

Features

- High precision ADC, ENOB=17.2bits@8sps, 1 differential or 3 single-ended inputs
- Low noise, high input impedance preamplifier with selectable gain: 1, 12.5, 50, 100, or 200
- 8 bits RISC ultra low power MCU, 49 instructions and 6 stack levels. The MCU current consumption is 500uA typically at 3V and 2MHz operating clock rate, 1uA at standby and 32kHz clock, and less than 1uA at sleep
- 8k Bytes OTP, 256 Bytes SRAM
- Low OTP programming voltage at 2.4 ~ 3.6V, can replace external EEPROM
- Internal RC oscillator, no external clock needed
- 8 bits interrupt timer
- Built-in temperature sensor, supports single point calibration
- Selectable voltage source for external transducer excitation: 2.4V/2.6V/2.9V/3.3V,
- Flexible battery voltage detection: 2.4V ~ 3.0V
- Schmitt trigger input, pull up resistor selectable
- Watch Dog Timer
- Low voltage detection and power on reset circuit
- Operating voltage range: 2.4V ~ 3.6V
- Operating temperature range: -40°C ~ 85°C

Description

Pin Diagram and Descriptions

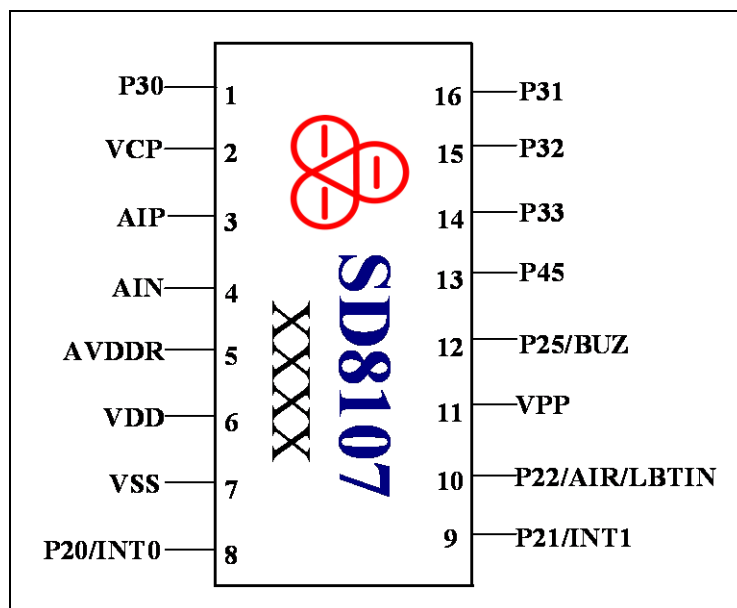


Figure 1. Pad diagram

The SD8107 is a CMOS SOC with built-in 20 bits ADC and 8k Bytes OTP memory. The built-in OTP has low programming voltage at 2.4V ~ 3.6V. It can be used in place of external EEPROM. The IC is specially designed for body weight or other domestic weight scale with LED display.

The IC was designed with ultra low power technology. Operates at 3V supply and halved internal RC oscillator frequency, the total typical operating current is 850uA (external transducer driving current not included). Such low current consumption is very suitable for battery powered applications.

Three working modes are provided so users can select the optimum choice between speed and power. They are normal mode, standby mode, and sleep mode.

Applications

Body weight scale, kitchen scale, palm scale, portable scale, tire pressure gauge

Ordering Information

SOP16 package

Table 1. Pad Descriptions

Pad No.	Pin Name	Attribute	Description
1	P30	I/O	Digital port P30
2	VCP	Analog	Connect 1uF filter capacitor to VDD
3	AIP	Analog	Analog signal differential inputs Should enable the internal pull-down resistor for unused input
4	AIN	Analog	
5	AVDDR	Analog	Internal LDO output for IC's internal analog module, can provide excitation to external transducer, connect 0.1uF filter capacitor to VSS
6	VDD	Power	Power supply voltage, connect 0.1uF capacitor to VSS
7	VSS	Ground	Power ground
8	P20/INT0	I/O	Digital port P20 or external interrupt INT0
9	P21/INT1	I/O	Digital port P21 or external interrupt INT1
10	P22/AIR/ LBTIN	I/O/ Analog	Digital port P22, analog signal or reference voltage input with respect to VSS, or low battery detect LBTIN input
11	VPP	I	OTP high voltage programming pin, connect 1uF capacitor to VSS
12	P25/BUZ	I/O	Digital port P25 or buzzer output BUZ
13	P45	I/O	Digital port P45
14-16	P33 -- P31	I/O	Digital port P33-31

Remark: All I/O ports Pnn have internal pull-up option (default OFF) and input hysteresis at 0.3VDD/0.7VDD.

Functional Block

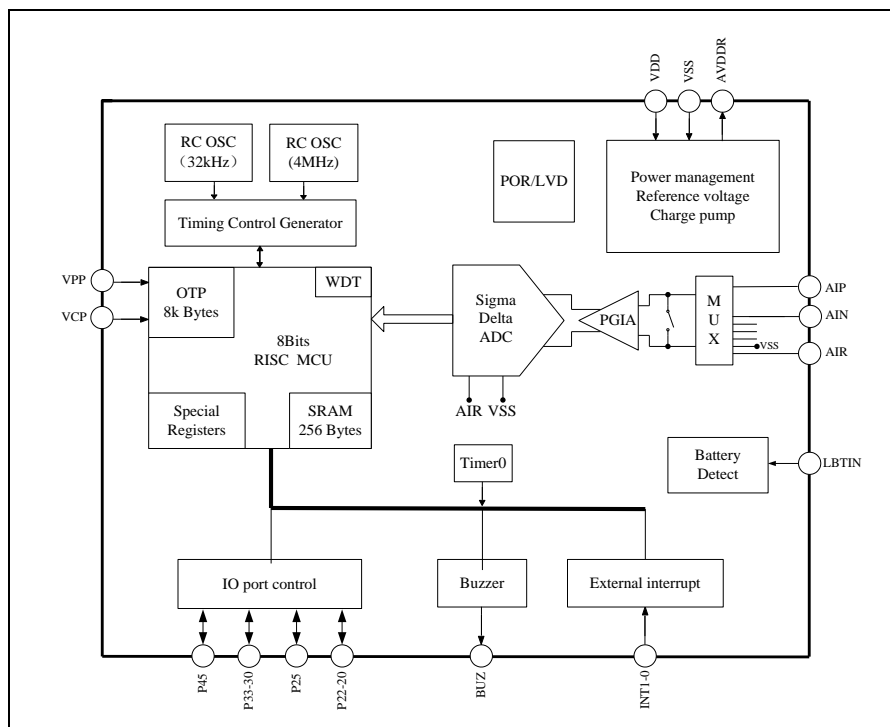


Figure 2. Functional block diagram

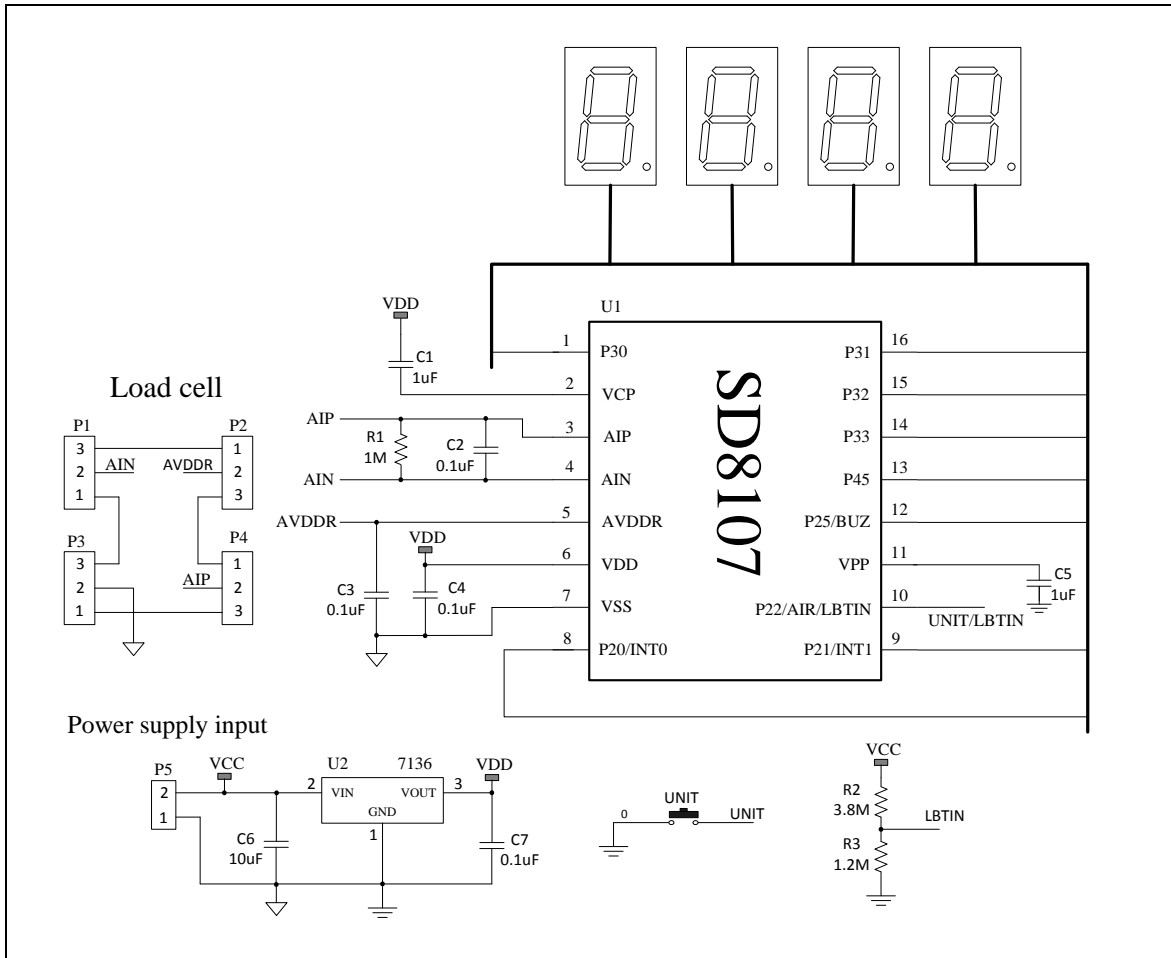
Typical Applications


Figure 3. LED Body scale typical application diagram

ADC Characteristics

 Table 2. ENOB and voltage noise $V_{n_{rms}}$ (AVDDR=2.4V, VREF=0.6V, SINC3, Buffer on)

ADC sampling rate = 128kHz										
OSR		128	256	512	1024	2048	4096	8192	16384	
Gain	200	ENOB	14.0	14.5	15.0	15.5	16.0	16.5	16.9	17.2
		$V_{n_{rms}}(nV)$	362	256	185	127	93	65	49	39
	100	ENOB	14.9	15.4	15.9	16.4	16.9	17.4	17.8	18.3
		$V_{n_{rms}}(nV)$	381	270	198	134	95	70	52	38
	1	ENOB	16.4	17.1	17.7	18.2	18.7	19.2	19.8	20.2
		$V_{n_{rms}}(nV)$	13761	8366	5806	3984	2807	1949	1348	1036

ADC sampling rate = 256kHz										
OSR		128	256	512	1024	2048	4096	8192	16384	
Gain	200	ENOB	13.6	14.2	14.7	15.2	15.7	16.2	16.6	17.0
		$V_{n_{rms}}(nV)$	471	322	229	162	115	82	60	47
	100	ENOB	14.4	15.1	15.6	16.1	16.6	17.1	17.5	18.0
		$V_{n_{rms}}(nV)$	709	335	242	173	121	87	65	45
	1	ENOB	16.2	16.5	17.3	17.9	18.5	19.1	19.7	20.1
		$V_{n_{rms}}(nV)$	15739	10405	7783	5191	3378	2183	1450	1060

Remark:

The above data are averages based on multiple ICs' measured results. Each IC contributes 1024 data points.

$$ENOB = \log_2\left(\frac{FRS}{V_{rms}}\right), \text{ FRS is the Full Scale Voltage Range } (2 * V_{ref} / \text{Gain}), V_{rms} \text{ is the rms Noise.}$$

Oscillator Characteristics

Figure 4 and figure 5 are SD8017 oscillating frequency as function of power supply voltage from five parts.

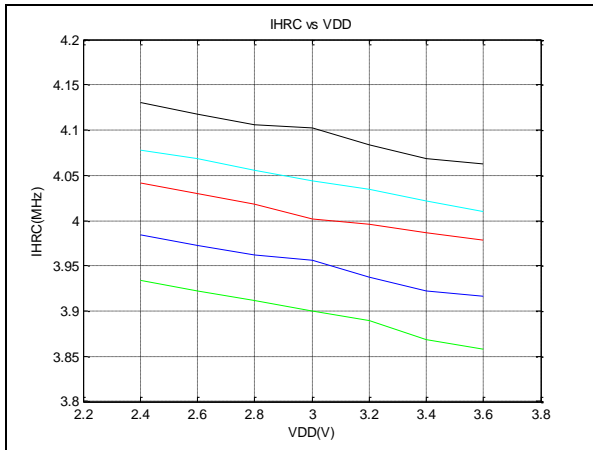


Figure 4. IHRC frequency vs voltage

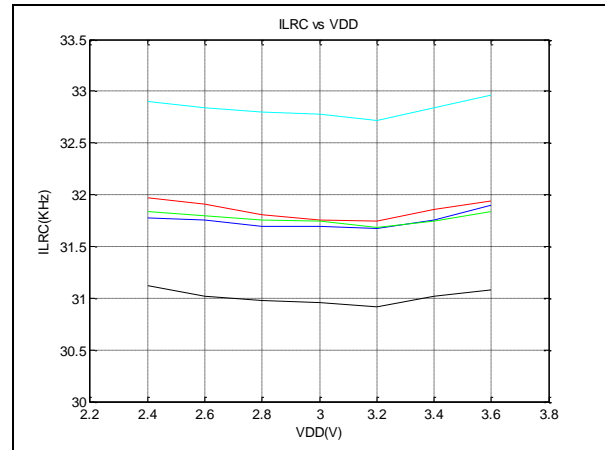


Figure 5. ILRC frequency vs voltage

Figure 6 and figure 7 are SD8017 oscillating frequency as function of temperature from five parts.

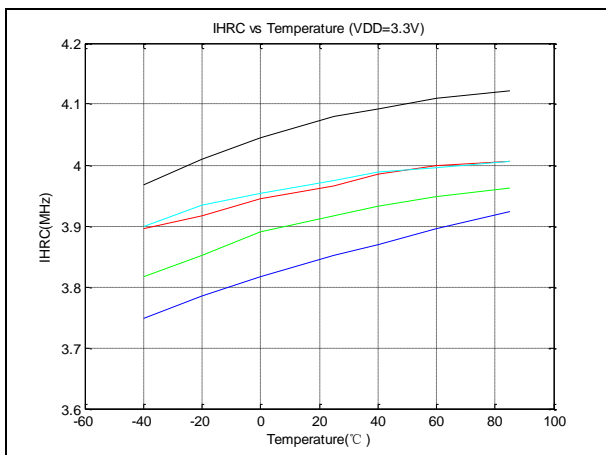


Figure 6. IHRC frequency vs temperature

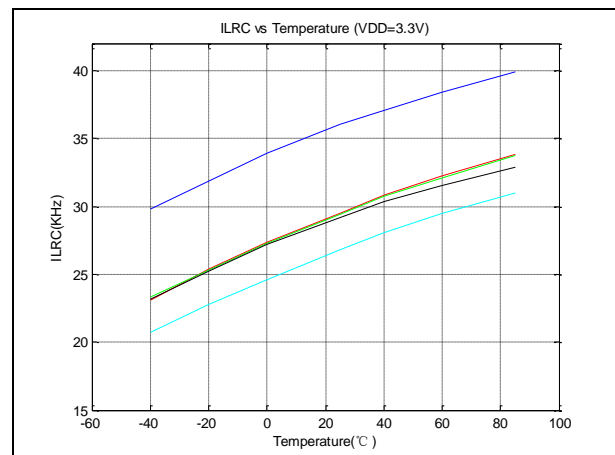


Figure 7. ILRC frequency vs temperature

Electrical Specifications

Table 3. Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Unit
T_A	Operating temperature	-40	+85	°C
T_S	Storage temperature	-55	+150	°C
V_{DD}	Supply voltage	-0.2	+4.0	V
V_{pp}	Programming voltage	-0.2	+7.5	V
V_{IN}, V_{OUT}	Digital input/output voltage	-0.2	$V_{DD}+0.3$	V
T_L	Reflow temperature profile	Per IPC/JEDECJ-STD-020C		°C

Remarks:

1. CMOS device can easily be damaged by electrostatics. It must be stored in conductive foam, and careful not to exceed the operating voltage range.
2. Turn off power before insert or remove the device.

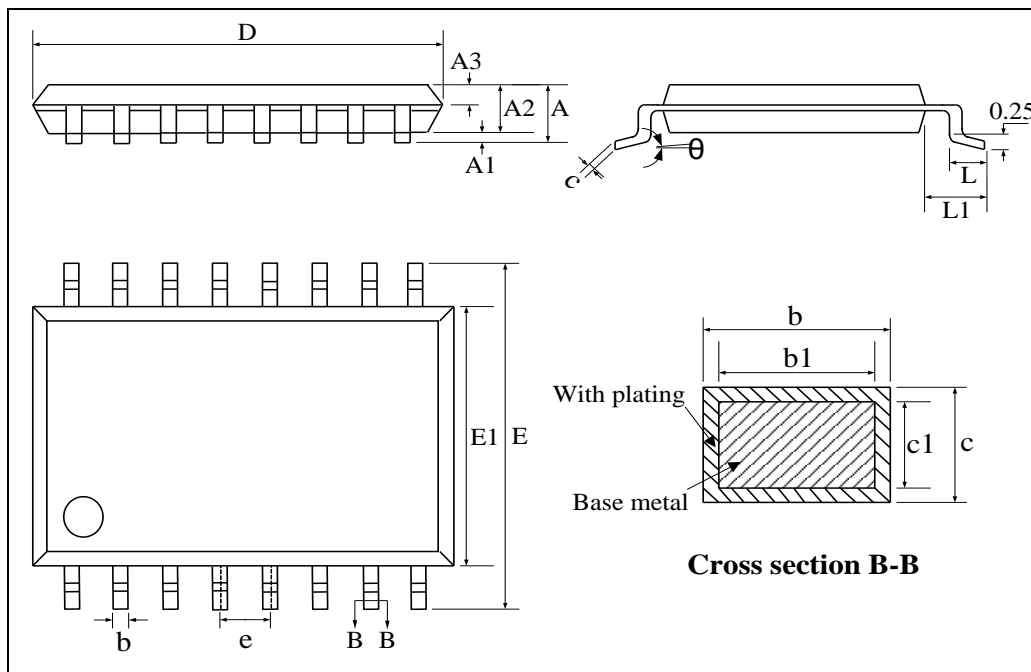
 Table 4. Electrical Specifications ($V_{DD}=3V, T_A=25^\circ C$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions/Remarks
VDD	Supply voltage	2.4	3.0	3.6	V	Analog modules operating voltage
		2.0	3.0	3.6	V	Digital modules and MCU operating voltage
FOSC	Operating frequency	0.016	2	4	MHz	FOSC must be 2MHz when read/write tables in OTP
IHRC	Internal high frequency RC oscillator	--	4	--	MHz	Frequency after calibration
ILRC	Internal low frequency RC oscillator	28	--	36	kHz	Frequency after calibration
IDD1	Operating current 1	--	850	--	uA	4MHz internal RC oscillator freq halved for MCU Digital and analog modules both active
IDD2	Operating current 2	--	1	--	uA	32kHz internal RC oscillator for MCU MCU at standby mode Analog modules inactive
IDD3	Operating current 3	--	--	1	uA	MCU at sleep mode Analog modules inactive
Fsam	ADC sampling rate	--	--	256	kHz	
OSR	Over sampling rate	128	--	16384		
NFbit	Noise free bits ¹	--	16	--	bits	Gain=200, input FSR= $\pm 4mV$
VINpga	PGIA differential input range ²	--	--	1800	mV	1X gain
		-Vref/12.5	--	Vref/12.5		12.5X gain
		-Vref/50	--	Vref/50		50X gain
		-Vref/100	--	Vref/100		100 X gain
		-Vref/200	--	Vref/200		200 X gain
Vavddr	AVDDR Voltage output		2.4	--	V	AVDDR [1:0]=00
			2.6	--		AVDDR [1:0]=01
			2.9	--		AVDDR [1:0]=10
			3.3	--		AVDDR [1:0]=11
Iavddr	AVDDR current	--	10	--	mA	
POR	POR voltage	--	2.0	--	V	
LVD	LVD voltage	--	1.9	--	V	

THlbt	LVD hysteresis	--	200	--	mV	
Vlbt	Low VDD alarm threshold				V	LBTX[3:0]=0000~0011: Vlbt off
			LBTIN	--		LBTX[3:0]=1000
			3.05	--		LBTX[3:0]=1001
			2.95	--		LBTX[3:0]=1010
			2.85	--		LBTX[3:0]=1011
			2.75	--		LBTX[3:0]=1100
			2.65	--		LBTX[3:0]=1101
			2.55	--		LBTX[3:0]=1110
			2.45	--		LBTX[3:0]=1111
Digital I/O parameter						
IOH	Output high current source	--	12	--	mA	VOH=VDD-0.3V
IOL	Output low current sink	--	12	--	mA	VOL=0.3V
VIH	Input high voltage	0.7VDD	--	--	V	
VIL	Input low voltage	--	--	0.3VDD	V	
VOH	Output high voltage	VDD-0.3	--	--	V	
VOL	Output low voltage	--	--	VSS+0.3	V	
Rpu	Pin pull up resistance	--	50	--	kΩ	VDD = 3.0

Note:

- Noise free bits and effective resolution are both related to the signal's full scale range. Its peak to peak or rms noise plays the decisive role.
- The signal input range is limited by the differential signal input range and the absolute voltage at the input terminals. The first one is the real signal input range. It is affected by the PGIA gain and the ADC voltage reference choice. The second one includes both differential and common mode components and is mainly limited by the circuit.

Packaging Information


Dimension:mm

Symbol	Min.	Nom.	Max.
A	—	—	1.75
A1	0.05	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.48
b1	0.38	0.41	0.43
c	0.21	—	0.26
c1	0.19	0.20	0.21
D	9.70	9.90	10.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	—	0.80
L1	1.05BSC		
θ	0.00	—	8°

Figure 8. SOP16 mechanical specification