MULTI DIMENSION
Sensing the Future

TMR401X

TMR Gear tooth sensor with high sensitivity to magnetic field gradient

General Description

The TMR401X magnetic gear tooth sensors utilize a unique push-pull Wheatstone bridge design, including one or two Wheatstone full bridges, with four or eight unshielded high sensitivity TMR sensing elements. The Wheatstone bridge creates a differential voltage output with respect to the magnetic field gradient along the sensor's sensitive direction. In the dual-bridge configuration, the two orthogonal Wheatstone full bridges provide sine and cosine voltage signals that can be used to measure both the gear tooth position and the direction of motion. The TMR401X magnetic gear tooth sensors offer superior performance with high sensitivity to the magnetic field gradient. They can detect very small changes in magnetic field, along with good temperature stability of the output signal.

The TMR401X magnetic gear tooth sensors are available in 8 different standard spacings of 0.4mm, 0.6mm, 0.8mm, 1.0mm, 1.2mm, 1.4mm, 1.6mmand 1.8mm. Three types of small form factor LGA packages are available. The package dimensions are 3mm × 3mm × 0.9mm, 3mm × 6mm × 0.9mm.

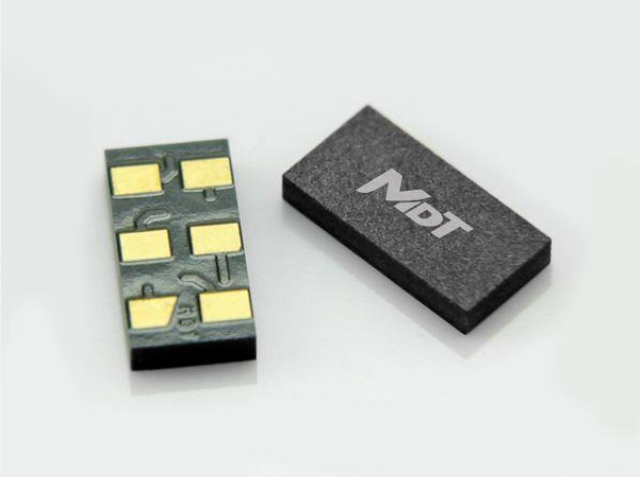
Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- High Saturation Point Allowing Operation under Large DC Magnetic Field
- Wide Air-Gap Tolerance
- High Sensitivity to Magnetic Field Gradient
- Capable of Small-Pitch Gear Tooth Detection
- DC(Zero-Speed) Operation
- Sine/Cosine Signal Outputs with Precise Phase Shift
- Excellent Thermal Stability
- Good Immunity to Environmental Magnetic Field
- Compact Ultra-Thin Package



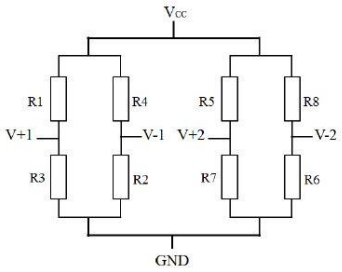
Applications

- Gear Tooth Motion, Speed, and Direction Sensing
- Linear and Rotary Speed Sensing
- Linear and Rotary position Sensing
- Linear Magnetic Scales
- Magnetic Encoders



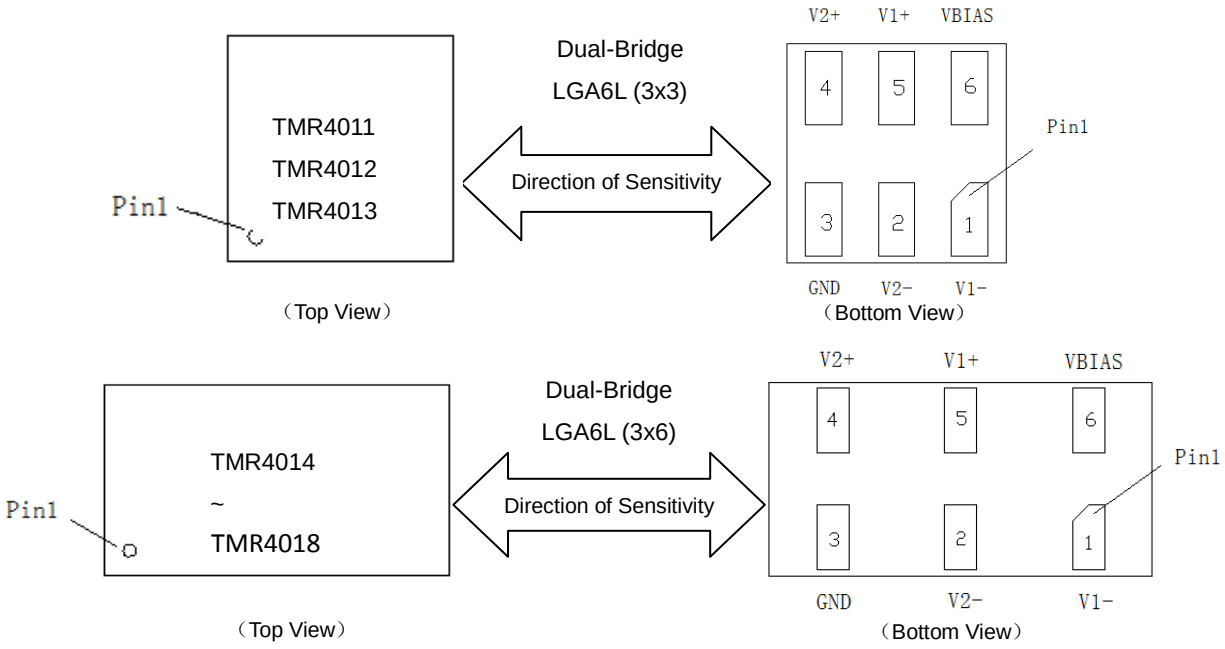
TMR400X

Wheatstone Bridge Connection



Dual-Bridge Configuration

Pin Configuration



Pin No.	Pin Name	Pin Function
1	V1-	Differential Output (-) of Bridge 1
2	V2- *	Differential Output (-) of Bridge 2 *
3	GND	Ground
4	V2+ *	Differential Output (+) of Bridge 2 *
5	V1+	Differential Output (-) of Bridge 1
6	V_{CC}	Supply Voltage

AbsoluteMaximum Ratings

Parameter	Symbol	Limit	Unit
Supply Voltage	V_{CC}	7	V
Reverse Supply Voltage	V_{Rcc}	7	V
Magnetic Field	H	1500	Oe (1)
ESD Voltage	V_{ESD}	4000	V
Operating Temperature	T_A	-40 ~ 125	°C
Storage Temperature	T_{stg}	-50 ~150	°C

Specification (V_{CC}=1.0V,T_A=25°C,Differential Output)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	Operating		1	7	V
Supply Current	I_{CC}	Output Open		67(2)		μA
Bridge Resistance	R			15(3)		kOhm
Single Resistor Sensitivity	SEN		-	0.46		%ΔR/Oe
Saturation Field	H_{sat}			±70 (4)		Oe
Linear Range 1	LIN1	Linearity ⩾ 98%		±20		Oe
Linear Range 2	LIN2	Linearity ⩾ 95%		±40		Oe
Offset Voltage	V_{offset}		-20		20	mV/V
Hysteresis	Hys	Fit @±20 Oe		1		%FS
Maximum Differential Voltage Output	$Vout_{Max}$			650		mV/V
Temperature Coefficient of Resistance	TCR	H = 0 Oe		-985		PPM/°C
Temperature Coefficient of Sensitivity	TCS			-1800		PPM/°C

Note:

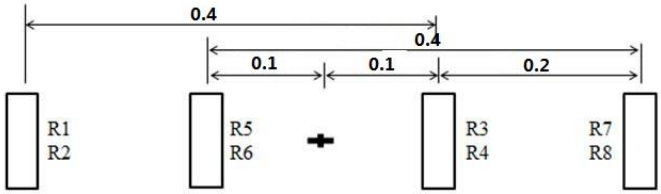
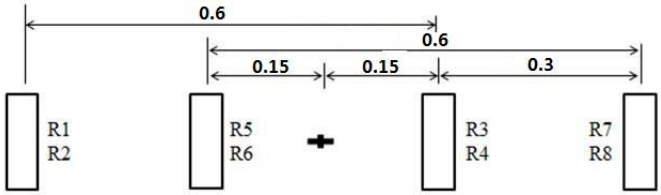
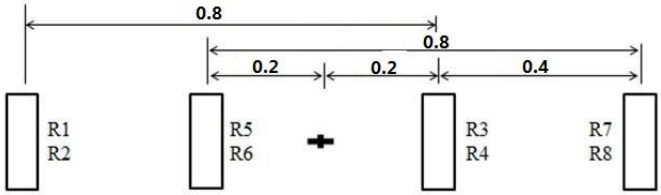
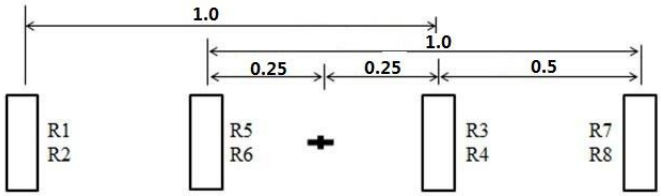
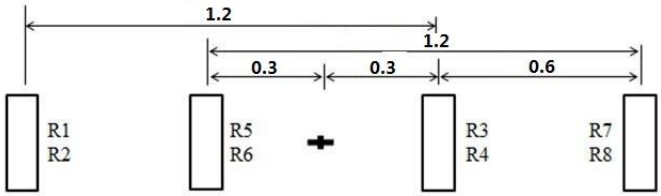
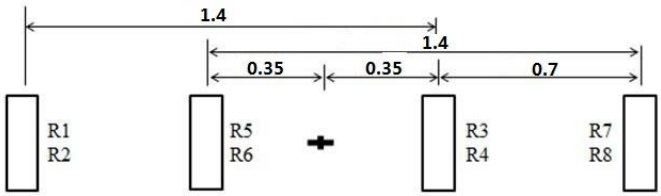
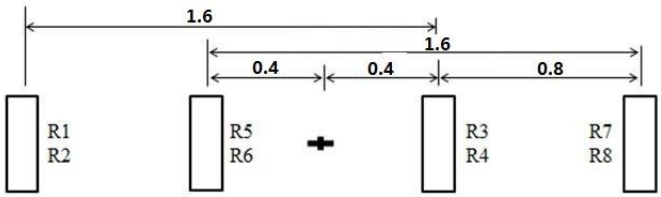
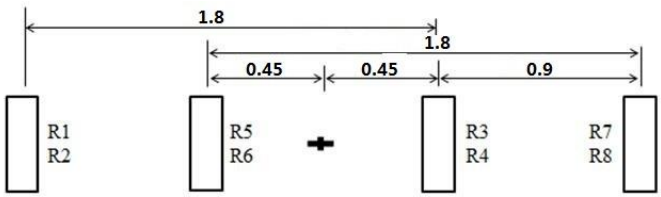
(1) 1 Oe (Oersted) = 1 Gauss in air = 0.1 millitesla = 79.8 A/m.

(2)Supply current is determined by the resistance of the sensor.

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

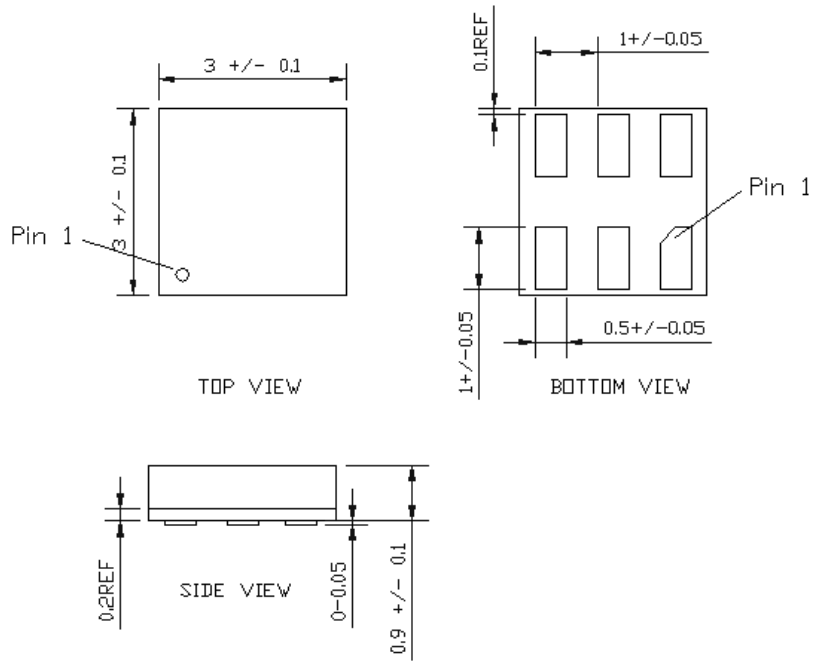
(4)The sensors may saturate if the magnetic field exceeds this range. Saturation field can be custom designed to meet special requirements.

TMR Element Layout

Part Number	Single/ Dual Bridge	TMR Element Spacing (mm) (TMR elements are placed symmetrially with respect to the center of the package, which is marked by the “+”symbol.)	Approx. Gear Tooth Pitch Range	Package Format
TMR4011	Dual		optimal pitch at0.8mm	LGA6L (3x3)
TMR4012	Dual		optimal pitch at 1.2mm	LGA6L (3x3)
TMR4013	Dual		optimal pitch at1.6mm	LGA6L (3x3)
TMR4014	Dual		optimal pitch at2.0mm	LGA6L (3x6)
TMR4015	Dual		optimal pitch at2.4mm	LGA6L (3x6)
TMR4016	Dual		optimal pitch at2.8mm	LGA6L (3x6)
TMR4017	Dual		optimal pitch at3.2mm	LGA6L (3x6)
TMR4018	Dual		optimal pitch at3.6mm	LGA6L (3x6)

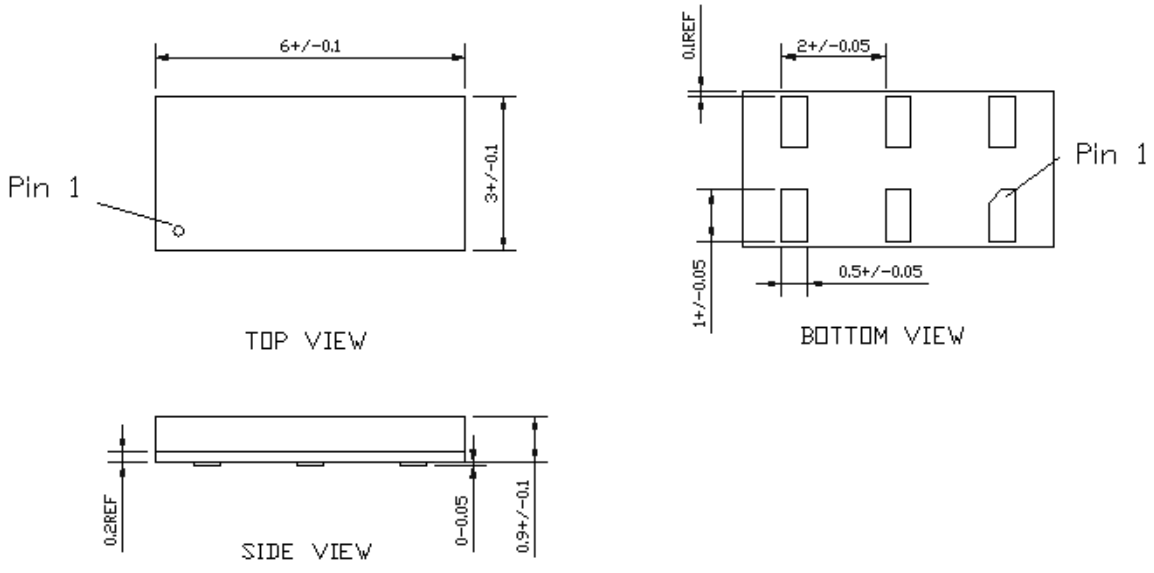
Package Information

LGA6L (3x3) package drawing:



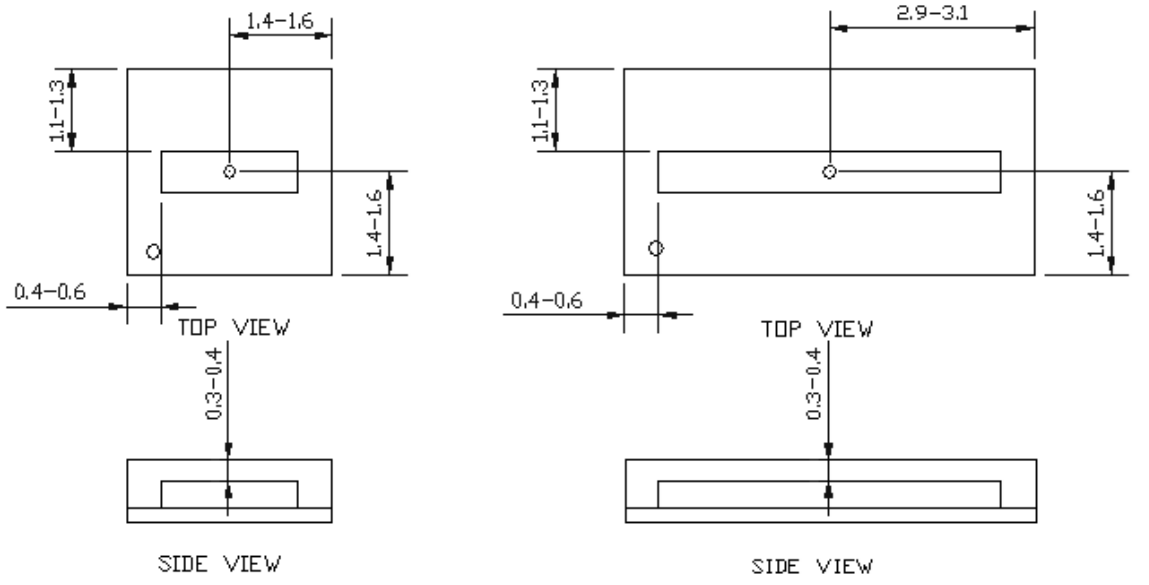
Unit: mm

LGA6L (3x6) package drawing:



Unit: mm

TMR Sensor Position



LGA6L (3x3)LGA6L (3x6)

Top view and side view(unit: mm)

RoHS COMPLIANT

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