

# 1 Diff Channel Meterage SOC with Display Driver, I<sup>2</sup>C and Keys

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## Features

- High precision 24 bits ADC, selectable gain at 1/2/8/16, 1 differential input. Measures signal's true RMS and instantaneous values
- 8 bits RISC low power MCU, 49 instructions and 6 stack levels. The MCU current consumption is 400uA typically at 3.3V and 2.048MHz 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 RC oscillator and PLL providing flexible clock selection
- 10SEG X 4COM LCD drive
- Built-in 1.16V low TC voltage reference
- Peripheral resources: I<sup>2</sup>C, TIMER, 2 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

SD3102 is a CMOS SOC with built-in 24 bits ADC. One differential inputs. Input gain factor is selectable to satisfy different needs.

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 IC has 10SEG X 4COM LCD driver. It can drive LED directly.

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

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.

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

- Single pair DC or single phase AC voltmeter or current meter with display
- DC signal measurement with display
- AC signal measurement with display

## Ordering Information

SSOP28 package

## Pin Diagram and Descriptions

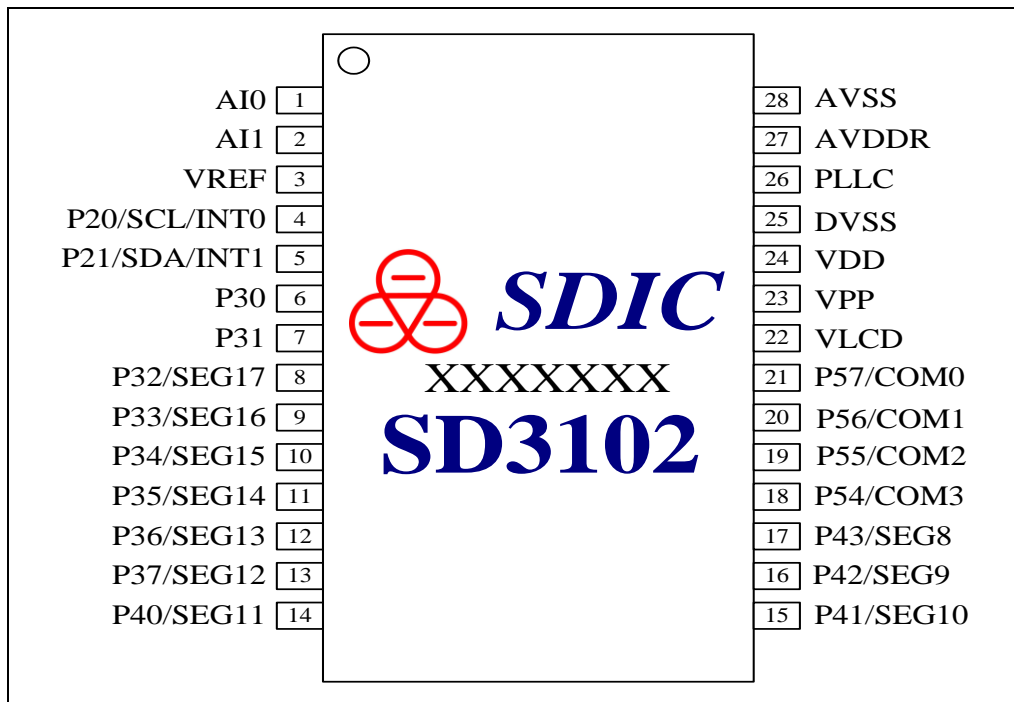


Figure 1. SSOP28 pin out diagram

Table 1. Pin Descriptions

Pin No.	Pin Name	Attribute	Descriptions
1-2	AI0--AI1	Analog input	Analog signal differential input
3	VREF	Analog	1.16V reference voltage for ADC, can connect to external reference source, connect 100pF and 10uF capacitor to AVSS
4	P20/SCL/INT0	I/O	Digital port P20, I <sup>2</sup> C port SCL, or external interrupt INT0
5	P21/SDA/INT1	I/O	Digital port P21, I <sup>2</sup> C port SDA, or external interrupt INT1
6-7	P30--P31	I/O	Digital port P30-31
8-13	P32/SEG17--P37/SEG12	I/O	Digital port P32-37 or LCD SEG17-12
14-17	P40/SEG11--P43/SEG8	I/O	Digital port P40-43 or LCD SEG11-8
18-21	P54/COM3--P57/COM0	I/O	Digital port P54-57 or LCD COM3-0
22	VLCD	Analog	LCD driver power source, connects internally to VDD or booster voltage through register setting, connect 1uF filter capacitor to VDD
23	VPP	Analog	OTP high voltage programming pin, connect 1uF capacitor to DVSS, internally boosted to 7.5V during programming
24	VDD	Power	Power supply for the IC, connect 0.1uF to DVSS
25	DVSS	Ground	Digital ground
26	PLLC	Analog	External PLL capacitor, connect 1nF to DVSS
27	AVDDR	Analog	Internal LDO output for IC's analog modules, connect 1uF to AVSS
28	AVSS	Ground	Analog ground

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

Functional Block

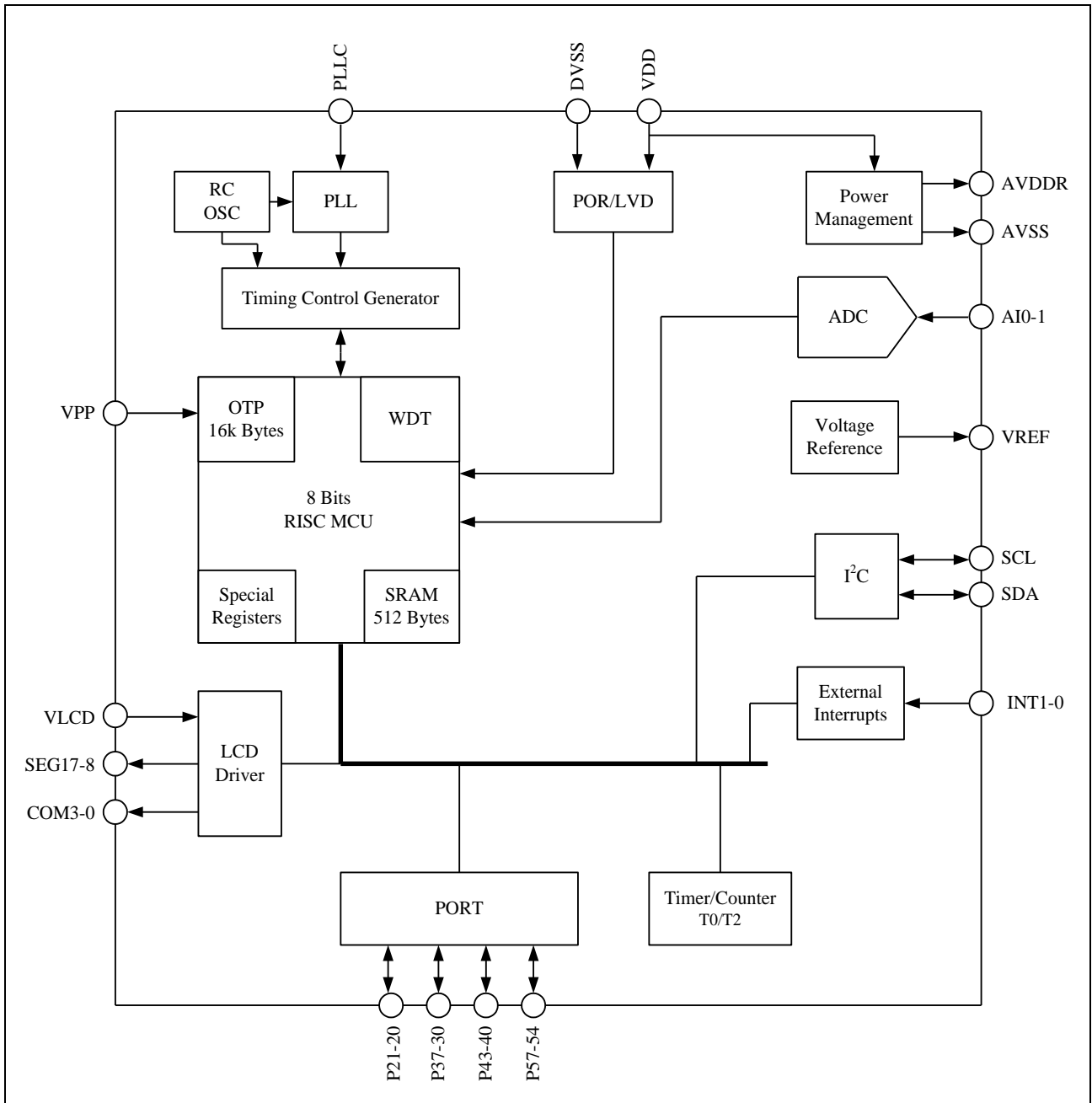


Figure 2. Functional block diagram

## Typical Application

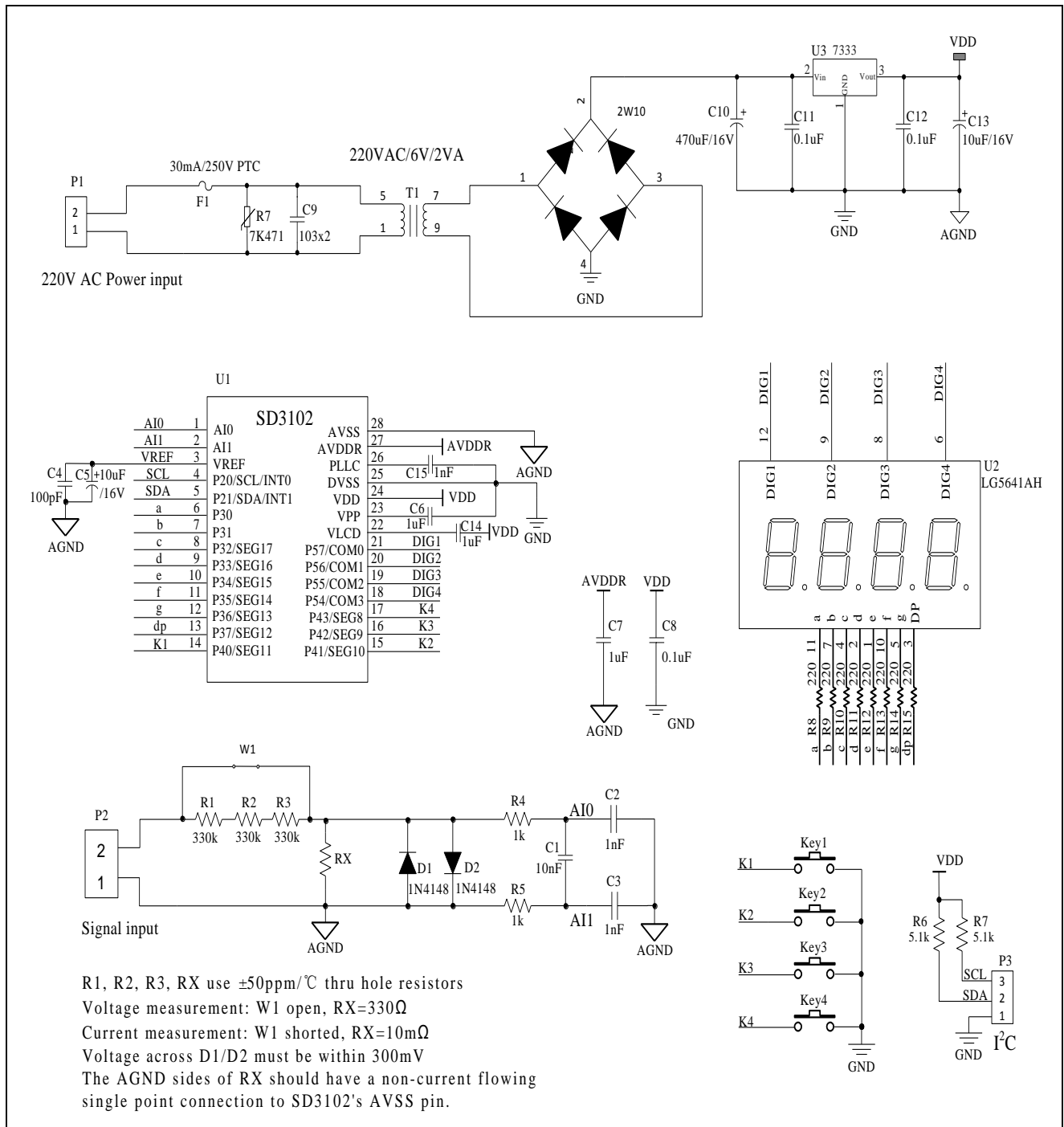


Figure 3. Four digits Voltage meter/Current meter typical application diagram

## 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 ( $V_{DD}=3.3V, T_A=25^\circ C$ )

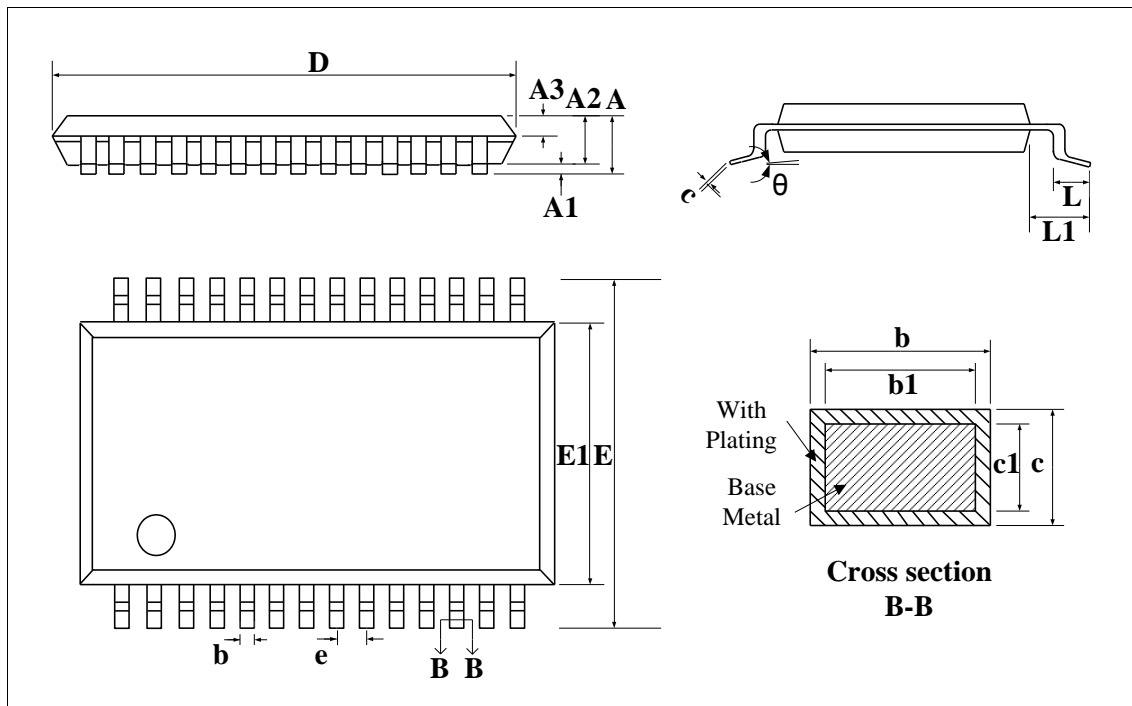
Symbol	Parameter	Minimum	Typical	Maximum	Unit	Conditions/Remarks
VDD	Power supply	2.0	3.3	3.6	V	Digital circuits operate down to 2.0V
FOSC	Operating frequency	0.032	2.048	4.095	MHz	FOSC must be around 2MHz when read/write tables in OTP
ILRC	Internal RC oscillator frequency	--	32	--	kHz	Frequency value after calibration
FPLL	PLL output frequency	--	4.096	--	MHz	ILRC clock source
IDD1	Operating current 1	--	1.2	--	mA	FPLL/2 freq for MCU clock PLL input clock = ILRC 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	
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	
Vnrms	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	
Vlcd	LCD charge pump output voltage	--	2.1	--	V	vlcdx[2:0]=000
		--	2.3	--		vlcdx[2:0]=001
		--	2.5	--		vlcdx[2:0]=010
		--	2.7	--		vlcdx[2:0]=011
		--	2.9	--		vlcdx[2:0]=100
		--	3.1	--		vlcdx[2:0]=101
		--	3.3	--		vlcdx[2:0]=110
		--	3.5	--		vlcdx[2:0]=111
Ilcd	LCD charge pump current output <sup>1</sup>	--	--	500	uA	
<b>Digital I/O parameter</b>						
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	--	200	--	kΩ	VDD = 3.0

Note:

1. Charge pump current drive capability is related to its working frequency. Higher frequency has stronger drive.

## 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	10.00	10.20	10.40
E	7.60	7.80	8.00
E1	5.10	5.30	5.50
L	0.55	0.75	0.95
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 4. SSOP28 mechanical specification