TMR138x

High-Voltage TMR Omnipolar Switch

Description

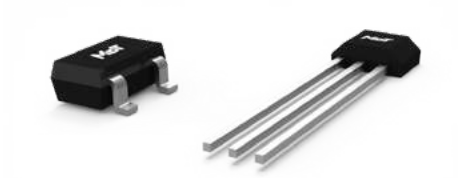
TMR138x is a digital omnipolar magnetic switch that integrates TMR and CMOS technology in order to provide a magnetically triggered digital switch with high sensitivity, high speed, and low power consumption. It is designed for use in applications that are both power-critical and performance-demanding. It contains a push-pull TMR sensor bridge 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 an open-drain 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 from 3 V up to 40 V. The TMR138x draws only 0.6 mA resulting in low-power operation. It has fast response, accurate switching points, excellent thermal stability, and immunity to stray field interference. It is available in two compact SOT23-3 and TO92S packages.

Features and Benefits

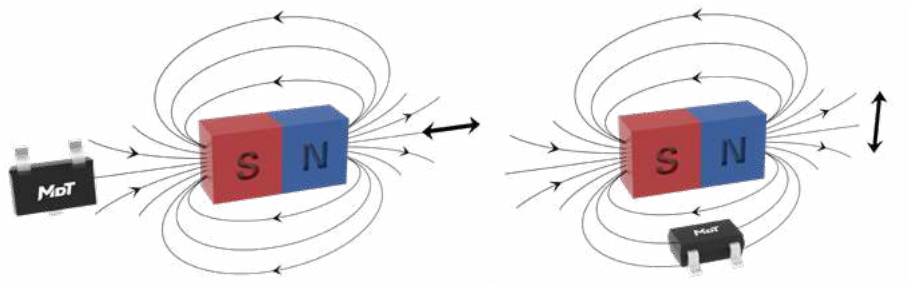
- Tunneling magnetoresistance (TMR) technology
- Low power consumption < 0.6 mA
- High frequency response ≥ 100 kHz
- Omnipolar operation
- In-plane X-Axis sensing
- High supply voltages of 40 V and 30 V reverse voltage
- Open-drain output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic field interference

Applications

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



SOT23-3 TO92S



Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1383S	0.5 mA	100 kHz	-40 °C to 125 °C	±26 Gs	±19 Gs	SOT23-3	Tape & Reel
TMR1383T	0.5 mA	100 kHz	-40 °C to 125 °C	±26 Gs	±19 Gs	TO92S	ESD Bag
TMR1387S	0.5 mA	100 kHz	-40 °C to 125 °C	±65 Gs	±40 Gs	SOT23-3	Tape & Reel
Note: Please contact MultiDimension Technology local sales for customizing operating and release points.							

Catalogue

1. Functional Block Diagram

TMR138x 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.

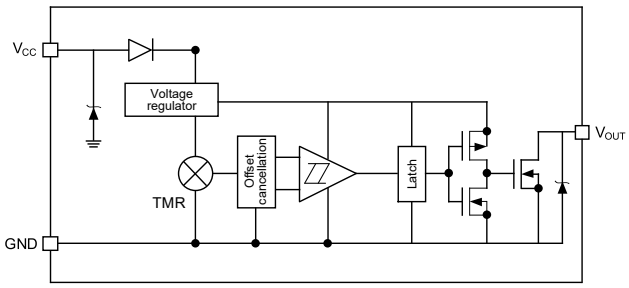


Figure 1. Block diagram

2. Switching Characteristics

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

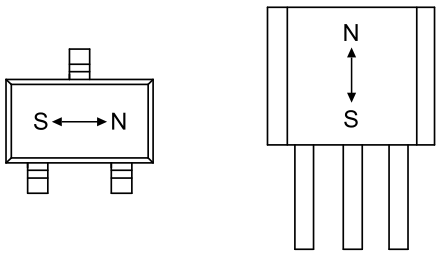


Figure 2. Sensing direction

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.

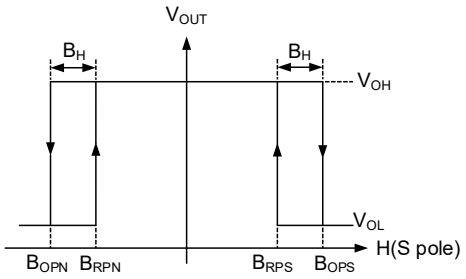


Figure 3. Switching characteristics

3. Pin Configuration

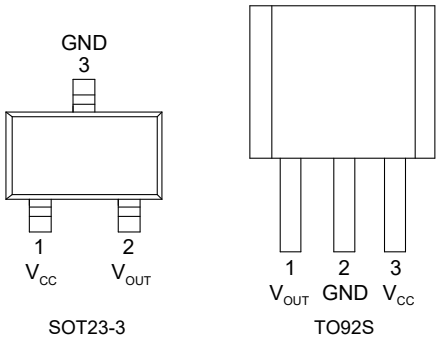


Figure 4. Pin configuration

Pin Number		Name	Function
SOT23-3	TO92S		
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}	-	40	V
Reverse supply voltage	V_{RCC}	-	30	V
Output current	I_{SINK}	-	25	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} = 24 V, T_A = 25 °C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	Operating	3	24	40	V
Output stress voltage	V_{stress}	-	-	-	40	V
Output leak current	I_{leak}	OUT = H, V_{CC} = 24 V, V_{OUT} = 24 V	-	3	-	μA
Off resistance of output	R_{OFF}	OUT = H	-	10	-	MΩ
Output low voltage	V_{OL}	OUT = L, V_{CC} = 24 V, I_{SINK} = 25 mA	-	-	0.3	V
On resistance of output	R_{ON}	OUT = L	-	-	10	Ω
Supply current	I_{CC}	Output Open	0.4	0.5	0.6	mA
Response frequency	F	-	0 to 100			kHz

Note: 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 during all tests in the table above.

6. Magnetic Specifications

V_{CC} = 24 V, T_A = 25 °C

TMR1383

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	26	-	Gs
	B_{OPN}	-	-26	-	Gs
Release point	B_{RPS}	-	19	-	Gs
	B_{RPN}	-	-19	-	Gs
Hysteresis	B_H	-	7	-	Gs

TMR1387

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-	65	-	Gs
	B_{OPN}	-	-65	-	Gs
Release point	B_{RPS}	-	40	-	Gs
	B_{RPN}	-	-40	-	Gs
Hysteresis	B_H	-	25	-	Gs

7. Typical Supply Voltage Characteristics

TMR1383 Supply Voltage Characteristics

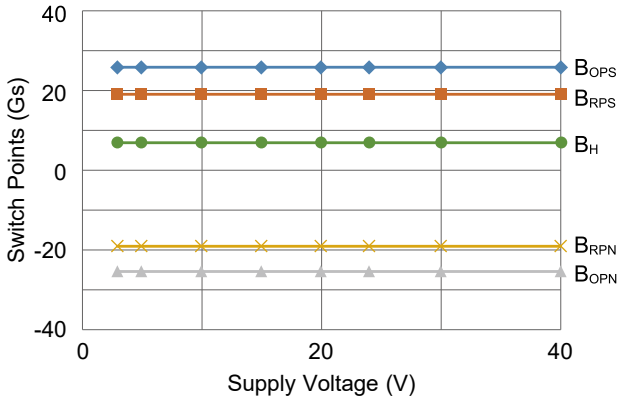


Figure 5. Switch points versus supply voltage (T_A = 25°C)

TMR1387 Supply Voltage Characteristics

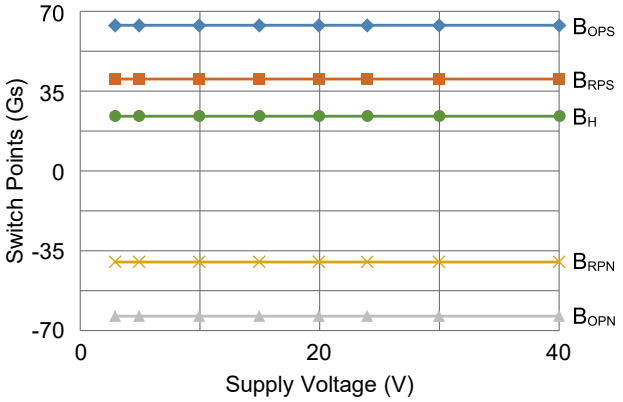


Figure 6. Switch points versus supply voltage (T_A = 25°C)

8. Typical Temperature Characteristics

TMR1383 Temperature Characteristics

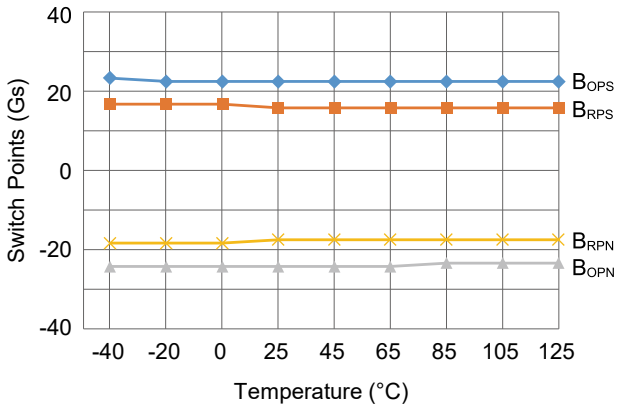


Figure 7. Switch points versus temperature (V_{CC} = 24 V)

TMR1387 Temperature Characteristics

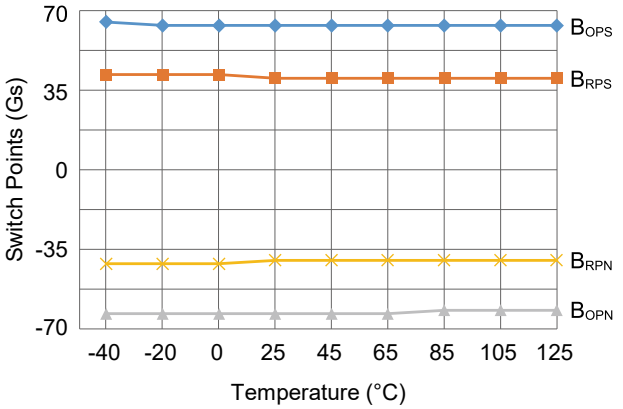


Figure 8. Switch points versus temperature (V_{CC} = 24 V)

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 9, the typical value is 0.1 μF.

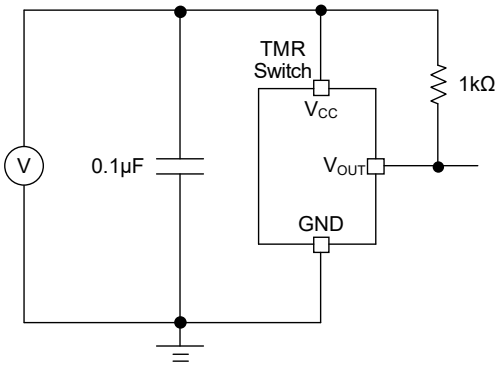


Figure 9. Application circuit diagram

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} 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

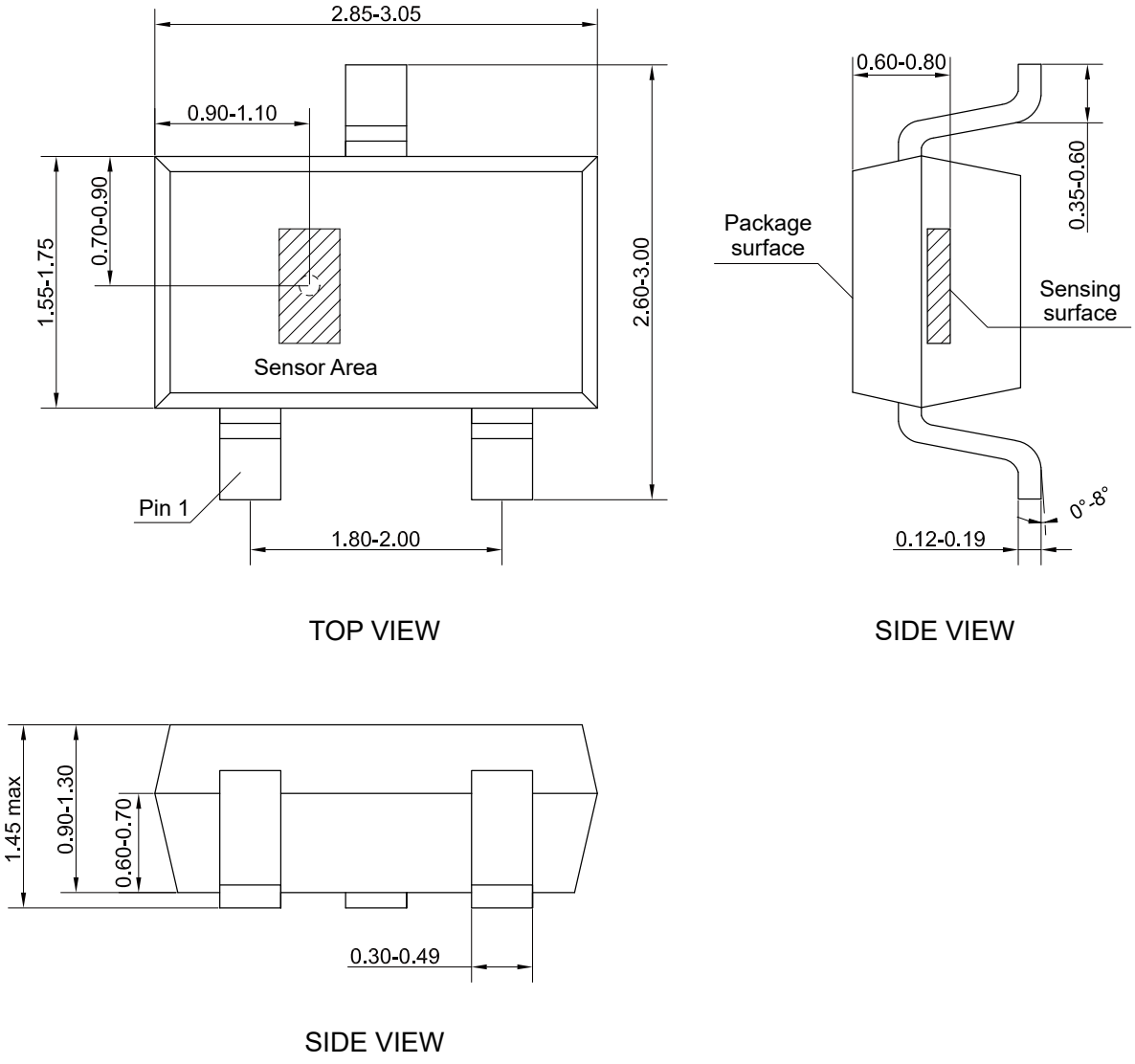


Figure 10. Package outline of SOT23-3 (unit: mm)

TO92S Package

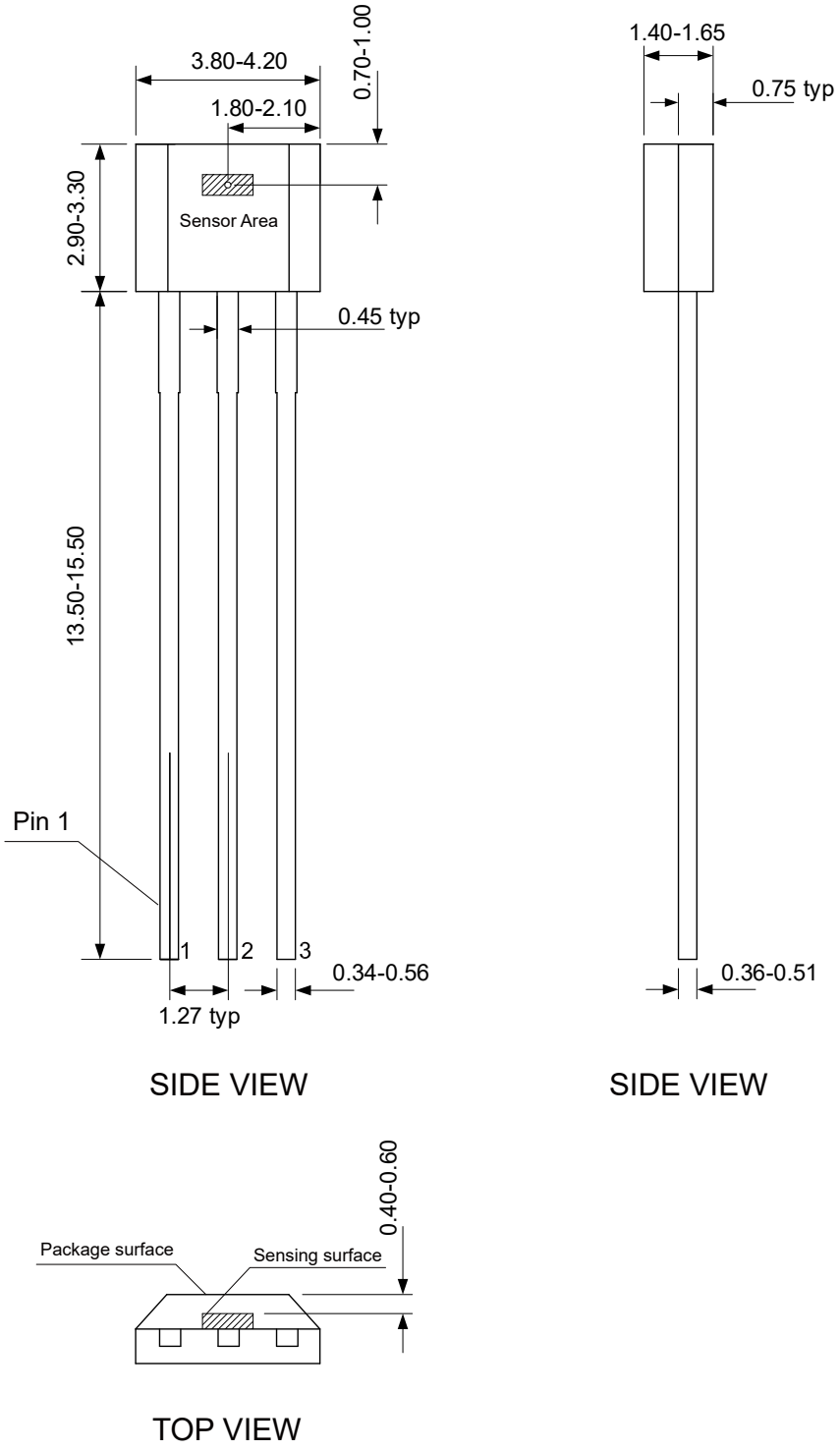


Figure 11. Package outline of TO92S (unit: mm)

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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