TMR3016

High Accuracy Analog TMR Angle Sensor

Description

TMR3016 contains a push-pull Wheatstone bridge, which is composed of four high-sensitivity tunneling magnetoresistance (TMR) elements. The sensor outputs a sinusoidal signal, and the period of this signal corresponds to a 360° rotation of the magnetic field direction within the sensing plane, independent of the externally applied magnetic field strength.

TMR3016 uses a compact DFN4L (0.8 mm × 0.4 mm × 0.23 mm) package for easy assembly in small spaces.

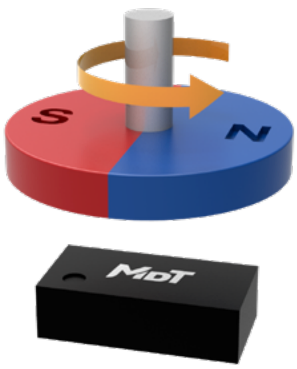
DFN4L

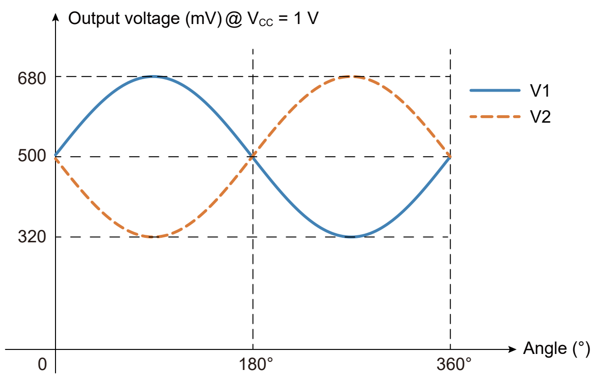
Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Wide range supply voltage
- Analog differential output
- Excellent temperature stability
- Adapt to large air gap
- Compact DFN package
- RoHS and REACH compliant

Applications

- Angular position sensing
- Linear position sensing





Selection Guide

Part Number	Output	Supply Voltage	Operating Temperature	Package	Packing Form
TMR3016D	Analog	≤ 5.5 V	-30 °C to 85°C	DFN4L	Tape & Reel

Catalogue

1. Functional Block Diagram

TMR3016 TMR angle sensor integrates a Wheatstone bridge using TMR elements to increase the output amplitude and improve the temperature characteristics.

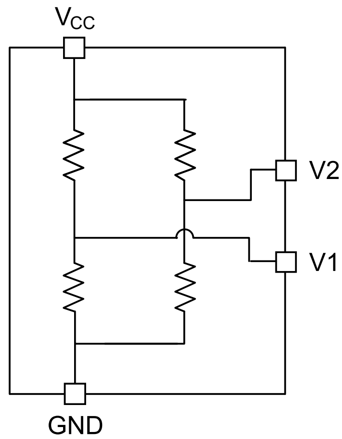


Figure 1. Block diagram

2. Pin Configuration

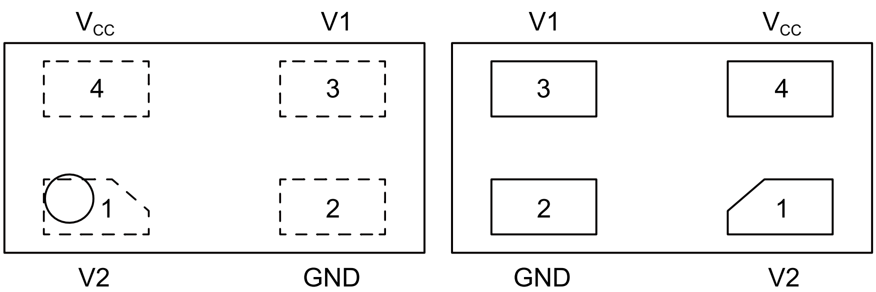


Figure 2. Pin configuration (DFN4L)

Number	Name	Function
1	V2	Differential Analog Output signal 1
2	GND	Power supply
3	V1	Differential Analog Output signal 2
4	V_{CC}	GND

3. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	-	6	V
Magnetic flux density	B	-	3000	Gs
ESD performance (HBM)	$V_{ESD(HBM)}$	-	3000	V
ESD performance (CDM)	$V_{ESD(CDM)}$	-	2000	V
Operating ambient temperature	T_A	-30	85	°C
Storage ambient temperature	T_{STG}	-40	125	°C

Note: The absolute maximum rating only lists the conditions under which the sensors are not permanently damaged. For normal operations please refer to Specifications.

4. Electrical Specifications

V_{CC} = 1.0 V, T_A = 25 °C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	operating	-	-	5.5	V
Bridge resistance	R_B	B = 300 Gs, field direction=0°	1	2.5	4	kΩ
Peak voltage	V_{PEAK}	B = 300 Gs	140	180	220	mV/V
Midpoint voltage	V_{Mid}	B = 300 Gs	450	500	550	mV/V
Offset voltage	V_{OFFSET}	B = 300 Gs	-15	0	15	mV/V
Temperature coefficient of bridge resistance	TCR_B	-	-	-0.05	-	%/°C
Temperature coefficient of amplitude	TCV_{PEAK}	-	-	-0.09	-	%/°C

5. Magnetic Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Magnetic flux density	B	-	200	-	800	Gs

Note: 1 Gauss in air = 0.1 millitesla = 79.8 A/m

6. Specification Definitions

6.1 Bridge resistance R_B

Resistance between pin V_{CC} and GND

6.2 Output amplitude V_{PEAK}

$$V_{PEAK}1 = \frac{V_{MAX}1 - V_{MIN}1}{2} \qquad V_{PP}1 = V_{MAX}1 - V_{MIN}1$$

$$V_{PEAK}2 = \frac{V_{MAX}2 - V_{MIN}2}{2} \qquad V_{PP}2 = V_{MAX}2 - V_{MIN}2$$

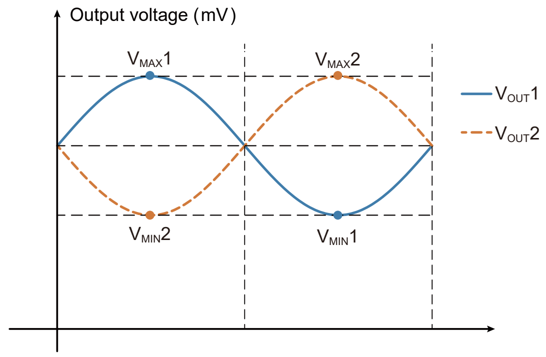


Figure 3. Definition of V_{MIN} and V_{MAX} in output signal

6.3 Midpoint voltage V_{Mid}

$$V_{Mid}1 = \frac{V_{MAX}1 + V_{MIN}1}{2}$$

$$V_{Mid}2 = \frac{V_{MAX}2 + V_{MIN}2}{2}$$

6.4 Offset V_{OFFSET}

$$V_{OFFSET} = V_{Mid}1 - V_{Mid}2$$

6.5 Temperature coefficient of bridge resistance TCR_B

R_H: High temperature resistance R_L: Low temperature resistance R_N: Resistance at 25°C

T_H: High temperature T_L: Low temperature T_N: 25°C

$$TCR_B = \frac{R_H - R_L}{R_N (T_H - T_L)} \times 100\%$$

6.6 Temperature coefficient of amplitude TCV_{PEAK}

$V_{PEAKH}1$: $V_{OUT}1$ in high temp $V_{PEAKL}1$: $V_{OUT}1$ in low temp $V_{PEAKN}1$: $V_{OUT}1$ at 25°C

$V_{PEAKH}2$: $V_{OUT}2$ in high temp $V_{PEAKL}2$: $V_{OUT}2$ in low temp $V_{PEAKN}2$: $V_{OUT}2$ at 25°C

T_H: High temperature T_L: Low temperature T_N: 25°C

$$TCV_{PEAK}1 = \frac{V_{PEAKH}1 - V_{PEAKL}1}{V_{PEAKN}1 (T_H - T_L)} \times 100\% \qquad TCV_{PEAK}2 = \frac{V_{PEAKH}2 - V_{PEAKL}2}{V_{PEAKN}2 (T_H - T_L)} \times 100\%$$

7. Applications

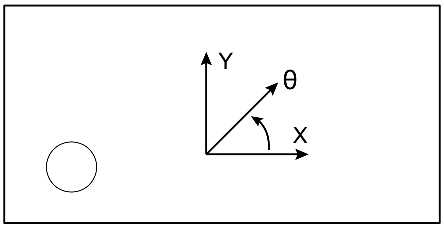


Figure 4. Sensing direction of TMR3016

The sensing direction is parallel to the X-Y plane where package laser mark is located as shown in Figure 4. When the sensor is in an appropriate magnetic field, the resistance value of each TMR element of the sensor changes due to the difference between the sensitive direction of each TMR element and the direction of the magnetic field, resulting in a corresponding change in the output voltage.

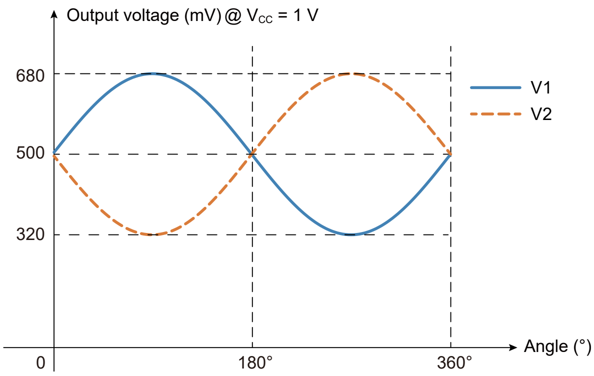


Figure 5. Single-ended output of TMR3016 in one period @ V_{CC} = 1 V

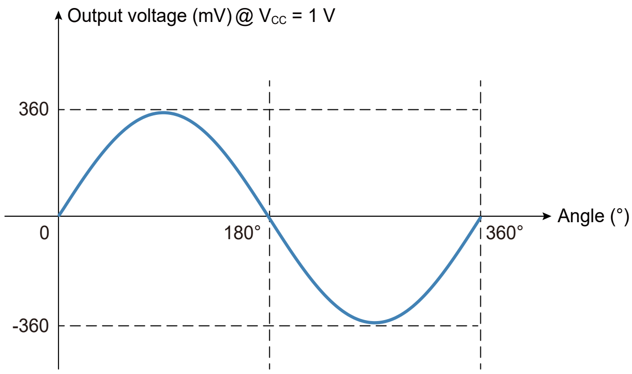


Figure 6. Differential output of TMR3016 in one period @ V_{CC} = 1 V

8. Dimensions

DFN4L Package

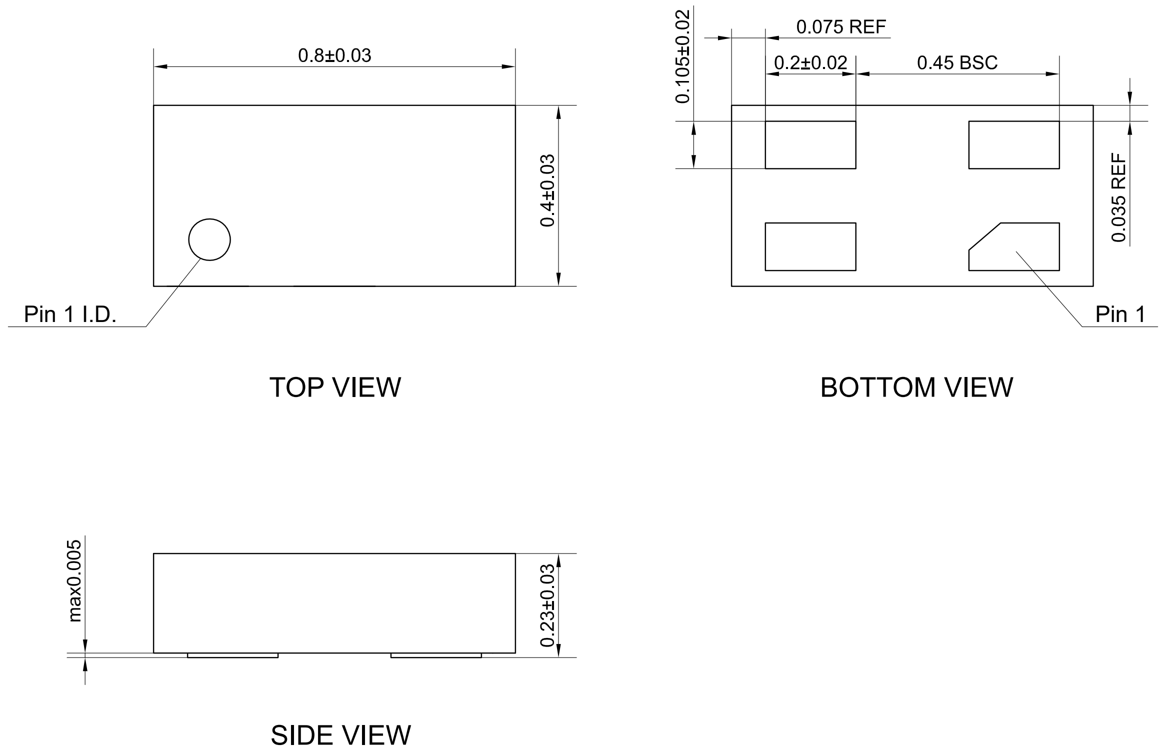


Figure 7. Package outline of DFN4L (unit: mm)

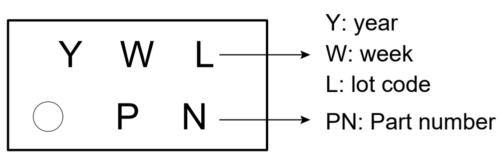
Product Marking Description

“Y” represents the year of material input, with one character for every half year, and 26 characters covering 13 years;

“W” represents the week of material input, with 26 letters representing 26 weeks;

“L” represents the batch of material input, with one character for each wafer per input;

“PN” represents the part number.



Absolute maximum ratings are the extreme limits the device will withstand without damage to the MDT product. However, the electrical and mechanical characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached. MDT disclaims any and all warranties and liabilities of the MDT product will operate at absolute maximum ratings.

Specifications may change without notice.

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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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