MT8652-3D

Omni-polar, Nano Power Hall-Effect Switch IC, 3D Sensing

1 Product Description

The MT8652-3D is produced with CMOS technology. The Hall IC internally includes high sensitivity horizontal hall plates, sleep/awake logics for mode control, a low-power on-chip oscillator, low noise analog signal chain with dynamic offset cancellation, hysteresis comparators and an output driver.

The MT8652-3D integrated IMC into the IC, that makes MT8652-3D sensitive to the magnetic flux which from X & Y & Z axis.

The product responds to either North pole or South pole magnetic fields. The output will be turned on (Low) when the magnetic flux density (B) is larger than the operating point (B_{OP}), and be turned off (High) when the magnetic flux density (B) is lower than the releasing point (B_{RP}).

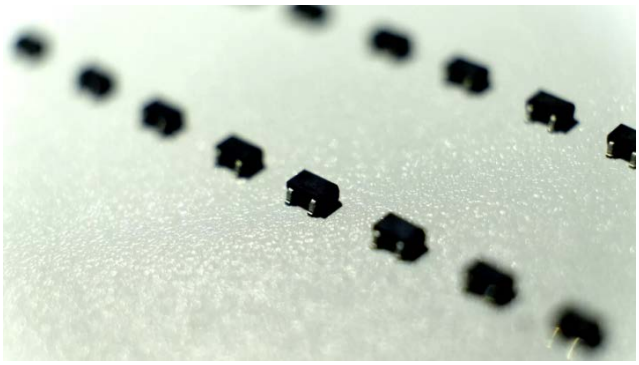
The MT8652-3D provides SOT-23-3L for surface mount. All packages are RoHS compliant.

2 Features

- CMOS Technology
- 3D Sensing (IMC Technology)
- Omni-polar Switch
- 2.0～5.5V Operating Vcc Range
- -40℃~125℃ Operating Temperature
- Package Option:
  SOT-23-3L
- Magnetic Sensitivity Option:
  B_{OP}=±16Gs, B_{RP}=±9Gs
- Open Drain Output
- Nano Power Consumption:
  Average Supply Current =600nA (Vcc=2.0V)
- RoHS Compliant: (EU)2015/863

3 Product Overview of MT8652-3D

Part No.	Description
MT8652AT-3D	SOT-23-3L, tape & reel (3000pcs/bag)



4 Applications

- Home appliances, Industrial
- Position Detection
- Solid-State Switch
- Proximity Switch
- Smart Meter
- Handheld Device
- Consumer Device

5. Pin Configuration and Functions

	Vcc	Out	GND
SOT-23-3L	1	2	3
Description	Power	Output Open Drain	Ground

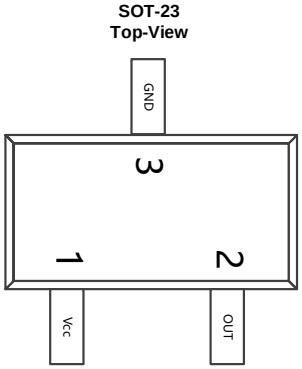


Figure.1 Pin Configuration & Functions

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Reversion History

1 Originally Version

6 Definition of Switching Function

Figure.2 shows the device functionality and hysteresis

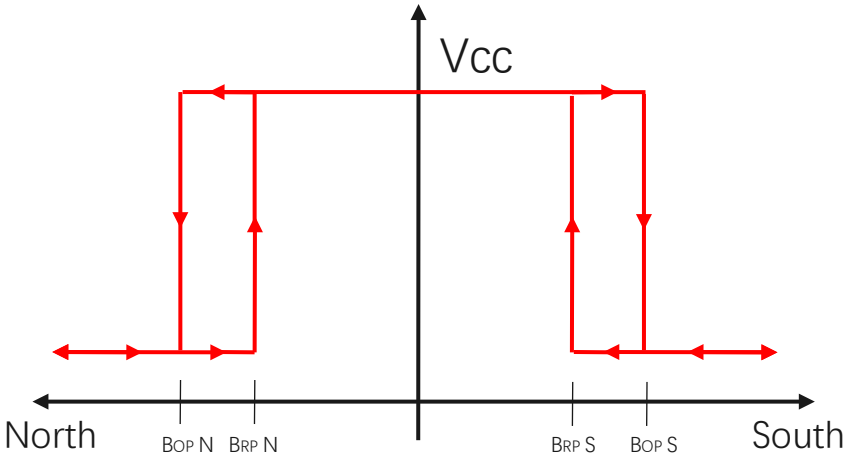

Figure.2 Omni-polar Switching Function

7 Function Description

B_{OP}: Operating Point, Magnetic flux density applied on the branded side of the package which turns the output driver ON (V_{OUT}=Low)

B_{RP}: Releasing Point, Magnetic flux density applied on the branded side of the package which turns the output driver OFF (V_{OUT}=High)

B_{HYST}: Hysteresis Window, $|B_{OP} - B_{RP}|$
Devices that have a lower magnetic threshold (V_{OUT}=High) detect magnets at a farther distance. Higher thresholds (V_{OUT}=Low) generally require a closer distance or larger magnet.

8 Feature Description

The MT8652-3D device is sensitive to the magnetic field from each axis of the chip

V_{OUT} = Low V_{OUT}= High

Figure.3 3D Sensing (South polar as example)

9 Functional Block Diagram

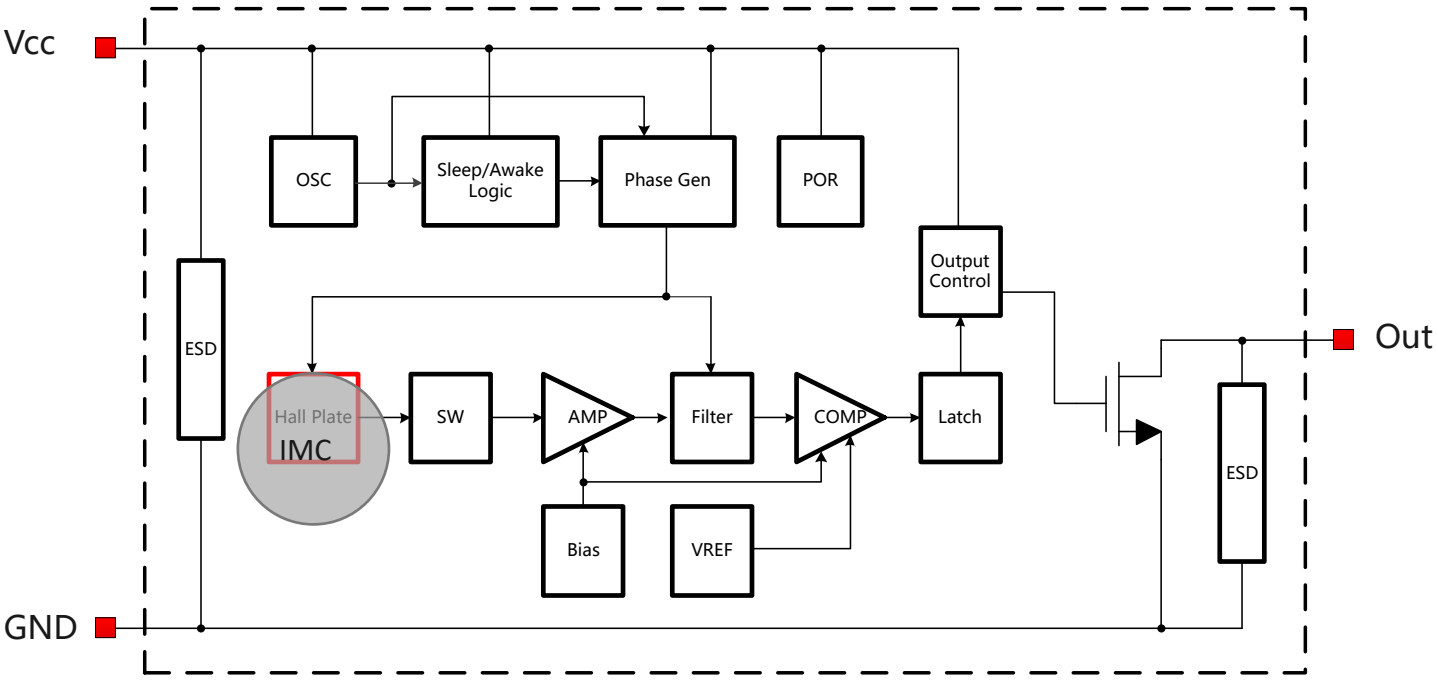

Figure.4 Functional Block Diagram

10 Electrical and Magnetic Characteristics

10.1 Absolute Maximum Ratings

Absolute maximum ratings are limited values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

Symbol	Parameters	Min	Max	Units
V_{CC}	Supply Voltage	-	7	V
V_{RCC}	Reverse Battery Voltage	-0.5	-	V
V_{OUT}	Output Voltage	-	7	V
I_{OUT}	Continuous Output Current	-	8	mA
T_A	Operating Ambient Temperature	-40	125	℃
T_S	Storage Temperature	-50	150	℃
T_J	Junction Temperature	-	165	℃
B	Magnetic Flux Density	No Limit		Gs

10.2 Electrical Specifications

At T_A=-40~125℃, V_{CC}=2.0V~5.5V (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	2.0	3.6	5.5	V
I_{CC}	Supply Current	V_{CC}=3.6V	-	1.2	2.0	uA
		V_{CC}=2.0V	-	600	-	nA
I_{AW}	Awake Current	V_{CC}=3.6V	-	3.0	5.0	mA
I_{SL}	Sleep Current	V_{CC}=3.6V	-	0.6	1.4	uA
V_{OL}	Output Low Voltage	I_{OUT}=5mA, |B|>|B_{OP}|	-	-	0.4	V
F_{SW}	Switching Frequency	V_{CC}=3.6V	10	20	40	Hz
T_{AW}	Awake Time	V_{CC}=2.0V to 5.5V	4	10	16	us
T_{SL}	Sleep Time	V_{CC}=2.0V to 5.5V	25	50	100	ms
D.C.	Duty Cycle	V_{CC}=2.0V to 5.5V	-	0.02	-	%
T_{PO}	Power on Time	dVcc/dt>5V/us, |B|>|B_{OP}|	-	-	120	us
R_{TH}	Thermal Resistance of SOT-23-3L		-	301	-	℃/W

10.3 Magnetic Characteristics

At V_{CC}=2.0V~5.5V (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT8652-3D Series	B_{OP}, T_A =25℃, Z axis	±8	±16	±24	Gs
	B_{RP}, T_A =25℃, Z axis	±2	±9	±16	Gs
	B_{HYST}, T_A =25℃, Z axis	-	7	-	Gs
	B_{OP}, T_A =25℃, X & Y axis	-	±16	-	Gs
	B_{RP}, T_A =25℃, X & Y axis	-	±9	-	Gs
	B_{HYST}, T_A =25℃, X & Y axis	-	7	-	Gs

10.4 ESD Ratings

Symbol		Reference	Values	Unit
V_{ESD}	Human-body model (HBM)	AEC-Q100-002	±5000	V
	Charged-device model (CDM)	AEC-Q100-011	±1000	V

10.5 Characteristic Performance

At V_{CC}=3.6V

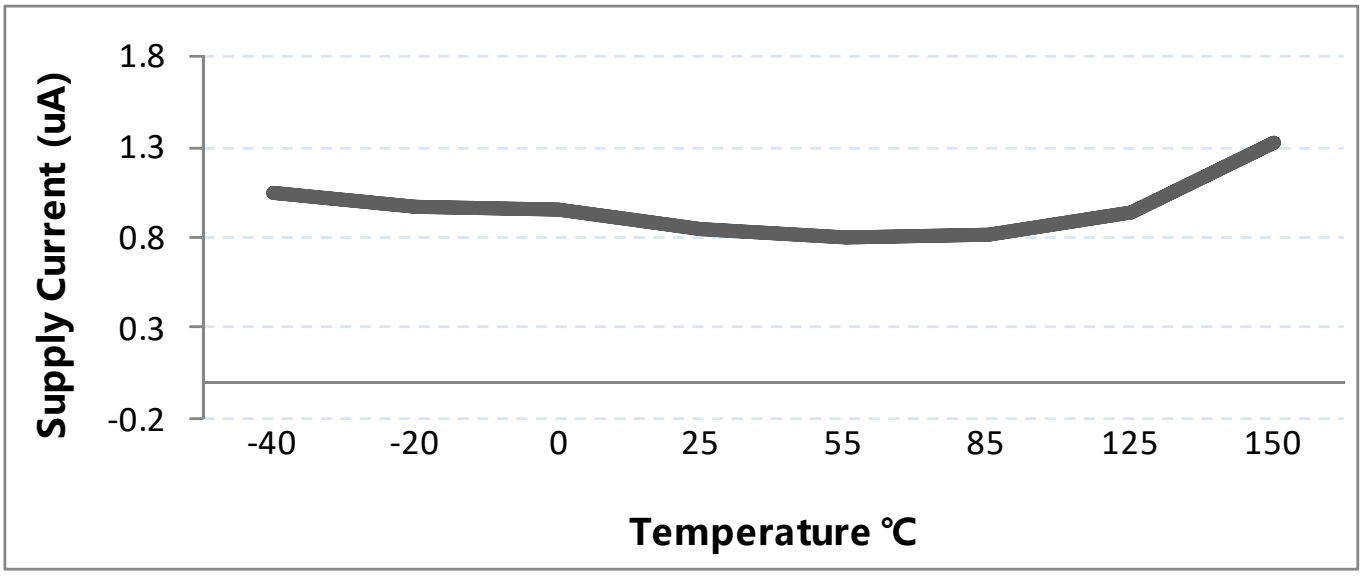

Figure.5 Supply Current vs. Temperature

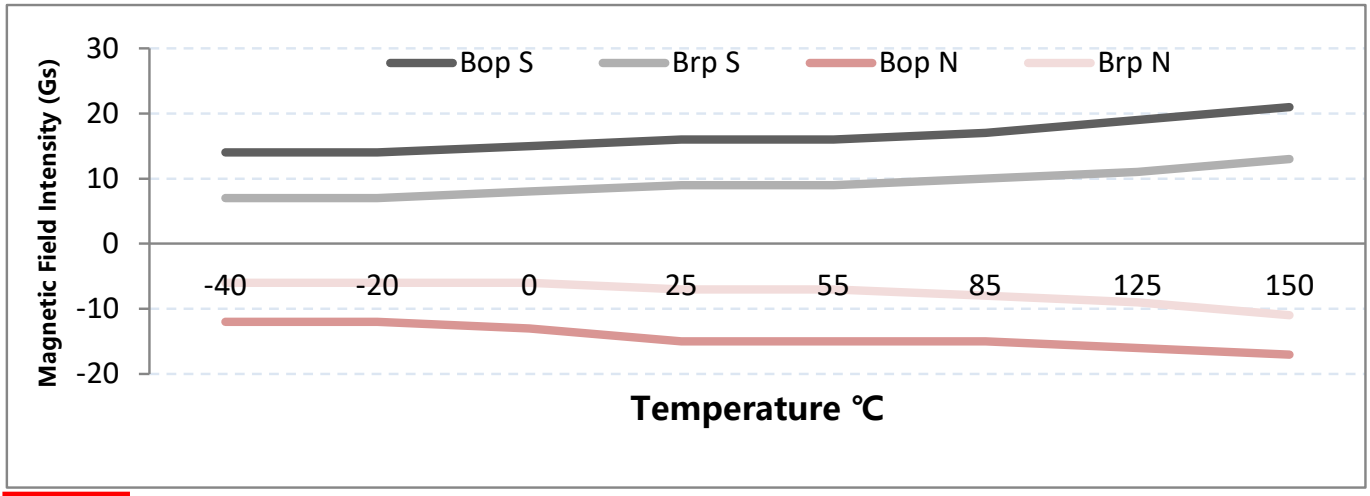

Figure.6 Magnetic Characteristics vs. Temperature (B_{OP} & B_{RP}) , Z axis as example

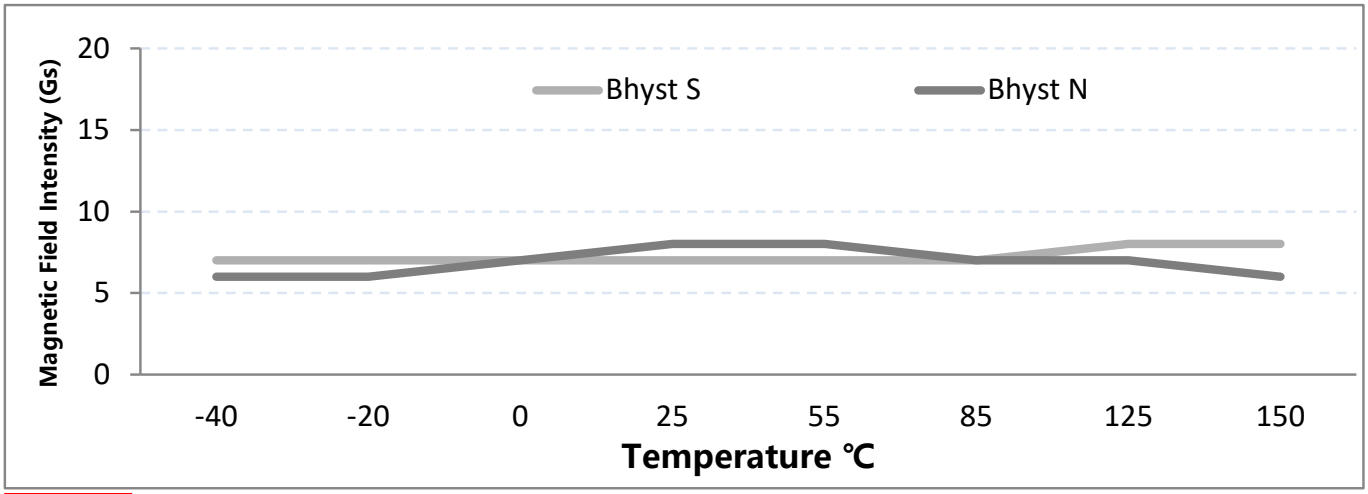

Figure.7 Magnetic Characteristics vs. Temperature (B_{HYST}) , Z axis as example

10.6 Typical Output Waveform

MT8652AT-3D as example

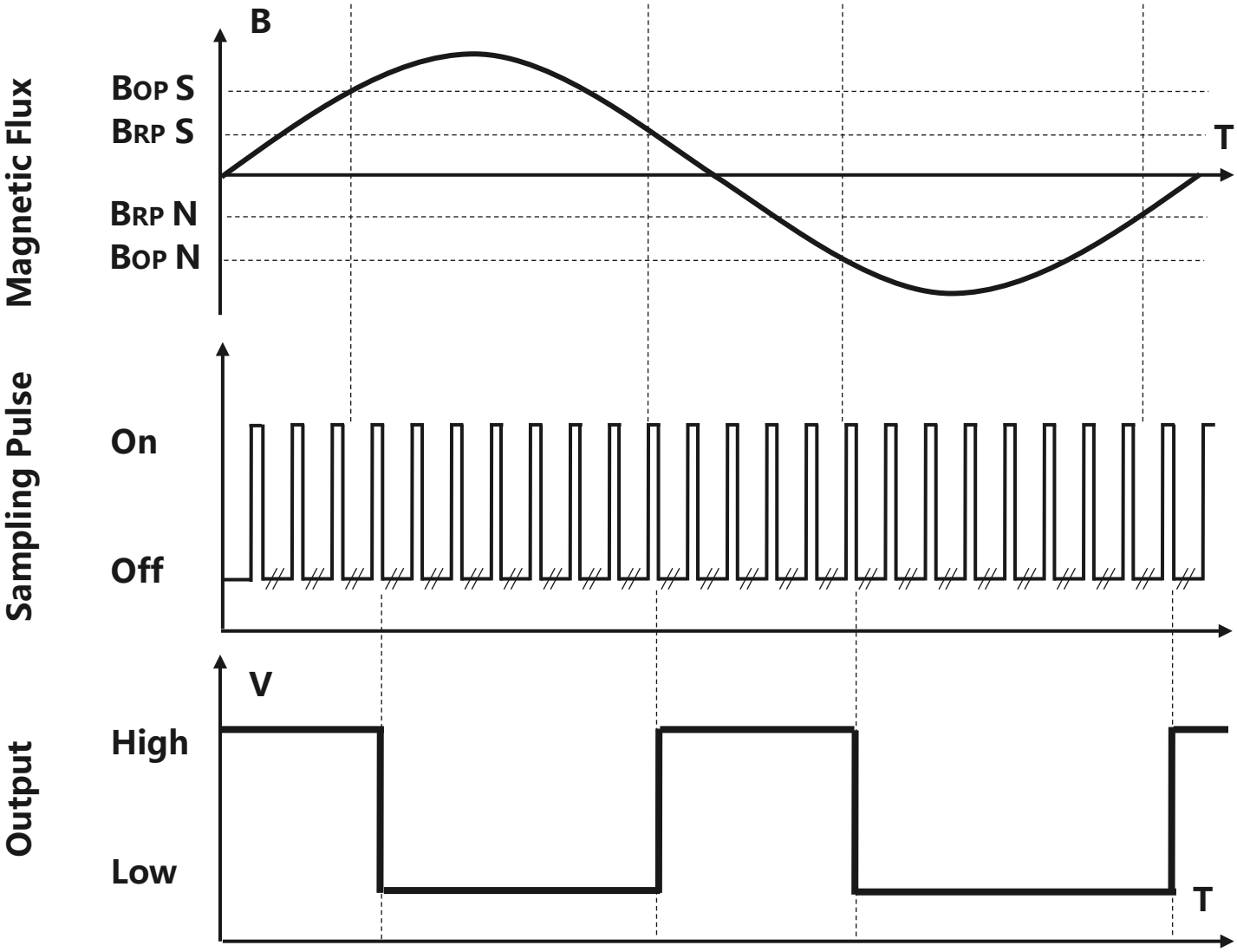

Figure.8 Digital Output vs. Magnetic Flux Density

11 Typical Application Circuit

MT8652AT-3D as example

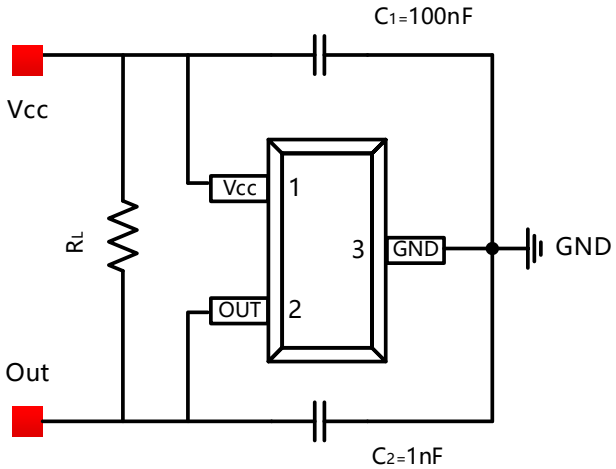

Figure.9 Typical Application Circuit

12 Package Material Information (For Reference Only – Not for Tooling Use)

12.1 SOT-23-3L Package Information

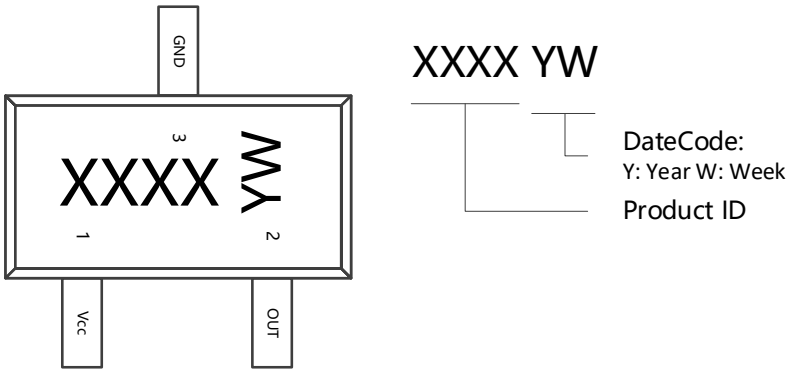

Figure.10 SOT-23-3L Chip Marking Spec

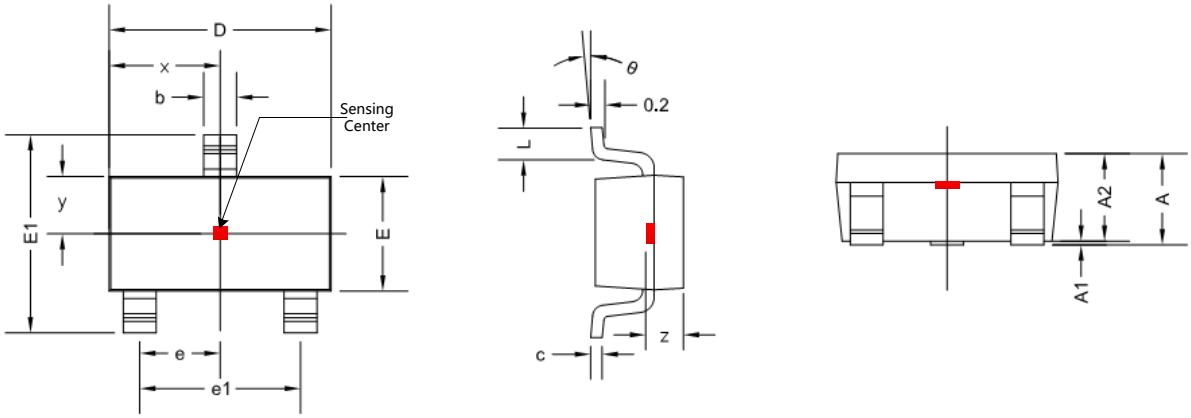

Figure.11 SOT-23-3L Package Drawing

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.300	0.041	0.051
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.300	0.500	0.012	0.020
c	0.080	0.220	0.003	0.009
D	2.800	3.020	0.110	0.119
E	1.500	1.700	0.059	0.067
E1	2.600	3.000	0.102	0.118
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0 °	8 °	0 °	8 °
x	1.460 TYP		0.057 TYP	
y	0.800 TYP		0.032 TYP	
z	0.600 TYP		0.024 TYP	

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