

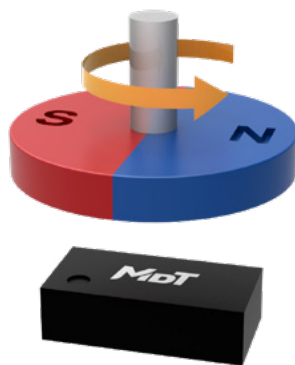
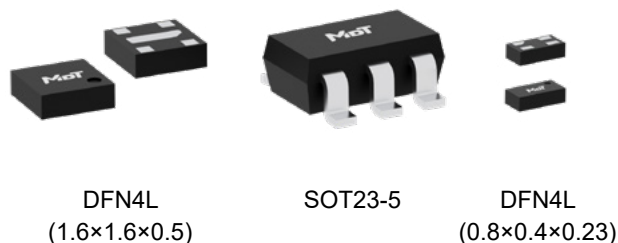
# TMR3017

## High Accuracy Analog TMR Angle Sensor

### Description

TMR3017 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 the signal is that the direction of the magnetic field rotates 360° in the sensing plane.

TMR3017 is available in three compact SOT23-5, DFN4L (0.8 mm × 0.4 mm × 0.23 mm) and DFN4L (1.6 mm × 1.6 mm × 0.5 mm) package for easy assembly in small spaces.

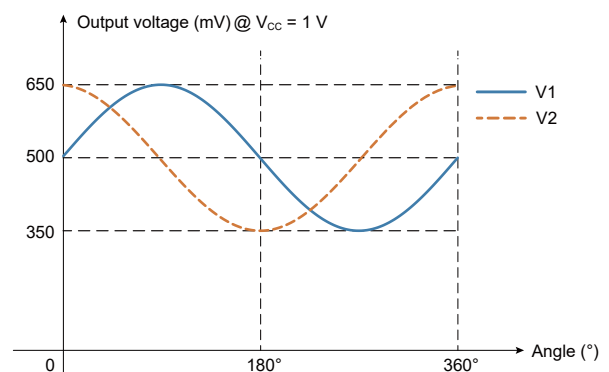


### Features and Benefits

- 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 | Note                |
|-------------|--------|----------------|-----------------------|-------------------------|--------------|---------------------|
| TMR3017D    | Analog | ≤ 5.5 V        | -30 °C to 125°C       | DFN4L<br>(0.8×0.4×0.23) | Tape & Reel  | -                   |
| TMR3017F    | Analog | ≤ 5.5 V        | -30 °C to 125°C       | DFN4L<br>(1.6×1.6×0.5)  | Tape & Reel  | Fanout<br>packaging |
| TMR3017S    | Analog | ≤ 5.5 V        | -30 °C to 125°C       | SOT23-5                 | Tape & Reel  | -                   |
| TMR3017F-CU | Analog | ≤ 5.5 V        | -30 °C to 125°C       | DFN4L<br>(1.6×1.6×0.5)  | Tape & Reel  | Wire<br>packaging   |

## Catalogue

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## 1. Functional Block Diagram

TMR3017 TMR angle sensor integrates a Wheatstone bridge using TMR elements to increase the output amplitude and improve the temperature characteristics.

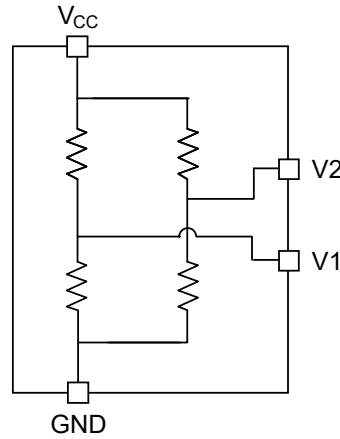


Figure 1. Block diagram

## 2. Pin Configuration

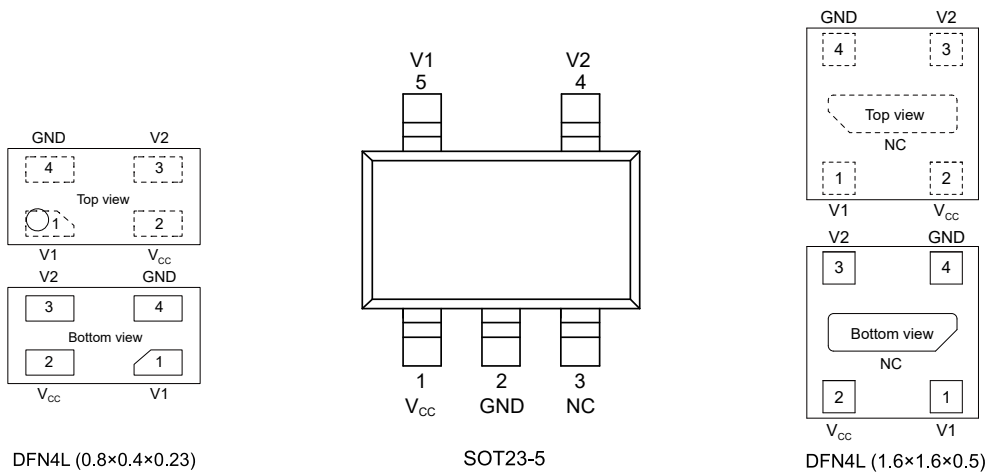


Figure 2. Pin configuration

| Number             |                    |         | Name            | Function        |
|--------------------|--------------------|---------|-----------------|-----------------|
| DFN4L<br>(0.8×0.4) | DFN4L<br>(1.6×1.6) | SOT23-5 |                 |                 |
| 1                  | 1                  | 5       | V1              | Output signal 1 |
| 2                  | 2                  | 1       | V <sub>CC</sub> | Power supply    |
| 3                  | 3                  | 4       | V2              | Output signal 2 |
| 4                  | 4                  | 2       | GND             | GND             |
| -                  | 5                  | 3       | NC              | NC              |

### 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  | 125  | °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

$V_{CC} = 1.0 \text{ V}$ ,  $T_A = 25 \text{ °C}$

| Parameter                                    | Symbol       | Condition  | Min. | Typ.  | Max. | Unit |
|----------------------------------------------|--------------|------------|------|-------|------|------|
| Supply voltage                               | $V_{CC}$     | operating  | -    | -     | 5.5  | V    |
| Bridge resistance                            | $R_B$        | B = 300 Gs | 100  | 200   | 300  | kΩ   |
| Peak voltage                                 | $V_{PEAK}$   | B = 300 Gs | 100  | 150   | 200  | 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 $V_{PEAK}$

$$V_{PEAK1} = \frac{V_{MAX1} - V_{MIN1}}{2} \quad V_{PP1} = V_{MAX1} - V_{MIN1}$$

$$V_{PEAK2} = \frac{V_{MAX2} - V_{MIN2}}{2} \quad V_{PP2} = V_{MAX2} - V_{MIN2}$$

### 6.3 Midpoint voltage $V_{Mid}$

$$V_{Mid1} = \frac{V_{MAX1} + V_{MIN1}}{2}$$

$$V_{Mid2} = \frac{V_{MAX2} + V_{MIN2}}{2}$$

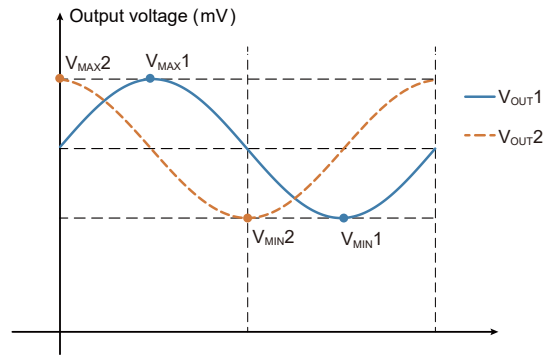


Figure 3. Definition of  $V_{MIN}$  and  $V_{MAX}$  in output signal

### 6.4 Offset $V_{OFFSET}$

$$V_{OFFSET} = V_{Mid1} - V_{Mid2}$$

### 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 $TCV_{PEAK}$

$V_{PEAKH1}$ :  $V_{OUT1}$  in high temp       $V_{PEAKL1}$ :  $V_{OUT1}$  in low temp       $V_{PEAKN1}$ :  $V_{OUT1}$  at 25°C

$V_{PEAKH2}$ :  $V_{OUT2}$  in high temp       $V_{PEAKL2}$ :  $V_{OUT2}$  in low temp       $V_{PEAKN2}$ :  $V_{OUT2}$  at 25°C

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

$$TCV_{PEAK1} = \frac{V_{PEAKH1} - V_{PEAKL1}}{V_{PEAKN1} (T_H - T_L)} \times 100\% \quad TCV_{PEAK2} = \frac{V_{PEAKH2} - V_{PEAKL2}}{V_{PEAKN2} (T_H - T_L)} \times 100\%$$

## 7. Applications

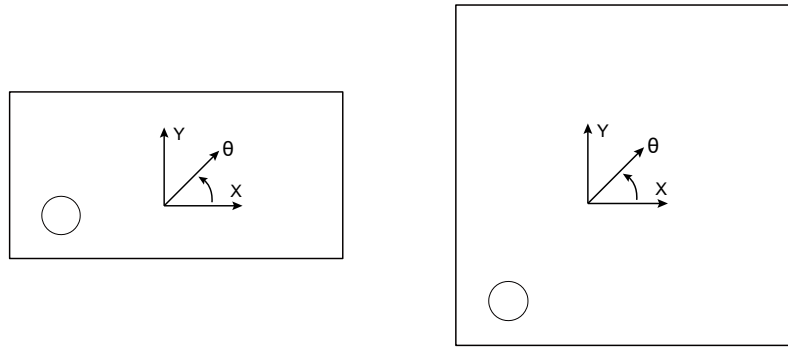


Figure 4-1. Sensing direction (DFN4L)

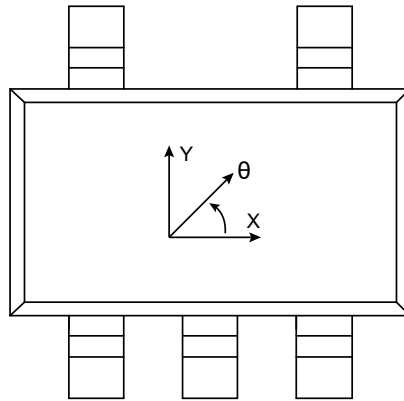


Figure 4-2. Sensing direction (SOT23-5)

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.

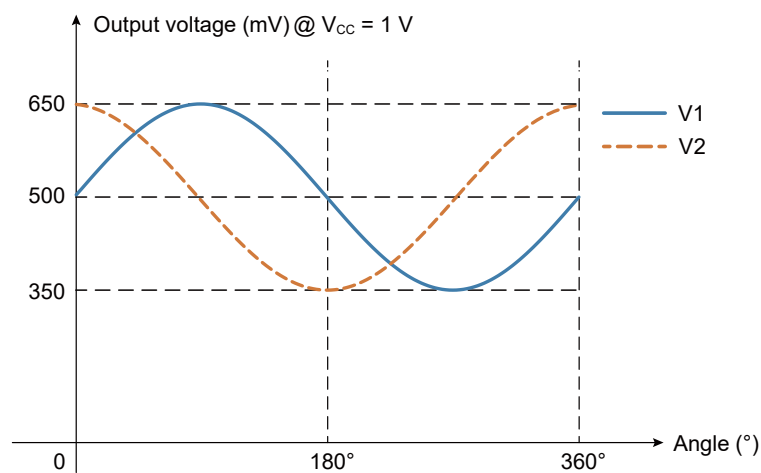


Figure 5. Single-ended output of TMR3017 in one period @  $V_{CC} = 1\text{ V}$

## 8. Dimensions

### DFN4L (0.8×0.4×0.23) Package

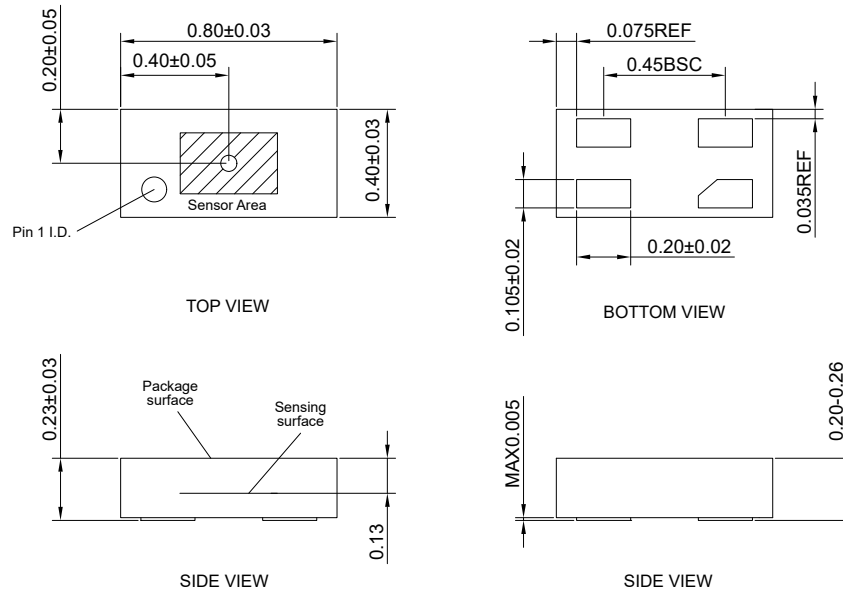


Figure 6. Package outline of DFN4L(0.8×0.4×0.23) (unit: mm)

### DFN4L (1.6×1.6×0.5) Package

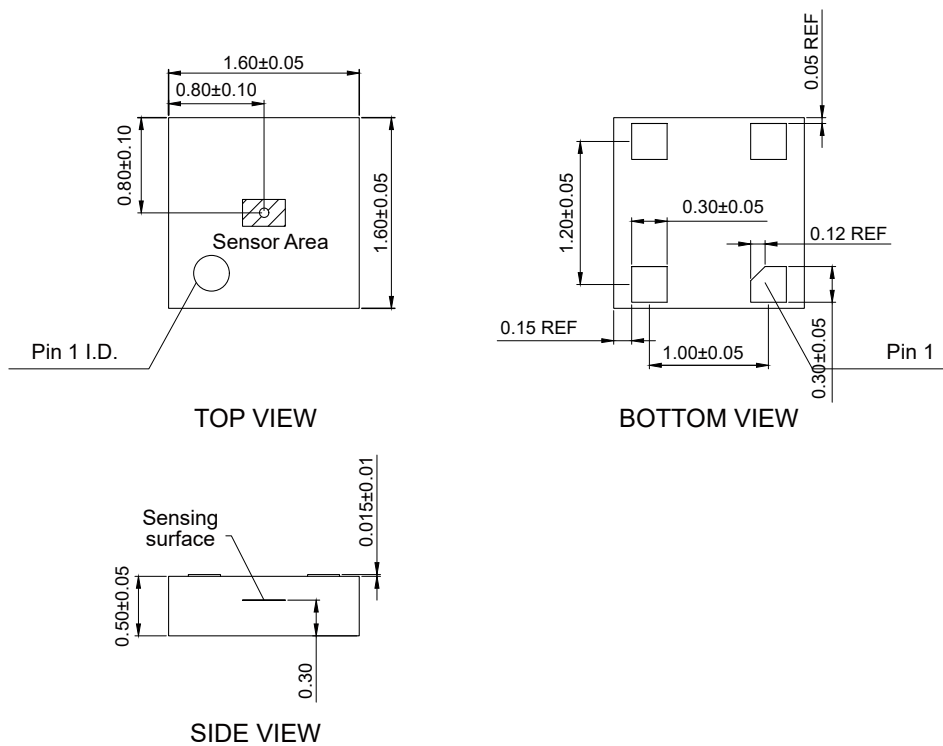


Figure 7. Package outline of DFN4L(1.6×1.6×0.5) (unit: mm)

## SOT23-5 Package

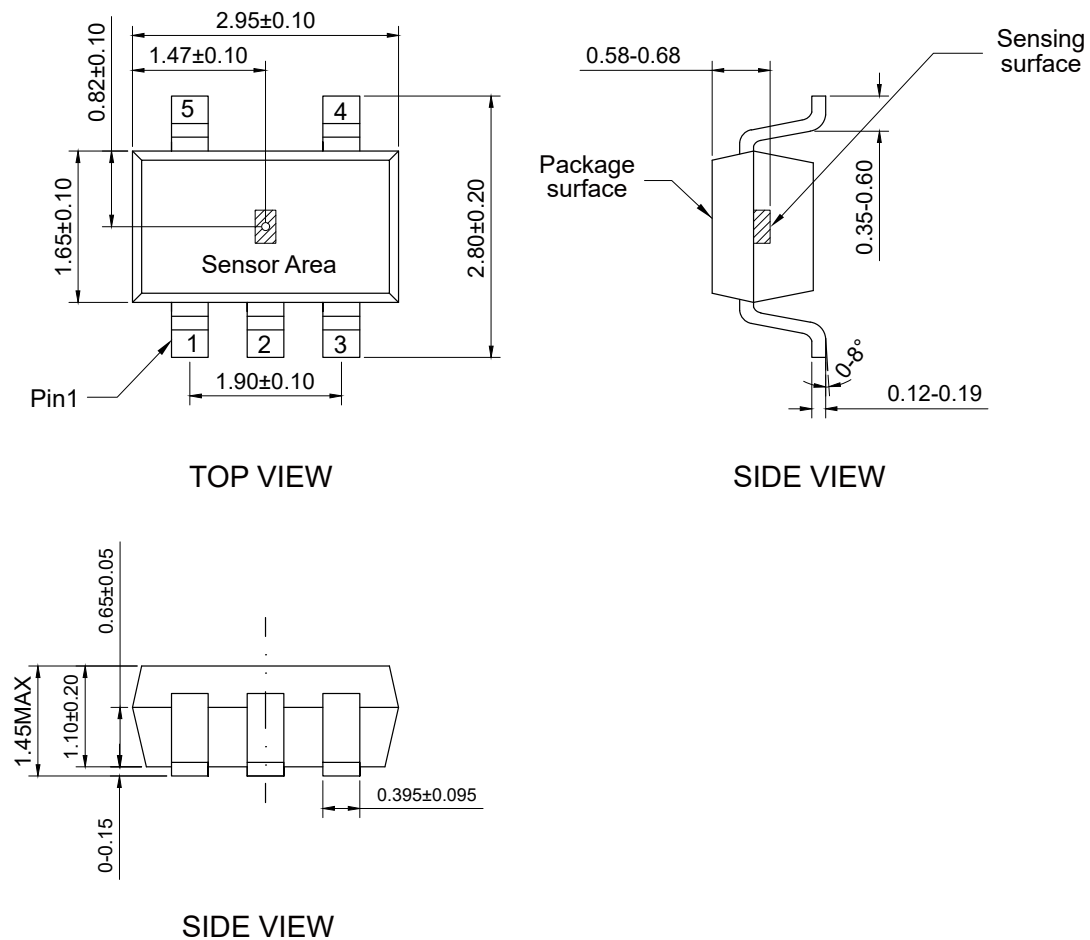


Figure 8. Package outline of SOT23-5 (unit: mm)

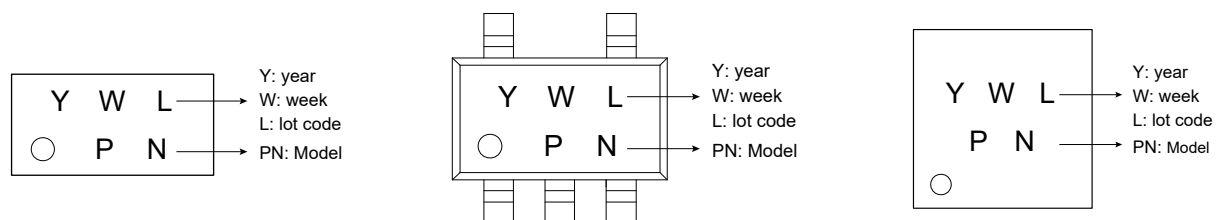
## Product Marking Description

“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.





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