

**TMR Dual-Axis Angle Sensor**

## General 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 LGA8 package of 3.0 mm x 3.0 mm x 0.9 mm.

## Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- Large Output Signal without Amplification
- Dual-Axis 360° Angle Measurement
- Compatible with wide Range of Supply Voltages
- High Resistance for Low Power Consumption
- Wide Air-Gap Tolerance
- Excellent Thermal Stability
- Compact LGA Package

## Applications

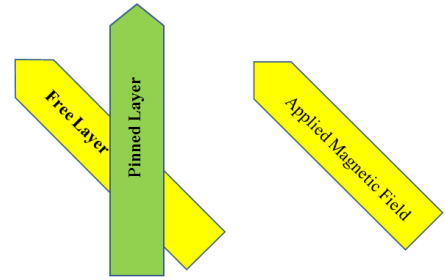
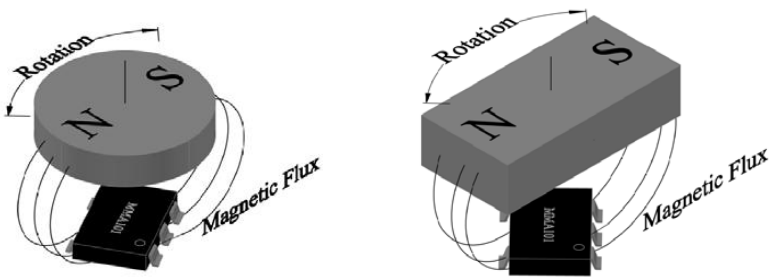
- Rotary Position Sensors
- Rotary Encoders
- Contactless Potentiometers
- Valve Position Sensors
- Knob Position Sensors



TMR3002

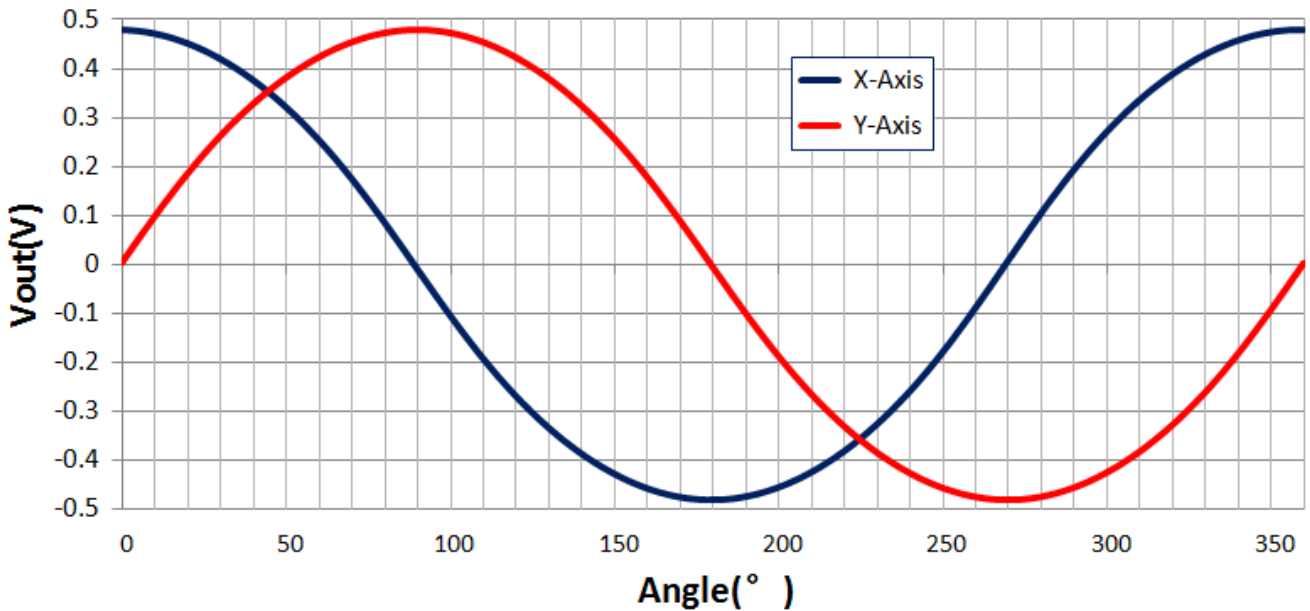
## Operation

A small magnet, placed above the TMR3002, can be used to provide a magnetic field in any desired orientation parallel to the plane of the TMR3002 package. The magnetic field is detected by TMR sensors in the TMR3002 that are composed of two magnetic layers. One layer of the TMR sensors is a “pinned layer” that is not affected by the magnetic field, and the other is “free layer,” which has a magnetization that aligns parallel to the applied magnetic field. Because the TMR effect produces a resistance that is proportional to the sine or cosine of the relative difference between the free and pinned layer magnetization orientations, the sensor output voltage is sinusoidally dependent on the angle of the applied magnetic field, thereby providing a measure of the orientation of the magnet.



The following chart show a typical sensor output as a function of the angle of the applied magnetic field using a 6 mm diameter, 2.5 mm thick magnet and a 1 V supply.

### Voltage output vs. Angle



### Pinout

(Bottom View)      (Top view)

(Bridge Schematic)

Pin No.	Pin Name	Function
1	GNDX	Ground(direction X)
2	X-	Analog Differential Output 2(direction X)
3	X+	Analog Differential Output 1(direction X)
4	GNDY	Ground(direction Y)
5	Y+	Analog Differential Output1(direction Y)
6	Y-	Analog Differential Output2(direction Y)
7	VccX	Supply Voltage(direction X)
8	VccY	Supply Voltage(direction Y)

## Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Supply Voltage	$V_{CC}$	7	V
Max Exposed Field	$H_{ext}$	3000	Oe <sup>(1)</sup>
ESD Voltage	$V_{ESD}$	4000	V
Operating Temperature	$T_A$	-40~85	°C
Storage Temperature	$T_{stg}$	-40 ~105	°C

## Specification ( $V_{CC}=1.0V$ , $T_A=25^{\circ}C$ , Differential Output)

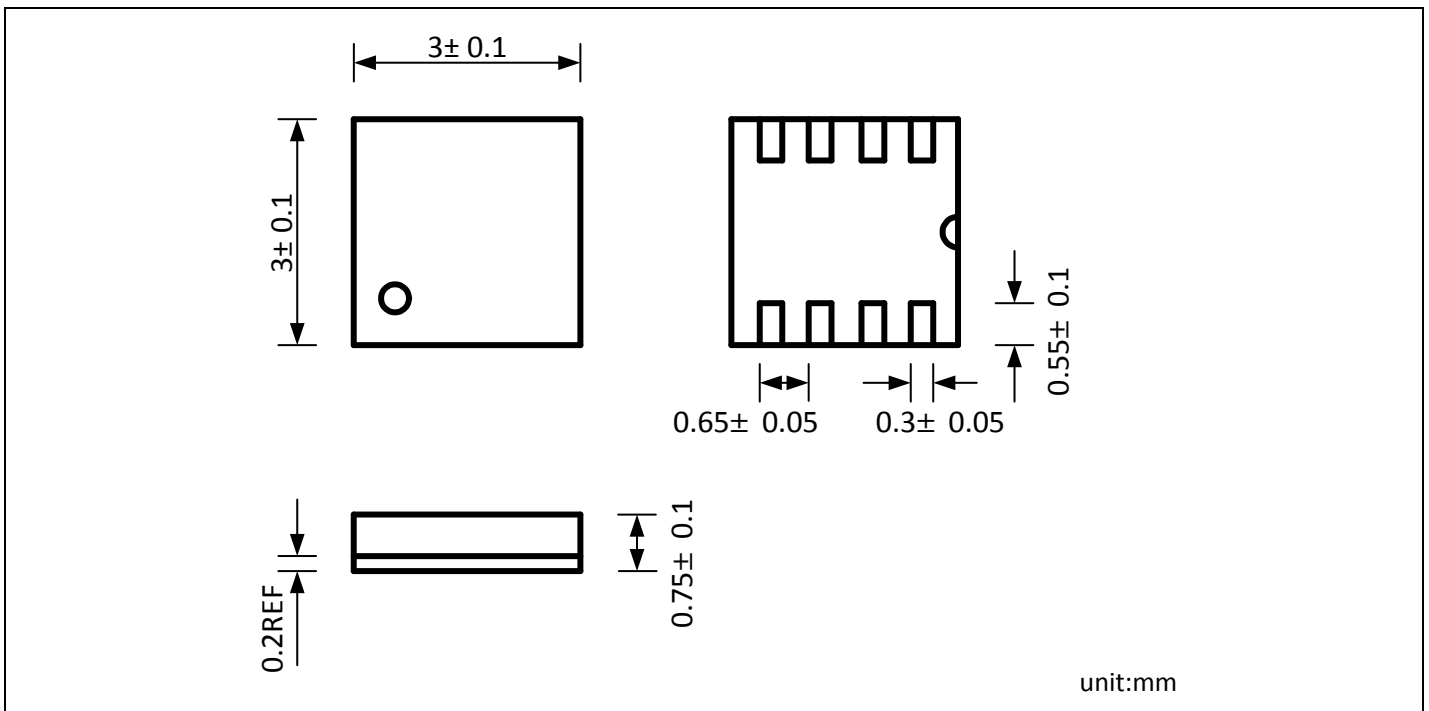
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$	Operating		1	7	V
Bridge Resistance	R	Operating	200	280 <sup>(2)</sup>	380	kOhm
Peak Voltage	$V_{peak}$	Operating		1030		mV/V
Offset Voltage	$V_{offset}$	Angle = 0°	-10		10	mV/V
Magnetic Field	H	Operating	100		400	Oe
Angular Error		Operating		± 2.5		°
Operation Coefficient of Peak Voltage	$TCV_{peak}$	$T_A$ in -40~85°C		-970		PPM/°C

Note:

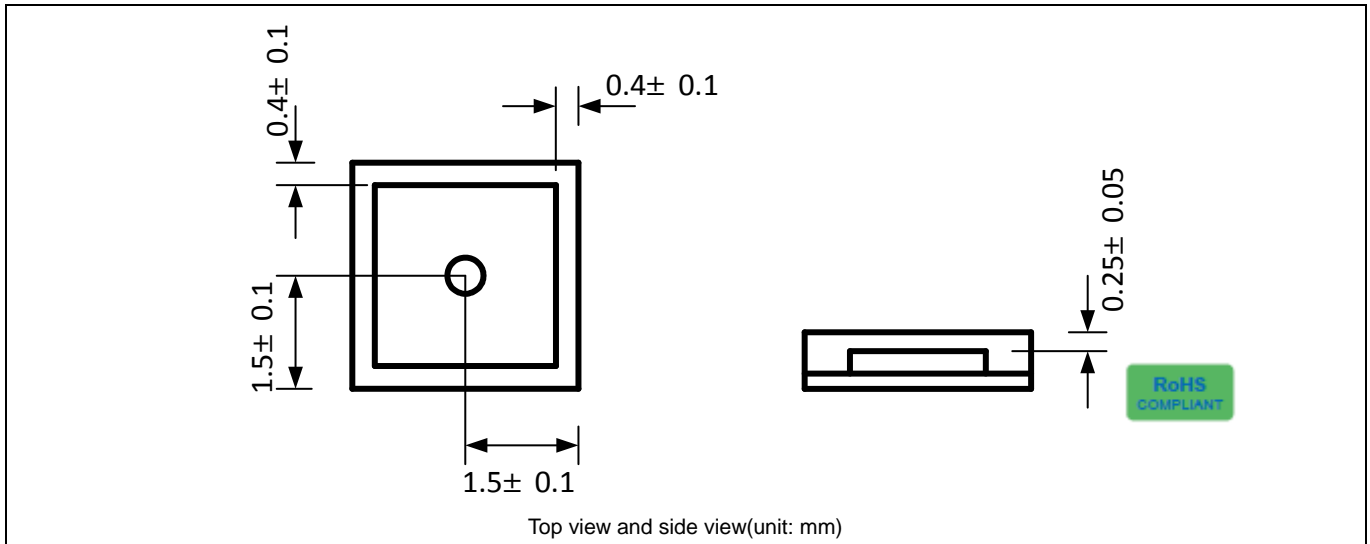
(1) 1 Oe (Oersted) = 1 Gauss in air = 0.1 millitesla = 79.8 A/m.

(2) Custom sensor resistance may be available upon request.

## Package Information



## TMR Sensor Position



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