TMR136x

NanoAmpere Fast Response Omnipolar Magnetic Switch Sensor

Description

TMR136x is an omnipolar magnetic switch integrated the tunnel magnetoresistance (TMR) magnetic sensor and CMOS circuitry, which is able to detect the change of magnetic field and output high and low voltage signals for high accuracy position detection.

As the time-sharing power supply version of the TMR130x series, TMR136x series sensor provide average supply current as low as 200 nA and maintaining the switching frequency of the magnetic signal is 50 Hz. Compared with Hall/AMR sensors that also use power-cycling mode, the switching frequency of TMR136x is several times higher, and the average supply current is only a fraction of that of Hall/AMR sensor products.

TMR136x allows a wide range of operating supply voltages from 1.8 V to 5.5 V with excellent temperature characteristics, and can meet the requirements of most applications.

TMR136x is available in three compact SOT23-3, TO92S and LGA3L (2 mm × 1.5 mm × 0.63 mm) packages.

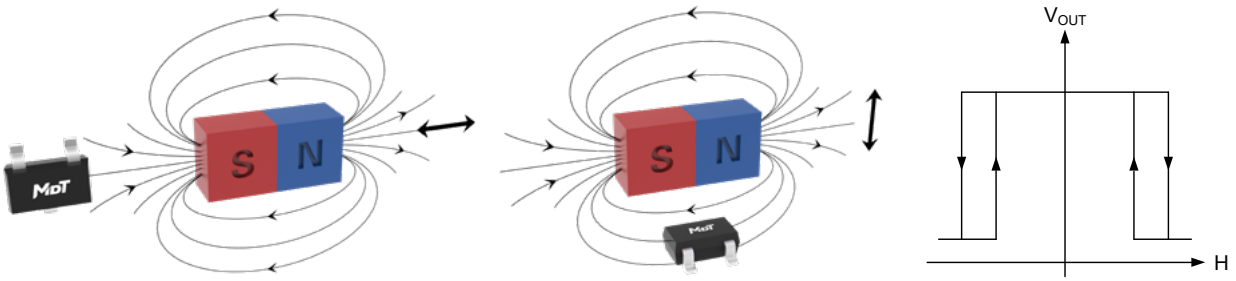
Features and benefits

- Tunneling magnetoresistance (TMR) technology
- Ultra-low power consumption at 200 nA
- Fast Switching Frequency at 50 Hz
- Omnipolar operation
- Wide range supply voltages: 1.8 V to 5.5 V
- CMOS push-pull output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant

Applications

- Utility meters: water, gas, and heat meters
- Proximity switches
- Speed sensing
- Linear and rotation position sensing
- Wake-up switch

SOT23-3 TO92S LGA3L



Selection Guide

Part Number	Supply Current	Switching frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1362S	200 nA	50 Hz	-40 °C to 125 °C	±17 Gs	±12 Gs	SOT23-3	Tape & Reel
TMR1362T	200 nA	50 Hz	-40 °C to 125 °C	±17 Gs	±12 Gs	TO92S	ESD Bag
TMR1362G	200 nA	50 Hz	-40 °C to 125 °C	±17 Gs	±12 Gs	LGA3L	Tape & Reel
TMR1363S	200 nA	50 Hz	-40 °C to 125 °C	±30 Gs	±23 Gs	SOT23-3	Tape & Reel
TMR1365S	200 nA	50 Hz	-40 °C to 125 °C	±45 Gs	±35 Gs	SOT23-3	Tape & Reel
TMR1366S	200 nA	50 Hz	-40 °C to 125 °C	±7 Gs	±5 Gs	SOT23-3	Tape & Reel
TMR1366T	200 nA	50 Hz	-40 °C to 125 °C	±7 Gs	±5 Gs	TO92S	ESD Bag
TMR1366G	200 nA	50 Hz	-40 °C to 125 °C	±7 Gs	±5 Gs	LGA3L	Tape & Reel
Note: Please contact MultiDimension Technology local sales for customizing operating and release points.							

Catalogue

1. Functional Block Diagram

TMR136x series switch chips are composed of TMR sensors and signal processing circuits. The TMR sensor detects external magnetic field, generates an analog voltage signal, and outputs a logical switch level after processing by the circuits as shown in Figure 1.

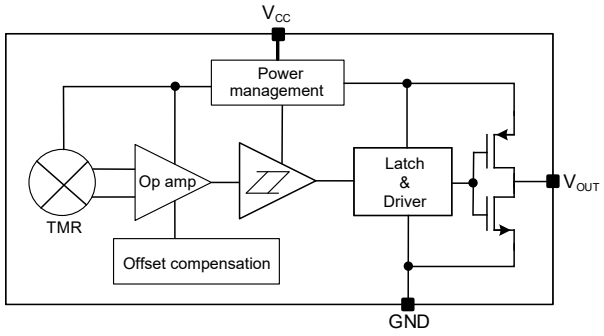


Figure 1. Block diagram

2. Switching Characteristics

The Figure 2 shows the sensing direction is parallel to the silkscreen surface of the package as shown by the arrow.

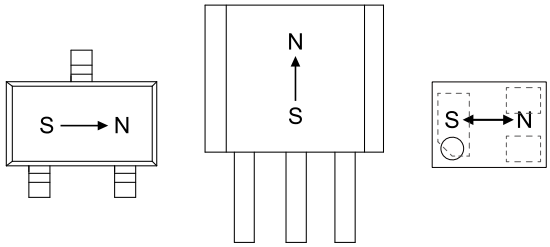


Figure 2. Sensing direction

The output is “High”, when power is on at zero magnetic field. B is the external magnetic field along the sensing direction, B_{OPS} (B_{OPN}) is the operating point, B_{RPS} (B_{RPN}) is the release point, and hysteresis B_H is define as the difference between B_{OPS} and B_{RPS} (B_{OPN} and B_{RPN}).

The sensor outputs a low level, when the magnetic field along the sensing axis exceeds the operate point B_{OPS} (B_{OPN}), and the device outputs a high level, when the magnetic field is reduced below the release point B_{RPS} (B_{RPN}) as shown in Figure 3.

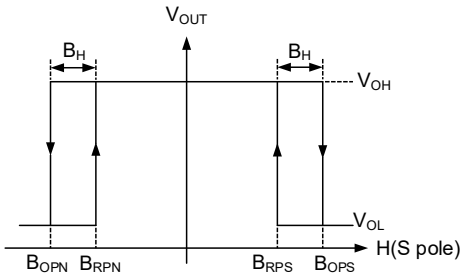


Figure 3. Switching characteristics

3. Pin Configuration

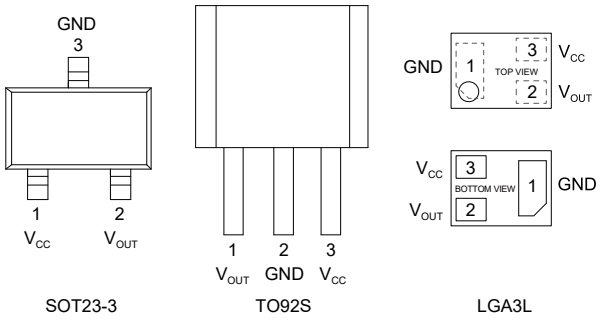


Figure 4. Pin configuration

Pin Number			Name	Function
SOT23-3	TO92S	LGA3L		
1	3	3	V_{CC}	Power supply
2	1	2	V_{OUT}	Output
3	2	1	GND	Ground

4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit	Applicable Part Number
Supply voltage	V_{CC}	-0.3	7	V	All parts
Output current	I_{SINK} and I_{SOURCE}	-	9	mA	All parts
Magnetic flux density	B	-	4000	Gs	All parts
ESD performance (HBM)	V_{ESD}	-	4	kV	All parts
Operating ambient temperature	T_A	-40	125	°C	All parts
Storage ambient temperature	T_{STG}	-50	150	°C	All parts

Note: I_{SINK} is the current flowing through the high side MOSFET, when the high side MOSFET is turned on, and I_{SOURCE} is the current flowing through the low side MOSFET when the low side MOSFET is turned on.

5. Electrical Specifications

V_{CC} = 3 V, T_A = 25 °C, a 0.1 μF capacitor is connected between V_{CC} and GND

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable Part Number
Supply voltage	V_{CC}	operating	1.8	3.0	5.5	V	All parts
Output high voltage	V_{OH}	RP status	V_{CC}-0.3	-	V_{CC}	V	All parts
Output low voltage	V_{OL}	OP status	0	-	0.2	V	All parts
Supply current	I_{CC}	output open	-	200	-	nA	All parts
Switching frequency	F	-	50			Hz	All parts

6. Magnetic Specifications

V_{CC} = 3 V, T_A = 25 °C, a 0.1 μF capacitor is connected between V_{CC} and GND

TMR1362

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	17	-	Gs
	B_{OPN}	-	-17	-	Gs
Release point	B_{RPS}	-	12	-	Gs
	B_{RPN}	-	-12	-	Gs
Hysteresis	B_H	-	5	-	Gs

TMR1363

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	30	-	Gs
	B_{OPN}	-	-30	-	Gs
Release point	B_{RPS}	-	23	-	Gs
	B_{RPN}	-	-23	-	Gs
Hysteresis	B_H	-	7	-	Gs

TMR1365

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	45	-	Gs
	B_{OPN}	-	-45	-	Gs
Release point	B_{RPS}	-	35	-	Gs
	B_{RPN}	-	-35	-	Gs
Hysteresis	B_H	-	10	-	Gs

TMR1366

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	7	-	Gs
	B_{OPN}	-	-7	-	Gs
Release point	B_{RPS}	-	5	-	Gs
	B_{RPN}	-	-5	-	Gs
Hysteresis	B_H	-	2	-	Gs

7. Typical Supply Voltage Characteristics

TMR136x Supply Voltage Characteristics

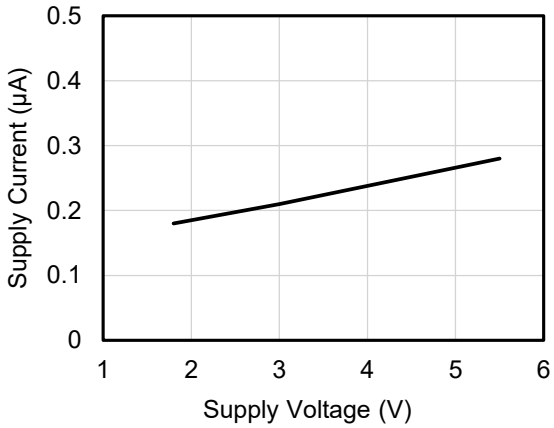


Figure 5. Supply current versus supply voltage (T_A=25°C)

TMR1362 Supply Voltage Characteristics

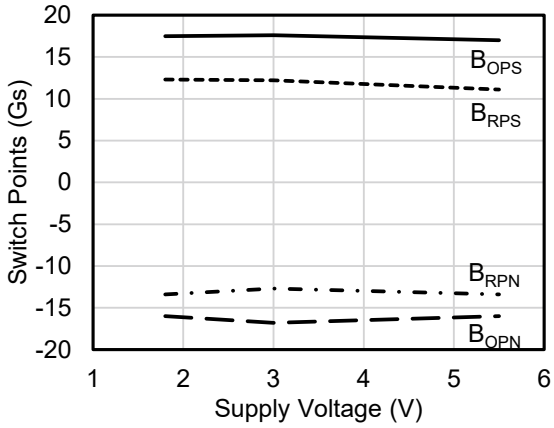


Figure 6. Switch points versus supply voltage (T_A=25°C)

TMR1363 Supply Voltage Characteristics

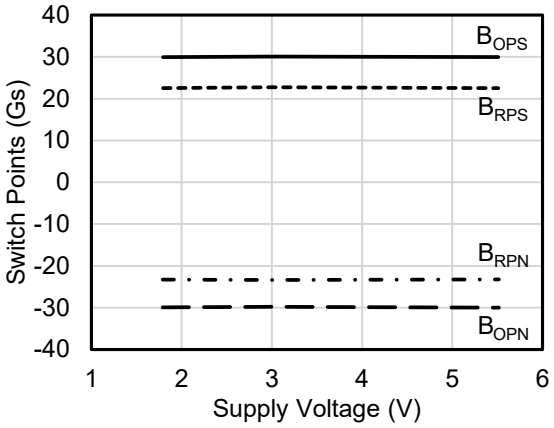


Figure 7. Switch points versus supply voltage (T_A=25°C)

TMR1365 Supply Voltage Characteristics

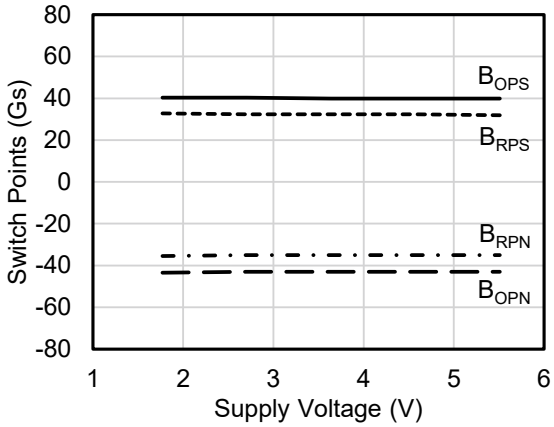


Figure 8. Switch points versus supply voltage (T_A=25°C)

TMR1366 Supply Voltage Characteristics

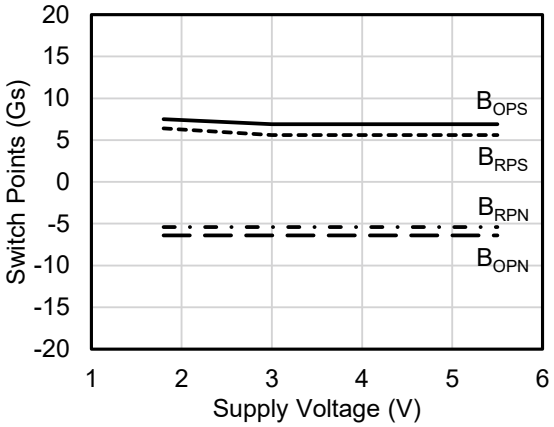


Figure 9. Switch points versus supply voltage (T_A=25°C)

8. Typical Temperature Characteristics

TMR136x Temperature Characteristics

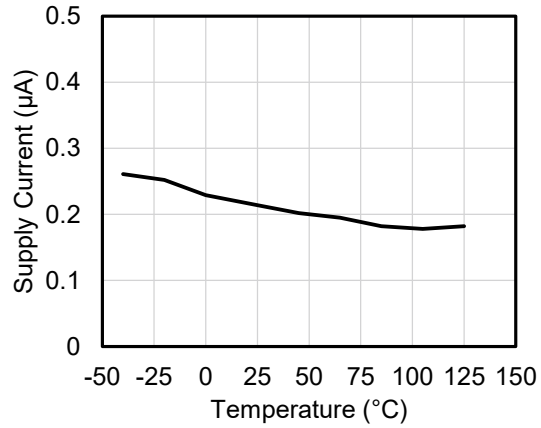


Figure 10. Supply current versus temperature (V_{CC} = 3 V)

TMR1362 Temperature Characteristics

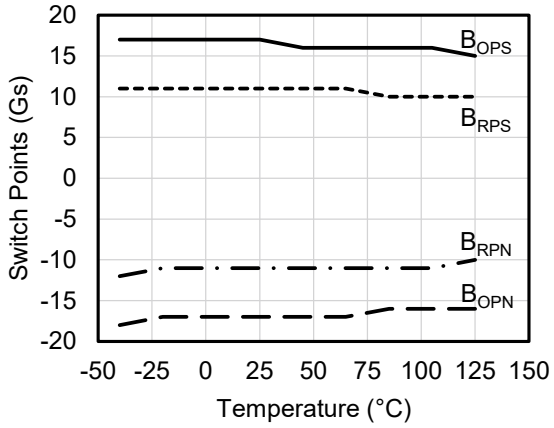


Figure 11. Switch points versus temperature (V_{CC} = 3 V)

TMR1363 Temperature Characteristics

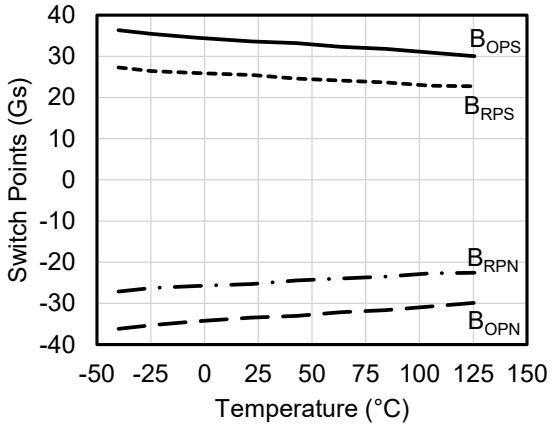


Figure 12. Switch points versus temperature (V_{CC} = 3 V)

TMR1365 Temperature Characteristics

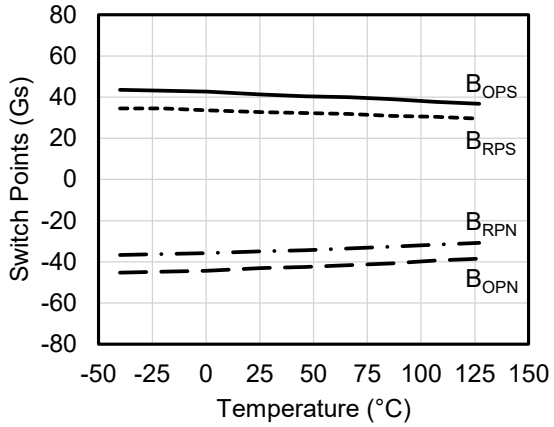


Figure 13. Switch points versus temperature (V_{CC} = 3 V)

TMR1366 Temperature Characteristics

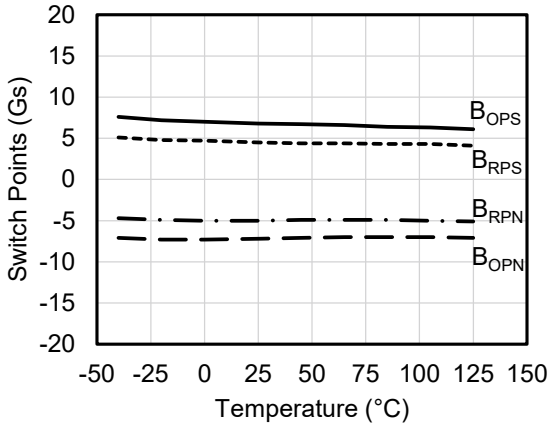


Figure 14. Switch points versus temperature (V_{CC} = 3 V)

9. Application Information

It is recommended to add a filter capacitor between the sensor power supply and ground (close to the sensor) to reduce external noise. As shown in Figure 15, the typical value is 0.1 μF.

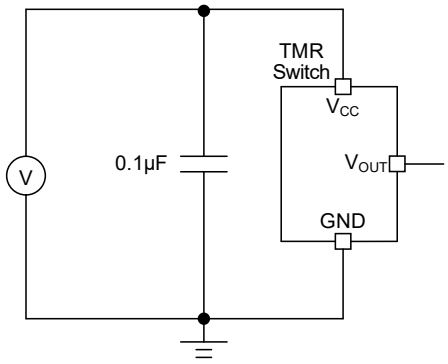


Figure 15. Application circuit diagram

The TMR136x series sensor chips are not suitable for driving power loads. The general method of use is utilizing the output voltage of V_{OUT} pin as a signal to input the MCU or drive a triode or MOS as shown in Figure 16.

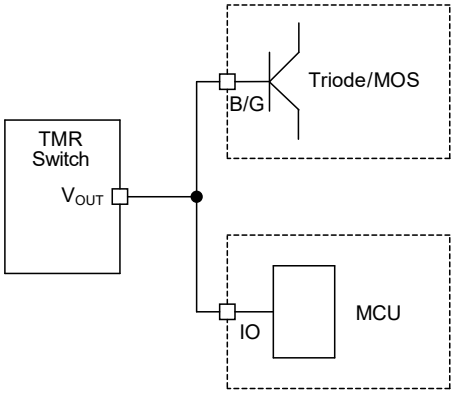


Figure 16. Application diagram for driving power load

Common failure conditions:

- The supply voltage exceeds the limit of absolute maximum ratings
- Absence of matching filter capacitor to power supply when the power supply is unstable, which can cause the product to restart repeatedly
- Using switch output V_{OUT} to control high-power relays, etc., and cause I_{SINK} and I_{SOURCE} exceeding the limit of absolute maximum ratings
- The external magnetic field exceeds the limit of absolute maximum ratings
- Operating in a humid environment for a long time, causing vapor penetration and increased power consumption
- Overheating when soldering
- Over bending of pins

10. Dimensions

SOT23-3 Package

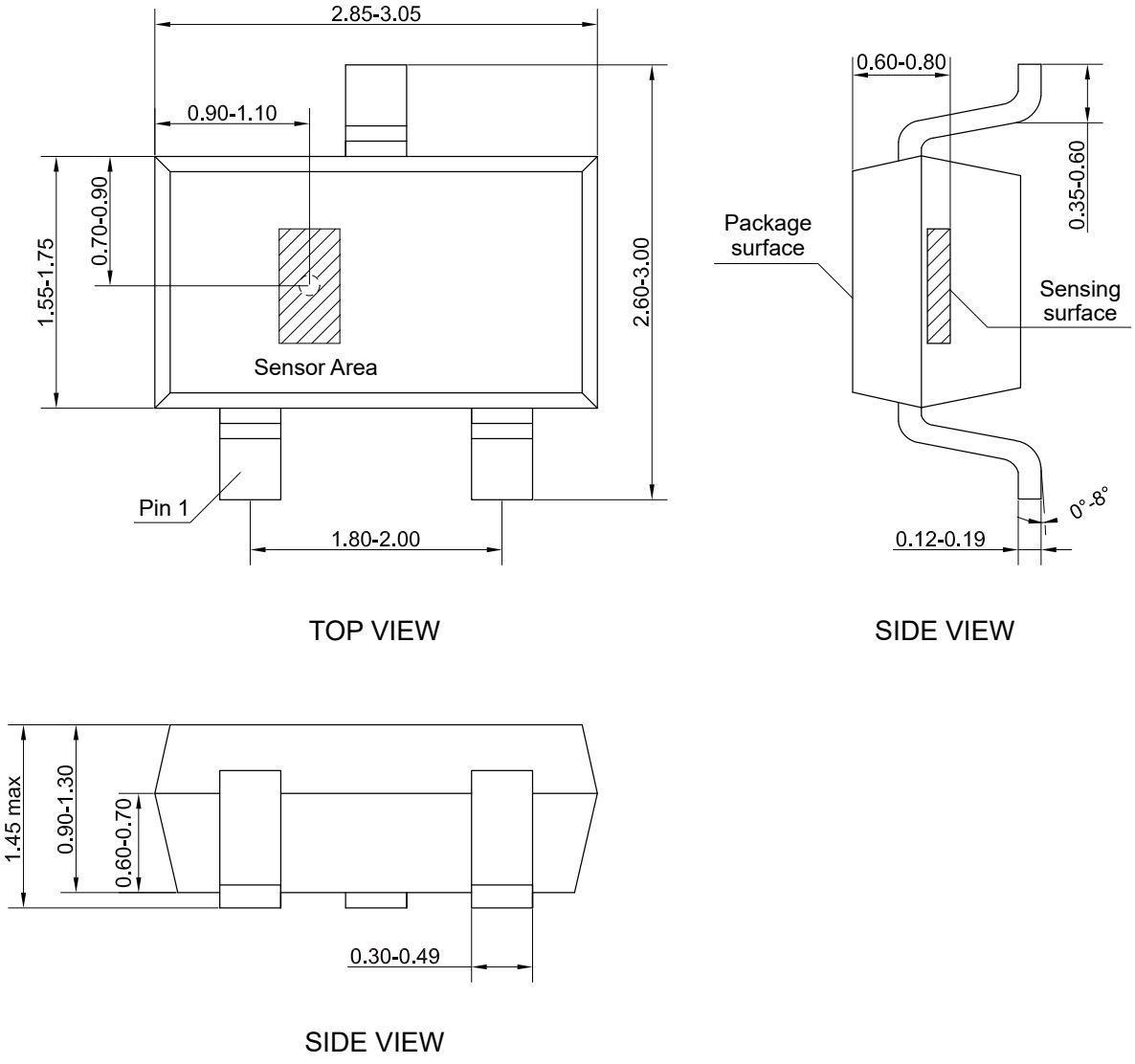


Figure 17. Package outline of SOT23-3 (unit: mm)

TO92S Package

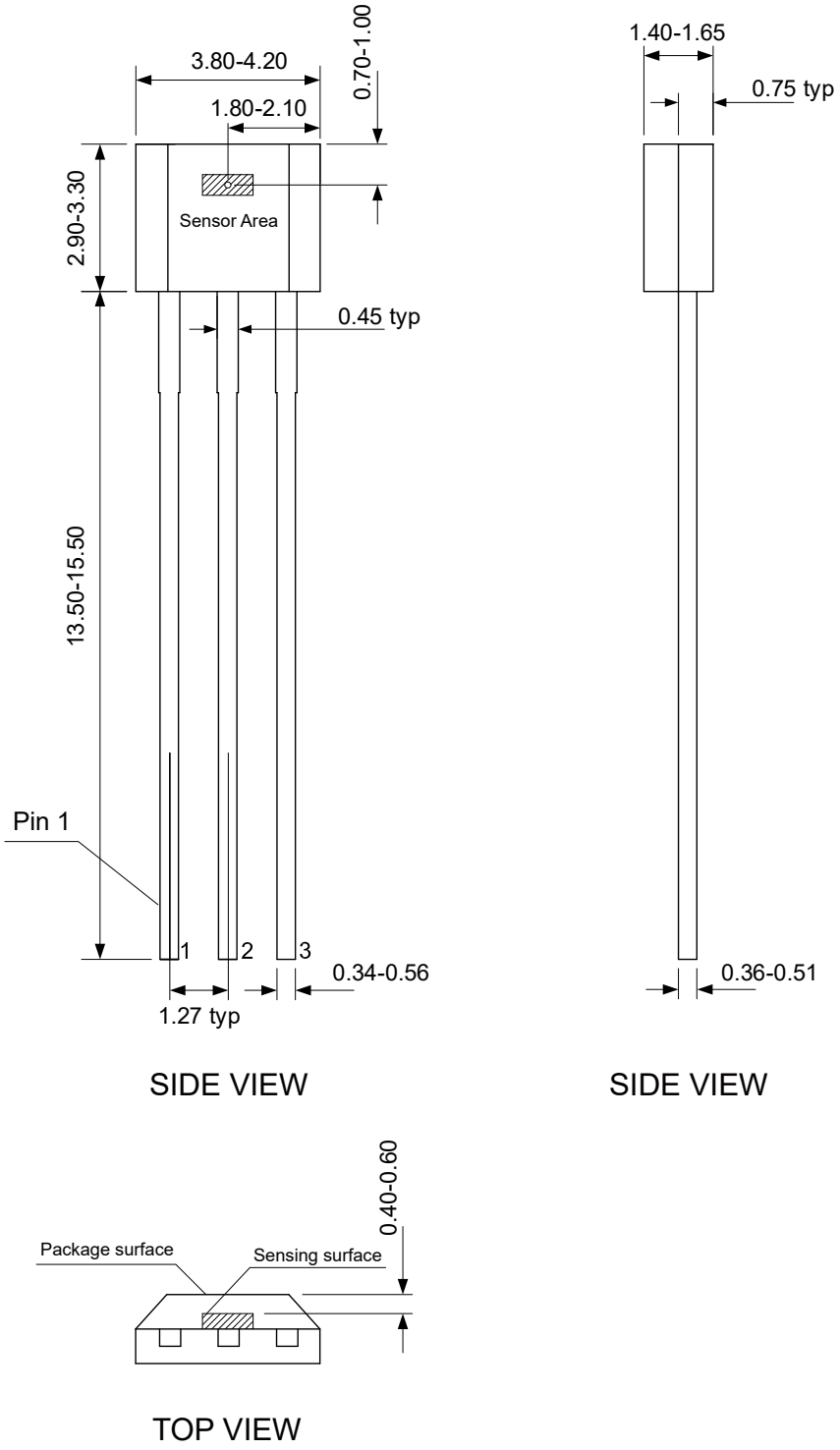


Figure 18. Package outline of TO92S (unit: mm)

LGA3L Package

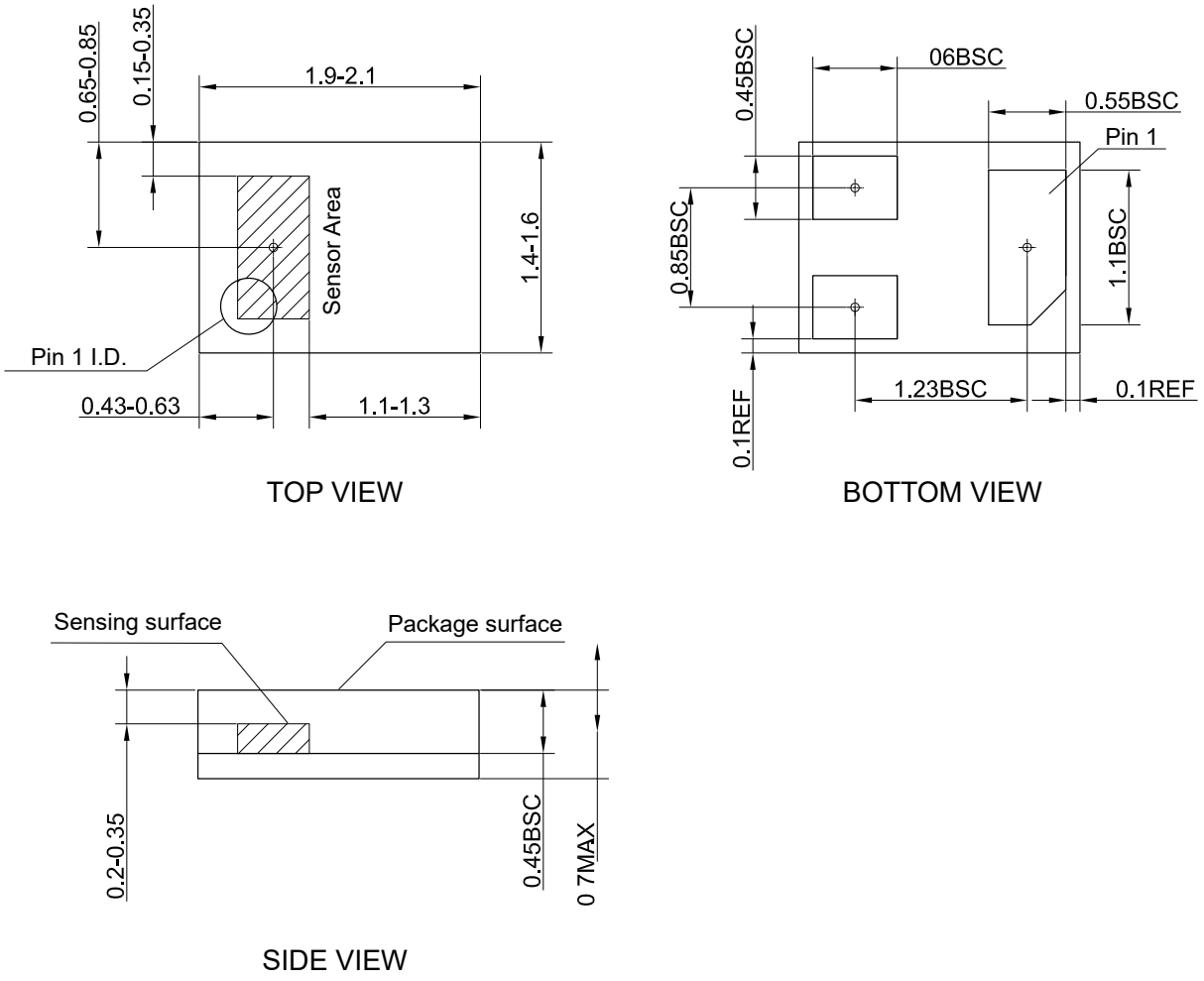


Figure 19. Package outline of LGA3L (unit: mm)

Recycling

The product(s) in this document need to be handed over to a qualified solid waste management services company for recycling in accordance with relevant regulations on waste classification after the end of the product(s) life.

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