

# TMR1202D

## MicroAmpere High Frequency Response Bipolar Magnetic Switch Sensor

### Description

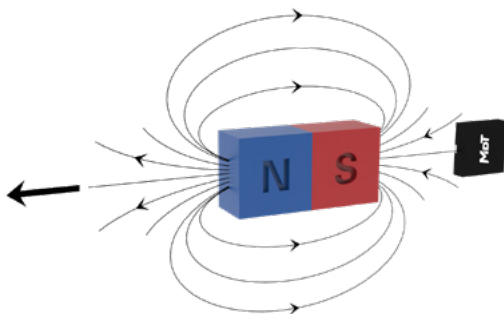
The TMR1202D series magnetic switch sensors are bipolar latching magnetic switch sensors that integrate Tunnel Magnetoresistance (TMR) sensors and CMOS circuits. They can convert changing magnetic field signals into digital voltage signals to achieve precise position detection.

Unlike Hall or Anisotropic Magnetoresistance (AMR) sensors, TMR sensors have extremely high resistance values. This allows the series of switch sensors to operate in a full-time power supply mode, maintaining low power consumption while achieving true continuous detection of magnetic field signals. This approach avoids the sampling errors that occur with traditional time-division power supply modes.

This series of sensors features a static supply current as low as 1.5  $\mu\text{A}$  and maintains a magnetic signal response frequency of 1 kHz.



DFN3L

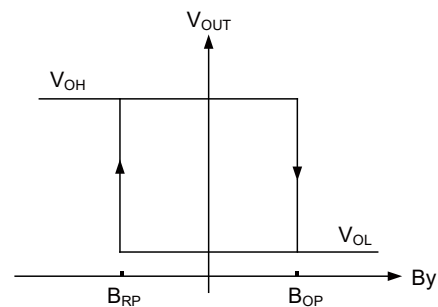


### Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Low power consumption: supply current 1.5  $\mu\text{A}$
- High frequency response: up to 1 kHz
- Bipolar latching magnetic switch
- Wide range supply voltages: 1.8 V to 5.5 V
- CMOS push-pull output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant
- Compliant with AEC-Q100 Grade 1
- Moisture Sensitivity Level 1 (MSL1)

### Applications

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



## Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1202D	1.5 $\mu$ A	0 to 1 kHz	-40 °C to 125 °C	14 Gs	-14 Gs	DFN3L	Tape
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

This series of switch sensors consists of a TMR sensor and signal processing circuitry. The TMR sensor detects external magnetic fields and generates analog voltage signals, which are processed by the circuitry to output logical decision levels, as shown in Figure 1.

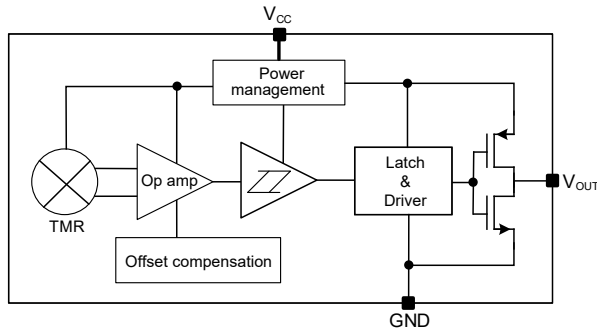


Figure 1. Block diagram

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.

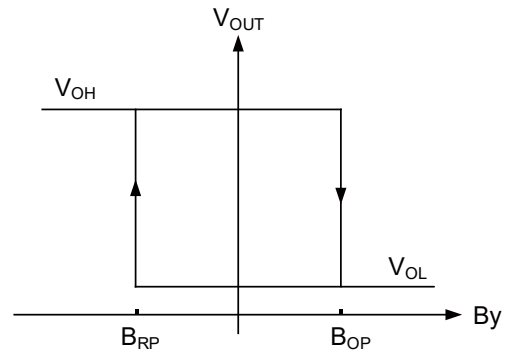


Figure 3. Switching characteristics

## 2. Switching Characteristics

The TMR1202D sensing axis is perpendicular 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.

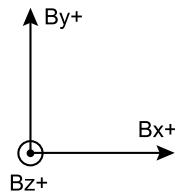


Figure 2-1. Definition of axis

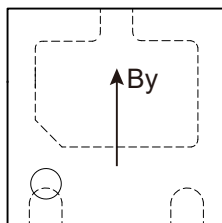


Figure 2-2. Axial diagram (DFN3L top view)

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

## 3. Pin Configuration

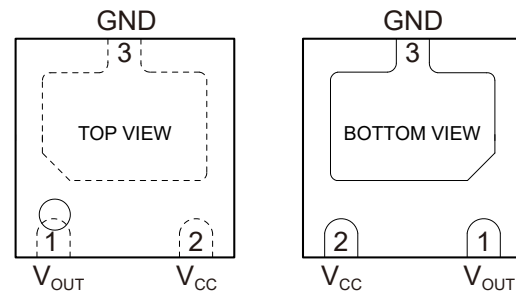


Figure 4. Pin configuration

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

## 4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	$V_{CC}$	-0.3	7	V
Output current	$I_{SINK}$ , $I_{SOURCE}$	-	9	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.  $I_{SOURCE}$  is the current flowing through the pin of the switch, when the output is turned off.

## 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 high voltage	$V_{OH}$	RP status	$V_{CC} - 0.3$	-	$V_{CC}$	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
Response frequency	F	-	0 to 1000			Hz

## 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	14	18	Gs
Release point	$B_{RP}$	-18	-14	-10	Gs
Hysteresis	$B_H$	20	-	36	Gs

## 7. Typical Supply Voltage Characteristics

### Supply Voltage Characteristics

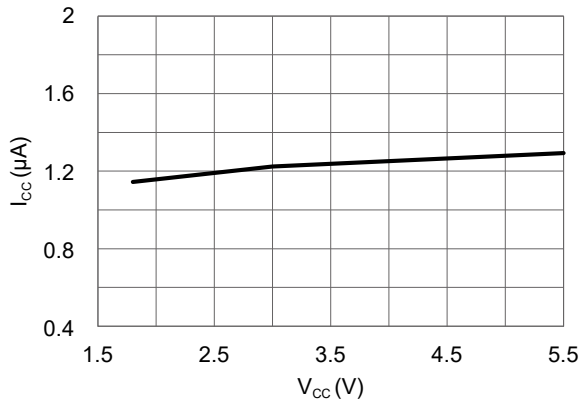


Figure 5. Supply current versus supply voltage (T<sub>A</sub>=25°C)

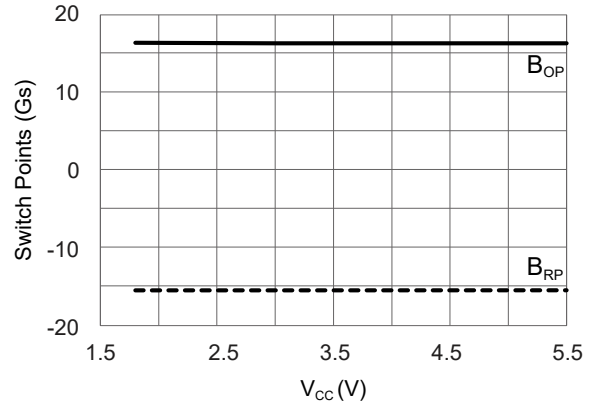


Figure 6. Switch points versus supply voltage (T<sub>A</sub>=25°C)

## 8. Typical Temperature Characteristics

### Temperature Characteristics

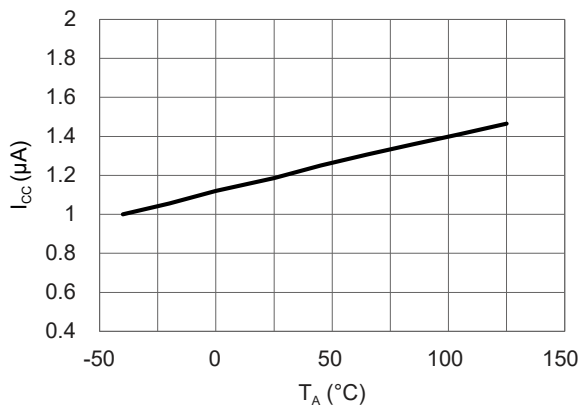


Figure 7. Supply current versus temperature (V<sub>CC</sub> = 3 V)

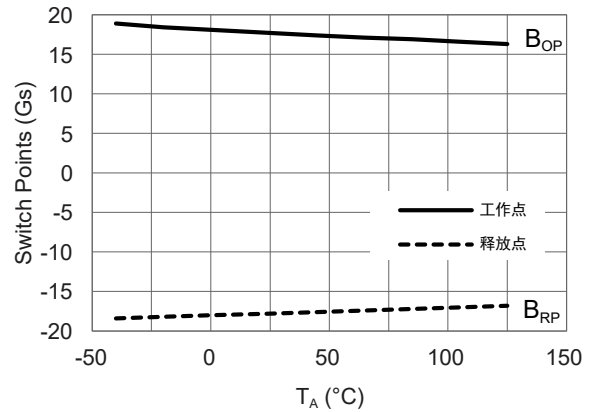


Figure 8. Switch points versus temperature (V<sub>CC</sub> = 3 V)

## 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.

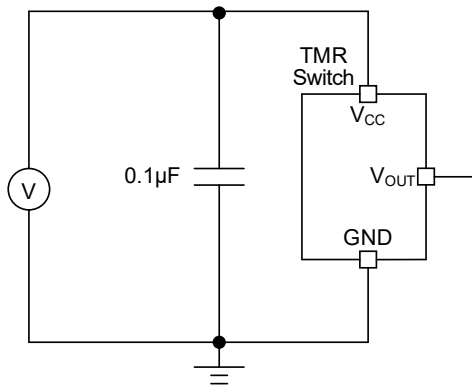


Figure 9. Application circuit diagram

The TMR1202D 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.

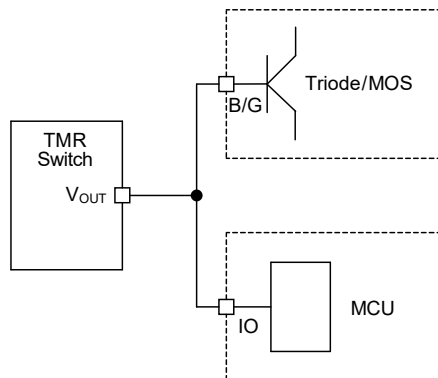


Figure 10. Application diagram for driving power load

Common failure conditions:

- The 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  $V_{\text{OUT}}$  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  $V_{\text{OUT}}$  pin, or powering the device through the  $V_{\text{OUT}}$  pin.

## 10. Dimensions

### DFN3L Package

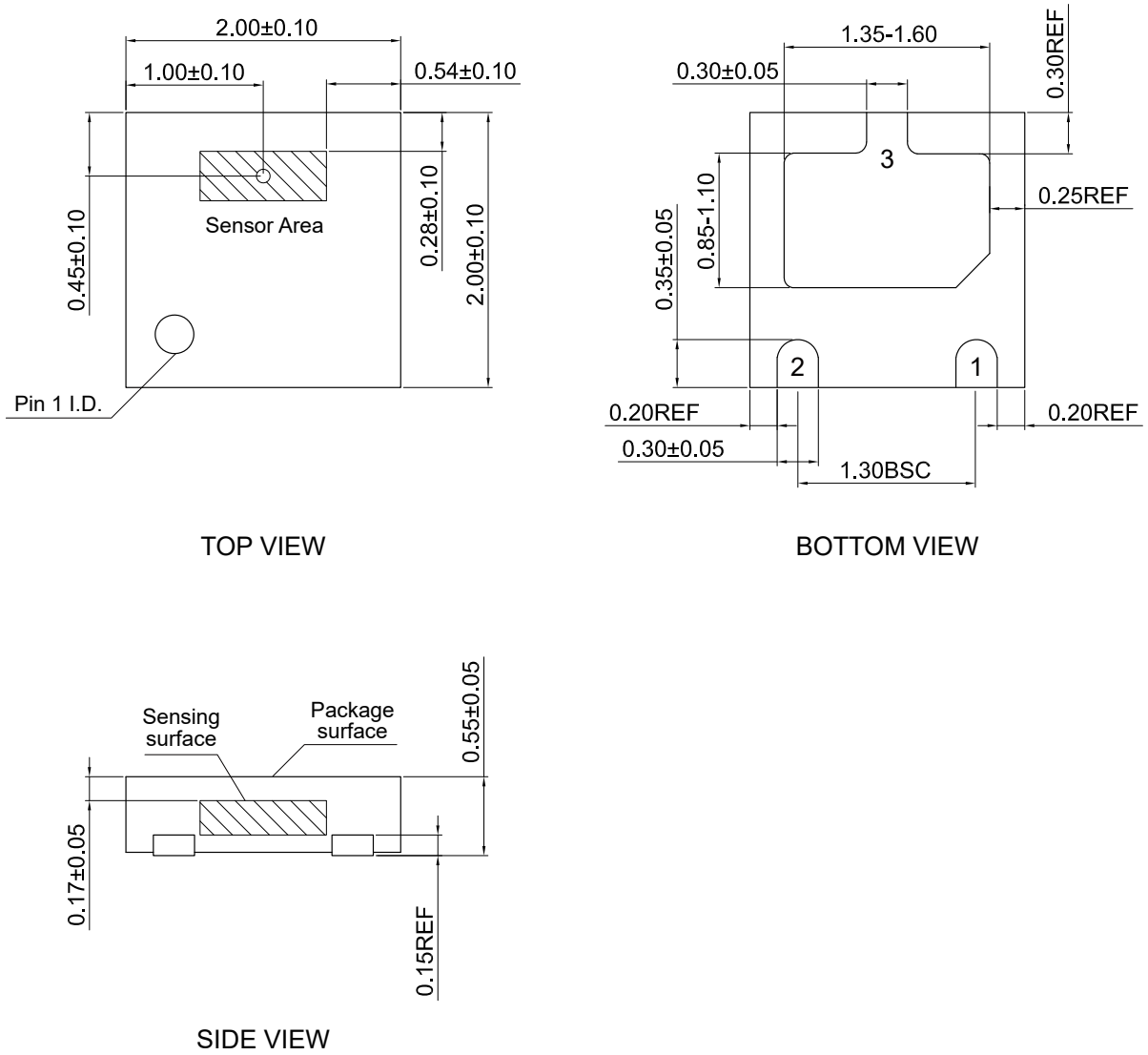


Figure 11. Package outline of DFN3L (unit: mm)

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