

# TMR3617

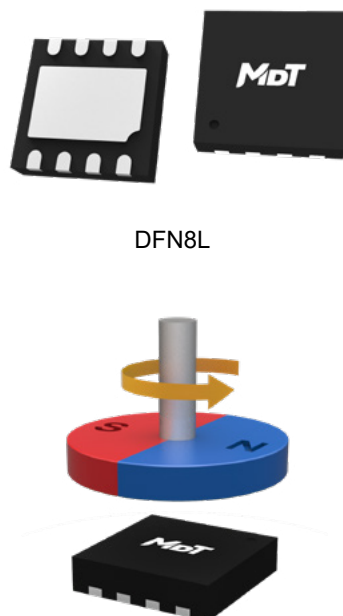
## Low Power, High Output Amplitude TMR Angle Sensor

### Description

The TMR3617 is a low-voltage, low-power, high-output-amplitude TMR programmable analog output angle sensor developed by MultiDimension Technology.

The sensor integrates a tunnel magnetoresistance (TMR) sensing element and a low-noise programmable operational-amplifier signal conditioning circuit. The built-in dedicated signal conditioning circuit allows adjustment and programming of offset, gain, and other parameters of the raw signal detected by the TMR sensor, and outputs corrected Sin/Cos voltage signals that vary with the external magnetic field angle. The signal period and phase are shown in the figure below. The sensor is suitable for various position detection applications and meets customer requirements for low-voltage operation, high resolution, and high signal-to-noise ratio.

This product is available in a DFN8L package (3.0 mm × 3.0 mm × 0.75 mm).

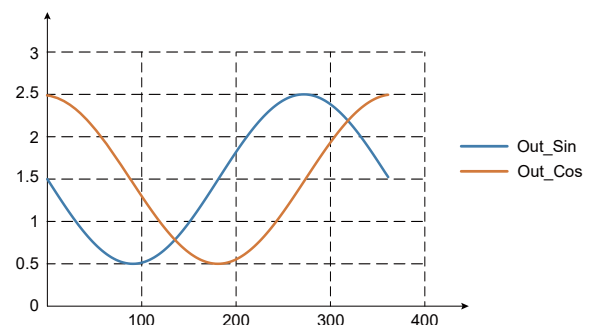


### Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Supply voltage: 2.4 V to 5.0 V
- $V_{OUT\ Max} = 95\%V_{DD}$
- Static power consumption: < 300  $\mu$ A
- Programmable gain: 4x to 11.75x (Step = 0.25)
- Output offset calibration range: -15 mV to +15 mV
- Low noise, low power consumption
- RoHS & REACH compliant

### Applications

- High-precision joystick
- Electric toothbrush
- Angular displacement sensing



## Selection Guide

Part Number	Supply Voltage	Operating Temperature	Static Power Consumption	Output Amplitude	Package	Packing Form
TMR3617D-AAC	2.4 V to 5.5 V	-40 °C to 85 °C	< 300 µA	Customer customized	DFN8L	Tape

## Product Model Description

**TMR3617D**

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**X**



A: Factory preset sensitivity and offset voltage  
B: User-programmable sensitivity and offset voltage

**X**



A: No attributes  
B: Attribute 1  
C: Attribute 2

**X**



C: Consumer  
I: Industrial

## Catalogue

1. Functional Block Diagram.....	03
2. Sensing Direction .....	03
3. Pin Configuration .....	03
4. Absolute Maximum Ratings .....	04
5. Electrical Specifications.....	04
6. Magnetic Specifications.....	04
7. Parameter Definition.....	05
8. Typical Output.....	06
9. Dimensions.....	07

## 1. Functional Block Diagram

The TMR3617 is a tunnel magnetoresistance (TMR) magnetic angle sensor with an integrated dedicated signal conditioning circuit. It consists of a TMR sensing element and a dedicated signal conditioning ASIC with a programmable OTP unit. The TMR sensing element outputs a set of Sin & Cos signals over a 0 to 360° range that vary with the external magnetic field. The built-in dedicated signal conditioning circuit conditions the raw signal from the TMR sensing element by programming offset gain, and other parameters, and finally outputs corrected and amplified Sin/Cos signals. The angle can then be calculated and detected from the Sin/Cos signals.

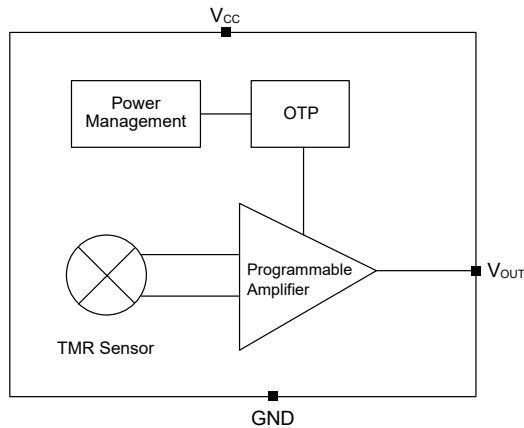


Figure 1. Block diagram

## 2. Sensing Direction

The sensing direction is parallel to the X-Y plane of the package top-marking surface, as shown in Figure 2.

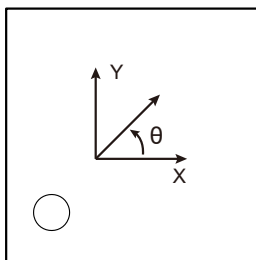


Figure 2. Sensing direction

## 3. Pin Configuration

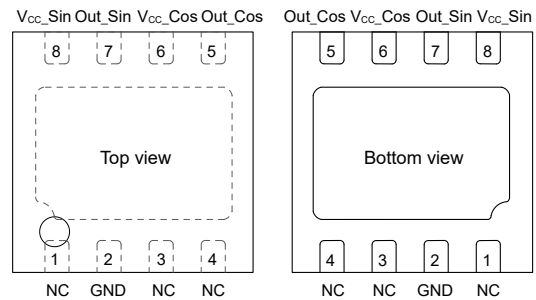


Figure 3. Pin configuration

Pin No.	Name	Function
1, 3, 4	NC	Not connected
2	GND	Ground
5	Out_Cos	Cos output
6	V <sub>CC_Cos</sub>	Cos power supply
7	Out_Sin	Sin output
8	V <sub>CC_Sin</sub>	Sin power supply

## 4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	$V_{CC}$	2	6	V
External magnetic field	B	-	3000	Gs
$V_{OUT}$ current driving capability	-	-	-	mA
ESD (HBM)	$V_{ESD}$ (HBM)	-	3000	V
ESD (CDM)	$V_{ESD}$ (CDM)	-	2000	V
Operating ambient temperature	$T_A$	-40	85	°C
Storage ambient temperature	$T_{STG}$	-50	150	°C

Note: The absolute maximum ratings define the limits beyond which the sensor may suffer permanent damage. For normal operating conditions, please refer to the “Electrical Performance Characteristics” section.

## 5. Electrical Specifications

$V_{CC} = 3\text{ V}$ ,  $T_A = 25\text{ °C}$ , 100 nF capacitor connected between  $V_{CC}$  and GND unless specified otherwise

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	$V_{CC}$	-	2.4	3.3	5	V
Supply current	$I_{CC}$	-	-	150	-	μA
TMR element output amplitude	$V_{PP1}$ , $V_{PP2}$	-	-	150	-	mV/V
Median voltage	$V_{M1}$ , $V_{M2}$	-	-	500	-	mV/V
Sensor output amplitude	PP	Gain or PP, $V_{DD}$	Customer customized or user-programmed calibration			mV/V
Angular error	AE	300 Gs	-	1.5	-	Degree
Peak voltage temperature drift	$TCV_{PEAK}$	$T_A = -40\text{ °C to }125\text{ °C}$	-	5000	-	%/°C

## 6. Magnetic Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Magnetic Field	B	-	200	-	800	Gs

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

## 7. Parameter Definition

The default gain magnification is set to 3X. If the magnification is  $\geq 4X$ , the peaks and troughs of the output waveform may be clipped.

### 7.1 Peak voltage $V_{PEAK}$

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

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

### 7.2 Median voltage $V_{MID}$

$$V_{MID1} = \frac{V_{MAX1} + V_{MIN1}}{2}$$

$$V_{MID2} = \frac{V_{MAX2} + V_{MIN2}}{2}$$

### 7.3 Offset voltage $V_{OFFSET}$

$$V_{OFFSET} = V_{MID1} - V_{MID2}$$

### 7.4 Peak voltage temperature coefficient $TCV_{PEAK}$

$V_{PEAKH1}$ :  $V_{OUT1}$  output amplitude at high temperature

$V_{PEAKL1}$ :  $V_{OUT1}$  output amplitude at low temperature

$V_{PEAKN1}$ :  $V_{OUT1}$  output amplitude at 25°C room temperature

$T_H$ : High temperature

$T_L$ : Low temperature

$T_N$ : 25°C

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

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

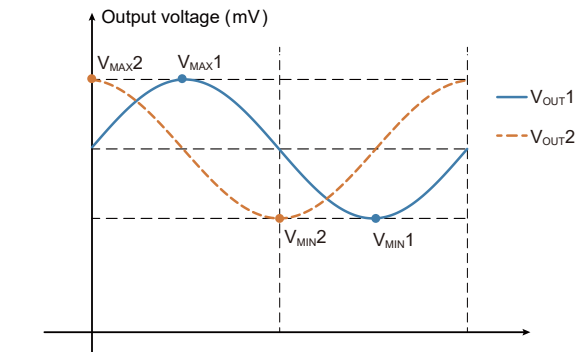


Figure 4. Output signal  $V_{MIN}$  and  $V_{MAX}$  definition

## 8. Typical Output

As shown in Figures 5 below, the output curve of the TMR3617 sensor varies with the angle of the applied in-plane magnetic field.

- When the magnetic field angle is  $0^\circ$ , the  $V_{OUT}$  output is equal to  $V_{CC} / 2$ .
- The actual output curve of the TMR3617 sensor depends on the programmed amplification factor.

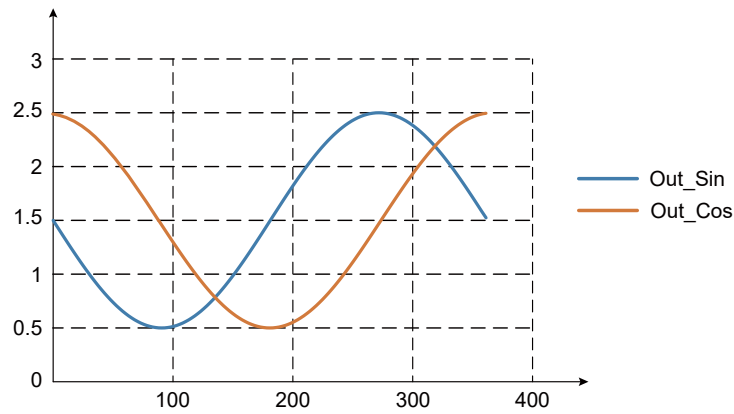


Figure 5. TMR+ASIC  $V_{OUT}$  output curve (3 V power supply)

## 9. Dimensions

### DFN8L Package

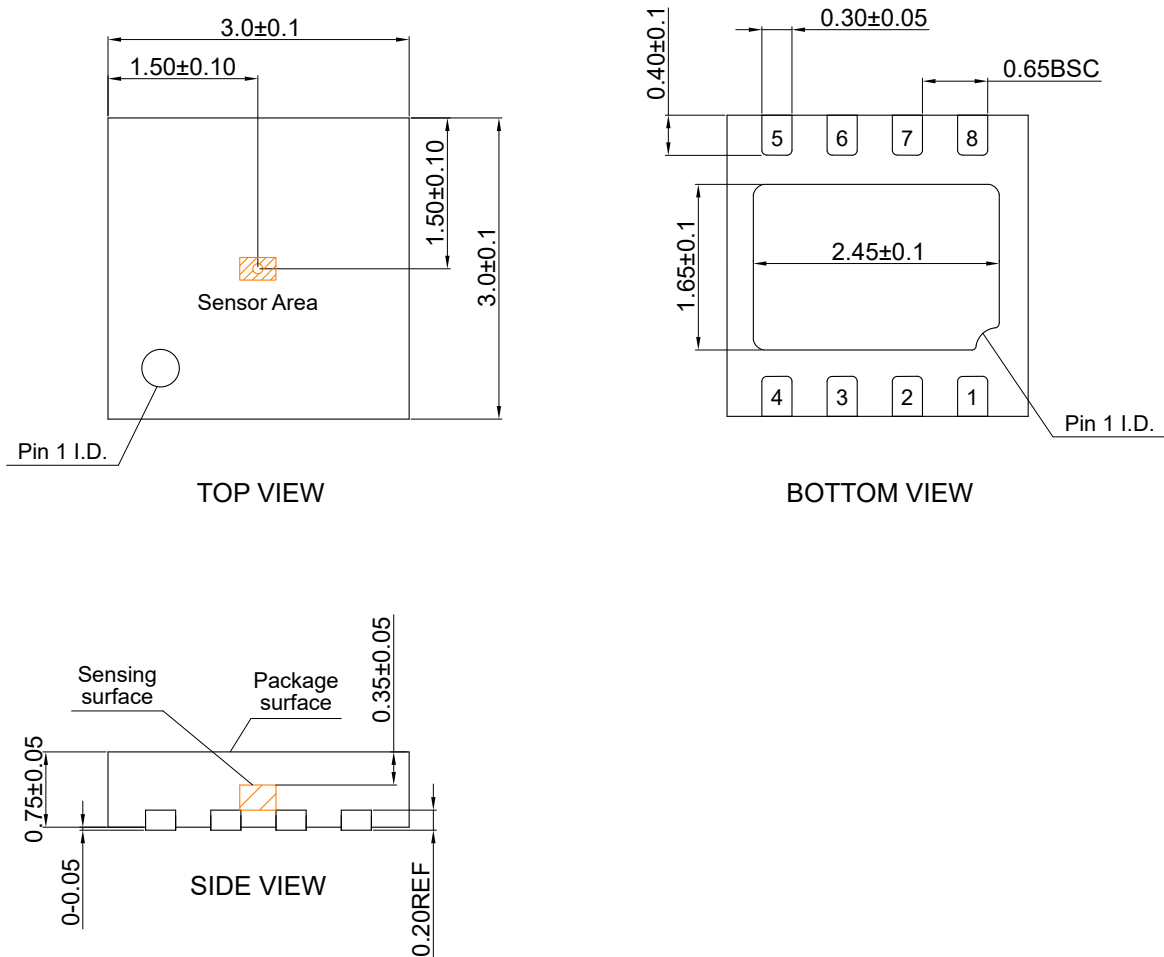


Figure 6. Package outline of DFN8L (unit: mm)

### Product Packaging Mark Description

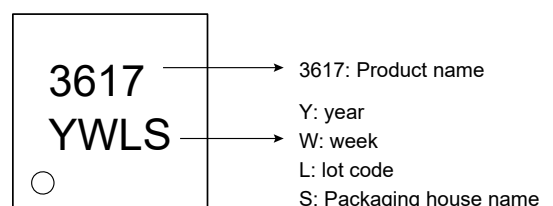
"3617" stands for product name.

"Y" represents the feeding year, with one character for every half year, and 26 characters for 13 years;

"W" stands for feeding week, and 26 letters represent 26 weeks;

"L" represents the batch, and each wafer is assigned one character each time;

"S" stands for the packaging house name.



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