

Latch, Hall-Effect Magnetic position sensor

1 Product Description

The MT177 family is produced by BCD technology with both high performance and high reliability. The Hall IC internally includes an on-chip Hall voltage generator, a voltage regulator for operation with supply voltage of 2.4V to 24V, a small signal amplifier, Hall sensors with dynamic offset cancellation, a schmitt trigger and an open-drain output with over-current protection. It features temperature compensation technique to make the magnetic switching points stable over a wide temperature range. Other key features such as reverse supply voltage protection, output over-current protection and ESD level exceeding $\pm 6\text{KV}$ (HBM) make the IC extremely robust and fault tolerant, which is important in demanding application environment such as automotive. Its extremely low operating supply voltage 2.4V also makes it possible to add external resistance in series with the supply pin for even greater protection against high voltage transients from the power supply. 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}).

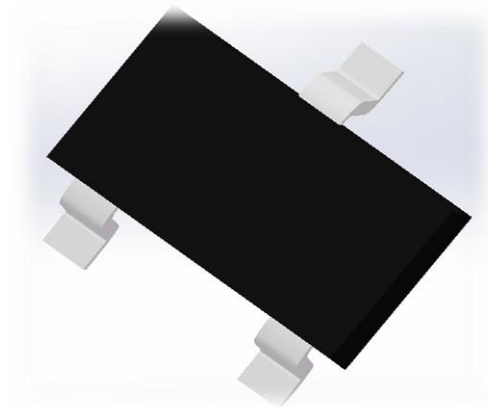
The MT177 is a SOT-23 surface mount package and is ROHS compliant.

2 Features

- BCD Technology
- 2.4 ~ 24V Operating Vcc Range
- $-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$ Operating Temperature
- Package Option: SOT-23
- Open Drain Output
- Switching Frequency: 100KHZ
- -27V Reversed Power Supply Protection
- Output Limiting Current Protection
- RoHS Compliant: (EU)2015/863

3 Product Overview of MT177

Part No.	Description
MT177	SOT-23, tape & reel (3000pcs/bag)



4 Applications

- Home appliances
- Industrial
- Position Detection
- Proximity Switch

5. Pin Configuration and Functions

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

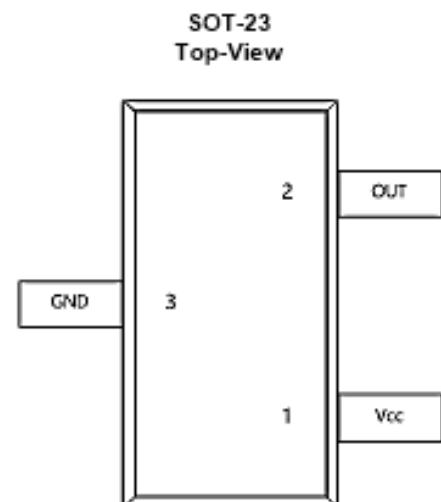


Figure.1

Pin Configuration & Functions

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Reversion History

Rev1.0 Originally Version

6 Definition of Switching Function

Figure.2 shows the device functionality and hysteresis

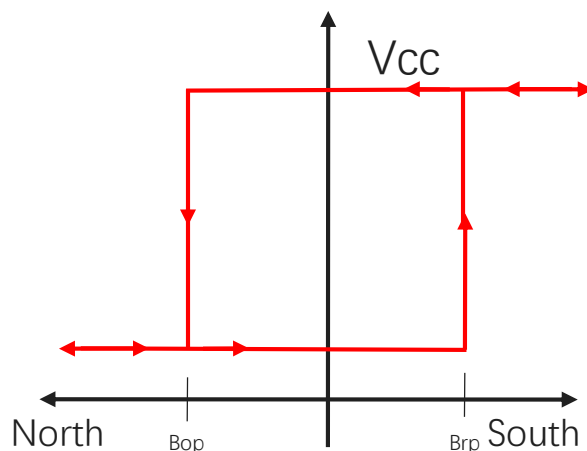


Figure.2 Switching Function of SOT-23

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 MT177 device is sensitive to the magnetic field component that is perpendicular to the top of the package

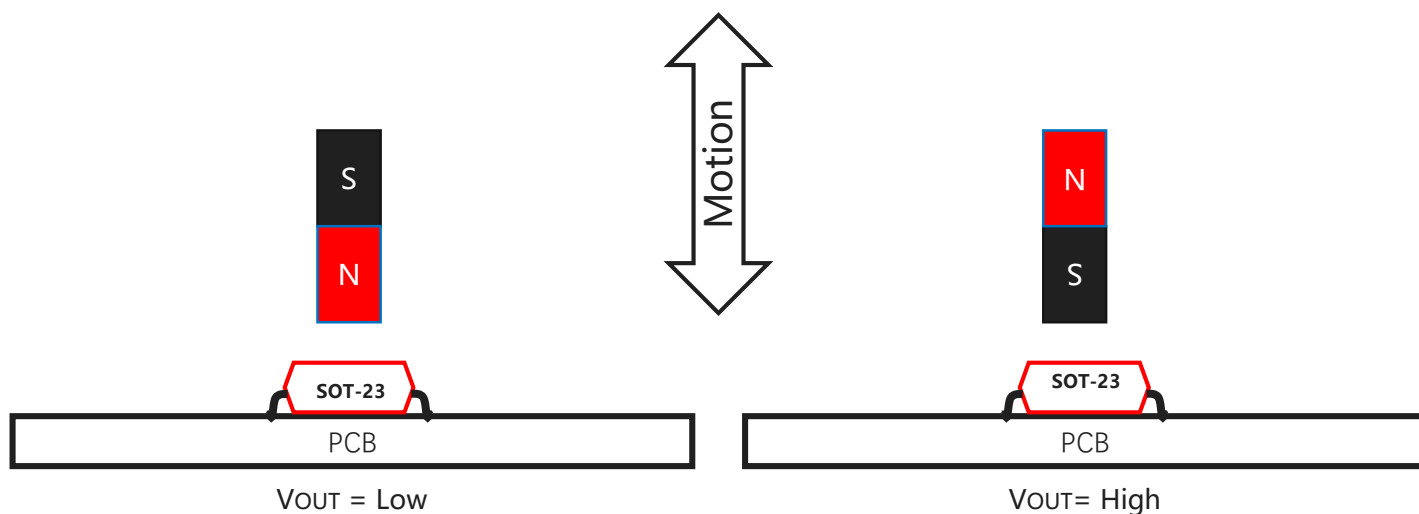


Figure.3 Flux Direction Polarity

9 Functional Block Diagram

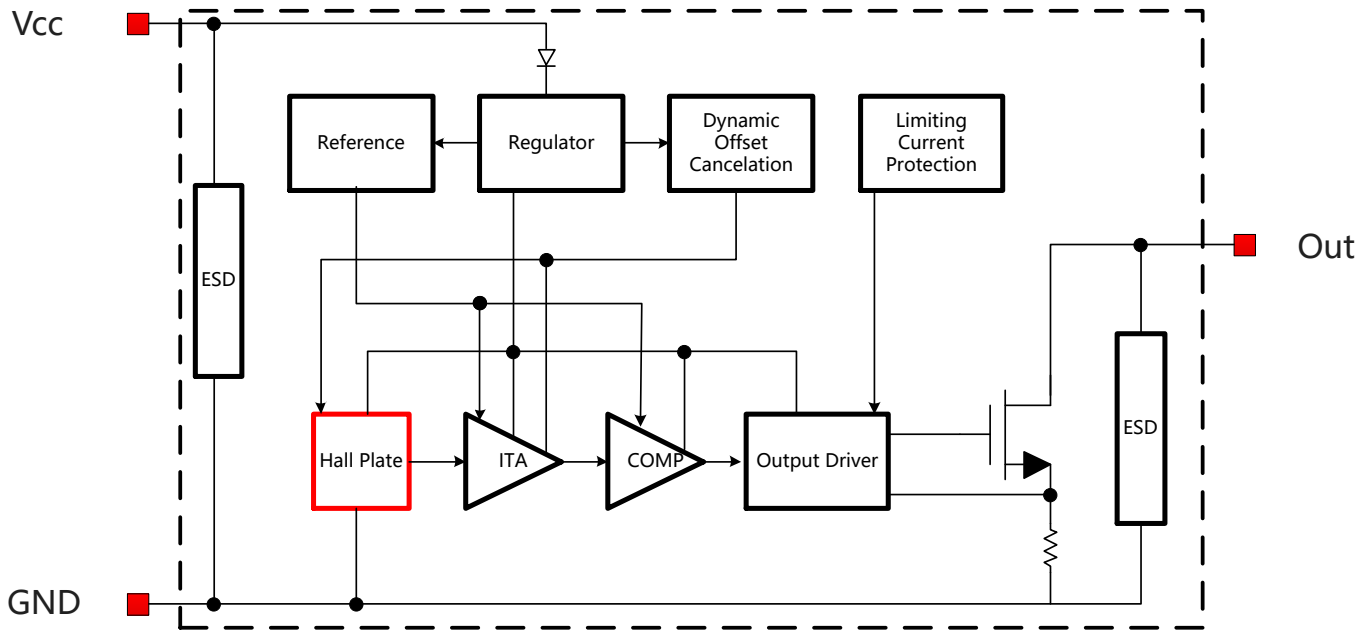


Figure.4 Functional Block Diagram

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	-	27	V
V _{RCC}	Reversed Power Supply Protection	-27	-	V
V _{OUT}	Output Voltage	-	27	V
I _{OUT}	Continuous Output Current	-	25	mA
T _A	Operating Ambient Temperature	-40	150	°C
T _S	Storage Temperature	-50	150	°C
T _J	Junction Temperature	-	165	°C
B	Magnetic Flux Density	No Limit		Gs

10.2 Electrical Specifications

At $T_A = -40 \sim 150^\circ\text{C}$, $V_{CC} = 2.4\text{V} \sim 24\text{V}$ (unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	2.4	-	24	V
I_{CC}	Supply Current	$V_{CC} = 5\text{V}$	-	1.2	-	mA
I_{AW}	Awake Current	$V_{CC} = 5\text{V}$	-	1.2	-	mA
V_{OL}	Output Low Voltage	$I_{OUT} = 10\text{mA}$, $ B > B_{OP} $	-	-	0.4	V
F_{SW}	Sampling Frequency	$V_{CC} = 5\text{V}$	-	100	-	KHz
T_{PO}	Power on Time	$dV_{CC}/dt > 5\text{V}/\mu\text{s}$, $ B > B_{OP} $	-	-	25	μs
R_{TH}	Thermal Resistance of SOT-23		-	301	-	$^\circ\text{C}/\text{W}$

10.3 Magnetic Characteristics

At $V_{CC} = 2.4\text{V} \sim 24\text{V}$ (unless otherwise specified)

Part No.	Symbol	Min	Typ	Max	Unit
MT177 Series	B_{OP} , $T_A = 25^\circ\text{C}$	10	20	30	Gs
	B_{RP} , $T_A = 25^\circ\text{C}$	-30	-20	-10	Gs
	B_{HYS} , $T_A = 25^\circ\text{C}$	20	40	60	Gs

10.4 ESD Ratings

Symbol		Reference	Values	Unit
V_{ESD}	Human-body model (HBM)	AEC-Q100-002	± 6000	V
	Charged-device model (CDM)	AEC-Q100-011	± 1000	V

10.5 Characteristic Performance

At $V_{CC}=5V$

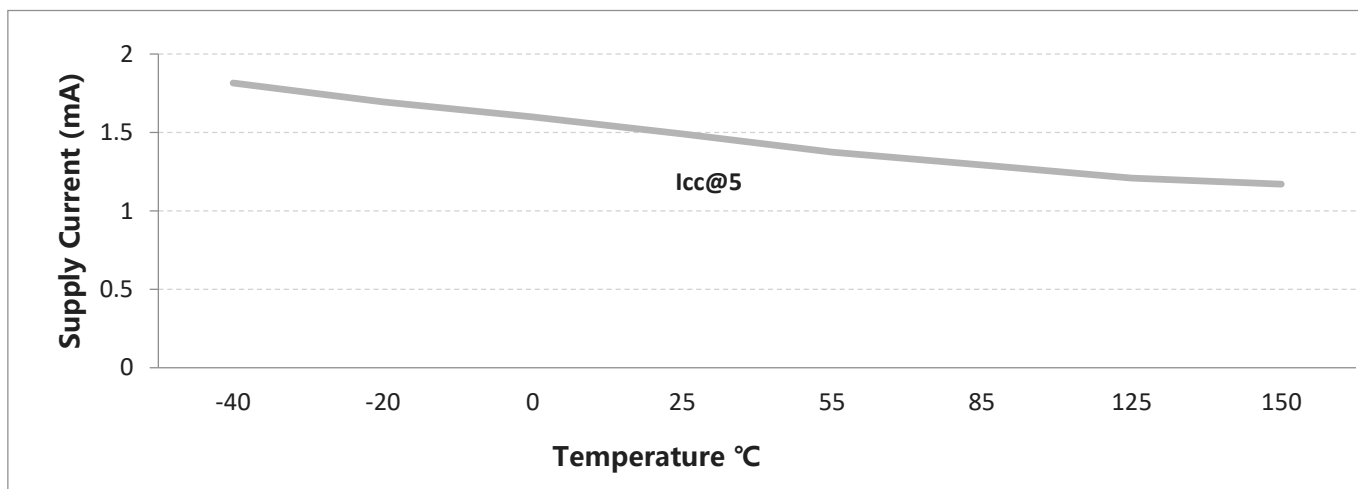


Figure.5 Supply Current vs. Temperature

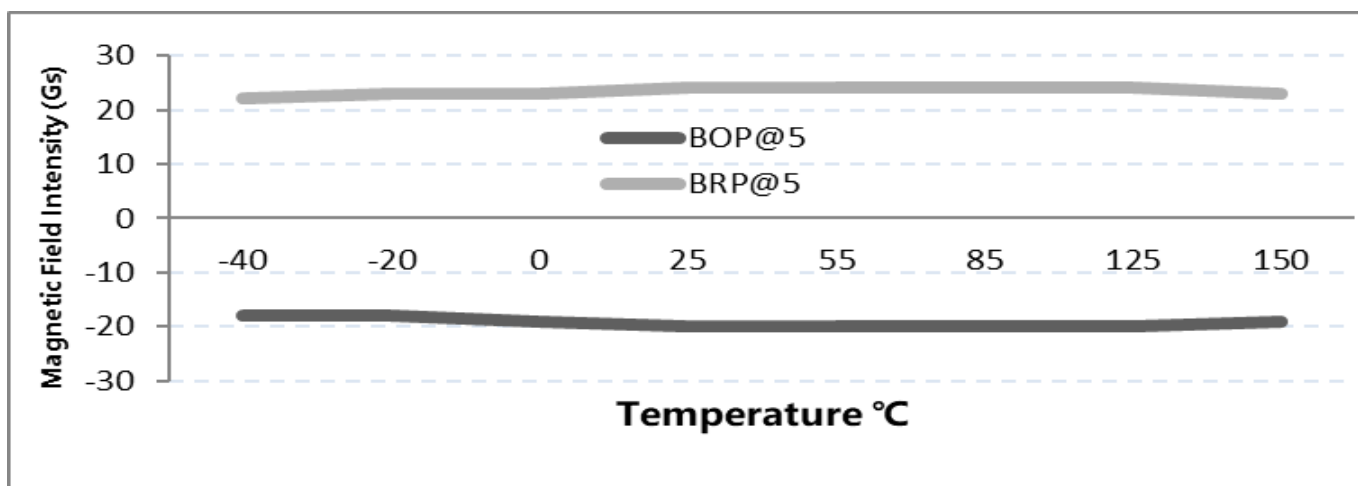


Figure.6 Magnetic Characteristics vs. Temperature (B_{OP} & B_{RP})

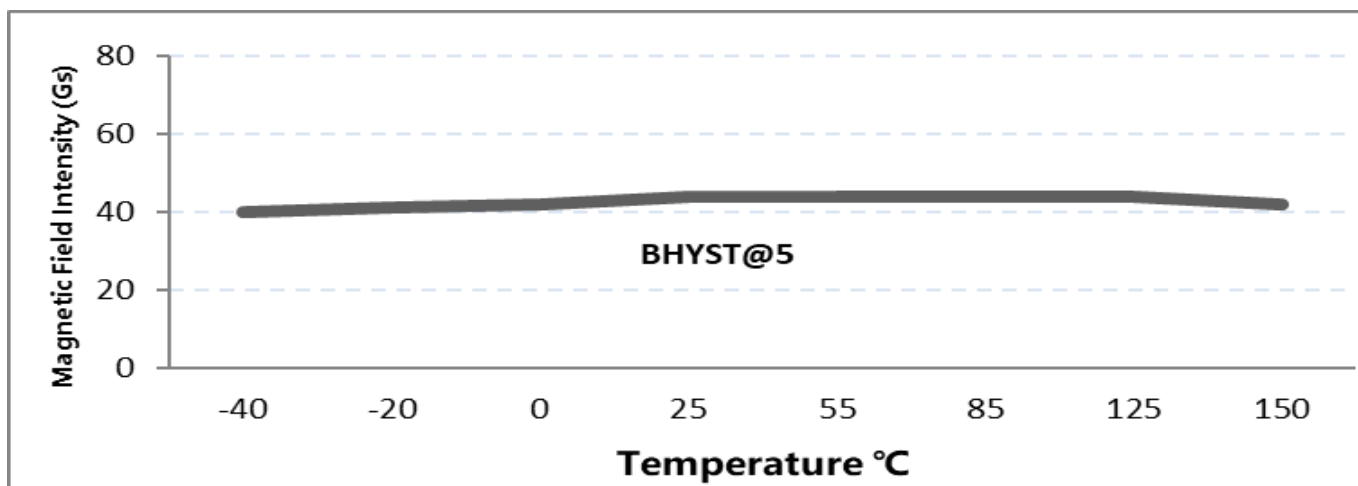


Figure.7 Magnetic Characteristics vs. Temperature (B_{HYST})

10.6 Typical Output Waveform

MT177 as example

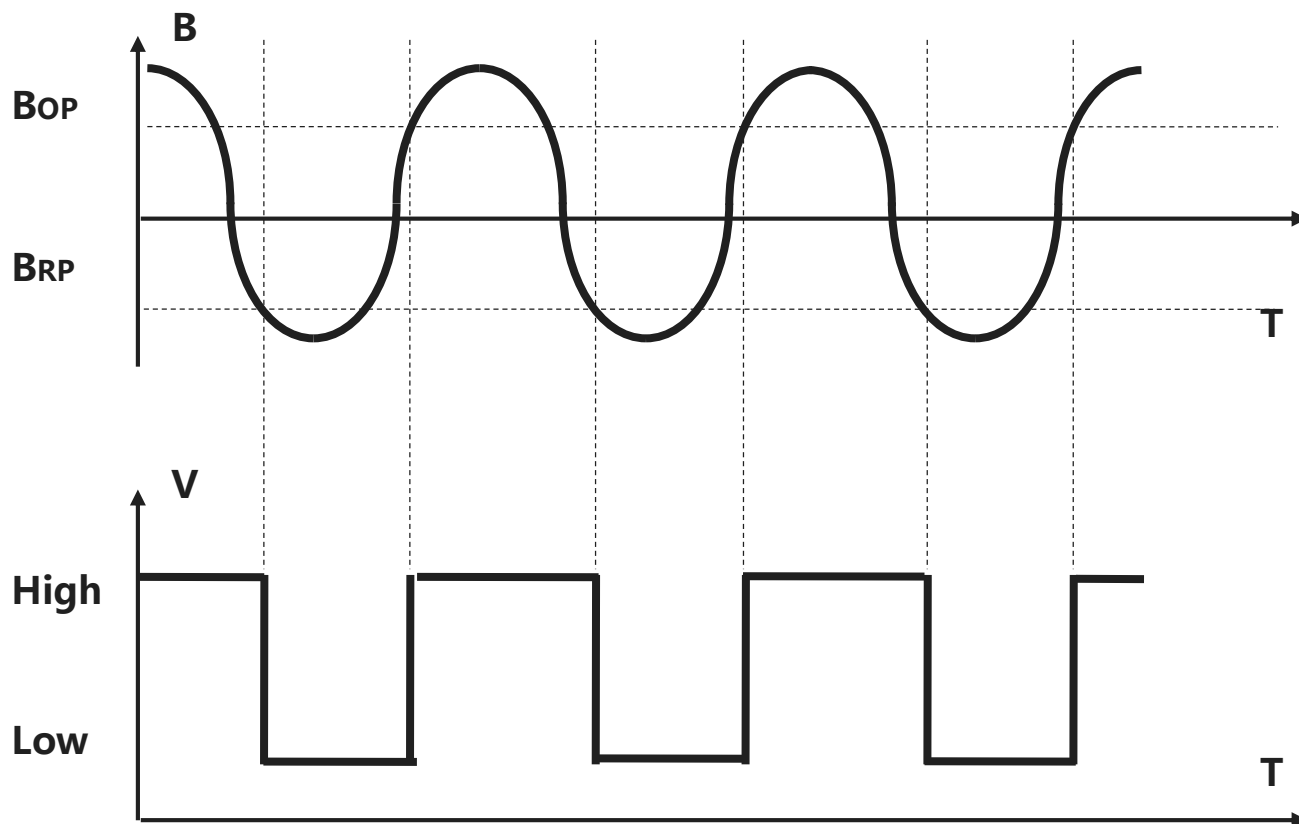


Figure.8 Digital Output vs. Magnetic Flux Density

11 Typical Application Circuit

MT177 as example

Note: Recommended value for R_L is 4.7KOhms to 10KOhms

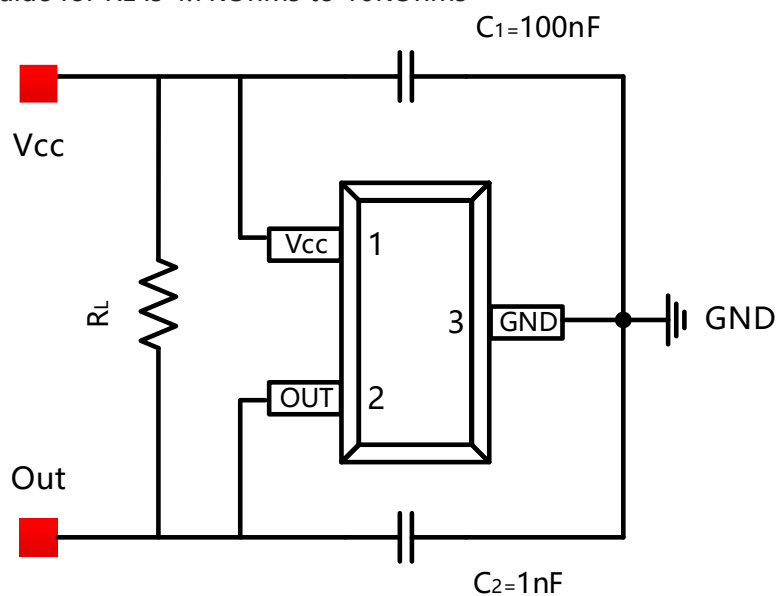


Figure.9 Typical Application Circuit

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

12.1 SOT-23 Package Information

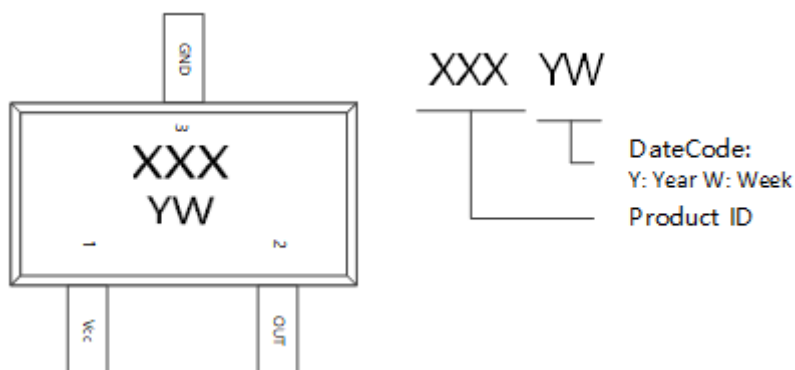


Figure.10 SOT-23 Chip Marking Spec

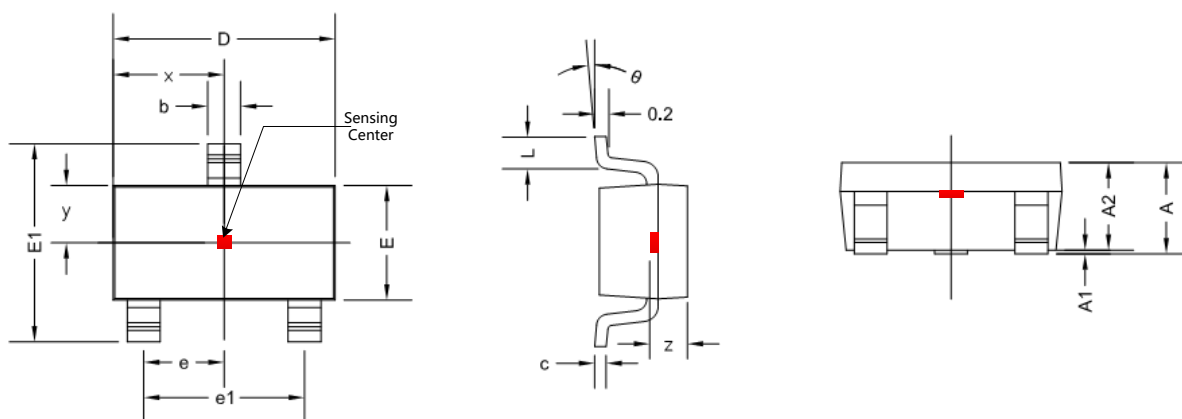


Figure.11 SOT-23 Package Drawing

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	0.700 TYP		0.027 TYP	