TMR1162

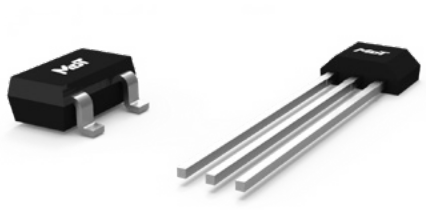
Nano-Ampere Unipolar Magnetic Switch Sensor

Description

The TMR1162 is a unipolar open-drain magnetic switch sensor that integrates TMR sensors with CMOS circuitry, converting magnetic field strength into digital voltage outputs.

The TMR1162 achieves a magnetic signal response frequency of 50 Hz with an ultra-low static supply current of 200 nA, making it suitable for low-power applications. Compared to Hall and AMR sensors operating in power-cycling modes, the TMR1162 offers higher response frequency and faster response time at a similar power level.

The TMR1162 operates over a supply voltage range of 1.8 V to 5.5 V with excellent temperature stability. It is available in SOT23-3 (TMR1162S) and TO92S (TMR1162T) packages, providing flexible integration options.



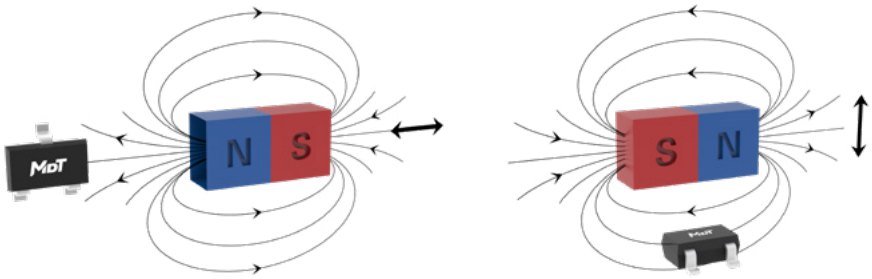
SOT23-3 TO92S

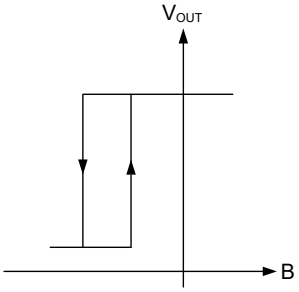
Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Low power consumption: supply current 200 nA
- Frequency response: 50 Hz
- Unipolar operation
- Open drain output
- High sensitivity
- Wide range supply voltages: 1.8 V to 5.5 V
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant

Applications

- Utility meters: water, gas, and heat meters
- Solid-state switch
- Speed sensing
- position sensing
- Motor and fan control
- Power window





Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1162S	200 nA	50 Hz	-40 °C to 125 °C	-17 Gs	-13 Gs	SOT23-3	Tape & Reel
TMR1162T	200 nA	50 Hz	-40 °C to 125 °C	-17 Gs	-13 Gs	TO92S	ESD Bag
Note: Please contact MultiDimension Technology local sales for customizing operating and release points.							

Catalogue

1. Functional Block Diagram

The TMR1162 series switch sensor is 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.

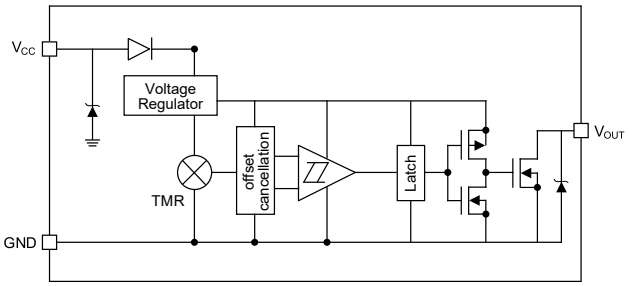


Figure 1. Block diagram

2. Switching Characteristics

The TMR1162 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.

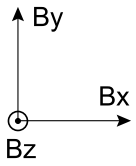


Figure 2-1. Definition of axis

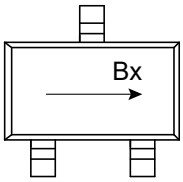


Figure 2-2. Axial diagram (SOT23-3 top view)

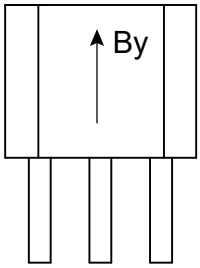


Figure 2-3. Axial diagram (TO92S side view)

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

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

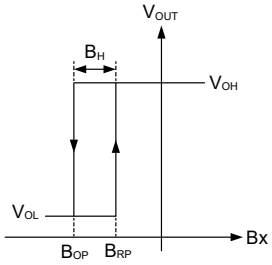


Figure 3-1. Switching characteristics (SOT23-3)

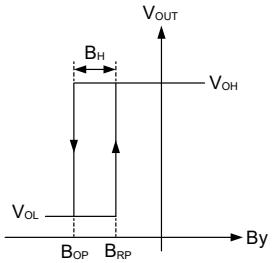


Figure 3-2. Switching characteristics (TO92S)

3. Pin Configuration

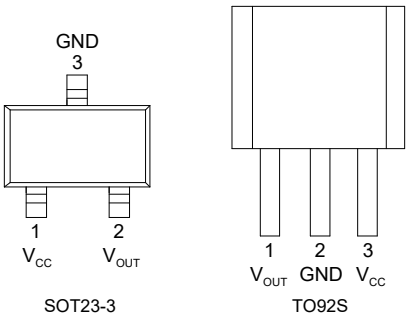


Figure 4. Pin configuration

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}	-	7	V
Reverse supply voltage	V_{RCC}	-	0.3	V
Output current	$I_{OUTSINK}$	-	20	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

5. Electrical Specifications

V_{CC} = 3.0 V, T_A = 25 °C, a 1 kΩ pull-up resistor is connected between V_{CC} and V_{OUT}, and 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 stress voltage	V_{stress}	-	-	-	5.5	V
Output leak current	I_{leak}	OUT = H, V_{CC} = 3V, V_{OUT} = 3V	-	-	1	μA
Output turn-off resistance	R_{OFF}	OUT = H	-	10	-	MΩ
Output low voltage	V_{OL}	OUT = L, V_{CC} = 3V, I_{SINK} = 3mA	-	-	0.1	V
Output turn-on resistance	R_{on}	OUT = L	-	-	10	Ω
Supply current	I_{CC}	Output open	-	200	-	nA
Response frequency	F	-	-	50	-	Hz

6. Magnetic Specifications

V_{CC} = 3.0 V, T_A = 25 °C, a 1 kΩ pull-up resistor is connected between V_{CC} and V_{OUT}, and a 0.1 μF capacitor is connected between V_{CC} and GND

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OP}	-25	-	-10	Gs
Release point	B_{RP}	-20	-	-5	Gs
Hysteresis	B_H	-	4	-	Gs

7. Typical Supply Voltage Characteristics

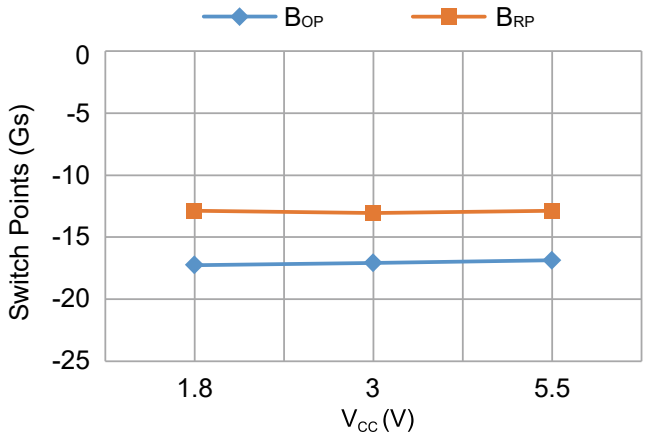


Figure 5. Switch points versus supply voltage (T_A=25°C)

8. Typical Temperature Characteristics

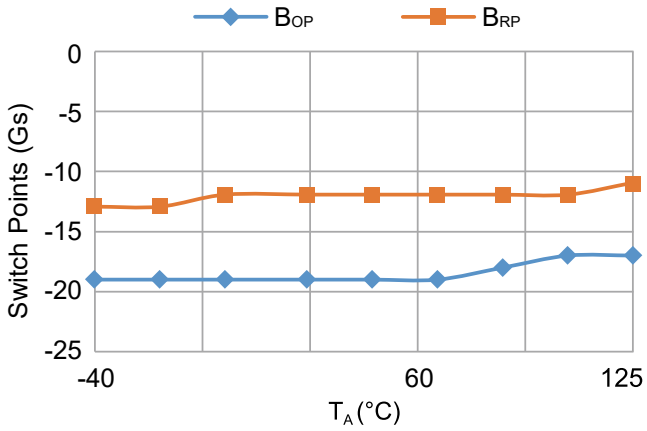


Figure 6. Switch points versus temperature (V_{CC} = 3 V)

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 7, the typical value is 0.1 μF.

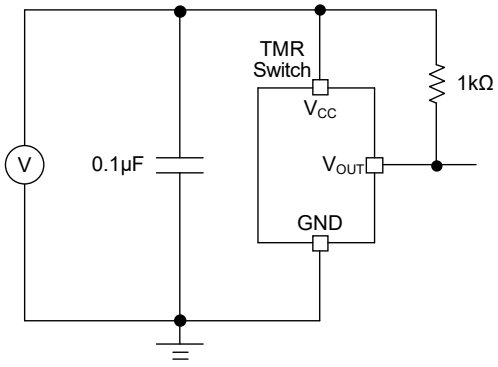


Figure 7. Application circuit diagram

The TMR1162 series sensors are not suitable for driving power loads. Figure 8 illustrates the general method of improving the drive capability is utilizing the output voltage of V_{OUT} pin as a signal to input the MCU or drive a triode or MOS.

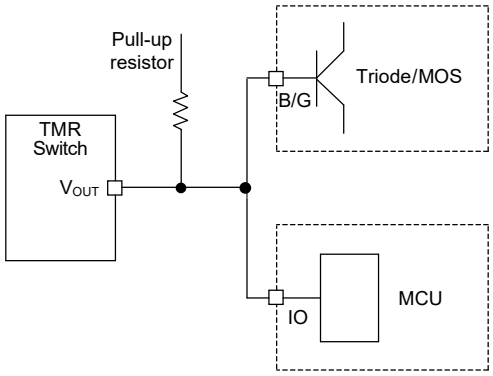


Figure 8. Application diagram for driving power load

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

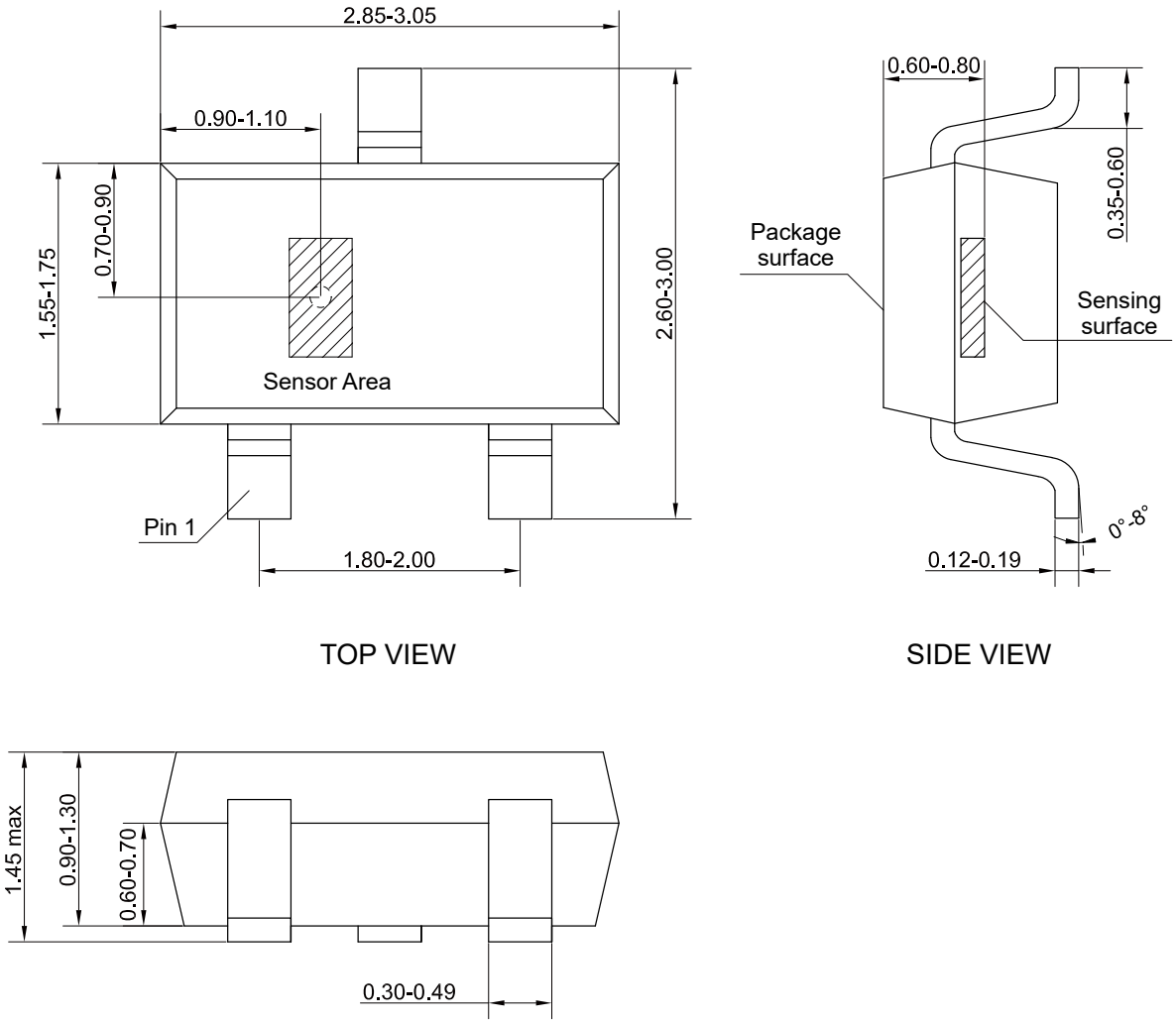


Figure 9. Package outline of SOT23-3 (unit: mm)

TO92S Package

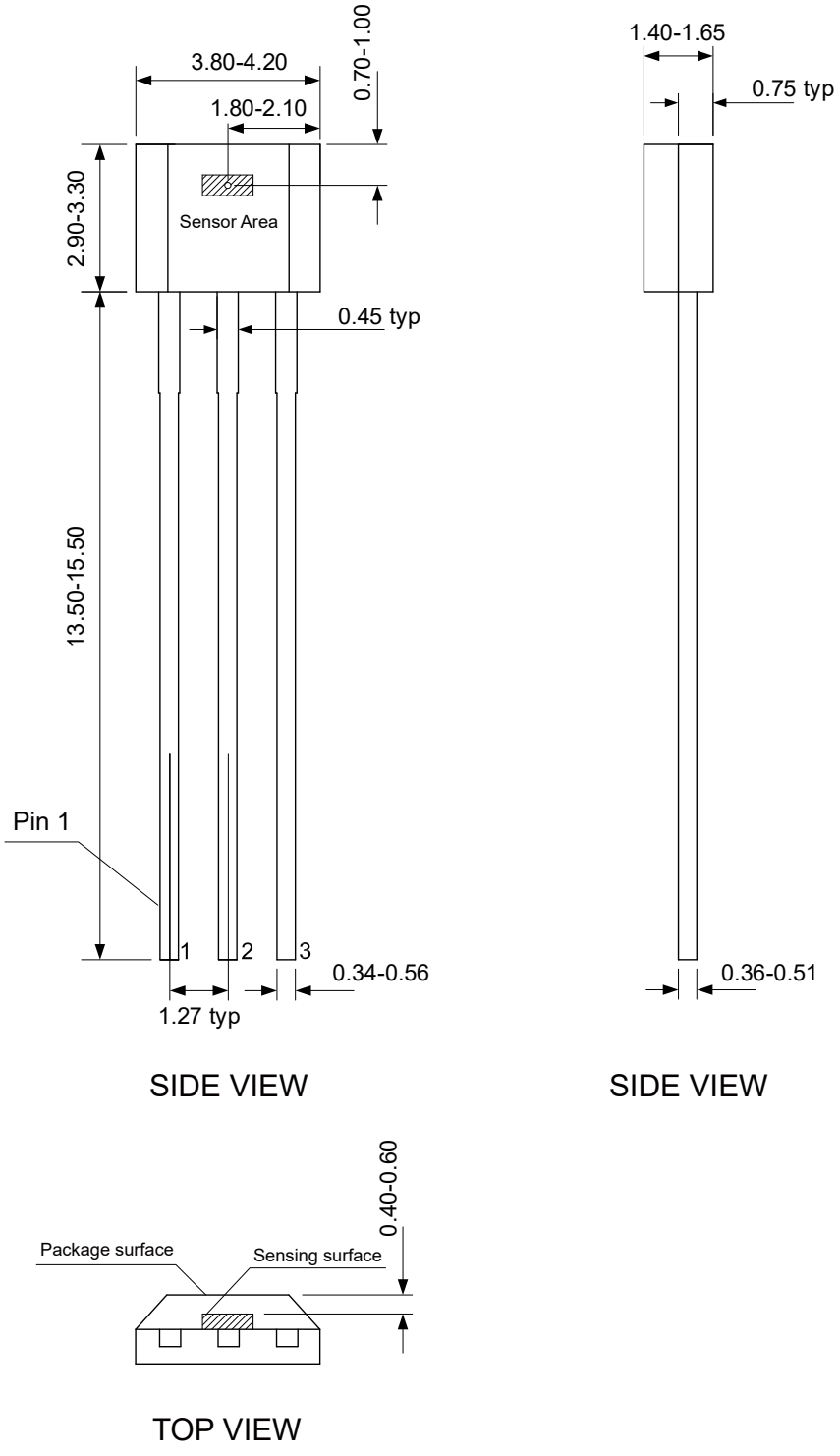


Figure 10. Package outline of TO92S (unit: mm)

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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