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.

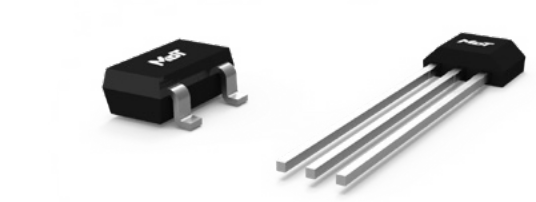
TMR136x is available in three compact SOT23-3, TO92S and LGA3L (2 mm × 1.5 mm × 0.63 mm) packages.

Features and Benefits

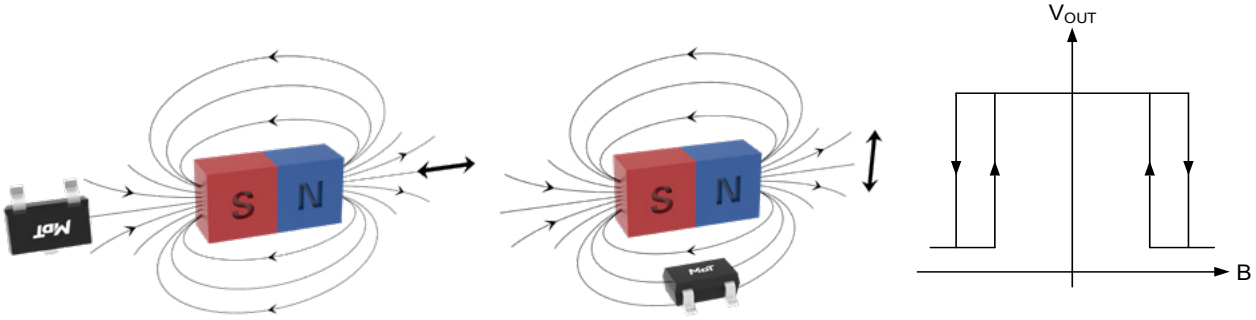
- Tunneling magnetoresistance (TMR) technology
- Ultra-low power consumption at 200 nA
- Fast Switching Frequency at 50 Hz
- Omnipolar operation
- Wide range supply voltages: 1.8 V to 5.5 V
- CMOS push-pull output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic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



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
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
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.

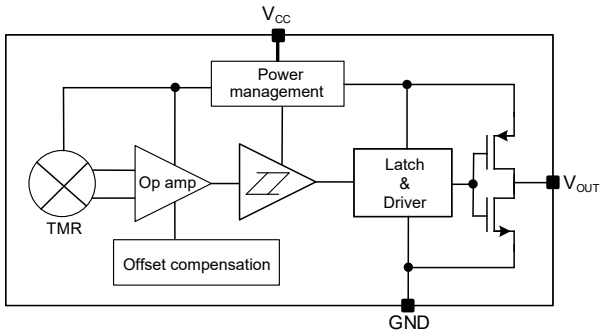


Figure 1. Block diagram

2. Switching Characteristics

The TMR136x sensing axis is parallel to the package top-marking surface; the sensing axis is defined from the N pole toward the S pole, as indicated by the arrow in the figure below.

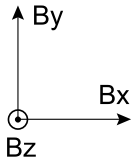


Figure 2-1. Definition of axis

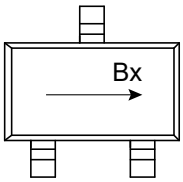


Figure 2-2. Axial diagram (SOT23-3 top view)

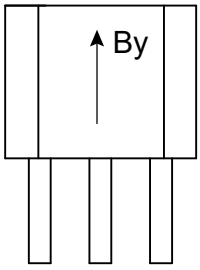


Figure 2-3. Axial diagram (TO92S side view)

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.

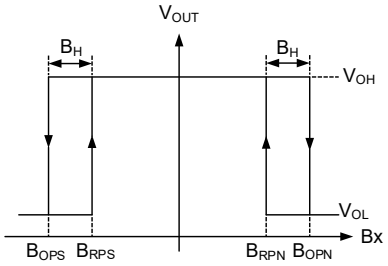


Figure 3-1. Switching characteristics (SOT23-3)

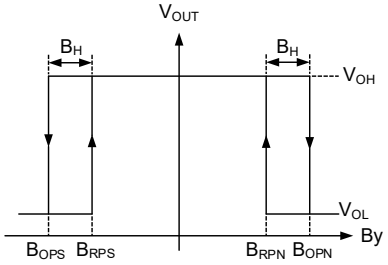


Figure 3-2. Switching characteristics (TO92S)

3. Pin Configuration

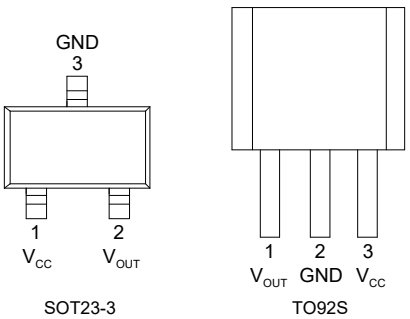


Figure 4. Pin configuration

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

4. Absolute Maximum Ratings

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

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
Supply voltage	V_{CC}	operating	1.8	3.0	5.5	V
Output high voltage	V_{OH}	RP status	V_{CC}-0.3	-	V_{CC}	V
Output low voltage	V_{OL}	OP status	0	-	0.2	V
Supply current	I_{CC}	output open	-	200	-	nA
Switching frequency	F	-	50			Hz

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_{OPN}	9	-	26	Gs
	B_{OPS}	-26	-	-9	Gs
Release point	B_{RPN}	5	-	20	Gs
	B_{RPS}	-20	-	-5	Gs
Hysteresis	B_H	-	5	-	Gs

TMR1363

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	23	-	37	Gs
	B_{OPS}	-37	-	-23	Gs
Release point	B_{RPN}	13	-	34	Gs
	B_{RPS}	-34	-	-13	Gs
Hysteresis	B_H	-	7	-	Gs

TMR1365

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	35	-	55	Gs
	B_{OPS}	-55	-	-35	Gs
Release point	B_{RPN}	23	-	47	Gs
	B_{RPS}	-47	-	-23	Gs
Hysteresis	B_H	-	10	-	Gs

TMR1366

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	4	-	11	Gs
	B_{OPS}	-11	-	-4	Gs
Release point	B_{RPN}	2	-	9	Gs
	B_{RPS}	-9	-	-2	Gs
Hysteresis	B_H	-	2	-	Gs

7. Typical Supply Voltage Characteristics

TMR136x Supply Voltage Characteristics

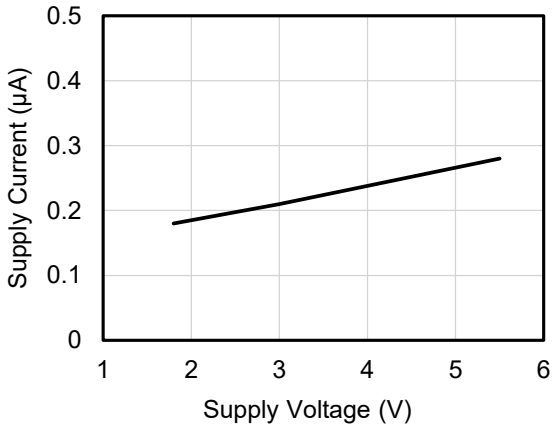


Figure 5. Supply current versus supply voltage (T_A=25°C)

TMR1362 Supply Voltage Characteristics

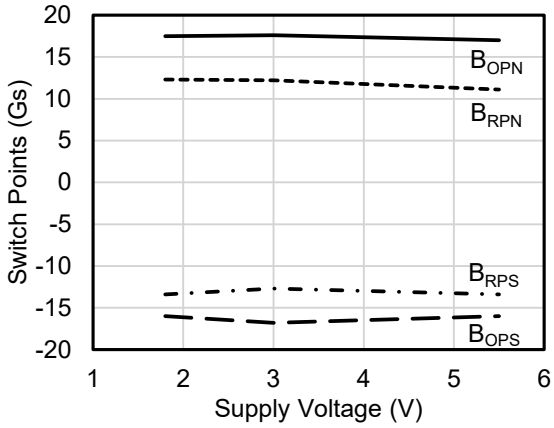


Figure 6. Switch points versus supply voltage (T_A=25°C)

TMR1363 Supply Voltage Characteristics

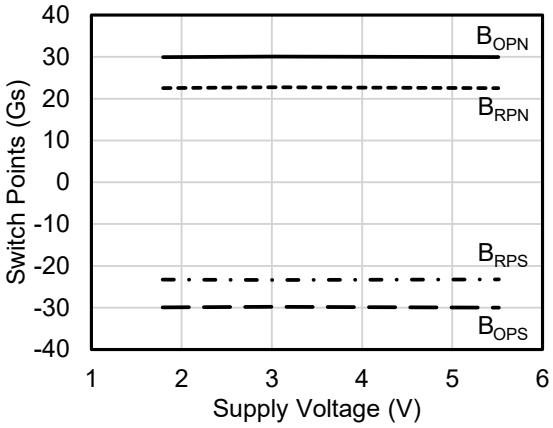


Figure 7. Switch points versus supply voltage (T_A=25°C)

TMR1365 Supply Voltage Characteristics

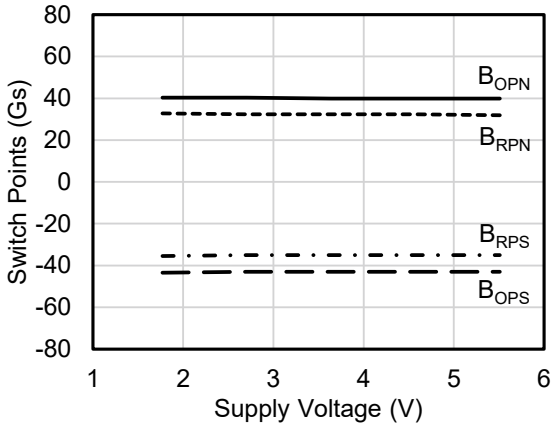


Figure 8. Switch points versus supply voltage (T_A=25°C)

TMR1366 Supply Voltage Characteristics

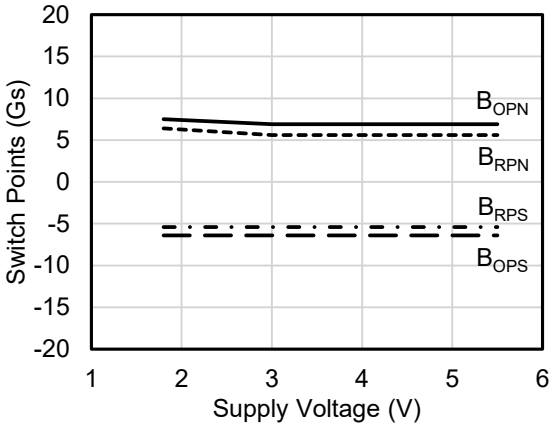


Figure 9. Switch points versus supply voltage (T_A=25°C)

8. Typical Temperature Characteristics

TMR136x Temperature Characteristics

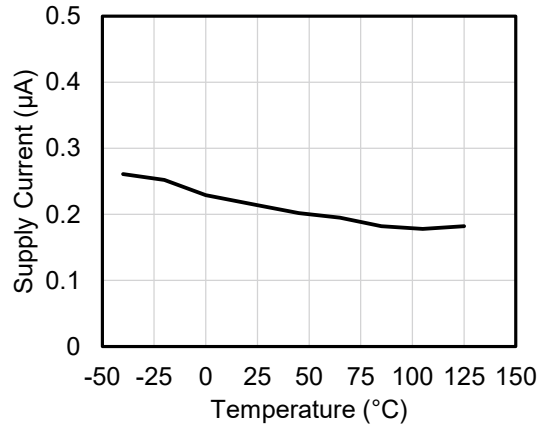


Figure 10. Supply current versus temperature (V_{CC} = 3 V)

TMR1362 Temperature Characteristics

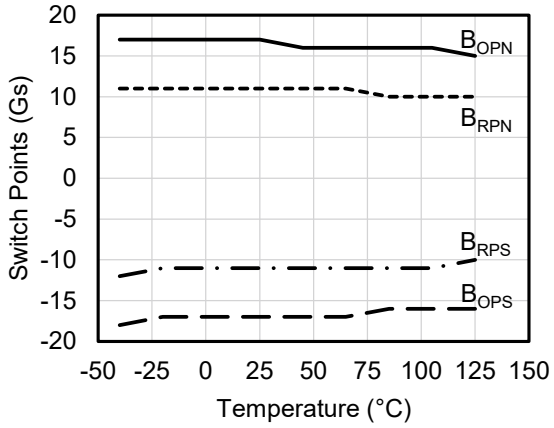


Figure 11. Switch points versus temperature (V_{CC} = 3 V)

TMR1363 Temperature Characteristics

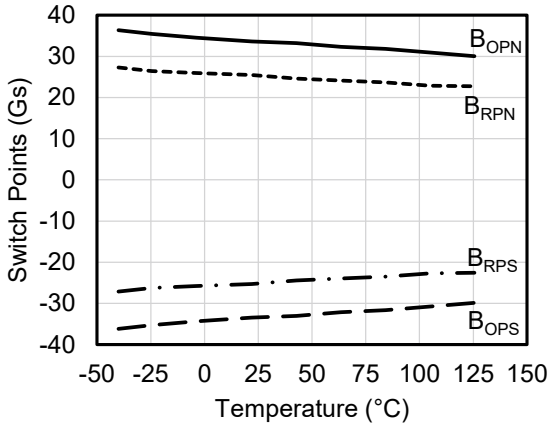


Figure 12. Switch points versus temperature (V_{CC} = 3 V)

TMR1365 Temperature Characteristics

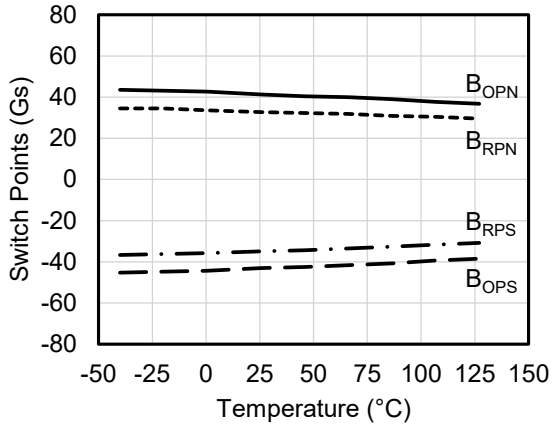


Figure 13. Switch points versus temperature (V_{CC} = 3 V)

TMR1366 Temperature Characteristics

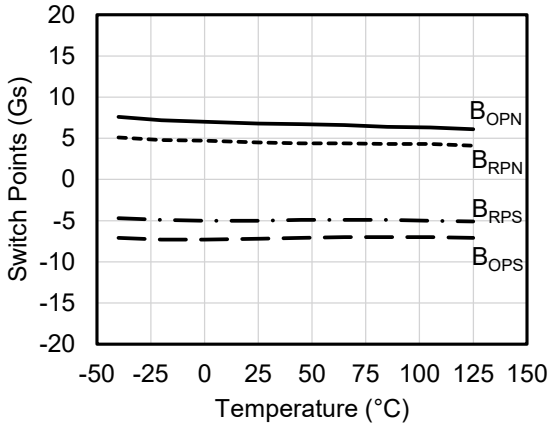


Figure 14. Switch points versus temperature (V_{CC} = 3 V)

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.

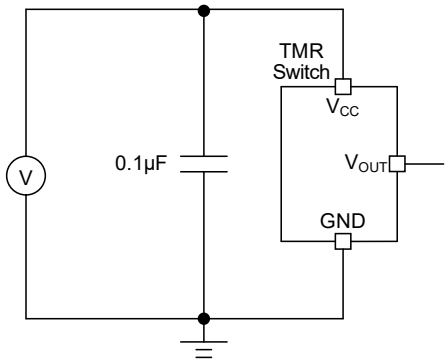


Figure 15. Application circuit diagram

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.

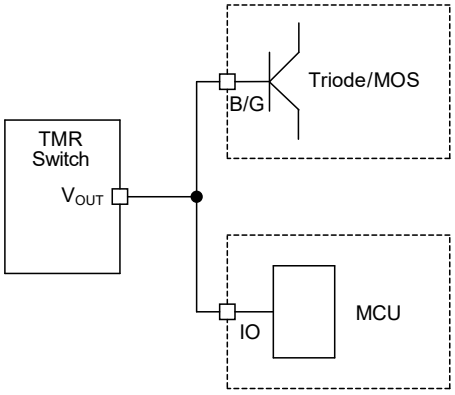


Figure 16. Application diagram for driving power load

Common failure conditions:

- The device is exposed to conditions exceeding any absolute maximum rating.
- The external circuit does not include properly matched supply-pin decoupling/filter capacitors.
- The device's V_{OUT} pin is used to directly drive power devices (e.g., relays), causing the output current to exceed the "Absolute Maximum Ratings".
- The device operates in a humid environment for an extended period.
- The maximum soldering temperature exceeds 260°C, or exposure above 250°C lasts longer than 10s.
- The device is exposed to temperatures above the maximum operating temperature while the external magnetic field exceeds 20 Gs.
- The device is exposed to an ultrasonic environment.
- Excessive deformation of the device leads/pins.
- Applying a voltage to the V_{OUT} pin, or powering the device through the V_{OUT} pin.

10. Dimensions

SOT23-3 Package

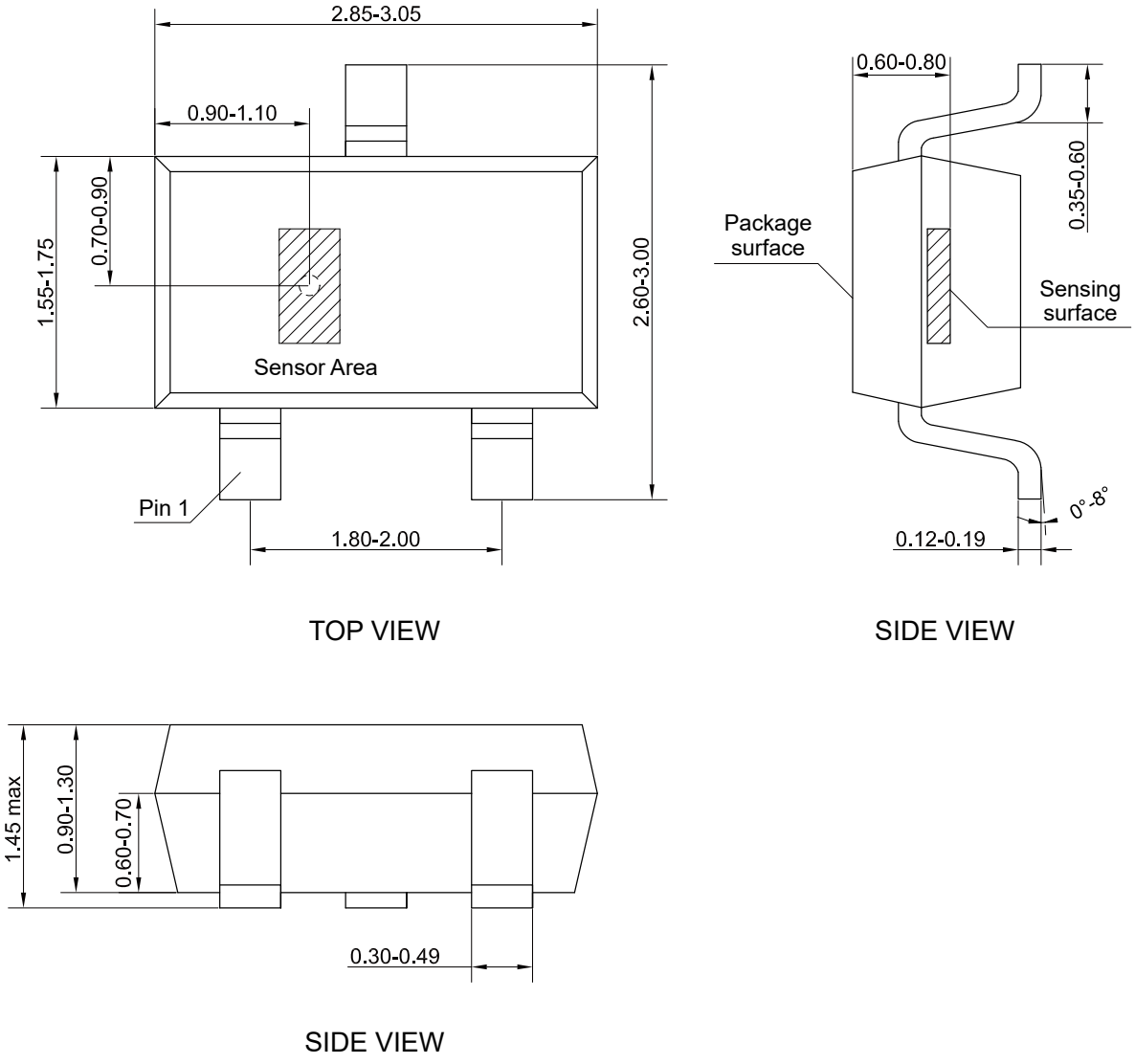


Figure 17. Package outline of SOT23-3 (unit: mm)

TO92S Package

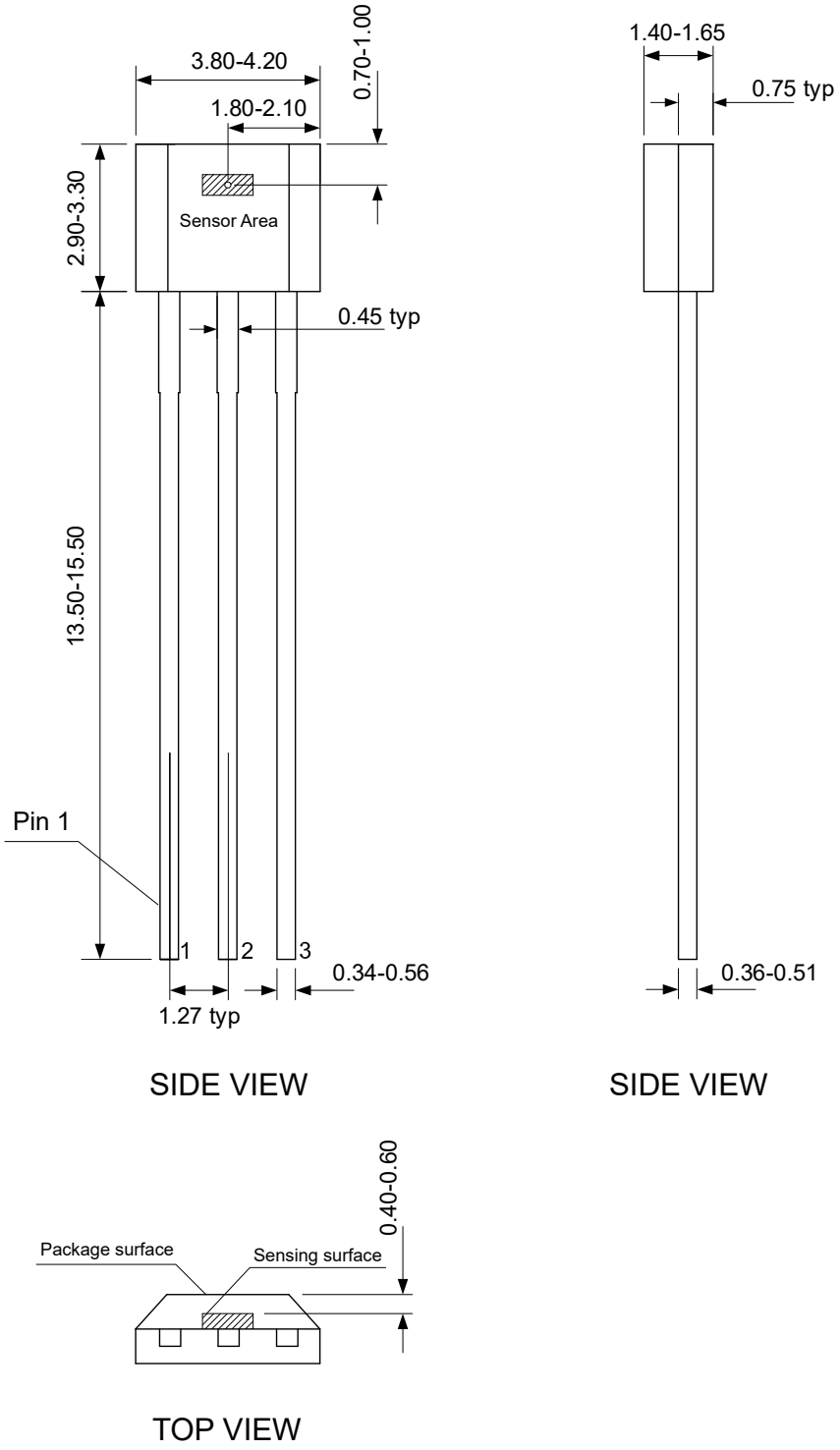


Figure 18. Package outline of TO92S (unit: mm)

Recycling

The product(s) in this document should be disposed of at the end of the product(s) life using a qualified waste management company for recycling in accordance with local regulations.

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