

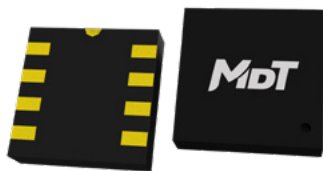
# TMR3002

## TMR Dual-Axis Angle Sensor

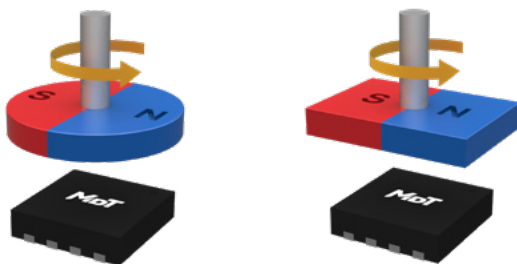
### Description

The dual-axis output voltages of the TMR3002 TMR angle sensor are proportional to the sine and cosine of the angle of a magnetic field applied parallel to the surface of the sensor, which can be provided by a small magnet positioned above the device.

The TMR3002 includes two Wheatstone bridges, which can be configured to output sine and cosine functions respectively. Each bridge includes four TMR sensor elements in a push-pull arrangement to produce a best-in-class peak-to-peak signal as large as 100% of the supply voltage, eliminating the need for amplification in many applications. Additionally, the unique TMR Wheatstone bridge technology accurately compensates the output against changes in ambient temperature. This sensor is assembled in a compact LGA8L package of 3mm × 3mm × 0.75mm.



LGA8L

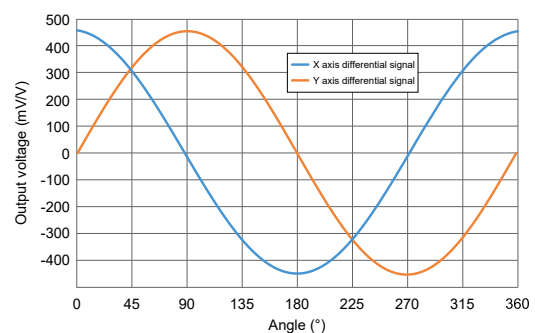


### Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Large output signal without amplification
- Dual-axis 0~360° angle measurement
- Compatible with a wide range of supply voltages
- High resistance for low power consumption
- Wide air-gap tolerance
- Excellent thermal stability
- Compact LGA package
- RoHS & REACH compliant

### Applications

- Rotary position sensors
- Rotary encoders
- Contactless potentiometers
- Valve position sensors
- Knob position sensors



## Selection Guide

Part Number	Angle range	Bridge resistance	Peak voltage	Angular error	Package	Packing Form
TMR3002G-1	0~360°	350 kΩ	870 mV/V	±2.5°	LGA8L	Tape & Reel

## Catalogue

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## 1. Functional Block Diagram

The TMR3002 angle sensors use dual Wheatstone bridges of high sensitivity TMR sensing elements to increase the sensors' output signal amplitude with enhanced temperature characteristic and anti-interference performance as shown in Figure 1.

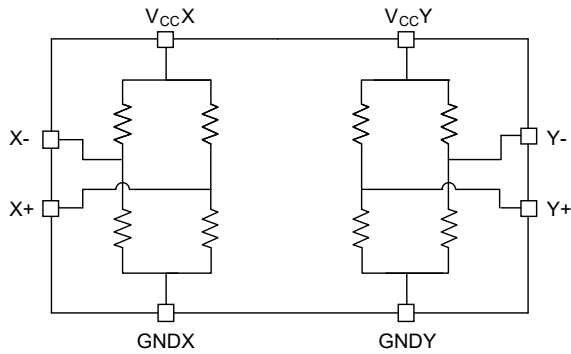


Figure 1. Block diagram

## 2. Operating Principle

The resistance value of the sensing elements changes with the target magnetic field, and the sensing direction is parallel to the chip surface as shown in Figure 2.

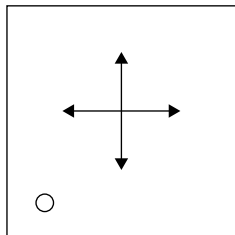


Figure 2. Sensing direction

A small dipole magnet, placed above the TMR3002, can provide a magnetic field in any desired orientation parallel to the plane of the TMR3002 package. When the Angle of the applied magnetic field changes, the output voltage waveform of the sensor is a cosine curve, thereby providing a true 360° measure of the orientation of the magnetic field.

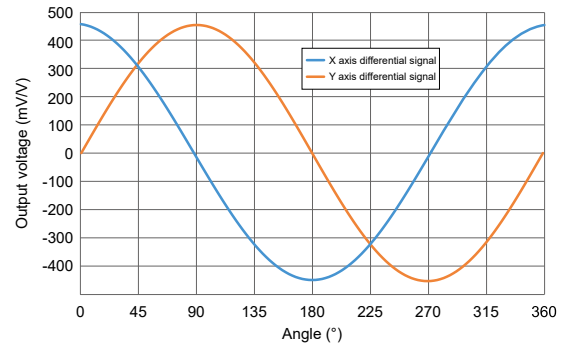


Figure 3. Typical output curve

## 3. Pin Configuration

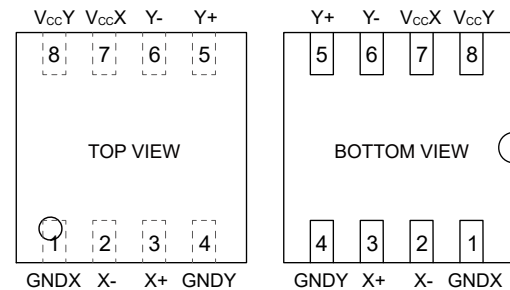


Figure 4. Pin configuration (LGA8L)

Number	Name	Function
1	GNDX	Ground (X axis)
2	X-	Analog Differential Output 2 (X axis)
3	X+	Analog Differential Output 1 (X axis)
4	GNDY	Ground (Y axis)
5	Y+	Analog Differential Output1 (Y axis)
6	Y-	Analog Differential Output2 (Y axis)
7	V <sub>cc</sub> X	Supply Voltage (X axis)
8	V <sub>cc</sub> Y	Supply Voltage (Y axis)

## 4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	$V_{CC}$	-	7	V
Magnetic flux density	B	-	3000	Gs
ESD performance (HBM)	$V_{ESD}$	-	4000	V
Operating ambient temperature	$T_A$	-40	125	°C
Storage ambient temperature	$T_{STG}$	-40	150	°C

## 5. Electrical Specifications

$V_{CC} = 1\text{ V}$ ,  $T_A = 25\text{ °C}$ , Differential Output

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	$V_{CC}$	Operating	-	1	7	V
Bridge resistance	$R_B$	Operating	200	350 <sup>1)</sup>	500	kΩ
Peak voltage	$V_{PP}$	Operating	740	870	1000	mV/V
Offset voltage	$V_{OFFSET}$	Angle = 0°	-10	-	10	mV/V
Magnetic field	$H_{ext}$	Operating	100	-	400	Gs
Angular error	$\Delta\theta$	Operating	-	±2.5	-	°
Operation coefficient of peak voltage	$TCV_{PEAK}$	$T_A = -40\text{ °C to }85\text{ °C}$	-	-970	-	PPM/°C

Notes:

- 1) Custom sensor resistance may be available upon request.

## 6. Applications

The sensing direction is parallel to the X-Y plane where package laser mark. 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.

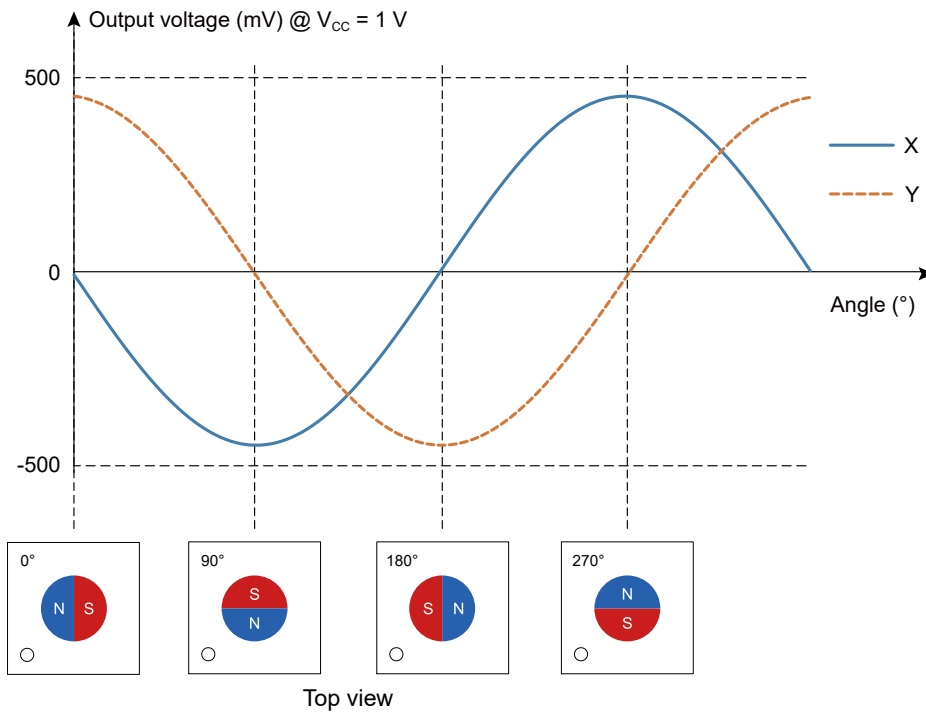


Figure 5. Single-ended output of TMR3002 in one period @  $V_{CC} = 1\text{ V}$

## 7. Dimensions

### LGA8L Package

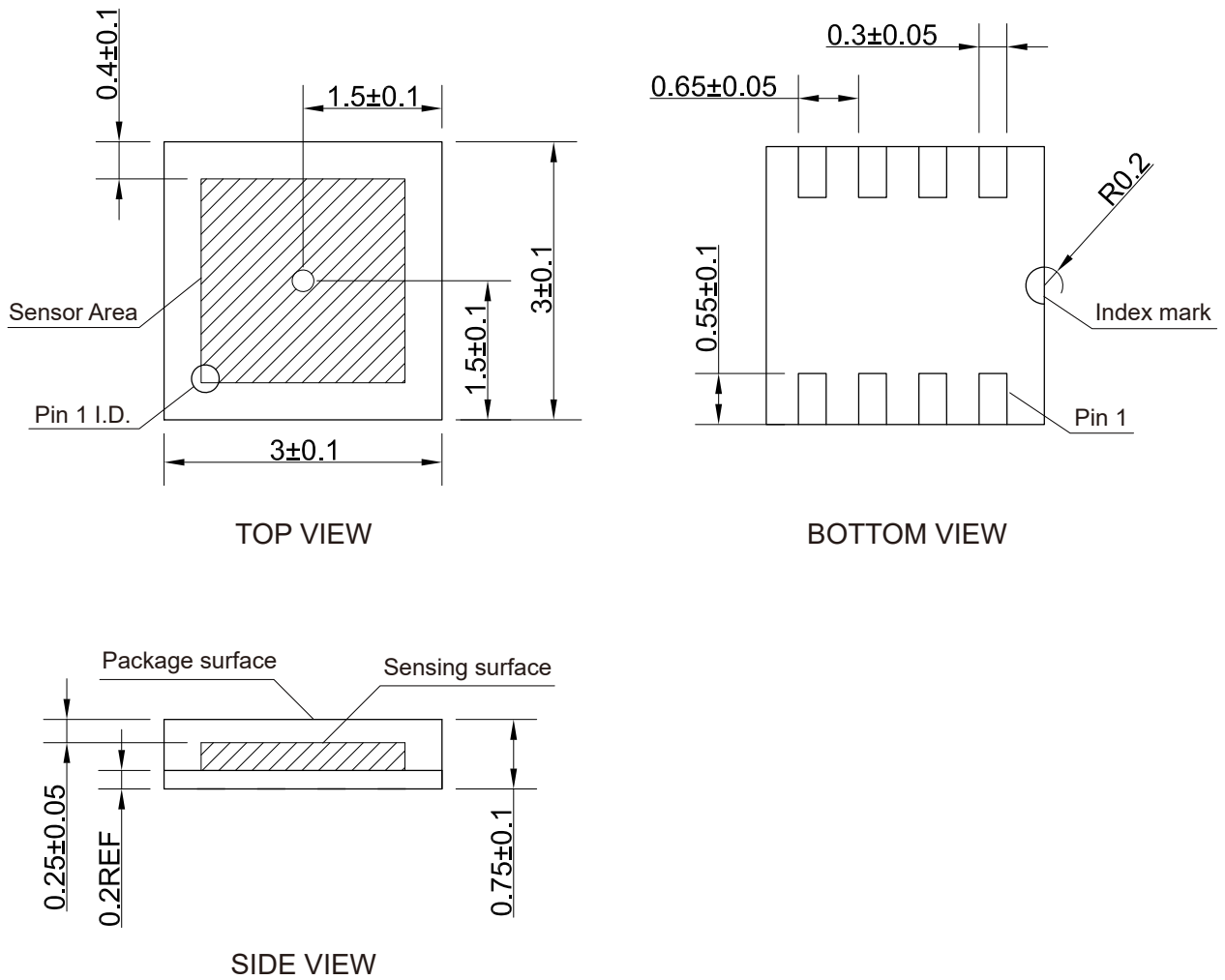


Figure 6. Package outline of LGA8L (unit: mm)

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