TMR40xx

TMR Geartooth Sensor

Description

The TMR40xx series of geartooth sensor adopts a unique push-pull Wheatstone bridge design. This design includes a single-channel or dual-channel Wheatstone full bridge composed of four or eight unshielded high-sensitivity tunneling magnetoresistance (TMR) sensing elements. The Wheatstone bridge provides a differential voltage output along the gradient of the applied magnetic field along the sensor's sensing direction.

The dual-channel Wheatstone full bridge generates two orthogonal sine/cosine voltage output signals to measure the position of the gear rotation and detect the direction of rotation. The high-sensitivity performance of the TMR40xx series enables detection of small magnetic field changes, and its output signal has good temperature stability.

The TMR40xx series is available in two compact LGA6L(3 mm × 3 mm × 0.9 mm) and LGA6L (3 mm × 6 mm × 0.9 mm) packages, with multiple configuration of TMR sensing element spacing:

- TMR4001: 0.25 mm
- TMR4002: 0.5 mm
- TMR4003: 0.75 mm
- TMR4004: 0.5 mm
- TMR4005: 1.0 mm
- TMR4006: 2.0 mm
- TMR4007: 3.0 mm
- TMR4011: 0.4 mm
- TMR4012: 0.6 mm
- TMR4013: 0.8 mm
- TMR4015: 1.2 mm
- TMR4016: 1.4 mm
- TMR4017: 1.6 mm
- TMR4018: 1.8 mm
- TMR4019: 2.4 mm

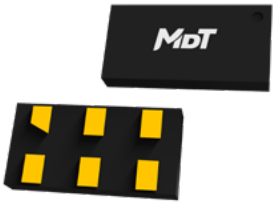
Features and benefits

- Tunneling magnetoresistance (TMR) technology
- High saturation field allows operation in large DC magnetic field
- High sensitivity to magnetic gradient
- Compatible to small pitch gear measurement
- Sine/cosine signal output with accurate phase difference
- Excellent resistance to external magnetic field interference
- Wide air gap tolerance
- DC (zero speed) operation
- Excellent thermal stability
- Compact package
- RoHS and REACH compliant

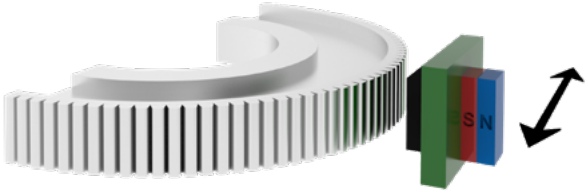
Applications

- Gear speed and direction measurement
- Linear and angular speed sensing
- Linear and angular displacement sensing
- Magnetic scale
- Magnetic encoder

LGA6L (3×3×0.9)



LGA6L (3×6×0.9)



Selection Guide

Part Number	Bridge Channel	TMR Element Spacing (d)	Gear Pitch (D)	Package	Packing Form
TMR4001	Single	0.25 mm	0.5 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4002	Single	0.5 mm	1.0 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4003	Single	0.75 mm	1.5 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4004	Dual	0.5 mm	1.0 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4005	Dual	1.0 mm	2.0 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4006	Dual	2.0 mm	4.0 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4007	Dual	3.0 mm	6.0 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4011	Dual	0.4 mm	0.8 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4012	Dual	0.6 mm	1.2 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4013	Dual	0.8 mm	1.6 mm	LGA6L (3×3×0.9)	Tape & Reel
TMR4015	Dual	1.2 mm	2.4 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4016	Dual	1.4 mm	2.8 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4017	Dual	1.6 mm	3.2 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4018	Dual	1.8 mm	3.6 mm	LGA6L (3×6×0.9)	Tape & Reel
TMR4019	Dual	2.4 mm	4.8 mm	LGA6L (3×6×0.9)	Tape & Reel

Catalogue

1. Functional Block Diagram

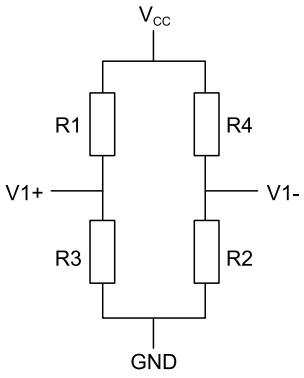


Figure 1-1. Single bridge

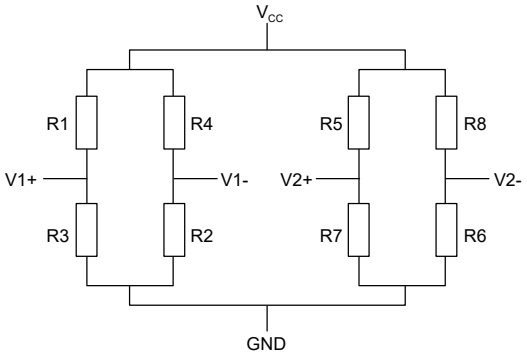


Figure 1-2. Dual bridge

2. TMR Sensing Element Spacing

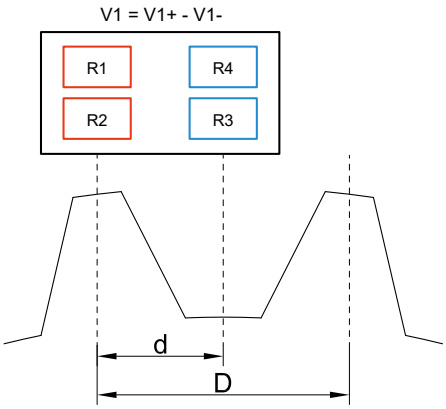


Figure 2-1. Single bridge TMR sensing element spacing

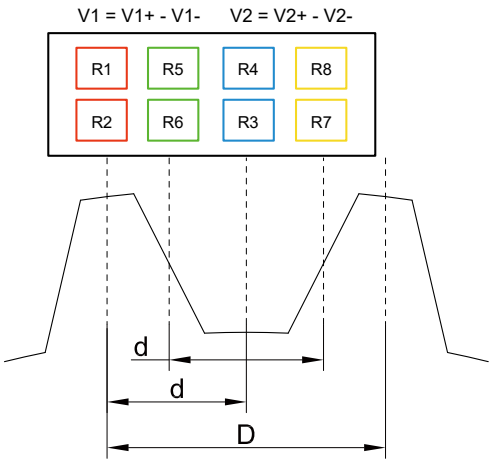


Figure 2-2. Dual bridge TMR sensing element spacing

3. Sensing Direction

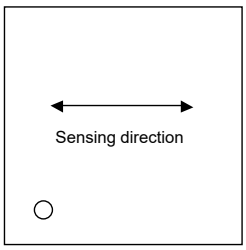


Figure 3-1. Sensing Direction (LGA6L)

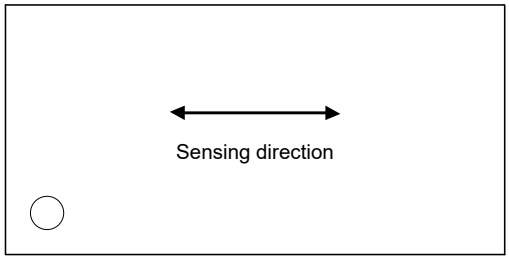


Figure 3-2. Sensing Direction (LGA6L)

4. Pin Configuration

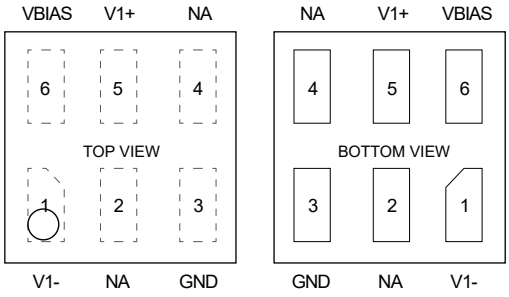


Figure 4-1. Single bridge pin configuration (LGA6L)

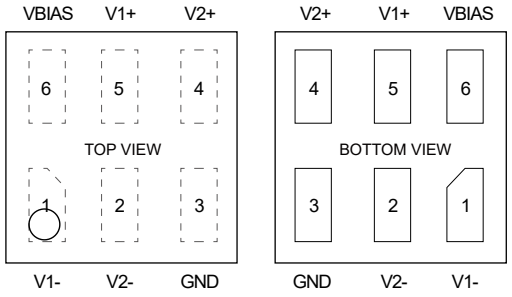


Figure 4-2. Dual bridge pin configuration (LGA6L)

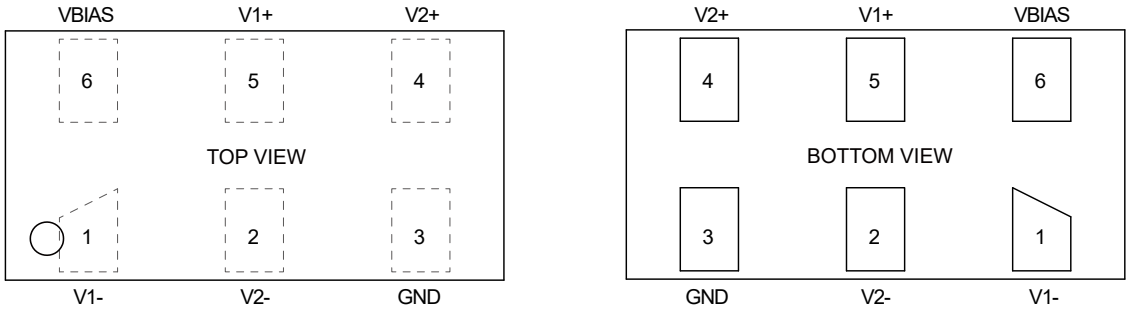


Figure 4-3. Dual bridge pin configuration (LGA6L)

5. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	-	7	V
Reverse supply voltage	V_{RCC}	-	7	V
Magnetic flux density	B	-	1500	Gs
ESD performance (HBM)	V_{ESD}	-	4000	V
Operating ambient temperature	T_A	-40	125	°C
Storage ambient temperature	T_{STG}	-50	150	°C

6. Electrical Specifications

V_{CC} = 3 V, T_A = 25 °C, differential output

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable Part Number
Supply voltage	V_{CC}	operating	-	3	7	V	All parts
Single bridge Bridge resistance [1)]	R_B	B = 0 Gs	-	9	-	kΩ	TMR4001 to TMR4003
Dual bridge Bridge resistance [1)]			-	4.5	-	kΩ	TMR4004 to TMR4019
Saturation magnetic field [2)]	H_{SAT}	-	-	±70	-	Gs	All parts
Non-linearity of resistance	$NONL_R$	fit in ±15 Gs	-	5	-	%FS	All parts
Offset	V_{OFFSET}	-	-20	-	20	mV/V	TMR4001 to TMR4005
		-	-35	-	35		TMR4006 to TMR4017
		-	-50	-	50		TMR4018 to TMR4019
Hysteresis	HYS	sweep in ±20 Gs	-	1	-	%FS	All parts
Typical differential output	V_{OUT_TYP}	-	-	650	-	mV/V	All parts
Resistance temperature coefficient	TCR_B	B = 0 Gs	-	-0.10	-	%/°C	All parts
Sensitivity temperature coefficient	TCS	-	-	-0.18	-	%/°C	All parts

Notes:

1) Bridge resistance (resistance between V_{CC} and GND) is can be custom designed. Please contact MultiDimension Technology for details.
2) Sensor may saturate beyond the range of this magnetic field. Saturation magnetic field can be custom designed. Please contact MultiDimension Technology for details.

7.Dimensions

LGA6L Package

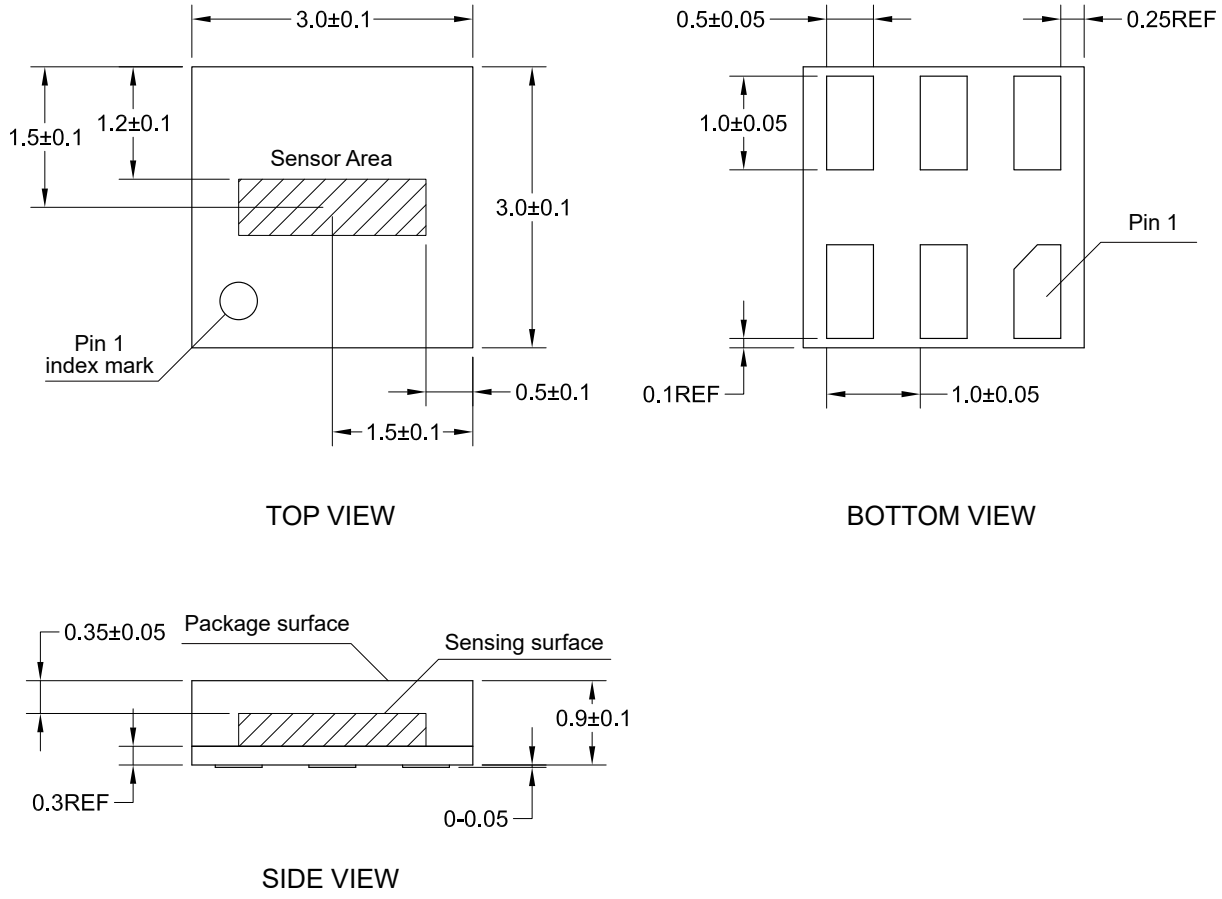


Figure 5. LGA6L (3×3×0.9) Package Drawing (unit: mm)

LGA6L Package

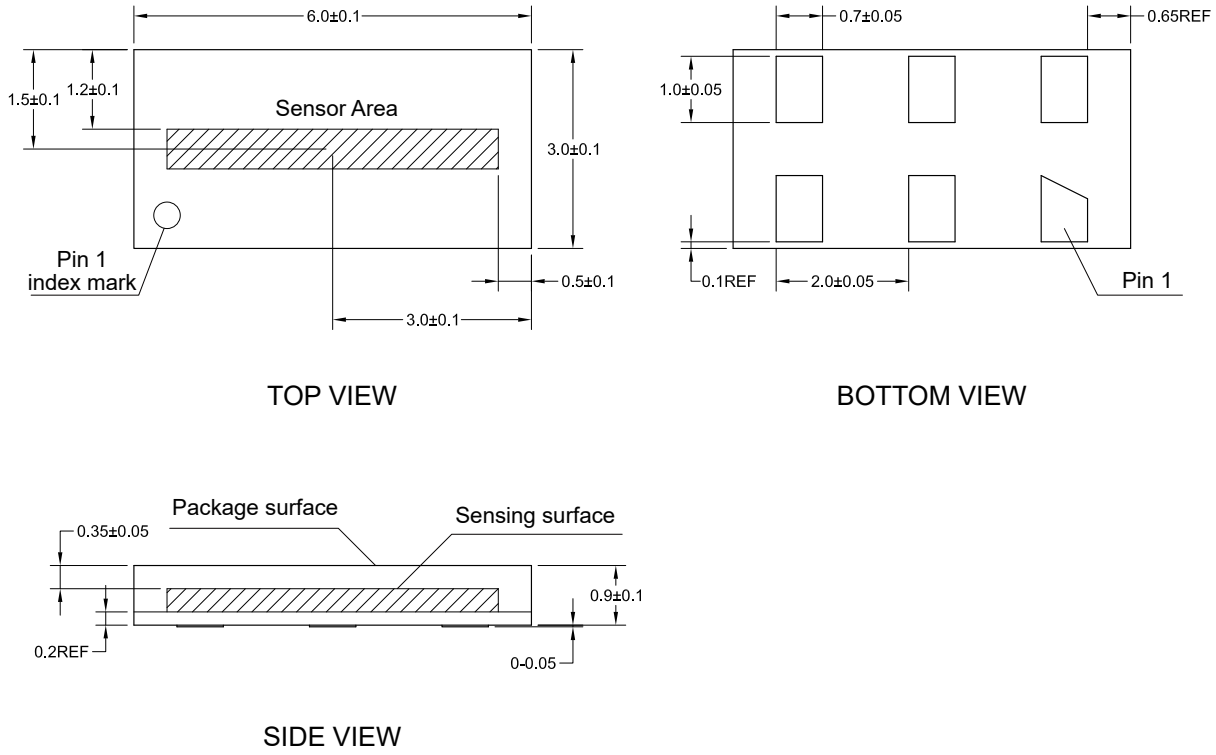


Figure 6. LGA6L (3×6×0.9) Package Drawing (unit: mm)

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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