

# TMR1148

## MicroAmpere High Frequency Response Unipolar Magnetic Switch Sensor

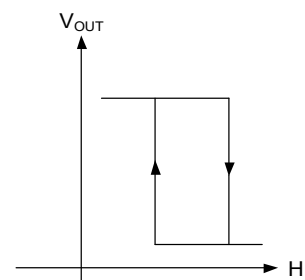
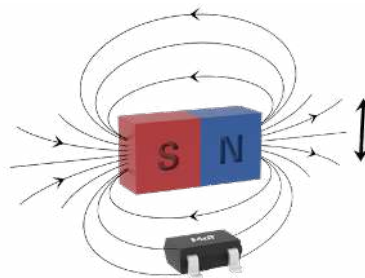
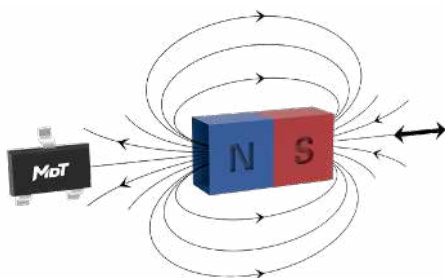
### Description

TMR1148 is a unipolar magnetic switch integrated the tunneling 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.

Unlike Hall/AMR sensors, TMR sensors with extremely high resistance values allows TMR1148 to achieve the supply current as low as 1.5  $\mu\text{A}$  while operating in the full-time power supply mode, and maintaining the response frequency of the magnetic signal is 1 kHz. Therefore, TMR1148 can provide true continuous detection of magnetic field signals, avoiding sampling errors from the traditional time-sharing power supply mode.



SOT23-3



### Features and benefits

- Tunneling magnetoresistance (TMR) technology
- Low power consumption: supply current 1.5  $\mu\text{A}$
- High frequency response: typ. 1 kHz
- Unipolar operation
- Wide range supply voltages: 1.8 V to 5.5 V
- Open-drain output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant
- Validation according to AEC-Q100 Grade1
- Fulfill MSL 1

### Applications

- Utility meters: water, gas, and heat meters
- Proximity switches
- Speed sensing
- Linear and rotation position sensing
- Wake-up switch
- Level switch

## Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1148S	1.5 $\mu$ A	0 to 1 kHz	-40 °C to 125 °C	15 Gs	10 Gs	SOT23-3	Tape & Reel
Note: Please contact MultiDimension Technology local sales representative for customizing B <sub>OP</sub> and B <sub>RP</sub> information.							

## Catalogue

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## 1. Functional Block Diagram

TMR1148 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 circuit as shown in Figure 1.

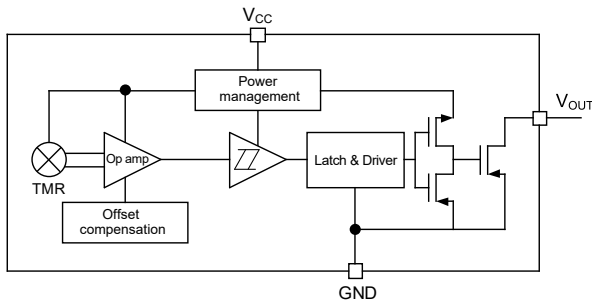


Figure 1. Block diagram

## 2. Switching Characteristics

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

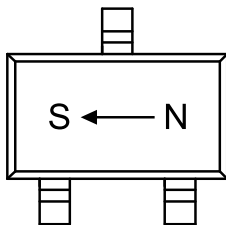


Figure 2. Sensing direction

The output is “High”, when power is on at zero magnetic field.  $B$  is the external magnetic field along the sensing direction,  $B_{OP}$  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.

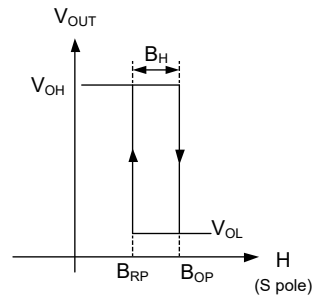


Figure 3. Switching characteristics

## 3. Pin Configuration

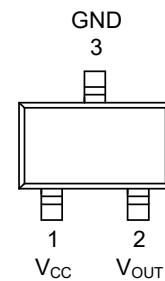


Figure 4. Pin configuration (SOT23-3)

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

## 4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	$V_{CC}$	-0.3	7	V
Output current	$I_{SINK}$	-	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

Note:  $I_{SINK}$  is the current flowing through the pin of sensor, when the output is turned on.

## 5. Electrical Specifications

$V_{CC}=3.0$  V,  $T_A=25$  °C, a 0.1  $\mu$ F capacitor is connected between  $V_{CC}$  and GND unless specified otherwise

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	-	-	1	$\mu$ A
On resistance of output	$R_{ON}$	OUT = L	-	0.75	1	$\Omega$
Off resistance of output	$R_{OFF}$	OUT = H	-	30	-	M $\Omega$
Output high voltage	$V_{OH}$	RP status	[2]	-	$V_{CC}$	V
Output low voltage	$V_{OL}$	OP status	0	-	0.2	V
Supply current	$I_{CC}$	OP and RP status	0.5	1.5	2	$\mu$ A
Power-on time	$t_{PO}$	$V_{CC}=3.0$ V	-	-	400	$\mu$ s
Power-on current	$I_{PO}$	$V_{CC}=3.0$ V	-	-	10	$\mu$ A
Response frequency	F	-	0 to 1000			Hz

[2]  $V_{OH}$  is affected by the resistance of the switch output pull-up resistor and the leakage current flowing through the pull-up resistor.

## 6. Magnetic Specifications

$V_{CC}=3.0$  V,  $T_A=25$  °C, a 0.1  $\mu$ F capacitor is connected between  $V_{CC}$  and GND unless specified otherwise

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	$B_{OP}$	10	15	25	Gs
Release point	$B_{RP}$	5	10	20	Gs
Hysteresis	$B_H$	2	5	9	Gs

## 7. Typical Supply Voltage Characteristics

### Supply Voltage Characteristics

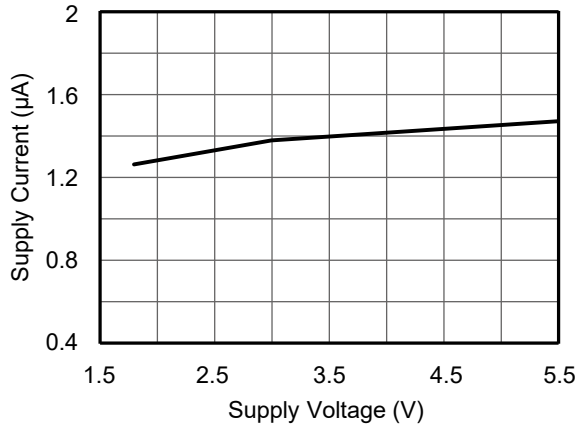


Figure 5. Supply current versus supply voltage (T<sub>A</sub>=25°C)

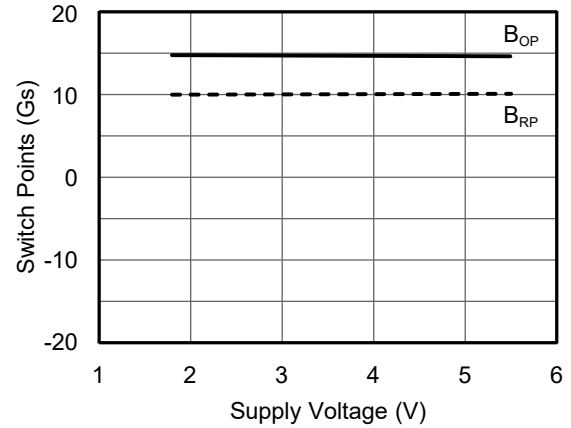


Figure 6. Switch points versus supply voltage (T<sub>A</sub>=25°C)

## 8. Typical Temperature Characteristics

### Temperature Characteristics

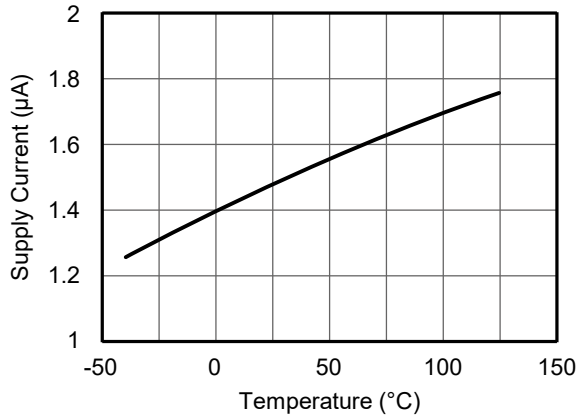


Figure 7. Supply current versus temperature (V<sub>CC</sub>=3V)

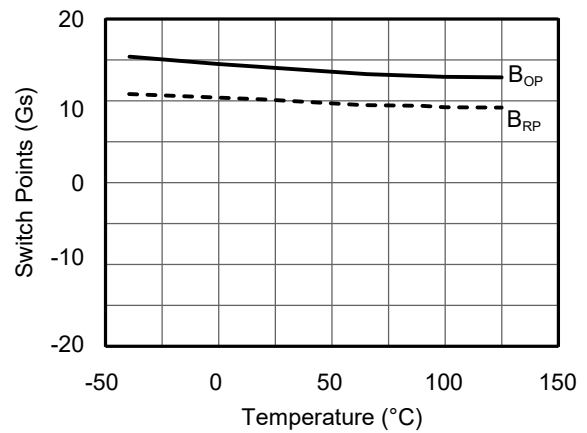


Figure 8. Switch points versus temperature (V<sub>CC</sub>=3V)

## 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.

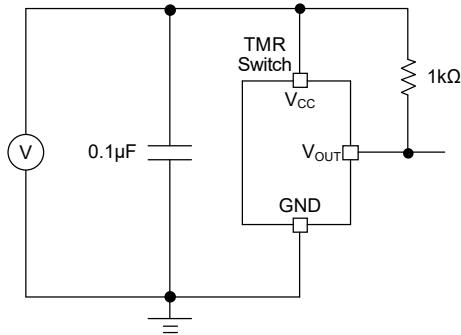


Figure 9. Application circuit diagram

The TMR1148 series sensor chips are not suitable for driving power loads. Figure 10 illustrates the general method of improving the drive capability is utilizing the output voltage of  $V_{\text{OUT}}$  pin as a signal to input the MCU or drive a triode or MOS.

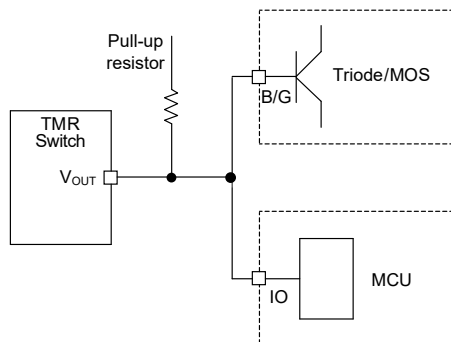


Figure 10. Application diagram for driving power load

Common failure conditions:

- The 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  $V_{\text{OUT}}$  to control high-power relays, etc., and cause  $I_{\text{SINK}}$  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

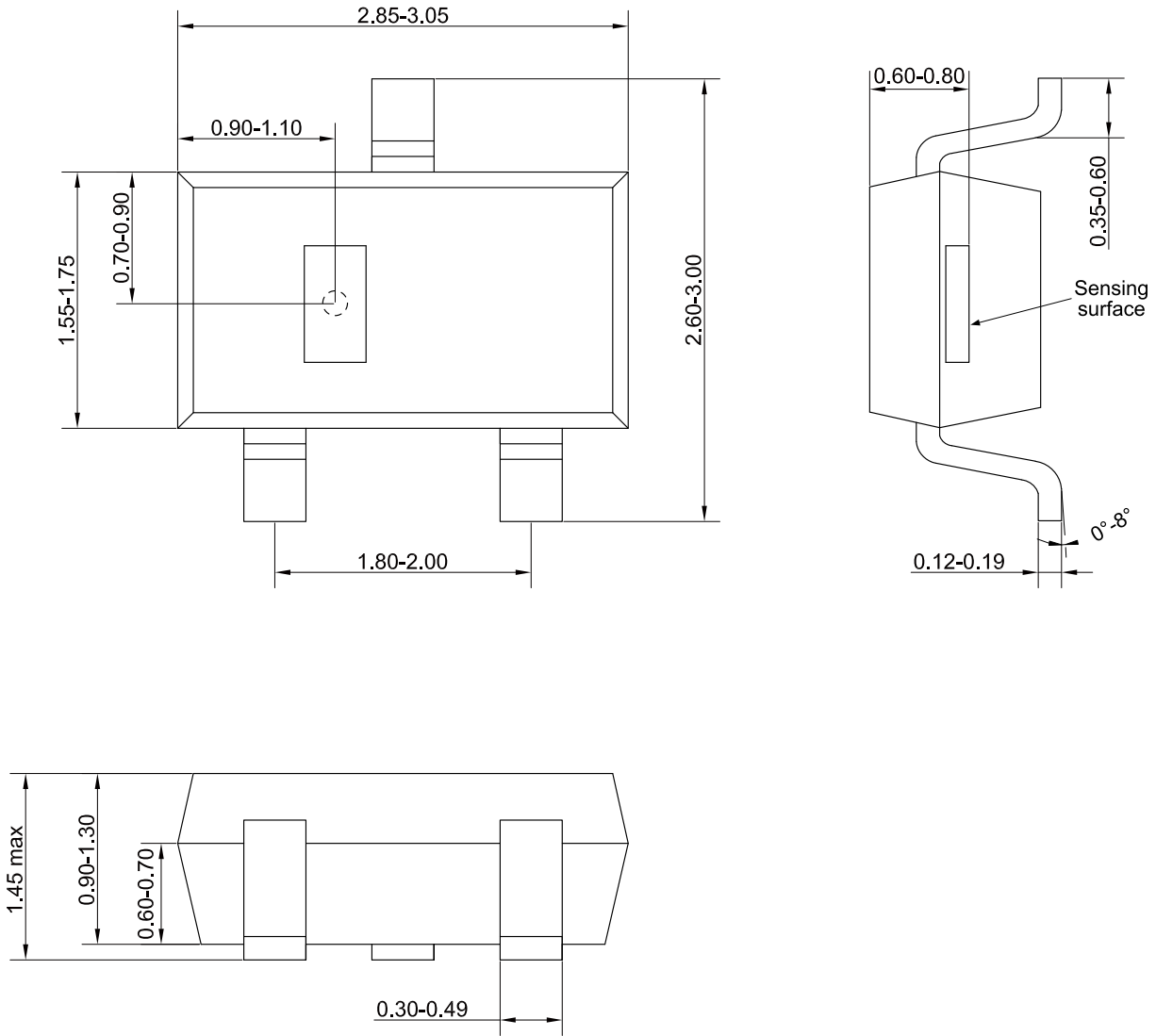


Figure 11. Package outline of SOT23-3 (unit: mm)

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