TMR3004

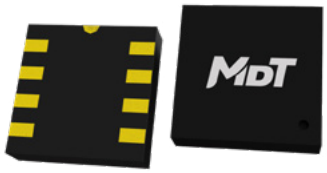
High Magnetic Field Dual-axis TMR Angle Sensor

Description

The output voltages of the dual-axis TMR3004 TMR high-field angle sensor are proportional to the sine and cosine of the angle of a magnetic field applied parallel to the surface of the TMR3004. These sine and cosine signals are provided by two orthogonal full bridge TMR angle sensors. Each full bridge TMR angle sensor includes four unique high-field TMR sensor arms connected in a push-pull arrangement to produce a best-in-class peak-to-peak signal as large as 90% of the supply voltage, eliminating the need for amplification in many applications, while maintaining low error as the magnetic field is varied over a range of 1 kGs. Additionally, the TMR full bridge technology accurately compensates the output against changes in ambient temperature. This sensor is assembled in packaging form factors of compact LGA8L (3 mm × 3 mm × 0.75 mm).

Features and Benefits

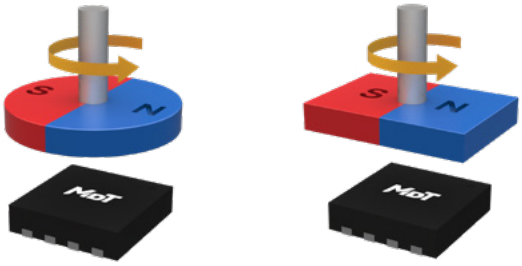
- Tunneling magnetoresistance (TMR) technology
- Wide 1 kGs operating range provides highest air gap Insensitivity
- Excellent immunity to environmental magnetic disturbance
- Large output signal without amplification
- High accuracy dual-axis 0~360° angle measurement
- Compatible with a wide range of supply voltages
- Fast Response for High-Speed Applications
- Excellent thermal stability
- Compact LGA package
- RoHS & REACH compliant

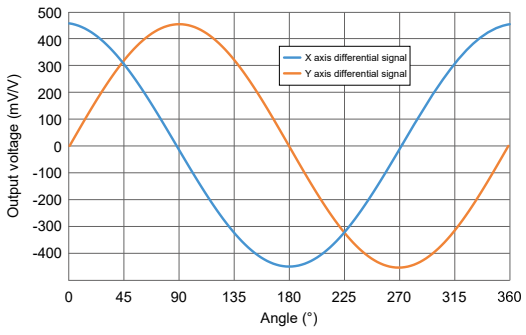


LGA8L

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
TMR3004G	0~360°	15 kΩ	480 mV/V	1.5°	LGA8L	Tape & Reel
TMR3004G-1	0~360°	15 kΩ	390 mV/V	1.5°	LGA8L	Tape & Reel

Catalogue

1. Functional Block Diagram

The TMR3004 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.

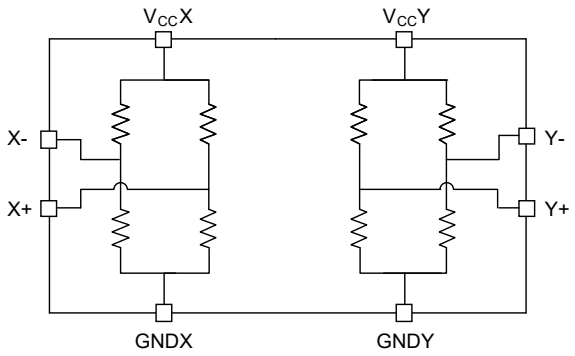


Figure 1. Block diagram

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.

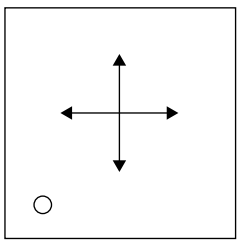


Figure 2. Sensing direction

A small dipole magnet, placed above the TMR3004, can provide a magnetic field in any desired orientation parallel to the plane of the TMR3004 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.

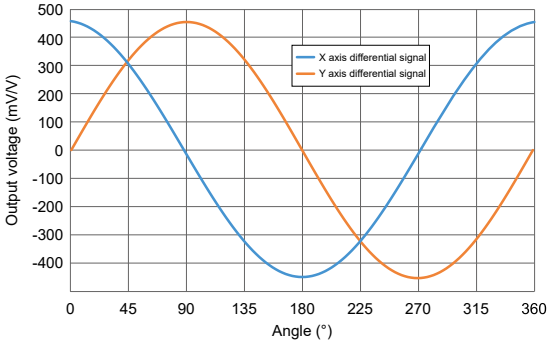


Figure 3. Typical output curve

3. Pin Configuration

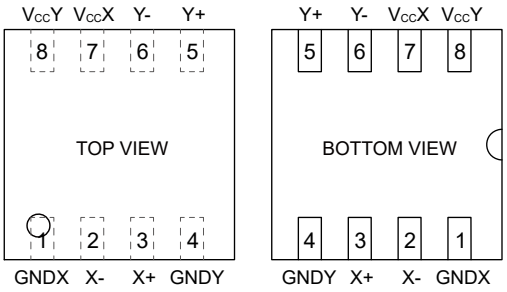


Figure 4. Pin configuration (LGA8L)

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	$V_{CC}X$	Supply Voltage (X axis)
8	$V_{CC}Y$	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	85	°C
Storage ambient temperature	T_{STG}	-40	150	°C

5. Electrical Specifications

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

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable Part Number
Supply voltage	V_{CC}	Operating	-	3.3	7	V	All parts
Bridge resistance	R_B	Operating	10	15 [1)]	20	kΩ	All parts
Peak voltage	V_{PEAK}	Operating	-	480	-	mV/V	TMR3004G
			-	390	-	mV/V	TMR3004G-1
Offset voltage	V_{OFFSET}	Operating	-10	-	10	mV/V	All parts
Magnetic field	H_{ext}	Operating	150	500	1100	Gs	All parts
Angular error	Δθ	Operating	-	1.5 [2)]	-	°	All parts
Operation coefficient of peak voltage	TCV_{PEAK}	T_A = -40 °C to 85 °C	-	-990	-	PPM/°C	All parts

Notes:

1) Custom sensor resistance may be available upon request. Bridge resistance refers to the resistance between V_{CC}X-GNDX and V_{CC}Y-GNDY.

2) Angle error is defined by zero-to-peak. Analog output accuracy can be improved by calibration.

6.Dimensions

LGA8L Package

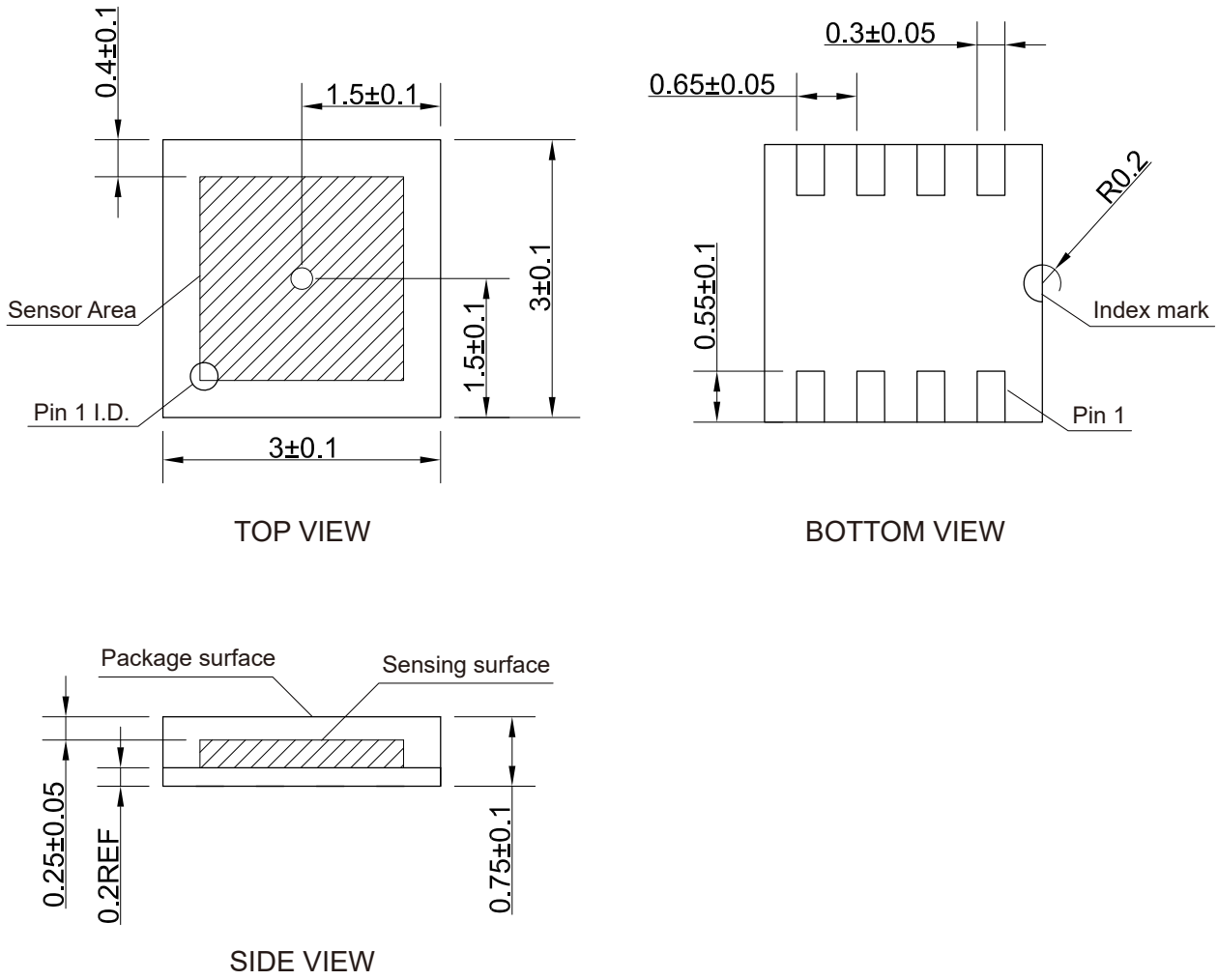


Figure 5. Package outline of LGA8L (unit: mm)

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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