

Features

- High precision 24 bits ADC, selectable gain at 1/2/8/16, 3 differential or 5 Pseudo-differential inputs. Measures signal's true RMS value, instantaneous value, and frequency
- 8 bits RISC low power MCU, 49 instructions and 6 stack levels. The MCU current consumption is 400uA typically at 3.3V and 2.097MHz operating clock rate. Standby current is 7.6uA at 32kHz clock, and less than 3uA at sleep
- 16k Bytes OTP, 512 Bytes SRAM
- Built-in low frequency crystal oscillator, RC oscillator, and PLL to provide flexible clock selection
- Built-in 1.16V low TC voltage reference
- RTC module together with external 32.768kHz crystal provides calendar/time information including leap year, timing accuracy is adjustable
- Peripheral resources: UART, I²C, PWM, PFD, TIMER, 2 external interrupts
- All I/O have Schmidt trigger inputs and pull up resistors
- Low voltage detection and power on reset circuit
- Operating voltage range: 2.5V~ 3.6V
- Operating temperature range: -40°C~ 85°C

Description

SD3101 is a CMOS SOC with built-in 24 bits ADC. Input channels can be set as three differentials or five Pseudo-differentials. Input gain factor is selectable. Thus different needs can be satisfied.

AC or DC signals are measured directly. AC signal does not have to go through external rectification circuit.

ADC data output rate is selectable for appropriate choice between speed and precision.

The SOC is highly integrated. Very few external components are needed for AC/DC voltmeter or current meter realization.

Built-in UART and I²C ports simplify communication to computer or other devices.

The OTP can be programmed in situ and the programming voltage is generated internally. Data that do not change frequently such as calibration factors can be stored in OTP in place of external EEPROM.

The IC was designed with ultra-low power technology. Typical total operating current is only 1.2mA.

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.

If external oscillator is used but stopped due to interference, the internal RC oscillator becomes the new MCU clock source automatically.

The IC passes 4kV Electrical Fast Transient (EFT) test easily without using any additional protection circuit. It is suitable for applications in harsh environment.

Applications

- Three pairs DC or three phases AC voltmeter or current meter with UART/I²C
- Single pair DC or single phase AC voltmeter or current meter with UART/I²C
- Multi-channel DC or AC signal measurement with UART/I²C

Ordering Information

SSOP24 package

Pin Diagram and Descriptions

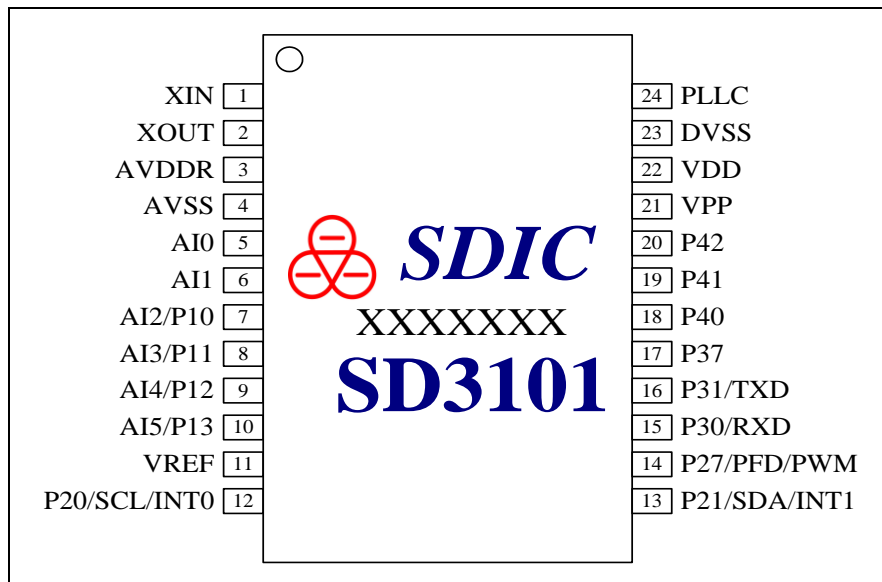


Figure 1. Pin out diagram

Table 1. Pin Descriptions

Pin No.	Pin Name	Attribute	Descriptions
1	XIN	Analog	Crystal oscillator input
2	XOUT	Analog	Crystal oscillator input
3	AVDDR	Analog	Internal LDO output for IC's analog module, connect 1uF capacitor to AVSS
4	AVSS	Ground	Analog ground
5-6	AI0--AI1	Analog input	Analog signal differential or two Pseudo-differential inputs
7-10	AI2/P10--AI5/P13	Analog input, I/O	Two analog differential or four Pseudo-differential inputs, or digital port P10-13
11	VREF	Analog	1.16V reference voltage for ADC, can connect to external reference source, connect 100pF and 10uF capacitor to AVSS
12	P20/SCL/INT0	I/O	Digital port P20, I ² C port SCL, or external interrupt INT0
13	P21/SDA/INT1	I/O	Digital port P21, I ² C port SDA, or external interrupt INT1
14	P27/PFD/PWM	I/O	Digital port P27 or PFD/PWM output
15	P30/RXD	I/O	Digital port P30 or UART port RXD
16	P31/TXD	I/O	Digital port P31 or UART port TXD
17	P37	I/O	Digital port P37
18-20	P40—P42	I/O	Digital port P40-42
21	VPP	Analog	OTP high voltage programming pin, connect 1uF capacitor to DVSS, internally boosted to 7.5V during programming
22	VDD	Power	Power supply for the IC, connect 0.1uF to DVSS

23	DVSS	Ground	Digital ground
24	PLL	Analog	PLL capacitor, connect 1nF to DVSS

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

Functional Block

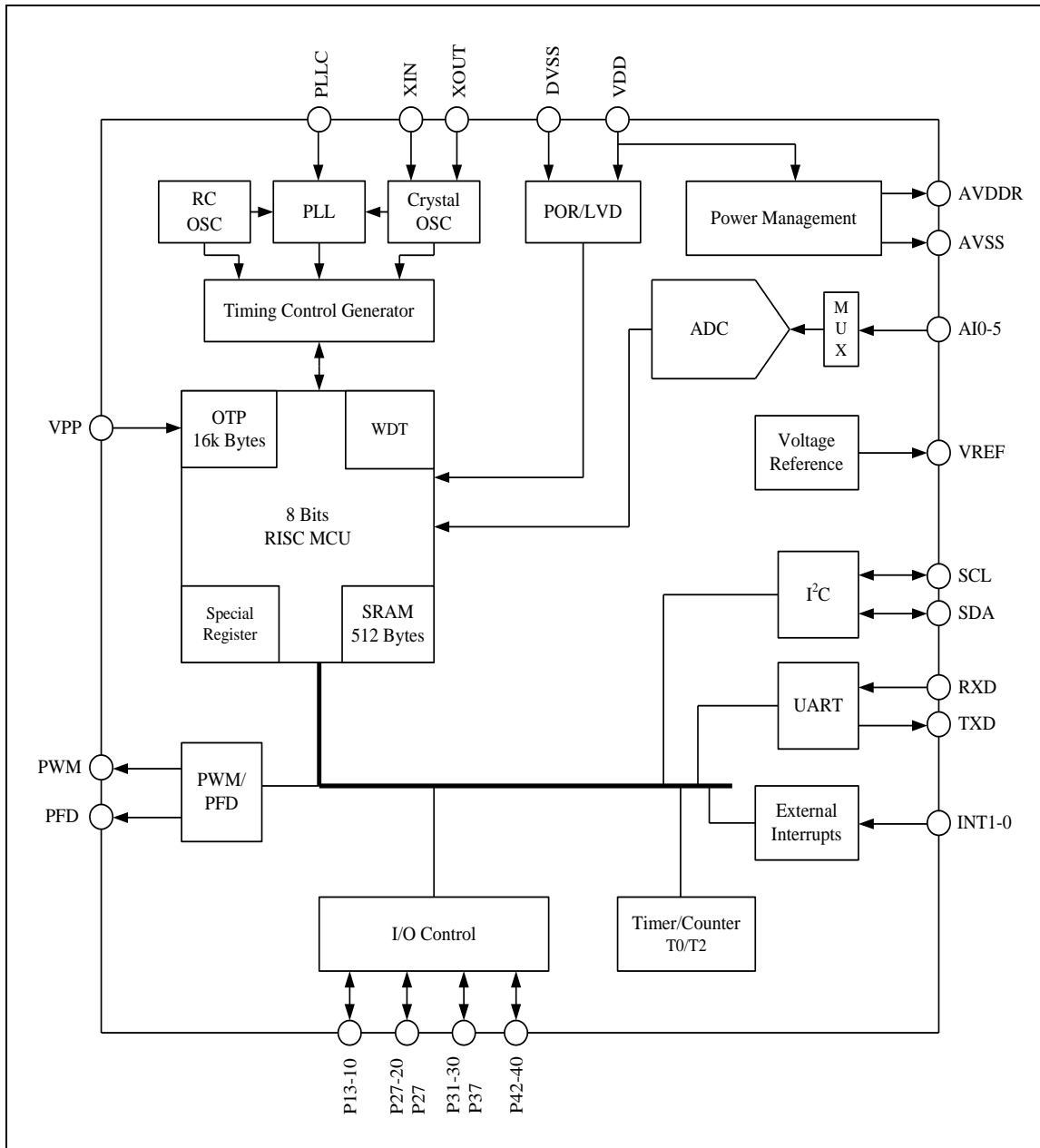


Figure 2. Functional block diagram

Typical Application

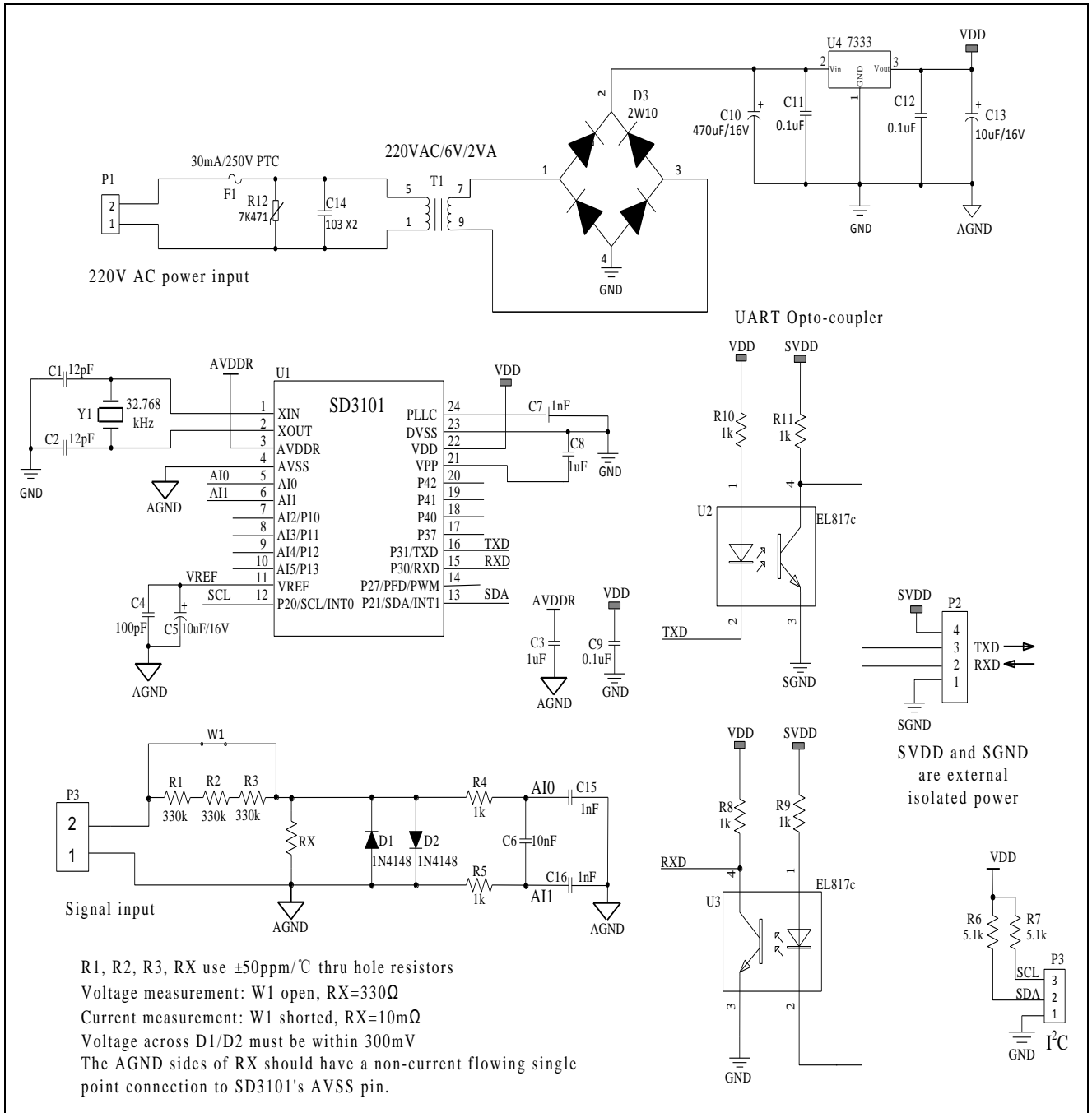


Figure 3. Single phase voltage meter/current meter typical application diagram

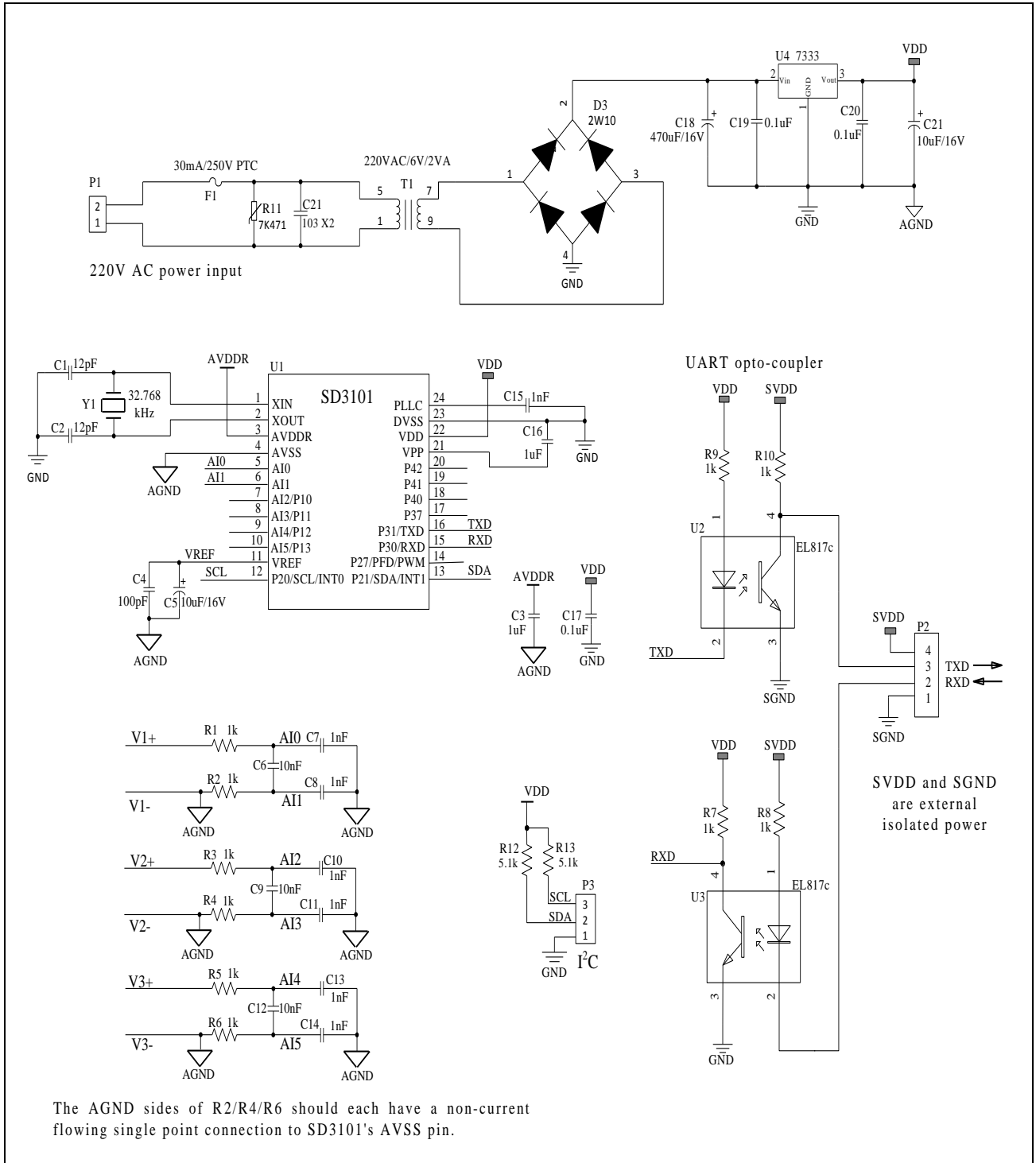


Figure 4. Three phases voltage meter/current meter typical application diagram

Electrical Specifications

Table 2. 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

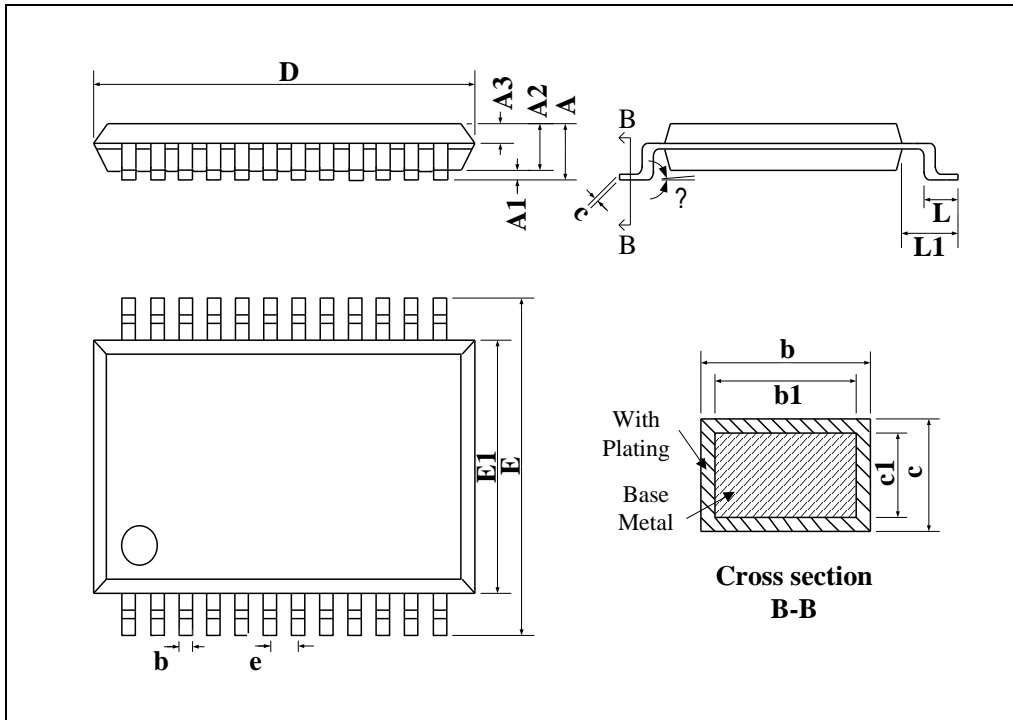
Remarks:

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 3. Electrical Specifications ($V_{DD}=3.3V, T_A=25^{\circ}C$)

Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions/Remarks
VDD	Power supply	2.0	3.3	3.6	V	Digital circuits operate down to 2.0V
FOSC	Operating frequency	0.032	2.097	4.194	MHz	FOSC must be around 2MHz when read/write tables in OTP
ILRC	Internal RC oscillator frequency		32		kHz	Frequency value after calibration
CRYXT	Crystal oscillator frequency		32.768		kHz	
FPLL	PLL output frequency		4.194		MHz	CRYXT clock source, can select ILRC instead
IDD1	Operating current 1		1.2		mA	FPLL/2 freq for MCU clock PLL input clock = CRYXT Analog modules active
IDD2	Operating current 2		7.6		uA	Internal RC oscillator for MCU clock MCU at standby mode Analog modules inactive
IDD3	Operating current 3		3		uA	MCU at sleep mode Analog modules inactive
Fsam	ADC sampling rate	--	1.05	--	MHz	
OSR	Over sampling rate	128	--	16384		Can select between 128 to 16384
GAIN	ADC gain	1		16		1/2/8/16 selectable
ENOB	Effective number of bits		19.5	--	bits	Gain=1
NMbit	No missing code	24	--	--	bits	SD3101AX
INL	Integral nonlinearity	--	0.002	--	%FSR	With external VREF
VINDif	ADC differential input voltage range	-0.6	--	+0.6	V	Gain=1
VINabs	ADC absolute input voltage range	-0.2	--	$AV_{DD}+0.2$	V	Gain=1
ACFreq	AC input signal frequency	40	--	400	Hz	

Nrms	RMS noise	--	2.2	--	uVrms	Gain=1
VREF	Voltage reference		1.16		V	
Rvref	VREF output resistance	--	4	--	kΩ	
TCvref	Vref TC	--	±50	--	ppm/°C	-40°C-85°C
Vavddr	AVDDR output voltage	--	2.4	--	V	avddrx[1:0]=00
		--	2.6	--		avddrx[1:0]=01
		--	2.9	--		avddrx[1:0]=10
		--	3.3	--		avddrx[1:0]=11
Iavddr	AVDDR output current	--	10	--	mA	
POR	Power on reset voltage	--	2.0	--	V	
LVD	Low voltage detect threshold	--	1.9	--	V	
THlbt	LVD hysteresis	--	200	--	mV	
Digital I/O parameter						
IOL	Low output current sink	--	12	--	mA	VOL=0.3V
IOH	High output current source	--	12	--	mA	VOH=VDD-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	Pull up resistance	--	50	--	kΩ	VDD = 3.0, P13-10
		--	200	--		VDD = 3.0, other I/O

Package Information


Dimensions: mm

Symbol	Min.	Nom.	Max.
A	—	—	2.00
A1	0.05	—	0.25
A2	1.65	1.75	1.85
A3	0.75	0.80	0.85
D	8.00	8.20	8.40
E	7.60	7.80	8.00
E1	5.10	5.30	5.50
L	0.75	—	1.05
L1	1.25BSC		
b	0.29	—	0.37
b1	0.28	0.30	0.33
c	0.15	—	0.20
c1	0.14	0.15	0.16
e	0.65BSC		
θ	0°	—	8°

Figure 5. SSOP24 mechanical specification