TMR3004

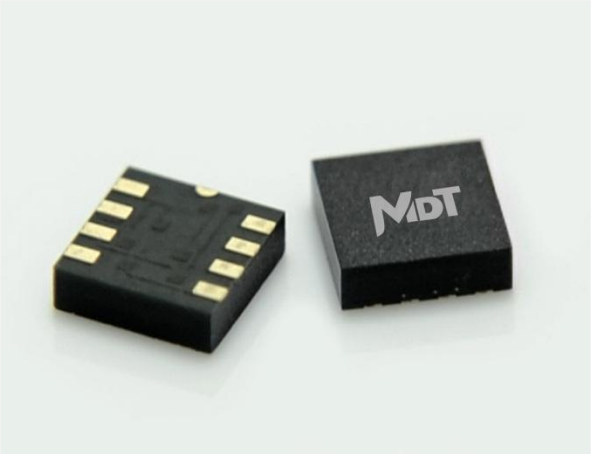
TMR High Magnetic Field Dual-Axis Angle Sensor

General 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 kOe. Additionally, the TMR full bridge technology accurately compensates the output against changes in ambient temperature. This sensor is assembled in a compact LGA8 package of 3.0 mm × 3.0 mm × 0.9 mm.

Features and Benefits

- High Magnetic Field Tunneling Magnetoresistance (TMR) Technology
- Wide 1 KOe Operating Range Provides Highest Air Gap Insensitivity
- Excellent Immunity to Environmental Magnetic Disturbance
- Large Output Signal without Amplification
- High Accuracy Dual-Axis360° Angle Measurement
- Compatible with Wide Range of Supply Voltages
- Fast Response for High-Speed Applications
- Excellent Thermal Stability
- Compact LGA Package



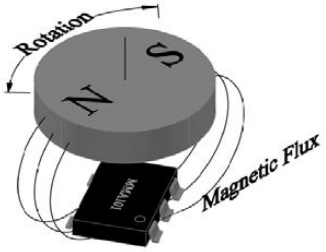
TMR3004

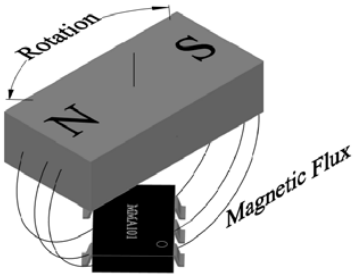
Applications

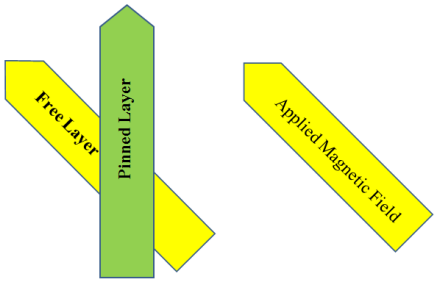
- Rotary Position Sensors
- Rotary Encoders
- Contactless Potentiometers
- Valve Position Sensors
- Knob Position Sensors

Operation

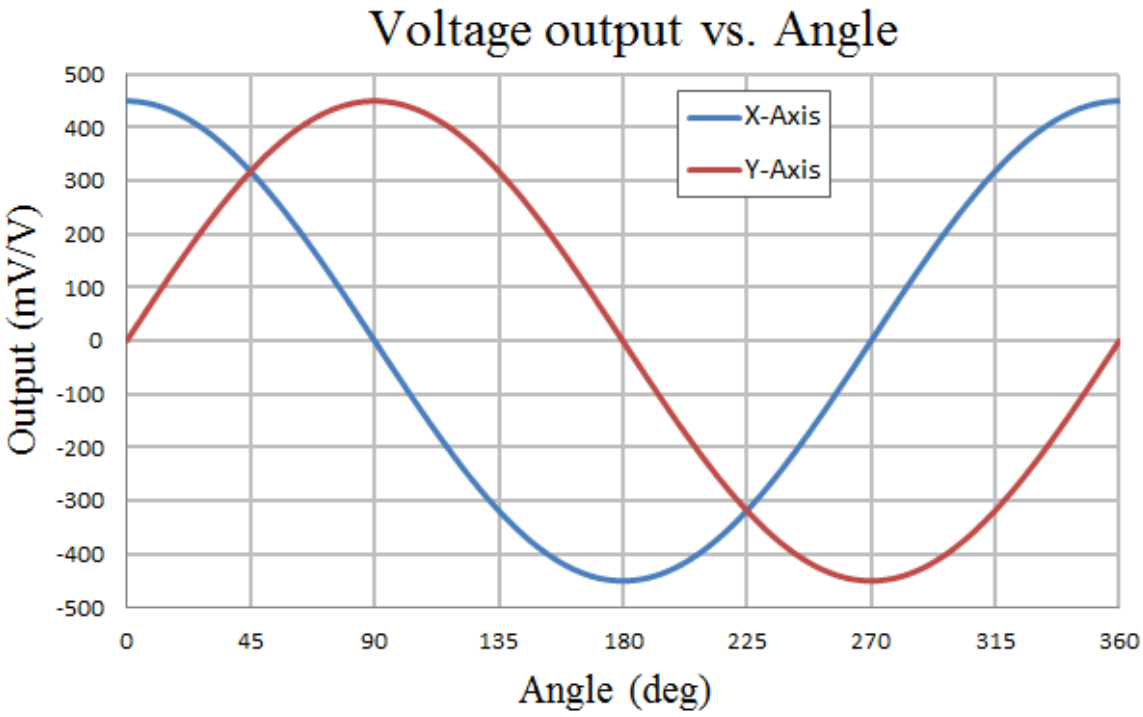
A small dipolar magnet, placed above the TMR3004, can provide a magnetic field in any desired orientation parallel to the plane of the TMR3004 package. The magnetic field is detected by the TMR sensors in the TMR3004 which are comprised of two ferromagnetic layers. One layer is a “pinned layer” that 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 true 360° measure of the orientation of the magnetic field.



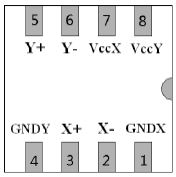




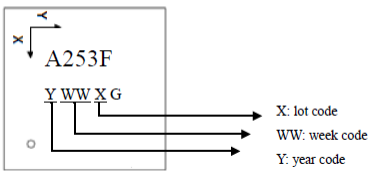
The following chart show a typical sensor output as a function of the angle of the applied magnetic field using a 6 mm diameter, 2.5 mm thick magnet and a 1 V supply.



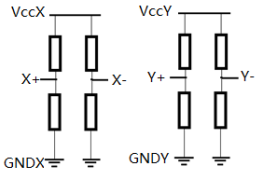
Pinout



(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	$V_{CC}X$	Supply Voltage(direction X)
8	$V_{CC}Y$	Supply Voltage(direction Y)

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Supply Voltage	V_{CC}	7	V
Max Exposed Field	H_{ext}	3000	Oe(1)
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°C, Differential Output)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	Operating		3.3	7	V
Bridge Resistance	R	Operating	5.5	7.5(2)	9.5	kOhm
Peak Voltage	V_{peak}	Operating		960		mV/V
Offset Voltage	V_{offset}	Angle = 0°	-10		10	mV/V
Magnetic Field	H	Operating	150	500	1100	Oe
Angular Error	Δα	Operating		±1.5(3)		°
Operation Coefficient of Peak Voltage	TCV_{peak}	T_A in -40~85°C		-990		PPM/°C

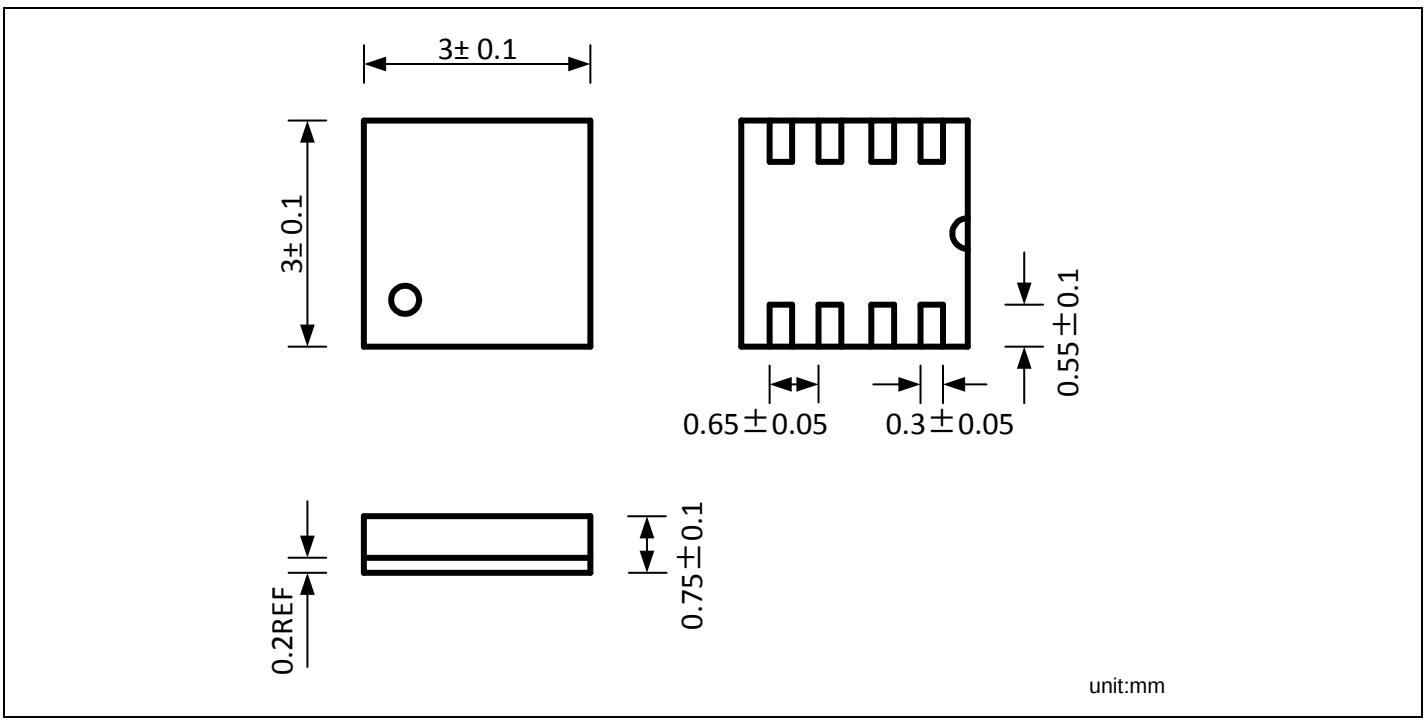
Note:

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

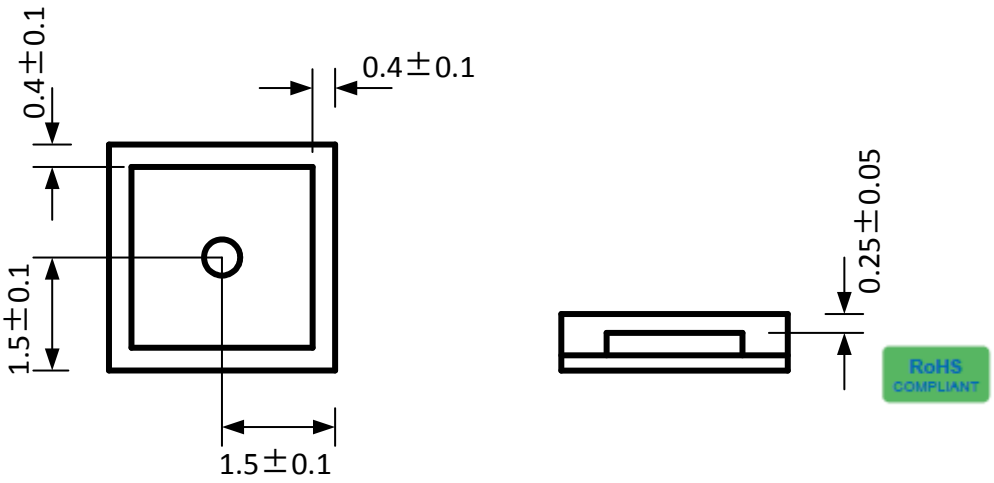
(2) Custom sensor resistance may be available upon request.

(3) Analog output accuracy can be improved by calibration.

Package Information



TMR Sensor Position



Top view and side view(unit: mm)

MultiDimension Technology Co., Ltd.

Address:No.7 Guangdong Road, Zhangjiagang Free Trade Zone, Jiangsu, 215634, China

Web: www.dowaytech.com/en

Email: info@dowaytech.com

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