

TMR1369

Low Power Consumption Omnipolar Magnetic Switch Sensor

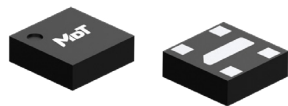
Description

The TMR1369 is an omnipolar magnetic switch that integrates Tunnel Magnetoresistance (TMR) sensor and CMOS technology, developed for high-sensitivity, low-power, high-precision, and low-voltage applications. The TMR1369 combines a TMR magnetic sensor with CMOS integrated circuits, including a voltage generator, comparator, Schmitt trigger, and push-pull output circuit, allowing it to convert varying magnetic field signals into digital voltage signal outputs.

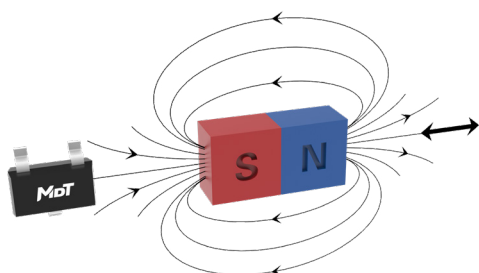
The TMR1369 provides a temperature-compensated power supply via an internal voltage regulator and supports a wide operating voltage range. With low operating voltage, nA-level supply current, a 3 Hz switching frequency, and a wide operating temperature range, the TMR1369 is an ideal choice for many low-voltage, low-power, and high-performance applications. It is available in SOT23-3 package and DFN4L (1.6 mm × 1.6 mm × 0.5 mm) package.



SOT23-3



DFN4L

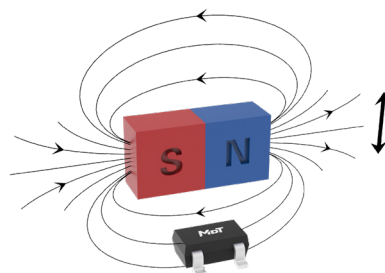
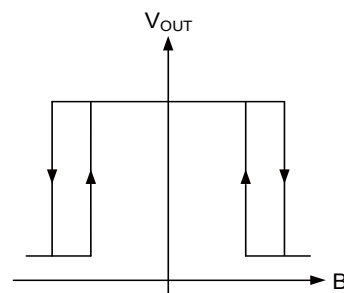


Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Ultra-low power consumption
- 3 Hz switching frequency
- Omnipolar operation
- X-axis sensitivity
- CMOS push-pull output
- High sensitivity
- Low supply voltages: 2 V to 3.5 V
- Excellent temperature stability
- RoHS & REACH compliant

Applications

- Utility meters: water, gas, and heat meters
- Proximity switches
- Linear and rotation position sensing
- Medical wake-up switches



Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1369S	100 nA	3 Hz	-40 °C to 85 °C	±14 Gs	±11 Gs	SOT23-3	Tape & Reel
TMR1369D	100 nA	3 Hz	-40 °C to 85 °C	±14 Gs	±11 Gs	DFN4L	Tape & Reel

Note: Please contact MultiDimension Technology local sales for customizing operating and release points.

Catalogue

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1. Functional Block Diagram

TMR1369 series switches 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.

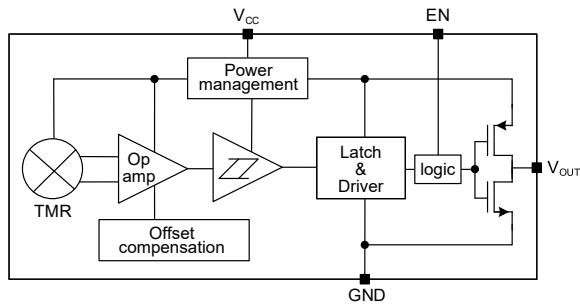


Figure 1. Block diagram

2. Switching Characteristics

The TMR1369 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.

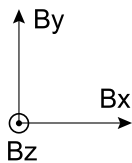


Figure 2-1. Definition of axis

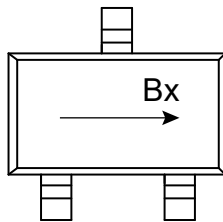


Figure 2-2. Axial diagram (SOT23-3 top view)

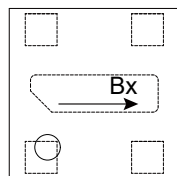


Figure 2-3. Axial diagram (DFN4L top view)

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 defined 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 exceed 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 4.

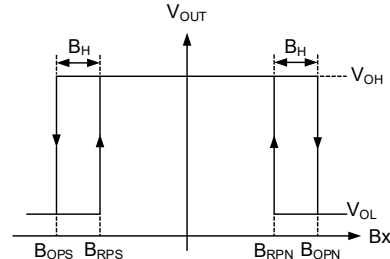


Figure 3. Switching characteristics

Specification	Condition	Output
Magnetic south(S)	$B > B_{OPS}$	V_{OL}
	$0 < B < B_{RPS}$	V_{OH}
Magnetic north(N)	$B < B_{OPN}$	V_{OL}
	$0 > B > B_{RPN}$	V_{OH}
Switch lock enabled	Pin EN is connected to 1.2 V to 3.5 V	Lock enabled, V_{OH}
	Pin EN not connected or grounded	Switch output follows external magnetic field logic

3. Pin Configuration

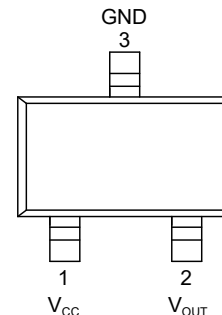


Figure 4-1. Pin configuration (SOT23-3)

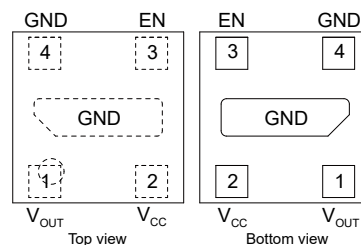


Figure 4-2. Pin configuration (DFN4L)

Pin Number		Name	Function
SOT23-3	DFN4L		
1	2	V_{CC}	Power supply
2	1	V_{OUT}	Output
3	4	GND	Ground
-	3	EN	Switch lock enable pin

4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	-	3.5	V
Reverse supply voltage	V_{RCC}	-	0.3	V
Output current	$I_{OUTSINK}$	-	12	mA
Magnetic flux density	B	-	4000	Gs
ESD performance (HBM)	V_{ESD}	-	2	kV
Operating ambient temperature	T_A	-40	85	°C
Storage ambient temperature	T_{STG}	-50	150	°C

5. Electrical Specifications

$T_A = 25\text{ °C}$, a 0.1 μF capacitor is connected between V_{CC} and GND unless specified otherwise

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	Operating	2.0	3.0	3.5	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}	$V_{CC} = 3.3\text{ V}$, OP and RP states	100	-	300	nA
Response frequency	F	$V_{CC} = 3.3\text{ V}$	-	3	-	Hz

6. Magnetic Specifications

$V_{CC} = 3\text{ V}$, $T_A = 25\text{ °C}$, a 0.1 μF capacitor is connected between V_{CC} and GND unless specified otherwise

Parameters	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPS}	-22	-14	-7	Gs
	B_{OPN}	7	14	22	Gs
Release point	B_{RPS}	-20	-11	-5	Gs
	B_{RPN}	5	11	20	Gs
Hysteresis	B_H	1	3	5	Gs

7. Typical Supply Voltage Characteristics

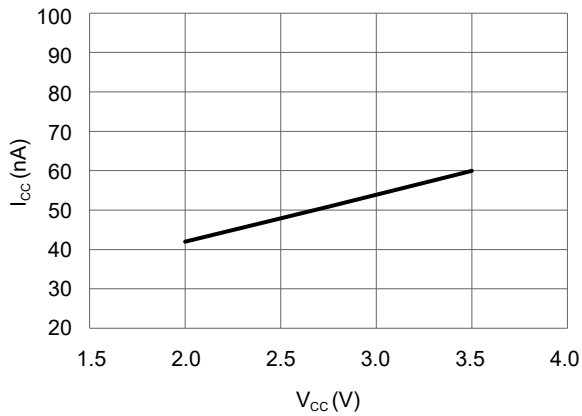


Figure 5. Supply current versus supply voltage (T_A=25°C)

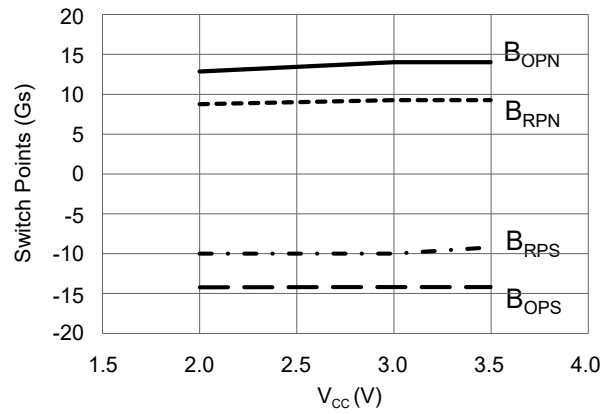


Figure 6. Switch points versus supply voltage (T_A=25°C)

8. Typical Temperature Characteristics

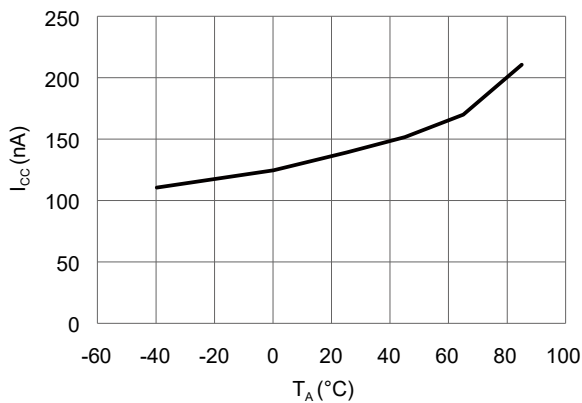


Figure 7. Supply current versus temperature (V_{cc} = 3 V)

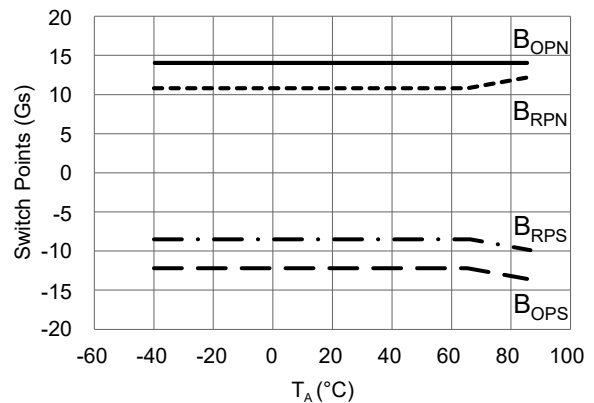


Figure 8. Switch points versus temperature (V_{cc} = 3 V)

9. Application Information

It is recommended to add a filter capacitor with the typical value of $0.1\ \mu\text{F}$ between the switch power supply and ground (close to the sensor) to reduce external noise as shown in Figure 9.

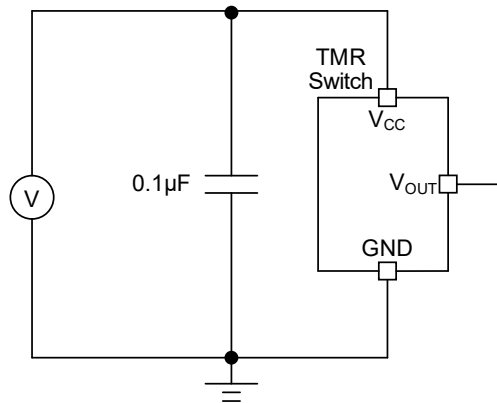


Figure 9. Application circuit diagram

The TMR1369 is not suitable for driving power loads. Figure 10 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.

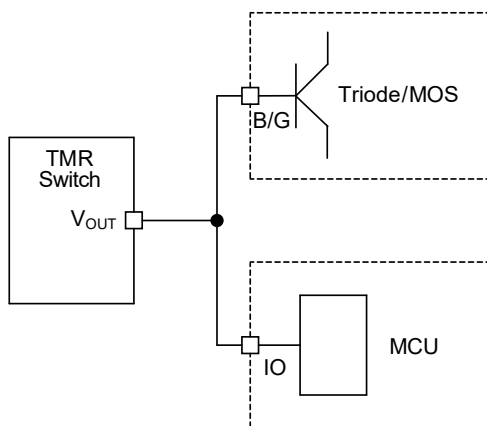


Figure 10. Application diagram for driving power load

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

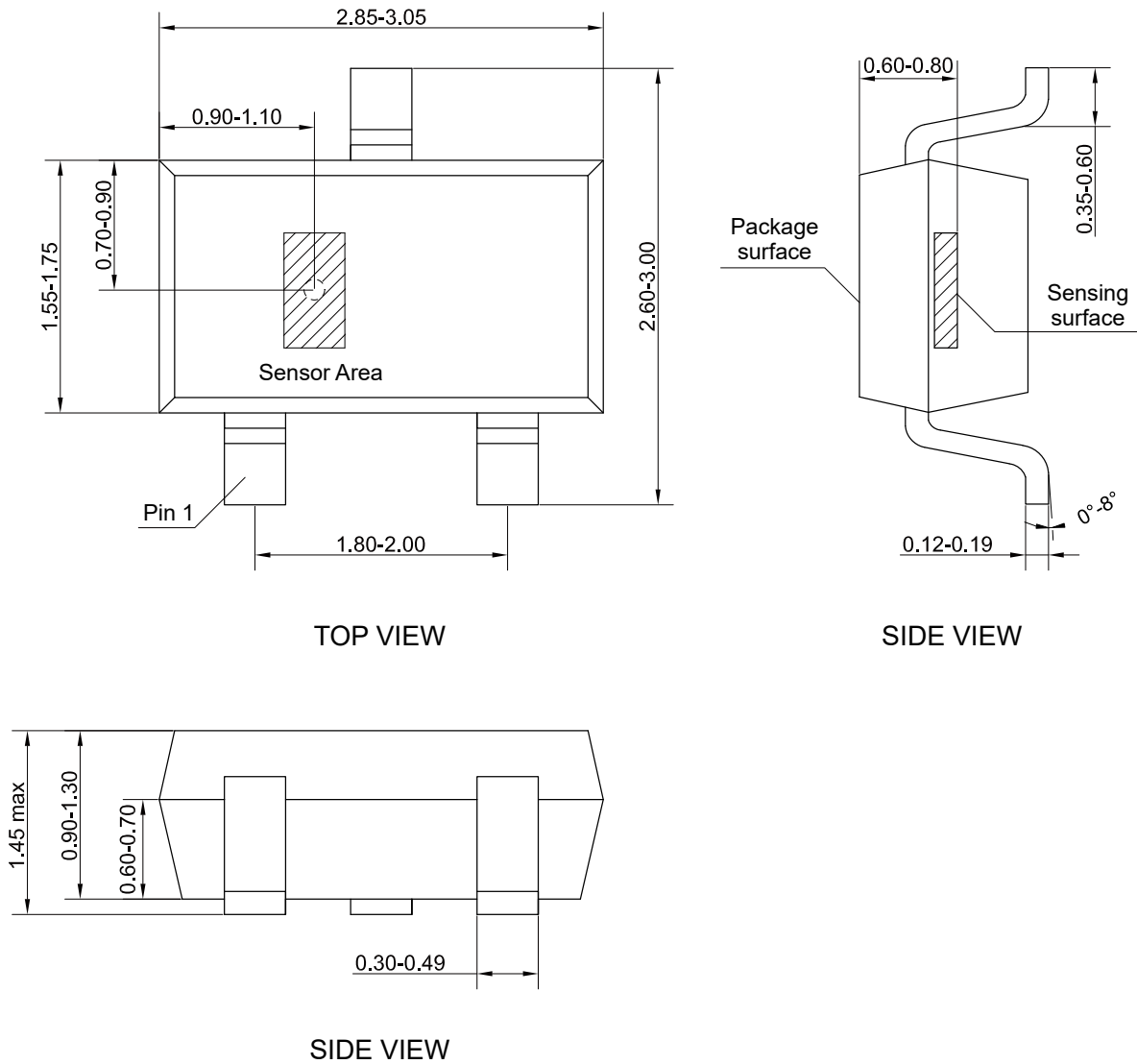


Figure 11. Package outline of SOT23-3 (unit: mm)

DFN4L (1.6×1.6×0.5) Package

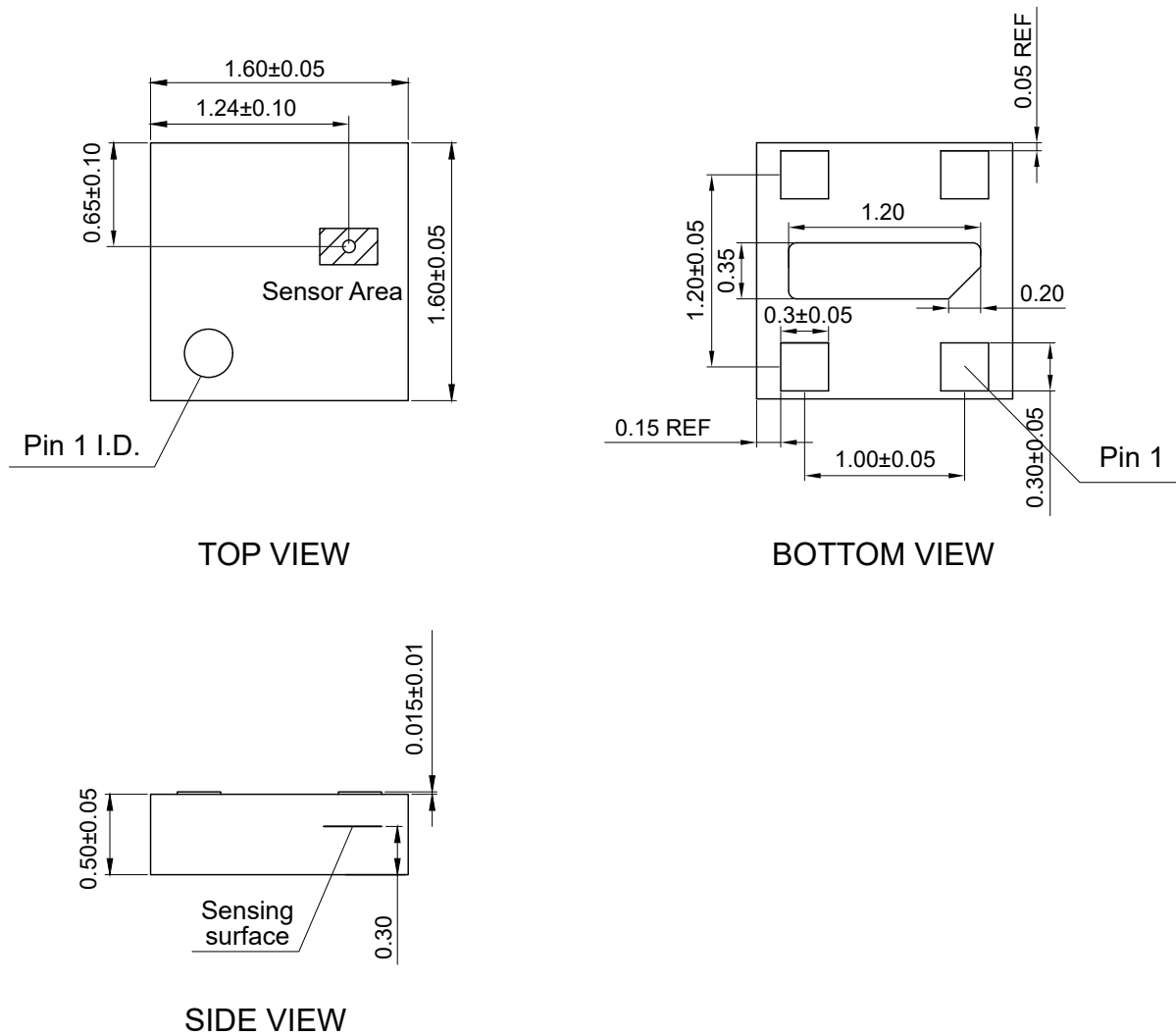


Figure 12. Package outline of DFN4L (unit: mm)

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