The AS5140H is pin-compatible to the AS5040; however it uses low-voltage OTP programming cells with additional programming options.

Key Features

- Contactless high resolution rotational position encoding over a full turn of 360 degrees
- Two digital 10-bit absolute outputs:
  - · Serial interface and
  - · Pulse width modulated (PWM) output
- Three incremental output modes:
  - · Quadrature A/B and Index output signal
  - · Step / direction and Index output signal
  - · 3-phase commutation for brushless DC motors
  - · 10, 9, 8 or 7-bit user programmable resolution
- User programmable zero / index position
- Failure detection mode for magnet placement monitoring and loss of power supply
- Rotational speeds up to 10,000 rpm
- Push button functionality detects movement of magnet in Z-axis
- Serial read-out of multiple interconnected AS5140H devices using Daisy Chain mode
- Fully automotive qualified to AEC-Q100, grade 0
- Wide ambient temperature range: -40 to +150°C
- Small Pb-free package: SSOP 16 (5.3mm x 6.2mm)

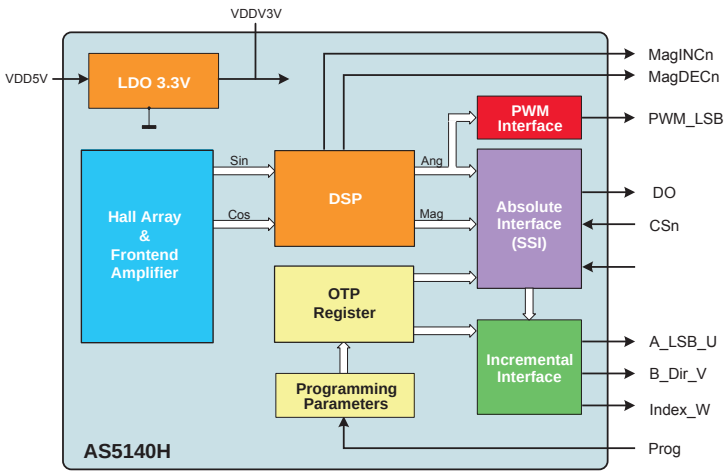
Applications

- Automotive applications:
  - · Engine compartment sensors
  - · Transmission gearbox encoder
  - · Throttle Valve position control
- Industrial applications
  - · Rotary sensors in high temperature environment



Typical arrangement of AS5140H and magnet

Block Diagram



AS5163

General Description

The AS5163 is a contactless magnetic angle position sensor for accurate angular measurement over a full turn of 360°. A sub range can be programmed to achieve the best resolution for the application. It is a system-on-chip, combining integrated Hall elements, analog front end, digital signal processing and a powerful automotive feature package in a single device.

To measure the angle, only a simple two-pole magnet, rotating over the center of the chip, is required. The magnet may be placed above or below the IC. The absolute angle measurement provides instant indication of the magnet's angular position with a resolution of 0.022° = 16384 positions per revolution. According to this resolution the adjustment of the application specific mechanical positions are possible. The angular output data is available as a 14-bit digital signal, as well as a 12-bit PWM or analog signal.

The AS5163 operates at a supply voltage of 5 V. The supply and output pins are protected against overvoltage up to +27 V. In addition the supply pins are protected against reverse polarity up to – 18 V. Programmability over the output pin reduces the number of pins on the application connector.

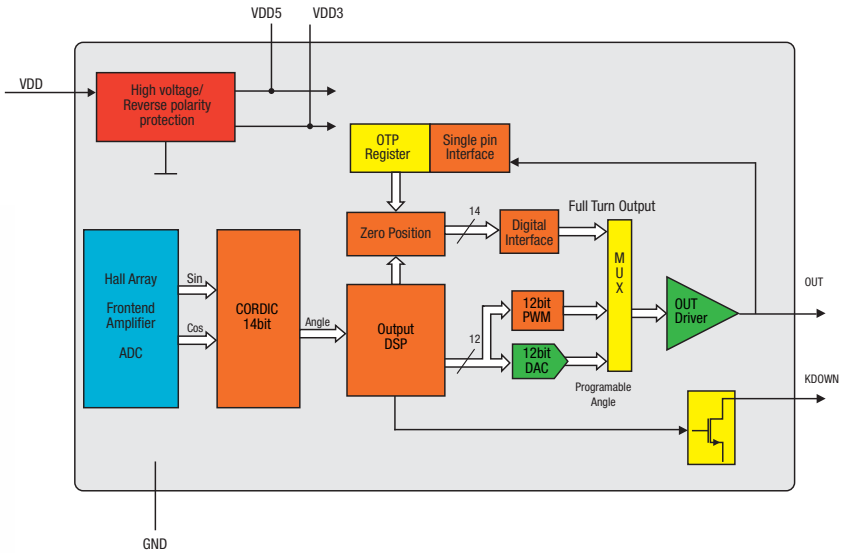
Key Features

- 360° contactless high resolution angular position encoding
- User programmable starting and end point of the application region
- User programmable clamping levels and programming of the transition point
- Powerful analog output
  - · fully short circuit protected
  - · high driving capability for resistive and capacitive loads
- 14-bit digital output
- Continuous short circuit monitoring
- Broken GND and VDD detection over a wide range of different load conditions
- Simplified programming due to provided programming hardware and software
- Failure detection mode for magnet placement monitoring and loss of power supply, indication of high voltage condition
- Wide temperature range: -40°C to +150°C
- Small Pb-free package: TSSOP-14

Applications

- Transmission gearbox position sensor
- Headlight position control
- Torque sensing
- Valve position sensing
- Pedal position sensing
- Throttle position sensing
- Non contact potentiometers

Typical arrangement of AS5163 and magnet



AS5243

General Description

The AS5243 is a contactless magnetic angle encoder for accurate measurement up to 360º and includes two AS5143 devices in a punched stacked leadframe.

It is a system-on-chip, combining integrated Hall elements, analog front-end and digital signal processing in a single device.

The AS5243 provides a digital 10-bit as well as a programmable analog output that is directly proportional to the angle of a magnet, rotating over the chip. The analog output can be configured in many ways, including user programmable angular range, adjustable output voltage range, voltage or current output, etc.

An internal voltage regulator allows operation of the AS5243 from 3.3V or 5.0V supplies. The AS5243 is fully automotive qualified to AEC-Q100, grade 1.

Key Features

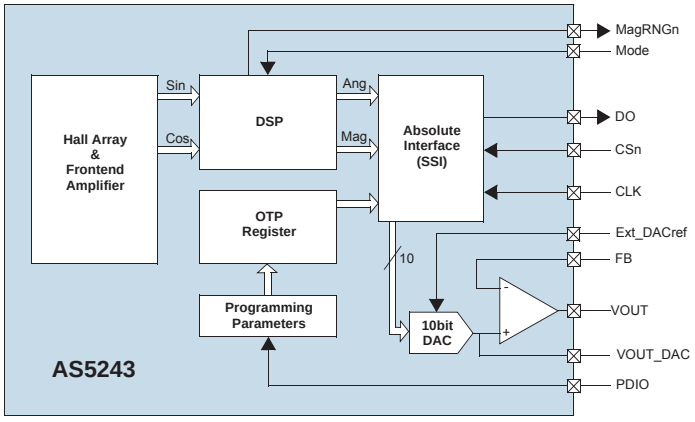
- User programmable zero position
- Digital serial 10-bit absolute output
- 10-bit Analog output with programmable angle down to 0.088º/step
- Failure detection mode for magnet field strength and loss of power supply
- Serial read-out of multiple interconnected AS5243 devices using daisy chain mode
- Mode input for optimizing noise vs. speed
- Alignment mode for magnet placement guidance
- Wide temperature range: - 40ºC to +150ºC
- Small package: QFN32LD(7x7)
- Unique Chip Identifier

Applications

The AS5243 is ideal for applications with an angular travel range from a few degrees up to a full turn of 360º. The device is suitable for automotive applications like Throttle position sensors, Gas/brake pedal position sensing, Headlight position control, Contactless rotary position sensing, Front panel rotary switches and Replacement of potentiometers.

Typical arrangement of AS5243 and magnet

Block Diagram



AS8118

General Description

The AS8118 is a very accurate single phase bi-directional instantaneous measurement curcuit, which surpasses all the accuracy requirements for IEC1036 alternating current static watt-hour meters.
The measured energy is converted into pulses with the number of pulses presented at the outputs being proportional to the measured energy.

The AS8118 is ideal for use in 'stand alone' simple kWh meter applications, where the IC directly drives an electromechanical counter with a two-phase stepper motor, or for more complex meter applications, the AS8118 interfaces directly to a micro-controller.

The highly integrated AS8118 design includes all the required functional blocks. The blocks comprise of the analog to digital converters (ADC) for the voltage and current Channels, digital filters, the digital signal processing block and a control block and non-volatile calibration memory enabling on-chip programming. The on-chip programming enables the setting of the input gain, the anticreep threshold, the output pulse rates and the system calibration. The high level of integration ensures that a minimal of non-critical external components is required.

The on-chip anti-creep circuit ensures that the AS8118 does not give out any pulses when the meter is in a noload condition and that the IEC1036 anti-creep test requirements are fully complied with, for both direct or transformer connection meters.

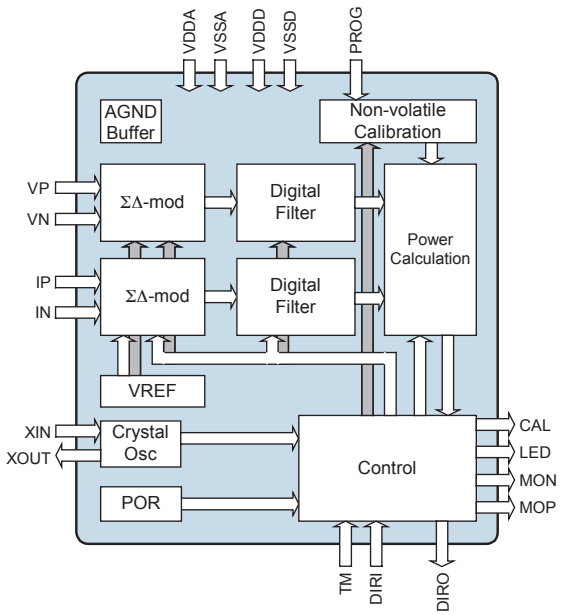
The AS8118 offers three different pulse outputs. A stepper motor drive output for directly driving a stepper motor display, a LED output for consumption indication and a dedicated higher frequency output for fast single point system calibration if required.

The AS8118 is available in either surface mount SOIC-18 or dual-in-line DIP-18 packages.

Key Features

- Extremely accurate, surpassing the accuracy requirements of the IEC 1036 Specification with less than 0.1% error over a dynamic range of 600 to 1
- On-chip programming provides for input gain selection for use with a low-resistance shunt resistor or a current transformer
- On-chip programming for output pulse rate selection
- On-chip calibration eliminates the need for an external resistor network or trim-potentiometer
- Programmable on-chip creep prevention under no-load condition
- All on-chip programmable functions may be reprogrammed a second time
- Outputs directly drive an electromechanical counter or two phase stepper motor and consumption LED indicator
- Fast calibration pulse output for high speed manual or automated calibration
- On-chip voltage reference and power supply monitoring
- Bi-directional or unidirectional measurement, with direction indication output available

Block Diagram



AS8168

General Description

The AS8168 is a very accurate single-phase bi-directional average energy measurement integrated circuit, which surpasses all the accuracy requirements for IEC1036 alternating current static watt-hour meters. The measured energy is converted into pulses with the number of output pulses being proportional to the measured energy.

The AS8168 is ideal for use in 'stand alone' kWh meter applications, where the IC directly drives an electromechanical counter with a two-phase stepper motor, or for more complex meter applications, the AS8168 interfaces directly to a micro-controller.

The highly integrated AS8168 design includes all the required functional blocks. The blocks comprise of analog to digital converters (ADC) for the voltage and current Channels, digital filters, a digital signal processing block, a control block and non-volatile calibration memory for the on-chip programming. The on-chip programming enables the setting of the current input gain, the anti-creep threshold, the output pulse rates and the system calibration. The high level of integration ensures a minimum number of non-critical external components are required.

The on-chip anti-creep circuit ensures that the AS8168 does not output pulses when the meter is in a no-load condition and that the IEC1036 anti-creep test requirements are fully complied with, for both direct or transformer connection meters.

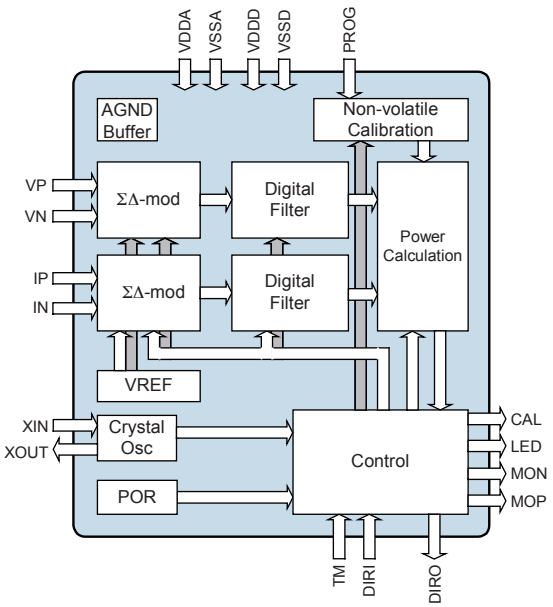
The AS8168 offers three different pulse outputs. A stepper motor drive output for directly driving a stepper motor display, a LED output for energy consumption indication and a dedicated high frequency output for fast single point system calibration.

The AS8168 is available in either surface mount SOIC-18 or dual-in-line DIP-18 packages.

Key Features

- Extremely accurate, surpassing the accuracy requirements of the IEC1036 Specification with less than 0.1% error over a 1000 : 1 dynamic range
- On-chip programmable current input gain suitable for use with low-resistance shunt resistor or current transformer
- On-chip programming for output pulse rate selection.
- On-chip calibration eliminates the need for an external resistor network or trim-potentiometer
- Programmable on-chip creep prevention under no-load condition
- All on-chip programmable functions may be reprogrammed a second time
- Outputs directly drive an electromechanical counter or a two phase stepper motor counter and consumption LED indicator
- Fast calibration pulse output for high speed manual or automated calibration
- On-chip voltage reference and power supply monitoring
- Bi-directional or unidirectional energy measurement, with direction indication output available

Block Diagram



General Description

The AS8218 / AS8228 are highly integrated CMOS single-phase energy metering devices for fully electronic LCD meter systems. The AS8218 / AS8228 have been designed to ensure that meters can fully comply with the international Standards IEC6052 and ANSI.

The AS8218 / AS8228 ICs include all the functions required for conventional 1 current or 2-current anti-tamper meters. The functions include precision energy measurement, an 8-bit microcontroller unit (MCU), an on-chip Liquid Crystal Display driver (LCDD), programmable and selectable multi-purpose Inputs/Outputs (MPIO), a real time clock/calendar (RTC) for complex tariff functions such as time-of-use or maximum demand billing and a Serial Peripheral Interface (SPI) for reading data from and writing data to an external non-volatile memory (EEPROM).

The AS8218 / AS8228 ICs have a dedicated energy measurement front-end, which include an analog front-end and programmable Digital Signal Processor (DSP) from which active energy, mains voltage and mains current are provided. Reactive and apparent energy can also be calculated.

The on-chip 8-bit 8051 compatible microcontroller is freely programmable and provides user access to the various functional blocks. The dedicated Universal Asynchronous Receiver / Transmitter (UART1) in the System Control block provides access to various system functions and blocks. A second UART (UART2) is also provided, which may for example be used for debugging. The on-chip memory includes 24kByte program memory and 1kByte data memory.

Due to the large diversity of non-volatile memory requirements for fully electronic single-phase metering systems, the AS8218 / AS8228 ICs allow the system designer to select the size of the external EEPROM memory, 1kByte to 32kByte (in binary steps).

An on-chip programmable watchdog timer (WDT) is available to automatically initiate a system reset if a regular ´ hold-off ` signal is not detected.

The system timing and real time clock (RTC) has a dedicated supply pin (VDD_BAT), which is separate from the rest of the IC, enabling the oscillator to be supplied with an external battery during 'power-down'. The RTC may be digitally calibrated for oscillator frequency accuracy. The LCD Driver (LCDD) block enables the display of information provided by the microcontroller, directly to the LCD. Two dedicated data register banks are provided to simplify programming, particularly in the case where the display data needs to be scrolled.

The programmable multi-purpose I/O pins (MPIO) may be independently configured as dedicated inputs or outputs. All the I/O pins are programmable for data direction, pull-up/pull-down resistors and drive strength (4mA/8mA). Such functions may include LED energy consumption pulse output, energy direction and fault condition indication depending on current 1 or current 2 being active for the energy calculation, push button for display scrolling, mains isolation relay control for prepayment meters, optical interface etc.

An on-chip analog ground buffer (ABUF) and voltage reference (VREF) ensures that no external circuitry is required. A power-supply monitor (PSM) provides a reset, when VDD falls below a safe operating threshold.

A reset pin (RES_N) is available for external system reset.

The AS8218 / AS8228 ICs are available in a LQFP64 plastic package.

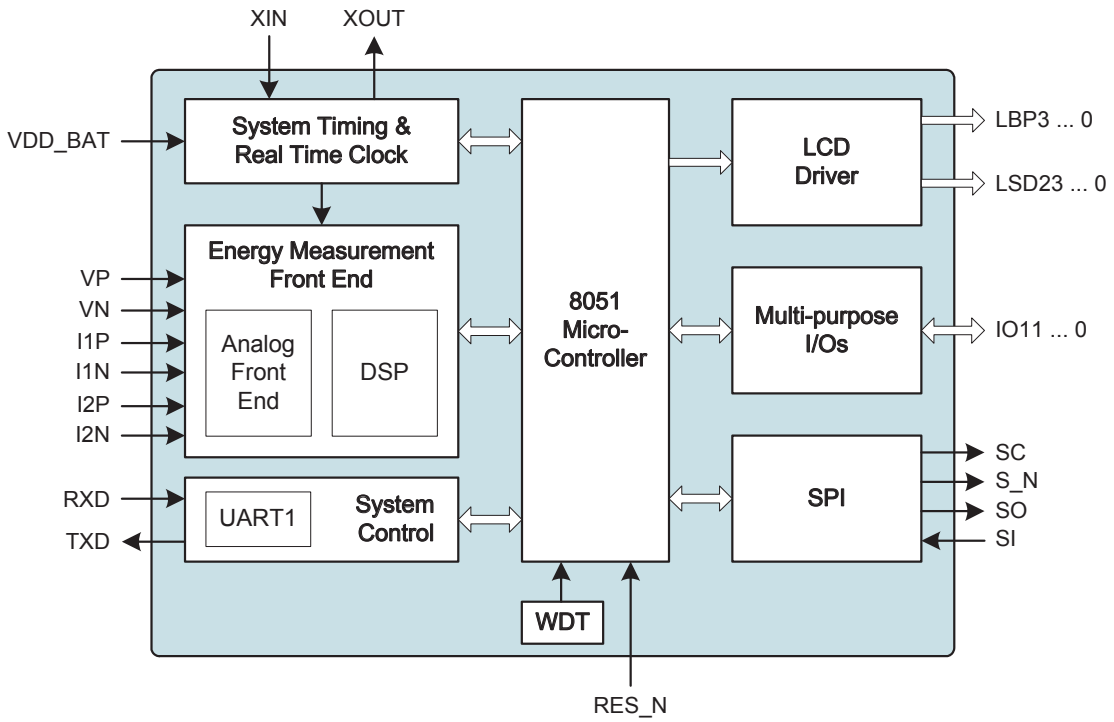
Key Features

- Precision single-phase, one or two current input energy measurement front-end including Sigma-Delta modulators for A/D-conversion and digital signal processor (DSP)
- Low current consumption of 5mA, depending on MCU activity
- Digital phase correction and selectable gain on both current Channels for use with two current transformers (CT) or one CT and one shunt
- Power-supply monitor (PSM) for power-on reset and reset when the supply voltage falls below a defined threshold
- Customer programmable 8-bit 8051 compatible microcontroller (MCU)
- Programmable MCU clock with optional low power operating conditions
- Programmable watchdog timer (WDT) and external reset pin
- 2 x Universal Asynchronous Receiver / Transmitters (UART) for external communications such as programme download and debugging
- Real-time clock/calendar (RTC) with on-chip digital calibration and separate battery backup pin
- On-chip voltage reference (VREF) with small temperature coefficient.
- Low power 3.0 – 4.0MHz crystal oscillator
- SPI compatible interface for external EEPROM memory
- Standard on-chip LCD driver (LCDD) interface
- Programmable multi-purpose I/Os (MPIO) with selectable data direction, pull-up or pull-down resistors and drive strength
- Mains current lead/lag status indication for reactive energy measurement
- Low power battery operating mode for meter reading when Mains voltage is not present
- The difference between the AS8218 and AS8228 ICs are:

  AS8218: 20 x 4 segment LCDD
  9 x multi-purpose I/O (MPIO)

  AS8228: 24 x 4 segment LCDD
  12 x multi-purpose I/O (MPIO)

Block Diagram



AS8267/AS8268

General Description

The AS8267 / AS8268 are highly integrated CMOS single-phase energy metering devices for fully electronic LCD meter systems. The AS8267 / AS8268 have been designed to ensure a meters full compliance with the international Standards IEC62052 and ANSI.

The AS8267 / AS8268 ICs include all the functions required for conventional 1 current or 2-current anti-tamper meters. The functions include precision energy measurement, an 8-bit microcontroller unit (MCU) with 32kBytes of Flash memory, an on-chip Liquid Crystal Display driver (LCDD), programmable multi-purpose Inputs/Outputs (MPIO), a real time clock/calendar (RTC) for complex tariff functions such as time-of-use or maximum demand billing and a Serial Peripheral Interface (SPI) for reading data from and writing data to an optional external non-volatile memory (EEPROM).

The AS8267 / AS8268 ICs have a dedicated energy measurement front-end, which includes an analog front-end and programmable Digital Signal Processor (DSP) from which active energy, mains voltage and mains current are provided. Reactive and apparent energy can also be calculated.

The on-chip 8-bit 8051 compatible microcontroller is freely programmable and provides user access to the various functional blocks. The dedicated Universal Asynchronous Receiver / Transmitter (UART1) in the System Control block allows access to various system functions and blocks. A second UART (UART2) is also provided, which may for example be used for debugging. The on-chip memory includes 32kByte of highly reliable non-volatile Flash program (and data) memory and 1kByte volatile data memory. The meter system designer also has the option of an additional external EEPROM memory, which is selectable in size from 1kByte to 32kByte (in binary steps).

Program and data stored in the on-chip non-volatile Flash memory can be secured by password protection, in addition to an attack counter which 'locks' access after 5 unauthorised attacks.
An on-chip programmable watchdog timer (WDT) is available to automatically initiate a system reset if a regular 'hold-off' signal is not detected.

The system timing and real time clock (RTC) has a dedicated external battery supply pin (VDD_BAT), enabling the oscillator and RTC to continue operation during 'power-down'. The RTC may be digitally calibrated for oscillator frequency accuracy.

The on-chip temperature sensor provides the meter designer the option of temperature compensation for any of the measured parameters or functional blocks provided, over the full operating temperature range of the device.

The LCD Driver (LCDD) block enables the display of information provided by the microcontroller, directly to the LCD. Two dedicated data register banks are provided to simplify programming, particularly in the case where scrolled display data is required.

The programmable multi-purpose I/O pins (MPIO) may be independently configured as inputs or outputs. All the I/O pins are programmable for data direction, pull-up/pull-down resistors and drive strength (4mA/8mA). Typical functions may include LED energy consumption pulse output, energy direction and fault condition indication depending on current 1 or current 2 being active for the energy calculation, push button for display scrolling, mains isolation relay control for prepayment meters, optical interface etc.

An on-chip analog ground buffer (ABUF) and voltage reference (VREF) ensures that no external circuitry is required. A power-supply monitor (PSM) provides a reset, when VDD falls below a safe operating threshold. A reset pin (RES_N) is available for external system reset.
The AS8267 / AS8268 ICs are available in LQFP64 plastic package.

AS8267/AS8268

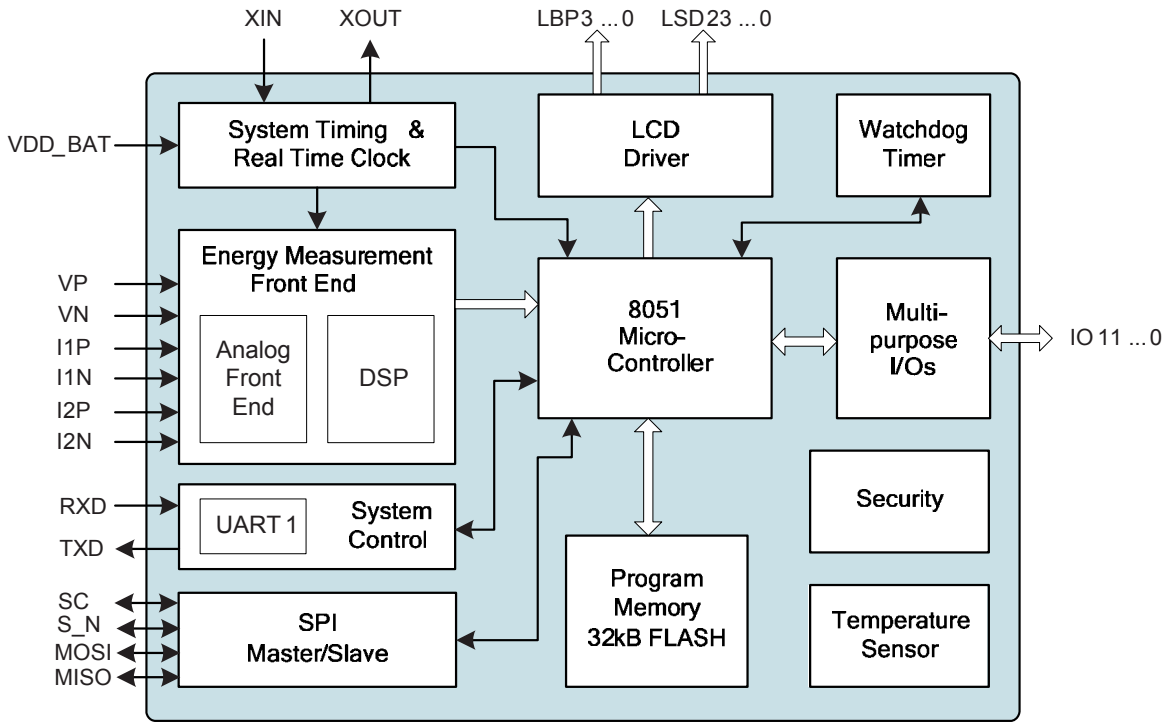
Key Features

- Precision single-phase, one or two current input energy measurement front-end including Sigma-Delta modulators for A/D-conversion and digital signal processor (DSP)
- Low current consumption of 5mA, depending on MCU activity
- Digital phase correction and selectable gain on both current channels for use with two current transformers (CT) or one CT and one shunt
- Power-supply monitor (PSM) for power-on reset and reset when the supply voltage falls below a defined threshold
- Customer programmable 8-bit 8051 compatible microcontroller (MCU).
- Programmable MCU clock for optional low power operating conditions
- Highly reliable 32kBytes of non-volatile Flash memory is provided on-chip for storage of both program and data
- Program and data security is provided by optional password and attack counter protection
- 2 x Universal Asynchronous Receiver / Transmitters (UART) for external communications such as programme download and debugging
- Programmable watchdog timer (WDT) and external system reset pin
- Real-time clock/calendar (RTC) with on-chip digital calibration and separate battery supply pin
- On-chip temperature sensor for optional temperature compensation.
- On-chip voltage reference (VREF) with small temperature coefficient (15ppm/K typ.)
- Low power 3.0 – 4.0MHz crystal oscillator
- SPI compatible interface for optional external non-volatile EEPROM memory selectable up to 32kBytes
- Mains current lead/lag status indication for reactive energy measurement
- Low power battery operating mode for meter reading when Mains voltage is not present

  AS8267: 20 x 4 segment LCDD
  9 x multi-purpose I/O (MPIO)

  AS8268: 24 x 4 segment LCDD
  12 x multi-purpose I/O (MPIO)

Block Diagram



FlexRay™ Basis Transceiver

AS8220

Optimized for terminal 15 ECUs

General Description

The AS8220 is a high-speed automotive bus driver according the FlexRay Electrical Physical Layer Specification V2.1 Rev B operating as bi-directional transceiver between the digital interface of the FlexRay Communication Controller and the FlexRay network connection with differential voltage signaling.

The device is optimized for usage in FlexRay nodes supplied by the ignition terminal. The AS8220 is supplied by 5 Volt and additionally provides a digital logic level interface for adaptation of digital signals interfacing the microcontroller and the FlexRay Communication Controller. Both input voltages are monitored and in case of low voltage conditions failures will be signaled to the microcontroller.

The microcontroller is operating the power modes of the Transceiver device via the low active STBN input pin. In Standby mode the transmitter and receiver are disabled, enabling current consumption below 40uA. During Normal mode the device is fully operational while transmitting and receiving FlexRay data streams.

A bus-guardian interface makes the device ready to be deployed in safety critical applications. Redundant monitoring devices consequently can disconnect the device from communication in case of local failures, avoiding a discontinuation of the communication on the network.

All austriamicrosystems FlexRay Transceivers provides a high-end diagnosis for bus failures consisting of two independent mechanisms. First, the high speed mechanism compares in transmitting mode the output signal with the concurrently received input signal and additionally a high resolution current measurement mechanism with detecting bus failures depending on the captured current on BP and BM.

The product is available in RoHS conform SSOP14 package.

Key Features

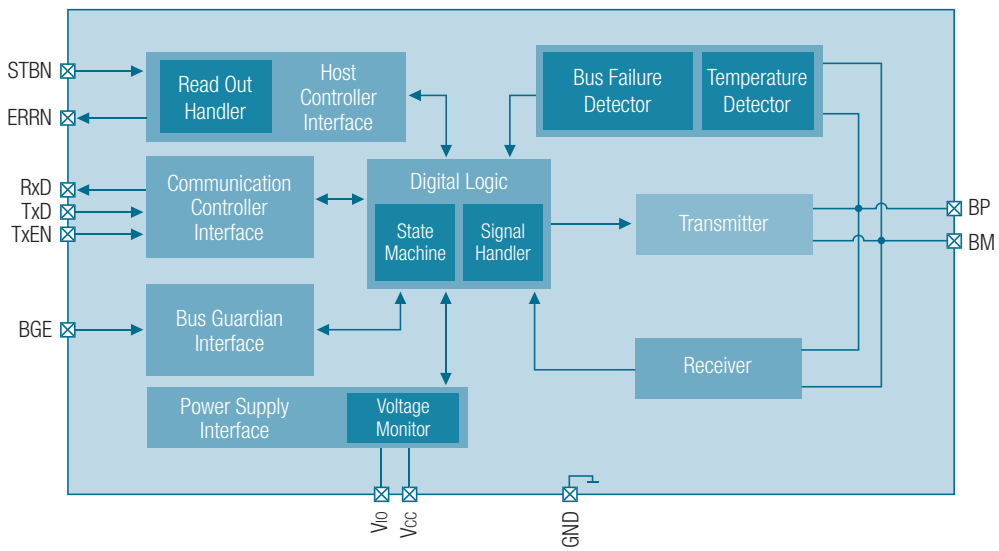
- Compliant with FlexRay Electrical Physical Layer Specification V2.1 Rev. B
- Data transfer up to 10 Mbps
- Excellent EMC performances. High common mode range ensuring excellent EMI
- Transmit enable pin for Bus Guardian or supervision circuits
- Automatic thermal shutdown protection
- Very low standby current
- Supports 2.5, 3, 3.3, 5 V microcontrollers and automatically adapts to interface levels
- Protection against damage due to short circuit conditions on the bus
- Very low asymmetric delay contribution
- Operating temperature range -40ºC to +125ºC
- Simplicity while providing the FlexRay basis functionality

Applications

The AS8220 FlexRay Basis Transceiver is best fitting for automotive applications whereby the electronic-control-unit is supplied by the terminal 15 (ignition). Whenever after start-up of the ECU the AS8220 gets sufficiently supplied, the device enters Standby mode, waiting for host commands.

The AS8220 addresses applications where the power management is inherited by the local voltage supply and microcontroller and is optimized for FlexRay nodes where no remote FlexRay bus-wake-up is needed.

Block Diagram



FlexRay™ Standard Transceiver

AS8221

FlexRay Conformance Test passed

General Description

The AS8221 is a high-speed automotive bus driver conforming to the FlexRay Electrical Physical Layer Specification V2.1 Rev B operating as bi-directional transceiver between the digital interface of the FlexRay Communication Controller and the FlexRay network connection with differential voltage signaling.

The device is a full featured FlexRay Transceiver providing an internal voltage regulator control to enable the start-up of an external voltage supply after the device gets waked-up either locally or by a valid FlexRay bus-wake-up pattern. The AS8221 is supplied by the battery voltage and the 5V supply as bus voltage reference. Additionally the device provides a digital logic level shift interface for adaptation of digital signals interfacing the microcontroller and FlexRay Communication Controller.

In case of undervoltage at one of the supply voltages (VBAT, VCC and VIO) the device will change its mode to a low power mode (either Standby or Sleep mode) and the device will signal an error accordingly. In case of low voltage is detected on both VBAT and VCC the device will enter the Power-Off mode, where no operation is possible.

Besides of the Normal mode with all enabled functionality of the device and the Standby mode with reduced current consumption, the device provides the Receive-Only mode for only receiving FlexRay data streams and the Sleep mode with very low power consumption. These modes are operated by a microcontroller via the low active input pins EN and STBN.

Ensuring application in safety critical environments a two-wire bus-guardian interface is implemented where redundant monitoring circuitries on the electronic-control-unit can disconnect the device from communication. At the RxEN output in low power modes wake conditions are signaled and in normal power modes FlexRay data stream shown.

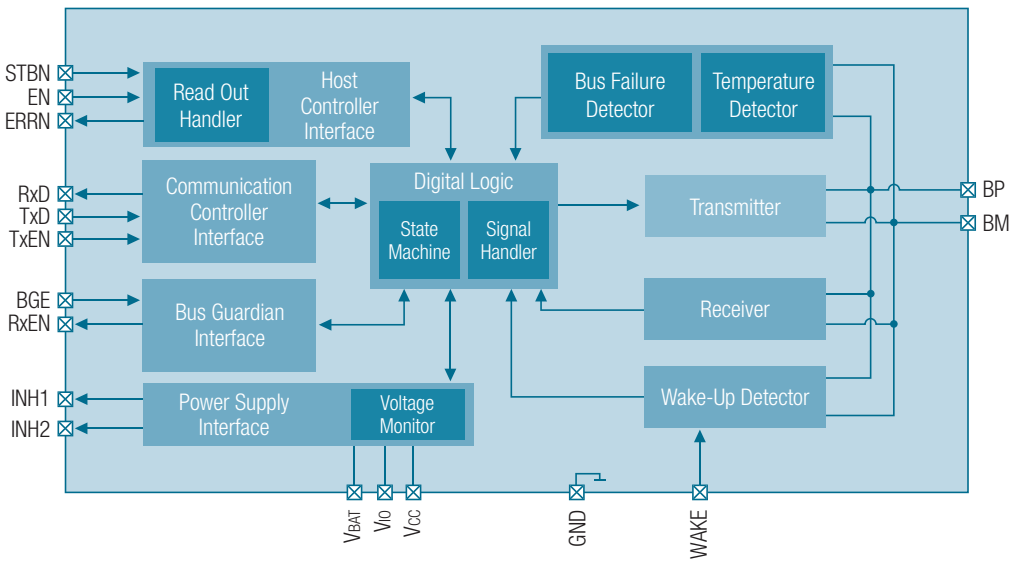
Key Features

- Compliant with FlexRay Electrical Physical Layer Specification V2.1 Rev. B
- Data transfer up to 10 Mbps
- Excellent EMC performances. High common mode range insure excellent EMI
- Interface for Bus Guardian or supervision circuits
- Automatic thermal shutdown protection
- Supports 12V and 24V systems with very low sleep current
- Integrated power management system
- Two inhibit pins for external voltage supply control
- Local wake-up input
- Remote wake-up via FlexRay bus
- Supports 2.5, 3, 3.3, 5 V microcontrollers and automatically adapts to interface levels
- Protection against damage due to short circuit conditions on the bus (positive and negative battery voltage)
- Very low asymmetric delay contribution
- Operating temperature range -40ºC to +125ºC

Applications

The AS8221 FlexRay Standard Transceiver is best fitting for all automotive applications where the full functionality of the FlexRay bus driver is needed. The device addresses all ECUs supplied by the permanent battery supply (terminal 30). The device manages the voltage regulator control, therefore can be deployed as the only wake-up component on the ECU providing very low power consumption in Sleep mode.

Block Diagram



Quad LVDS Receiver, 500 Mbps

AS1150/AS1151

General Description

The AS1150 and AS1151 are quad flow-through LVDS (low-voltage differential signaling) receivers which accept LVDS differential inputs and convert them to LVCMOS outputs. The receivers are perfect for lowpower low-noise applications requiring high signaling rates and reduced EMI emissions.

The devices are guaranteed to receive data at speeds up to 500Mbps (250MHz) over controlled impedance media of approximately 100Ω. Supported transmission media are PCB traces, backplanes, and cables.

The AS1150 uses high impedance inputs and requires an external termination resistor when used in a point-topoint connection.
The AS1151 features integrated parallel termination resistors (nominally 107Ω), which eliminate the requirement for discrete termination resistors, and reduce stub lengths.

The integrated failsafe feature sets the output high if the inputs are open, undriven and terminated, or undriven and shorted. Enable inputs (EN and ENn – internally pulled down to GND) control the high-impedance output and are common to all four receivers. All inputs conform to the ANSI TIA/EIA- 644 LVDS standards. Flow-through pinout simplifies PC board layout and reduces crosstalk by separating the LVDS inputs and LVCMOS outputs.

The devices are available in a 16-pin TSSOP package.

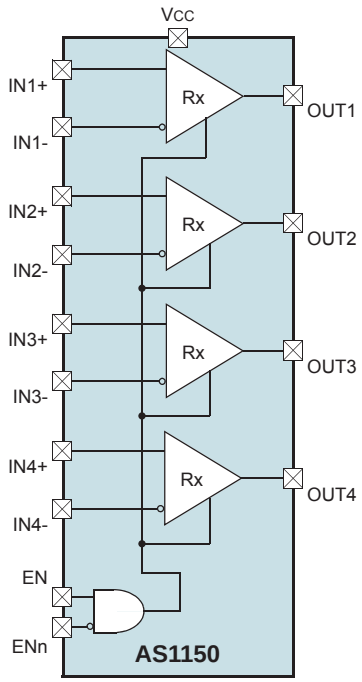
Key Features

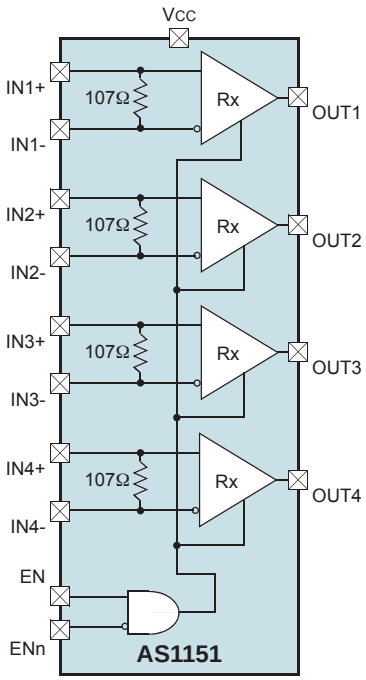
- Flow-through pinout
- Guaranteed 500mbps
- 300ps pulse skew (max)
- Conform to ANSI TIA/EIA-644 LVDS standards
- Single +3.3V supply
- Operating temperature range: -40 to +85°C
- Failsafe circuit
- Integrated termination (AS1151)
- 16-pin TSSOP package

Applications

The devices are ideal for digital copiers, laser printers, cellular phone base stations, add/drop muxes, digital cross-connects, DSLAMs, network switches/routers, backplane interconnect, clock distribution computers, intelligent instruments, controllers, critical microprocessors and microcontrollers, power monitoring, and portable/battery-powered equipment.

Block Diagrams





General Description

The AS1152 is a Quad Flow-Through LVDS (Low-Voltage Differential Signaling) Line Driver which accepts and converts LVTTL/LVCMOS input levels into LVDS output signals. The device is perfect for low-power lownoise applications requiring high signaling rates and reduced EMI emissions.

The device is guaranteed to transmit data at speeds up to 500Mbps (250MHz) over controlled impedance media of approximately 100Ω. Supported transmission media are PCB traces, backplanes, and cables.

The AS1152 is capable of setting all four outputs to a high-impedance state through two Enable Inputs (EN and ENn – internally pulled down to GND), dropping the device to an ultra-low-power state of typically 16mW during high impedance. The Enable Inputs are common to all four drivers.

Outputs conform to the ANSI TIA/EIA-644 LVDS standards. Flow-through pinout simplifies PC board layout and reduces crosstalk by separating the LVTTL/LVCMOS inputs and LVDS outputs.

The device is available in a 16-pin TSSOP package.

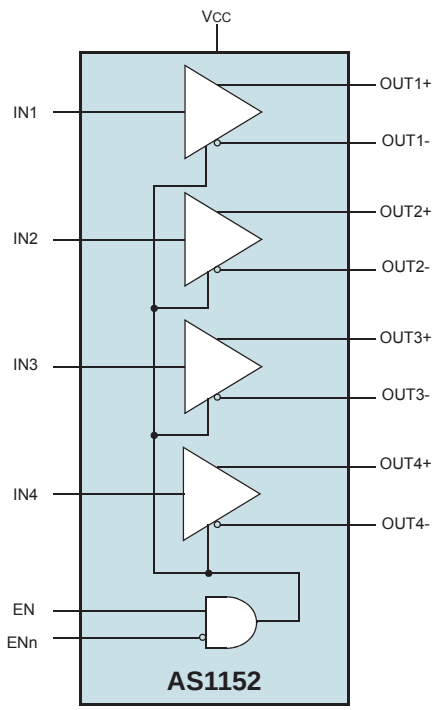
Key Features

- Flow-through pinout
- Guaranteed 500mbps data rate
- 350ps pulse skew (max)
- Conforms to ANSI TIA/EIA-644 LVDS standards
- Single +3.3V supply
- Operating temperature range: -40 to +85°C
- 16-pin TSSOP package

Applications

Digital copiers, laser printers, cellular phone base stations, add/drop muxes, digital cross-connects, DSLAMs, network switches/routers, backplane interconnect, clock distribution computers, intelligent instruments, controllers, critical microprocessors and microcontrollers, power monitoring, and portable/battery-powered equipment.

Block Diagram



Single/dual LVDS Driver, 800Mbps

AS1154/AS1156

General Description

The AS1156/AS1154 is a Single/Dual Flow-Through LVDS (Low-Voltage Differential Signaling) Line Driver which accepts and converts LVTTL/LVCMOS input levels into LVDS output signals.
The device is perfect for low-power low-noise applications requiring high signaling rates and reduced EMI emissions.

The device is guaranteed to transmit data at speeds up to 800Mbps (400MHz) over controlled impedance media of approximately 100Ω. Supported transmission media are PCB traces, backplanes, and cables.

The AS1156 is a single LVDS transmitter, and the AS1154 is a dual LVDS transmitter. Outputs conform to the ANSI TIA/EIA-644 LVDS standards. Flow-through pinout simplifies PC board layout and reduces crosstalk by separating the LVTTL/LVCMOS inputs and LVDS outputs.

The devices are available in a 8-pin SOIC package.

Key Features

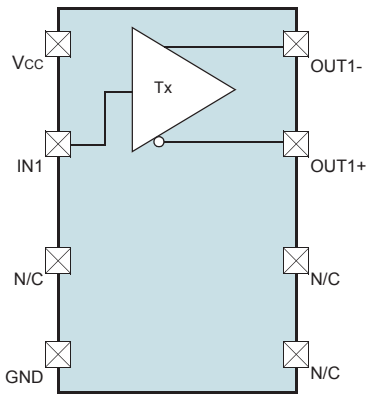
- Flow-through pinout
- Guaranteed 800mbps data rate
- 250ps pulse skew (max)
- Conforms to ANSI TIA/EIA-644 LVDS standards
- Single +3.3V supply
- Operating temperature range: -40 to +85°C
- 8-pin SOIC package

Applications

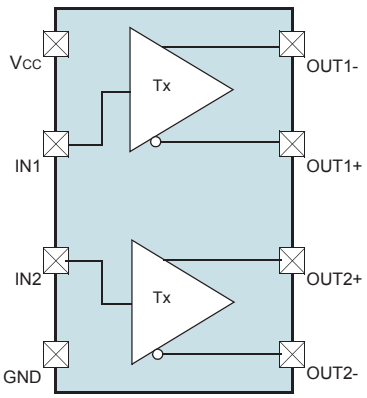
Digital copiers, laser printers, cellular phone base stations, add/drop muxes, digital cross-connects, DSLAMs, network switches/routers, backplane interconnect, clock distribution computers, intelligent instruments, controllers, critical microprocessors and microcontrollers, power monitoring, and portable/battery-powered equipment.

Block Diagrams

AS1156



AS1154



General Description

The AS1153/55/57/58 are Single/Dual flow-through LVDS (low-voltage differential signaling) receivers which accept LVDS differential inputs and convert them to LVCMOS outputs. The receivers are perfect for lowpower low-noise applications requiring high signaling rates and reduced EMI emissions.

The devices are guaranteed to receive data at speeds up to 260Mbps (130MHz) over controlled impedance media of approximately 100Ω. Supported transmission media are PCB traces, backplanes, and cables.

The AS1155/58 are single LVDS receivers, and the AS1153/57 are dual LVDS receivers.

The AS1157/58 features integrated parallel termination resistors (nominally 107Ω), which eliminate the requirement for discrete termination resistors, and reduce stub lengths. The AS1153/55 uses high impedance inputs and requires an external termination resistor when used in a point-to-point connection.

The integrated Failsafe feature sets the output high if the inputs are open, undriven and terminated, or undriven and shorted.

All inputs conform to the ANSI TIA/EIA- 644 LVDS standards. Flow-through pinout simplifies PC board layout and reduces crosstalk by separating the LVDS inputs and LVCMOS outputs.

The devices are available in a 8-pin SOIC package.

Key Features

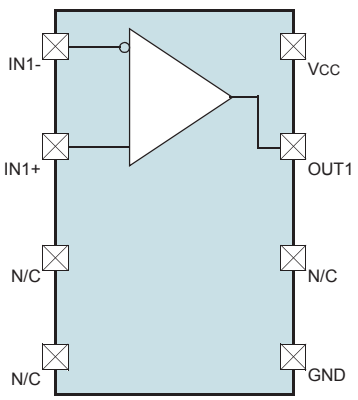
- Flow-through pinout
- Guaranteed 260mbps data rate
- 300ps pulse skew (max)
- Conform to ANSI TIA/EIA-644 LVDS standards
- Single +3.3V supply
- Operating temperature range: -40 to +85°C
- Failsafe circuit
- Integrated termination (AS1157/58)
- 8-pin SOIC package

Applications

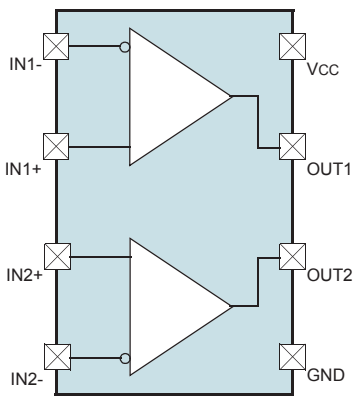
Digital copiers, laser printers, cellular phone base stations, add/drop muxes, digital cross-connects, DSLAMs, network switches/routers, backplane interconnect, clock distribution computers, intelligent instruments, controllers, critical microprocessors and microcontrollers, power monitoring, and portable/battery-powered equipment.

Block Diagrams

AS1155/58



AS1153/57



AS3691

General Description

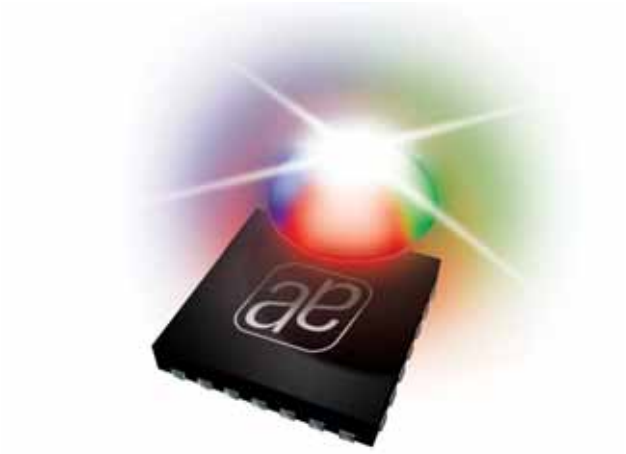
The AS3691 features four high precision current sources for driving up to four LED strings (RGB or single color LEDs).
Each of the four currents sources can be controlled independently by PWM inputs. The full scale current value is set by external resistors.

Applications

- General Lighting
- Backlighting
- RGB Backlighting for LCD TV/Monitors with white Color Balancing

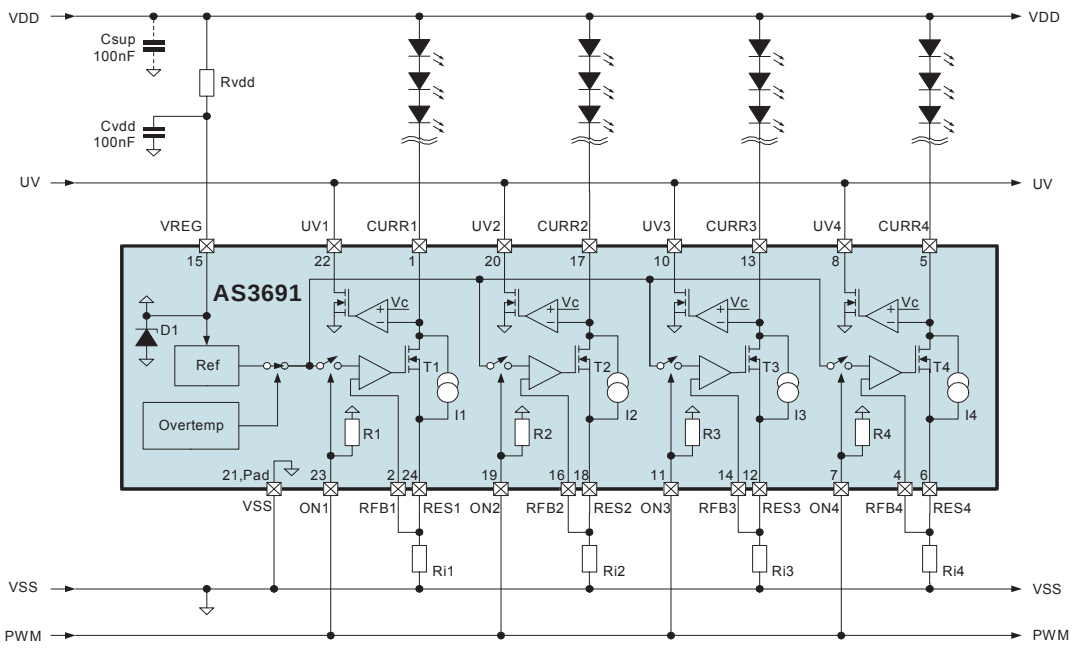
Key Features

- 4 x 400mA constant current outputs
- Programmable with external resistors
- 4 independent PWM inputs
- Absolute current accuracy +/-0.5%
- 'Automatic Supply Regulation' to reduce power dissipation[1)]
- Very wide output voltage current source voltage compliance
  - Down to 0.41V
  - Up to 15V [2)]
- Integrated overtemperature protection
- Separate sense pads (RFB1-RFB4) for easy and precise PCB Layout
- Package
  - DIE
  - QFN24 4x4mm
  - EPTSSOP (Enhanced Power TSSOP)



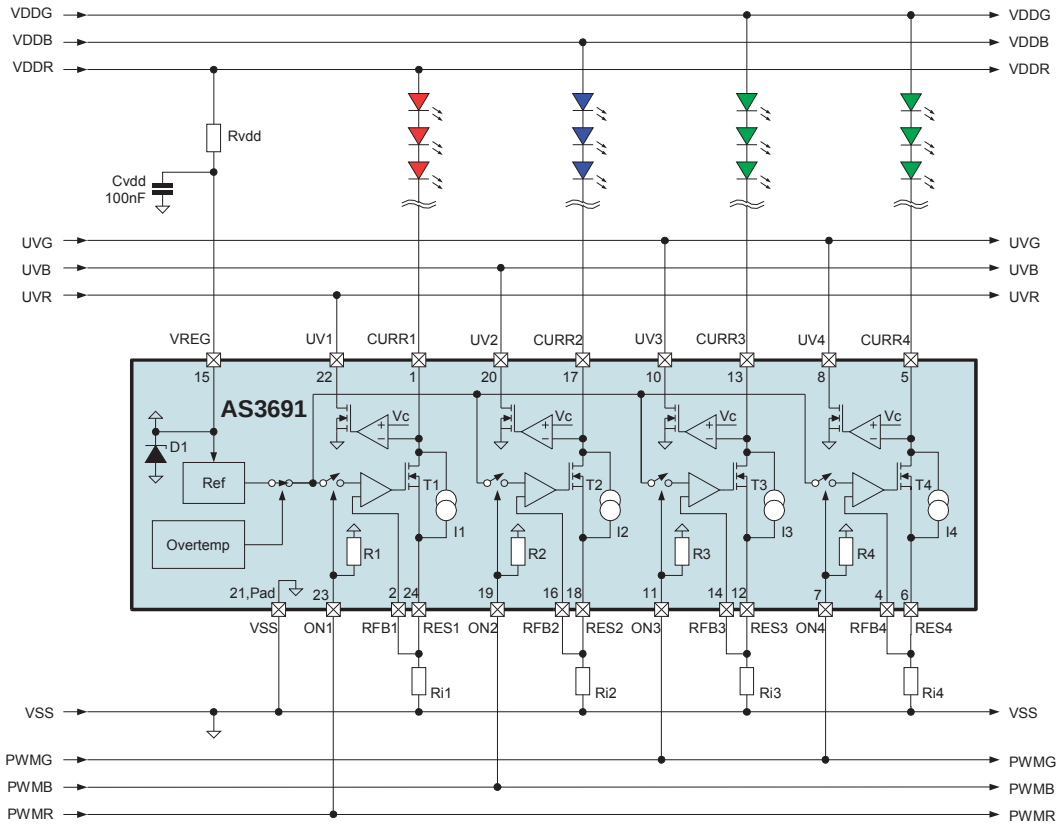
Block Diagrams

Application diagram of AS3691 for single color lighting (single module shown)

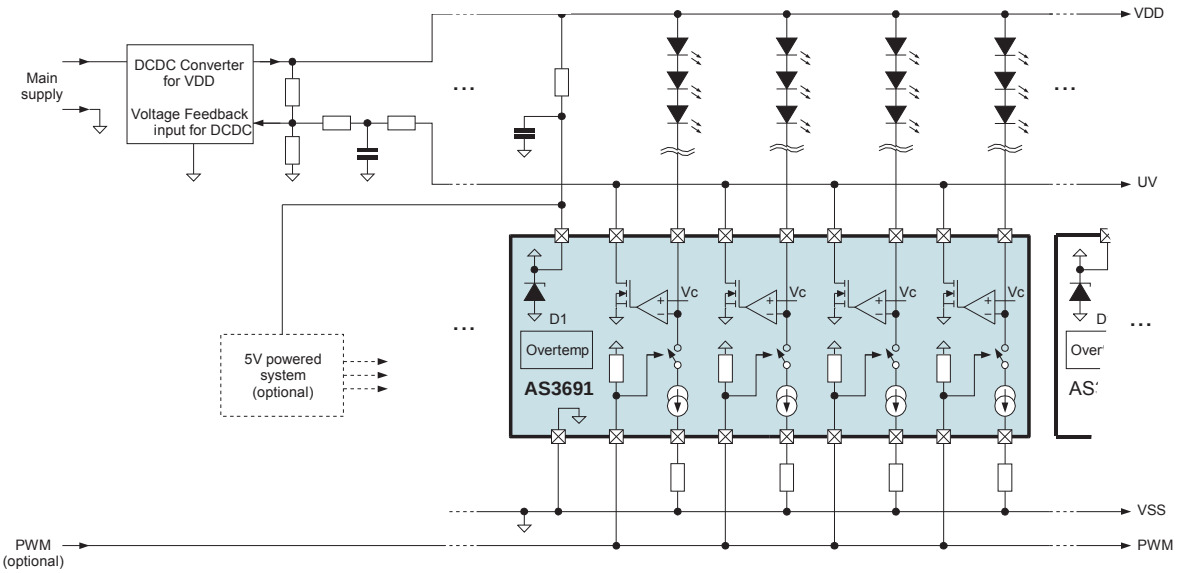


[1)] Patent Pending
[2)] 15V is sufficient for most applications as the AS3691 does not switch off the LED current completely

Application diagram of AS3691 for RGB lighting (single module shown)



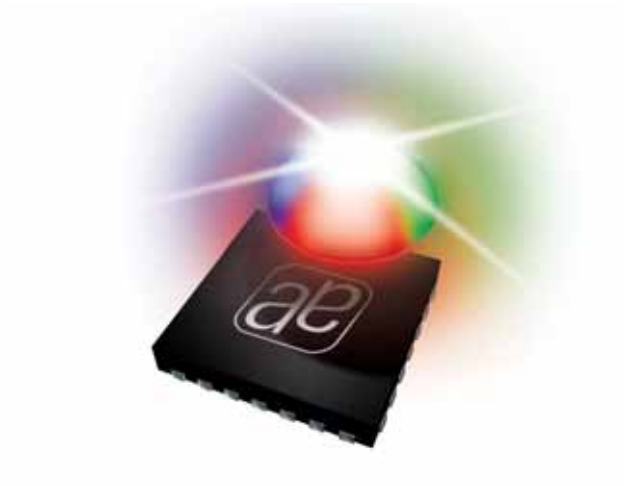
Complete AS3691 application using white LEDs



AS3693A

General Description

The AS3693A is a 16 cannels high precision LED driver with build in PWM generators for building backlight panels in LCD-TV-sets.
External clock and synchronizing inputs allow the synchronization of the LCD backlight with the TV picture. Local dimming and scan dimming is supported by 16 independent PWM generators with programmable delay, period and duty cycle. Three free configurable dynamic power feedback circuits make the device usable for white LED as well as RGB backlights. Build in safety features include thermal shutdown as well as open and short LED detection. All circuit parameters are programmable via I²C or SPI interface.

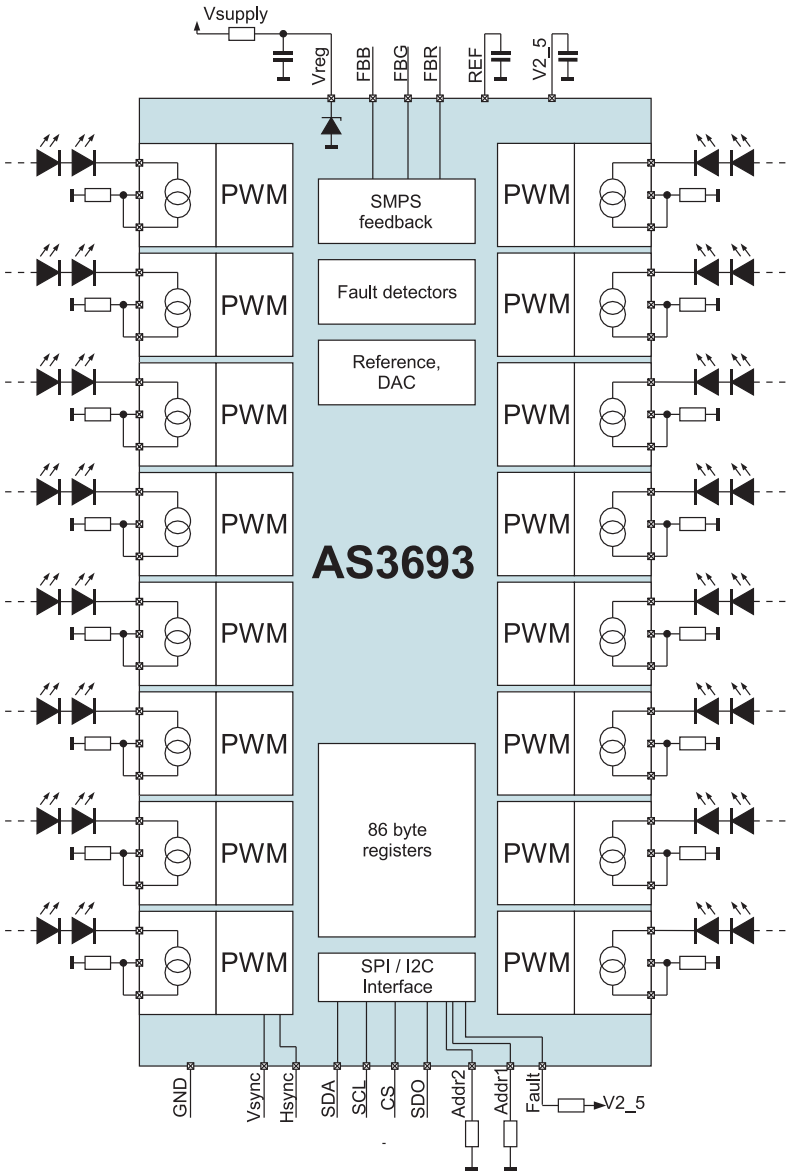


Key Features

- 16 independent LED channels
- Output current 70mA
- Output voltage up to 50V
- Absolute current accuracy ±0.5%
- Current programmable with external resistor
- 16 independent PWM generators with 12 bit resolution
- H-Sync, F-Sync inputs to synchronize with TVset
- Three independent power feedback for R-, G-, B-supply regulation
- Build in 5V shunt regulator
- I²C or SPI interface with 6 bit address
- Fault interrupt output
- Open LED detection
- Short LED detection
- Temperature shutdown
- Packages:
  · ePTQFP64 10x10, 0.5mm pitch
  · QFN48, 6x6, 0.4mm pitch

Applications

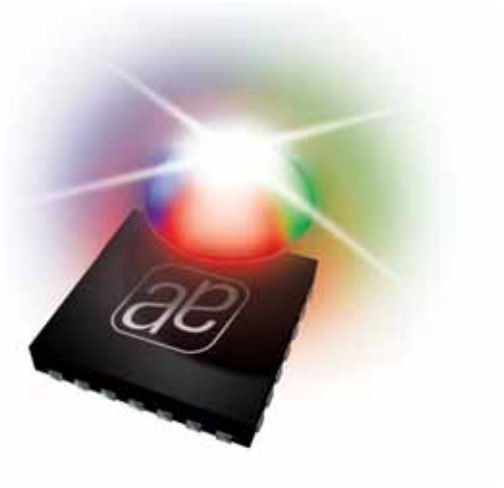
LED Backlighting for LCD – TV Sets and Monitors



AS3693B

General Description

The AS3693B is a 16 cannels high precision LED controller with build in PWM generators for driving external FETs in LCD-backlight panels. External clock and synchronizing inputs allow the synchronization of the LCD backlight with the TV picture. Local dimming and scan dimming is supported by 16 independent PWM generators with programmable delay, period and duty cycle. Three free configurable dynamic power feedback circuits make the device usable for white LED as well as RGB backlights. Build in safety features include thermal shutdown as well as open and short LED detection. All circuit parameters are programmable via I²C or SPI interface.

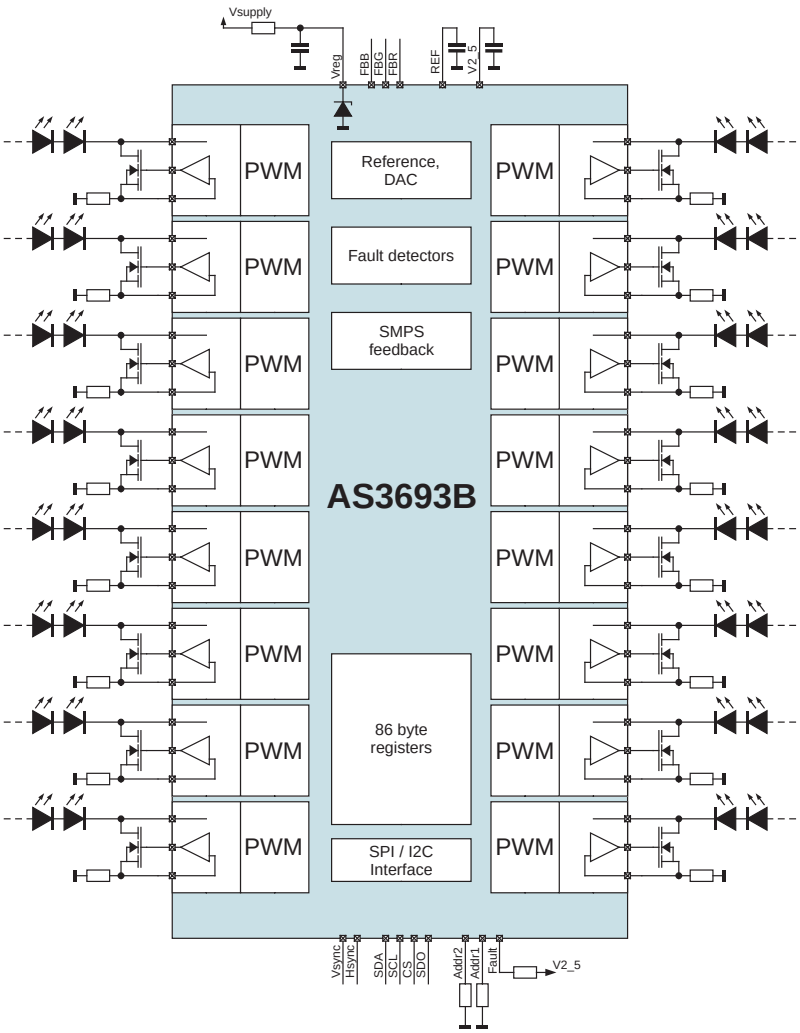


Key Features

- 16 independent LED channels
- External FET control and current sensing
- Output voltage sense up to 50V
- Absolute current accuracy ±0.5%
- Output slew rate limited to reduce EMI
- Current programmable with external resistor
- 16 independent PWM generators with 12 bit resolution
- H-Sync, V-Sync inputs to synchronize with TV-set
- Three independent power feedback for R-, G-, B-supply regulation
- Build in 5V shunt regulator
- I²C or SPI interface with 5 bit device address
- Fault interrupt output
- Open LED detection
- Short LED detection
- Temperature shutdown
- Packages:
  · ePTQFP64, 10x10, 0.5mm pitch
  · QFN64, 9x9, 0.5 mm pitch

Applications

LED Backlighting for LCD-TV Sets and Monitors

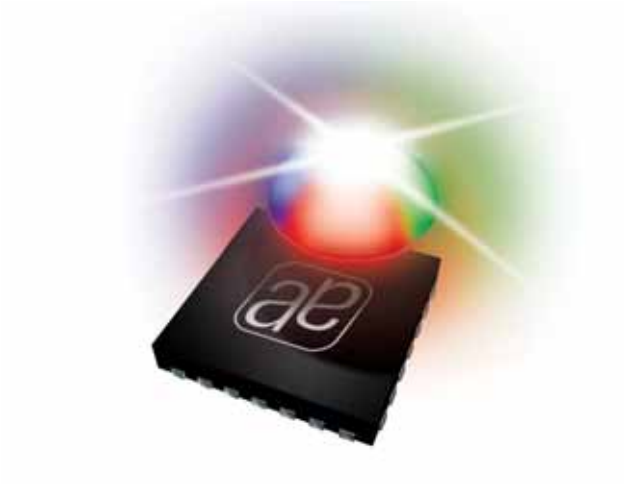


9 Channel High Precision LED Controller for LCD backlight

AS3693C

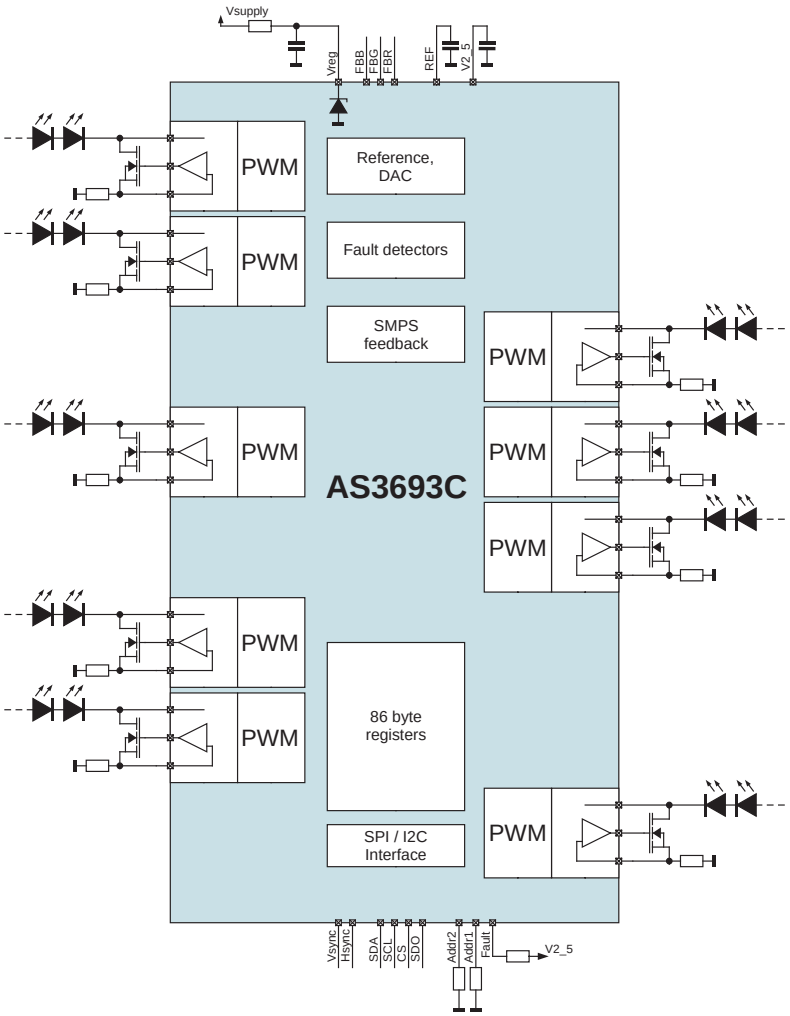
General Description

The AS3693C is a 9 channels high precision LED controller with build in PWM generators for driving external FETs in LCD-backlight panels. External clock and synchronizing inputs allow the synchronization of the LCD backlight with the TV picture. Local dimming and scan dimming is supported by 9 independent PWM generators with programmable delay, period and duty cycle. Three free configurable dynamic power feedback circuits make the device usable for white LED as well as RGB backlights. Build in safety features include thermal shutdown as well as open and short LED detection. All circuit parameters are programmable via I²C or SPI interface.



Key Features

- 9 Channel LED driver
- Output current only limited by external transistor
- Output voltage 0.4V to 50V
- Absolute current accuracy +/- 0.5%
- Output slew rate programmable
- Current programmable with external resistor
- Linear current control with 8 - bit DAC
- Linear current control with external analog voltage
- Digital current control with 9 independent PWM generators
- Free programmable 12 bit resolution (period, high time and delay)
- Overvoltage detection (short LED)
- Undervoltage detection (open LED)
- Temperature shutdown
- Fault interrupt output
- H-Sync, V-Sync inputs to synchronize with TV set
- Internal or external PWM – clock
- I²C interface
- SPI interface
- 5 bit device - address (sets device address and interface mode)
- Automatic supply regulation feedback
- Each output can be assigned to red, green or blue feedback
- Package LQFP64, 10x10, 0.8mm pitch



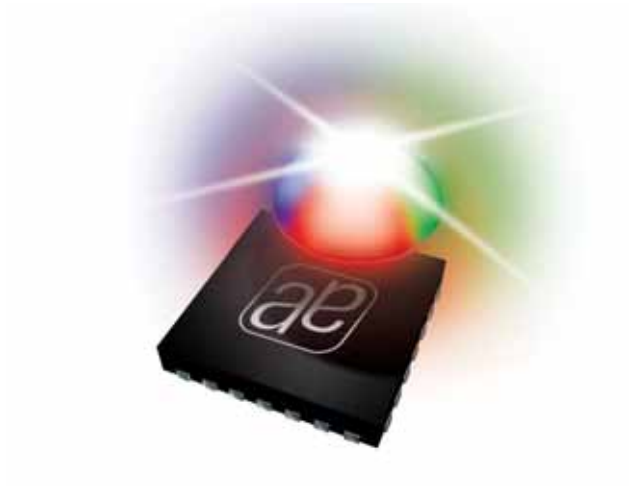
Applications

LED backlighting for LCD-TV sets and monitors

AS3694

General Description

The AS3694 is a 12 cannels high precision LED driver with build in PWM generators for building backlight panels in LCD-TV-sets. 3 DCDC Step Up controllers can be used to build the power supplies for red, green and blue LED strings. External clock and synchronizing inputs allow the synchronization of the LCD backlight with the TV picture. Local dimming and scan dimming is supported by 12 independent PWM generators with programmable delay, period and duty cycle. Three free configurable dynamic power feedback circuits make the device usable for white LED as well as RGB backlights. Build in safety features include thermal shutdown as well as open and short LED detection. All circuit parameters are programmable via I²C or SPI interface.

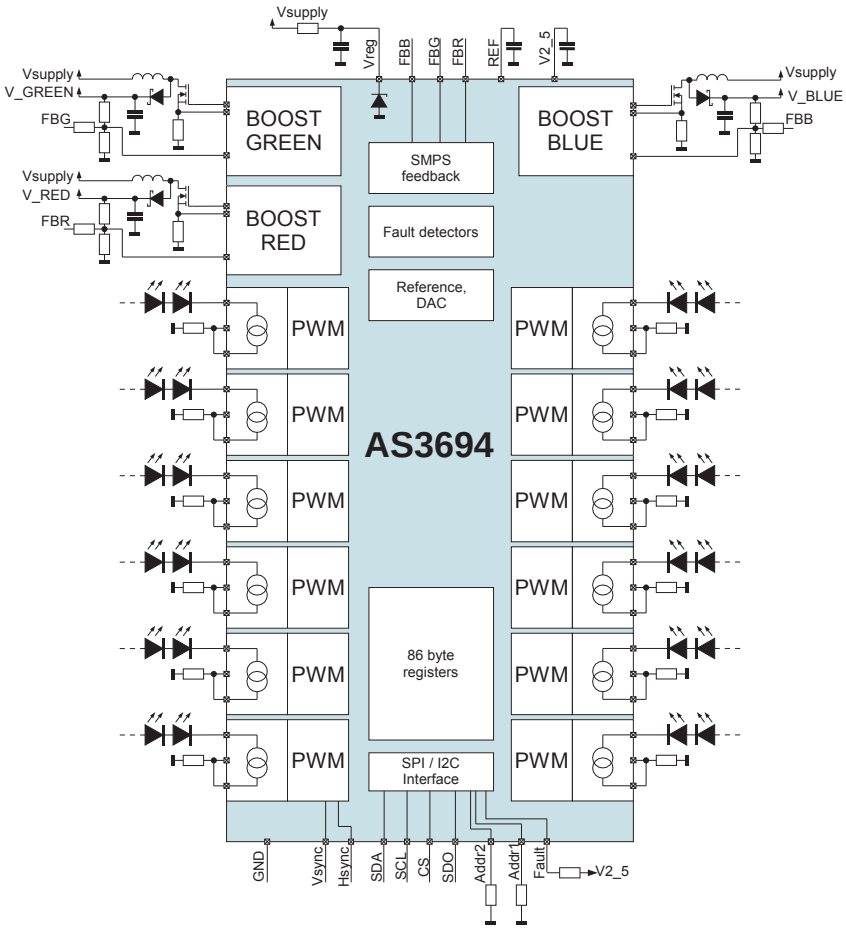


Key Features

- 12 independent LED channels
- Output current 70mA
- Output voltage up to 50V
- Absolute current accuracy ±0.5%
- Output slew rate limited to reduce EMI
- Current programmable with external resistor
- 12 independent PWM generators with 12 bit resolution
- H-Sync, F-Sync inputs to synchronize with TVset
- Three independent power feedback for R-, G-, B-supply regulation
- Build in 5V shunt regulator
- I²C or SPI interface with 6 bit address
- Fault interrupt output
- Open LED detection
- Short LED detection
- Temperature shutdown
- 3 DCDC Step Up controller
- Current mode
- Efficiency > 90%
- Input voltage range 15V to 50V
- Output voltage up to 50V / 200mA
- Package epTQFP64

Applications

LED Backlighting for LCD – TV Sets and Monitors



AS1100

General Description

The AS1100 is an LED driver for 7 segment numeric displays of up to 8 digits. The AS1100 can be programmed via a conventional 4 wire serial interface.

It includes a BCD code-B decoder, a multiplex scan circuitry, segment and display drivers and a 64-bit memory. The memory is used to store the LED settings, so that continuos reprogramming is not necessary. Every individual segment can be addressed and updated separately. Only one external resistor is required to set the current through the LED display.

Brightness can be controlled either in an analog or digital way. The user can choose the internal code-B decoder to display numeric digits or to address each segment directly. The AS1100 features an extremely low shutdown current of only 20µA. and an operational current of less than 500µA.

The number of visible digits can be programmed as well. The AS1100 can be reset by software and an external clock can be used. Several test modes support easy debugging.

AS1100 is offered in a 24-pin PDIP and SOIC package.

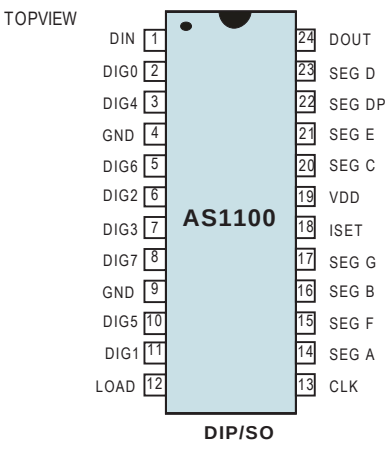
Key Features

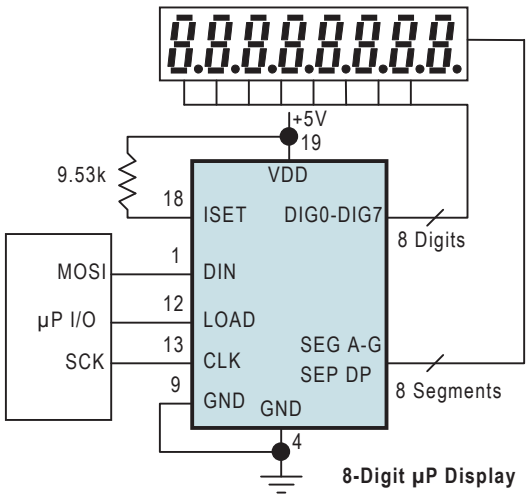
- 10MHz serial interface
- Individual LED segment control
- Decode/no-decode digit selection
- 20µA low-power shutdown (data retained)
- Extremely low operating current 0.5mA in open loop
- Digital and analog brightness control
- Display blanked on power-up
- Drive common-cathode LED display
- Software reset
- Optional external clock
- 24-pin DIP and SO package

Applications

- Bar graph displays
- Industrial controllers
- Panel meters
- LED matrix displays

Block Diagram & Pinout





AS1101

General Description

The AS1101 is designed to drive two white, blue or any color LEDs.

The current sources are matched and provide up to 80mA for each LED. The remaining voltage drop is less than 150mV, which supports the direct use of Li-Ion battery.

The current through the LEDs can be set externally through a resistor. The current can be calculated by 460 x SET, where SET is the current through the external resistor connected to the CTRL pin.

The AS1101 features a low active shutdown mode, where it consumes less than 1µA.

The AS1101 dual LED driver is available in a 6-lead SC-70 package.

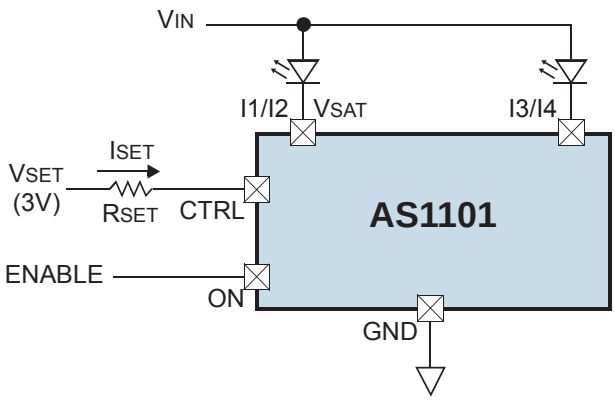
Key Features

- Dual LED drivers for parallel-connected LEDs
- Ultra-low voltage drop (< 150mV) to support direct Li-Ion batteries
- Both analog and PWM brightness control
- LED current up to 80mA for each LED
- No EMI, no switching noise
- No external components needed for current matching
- Active low shutdown mode
- Shutdown current < 1µA
- Enable pin
- 6-lead SC-70 package

Applications

- Mobile phones
- Cordless phones
- PDA and MP3 players
- LCD display modules
- Handheld computers
- Toys
- Keyboard backlight
- LED displays

Application Diagram



AS1102

General Description

The AS1102 is designed to drive three white, blue or any color LEDs. The current sources are matched and provide up to 40mA for each LED.

The remaining voltage drop is less than 150mV, which supports the direct use of Li-Ion battery. The current through the LEDs can be set externally through a resistor.

The current can be calculated by 230 x SET, where SET is the current through the external resistor connected to the CTRL pin. The AS1102 features a low active shutdown mode, where it consumes less than 1µA.

The AS1102 triple LED driver is available in a 6-lead SC-70 package.

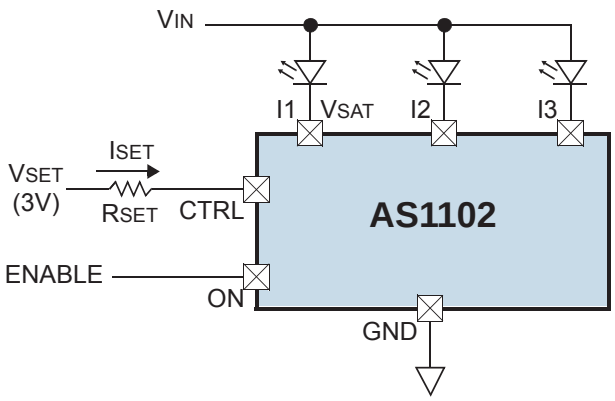
Key Features

- Triple LED drivers for three parallel-connected LEDs
- Ultra-low voltage drop (< 150mV) to support direct Li-Ion batteries
- Both analog and PWM brightness control
- LED current up to 40mA for each LED
- No EMI, no switching noise
- No external components needed for current matching
- Active low shutdown mode
- Shutdown current < 1µA
- Enable pin
- 6-lead SC-70 package

Applications

- Mobile phones
- Cordless phones
- PDA and MP3 players
- LCD display modules
- Handheld computers
- Toys
- Keyboard backlight
- LED displays

Application Diagram



AS1103

General Description

The AS1103 is designed to drive four white, blue or any color LEDs. The current sources are matched and provide up to 40mA for each LED.

The remaining voltage drop is less than 150mV, which supports the direct use of Li-Ion battery. The current through the LEDs can be set externally through a resistor.

The current can be calculated by 230 x SET, where SET is the current through the external resistor connected to the CTRL pin.

The AS1103 quad LED driver is available in a 6-pin SC-70 package.

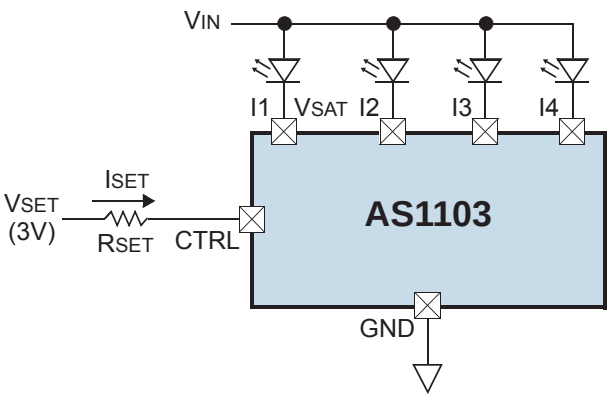
Key Features

- Quad LED drivers for four parallel-connected LEDs
- Ultra-low voltage drop (< 150mV) to support direct Li-Ion batteries
- Both analog and PWM brightness control
- LED current up to 40mA for each LED
- No EMI, no switching noise
- No external components needed for current matching
- 6-pin SC-70 package

Applications

- Mobile phones
- Cordless phones
- PDA and MP3 players
- LCD display modules
- Handheld computers
- Toys
- Keyboard backlight
- LED displays

Application Diagram



AS1104

General Description

The AS1104 is designed to drive four white, blue or any color LEDs. The current sources are matched and provide up to 40mA for each LED.

The remaining voltage drop is less than 150mV, which supports the direct use of Li-Ion battery. The current through the LEDs can be set externally through a resistor. The current can be calculated by 230 x SET, where SET is the current through the external resistor connected to the CTRL pin.

The AS1104 features a low active shutdown mode, where it consumes less than 1µA.

The AS1104 quad LED driver is available in an 8-pin MSOP package.

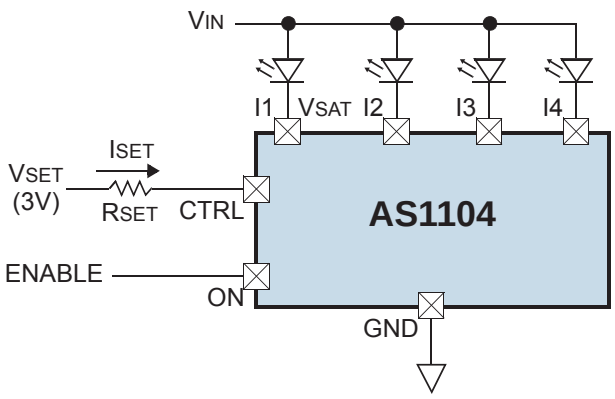
Key Features

- Quad LED Drivers for four parallel-connected LEDs
- Ultra-low voltage drop (< 150mV) to support direct Li-Ion batteries
- Both analog and PWM brightness control
- LED current up to 40mA for each LED
- No EMI, no switching noise
- No external components needed for current matching
- Active low shutdown mode
- Shutdown current < 1µA
- 8-pin MSOP package
- Enable pin

Applications

- Mobile phones
- Cordless phones
- PDA and MP3 players
- LCD display modules
- Handheld computers
- Toys
- Keyboard backlight
- LED displays

Application Diagram



AS1105

General Description

The AS1105 is a LED driver for 7 segment numeric displays of up to 4 digits. The AS1105 can be programmed via a conventional 4 wire serial interface.

It includes a BCD code-B decoder, a multiplex scan circuitry, segment and display drivers and a 32-bit memory. The memory is used to store the LED settings, so that continuos reprogramming is not necessary. Every individual segment can be addressed and updated separately.

Only one external resistor is required to set the current through the LED display. Brightness can be controlled either in an analog or digital way. The user can choose the internal code-B decoder to display numeric digits or to address each segment directly.

The AS1105 features an extremely low shutdown current of only 20µA. and an operational current of less than 500µA. The number of visible digits can be programmed as well. The AS1105 can be reset by software and an external clock can be used. Several test modes support easy debugging.

AS1105 is offered in a 20-pin SOIC package.

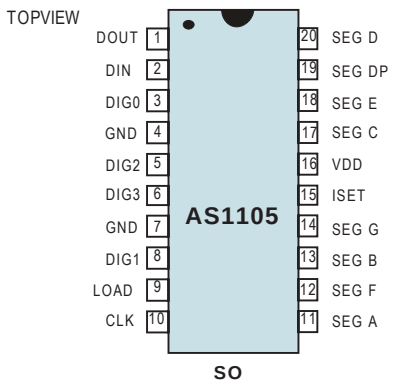
Key Features

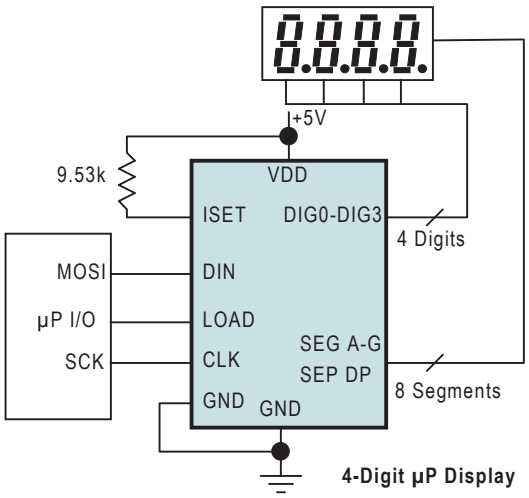
- Cost effective version of AS1100 functionality for applications up to 4-digits
- 10MHz serial interface
- Individual 32 LED segment control
- Decode/no-decode digit selection
- 20µA low-power shutdown (data retained)
- Extremely low operating current 0.5mA in open loop
- Digital and analog brightness control
- Display blanked on power-up
- Drive common-cathode LED display
- Software reset
- Optional external clock
- 20-pin SO package
- Functional compatible to AS1100

Applications

- Bar graph displays
- Industrial controllers
- Panel meters
- LED matrix displays

Block Diagram & Pinout





AS1106/AS1107

General Description

The AS1106 and the AS1107 are compact display drivers for 7-segment numeric displays of up to 8 digits. The devices can be programmed via SPI, QSPI, and Microwire as well as a conventional 4-wire serial interface.

The devices include an integrated BCD code-B/HEX decoder, multiplex scan circuitry, segment and display drivers, and a 64-bit memory. Internal memory stores the LED settings, eliminating the need for continuous device reprogramming.

Every segment can be individually addressed and updated separately. Only one external resistor (R_{SET}) is required to set the current through the LED display. LED brightness can be controlled by analog or digital means. The devices can be programmed to use the internal code-B/HEX decoder to display numeric digits or to directly address each segment.

The AS1106 and the AS1107 feature an extremely low shutdown current of typically 3µA, and an operational current of less than 500µA. The number of digits can be programmed, the devices can be reset by software, and an external clock is also supported. Additionally, segment blinking can be synchronized across multiple drivers.

Several test modes are available for easy application debugging.

The devices are available in 24-pin DIP and SOIC package.

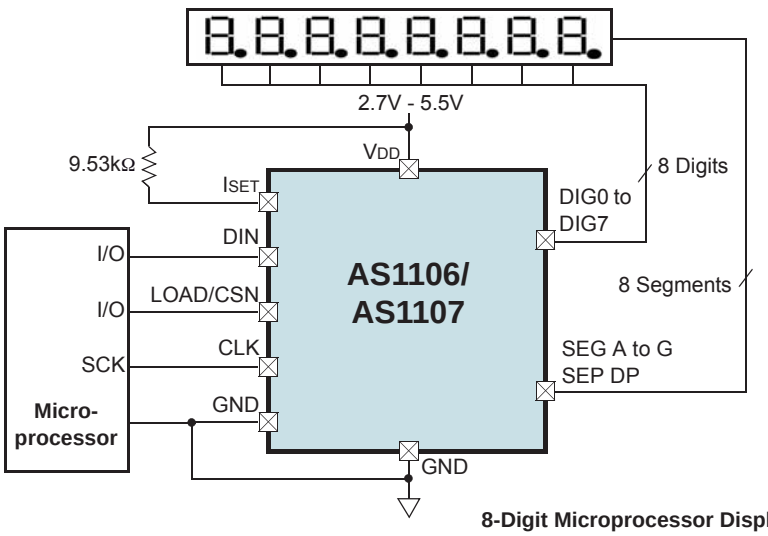
Key Features

- 10MHz SPI-, QSPI-, microwire-compatible serial I/O
- Individual 64 LED segment control
- Segment blinking control (can be synchronized across multiple drivers)
- Hexadecimal- or bcd-code/no-decode digit selection
- 3µA low-power shutdown current (typ; data retained)
- Extremely low operating current 0.5mA in open-loop
- Digital and analog brightness control
- Display blanked on power-up
- Drive common-cathode LED displays
- Low-EMI low slew-rate limited segment drivers (AS1107)
- Supply voltage range: 2.7 to 5.5V
- Software reset
- Optional external clock
- 24-pin DIP and 24-pin SOIC package

Applications

The AS1106 and AS1107 are ideal for bar-graph displays, instrument-panel meters, LED matrix displays, dot matrix displays, set-top boxes, white goods, professional audio equipment, medical equipment, industrial controllers and panel meters.

Application Diagram



8-Digit Microprocessor Display

AS1108

General Description

The AS1108 is a compact display driver for 7-segment numeric displays of up to 4 digits. The device can be programmed via SPI, QSPI, and Microwire as well as a conventional 4-wire serial interface.

The device includes an integrated BCD code-B/HEX decoder, multiplex scan circuitry, segment and display drivers, and a 32-bit memory. Internal memory stores the LED settings, eliminating the need for continuous device reprogramming.

Every segment can be individually addressed and updated separately. Only one external resistor (R_{SET}) is required to set the current through the LED display. LED brightness can be controlled by analog or digital means. The device can be programmed to use the interna code-B/HEX decoder to display numeric digits or to directly address each segment.

The AS1108 features an extremely low shutdown current of typically 3µA, and an operational current of less than 500µA. The number of digits can be programmed, the device can be reset by software, and an external clock is also supported. Additionally, segment blinking can be synchronized across multiple drivers.

The AS1108 provides several test modes for easy application debugging.

The device is available in a 20-pin DIP and SOIC package.

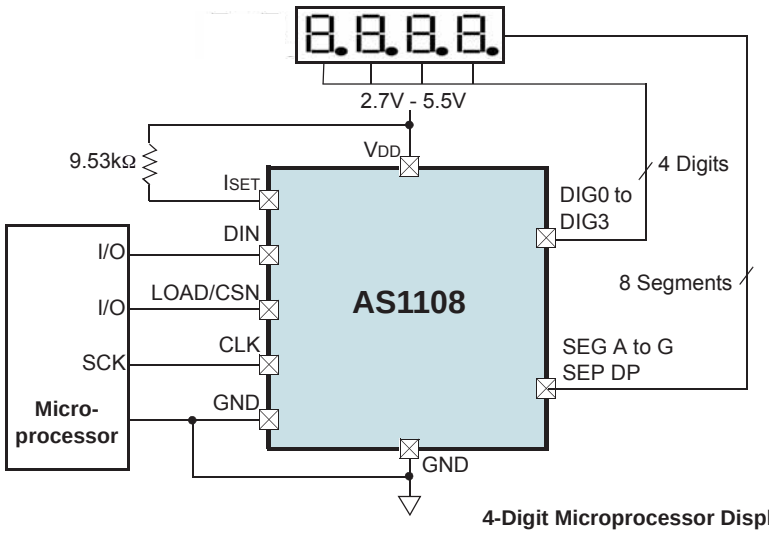
Key Features

- 10MHz SPI-, QSPI-, microwire-compatible serial I/O
- Individual 32 LED segment control
- Segment blinking control (can be synchronized across multiple drivers)
- Hexadecimal- or bcd-code/no-decode digit selection
- 3µA low-power shutdown current (typ; data retained)
- Extremely low operating current 0.5mA in open-loop
- Digital and analog brightness control
- Display blanked on power-up
- Drive common-cathode LED displays
- Supply voltage range: +2.7 to +5.5V
- Software reset
- Optional external clock
- 20-pin DIP and 20-pin SOIC package

Applications

The AS1108 is ideal for bar-graph displays, instrumentpanel meters, LED matrix displays, dot matrix displays, set-top boxes, white goods, professional audio equipment, medical equipment, industrial controllers and panel meters.

Application Diagram



4-Digit Microprocessor Display

AS1109

Diagnostic Functions

General Description

The AS1109 is designed to drive up to 8 LEDs through a fast serial interface and features 8 output constant current drivers and an on-chip diagnostic read-back function.

The high clock-frequency (up to 50MHz), adjustable output current, and flexible serial interface makes the device perfectly suited for high-volume transmission applications.

Output current is adjustable (up to 100mA/channel) using an external resistor (REXT).

The serial interface with Schmitt trigger inputs includes an integrated shift register. Additionally, an internal data register stores the currently displayed data. The device features integrated diagnostics for over-temperature, open-LED, and shorted-LED conditions.

Integrated registers store global fault status information during load as well as the detailed temperature/open-LED/shorted-LED diagnostics results.

The AS1109 also features a low-current diagnostic mode to minimize display flicker during fault testing. With an operating temperature range from -40 to +125°C the AS1109 is also ideal for industrial applications.

The AS1109 is available in a 16-pin SOIC-150, a 16-pin QFN 4x4 and the 16-pin SSOP-150 package.

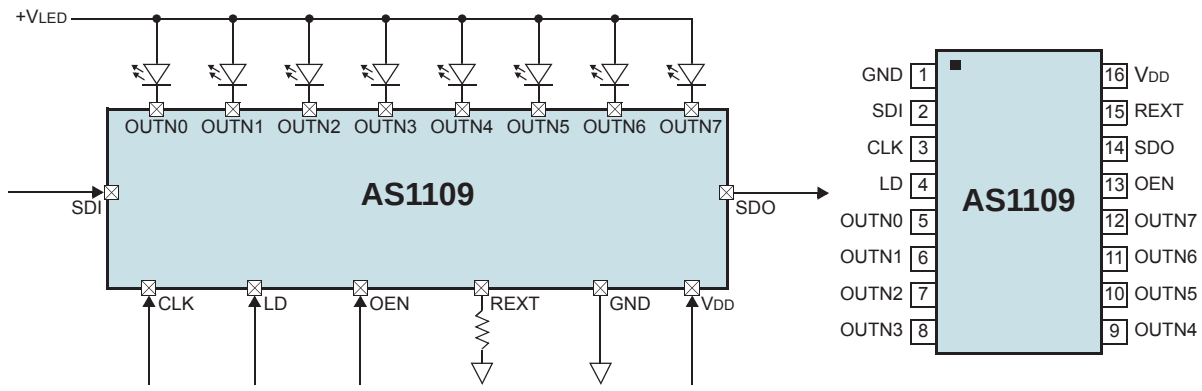
Key Features

- 8 constant-current output channels
- Excellent output current accuracy
  - Between channels: ±2%
  - Between AS1109 devices: ±2%
- Output current per channel: 0.5 to 100mA
- Controlled in-rush current
- Over-temperature, open-LED, shorted-LED
- Diagnostics functions
- Low-current test mode
- Global fault monitoring
- Low shutdown mode current: 3µA
- Fast serial interface: up to 50MHz
- Cascaded configuration
- Fast output drivers suitable for PWM
- 16-pin SOIC-150, 16-pin QFN 4x4 and 16-pin SSOP-150 package

Applications

The device is ideal for fixed- or slow-rolling displays using static or multiplexed LED matrix and dimming functions, large LED matrix displays, mixed LED display and switch monitoring, displays in elevators, public transports (underground, trains, buses, taxis, airplanes, etc.), large displays in stadiums and public areas, price indicators in retail stores, promotional panels, bar-graph displays, industrial controller displays, white good panels, emergency light indicators, and traffic signs.

Application Diagram & Pin Out



AS1110

Diagnostic Functions

General Description

The AS1110 is designed to drive up to 16 LEDs through a fast serial interface and features 16 output constant current drivers and an on-chip diagnostic read-back function.

The high clock-frequency (up to 50MHz), adjustable output current, and flexible serial interface makes the device perfectly suited for high-volume transmission applications.

Output current is adjustable (up to 100mA/Channel) using an external resistor (R_{EXT}).

The serial interface with Schmitt trigger inputs includes an integrated shift register. Additionally, an internal data register stores the currently displayed data.

The device features integrated diagnostics for over-temperature, open-LED, and shorted-LED conditions. Integrated registers store global fault status information during load as well as the detailed temperature/open-LED/shorted-LED diagnostics results.

The AS1110 also features a low-current diagnostic mode to minimize display flicker during fault testing.

The AS1110 is available in a 24-pin SSOP and a 28-pin QFN 5x5 package.

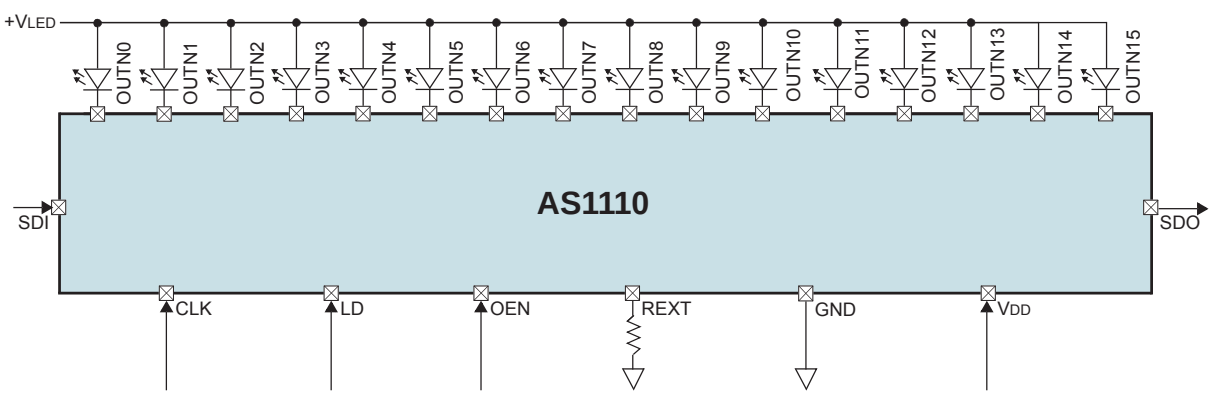
Key Features

- 16 constant-current output channels
- Excellent output current accuracy
  - Between channels: <±3%
  - Between devices: <±6%
- Output current per channel: 0.5 to 100mA
- Controlled in-rush current
- Over-temperature, open-LED, shorted-LED diagnostic functions
- Low-current test mode
- Global fault monitoring
- Low shutdown mode current: 10µA
- Fast serial interface: 50MHz
- Cascaded configuration
- Extremely fast output drivers suitable for PWM
- 24-pin SSOP and 28-pin QFN 5x5 package

Applications

The device is ideal for fixed- or slow-rolling displays using static or multiplexed LED matrix and dimming functions, large LED matrix displays, mixed LED display and switch monitoring, displays in elevators, public transports (underground, trains, buses, taxis, airplanes, etc.), large displays in stadiums and public areas, price indicators in retail stores, promotional panels, bar-graph displays, industrial controller displays, white good panels, emergency light indicators, and traffic signs.

Application Diagram



80mA, 16-channel LED Driver with Dot Correction and Greyscale PWM

AS1112

4096 Steps PWM

General Description

The AS1112 is a 16-channel, constant current-sink LED driver. Each of the 16 channels can be individually adjusted by 4096-step greyscale PWM brightness control and 64-step constant-current sink (dot correction).

The dot correction circuitry adjusts the brightness variations between the AS1112 channels and other LED drivers. Greyscale control and dot correction circuitry are accessible via the SPI-compatible serial interface.

A single external resistor sets the maximum current value of all 16 channels. The device features two error detection functions. The open LED detection function indicates a broken or disconnected LED at one or more of the outputs. The overtemperature flag indicates that the device is in an overtemperature condition.

The AS1112 is available in a 32-pin TQFN 5x5 mm package.

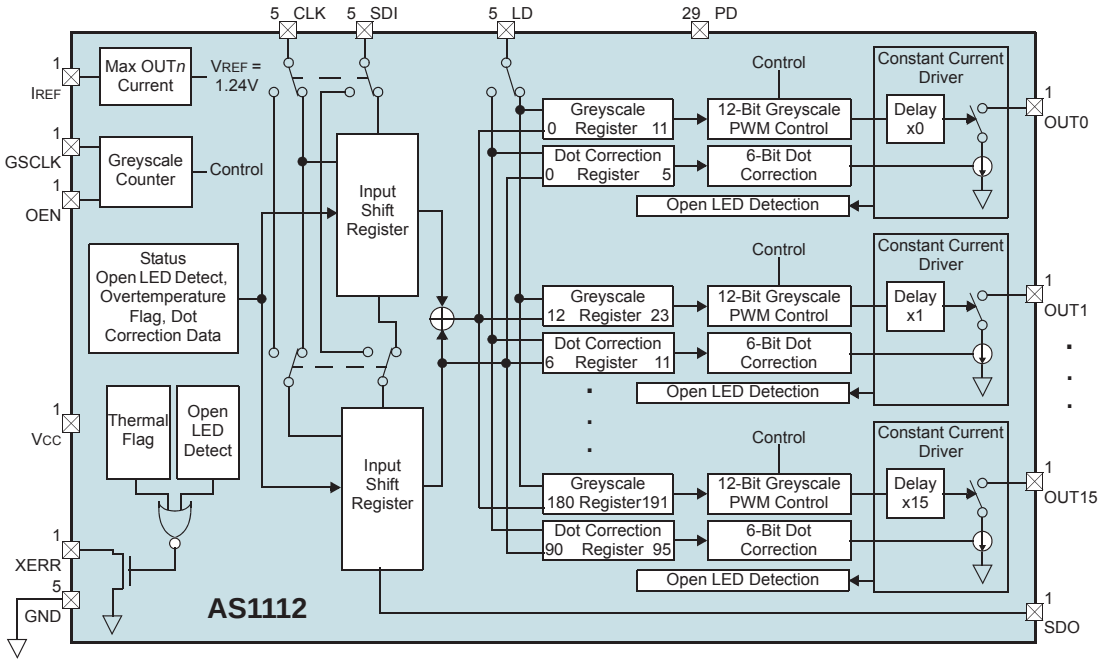
Key Features

- 16 Channels
- Greyscale PWM control: 12-bit (4096 steps)
- Dot correction: 6-bit (64 steps)
- Drive capability (constant-current sink): 0 to 80mA
- LED power supply voltage: up to 15V
- Supply voltage range: 3.0 to 5.5V
- SPI-compatible serial interface
- Controlled in-rush current
- Data transfer rate: 30 MHz
- CMOS level I/O
- Diagnostic features
  - · LED open/short detection
  - · Overtemperature flag
- 32-pin TQFN 5x5 mm package

Applications

The device is ideal for mono-, multi-, and full-color LED displays, LED signboards, and display backlights.

Application Diagram



General Description

The AS1113 is designed to drive up to 16 LEDs through a fast serial interface and features 16 output constant current drivers and an on-chip diagnostic read-back function.

The high clock-frequency (up to 50MHz), adjustable output current, and flexible serial interface makes the device perfectly suited for high-volume transmission applications.

Output current is adjustable (up to 50mA/channel) using an external resistor (REXT).

The serial interface with Schmitt trigger inputs includes an integrated shift register. Additionally, an internal data register stores the currently displayed data.

The device features integrated diagnostics for overtemperature, open-LED, and shorted-LED conditions. Integrated registers store global fault status information during load as well as the detailed temperature/open-LED/shorted-LED diagnostics results.

The AS1113 also features a low-current diagnostic mode to minimize display flicker during fault testing.

The AS1113 is available in a 24-pin SSOP and the 28-pin QFN (5x5mm) package.

If a higher output current is needed, please see the AS1110 with 100mA drive capability.

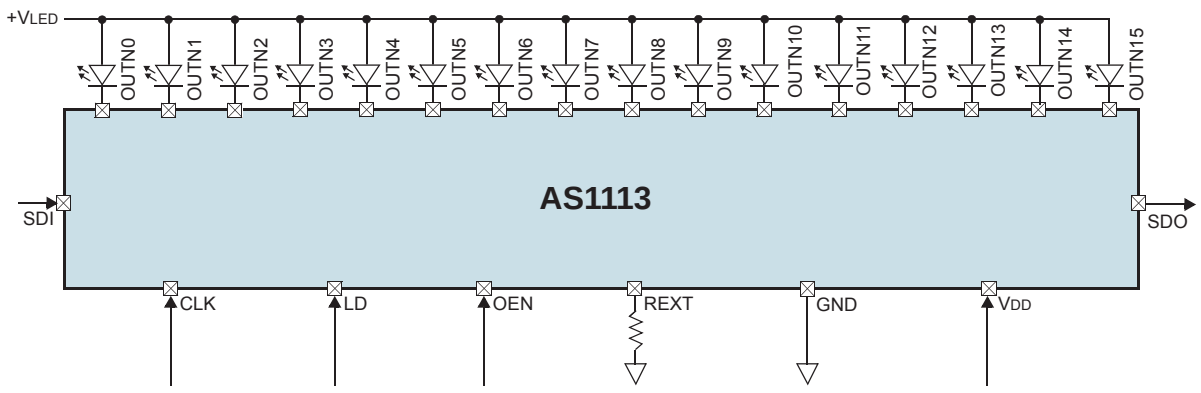
Key Features

- 16 constant-current output channels
- Excellent output current accuracy
  - Between channels: <±3%
  - Between devices: <±6%
- Output current per channel: 0.5 to 50mA
- Controlled in-rush current
- Over-temperature, open-LED, shorted-LED diagnostic functions
- Low-current test mode
- Global fault monitoring
- Low shutdown mode current: 10µA
- Fast serial interface: 50MHz
- Cascaded configuration
- Extremely fast output drivers suitable for PWM
- 24-pin SSOP and 28-pin QFN (5x5mm) package

Applications

The device is ideal for fixed- or slow-rolling displays using static or multiplexed LED matrix and dimming functions, large LED matrix displays, mixed LED display and switch monitoring, displays in elevators, public transports (underground, trains, buses, taxis, airplanes, etc.), large displays in stadiums and public areas, price indicators in retail stores, promotional panels, bar-graph displays, industrial controller displays, white good panels, emergency light indicators, and traffic signs.

Application Diagram



AS1115

General Description

The AS1115 is a compact LED driver for 64 single LEDs or 8 digits of 7-segments. The devices can be programmed via an I²C compatible 2-wire interface.

Every segment can be individually addressed and updated separately. Only one external resistor (RSET) is required to set the current. LED brightness can be controlled by analog or digital means.
The devices include an integrated BCD code-B/HEX decoder, multiplex scan circuitry, segment and display drivers, and a 64-bit memory. Internal memory stores the shift register settings, eliminating the need for continuous device reprogramming.

All outputs of the AS1115 can be configured for key readback. Key-switch status is obtained by polling for up to 64 keys while 16 keys can be used to trigger an interrupt. Additionally the AS1115 offers a diagnostic mode for easy and fast production testing.
The AS1115 features a low shutdown current of typically 200nA, and an operational current of typically 350µA. The number of digits can be programmed, the devices can be reset by software, and an external clock is also supported.

The device is available in a QSOP-24 and the TQFN(4x4)-24 package.

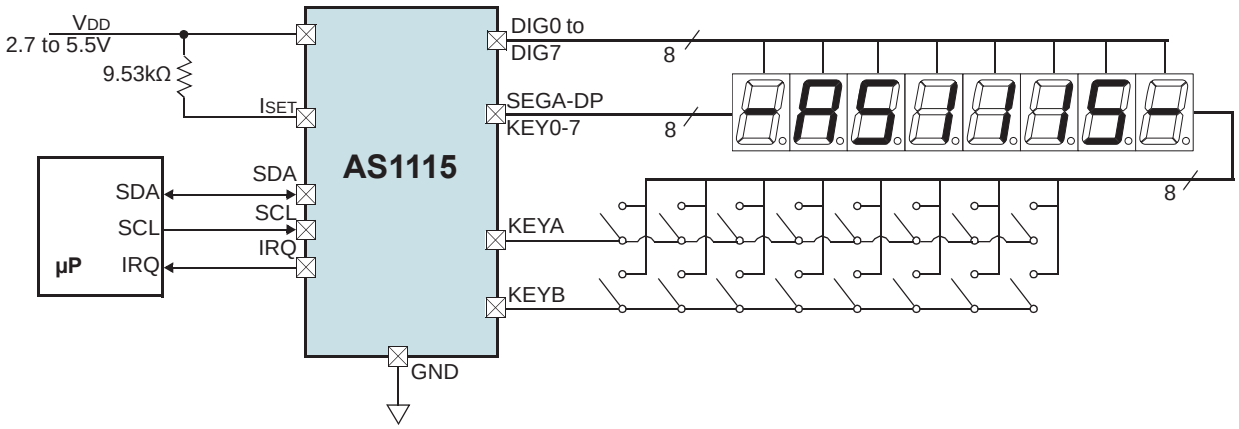
Key Features

- 3.4MHz I²C-Compatible Interface
- Individual LED Segment Control
- Readback for 16 Keys plus Interrupt
- Open and Shorted LED Error Detection
- Global or Individual Error Detection
- Hexadecimal- or BCD-Code for 7-Segment Displays
- 200nA Low-Power Shutdown Current (typ; data retained)
- Digital and Analog Brightness Control
- Display Blanked on Power-Up
- Drive Common-Cathode LED Displays
- Supply Voltage Range: 2.7 to 5.5V
- Software Reset
- Optional External Clock
- Package:
- QSOP-24
- TQFN(4x4)-24

Applications

The AS1115 is ideal for seven-segment or dot matrix user interface displays of set-top boxes, VCRs, DVDplayers, washing machines, micro wave ovens, refrigerators and other white good or personal electronic applications.

Block Diagram



AS1116

General Description

The AS1116 is a compact LED driver for 64 single LEDs or 8 digits of 7-segments. The devices can be programmed via an SPI compatible 3-wire interface.

Every segment can be individually addressed and updated separately. Only one external resistor (RSET) is required to set the current. LED brightness can be controlled by analog or digital means.
The devices include an integrated BCD code-B/HEX decoder, multiplex scan circuitry, segment and display drivers, and a 64-bit memory. Internal memory stores the shift register settings, eliminating the need for continuous device reprogramming.

Additionally the AS1116 offers a diagnostic mode for easy and fast production testing and allows the use of the AS1116 for critical applications. The diagnostic allows to detect individual open or shorted LEDs. The AS1116 features a low shutdown current of typically 200nA, and an operational current of typically 350µA. The number of digits can be programmed, the devices can be reset by software, and an external clock is also supported.

The device is available in a QSOP-24 and TQFN(4x4)-24 package.

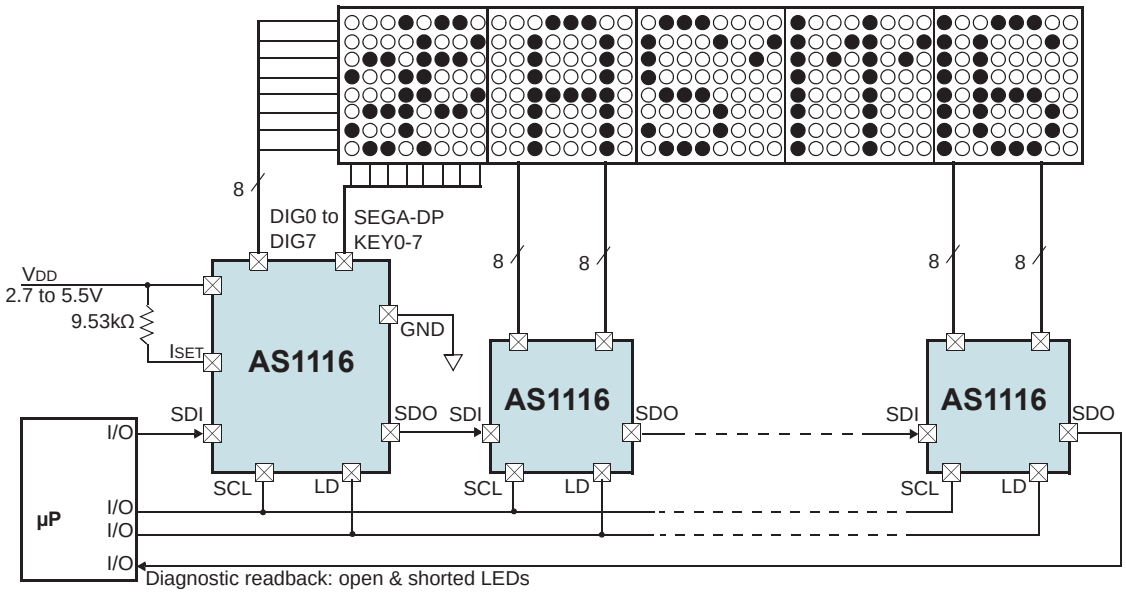
Key Features

- 10MHz SPI-Compatible Interface
- Open and Shorted LED Error Detection
- Global or Individual Error Detection
- Hexadecimal- or BCD-Code for 7-Segment Displays
- 200nA Low-Power Shutdown Current (typ; data retained)
- Individual Digit Brightness Control
- Digital and Analog Brightness Control
- Display Blanked on Power-Up
- Drive Common-Cathode LED Displays
- Supply Voltage Range: 2.7 to 5.5V
- Software Reset
- Optional External Clock
- Package:
- QSOP-24 and TQFN(4x4)-24

Applications

The AS1116 is ideal for seven-segment or dot matrix displays in public information displays at subway, train or bus stations, at airports and also at displays in public transportation like buses or trains mobile phones, personal electronic and toys.

Block Diagram



General Description

The AS3682 is a low-noise, high-current charge pump designed for camera flash LEDs and LCD backlighting applications. The device is capable of driving up to 480mA of load current.

The AS3682 integrates two independent LED blocks for driving a single flash LED (CURR11 to CURR13) with up to 480mA, and general purpose LEDs (CURR2 to CURR4) with up to 160mA/LED. The general purpose LEDs are controlled individually and can be used for backlighting, but also in support of an RGB fun-light or a movie indicator lamp.

The AS3682 utilizes austriamicrosystems's patent-pending Intelligent Adaptive Mode Setting (IAMS) to switch between 1:1, 1:1.5, and 1: 2 modes. In combination with very-low-drop-out current sinks, the device achieves high efficiency over the full single-cell Li+ battery voltage range. The charge pump operates at a fixed frequency of 1MHz allowing for tiny external components and its design ensures low EMI and low input-ripple.

The ultra-flexible brightness control scheme allows for simple adaptation of the device to different system architectures.

In Normal and Softflash Modes the device is controlled by an I²C interface. In these modes the LED brightness, flash duration, GPIOs and various charge pump states are controlled by internal register settings. The GPIO pins can act as programmable input or output pins and can also be set to trigger preview and flash light directly by a camera module.

In Hardflash Mode, the LED brightness is controlled by the Enable pins. Those programming pins can be used as simple enable pins, as PWM input, again offering ample flexibility for setting the LED brightness.

Key Features

- High-efficiency high-power charge pump
  - · 1:1, 1:1.5, and 1:2 intelligent adaptive mode setting (IAMS)
  - · Efficiency up to 95%
  - · Soft start to reduce inrush current
  - · Low-noise constant-frequency operation

- Current sinks
  - · 400mA continuous flash current (@V_{IN} = 3.2 to 5V, V_{OUT} = 5V)
  - · 480mA maximum pulsed flash current
  - · Programmable: 0 to 160mA, 0.625mA resolution

- Flexible brightness control
  - · Three 0 to 160mA LEDs
  - · Individually addressable via I²C interface

- Three operating modes
  - · Normal mode (I²C interface)
  - · Softflash mode (I²C interface)
  - · Dedicated control pins for hardflash modes

- Two general purpose inputs/outputs
  - · Digital input, output, and tristate
  - · Programmable pull-up and pull-down
  - · Strobe pin can be used for camera flash control

- LED disconnect in shutdown
- Open LED detection
- Low stand-by current (6µA), interface fully operating
- Low shut-down current (0.2µA)
- Wide battery supply range: 3.0 to 5.5V
- Thermal protection

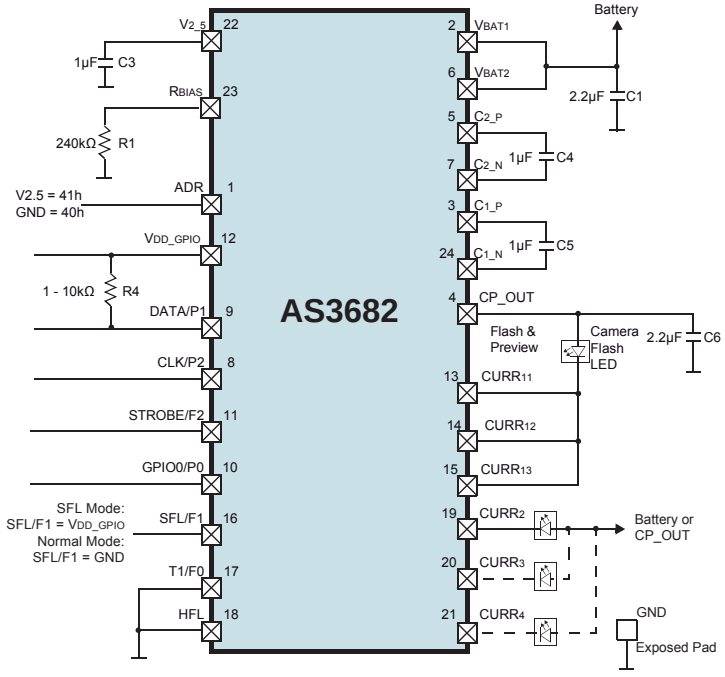
- 24-pin, small form-factor QFN package
  - · 4 x 4 x 0.85mm, 0.5mm pitch
  - · Enhanced thermal characteristics

Applications

Lighting management for cameras, mobile telephones, PDAs, and other 1-cell Li+ or 3-cell NiMH powered devices.

Block Diagram

Normal and softflash mode block diagram



Feature		Normal Mode	Softflash Mode
Interface		I²C	I²C
Flash LEDs	Current Sinks	3	3
	Total Current	0 to 450mA	0 to 480mA
	Addressable	Block	Block
	Strobe Trigger	STROBE/F2 or software	STROBE/F2 or software
	Strobe Preview	GPIO0/P0 or software	GPIO0/P0 or software
General Purpose LEDs (CURR2, CURR3, CURR4)	Current Sinks	3	3
	Current per Sink	0 to 37.5mA	0 to 160mA
	Addressable	Individual	Individual

General Description

The AS3683 is a low-noise, high-current 1A charge pump designed for camera flash LEDs and LCD backlighting applications. The current sinks are capable of driving up to 960mA of load current.

The AS3683 integrates two independent current source blocks for driving a single flash LED (CURR11 to CURR13) with up to 480mA, and general purpose LEDs (CURR2 to CURR4) with up to 160mA/LED. The general purpose LEDs are controlled individually and can be used for backlighting, but also in support of an RGB funlight or a movie indicator lamp. to meet high-flash current requirements (up to 960mA), both current source blocks can be connected together (CURR11 to CURR13 and CURR2 to CURR4).

The AS3683 utilizes austriamicrosystems's patent-pending Intelligent Adaptive Mode Setting (IAMS) to switch between 1:1, 1:1.5, and 1: 2 modes. In combination with very-low-drop-out current sinks, the device achieves high efficiency over the full single-cell Li+ battery voltage range. The charge pump operates at a fixed frequency of 1MHz allowing for tiny external components and its design ensures low EMI and low input-ripple.

The ultra-flexible brightness control scheme allows for simple adaptation of the device to different system architectures.

In Softflash Mode the device is controlled by an I²C interface. In these modes the LED brightness, flash duration, GPIOs and various charge pump states are controlled by internal register settings. The GPIO pins can act as programmable input or output pins and can also be set to trigger preview and flash light directly by a camera module.

In Hardflash Mode the LED brightness is controlled by the Enable pins. These programming pins can be used as simple enable pins, or as PWM input, again offering ample flexibility for setting the LED brightness.

Key Features

- High-power 1A charge pump
  - · 1:1, 1:1.5, and 1:2 intelligent adaptive mode setting (IAMS)
  - · Efficiency up to 95%
  - · Soft start to reduce inrush current
  - · Low-noise constant-frequency operation

- Current sinks
  - · 400mA continuous current (@V_{IN} = 3.2 to 5V, V_{OUT} = 5V)
  - · Up to 960mA pulsed flash current
  - · Programmable: 0 to 160mA, 0.625mA resolution

- Flexible brightness control
  - · Three 0 to 160mA LEDs
  - · Individually addressable via I²C interface

- 2 operating modes
  - · Softflash mode (I²C interface)
  - · Hardflash mode (dedicated control pins)

- 2 general purpose inputs/outputs in softflash mode
  - · Digital input, output, and tristate
  - · Programmable pull-up and pull-down
  - · Strobe pin can be used for camera flash control

- LED disconnect in shutdown
- Open LED detection
- Low stand-by current (6µA), interface fully operating
- Low shut-down current (0.2µA)
- Wide battery supply range: 3.0 to 5.5V
- Thermal protection

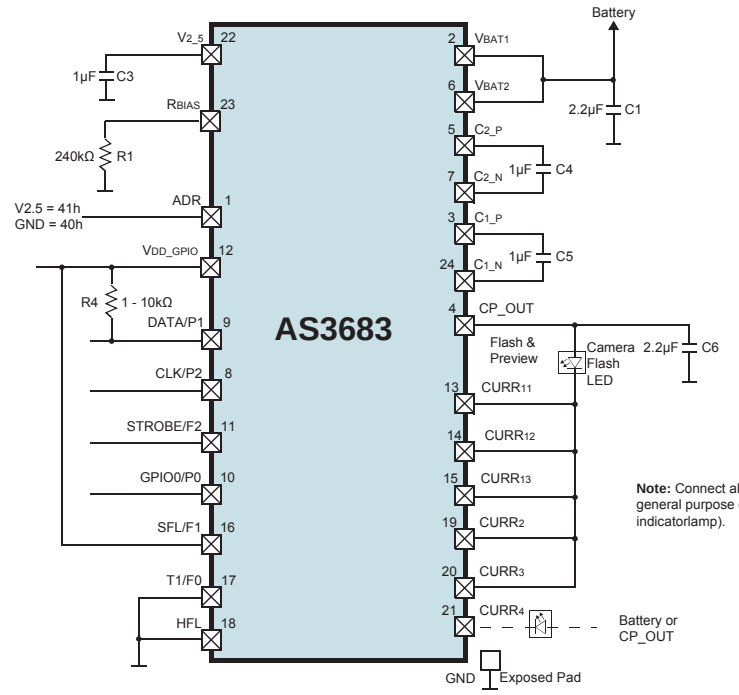
- 24-pin, small form-factor QFN package
  - 4 x 4 x 0.85mm, 0.5mm pitch
  - Enhanced thermal characteristics

Applications

Lighting management for cameras, mobile telephones, PDAs, and other 1-cell Li+ or 3-cell NiMH powered devices.

Block Diagrams

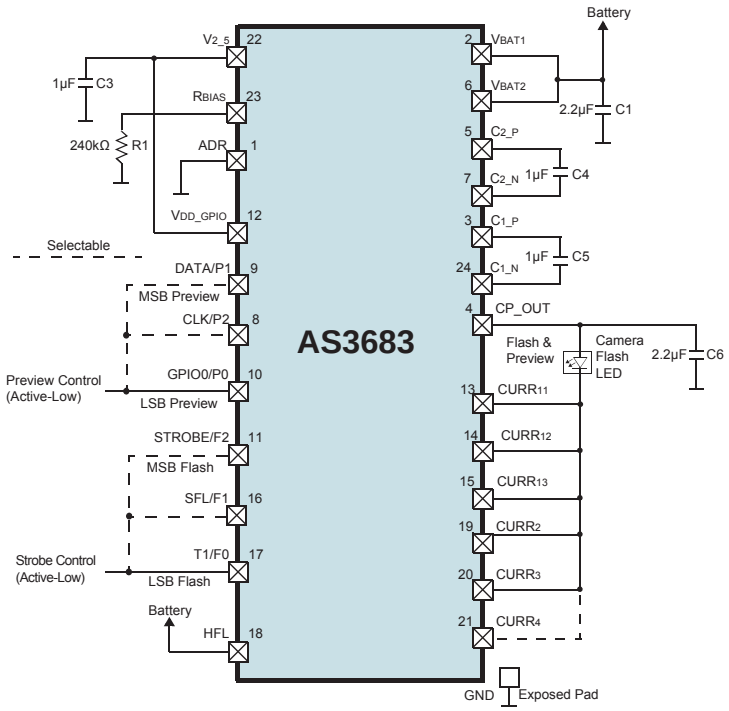
Softflash mode block diagram



Feature		Softflash Mode
Interface		I²C
Flash LEDs	Current Sinks	3 to 6
	Total Current	0 to 960mA
	Addressable	Block
	Strobe Trigger	Pin STROBE/F2 or software
	Strobe Preview	Pin GPIO0/P0 or software
General Purpose LEDs (CURR2, CURR3, CURR4)	Current Sinks	3
	Current per Sink	0 to 160mA
	Addressable	Individually

Note: Connect all 6 current sinks in parallel or use general purpose current sink for other functions (e.g., indicatorlamp).

Hardflash mode block diagram



Feature		Hardflash Mode
Interface		Dedicated Control Pins for Strobe (3x) & Preview (3x)
Flash LEDs	Current Sinks	6
	Total Current	Strobe: 0 to 900mA Preview: 0 to 480mA
	Addressable	Block
	Strobe Trigger	By Strobe Control Pins
	Strobe Preview	By Preview Control Pins
General Purpose LEDs (CURR2, CURR3, CURR4)	Current Sinks	N/A
	Current per Sink	N/A
	Addressable	N/A

General Description

The AS3685 is low noise high efficiency capacitive charge pump with 1:1, 1:1.5 and 1:2 operating modes in a small 3x3mm DFN10 or a tiny 2x1.5mm WL-CSP (Wafer Level Chip Scale Package) package. It can drive one flash LED at up to 700mA current. It supports flash/torch and indicator mode for the flash LED. Additionally the AS3685 limits the flash time automatically to protect the flash LED.

Key Features

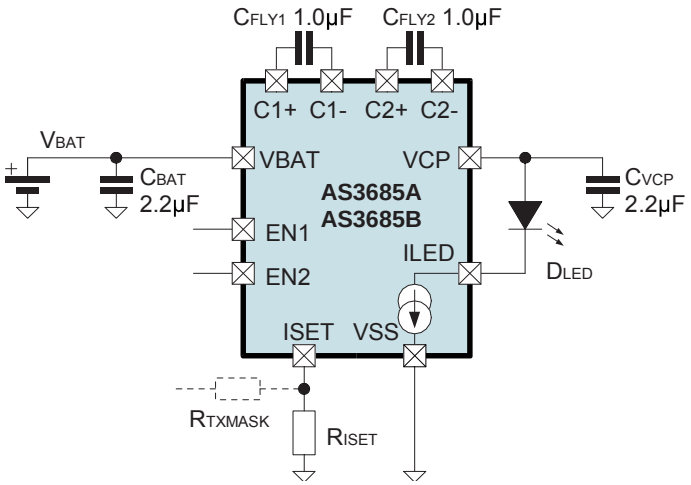
- High efficiency capactive charge pump with 1:1, 1:1.5 and 1:2 modes
  - 1:2 mode can be disabled (factory programmable)
- Up to 700mA LED current
- Automatic charge pump mode switching (up)
- LED cathode disconnect in shutdown
- Overtemperature protection
- Automatic 800ms flash timeout to protect the flash LED (Time factory programmable)
- Two device variants:
  - AS3685A: direct control to select three currents
  - AS3685B: single pin interface or two pin interface with strobe input; 17 different currents can be selected
- Package
  - DFN10 3x3mm (10 pins + exposed pad)
  - WL-CSP (wafer level chip scale package) 3x4 balls 0.5mm pitch (2x1.5mm)

Applications

- Flash / torch for mobile phones, digital cameras and PDA

Application Diagram

Application diagram of AS3685A/AS3685B



AS3686A/B

General Description

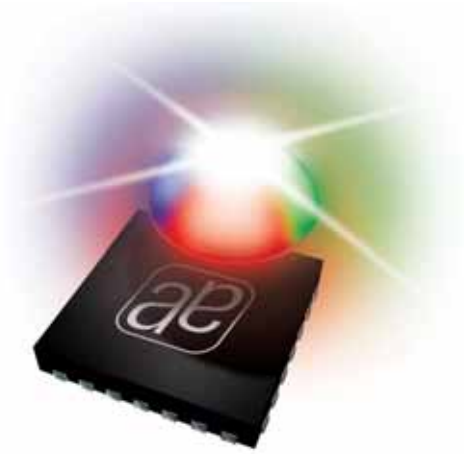
The AS3686 is low noise high efficiency capacitive charge pump with 1:1, 1:1.5 and 1:2 operating modes in a small 3x3mm DFN12 or a tiny 2x1.5mm WL-CSP (Wafer Level Chip Scale Package) package. It can drive one flash led at up to 700mA current. It supports falsh/torch mode for the flash led and indicator mode for the indicator LED.
Additionally the AS3686 limits the flash time automatically to protect the flash LED.

Key Features

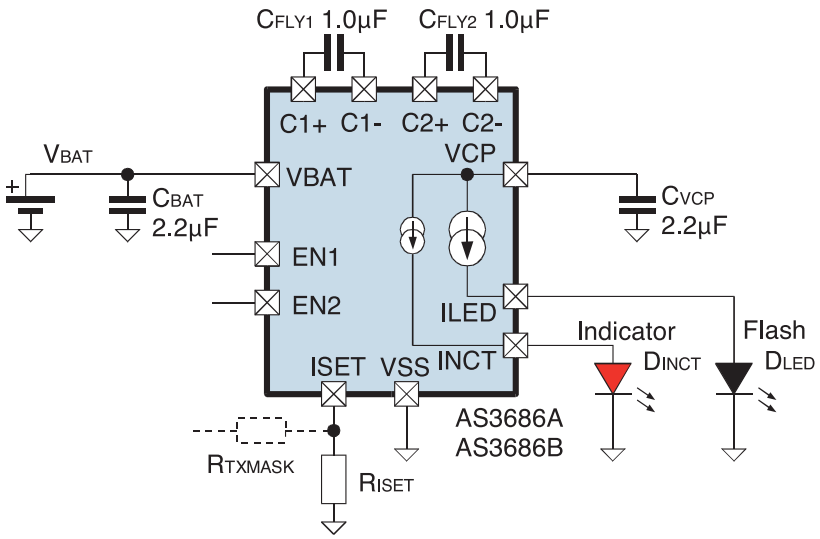
- High Efficiency capactive charge pump with 1:1, 1:1.5 and 1:2 modes
  1:2 Mode can be disabled (factory programmable)
- Up to 700mA Led Current
  - Flash/Torch Modes
  - Dedicated indicator LED output
  - If no indicator LED is used, main LED is used for indicator function
- Automatic Charge Pump Mode switching (Up)
- Overtemperature Protection
- LED cathodes connected directly to VSS
  - Better thermal performance of LED
  - Simple layout of LED connector
  - LEDs disconnect in Shutdown
- Automatic 800ms Flash Timeout to protect the flash LED
  (time factory programmable)
- Two Device Variants:
  - AS3686A: Direct control to select three currents
  - AS3686B: Single Pin Interface with Flash Strobe Input
- Package
  - WL-CSP (Wafer Level Chip Scale Package)
    3x4 balls 0.5mm pitch (2x1.5mm)
  - DFN12 3x3mm (12 pins + exposed pad)

Applications

Flash / Torch for Mobile Phones, Digital Cameras and PDA



Block Diagram



AS3675

General Description

The AS3675 is a highly-integrated CMOS Power and Lighting Management Unit for mobile telephones, and other 1-cell Li+ or 3-cell NiMH powered devices.

The AS3675 incorporates one Step Up DC/DC Converter for white backlight LEDs, one high-power Charge Pump, one Analog-to-Digital Converter, 13 current sinks, the RGB and white LEDs can be controlled by an audio input, LED in-circuit function test, a two wire serial interface, and control logic all onto a single device. Output voltages and output currents are fully programmable.

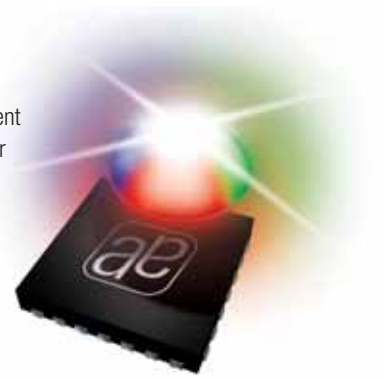
The AS3675 is a successor to the austriamicro-systems AS3687/87XM and AS3689. It is software compatible to AS3687/87XM and AS3689.

Key Features

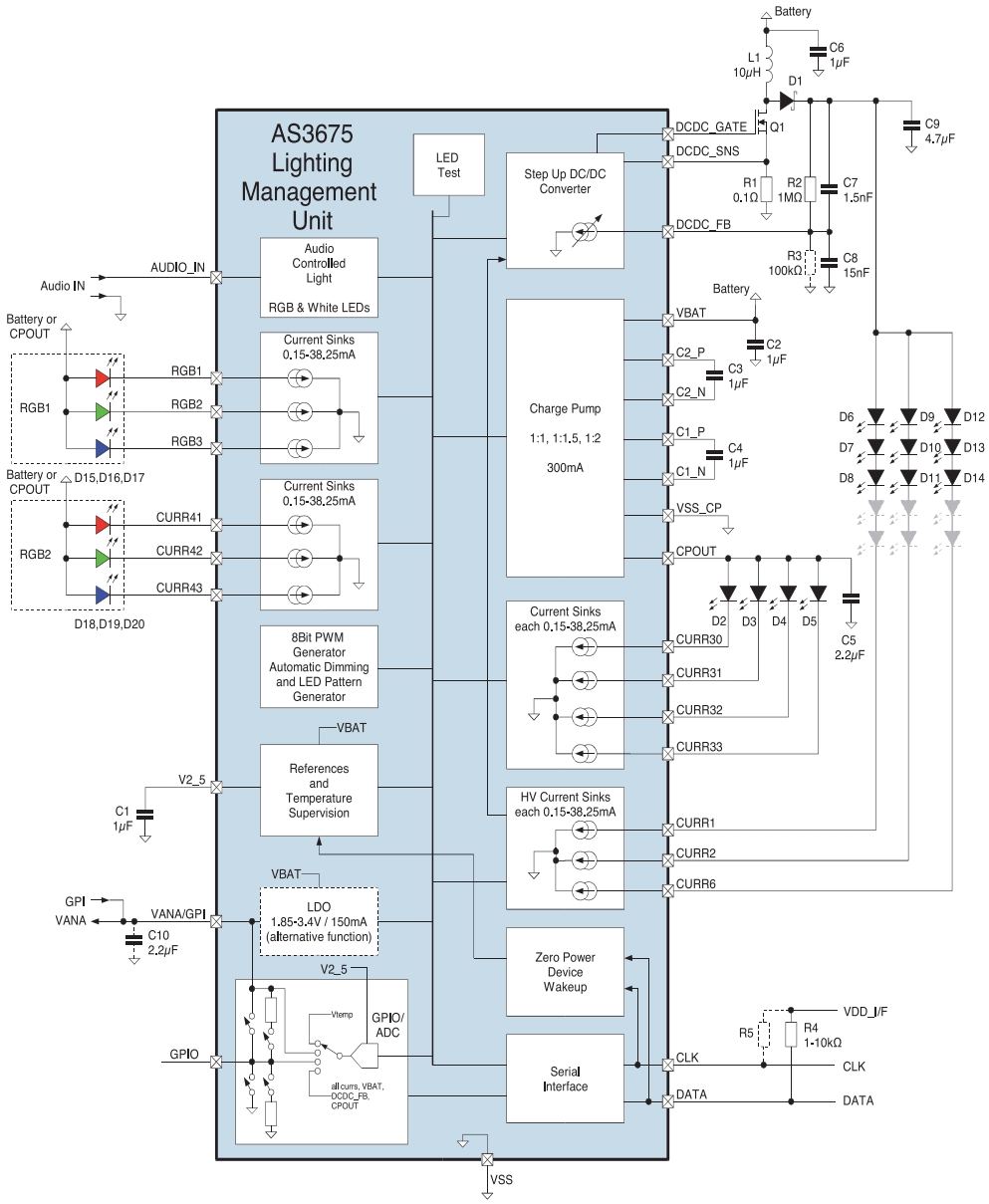
- High-Efficiency Step Up DC/DC Converter
  - Up to 25V/50mA for White LEDs
  - Programmable Output Voltage with External Resistors and Serial Interface
  - Over voltage Protection
- High-Efficiency High-Power Charge Pump
  - 1:1, 1:1.5, and 1:2 Mode
  - Automatic Up Switching (can be disabled and 1:2 mode can be blocked)
  - Output Current up to 300mA/500mA pulsed
  - Efficiency up to 95%
  - Very Low effective Resistance (2.5Ω typ. in 1:1.5)
  - Only 4 External Capacitors Required: 2 x 1µF Flying Capacitors, 2 x 2.2µF Input/Output Capacitors
  - Supports LCD White Backlight LEDs, or RGB LEDs
- 13 Current Sinks
  - All 13 current sinks fully Programmable (8-bit) from: 0.15mA to 38.5mA (CURR1, CURR2, CURR6, CURR30, CURR31, CURR32, CURR33, CURR41, CURR42, CURR43, RGB1, RGB2, RGB3)
  - Three current sinks are High Voltage capable (CURR1, CURR2, CURR6)
  - Programmable Hardware Control (Strobe, and Preview or PWM)
  - Selectively Enable/Disable Current Sinks
- Internal PWM Generation
  - 8 Bit resolution
  - Autonomous Logarithmic up/down dimming
- LED Pattern Generator
  - Autonomous driving for Fun RGB LEDs
  - Support indicator LEDs
- 10-bit Successive Approximation ADC
  - 27µs Conversion Time
  - Selectable Inputs: GPIO, all current sources, VBAT, CP_OUT, DCDC_FB
  - Internal Temp. Measurement
  - Light Sensor input
- Support for automatic LED testing (open and shorted LEDs can be identified)
- Support for external Temperature Sensor for high current LED protection (CURR3x)
- Strobe Timeout protection
  - Up to 1600ms
  - Three different timing modes
- Two General Purpose Inputs/Output
  - GPI Input, GPIO Input/Output
  - Digital Input, Digital Output using VANA supply and Tristate
  - GPI internal pull down
  - GPIO Programmable Pull-Up/Down
  - GPIO can control CURR3x on/off
  - GPIO Can be used as PWM input
- Programmable LDO
  - 1.85 to 3.4V, 150mA
  - Programmable via Serial Interface
- Standby LDO always on
  - Regulated 2.5V max. output 10mA
  - 3µA Quiescent Current
- Audio can be used to drive RGB LED or up to four white LEDs
  - RGB Colour and Brightness is dependent on audio input amplitude or frequency
  - White LEDs can be controlled by amplitude or frequency (different modes like bar-type or two and two LEDs driven by frequency filters)
- Wide Battery Supply Range: 3.0 to 5.5V
- Two Wire Serial Interface Control
- Over current and Thermal Protection
- Small Package
  - WL-CSP 6 x 5 balls, 0.5mm pitch

Applications

Power- and lighting-management for mobile telephones and other 1-cell Li+ or 3-cell NiMH powered devices.



Block Diagram



AS3681

General Description

The AS3681 is a highly-integrated CMOS Power and Lighting Management Unit to supply power to LCD-and cameramodules in mobile telephones, and other 1-cell Li+ or 3-cell NiMH powered devices.

The AS3681 incorporates one low-power, low-dropout regulator (LDO), one Step Up DC/DC Converter for white backlight LEDs, one high-power Charge Pump for camera flash LEDs, one Analog-to-Digital Converter, support for up to 11 current sinks, a serial interface, and control logic all onto a single DIE.

The linear analog regulator features extremely high analog performance regarding:
- Noise (< 30µVRMS from 100Hz to 100kHz)
- Line/load regulation (<1mV static and <20mV transient)
- Power supply rejection (>70dB@1kHz)
- Ultra-low power consumption (1µA shutdown, 6µA standby)

LDO output voltages and output currents are programmable via a serial interface.

Key Features

- Programmable high-performance regulator
  - · Low-noise LDO (1.8 to 3.4V, 100mA)
  - · 2.8V default output voltage after power-up
  - · 3µA quiescent current in standby (I_{OUT} <5mA)
  - · Turns on/off with rising/falling edge of GPIO supply voltage
  - · Programmable via serial interface

- High-efficiency step up DC/DC converter
  - · Up to 25V/50mA for white LEDs
  - · Programmable output voltage with external resistors and serial interface

- High-efficiency high-power charge pump
  - · 1:1, 1.5:1 and 2:1 mode
  - · Output current up to 400mA
  - · Efficiency up to 95%
  - · Only 4 external capacitors required: 2 x 1µF flying capacitors, 2 x 2.2µF input/output capacitors
  - · Supports LCD white backlight LEDs, camera flash white LEDs, and keypad backlight LEDs

- Supports up to 11 current sinks
  - · Three programmable (4-bit) from: 10 to 300mA
  - · Two programmable (4-bit) from: 2.5 to 37.5 mA
  - · Three programmable (4-bit) from: 2.5 to 37.5 mA for RGB LEDs
  - · Three programmable (4-bit) from: 2.5 to 37.5mA for general purpose applications
  - · Programmable hardware control (strobe, PWM)
  - · Selectively enable/disable current sinks

- 10-bit successive approximation ADC
  - · 11µs conversion time
  - · Two selectable inputs: GPIO0 and GPIO1

- Four general purpose inputs/outputs
  - · Digital input, digital output, and tristate
  - · Programmable pull-up, and pull-down
  - · GPIO2 can be used as camera flash strobe

- Negative or high-voltage charge pump
  - · Regulated output voltage, programmable by dual resistors e.g. -6V, 10mA for OLED or ±15V, 5mA for TFT
  - · ± 5% Accuracy
  - · Requires few external components

- Standby LDO
  - · Regulated 2.5V
  - · Maximum output current 10mA
  - · Always on (supplies internal digital blocks)
  - · 3µA quiescent current

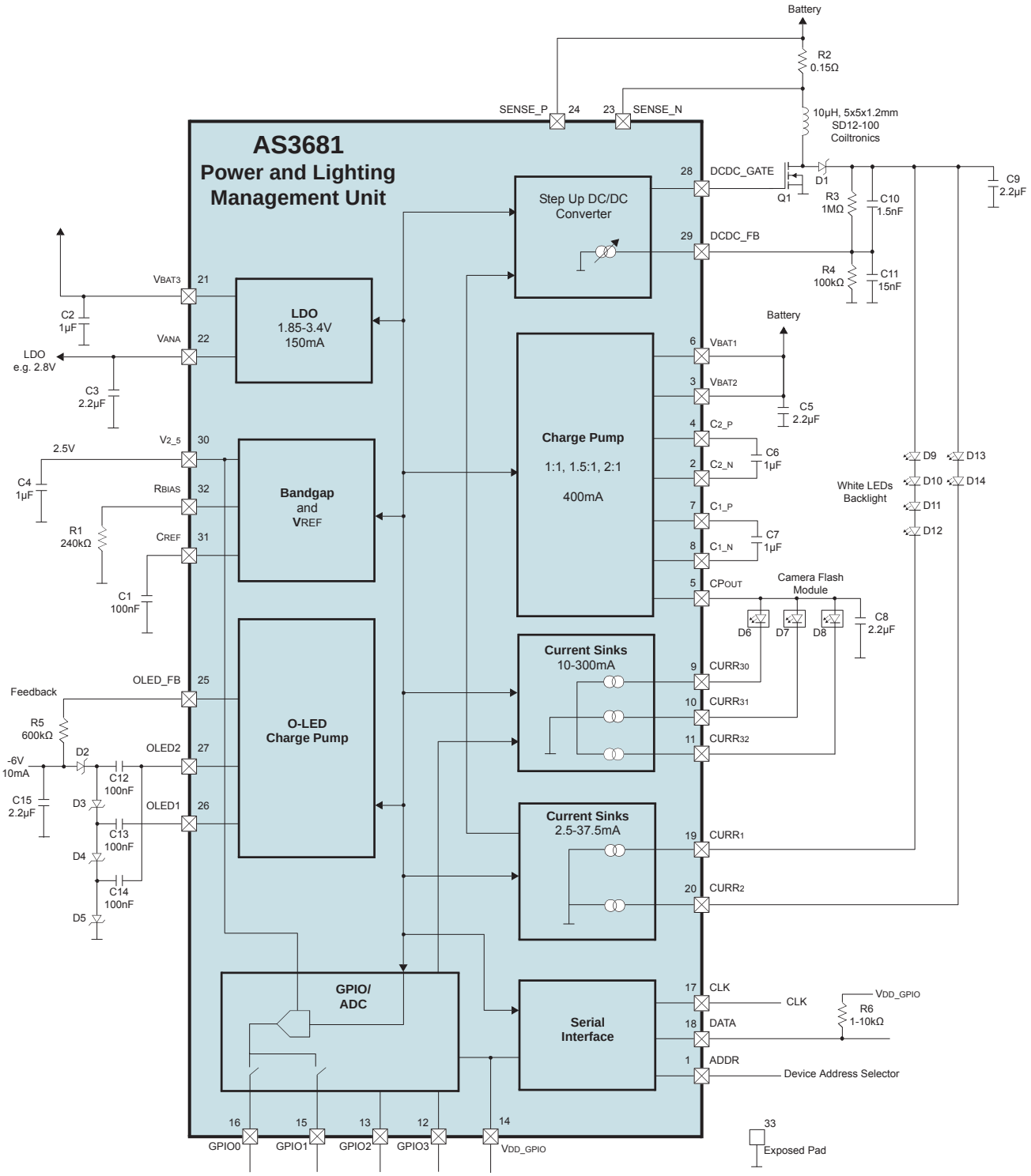
- Wide battery supply range: 3.0 to 5.5V
- Serial interface control
- On-chip bandgap tuning for high accuracy (±1%)
- Overcurrent and thermal protection
- 32-pin, small form-factor QFN package (5 x 5 x 1mm, 0.5mm pitch), enhanced thermal characteristics
- 1 Watt power dissipation @ TAMBIENT = 70°C

Applications

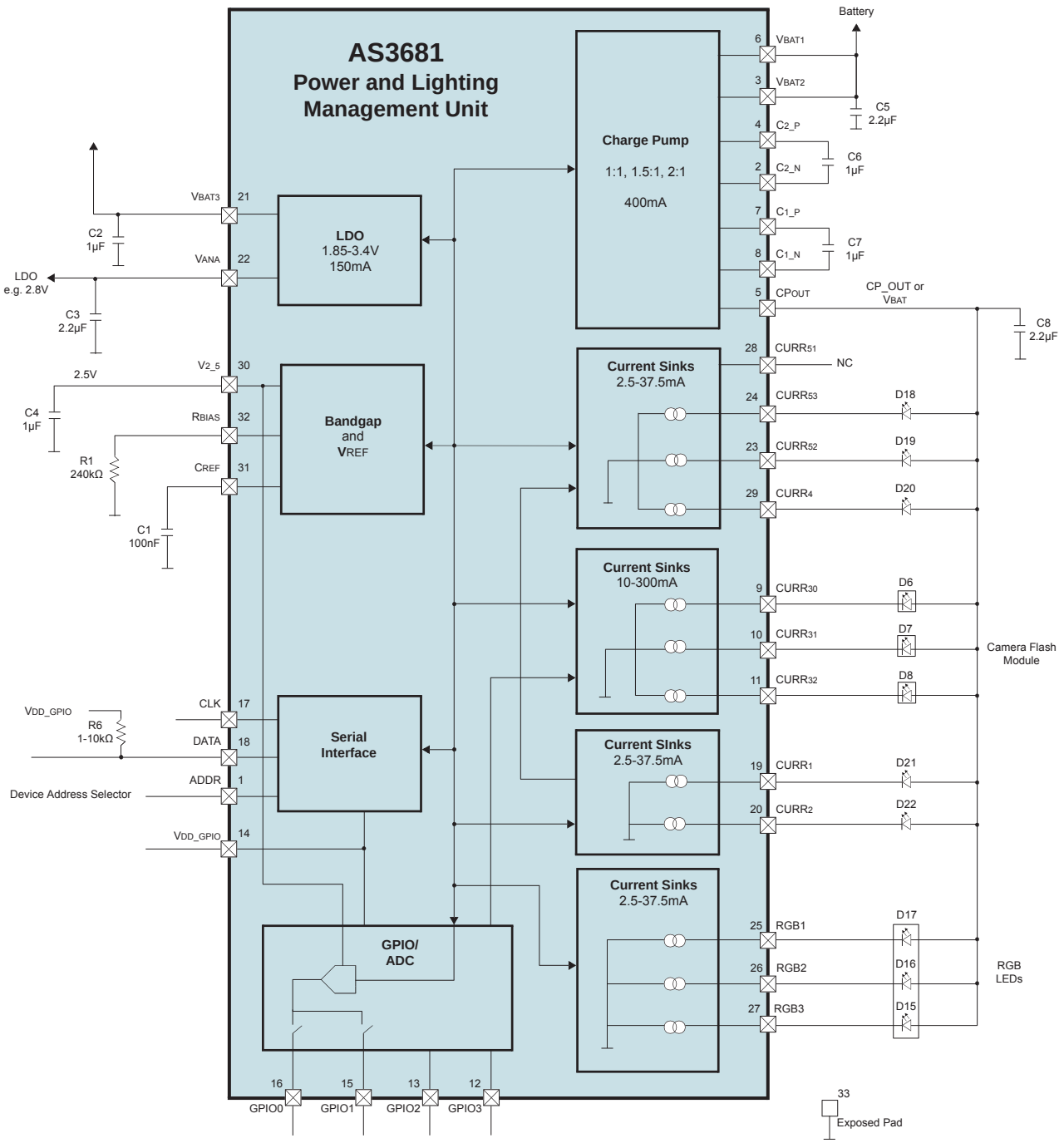
Power- and lighting-management for mobile telephones and other 1-cell Li+ or 3-cell NiMH powered devices.

Block Diagrams

Serial LED configuration option (by software): step up DC/DC converter (pins 23, 24, 28, 29) and external charge pump (pins 25, 26, 27)



Parallel LED configuration option (by software): general purpose current sinks (pins 23, 24, 28, 29) and RGB LED current sinks (pins 25, 26, 27)



AS3687/AS3687XM

General Description

The AS3687/87XM is a highly-integrated CMOS Lighting Management Unit for mobile telephones, and other 1-cell Li+ or 3-cell NiMH powered devices.

The AS3687/87XM incorporates one Step Up DC/DC Converter for white backlight LEDs, one low noise Charge Pump for indicator- or RGB- LEDs, LED test circuit (production test of the soldered LEDs at the customer site), one Analog-to-Digital Converter, seven current sinks, a two wire serial interface, and control logic all onto a single device. Output voltages and output currents are fully programmable. The AS3687XM has an audio input to control one or two RGB LEDs.

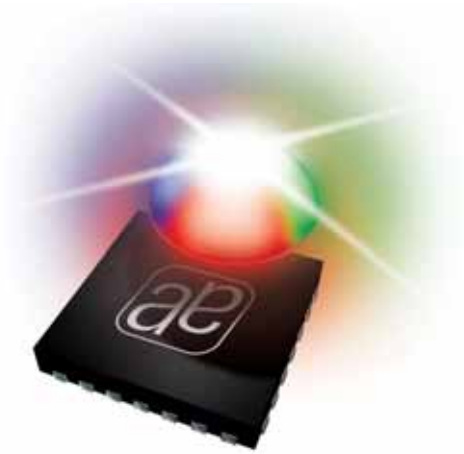
The AS3687/87XM is a successor to the austrimicrosystems AS3689 and therefore software compatible to the AS3689 (software written for the AS3689 can be easily reused for the AS3687/87XM).

Key Features

- High-Efficiency Step Up DC/DC Converter
  - Up to 25V/50mA for White LEDs
  - Programmable Output Voltage with External Resistors and Serial Interface
  - Overvoltage Protection
- High-Efficiency Low Noise Charge Pump
  - 1:1, 1:1.5, and 1:2 Mode
  - Automatic Up Switching (can be disabled and 1:2 mode can be blocked)
  - Output Current up to 100mA
  - Efficiency up to 95%
  - Only 4 External Capacitors Required: 2 x 500nF Flying Capacitors, 2 x 1µF Input/Output Capacitors
  - Supports LCD White Backlight or RGB LEDs
- Seven Current Sinks
  - All seven current sinks fully Programmable (8-bit) from: 0.15mA to 38.5mA (CURR1, CURR2, CURR6, CURR30, CURR31, CURR32, CURR33)
  - Three current sinks are High Voltage capable (CURR1, CURR2, CURR6)
  - Selectively Enable/Disable Current Sinks
- Internal PWM Generation
  - 8 Bit resolution
  - Autonomous Logarithmic up/down dimming
- LED Pattern Generator
  - Autonomous driving for Fun RGB LEDs
  - Support indicator LEDs
- 10-bit Successive Approximation ADC
  - 27µs Conversion Time
  - Selectable Inputs: all current sources, VBAT, CP_OUT, DCDC_FB
  - Internal Temp. Measurement
- Support for automatic LED testing (open and shorted LEDs can be identified in-circuit)
- Standby LDO always on if serial interface is on
  - Regulated 2.5V max. output 10mA
  - 3µA Quiescent Current
  - Automatic wakeup if serial interface is enabled (allows ultra low power for device shutdown)
- Audio can be used to drive RGB LED (AS3687XM only)
  - RGB Color and Brightness is dependent on audio input amplitude
  - Can drive one or two RGB LEDs
- Wide Battery Supply Range: 3.0 to 5.5V
- Two Wire Serial Interface Control
- Overcurrent and Thermal Protection
- Small Package WL-CSP 4x5 balls 0.5mm pitch

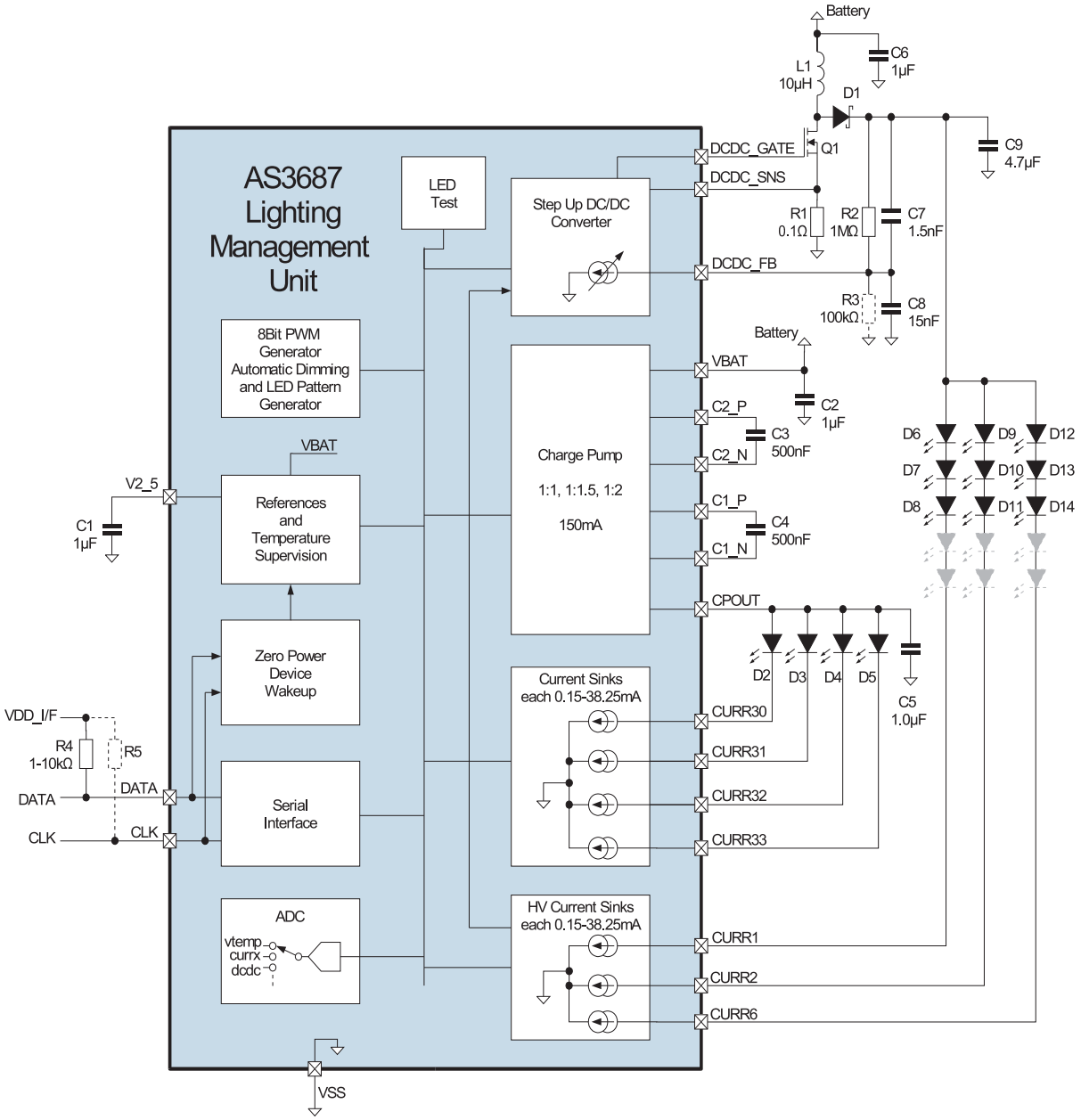
Applications

Lighting-management for mobile telephones and other 1-cell Li+ or 3-cell NiMH powered devices.

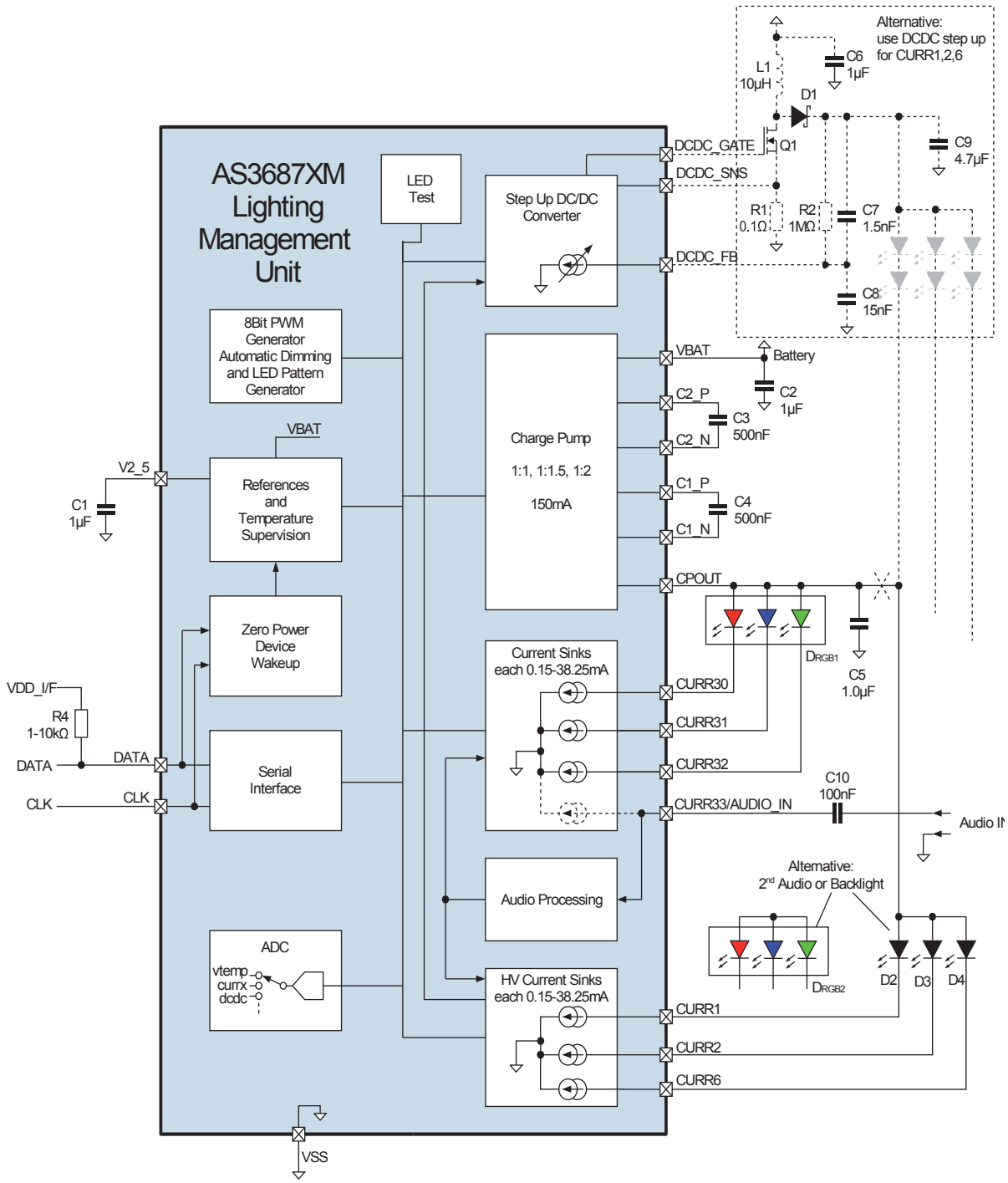


AS3687/AS3687XM

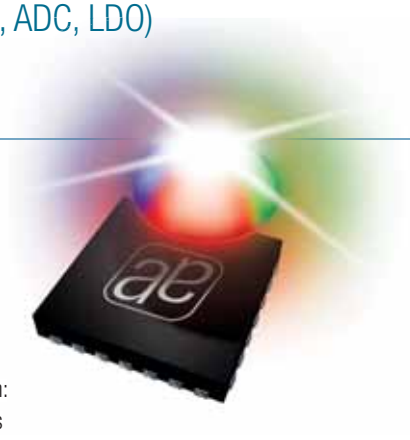
AS3687 Block Diagram



AS3687XM Block Diagram



AS3688



General Description

The AS3688 is a highly-integrated CMOS Power and Lighting Management Unit to supply power to LCD-and cameramodules in mobile telephones, and other 1-cell Li+ or 3-cell NiMH powered devices.

The AS3688 incorporates one low-power, lowdropout regulator (LDO), one Step Up DC/DC Converter for white backlight LEDs, one high-power Charge Pump for camera flash LEDs, one Analog-to-Digital Converter, support for up to 11 current sinks, a two wire serial interface, and control logic all onto a single device. Output voltages and output currents are fully programmable.

The AS3688 is a successor to the austrimicrosystems AS3681 with several additional features (Charge Pump Automatic Up Switching, Extended timer features, autonomous logarithmic and linear PWM dimming, LED pattern generator, DC/DC step up overvoltage protection, improved Charge Pump and a fourth high current sink).

Key Features

New features of the AS3688 compared to the AS3681 are written in boldface italics.

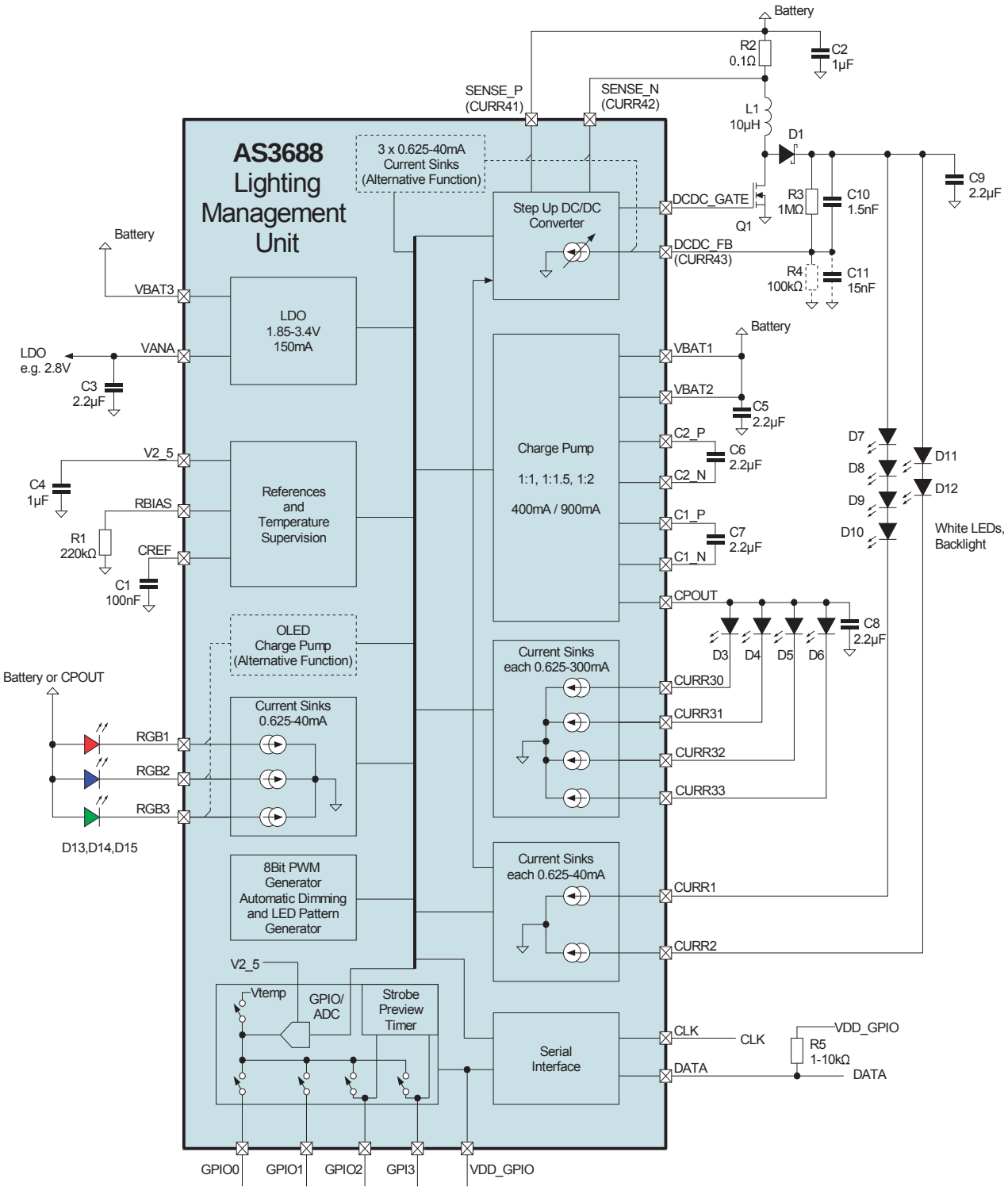
- Programmable high-performance regulator
  - · Low-noise LDO (1.85 to 3.4V, 150mA)
  - · Default off after power-up
  - · 3µA quiescent current in standby
  - · Programmable via serial interface
- High-efficiency step up DC/DC converter
  - · Up to 25V/50mA for white LEDs
  - · Programmable output voltage with external resistors and serial interface
  - · Overvoltage protection
  - · 0.1Ω shunt resistor
- High-efficiency high-power charge pump
  - · 1:1, 1:1.5, and 1:2 mode
  - · Automatic up switching (can be disabled and 1:2 mode can be blocked)
  - · Output current up to 400mA/900mA pulsed
  - · Efficiency up to 95%
  - · Very low effective resistance (0.5Ω typ. 1Ω max. in 1:1 mode, 1.4Ω typ. 2Ω max. in 1:1.5)
  - · Only 4 external capacitors required: 2 x 1µF flying capacitors, 2 x 2.2µF input/output capacitors
  - · Supports LCD white backlight LEDs,
  - · Camera flash white LEDs, and keypad backlight LEDs
- Supports up to 12 current sinks
  - · Four programmable (8+1bit) from: 0.625mA to 300mA
  - · Two high voltage programmable (8-bit) from: 0.156mA to 40mA
  - · Three programmable (8-bit) from: 0.156mA to 40mA for RGB LEDs
  - · Three programmable (8-bit) from: 0.156mA to 40mA for general purpose applications
  - · Programmable hardware control (strobe, and preview or PWM)
  - · Selectively enable/disable current sinks
- Internal PWM generation
  - · 8-bit resolution
  - · Logarithmic and linear up/down dimming
- LED pattern generator
  - · Autonomous driving for fun RGB LED
- 10-bit successive approximation ADC
  - · 11µs conversion time
  - · Four selectable inputs: GPIO0-3
  - · Internal temp. Measurement
- Support for external temperature sensor for high current LED protection (CURR3x)
- Strobe timeout protection
  - · Up to 800ms
  - · Three different timing modes
- Txmask function (reduce current during strobe) selectable on pin GPIO1
- Four general purpose inputs/outputs
  - · GPIO0-2 input/output, GPI3 only input
  - · Digital input, digital output, and tristate
  - · Programmable pull-up, and pull-down
  - · GPI3 can be used as flash strobe
  - · GPIO2 can be used for preview mode
- Negative or high-voltage charge pump
  - · Regulated output voltage, programmable by dual resistors e.g. -6V, 10mA for OLED or ±15V, 5mA for TFT
  - · ±5% Accuracy
- Standby LDO always on
  - · Regulated 2.5V max. output 10mA
  - · 3µA quiescent current
- Wide battery supply range: 3.0 to 5.5V
- Two wire serial interface control
- Overcurrent and thermal protection
- Removed ADR pin
- Package CSP 3.1 x 3.1mm

Applications

Power- and lighting-management for mobile telephones and other 1-cell Li+ or 3-cell NiMH powered devices.

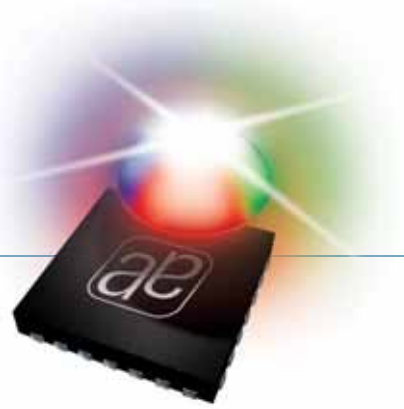
Block Diagram

Serial LED configuration option (by software), step up DC/DC converter, RGB current sinks



Flexible Lighting Management

AS3689



General Description

The AS3689 is a highly-integrated CMOS Power and Lighting Management Unit to supply power to LCD-and cameramodules in mobile telephones, and other 1-cell Li+ or 3-cell NiMH powered devices.
The AS3689 incorporates one low-power, lowdropout regulator (LDO), one Step Up DC/DC Converter for white backlight LEDs, one high-power Charge Pump for camera flash LEDs, one Analogto-Digital Converter, support for up to 11 current sinks, a two wire serial interface, and control logic all onto a single device. Output voltages and output currents are fully programmable.

The AS3689 is a successor to the austrimicrosystems AS3681 with several additional features (Charge Pump Automatic Up Switching, Extended timer features, autonomous logarithmic and linear PWM dimming, LED pattern generator, DC/DC step up overvoltage protection, improved Charge Pump and a fourth high current sink).

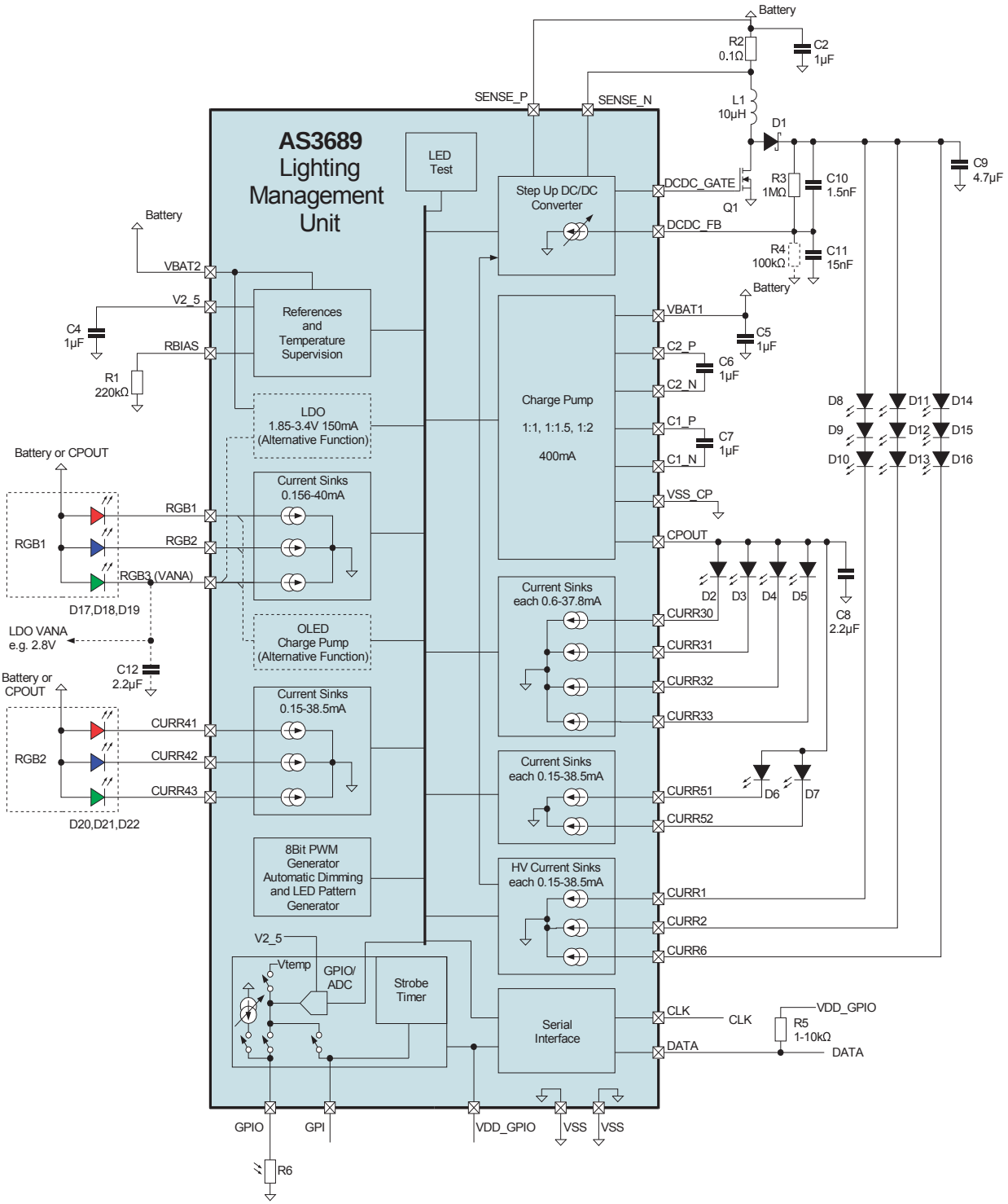
Key Features

- High-efficiency step up DC/DC converter
  - Up to 25V/50mA for white LEDs
  - Programmable output voltage with external resistors and serial interface
  - Overvoltage protection
  - 0.1Ω shunt resistor
- High-efficiency high-power charge pump
  - 1:1, 1:1.5, and 1:2 mode
  - Automatic up switching (can be disabled and 1:2 mode can be blocked)
  - Output current up to 400mA
  - Efficiency up to 95%
  - Very low effective resistance (0.5Ω typ. 1Ω max. in 1:1 mode, 1.8Ω typ. In 1:1.5)
  - Only 4 external capacitors required: 2 x 1µF flying capacitors, 2 x 2.2 µF Input/output capacitors
  - Supports LCD white backlight LEDs
  - Camera flash white LEDs, and keypad backlight LEDs
- Supports up to 15 current sinks
  - Four programmable (6-bit) from: 0.6mA to 37.8mA
  - Two programmable (8-bit) from: 0.15mA to 38.5mA
  - Three high voltage programmable (8-bit) from: 0.15mA to 38.5mA (keyboard LEDs)
  - Six programmable (8-bit) from: 0.15mA to 38.5mA (2 RGB LEDs)
  - Programmable hardware control (strobe and preview or PWM)
  - Selectively enable/disable current sinks
- Internal PWM generation
  - 8-bit resolution
  - Logarithmic up/down dimming
- LED pattern generator
  - Autonomous driving for fun RGB LEDs
- 10-bit successive approximation ADC
  - 27µs conversion time
  - Selectable inputs: GPIO, GPI, all current sources, V_{BAT}, CP_OUT, DC/DC_FB
  - Internal temp. Measurement
  - Light sensor, including a adjustable current source (0-15µA) to V2_5
- Support for automatic LED testing (open and Shorted LEDs can be identified)
- Support for external temperature sensor for high current LED protection (CURR3x)
- Strobe timeout protection
  - Up to 1600ms
  - Three different timing modes
- 2 General purpose inputs/outputs
  - GPIO input/output, GPI only input
  - Digital input, digital output, and tristate
  - Programmable pull-up, and pull-down
  - GPI can be used as flash strobe
  - GPIO can be used for preview mode
  - GPIO can be used as PWM input
- Negative or high-voltage charge pump
  - Regulated output voltage, programmable by dual resistors e.g. -6V, 10mA for OLED or ±15V, 5mA for TFT
  - ±5% accuracy
- Programmable LDO (shared with RGB3)
  - 1.85 to 3.4V, 150mA
  - Programmable via serial interface
- Standby LDO always on
  - Regulated 2.5V max. output 10mA
  - 3µA quiescent current
- Wide battery supply range: 3.0 to 5.5V
- Two wire serial interface control
- Overcurrent and thermal protection
- Package: CSP 3 x 3 mm

Applications

Power- and lighting-management for mobile telephones and other 1-cell Li+ or 3-cell NiMH powered devices.

Block Diagram



AS3931

General Description

AS3931 is an ultra low power, three channel LF ASK receiver designed to operate in various applications such as LF identification systems and LF tag receivers. AS3931 is able to detect a low frequency ASK-modulated signal by looking for a digital wake-up pattern and generates a WAKE signal after successful pattern detection. The device incorporates an intelligent pattern detection algorithm that provides reliable operation even in presence of strong interferences. RSSI signals can be generated at the RSSI pin for each receiver channel.

Key Features

- 3D wake-up pattern detection
- 3D LF field strength measurement
- Antenna rotation for easy calibration
- High sensitivity and high dynamic range
- Wide operating frequency range
- Reliable, interference resistant wake-up decoding
- Highly protected differential inputs
- Ultra low power consumption

Benefits

- Wake-up sensitivity: 350 µVpp
- LF carrier frequency range: 19 – 150 kHz
- Data rate: 2.731 kb/s
- Current consumption in standby mode: 6.6 µA
- Dynamic range: 60dB
- RSSI step: (ΔVRSSI @ 1 mVpp input amp.): 290 mV

Additional Features

- Antenna rotation switch
- three independent LF receiver chains
- Wake-up output combining the three receiver chains
- Low power 32.768 kHz crystal oscillator circuit
- Serial programming interface
- Voltage regulator with 2.4V output, on/off switchable

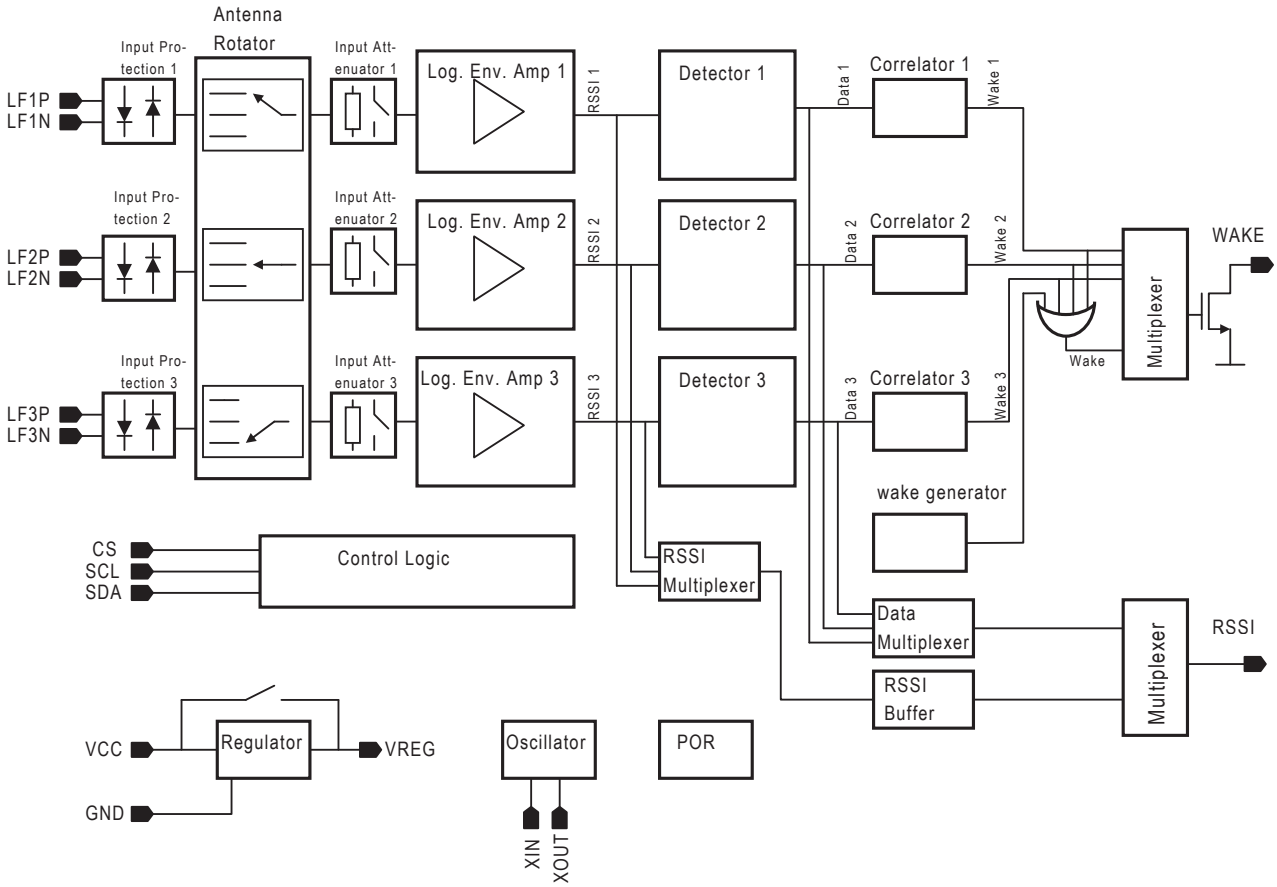
Each independent LF receiver chain contains:

- Input overload protection
- Input attenuator
- Ultra low power LF amplifier with logarithmic envelope output
- Robust data detector with adaptive slicing threshold that translates the logarithmic envelope into a digital data signal
- Error tolerant digital pattern correlator that detects a given code sequence in the received data signal and generates a wake-up signal
- Sophisticated power management logic that powers down the correlator if no data is received

Applications

- LF identification systems
- LF tag receivers
- Three-dimensional LF field strength measurement systems
- Ultra low power wake-up systems

Block Diagram



AS3932

General Description

The AS3932 is an ultra low power 3-axis ASK wakeup and data receiver that is able to generate a wakeup upon detection of a data signal which uses a low frequency carrier. The integrated correlator is available for analysis of the programmable wakeup pattern. The device can operate using one, two or three active channels.

AS3932 provides a digital RSSI value for each active channel, it supports a programmable data rate and Manchester decoding with clock recovery. AS3932 offers a fully integrated real-time clock (RTC), which is either derived from a crystal oscillator or the internal RC oscillator.

The programmable features of AS3932 enable to optimize its settings for achieving a longer distance while retaining a reliable wakeup generation. The sensitivity level of AS3932 can be adjusted in presence of a strong field or in a noisy environment.

Key Features

- 3-axis ASK wakeup receiver
- Continuous data reception supported
- Low power listening modes
- High sensitivity at very low current consumption
- One, two or three channel operation
- Programmable wakeup pattern (16bits)
- Single/double wakeup pattern detection
- Wakeup without pattern detection supported
- Adjustable sensitivity level
- False wakeup counter
- Periodical forced wakeup (1s – 2h)
- Data rate adjustable from 0.5 - 4 kbps (Manchester)
- Manchester decoding with clock recovery
- Real-time monitoring of digital RSSI for each channel
- Power down mode
- RTC based on XTAL or internal RC-OSC

Main Characteristics

- Carrier frequency range 110 - 150 kHz
- Wakeup sensitivity 100µVRMS (typ.)
- Current consumption (typ.) in 3-channel listening mode: 2.7 µA (scan mode), 1.7 µA (ON/OFF mode)
- 5 bit RSSI (dynamic range 64dB)

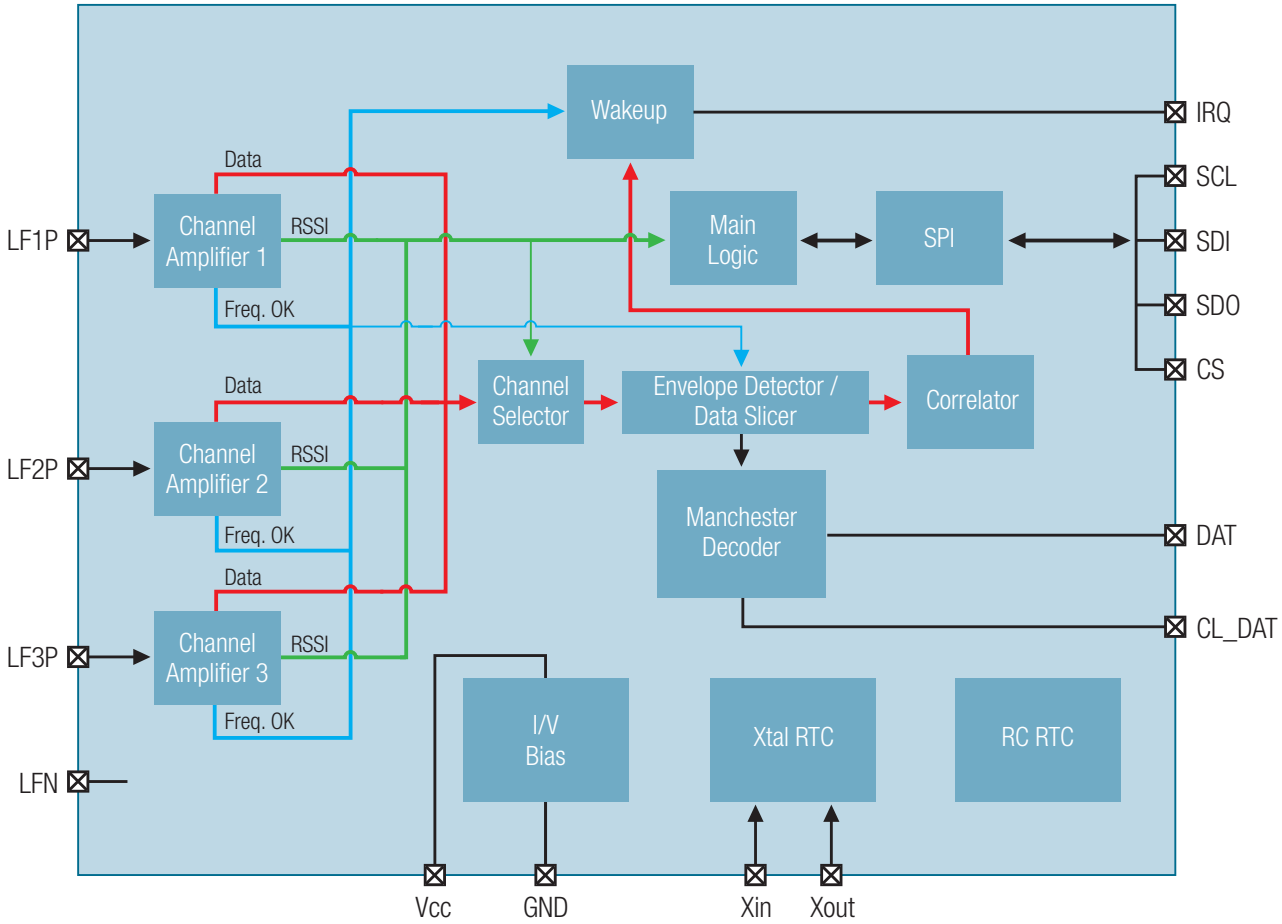
Additional Features

- Operating temperature range -40 to +85°C
- Operating supply voltage 2.4 - 3.6V (TA = 25°C)
- Bidirectional serial digital interface (SDI)
- Package option QFN16 (4x4), TSSOP16

Applications

- Active RFID tags
- Real-time location systems
- High-value asset tracking
- Operator identification
- Access control
- Wireless sensors

Block Diagram



AS3990/91

General Description

The AS3990/AS3991 UHF reader chip is an integrated analog front end and protocol handling system for a ISO18000-6C 900MHz RFID reader system.

Equipped with built-in programming options, the device is suitable for a wide range of applications in UHF RFID systems. The reader configuration is achieved by selecting the desired protocol in control registers. Direct access to all control registers also allows fine tuning of different reader parameters, if needed.
Parallel or serial interface can be selected for communication between the host system (MCU) and the reader IC. When hardware coders and decoders are used, transmission and receive data is transferred via. 24 bytes FIFO register.

In case of direct transmission or reception, coders and decoders are bypassed and the host system has to service the analog front end in real time. The transmitter generates 20dBm output power into 50Ω load and is capable of ASK or PR-ASK modulation. The integrated supply voltage regulators ensure supply rejection of the complete reader system. The transmission system comprises low level data coding. Automatic generation of FrameSync, Preamble, and CRC is supported.
The receiver system allows AM and PM demodulation. The receiver also comprises automatic gain control option (patent pending) and selectable gain and signal bandwidth to cover a range of input link frequency and bit rate options.

The signal strength of AM and PM modulation is measured and can be accessed in RSSI register. The receiver output is selectable between digitized subcarrier signal and any of integrated sub-carrier decoders. Selected decoders deliver bit stream and data clock as outputs. The receiver system also comprises framing system. This system performs the CRC check and organizes the data in bytes. Framed data is accessible to the host system through a 24 byte FIFO register. To support external MCU and other circuitry a 3.3V regulated supply and clock outputs are available. The regulated supply has 20mA current capability.

The AS3990/AS3991 is available in a 64 pin QFN (9mm x 9mm), ensuring the smallest possible footprint.

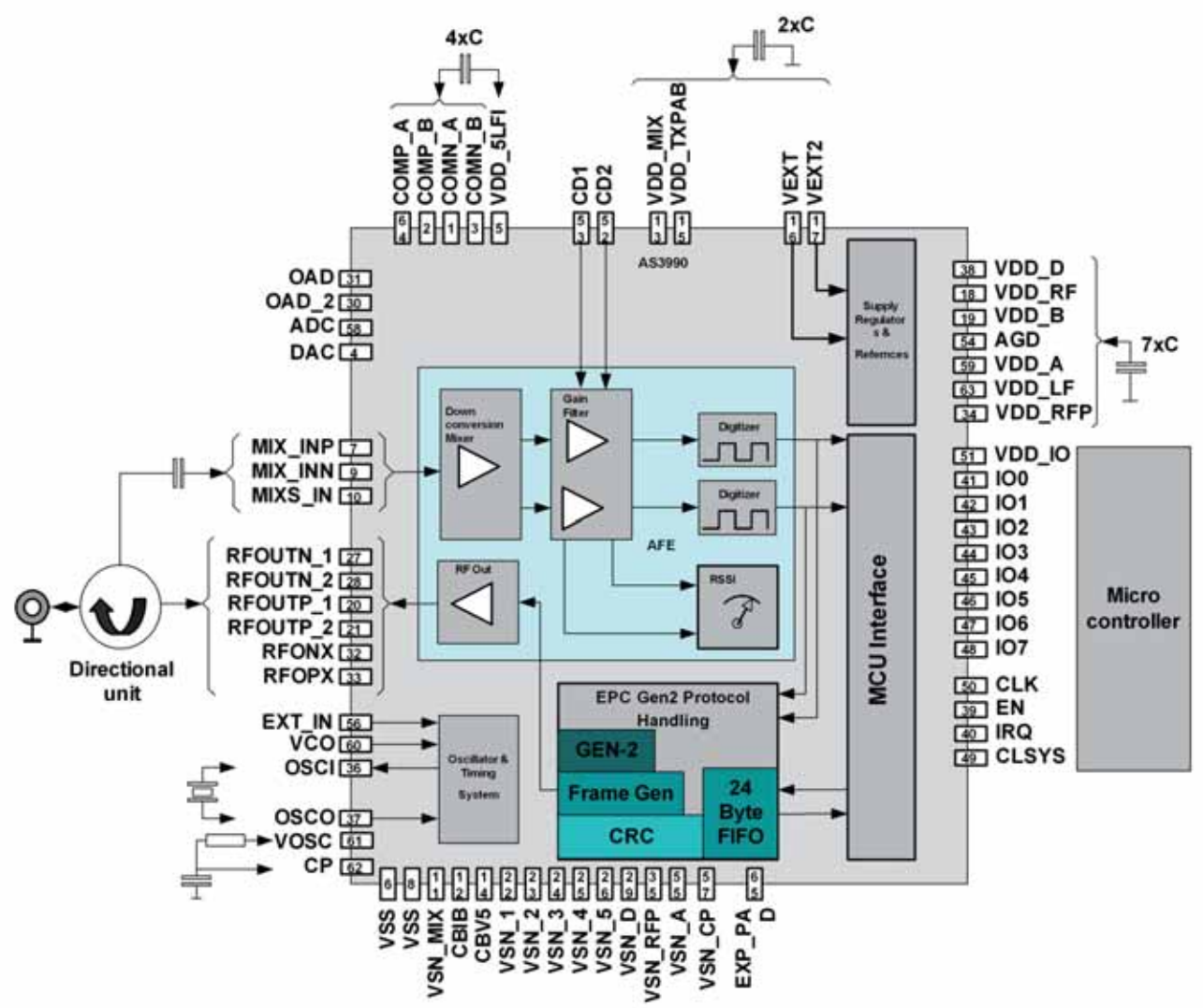
Key Features

- ISO18000-6C (EPC Gen2) full protocol support
- ISO18000-6A,B compatibility in direct mode
- Integrated low level transmission coding
- Integrated low level decoders
- Integrated data framing
- Integrated CRC checking
- Parallel 8-bit or serial 4 pin SPI interface to MCU using 24 bytes FIFO
- Voltage range for communication to MCU between 1.8V and 5.5V
- Selectable clock output for MCU
- Integrated supply voltage regulator (20mA), which can be used to supply MCU and other externalcircuitry
- Integrated supply voltage regulator for the RF output stage, providing rejection to supply noise
- Internal power amplifier (20dBm) for short range applications
- Modulator using ASK or PR-ASK modulation
- Adjustable ASK modulation index
- AM & PM demodulation ensuring no “communication holes” with automatic I/Q selection
- Built in reception low-pass and high-pass filters having selectable corner frequencies
- Selectable reception gain
- Reception automatic gain control
- AD converter for measuring TX power using external RF power detector
- DA converter for controlling external power amplifier
- Frequency hopping support
- On-board VCO and PLL covering complete RFID frequency range 840MHz to 960MHz
- Oscillator using 20MHz crystal
- Power down, standby and active mode
- Can be powered by USB with no need for step conversion

Applications

The device is an ideal solution for Gen2 UHF RFID reader systems and hand-held Gen2 UHF RFID readers.

Block Diagram



Multi-Channel Narrowband FSK Transmitter

AS3977

General Description

The AS3977 is a low-power fully integrated ETSI, FCC and ARIB compliant FSK transmitter capable of operating at any ISM frequency in the range of 300 to 928 MHz. It is based on a sigma-delta controlled fractional-N synthesiser phase locked loop with fully integrated voltage controlled oscillator. The power amplifier output is programmable and can deliver output power ranging from –20dBm up to +10dBm. An on-chip low drop-out regulator is available in case an accurate output power independent of voltage supply variation is required.

The output signal can be shaped using a programmable Gaussian filter to minimise the occupied bandwidth and adjacent channel power. The maximum data rate can be up to 100 kb/s – depending on the required filtering. The FSK frequency deviation is programmable up to a maximum of 64kHz.

The crystal oscillator can handle a wide range of frequencies. For narrow-band applications a temperature sensor with digital read-out is included that allows compensation of the crystal frequency drift due to temperature variation.

The AS3977 is connected to an external microcontroller via a bi-directional digital interface. The device operates at very low current consumption with a power supply range from 2.0V to 3.6V and can be powered down when not in use.

The device is fabricated in austriamicroystems advanced 0.35µm SiGe-BiCMOS technology.

Key Features

- Compliant to ETSI EN 300-220, FCC CFR 47 part 15 and ARIB STD-T67
- Multi-channel with narrow bandwidth
- 300 – 928 MHz operating frequency range (ISM)
- Filtered FSK
- Data rate up to 100kb/s
- FSK deviation programmable up to 64kHz
- Extremely low power consumption
- Automotive qualified

Main Characteristics

- 2.0 – 3.6V power supply
- Power down current consumption 100nA (3V, 25°C)
- Output power up to +10dBm
- Occupied bandwidth 8.5 kHz (4.8 kb/s, FFSK, ARIB)
- Operating temperature range -40 to +85°C

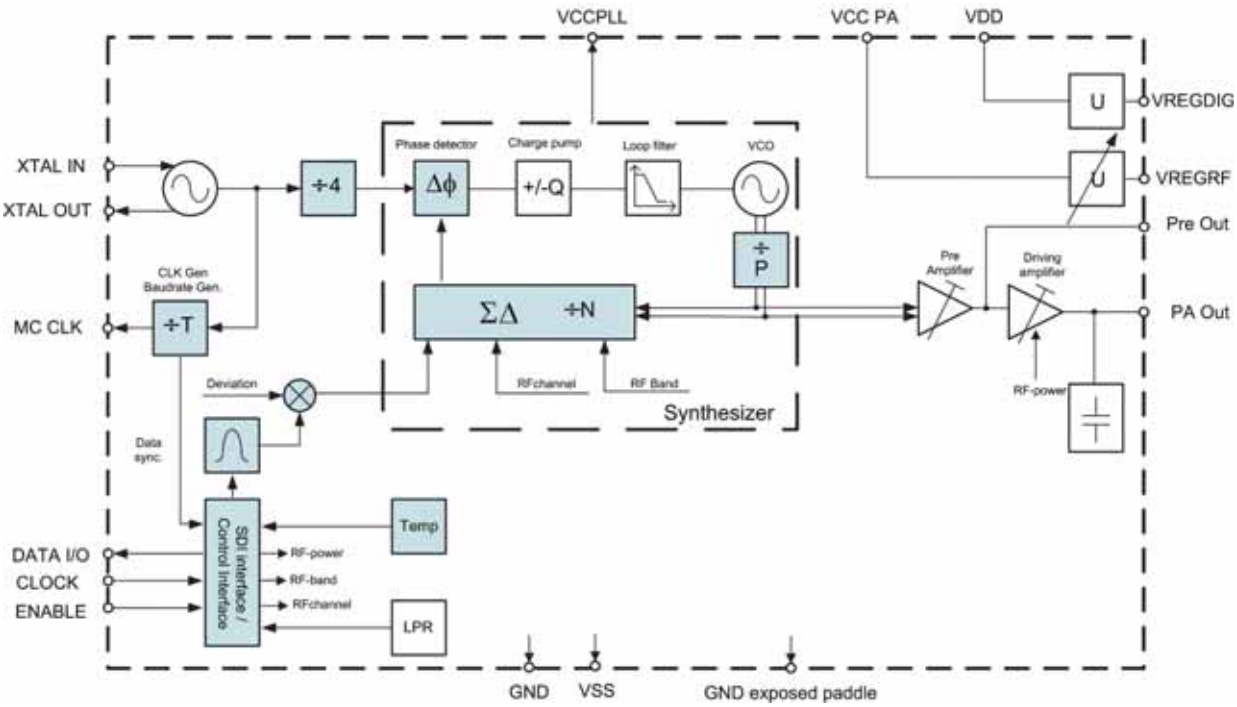
Additional Features

- Sigma-Delta controlled fractional-N synthesiser
- Resolution of synthesiser <100Hz
- Fully integrated PLL
- Fully integrated voltage controlled oscillator
- 4kV ESD protection (1.5kV for analogue pins)
- Automatic antenna tuning
- 12 – 20 MHz crystal oscillator
- On-chip temperature sensor with digital readout for AFC purposes
- Integrated Manchester coder
- Digital lock detector
- Low drop-out regulator
- Bi-directional serial interface

Applications

- Remote keyless entry systems
- Short range radio data transmission
- Domestic and consumer remote control units
- Cordless alarm systems
- Remote metering
- Low power telemetry

Block Diagram



AS1520/AS1521

General Description

The AS1520/AS1521 are low-power, 8/4-channel, 400/300ksps, 10-bit analog-to-digital (A/D) converters specifically designed to operate with single-supply devices.

Superior AC characteristics, very low power consumption, and highly-reliable packaging make these ultrasmall devices perfect for battery-powered remote-sensor and data-acquisition devices.

The successive-approximation register (SAR), highspeed sampling, high-bandwidth track/hold circuitry, and multi-mode operation combine to make these devices highly-flexible and configurable.

Both devices require low supply current (2.8mA @ 400ksps, AS1520; 2.2mA @ 300ksps, AS1521) and feature a reduced-power mode and a power-down mode to lower power consumption at slower throughput rates.

The devices operate from a single supply (+4.5 to +5.5V, AS1520; +2.7 to +3.6V, AS1521). Both devices contain an internal 2.5V reference, an integrated reference buffer, and feature support for an external reference (1V to VDD).

Data accesses are made via the high-speed, 4-wire, SPI, QSPI-, and Microwire-compatible serial interface.

The devices are available in a 20-pin TSSOP package.

Key Features

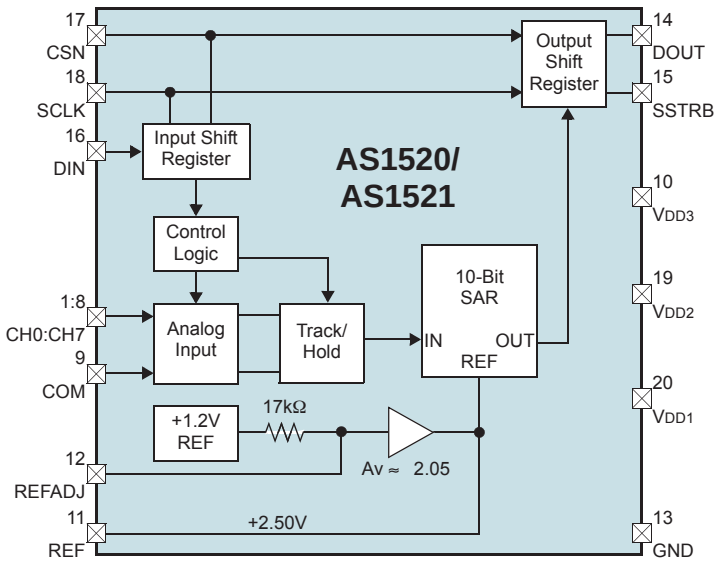
- Single-supply operation:
  - +4.5 to +5.5V (AS1520)
  - +2.7 to +3.6V (AS1521)
- Sampling rate:
  - 400ksps (AS1520)
  - 300ksps (AS1521)
- Software-configurable analog input types:
  - 8-channel single-ended
  - 8-channel pseudo differential referenced to COM
  - 4-channel pseudo differential
  - 4-channel fully differential
- Software-configurable input range
- Internal +2.5V reference
- Low-current operation:
  - 2.8mA @ 400ksps (AS1520)
  - 2.2mA @ 300ksps (AS1521)
  - 0.4mA in reduced-power mode
  - 0.5µA in full power-down mode
- SPI/QSPI/Microwire/TMS320-compatible
- 20-pin TSSOP package

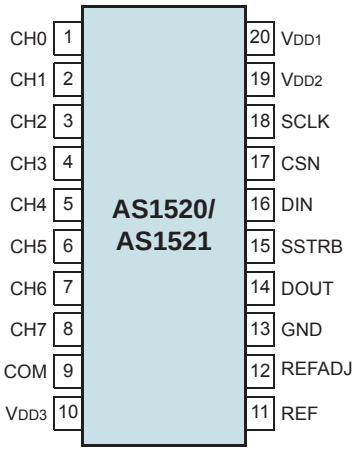
Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram

Block diagram and pin assignments





AS1522/AS1523

General Description

The AS1522/AS1523 are low-power, 4/2-channel, 400/300ksps, 10-bit analog-to-digital (A/D) converters specifically designed to operate with single-supply devices.

Superior AC characteristics, very low power consumption, and highly-reliable packaging make these ultrasmall devices perfect for battery-powered remote-sensor and data-acquisition devices.

The successive-approximation register (SAR), highspeed sampling, high-bandwidth track/hold circuitry, and multi-mode operation combine to make these devices highly-flexible and configurable.

Both devices require low supply current (2.8mA @ 400ksps, AS1522; 2.2mA @ 300ksps, AS1523) and feature a reduced-power mode and a power-down mode to lower power consumption at slower throughput rates.

The devices operate from a single supply (+4.5 to +5.5V, AS1522; +2.7 to +3.6V, AS1523). Both devices contain an internal 2.5V reference, an integrated reference buffer, and feature support for an external reference (1V to VDD).

Data accesses are made via the high-speed, 4-wire, SPI, QSPI-, and Microwire-compatible serial interface.

The devices are available in a 16-pin TSSOP package.

Key Features

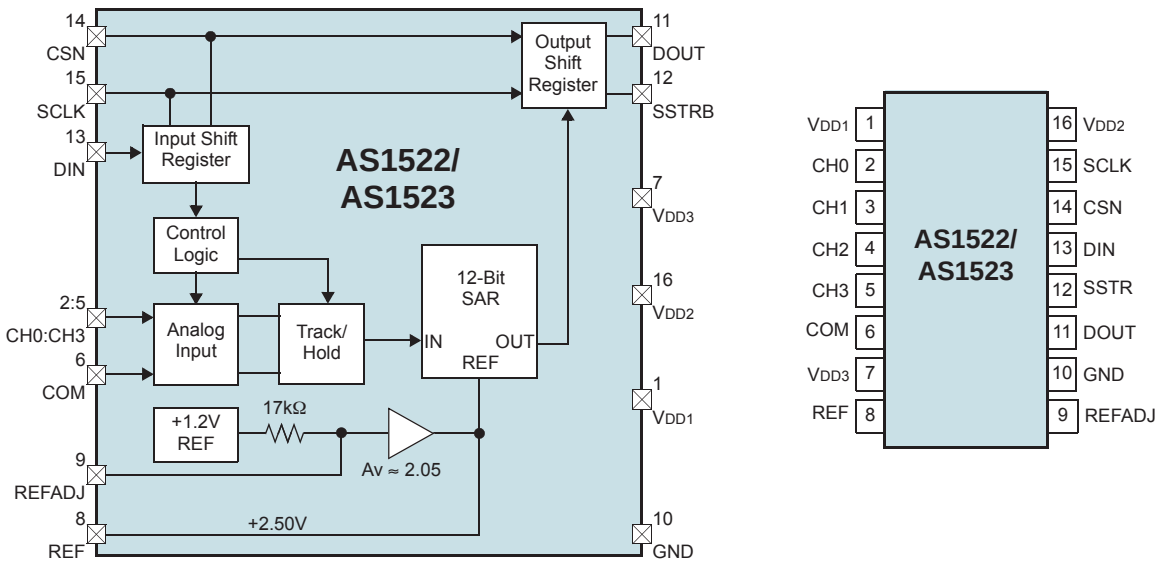
- Single-supply operation:
  - +4.5 to +5.5V (AS1522)
  - +2.7 to +3.6V (AS1523)
- Sampling rate:
  - 400ksps (AS1522)
  - 300ksps (AS1523)
- Software-configurable analog input types:
  - 4-channel single-ended
  - 4-channel pseudo differential referenced to COM
  - 2-channel pseudo differential
  - 2-channel fully differential
- Software-configurable input range
- Internal +2.5V reference
- Low-current operation:
  - 2.8mA @ 400ksps (AS1522)
  - 2.2mA @ 300ksps (AS1523)
  - 0.4mA in reduced-power mode
  - 0.5µA in full power-down mode
- SPI/QSPI/Microwire/TMS320-compatible
- 16-pin TSSOP package

Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram

Block diagram and pin assignments



AS1524/AS1525

Ultra Low Power

General Description

The AS1524/AS1525 are micro-power, 12-bit analog-to-digital converters (ADCs) designed to operate with a single +2.7 to +5.25V supply. Excellent dynamic performance, lowest power consumption, and simplicity make these devices perfect for portable battery-powered data acquisition applications.

The devices are available as the standard products listed below.

Standard Products

Model	Input Type	Input Voltages
AS1524	1-channel, Pseudo/ True-Differential	0 to VREF / -VREF/2 to VREF/2
AS1525	2-channel, Single-Ended	0 to VREF

The devices feature a successive-approximation register (SAR), automatic shutdown, fast wakeup (1.4µs), and low-power consumption at the maximum sampling rate of 150ksps.

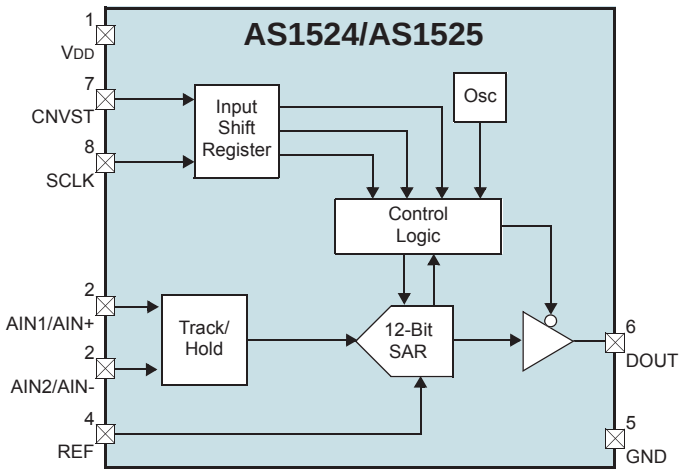
Automatic shutdown (0.2µA) between conversions results in reduced power consumption (at slowerthroughput rates).

Data access are made via an external clock through the SPI-/QSPI-/MICROWIRE-compatible 3-wire high-speed serial interface.

The AS1525/AS1524 are available in a 8-pin TDFN (3x3mm) package.

Block Diagram

Block diagram and pin assignments



Key Features

- Single-supply operation: +2.7 to +5.25V
- Automatic shutdown between conversions
- Low power consumption
  - 350µA @ 150ksps
  - 245µA @ 100ksps
  - 24µA @ 10ksps
  - 2.5µA @ 1ksps
  - 200nA in automatic shutdown mode
- True-differential track/hold, 150kHz sampling rate
- Software-configurable unipolar/bipolar conversion (AS1524)
- Input common mode range from GND to vdd
- 3-Wire SPI-/QSPI-/MICROWIRE-compatible serial interface
- Internal conversion clock
- 8-pin TDFN (3x3mm) package

Applications

The devices are ideal for remote sensors, data-acquisition, data logging devices, lab instruments, or for any other space-limited A/D devices with low power consumption and single-supply requirements.

General Description

The AS1526/AS1527 are low-power, 10-bit, 73ksps analog-to-digital (A/D) converters specifically designed for single-supply A/D applications. Superior AC characteristics, very low power consumption, and robust packaging make these ultra-small devices perfect for battery-powered analog-data collection devices.

The integrated successive-approximation register (SAR) and a fast (1.5µs) sampling track/hold time provide an economic and highly-reliable A/D conversion solution.

The AS1526/AS1527 operate from a single 2.7 to 5.25V supply. The AS1527 requires an external reference, using less power than the AS1526, however, the AS1526 features an internal 2.5V reference.

As with the AS1527, the AS1526 can also be used with an external reference, which uses the input range 0V to VREF, including the positive supply range.

The AS1527 consumes only 3mW (VDD = 3V) at the 73ksps maximum sampling speed. Both devices feature a low-current (0.3µA) shutdown mode, which reduces power consumption at slower throughput rates.

Data accesses are made via the standard, high-speed 3-wire serial interface, which is SPI-, QSPI-, and Microwire-compatible. Both devices contain an internal clock, however, both devices also support an external clock for increased flexibility.

The AS1526/AS1527 are available in an 8-pin SOIC-150 package.

Key Features

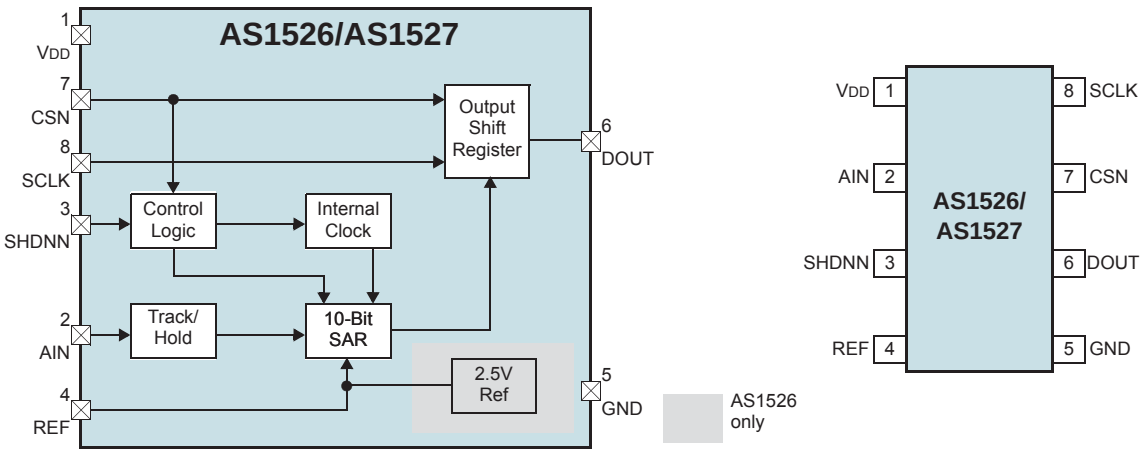
- 10-bit resolution with 7.5µs conversion time
- Sampling rate: 73ksps
- Straight binary (unipolar) data format
- Single-supply operation:+2.7 to +5.25V
- Internal 2.5V reference (AS1526)
- Low power-consumption:
  - 4mW (73ksps, AS1526)
  - 3mW (73ksps, AS1527)
  - 66µW (1ksps, AS1527)
  - 1µW (shutdown mode)
- Integrated track/hold amplifier
- Internal clock
- SPI/QSPI/Microwire 3-wire serial interface
- Operating temperature range: -40 to +85°C
- 8-pin SOIC-150 package

Applications

The devices are ideal for remote sensors, data-acquisition, data logging devices, lab instruments, or for other space-limited A/D devices with low power consumption and single-supply requirements.

Block Diagram

Block Diagram and Pin Assignments



AS1528/29

General Description

The AS1528/AS1529 are low-power, 10-bit analog-to-digital converters (ADCs) designed to operate with a single +2.7 to +5.25V supply. Excellent dynamic performance, low power consumption, and simplicity make these devices perfect for portable battery-powered data acquisition applications. The devices are available as the standard products listed below.

Device	Input Type	Input Voltage
AS1528	1-Channel, Pseudo / True-Differential	0 to V_{REF} / -V_{REF}/2 to V_{REF}/2
AS1529	2-Channel, Single-Ended	0 to V_{REF}

The devices feature a successive-approximation register (SAR), automatic shutdown, fast wakeup (1.4µs), and low-power consumption at the maximum sampling rate of 150ksps. Automatic shutdown (0.2µA) between conversions results in reduced power consumption (at slower throughput rates). Data access are made via an external clock through the SPI-/QSPI-/MICROWIRE-compatible 3-wire high-speed serial interface. The AS1529/AS1528 are available in a 8-pin TDFN (3x3mm) package.

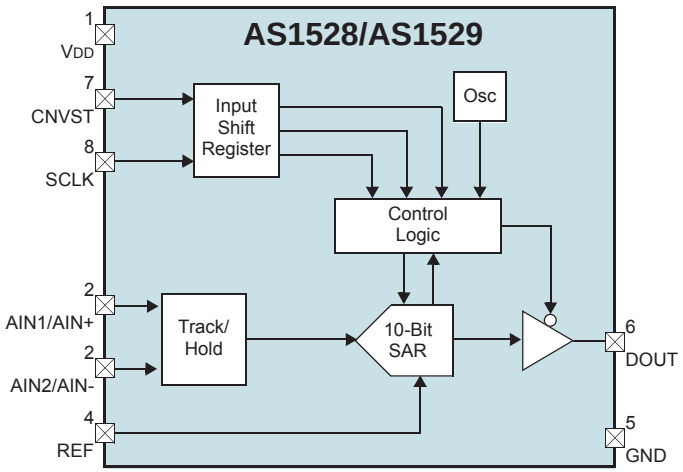
Key Features

- Single-Supply Operation: +2.7 to +5.25V
- Automatic Shutdown Between Conversions
- Low Power Consumption
  - 350µA @ 150ksps
  - 245µA @ 100ksps
  - 24µA @ 10ksps
  - 2.5µA @ 1ksps
  - 200nA in Automatic Shutdown Mode
- True-Differential Track/Hold, 150kHz Sampling Rate
- Software-Configurable Unipolar/Bipolar Conversion (AS1528)
- Input Common Mode Range from GND to VDD
- 3-Wire SPI-/QSPI-/MICROWIRE-Compatible Serial Interface
- Internal Conversion Clock
- 8-pin TDFN (3x3mm) Package

Applications

The devices are ideal for remote sensors, data-acquisition, data logging devices, lab instruments, or for any other space-limited A/D devices with low power consumption and single-supply requirements.

Block Diagram



General Description

The AS1530/AS1531 are low-power, 8/4-channel, 400/300ksps, 12-bit analog-to-digital (A/D) converters specifically designed to operate with single-supply devices. Superior AC characteristics, very low power consumption, and highly-reliable packaging make these ultrasmall devices perfect for battery-powered remote-sensor and data-acquisition devices.

The successive-approximation register (SAR), highspeed sampling, high-bandwidth track/hold circuitry, and multi-mode operation combine to make these devices highly-flexible and configurable.

Both devices require low supply current (2.8mA @ 400ksps, AS1530; 2.2mA @ 300ksps, AS1531) and feature a reduced-power mode and a power-down mode to lower power consumption at slower throughput rates.

The devices operate from a single supply (+4.5 to +5.5V, AS1530; +2.7 to +3.6V, AS1531). Both devices contain an internal 2.5V reference, an integrated reference buffer, and feature support for an external reference (1V to VDD).

Data accesses are made via the high-speed, 4-wire, SPI, QSPI-, and Microwire-compatible serial interface.

The devices are available in a 20-pin TSSOP package.

Key Features

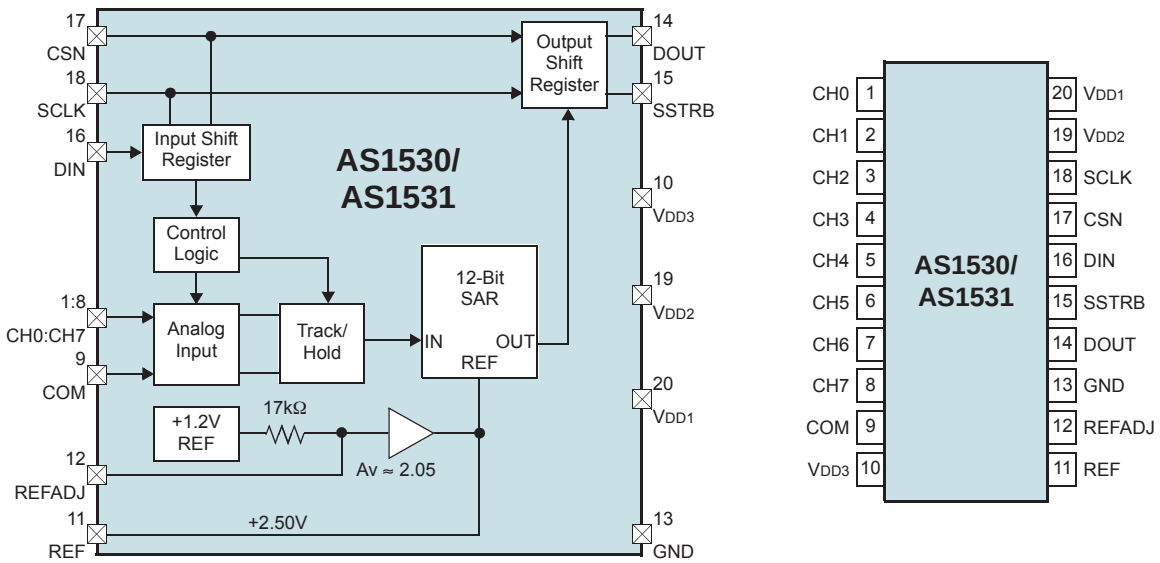
- Single-supply operation:
  - +4.5 to +5.5V (AS1530)
  - +2.7 to +3.6V (AS1531)
- Sampling rate:
  - 400ksps (AS1530)
  - 300ksps (AS1531)
- Software-configurable analog input types:
  - 8-channel single-ended
  - 8-channel pseudo differential referenced to COM
  - 4-channel pseudo differential
  - 4-channel fully differential
- Software-configurable input range
- Internal +2.5V reference
- Low-current operation:
  - 2.8mA @ 400ksps (AS1530)
  - 2.2mA @ 300ksps (AS1531)
  - 0.4mA in reduced-power mode
  - 0.5µA in full power-down mode
- SPI/QSPI/Microwire/TMS320-compatible
- 20-pin TSSOP package

Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram

Block diagram and pin assignments



AS1532/AS1533

General Description

The AS1532/AS1533 are low-power, 4/2-channel, 400/300ksps, 12-bit analog-to-digital (A/D) converters specifically designed to operate with single-supply devices.

Superior AC characteristics, very low power consumption, and highly-reliable packaging make these ultrasmall devices perfect for battery-powered remote-sensor and data-acquisition devices.

The successive-approximation register (SAR), highspeed sampling, high-bandwidth track/hold circuitry, and multi-mode operation combine to make these devices highly-flexible and configurable.

Both devices require low supply current (2.8mA @ 400ksps, AS1532; 2.2mA @ 300ksps, AS1533) and feature a reduced-power mode and a power-down mode to lower power consumption at slower throughput rates.

The devices operate from a single supply (+4.5 to +5.5V, AS1532; +2.7 to +3.6V, AS1533). Both devices contain an internal 2.5V reference, an integrated reference buffer, and feature support for an external reference (1V to VDD).

Data accesses are made via the high-speed, 4-wire, SPI, QSPI-, and Microwire-compatible serial interface.

The devices are available in a 16-pin TSSOP package.

Key Features

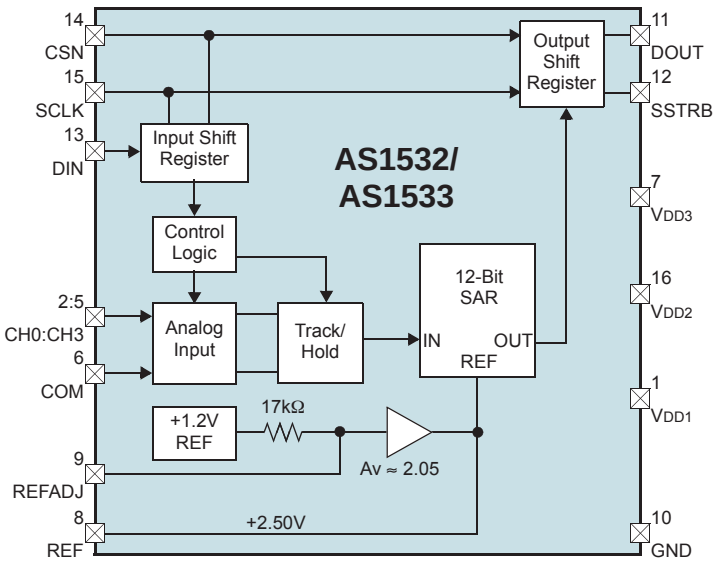
- Single-supply operation:
  - +4.5 to +5.5V (AS1532)
  - +2.7 to +3.6V (AS1533)
- Sampling rate:
  - 400ksps (AS1532)
  - 300ksps (AS1533)
- Software-configurable analog input types:
  - 4-channel single-ended
  - 4-channel pseudo differential referenced to COM
  - 2-channel pseudo differential
  - 2-channel fully differential
- Software-configurable input range
- Internal +2.5V reference
- Low-current operation:
  - 2.8mA @ 400ksps (AS1532)
  - 2.2mA @ 300ksps (AS1533)
  - 0.4mA in reduced-power mode
  - 0.5µA in full power-down mode
- SPI/QSPI/Microwire/TMS320-compatible
- 16-pin TSSOP package

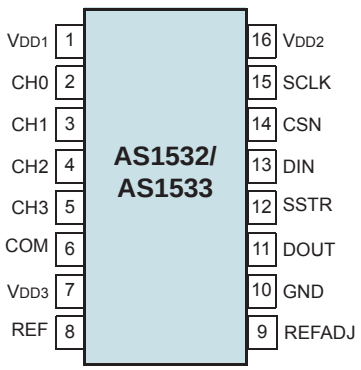
Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram

Block diagram and pin assignments





AS1535

General Description

The AS1535 is a low-power, 8-channel, 400ksps, 12-bit analog-to-digital (A/D) converter specifically designed to operate with single-supply devices. Superior AC characteristics, very low power-consumption, and highly-reliable packaging make the AS1535 perfect for battery powered remote-sensor and data-acquisition devices.

The successive-approximation register (SAR), highspeed sampling, high-bandwidth track/hold circuitry, and configurable inputs combine to make the AS1535 highly flexible and configurable.

Internal registers are used to control the AS1535 features, report on the status of the device, and hold the A/D conversion results.

The device requires very low supply-current at the 400ksps max sampling speed, and features flexible power-down modes to reduce power consumption at slower throughput rate.

The AS1535 operates from a single +3 to +3.6V supply and contains an internal 2.5V reference and integrated reference buffer. The device also supports an external reference.

Data accesses are made via the fast 8-bit Parallel Interface in support of a wide range of microprocessors.

The AS1535 is available in a 32-pin QFN package.

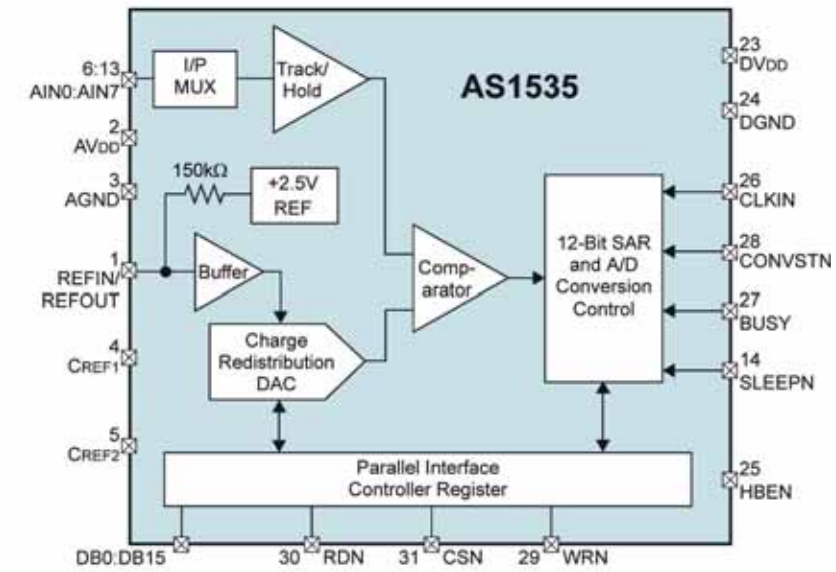
Key Features

- Sampling rate: 400ksps
- 8-bit parallel interface
- Analog input types:
  - 8-channel single-ended
  - 4-channel pseudo-differential
  - 4-channel fully-differential
- Software-configurable unipolar or bipolar inputs
- Internal +2.5V reference
- External reference: 1.2V to V_{dd}
- Low-power operation:
  - 7.5mW (V_{dd} = 3V)
  - 1.5mW (using automatic power-down after conversion; V_{dd} = 3V, 10ksps)
- Single-supply operation: +3 to +3.6V
- 32-pin QFN (5x5mm) package

Applications

The device is ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram



AS1536/37

General Description

The AS1536/AS1537 are low-power, 12-bit, 73ksps analog-to-digital (A/D) converters specifically designed for single-supply A/D applications. Superior AC characteristics, very low power consumption, and robust packaging make these ultra-small devices perfect for battery-powered analog-data collection devices.

The integrated successive-approximation register (SAR) and a fast (1.5µs) sampling track/hold time provide an economic and highly-reliable A/D conversion solution.

The AS1536/AS1537 operate from a single 2.7V to 5.25V supply. The AS1537 requires an external reference, using less power than the AS1536, however, the AS1536 features an internal 2.5V reference. As with the AS1537, the AS1536 can also be used with an external reference, which uses the input range 0V to VREF, including the positive supply range.

The AS1537 consumes only 3mW (VDD = 3V) at the 73ksps maximum sampling speed. Both devices feature a low-current (0.3µA) shutdown mode, which reduces power consumption at slower throughput rates. Data accesses are made via the standard, high-speed 3-wire serial interface, which is SPI-, QSPI-, and Microwire-compatible. Both devices contain an internal clock, however, both devices also support an external clock for increased flexibility.

The AS1536/AS1537 are available in an 8-pin SOIC-150 package.

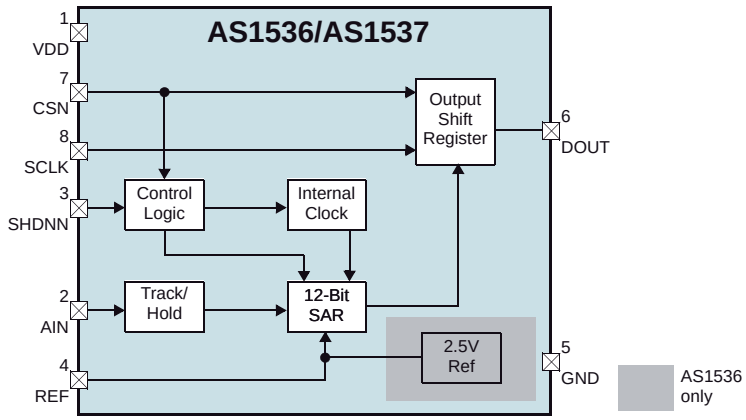
Key Features

- 12-Bit Resolution with 7.5µs Conversion Time
- Sampling Rate: 73ksps
- Straight Binary (Unipolar) Data Format
- Single-Supply Operation:+2.7V to +5.25V
- Internal 2.5V Reference (AS1536)
- Low Power-Consumption:
  - 4mW (73ksps, AS1536)
  - 3mW (73ksps, AS1537)
  - 66µW (1ksps, AS1537)
  - 1µW (Shutdown Mode)
- Integrated Track/Hold Amplifier
- Internal Clock
- SPI/QSPI/Microwire 3-Wire Serial Interface
- Operating Temperature Range: -40 to +85ºC
- 8-pin SOIC-150 Package

Applications

The devices are ideal for remote sensors, data-acquisition, data logging devices, lab instruments, or for any other space-limited A/D devices with low power consumption and single-supply requirements.

Block Diagram



General Description

The AS1538/AS1540 are single-supply, low-power, 12-bit data acquisition devices featuring a serial I²C interface and an 8-channel (AS1538) or 4-channel (AS1540) multiplexer.

The analog-to-digital (A/D) converters features a sample-and-hold amplifier an internal asynchronous clock and an internal reference. The combination of an I²C serial, 2-wire interface and micropower consumption makes the AS1538 and AS1540 ideal for applications requiring the A/D converter to be close to the input source in remote locations and for applications requiring isolation.

The device is available in a TSSOP-16 or TQFN 4x4 16-pin package.

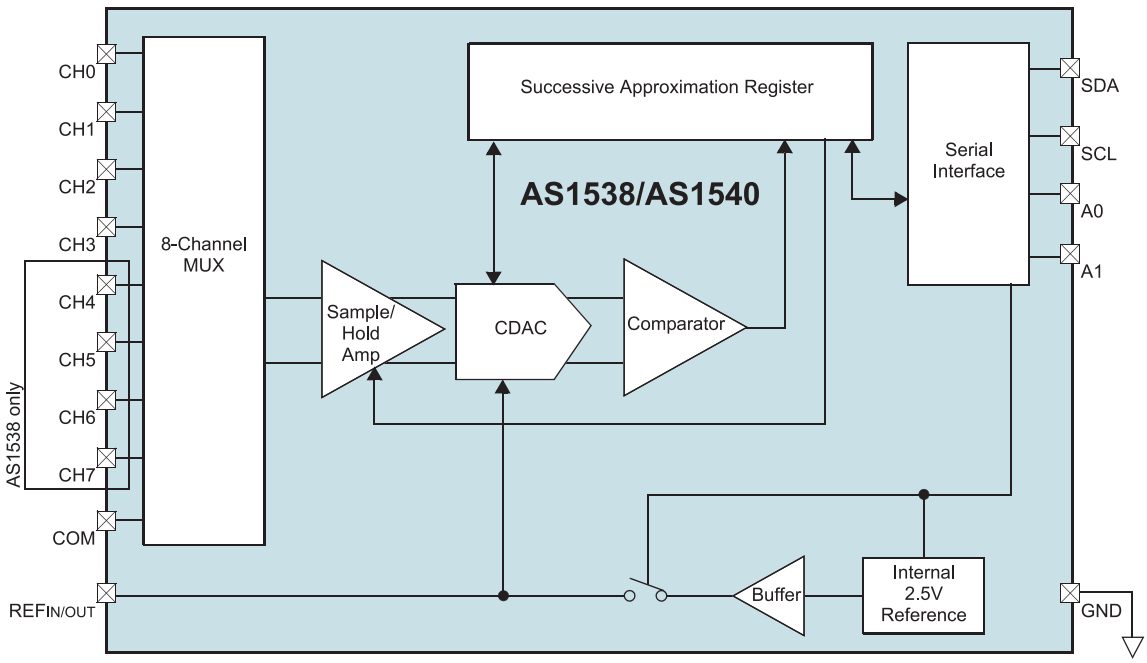
Key Features

- Single Supply: 2.7 to 5.25V
- 8-Channel Multiplexer (AS1538)
- 4-Channel Multiplexer (AS1540)
- Sampling Rate: 50kSPS
- No Missing Codes
- Internal Reference: 2.5V
- High Speed I²C Interface at 3.4MHz
- <1.5µA Full Shutdown Current
- TSSOP-16 or TQFN 4x4 16-pin Package

Applications

The device is ideal for voltage-supply monitoring, isolated data acquisition, transducer interfaces, batteryoperated systems, remote data acquisition or any other analog-to-digital conversion application.

Block Diagram



AS1539/41

General Description

The AS1539/AS1541 are single-supply, low-power, 10-bit data acquisition devices featuring a serial I²C interface and an 8-channel (AS1539) or 4-channel (AS1541) multiplexer.

The analog-to-digital (A/D) converters features a sample-and-hold amplifier an internal asynchronous clock and an internal reference. The combination of an I²C serial, 2-wire interface and micropower consumption makes the AS1539 and AS1541 ideal for applications requiring the A/D converter to be close to the input source in remote locations and for applications requiring isolation.

The device is available in a TSSOP-16 or TQFN 4x4 16-pin package.

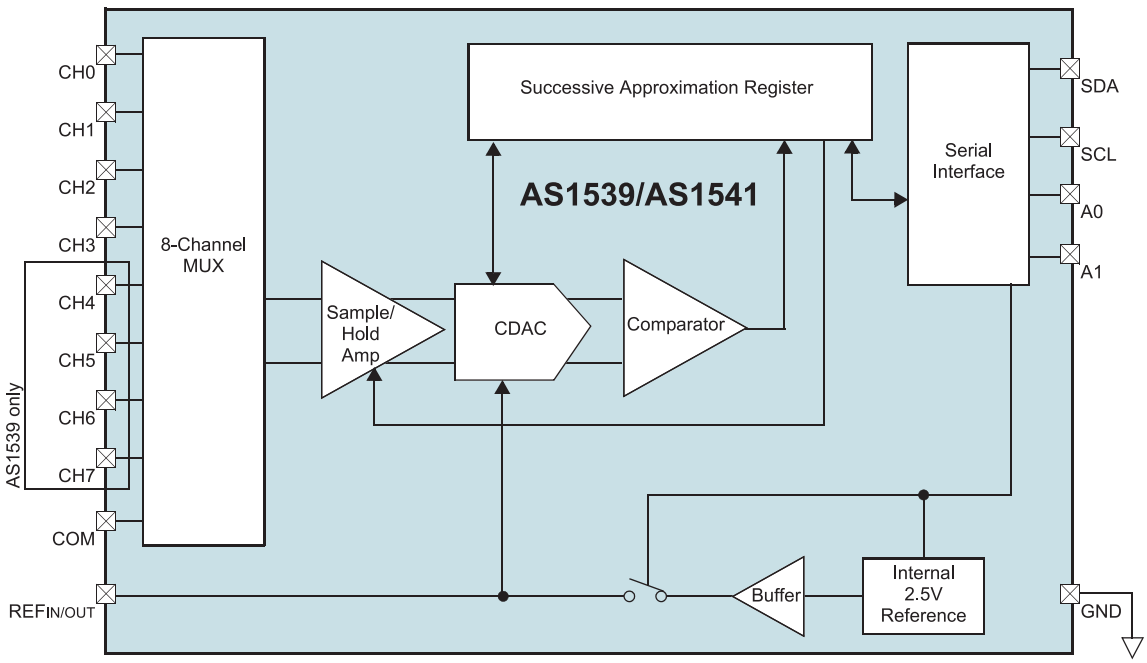
Key Features

- Single Supply: 2.7 to 5.25V
- 8-Channel Multiplexer (AS1539)
- 4-Channel Multiplexer (AS1541)
- Sampling Rate: 50kSPS
- No Missing Codes
- Internal Reference: 2.5V
- High Speed I²C Interface at 3.4MHz
- <1.5µA Full Shutdown Current
- TSSOP-16 or TQFN 4x4 16-pin Package

Applications

The device is ideal for voltage-supply monitoring, isolated data acquisition, transducer interfaces, batteryoperated systems, remote data acquisition or any other analog-to-digital conversion application.

Block Diagram



General Description

The AS1542 is a 12-bit high-speed, low-power, 16-channel, successive-approximation ADC that operates from a single 2.7 to 5.25V supply. The device features high throughput rates (1Msps) and a low-noise, wide-bandwidth track-and-hold amplifier that can handle input frequencies in excess of 1 MHz.

The AS1542 features 16 single-ended or 8 fully differential analog inputs with a channel sequencer to allow a programmed selection of channels to be converted sequentially. The conversion time is determined by the SCLK frequency (also used as the master clock to control the conversion).

The conversion process and data acquisition are controlled using a chip select pin and a serial clock signal, allowing the device to easily interface with microprocessors or DSPs. The input signal is sampled on the falling edge of CSN and conversion is also initiated at this point. There are no pipeline delays associated with the device.

The AS1542 uses advanced design techniques to achieve very low power dissipation at high throughput rates. At maximum throughput rates, the AS1542 consumes just 1.8mA (@3V), and 2.5mA (@5V).

By using internal control register, single-ended or fully differential conversion mode with different input ranges can be used with either straight binary or twos complement output coding.

The device is available in a TSSOP-28 pin package.

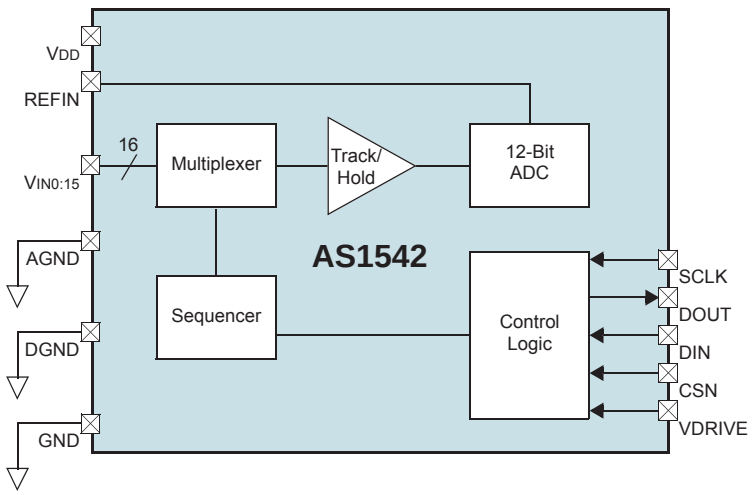
Key Features

- Single supply operation with VDRIVE function: 2.7 to 5.25V
- Fast throughput rate: 1 msps
- Software-configurable analog input types:
  - 16-channel single-ended
  - 8-channel fully-differential
- Software-configurable input range
- Low power consumption at max throughput rates:
  - 5.4mW @ 1msps (3V supply)
  - 12.5mW @ 1msps (5V supply)
- Shutdown mode current: 0.5A
- Flexible power/serial clock speed management
- Wide input bandwidth: 69.5 dB SNR @ 50 kHz input frequency
- No pipeline delays
- High speed SPI/QSPI/microwire/DSP interface
- TSSOP-28 package

Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Application Diagram



AS1543/44

General Description

The AS1543/44 is a 12-bit high-speed, low-power, 8/4-channel, successive-approximation ADC that operates from a single 2.7 to 5.25V supply. The device features high throughput rates (1Msps) and a low-noise, widebandwidth track-and-hold amplifier that can handle input frequencies in excess of 1 MHz.

The AS1543/44 features 8/4 single-ended or 4/2 fully differential analog inputs with a channel sequencer to allow a programmed selection of channels to be converted sequentially. The conversion time is determined by the SCLK frequency (also used as the master clock to control the conversion).

The conversion process and data acquisition are controlled using a chip select pin and a serial clock signal, allowing the device to easily interface with microprocessors or DSPs. The input signal is sampled on the falling edge of CSN and conversion is also initiated at this point. There are no pipeline delays associated with the device.

The AS1543/44 uses advanced design techniques to achieve very low power dissipation at high throughput rates. At maximum throughput rates, the AS1543/44 consumes just 2.8mA (@3.6V), and 3.5mA (@5.25V).

By using internal control register, single-ended or fullydifferential conversion mode with different input ranges can be used with either straight binary or twos complement output coding.
The device is available in a TQFN(4x4)-20 pin package.

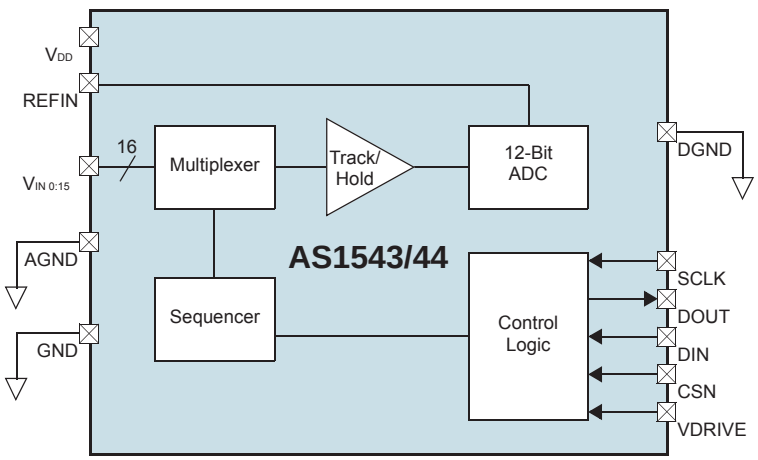
Key Features

- Single Supply Operation with VDRIVE Function: 2.7 to 5.25V
- Fast Throughput Rate: 1 Msps
- Sequencer & Channel Counter
- Software-Configurable Analog Input Types:
  - 8/4-Channel Single-Ended
  - 4/2-Channel Fully-Differential
- Software-Configurable Input Range
- Low Power Consumption at Max Throughput Rates:
  - 10.1mW @ 1Msps (3.6V Supply)
  - 18.4mW @ 1Msps (5.25V Supply)
- Shutdown Mode Current: 0.5µA
- Flexible Power/Serial Clock Speed Management
- Wide Input Bandwidth: 71dB SNR @ 50 kHz Input Frequency
- No Pipeline Delays
- High Speed SPI/QSPI/Microwire/DSP Interface
- TQFN(4x4)-20 Package

Applications

The devices are ideal for remote sensors, data-acquisition and data-logging devices, pen-digitizers, process control, or any other space-limited A/D application with low power-consumption requirements.

Block Diagram



Typical Application

General Description

The AS1545 is a dual, 12-bit, 6-channel, 1 MSPS, high speed, successive approximation (SAR) analog-to-digital converters (ADCs). The AS1545 is designed to operate with a single +2.7V to +5.25V supply and a sampling rate of up to 1 MSPS.

The device contains two ADCs, each preceded by a 6-channel multiplexer and a high-bandwidth track/hold amplifier. Data access is made via standard control inputs in support of wide range of microprocessors and DSPs.

The device requires very low supply-current at the 1MSPS maximum sampling speed, and features flexible power-down modes to reduce power consumption at slower throughput rate.

The AS1545 contains an internal 2.5V reference and integrated reference buffer that can be over driven when an external reference is required.

Superior AC characteristics, low power consumption, and highly reliable packaging makes the AS1545 perfect for portable battery-powered remote sensors and data-acquisition devices.

The AS1545 is available in a 32-lead TQFN package.

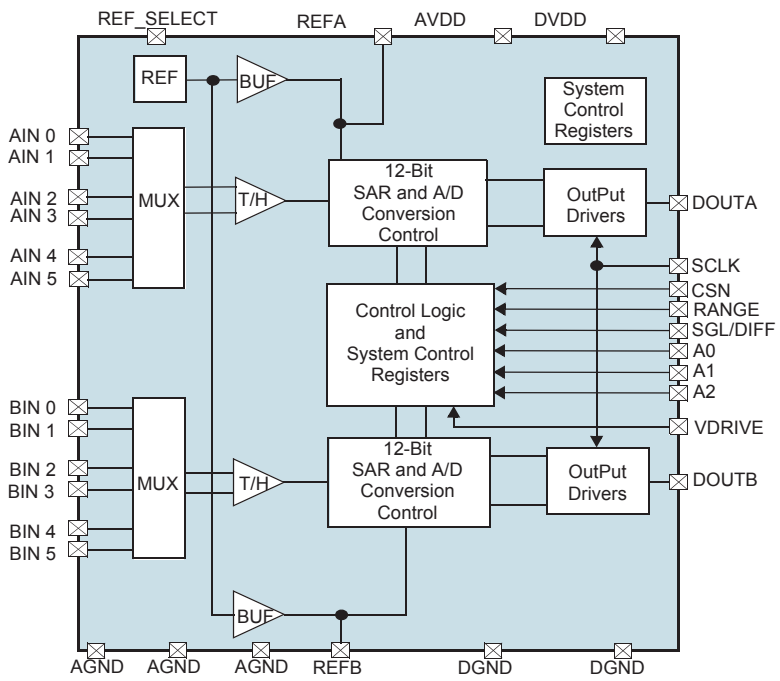
Key Features

- Sampling Rate: 1MSPS per ADC
- Dual 12-bit serial interface
- Software Configurable Analog Input Types:
  - 12-Channel Single-Ended
  - 6-Channel Pseudo-Differential
  - 6-Channel Fully Differential
- Internal +2.5V Reference or External: 1V to VDD
- Rail to Rail Common Mode Input Range
- Low-Power Consumption
  - 15mW max. at 1MSPS with 2.7V supplies
  - 37mW max. at 1MSPS with 5.25V supplies
- Dual conversion with read at 20 MHz SCLK
- Single-Supply Operation: +2.7V to +5.25V
- Motor Control Registers: Difference of Inputs, Quadrature Signal Phases, Direction and Step Down Counter
- 32-lead TQFN Package

Applications

The device is ideal for motor control like encoder feed-back or current sense, motion control such as robotics, sonar, or for any other radio frequency identification.

Block Diagram



Block Diagram

AS1741/AS1742/AS1743

General Description

The AS1741/AS1742/AS1743 are high-speed, low-voltage, dual single-pole/single-throw (SPST) analog switches.

Fast switching speeds, low ON-resistance, and low power-consumption make these devices ideal for singlecell battery powered applications.

These highly-reliable devices operate from a single +1.6 to +3.6V supply, and are differentiated by the type and number of switches:

- AS1741 – Two normally open (NO) switches
- AS1742 – Two normally closed (NC) switches
- AS1743 – One NO switch and one NC switch

The AS1743 supports break-before-make switching.

With very low ON-resistance (R_{ON}), R_{ON} matching, and R_{ON} flatness, the devices can accurately switch signals for sample and hold circuits, digital filters, and op-amp gain switching networks.

The AS1741/AS1742/AS1743 digital logic input is 1.8V CMOS-compatible when using a single +3V supply, and all devices can handle Rail-to-Rail signals.

The devices are available in an 8-pin MSOP and an 8-pin SOT 23 Package.

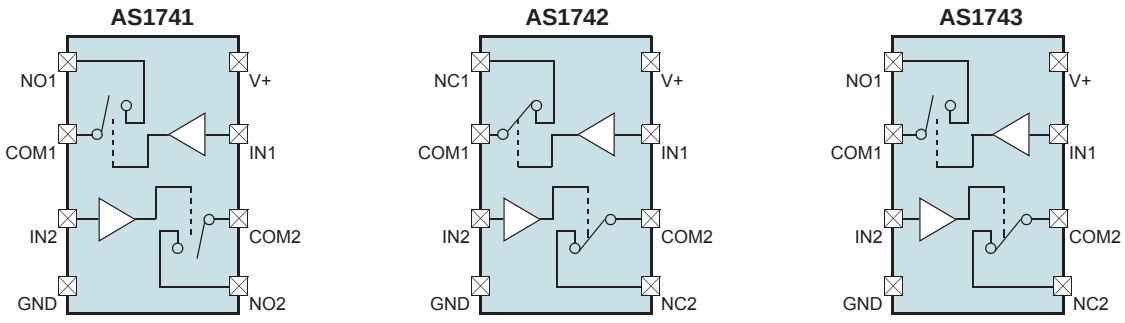
Key Features

- On-resistance:
  - 0.8Ω (+3V supply)
  - 2.5Ω (+1.8V supply)
- R_{ON} matching: 0.08Ω (+3V supply)
- R_{ON} flatness: 0.18Ω (+3V supply)
- Supply voltage range: +1.6 to +3.6V
- Switching Action: t_{ON} = 22ns, t_{OFF} = 14ns
- Current-handling: 250mA continuous
- Break-before-make switching (AS1743)
- Rail-to-rail signal handling
- 1.8V CMOS logic compatible (+3V supply)
- Total harmonic distortion: 0.03%
- Operating temperature range: -40 to +85°C
- Package types:
  - 8-pin MSOP package
  - 8-pin SOT-23 package

Applications

The devices are ideal for use in power routing systems, cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, hard drives, and any other application where high-speed signal switching is required.

Block Diagrams



General Description

The AS1744/AS1745 are high-speed, low-voltage, dual single-pole double-throw (SPDT) analog switches.

Fast switching speeds, low ON-resistance, and low power-consumption make these devices ideal for singlecell battery powered applications.

These highly-reliable devices operate from a +1.8 to +5.5V supply, are differentiated by inverted logic, and support break-before-make switching.

With low ON-resistance (RON), RON matching, and RON flatness, the devices can accurately switch signals for sample and hold circuits, digital filters, and op-amp gain switching networks.

The devices are available in a 10-pin MSOP package and the 10-pin TDFN Package.

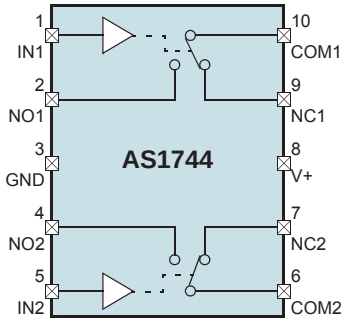
Key Features

- On-resistance:
  - 4Ω (+5V supply)
  - 5.5Ω (+3V supply)
- RON matching: 0.2Ω (+5V supply)
- RON flatness: 1Ω (+5V supply)
- Supply voltage range: +1.8 to +5.5V
- 1.8V operation:
  - 9.5Ω on-resistance over temperature
  - 38ns turn on time
  - 12ns turn off time
- Current-handling: 100mA continuous
- Break-before-make switching
- Rail-to-rail signal handling
- Crosstalk: -90dB at 1MHz
- Off-isolation: -85dB at 1MHz
- Total harmonic distortion: 0.1%
- Operating temperature range: -40 to +85°C
- 10-pin MSOP package
- 10-pin TDFN package

Applications

The devices are ideal for use in power routing systems, cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, and any other application where high-speed signal switching is required.

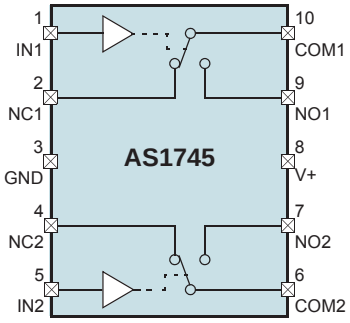
Block Diagrams



Truth Table

INx	NOx to COMx	NCx to COMx
Low	Off	On
High	On	Off

Switches shown for low input.



AS1746

General Description

The AS1746 is a low on-resistance (RON), low-voltage, dual-single-pole/double-throw (SPDT) analog switch designed to operate from a single +1.8 to +5.5V supply.

The device features a 0.5Ω (max) RON for normally closed (NC) switches and a 0.6Ω (max) RON for normally open (NO) switches using a +2.7V supply.

The AS1746 features break-before-make switching (2ns) with tON = 50ns and tOFF = 30ns (using a +2.7V supply).

The digital logic inputs are 1.8V logic-compatible with +2.7 to +3.3V supplies.

The AS1746 is available in a TDFN-10 (3x3mm) package, and a WL-CSP-10 package.

Key Features

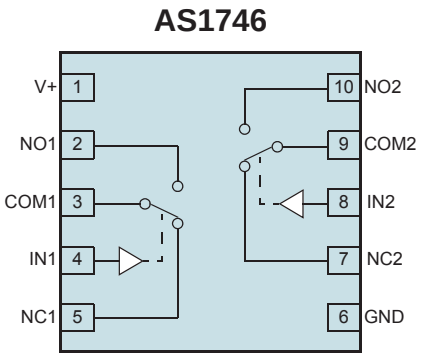
- Single supply operation: +1.8 to +5.5V
- Normally closed switch ron: 0.45Ω (+2.7V supply)
- Normally open switch ron: 0.55Ω (+2.7V supply)
- RON matching between channels: 0.06Ω
- RON flatness over signal range: 0.15Ω
- Supply current: 50nA
- Rail-to-rail signal handling
- 1.8V logic compatibility
- Low crosstalk: -60dB (100kHz)
- High off-isolation: -64dB (100kHz)
- Total harmonic distortion: 0.025%
- Ultra-low leakage currents: 1nA (@ TAMB = +25ºC)
- Package types:
  - TDFN-10 (3x3mm)
  - WL-CSP-10

Applications

The device is ideal for audio headsets, MP3 players, power routing switches, relay replacements, audio and video signal routing, communications circuits, PCMCIA cards, mobile phones, MODEMs, and any battery-operated equipment.

Block Diagram

TDFN-10 (3x3mm)



Truth Table

IN	NO*x* to COM	NC*x* to COM
Low	Off	On
High	On	Off

Switch shown for logic low input.

AS1747-50

General Description

The SPDT (single-pole/double-throw) switches AS1747, AS1748, AS1749, AS1750 allowing signals below ground to pass through without ditortion. These analog switches are ideal for switching audio signals, due to their supply voltage from +1.8V to +5.5V and their low 0.4Ω on-resistance.

An included comparator offer the AS1748 and AS1750 with a headphone detection or a mute/send key function.

To reduce click-and-pop sounds when switching between precharged points the AS1749 and AS1750 have an internal shunt switch. This shunt switch automatically discharges any capacitance at the NO and NC connection points.

These SPDT switches are available in space-saving 10-pin TDFN 3x3, 16-pin TQFN 3x3, and WL-CSP packages and operate over the -40ºC to +85ºC extended temperature range.

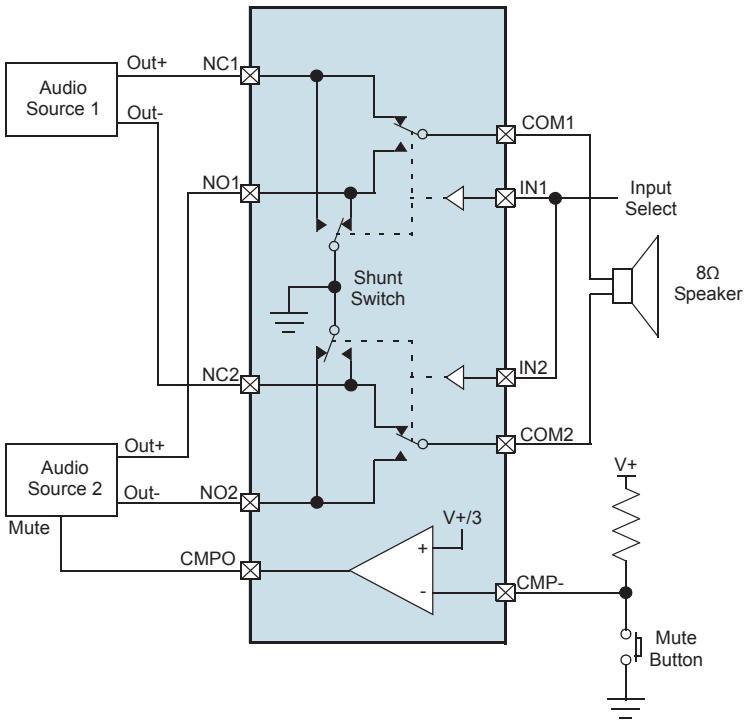
Key Features

- Distortion -Free Negative Signal Throughput Down to V_{CC} - 5.5V
- Comparator for Headphone or Mute Detection (AS1748/AS1750-
  Output Voltage Accuracy: Up to ±0.75%
- Internal Shunt Resistor Reduces Click/Pop
  (AS1749/AS1750)
- Low On-Resistance (RON) 0.4Ω at +2.7V Supply
- 0.25Ω On-Resistance Flatness
- 0.05Ω On-Resistance Matching
- +1.8V to 5.5V Supply Voltage
- -70dB Crosstalk (100kHz)
- -65dB Off-Isolation (100kHz)
- 0.01% Total Harmonic Distortion
- Available in 10-pin TDFN 3x3, 16-pin TQFN 3x3, and WL-CSP Packages

Applications

The devices are ideal for cell phones, PDAs and handheld devices, notebook computers and MP3 players.

Block Diagram



Typical Operating Circuit

AS1751/AS1752/AS1753

General Description

The AS1751/AS1752/AS1753 are high-speed, low-voltage, quad single-pole/single-throw (SPST) analog switches.

Fast switching speeds, low ON-resistance, and low power consumption make these devices ideal for singlecell battery powered applications.

These highly-reliable devices operate from a single +1.6 to +3.6V supply, and are differentiated by the type and number of switches:

-AS1751 – Four normally open (NO) switches
-AS1752 – Four normally closed (NC) switches
-AS1753 – Two NO switches and Two NC switches

The AS1753 supports break-before-make switching.

With very low ON-resistance (R_{ON}), R_{ON} matching and R_{ON} flatness, the devices can accurately switch signals for sample and hold circuits, digital filters, and op-amp gain switching networks.

The AS1751/AS1752/AS1753 digital logic input is 1.8V CMOS-compatible when using a +3V supply, and all devices can handle Rail-to-Rail signals.

The devices are available in a 3mm x 3mm 16-pin TQFN package and a 14-pin TSSOP package.

Key Features

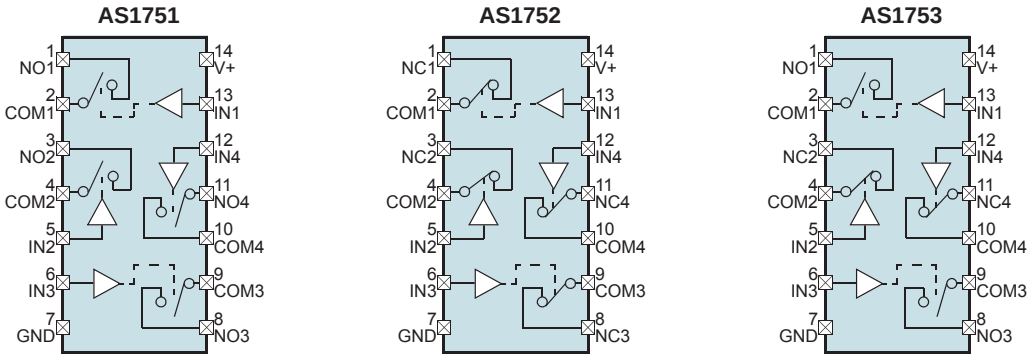
- ON-Resistance:
  - 0.9Ω (+3V supply)
  - 2.5Ω (+1.8V supply)
- R_{ON} Matching:
  - 0.12Ω (+3V supply)
  - 0.25Ω (+1.8V supply)
- R_{ON} Flatness: 0.1Ω (+3V Supply)
- Supply Voltage Range: +1.6 to +3.6V
- Switching Speed: t_{ON} = 22ns, t_{OFF} = 14ns
- Current-handling: 250mA continuous
- Break-before-make switching (AS1753)
- Rail-to-rail signal handling
- 1.8V CMOS logic compatible (+3V supply)
- Operating temperature range: -40 to +85°C
- Package types:
  - 16-pin TQFN (3mm x 3mm)
  - 14-pin TSSOP

Applications

The devices are ideal for use in power routing systems, cordless and mobile phones, MP3 players, CD and DVD players, PDAs, handheld computers, digital cameras, hard drives, and any other application where high-speed signal switching is required.

Block Diagrams

14-pin TSSOP block diagrams



Device	Input	Switch State	
AS1751	Low	Off	
	High	On	
AS1752	Low	On	
	High	Off	
AS1753	Low	Switches 1, 3 = Off	Switches 2, 4 = On
	High	Switches 1, 3 = On	Switches 2, 4 = Off

General Description

The AS1504/AS1505 are low-power (5µA @ 5V) individually programmable 8-channel, 8-bit resolution digital-to-analog converters. All eight DACs share a common reference-voltage input making them ideal for applications where adjustments start at a nominal voltage.

Standard Products

Model	Functionality
AS1504	Mid-Scale Reset Pin
AS1505	Separate VREFL Range Settings

The devices feature a low-power shutdown reference input current (5µA) that enables the devices to maintain individual DAC latch settings during shutdown until normal operation is resumed.

The devices are controlled via a standard 3-wire serial interface. Data is shifted into the DACs via the internal serial-to-parallel shift register.

The AS1504/AS1505 are available in a 16-pin SOIC-150 package.

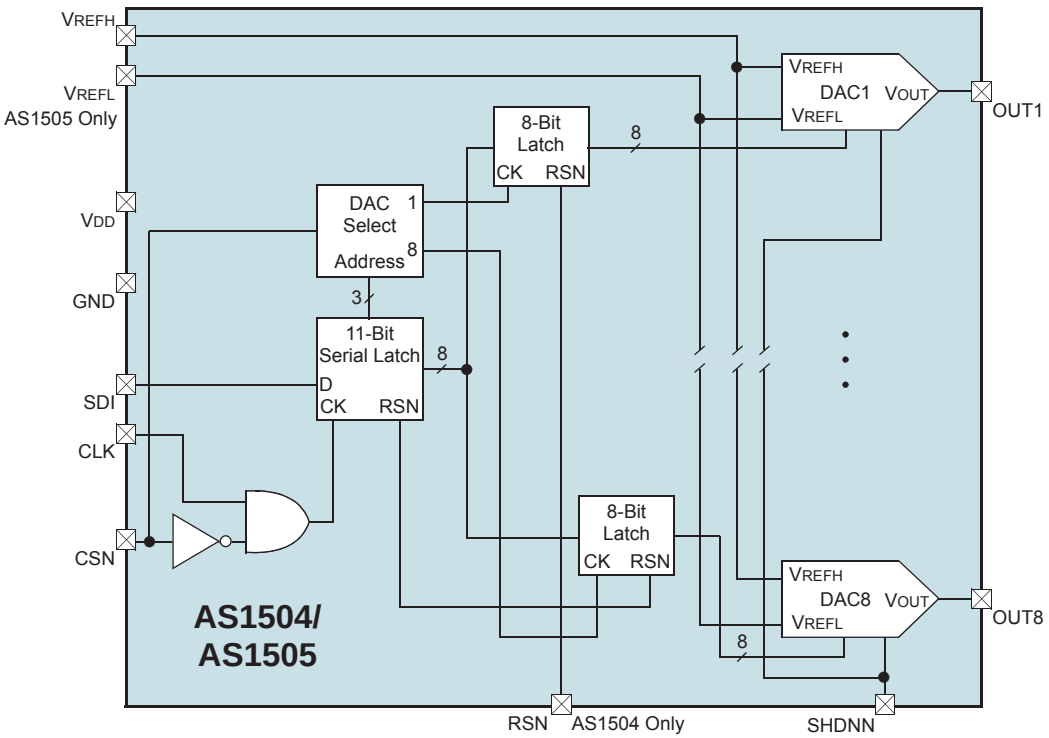
Key Features

- 8 Individually-controlled DACs
- Replaces 8 potentiometers
- Standard 3-wire serial interface
- Single-supply operation: +3 to +5V
- Mid-scale reset pin (AS1504)
- Separate VREFL range setting (AS1505)
- Shutdown mode: ≤25µW (IDD and IREF)
- Power-on reset
- 16-pin SOIC-150 package

Applications

The devices are ideal for video amplifier gain control, video equipment voltage-controlled frequencies and bandwidths, CRT display geometric corrections and automatic adjustments, or any other space-limited DAC application with low power-consumption requirements.

Block Diagram



AS1500/AS1501/AS1502/AS1503

General Description

The AS1500 is a digital potentiometer with 256 programmable steps. The values of the resistor can be controlled via 3-wire serial interface capable to handle programming rates up to 10MHz.

The AS1500 is available in four different resistor values. The AS1500 incorporates a 10kΩ, the AS1501 a 20kΩ, the AS1502 a 50kΩ and the AS1503 a 100kΩ fixed resistor.

The wiper contact taps the fixed resistor at points determined by the 8-bit digital code word. The resistance between the wiper and the endpoint of the resistor is linear. The switching action is performed in a way that no glitches occur. Furthermore the AS150x product family includes a shutdown mode, where it consumes less than 1µA.

The AS150x is available in an 8-pin SOIC package.

All parts are guaranteed to operate over the extended industrial temperature range of -40 to +125°C.

Key Features

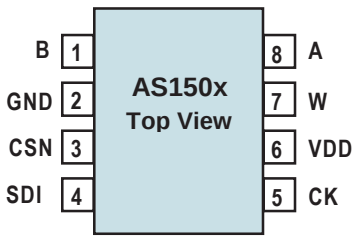
- 256-Position
- Available in four resistance values:
  - · AS1500 resistance 10kΩ
  - · AS1501 resistance 20kΩ
  - · AS1502 resistance 50kΩ
  - · AS1503 resistance 100kΩ
- Power shutdown less than 1µA
- 3-Wire SPI-compatible serial data input
- 10 MHz update data loading rate
- 2.7V to 5.5V single-supply operation
- Midscale preset
- Temperature range -40 to +125°C
- Package SO-8

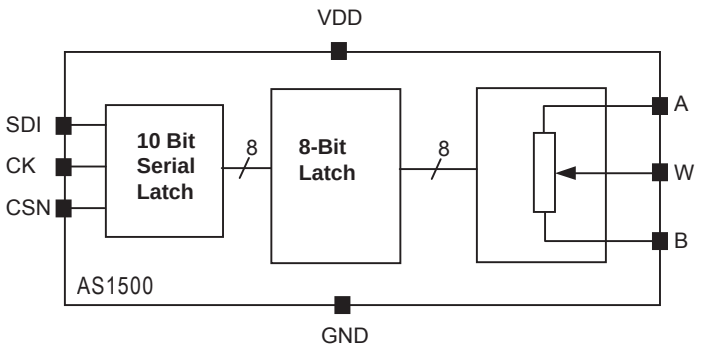
Applications

- Line impedance matching
- Volume control, panning
- Mechanical potentiometer replacement
- Power supply adjustment
- Programmable filters, delays, time constants

Block Diagrams

Pinout and functional block diagram of digital potentiometer AS150x family





AS1506

Hi-EPR EEPROM

General Description

The AS1506 is a linear, 256-tap digital potentiometer specifically designed to replace discrete/mechanical potentiometers and is ideal for applications requiring a low-temperature-coefficient variable resistor, such as low-drift, programmable gain, and amplifier circuit configurations.

The device is controlled via a 3-wire SPI-compatible interface and features an internal EEPROM for storing wiper positions.

Several device variants are available differentiated by end-to-end resistance as shown below.

Standard Products

Model	End-to-End Resistance (kΩ)
AS1506-10	10
AS1506-50	50
AS1506-100	100

The 3-wire SPI-compatible serial interface allows communication at data rates up to 5MHz. The internal EEPROM stores the last wiper position for initialization during power-up and a low-power standby mode.

The devices are available in an 8-pin TDFN 3x3mm package.

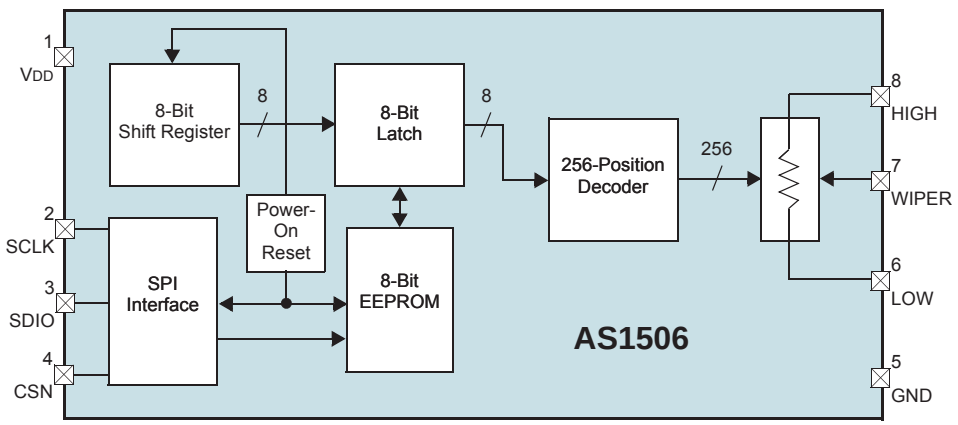
Key Features

- High endurance: EEPROM up to 10m cycles
- High reliability: EEPROM up to 150 years data retension @ 85°C
- Wiper position retained in EEPROM and loaded at power-up
- 256 tap positions
- ±0.5 LSB DNL in voltage divider mode
- ±0.5 LSB INL in voltage divider mode
- End-to-end resistance: 10/50/100kΩ
- Low end-to-end resistance temperature Coefficient: 90ppm/°C
- Low-power standby mode: 100nA
- 5MHz SPI-compatible serial interface
- Single-supply operation: +2.7 to +5.5V
- 8-pin TDFN 3x3mm package

Applications

The device is ideal for mechanical potentiometer replacement, low-drift programmable gain amplifiers, audio volume control, LCD contrast control, and low-drift programmable filters.

Block Diagram



AS1507

General Description

The AS1507 is a linear, dual 256-tap digital potentiometer specifically designed to replace discrete/mechanical potentiometers and is ideal for applications requiring a low-temperature-coefficient variable resistor. The device is controlled via a 3-wire SPI-compatible interface and features an internal EEPROM for storing wiper positions. Several device variants are available differentiated by end-to-end resistance as shown below.

Model	End-to-End Resistance (kΩ)
AS1507-10	10
AS1507-50	50
AS1507-100	100

The 3-wire SPI-compatible serial interface allows communication at data rates up to 5MHz. The internal EEPROM stores the last wiper position for initialization during power-up.
The devices are available in an TQFN 3x3mm 16-pin package.

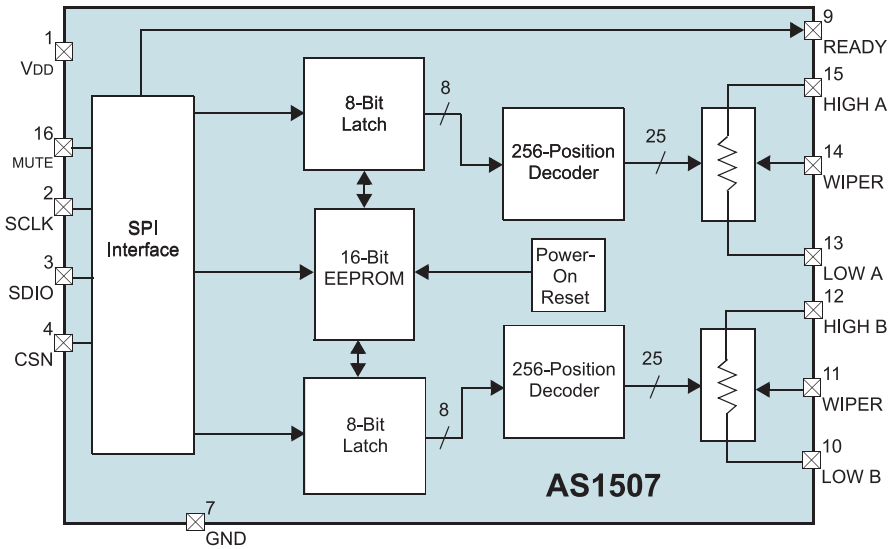
Key Features

- High Endurance: EEPROM up to 10M cycles
- High Reliability: EEPROM up to 150 years data retention @ 85°C
- Wiper Position retained in EEPROM and loaded at Power-Up
- 256 Tap Positions
- ±0.5LSB DNL in Voltage Divider Mode
- ±0.5LSB INL in Voltage Divider Mode
- End-to-End Resistance: 10/50/100kΩ
- Low End-to-End Resistance Temperature Coefficient: 90ppm/ºC
- Low-Power Standby Mode: 100nA
- 5MHz SPI-Compatible Serial Interface
- Single-Supply Operation: +2.7 to +5.5V
- TQFN 3x3mm 16-pin Package

Applications

The device is ideal for mechanical potentiometer replacement, low-drift programmable gain amplifiers, audio volume control, LCD contrast control, and low-drift programmable filters.

Block Diagram



General Description

The AS8500 is a complete, low power data acquisition system for very small signals (i.e. voltages from shunt resistors, thermocouples) that operates on a single 5V power supply. The chip powers up with a set of default conditions at which time it can be operated as a read-only converter.

Reprogramming is at any time possible by just writing into two internal registers via the serial interface.

The AS8500 has four ground referring inputs which can be switched separately to the internal PGA. Two input Channels can also be operated as a fully differential ground free input. The system can measure both positive and negative input signals.

The PGA amplification ranges from 6 to 100 which enables the system to measure signals from 7mV to 120 mV full scale range with high accuracy, linearity and speed.

The chip contains a high precision band gap reference and an active offset compensation that makes the system offset free (better than 0,5 µV) and the offset-TC value negligible. The built-in programmable digital filter allows an effective noise suppression if the high speed is not necessary in the application.

The input noise density is only 35 nV / Hz and due to the high internal chopping frequency the system is free of 1/f-noise down to DC. The 0-10 Hz noise is typical below 1 µV i.e. as good or better than any other available chopper amplifier.

For high speed synchronous measurements the chip can run in an automatic switching mode between two input Channels with preprogrammed parameter sets.

The circuit has been optimised for the application in battery management systems in automotive systems. As a front-end data acquisition system it allows an high quality measurement of current, voltage and temperature of the battery.

With a high quality 100 µΩ resistor the system can handle the starter current of up to 1500 A, a continuous current of ± 300 A as well as the very low idle current of a few mA in the standby mode.

For external temperature measurement the chip can use a wide variety of different temperature sensors such as RTD, PTC, NTC, thermocouples or even diodes or transistors. A built-in programmable current source can be switched to any input and activate these sensors without the need of other external components.

The measurement of the chip temperature with the integrated internal temperature sensor allows in addition the temperature compensation of sensitive parameters which increases the total accuracy considerably.

The flexibility of the system is further increased by a digital comparator that can be assigned to any measured property (current, voltage, temperature) and an active wake-up in the sleep-mode.

All analog input-terminals can be checked for wire break via the SDI-interface.

Key Features

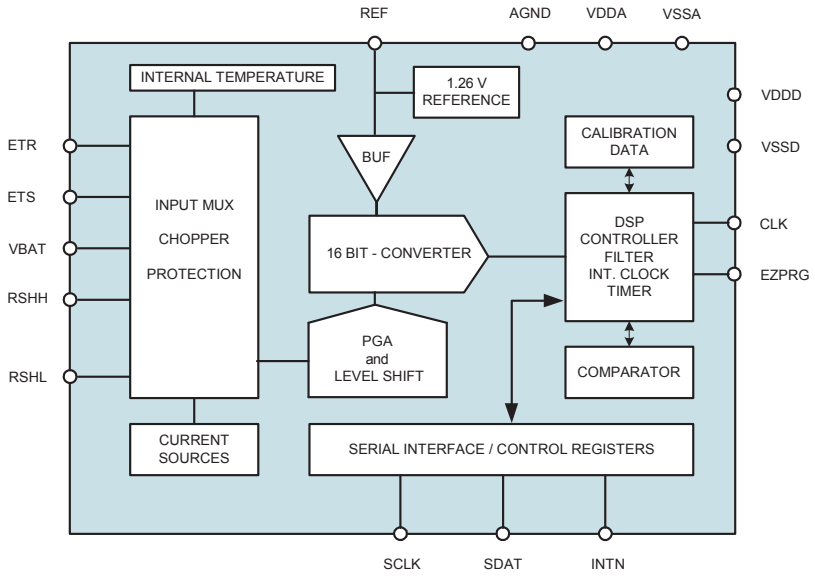
- 16-bits resolution
- Differential inputs
- Single + 5V supply
- Low power 15mW
- SOIC-16 package
- Up to 8kHz sampling rate
- Internal temperature sensor
- Internal reference
- Programmable current sources
- Digital comparator
- Active wake-up
- PGA gains 6, 24, 50, 100
- Zero offset
- Zero offset TC
- Extremely low noise
- Internal oscillator with comparator for active wake up
- 3-wire serial interface, µP compatible
- Temperature range -40 to +125°C

Applications

Battery management for automotive systems
- Power management
- mV/µV-meter
- Thermocouple temperature measurement
- RTD precision temperature measurement
- High-precision voltage and current measurement

Block Diagram

Functional block diagram



General Description

The AS8501 is a complete, low power data acquisition system for very small signals (i.e. voltages from shunt resistors, thermocouples) that operates on a single 5V power supply. The chip powers up with a set of default conditions at which time it can be operated as a read-only converter.

Reprogramming is possible at any time by just writing into two internal registers via the serial interface.

The AS8501 has four ground referring inputs which can be switched separately to the internal PGA. Two input Channels can also be operated as a fully differential ground free input. The system can measure both positive and negative input signals.

The PGA amplification ranges from 6 to 100 which enables the system to measure signals from 7mV to 120 mV full scale range with high accuracy, linearity and speed.

The chip contains a high precision band gap reference and an active offset compensation that makes the system offset free (better than 0,5 µV) and the offset-TC value negligible. The built-in programmable digital filter allows an effective noise suppression if the high speed is not necessary in the application.

The input noise density is only 35 nV / Hz and due to the high internal chopping frequency the system is free of 1/fnoise down to DC. The 0-10 Hz noise is typical below 1 µV i.e. as good or better than any other available chopper amplifier.

For high speed synchronous measurements the chip can run in an automatic switching mode between two input Channels with preprogrammed parameter sets.

The circuit has been optimised for the application in battery management systems in automotive systems. As a front-end data acquisition system it allows a high quality measurement of current, voltage and temperature of the battery.

With a high quality 100 µΩ resistor the system can handle the starter current of up to 1500 A, a continuous current of ± 300 A as well as the very low idle current of a few mA in the standby mode.

For external temperature measurement the chip can use a wide variety of different temperature sensors such as RTD, PTC, NTC, thermocouples or even diodes or transistors. A built-in programmable current source can be switched to any input and activate these sensors without the need of other external components.

The measurement of the chip temperature with the integrated internal temperature sensor allows in addition the temperature compensation of sensitive parameters which increases the total accuracy considerably.

Sensor specific data can be stored in the internal Zener-Zap memory and are used to calibrate each measurement in the internal data processing unit before transmission to the external µC via the serial SDI interface.

The flexibility of the system is further increased by a digital comparator that can be assigned to any measured property (current, voltage, temperature) and an active wake-up in the sleep-mode.

All analog input-terminals can be checked for wire break via the SDI-interface.

Key Features

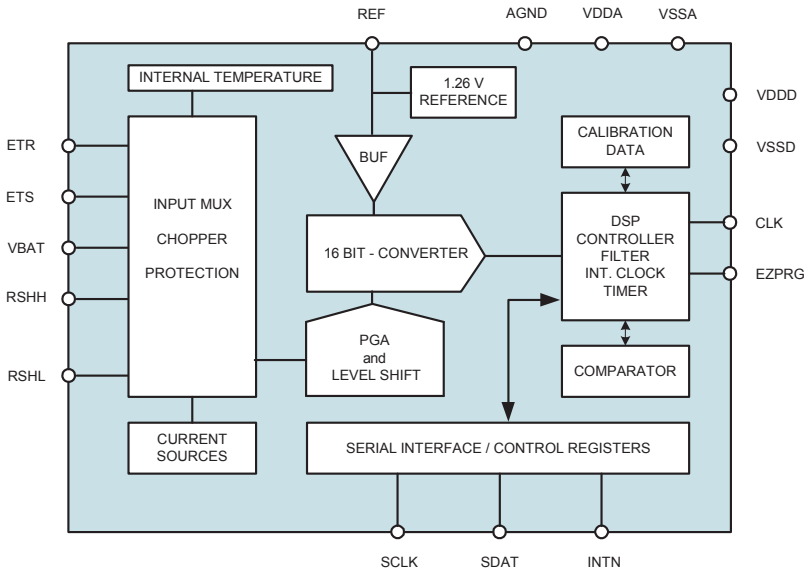
- 16-bits resolution
- Differential inputs
- Single + 5V supply
- Low power 15mW
- SOIC16 package
- Self- and system-calibration
  with auto-calibration on power up
- Up to 8kHz sampling rate
- Internal temperature measurement
- Internal factory trimmed precision reference
- Programmable current sources
- Digital comparator
- Active wake-up
- PGA gains 1, 6, 24, 50, 100
- Zero offset
- Zero offset TC
- Extremely low noise
- Internal oscillator with comparator for active wake up
- 3-wire serial interface, µP compatible
- Temperature range -40 to +125°C
- Individual 24-bit serial number

Applications

- Battery management for automotive systems
- Power management
- mV/µV-meter
- High-precision voltage and current measurement

Block Diagram

Functional block diagram



Full Service Foundry

Your Analog Foundry Partner

- CMOS based High-Voltage process outperforming BCD processes
- Low power SiGe-BiCMOS process outperforming RF-CMOS processes
- Highly accurate models ensuring first time right designs

We are the specialty analog foundry
- CMOS, High-Voltage CMOS with NVM and SiGe-BiCMOS

We go the extra mile for our customers
- Superior service in process design, engineering and backend
- Usability and highest accuracy of models

We offer a Full Service Foundry approach
- Complete foundry turnkey products
- Packaged and tested devices from customer design

We provide long-term supply
- Process availability more than 10 years in average

We have medical and automotive certified operations
- Regularly audited by the certification authorities
- ISO 16949:2002, ISO 13485, CECC 90000

We provide multiple sourcing via partnerships
- TSMC for 0.35µm CMOS
- Infineon for 0.35µm High-Voltage CMOS
- IBM for 0.18µm CMOS and High-Voltage CMOS

Technology Overview

Feature Size	austriamicrosystems Process Technology		# Masks	# Metal	5V Module	High Res Poly	Poly Caps	MIM Caps	Thick Metal	Additional Information
0.18µm	High-Voltage CMOS 20V / 50V	H18	27-34	3-7	✓	✓		✓	✓	R_{on}: 0,09 Ohm mm²
0.35µm	High-Voltage CMOS 20V / 50V	H35	18-27	3-4	✓	✓	✓		✓	R_{on}: 0,11 Ohm mm²
0.35µm	High-Voltage CMOS embedded Flash	H35EE	21-32	3-4	✓	✓	✓		✓	1Kx8 - 4Kx16 block size, high reliability
0.8µm	High-Voltage CMOS 50V	CXZ	15-17	2	✓	✓	✓			R_{on}: 0,29 Ohm mm²
0.35µm	SiGe-BICMOS 3.3/5V	S35	23-31	3-4	✓	✓	✓	✓	✓	f_T: 60/35 GHz, f_{max}: 70/50 GHz, B_{VCEO}: 2.7/5.5 V
0.8µm	BICMOS 5V	BYQ	16-17	2	✓	✓	✓			f_T: 12 GHz, f_{max}: 14 GHz, B_{VCEO}: >6 V
0.35µm	Opto-CMOS 3.3/5V	C350	17-19	4	✓	✓	✓			ARC layer, sensitivity 350mA/W at 550-900nm
0.35µm	CMOS embedded Flash 3.3/5V	C35EE	21-25	3-4	✓	✓	✓			1Kx8 - 32Kx16 block size, high reliability
0.35µm	CMOS Mixed-Signal 3.3/5V	C35	13-22	3-4	✓	✓	✓	✓	✓	TSMC compatible, RF extension
0.8µm	CMOS Mixed-Signal 5V	CXQ	11-13	2	✓	✓	✓			Suitable for high performance analog mixed-signal sensor applications

austriamicrosystems

foundry@austriamicrosystems.com

ASICs

Application Specific Integrated Circuits

Talk to the Experts

Your Partner for Turnkey ASIC Solutions

Industrial Sensors

Capacitive, magnetic and optical sensors and sensor interfaces from austriamicrosystems meet challenging specifications to enable advanced sensing systems in industrial process automation and building control.

Portable Medical Devices

austriamicrosystems provides highly integrated, low-power solutions for portable glucose meters, insulin pens and personal heart-rate monitors, bringing value to patients and health-conscious consumers.

Mobile Phones

Global leaders trust austriamicrosystems for special functions in mobile phones such as low-noise MEMS microphone interfaces. MEMS microphones offer space savings, better sound quality and reliability.

Automotive Sensors

austriamicrosystems' sensor interfaces comply with the most stringent safety and quality requirements. Applications include ESP and position measurement for steering wheel, accelerator and gear box.

Medical Imaging Equipment

austriamicrosystems supplies low-noise, high-precision detector interface components for digital X-ray machines and computer tomography systems. Technology leadership drives strategic partnerships with key OEMs.

Your Partner for High Quality Products

Integration of Complex Functions on CMOS Silicon

Integrated Sensors
Hall Elements
Photo Diodes
Temperature Sensor

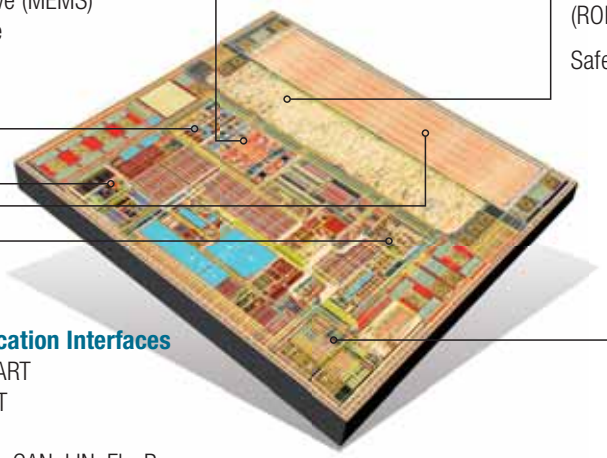
Sensor Interfaces
Magnetic
Optical
Resistive
Capacitive (MEMS)
Inductive

Signal Conversion
High Performance ADCs/DACs

Signal Processing
Digital Signal Processors with Calibration Memory (OTP/EEPROM)

Embedded Microcontroller (ROM/FLASH-based)

Safety Monitoring (IEC61508)



Actuation
Relay Driver
Full/Half Bridges

Gate Driver for External Transistors

Integrated Low/High Side Drivers

Capacitive Actuation (MEMS)

Communication Interfaces
SPI, SSI, UART
PWM, SENT
I^2C, I^2S
Automotive: CAN, LIN, FlexRay,
Ratiometric Analog Output

Power Management
Low Drop Regulator
(V_{input}: max. 50V/120V)
DC/DC Converters

Protections
Reverse Polarity
Load Dump
EMC/EMV

High Quality Products

Leading-Edge Technologies

State-of-the-art processes for

- High-Voltage CMOS (3V – 120V operating voltage)
- SiGe-BiCMOS
- Non-Volatile-Memory in CMOS and High-Voltage CMOS

0.35µ and 0.18µ process nodes.

Committed to Quality and Environment

As part of a comprehensive Zero Defect Program, austriamicrosystems has developed a highly respected design and manufacturing flow to ensure our products meet the most stringent quality requirements. austriamicrosystems is certified to all relevant automotive and medical standards including ISO/TS 16949:2000 and ISO/TS 13485:2003.

Long Process Availability

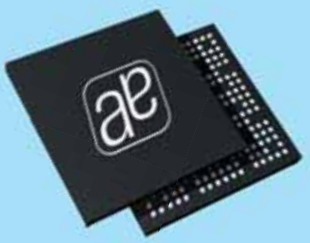
austriamicrosystems supports long life cycles for our customers' products as required in the automotive, industrial and medical markets.

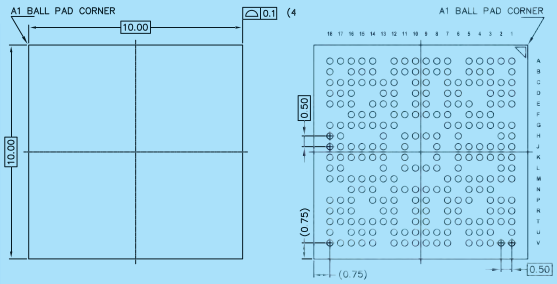
austriamicrosystems

a leap ahead in analog

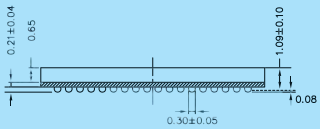
Overview Common Package Types

CTBGA Package



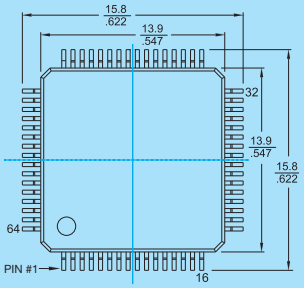


Top View Bottom View

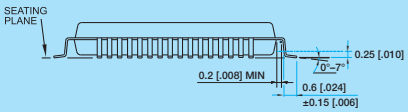


Side View

LQFP Package

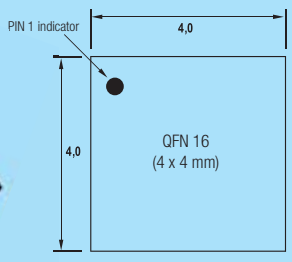


Top View

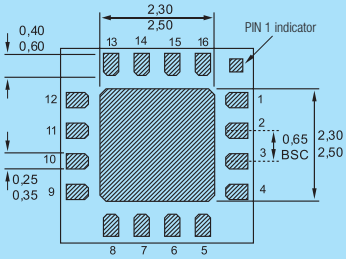


Side View

QFN Package



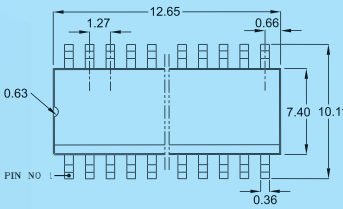
Top View



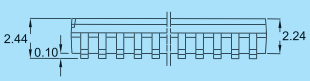
Bottom View

Side View

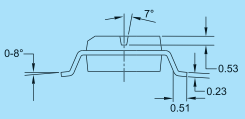
SOIC Package



Top View



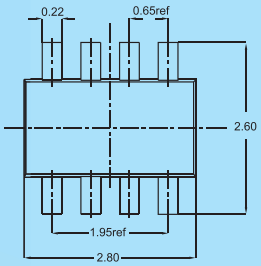
Side View



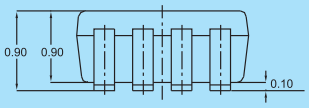
End View

Overview Common Package Types

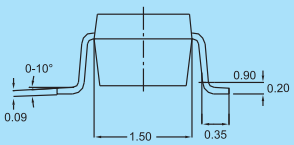
SOT Package



Top View

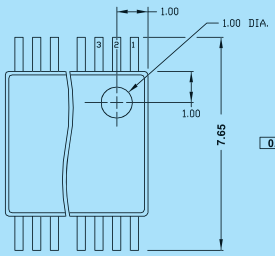


Side View

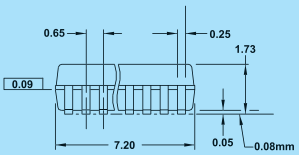


End View

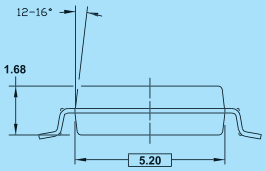
SSOP Package



Top View

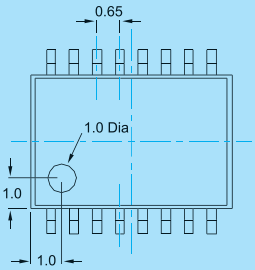


Side View

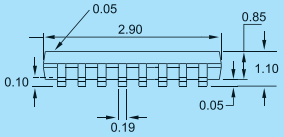


End View

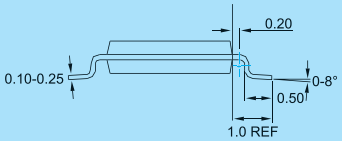
TSSOP Package



Top View

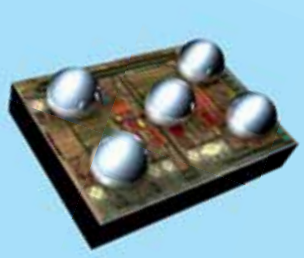


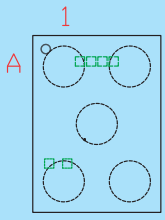
Side View



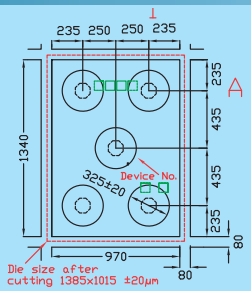
End View

WL-CSP Package

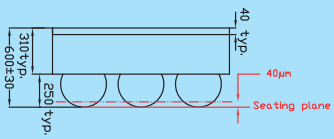




Top Through View



Bottom View



Side View

Notes