TMR1305

TMR Z-Axis Omnipolar Magnetic Switch Sensor

Description

TMR1305 is a digital omnipolar magnetic switch that integrates TMR and CMOS technology in order to provide a magnetically triggered digital switch with high sensitivity, high speed, and ultra-low power consumption.

It is designed for use in applications that are both power-critical and performance-demanding. It contains a push-pull half-bridge TMR magnetic sensor and CMOS signal processing circuitry within the same package, including an on-chip TMR voltage generator for precise magnetic sensing, a TMR voltage amplifier and comparator plus a Schmitt trigger to provide switching hysteresis for noise rejection, and CMOS push-pull output. An internal band gap regulator is used to provide a temperature compensated supply voltage for internal circuits, permitting a wide range of supply voltages. The TMR1305 draws only 2μA resulting in ultra-low power operation. It has fast response, accurate switching points, excellent thermal stability, and immunity to stray field interference.

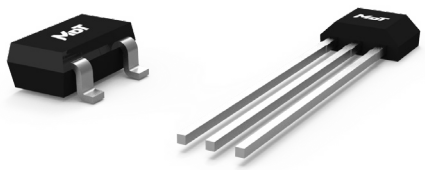
It is available in the SOT23-3 package and the TO92S package.

Features and Benefits

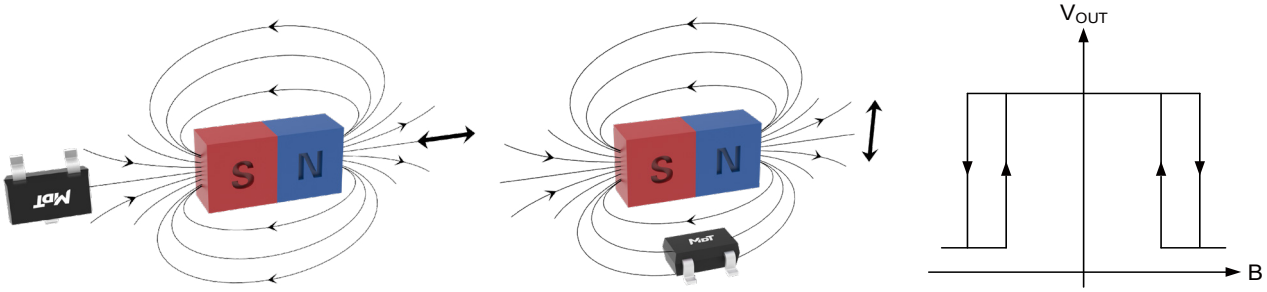
- Tunneling magnetoresistance (TMR) technology
- Ultra low power consumption at 2 μA
- High frequency response: >1 kHz
- Operation with north or south pole
- Low switching points for high sensitivity
- Compatible with a wide range of supply voltages
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant

Applications

- Utility meters: water, gas, and heat meters
- Proximity switches
- Position and speed sensing
- Motor and fan control



SOT23-3 TO92S



Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1305S	2 μA	1 kHz	-40 °C to 125 °C	±17 Gs	±10 Gs	SOT23-3	Tape & Reel
TMR1305T	2 μA	1 kHz	-40 °C to 125 °C	±17 Gs	±10 Gs	TO92S	ESD Bag
Note: Please contact MultiDimension Technology local sales for customizing operating and release points.							

Catalogue

1. Functional Block Diagram

TMR1305 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.

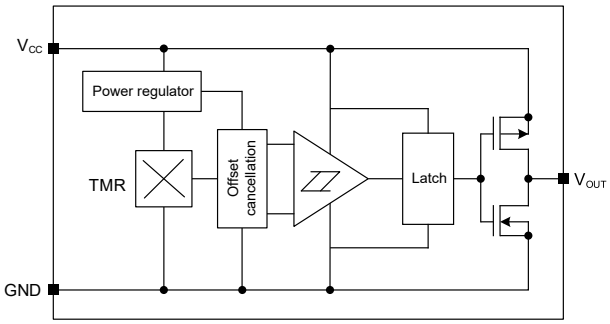


Figure 1. Block diagram

2. Switching Characteristics

The TMR1305 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.

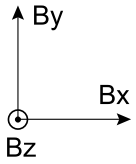


Figure 2-1. Definition of axis

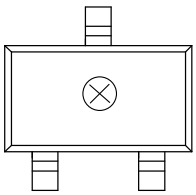


Figure 2-2. Axial diagram (SOT23-3 top view)

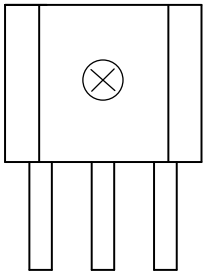


Figure 2-3. Axial diagram (TO92S side view)

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.

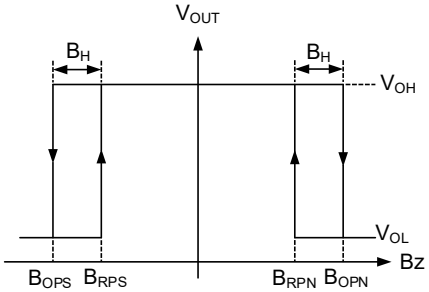


Figure 3. Switching characteristics

Specification	Condition	Output
Magnetic south(S)	$B > B_{OPS}$	Low (On)
	$0 < B < B_{RPS}$	High (Off)
Magnetic north(N)	$B < B_{OPN}$	Low (On)
	$0 > B > B_{RPN}$	High (Off)

Note: when power is turned on under zero magnetic field, the output is “High”.

3. Pin Configuration

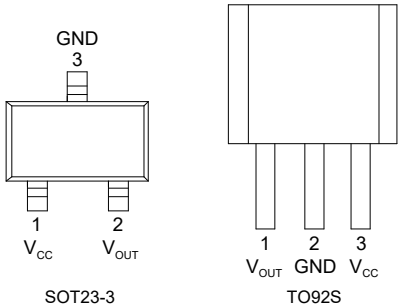


Figure 4. Pin configuration

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}	-	7	V
Reverse supply voltage	V_{RCC}	-	0.3	V
Output current	$I_{OUTSINK}$	-	9	mA
Magnetic flux density	B	-	2800	Gs
ESD performance (HBM)	V_{ESD}	-	2	kV
Operating ambient temperature	T_A	-40	125	°C
Storage ambient temperature	T_{STG}	-50	150	°C

5. Electrical Specifications

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

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	Operating	1.8	3.0	5.5	V
Output high voltage	V_{OH}	-	V_{CC}-0.3	-	V_{CC}	V
Output low voltage	V_{OL}	-	0	-	0.2	V
Supply current	I_{CC}	Output Open	0	2	2.5	μA
Response frequency	F	-	-	1000	-	Hz

6. Magnetic Specifications

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

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	8	-	34	Gs
	B_{OPS}	-34	-	-8	Gs
Release point	B_{RPN}	5	-	30	Gs
	B_{RPS}	-30	-	-5	Gs
Hysteresis	B_H	3	-	15	Gs

7. Typical Supply Voltage Characteristics

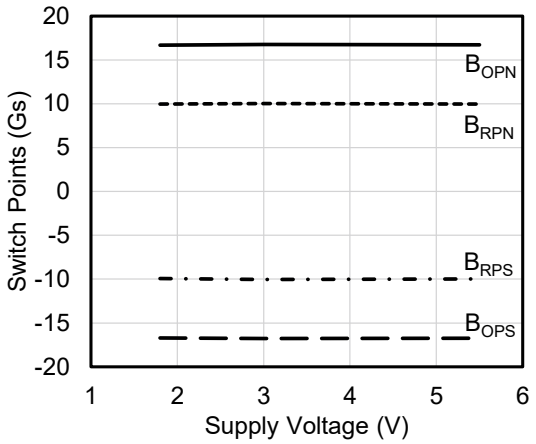


Figure 5. Switch points versus supply voltage (T_A=25°C)

8. 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 6, the typical value is 0.1 μF.

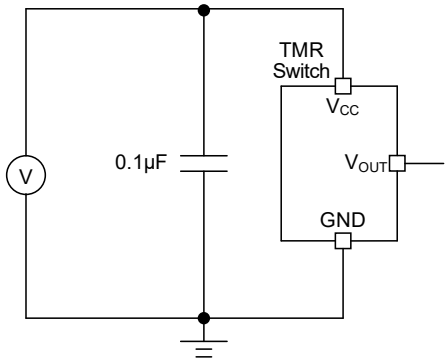


Figure 6. Application circuit diagram

The TMR1305 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 7.

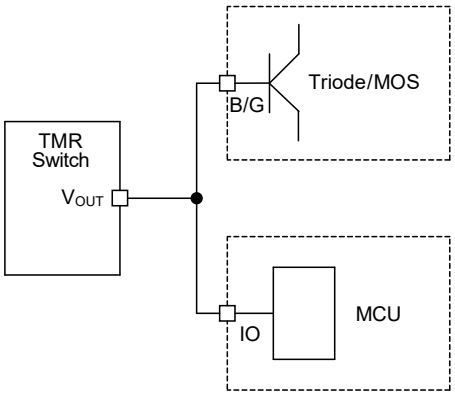


Figure 7. Application diagram for driving power load

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.

9. Dimensions

SOT23-3 Package

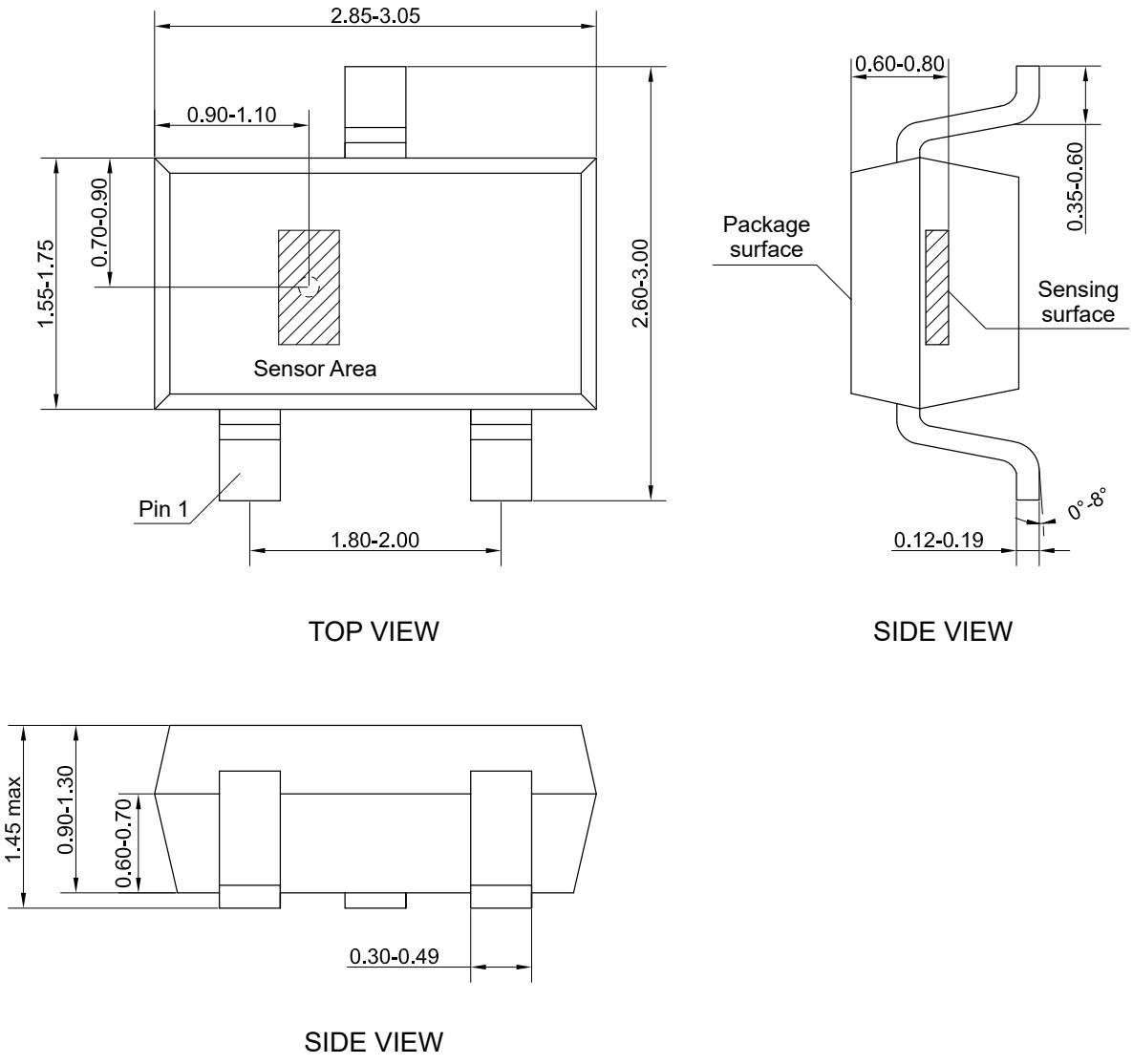


Figure 8. Package outline of SOT23-3 (unit: mm)

TO92S Package

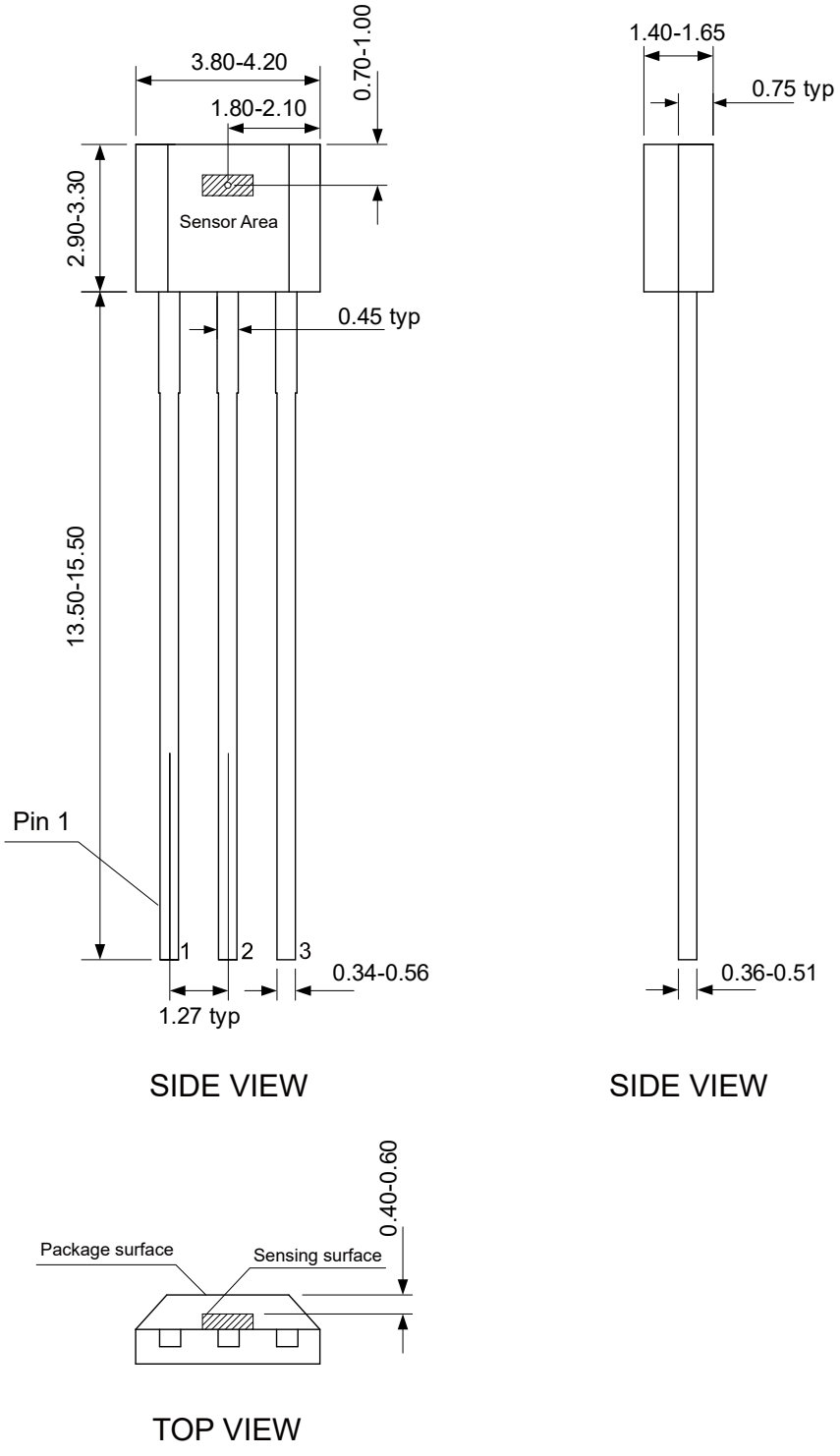


Figure 9. Package outline of TO92S (unit: mm)

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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