

## General

- The TMR40XX magnetic geartooth 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 TMR40XX magnetic geartooth 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 TMR40XX magnetic gear tooth sensors are available in 14 different standard spacings of 0.25mm, 0.4mm, 0.50mm, 0.6mm, 0.75mm, 0.8mm, 1.0mm, 1.2mm, 1.4mm, 1.6mm, 1.8mm, 2.0mm, 3.0mm and 4.0mm.
- Two types of small form factor LGA packages are available. The package dimensions are 3mm × 3mm × 0.9mm and 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

## Typical Applications

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

## Absolute Maximum Ratings

PARAMETER	SYMBOL	LIMIT	UNIT
Supply Voltage	$V_{CC}$	7	V
Reverse Supply Voltage	$H_{RCC}$	7	V
Magnetic Field	$H_e$	1500	Oe <sup>(1)</sup>
ESD Voltage	$V_{ESD}$	4000	V
Operating Temperature	$T_A$	-40~125	°C
Storage Temperature	$T_{stg}$	-50~150	°C

## Electrical & Magnetic Characteristics ( $V_{CC}=1.0V$ , $T_A=25\text{ °C}$ , Differential Output)

PARAMETER	SYMBOL	CONDITION	MIN	TYPICAL	MAX	UNIT
Supply Voltage	$V_{CC}$	Operating		1	7	V
Supply Current	$I_{CC}$	Output Open		67 <sup>(2)</sup>		$\mu A$
Bridge Resistance	R			15 <sup>(3)</sup>		kOhm
Single Resistor Sensitivity	SEN			0.46		% $\Delta R/Oe$
Saturation Field	$H_{sat}$			$\pm 70$ <sup>(4)</sup>		Oe
Linear Range 1	LIN1	LIN $\geq 98\%$		$\pm 20$		Oe
Linear Range 2	LIN2	LIN $\geq 95\%$		$\pm 40$		Oe
Offset Voltage	$V_{offset}$		-20		20	mV/V
Hysteresis	Hys	Fit@ $\pm 20Oe$		1		%FS
Maximum Differential Voltage Output	$V_{outMax}$			650		mV/V
Temperature Coefficient of Resistance	TCR	H=0 Oe		-985		PPM/°C
Temperature Coefficient of Sensitivity	TCS			-1800		PPM/°C

Note:

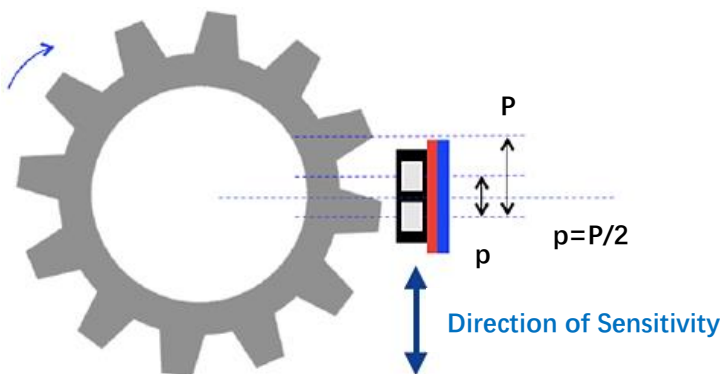
(1) 1 Oe (Oersted) = 1 Gauss in air = 0.1 millitesla = 79.8 A/m.

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

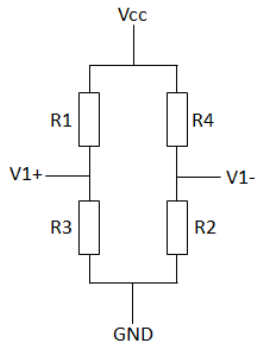
(3) Custom sensor resistance may be available upon request.

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

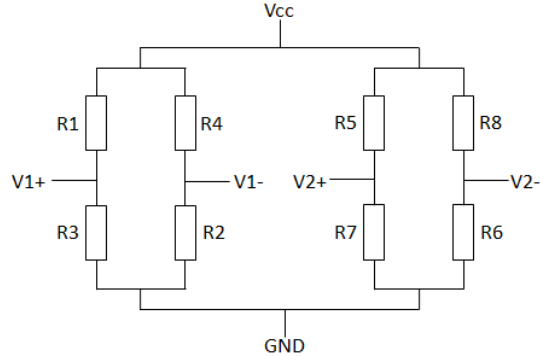
## Usage Method



### Wheatstone Bridge Connection

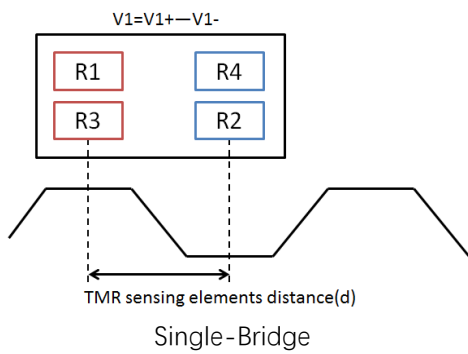


Single-Bridge Configuration

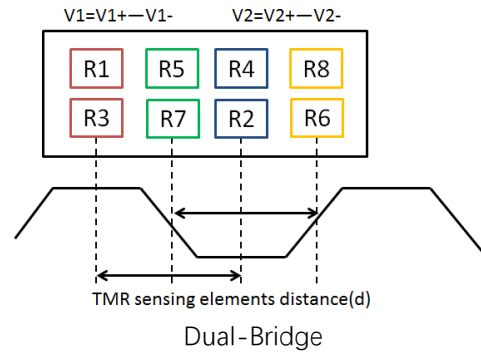


Dual-Bridge Configuration

### TMR Sensing Elements Layout



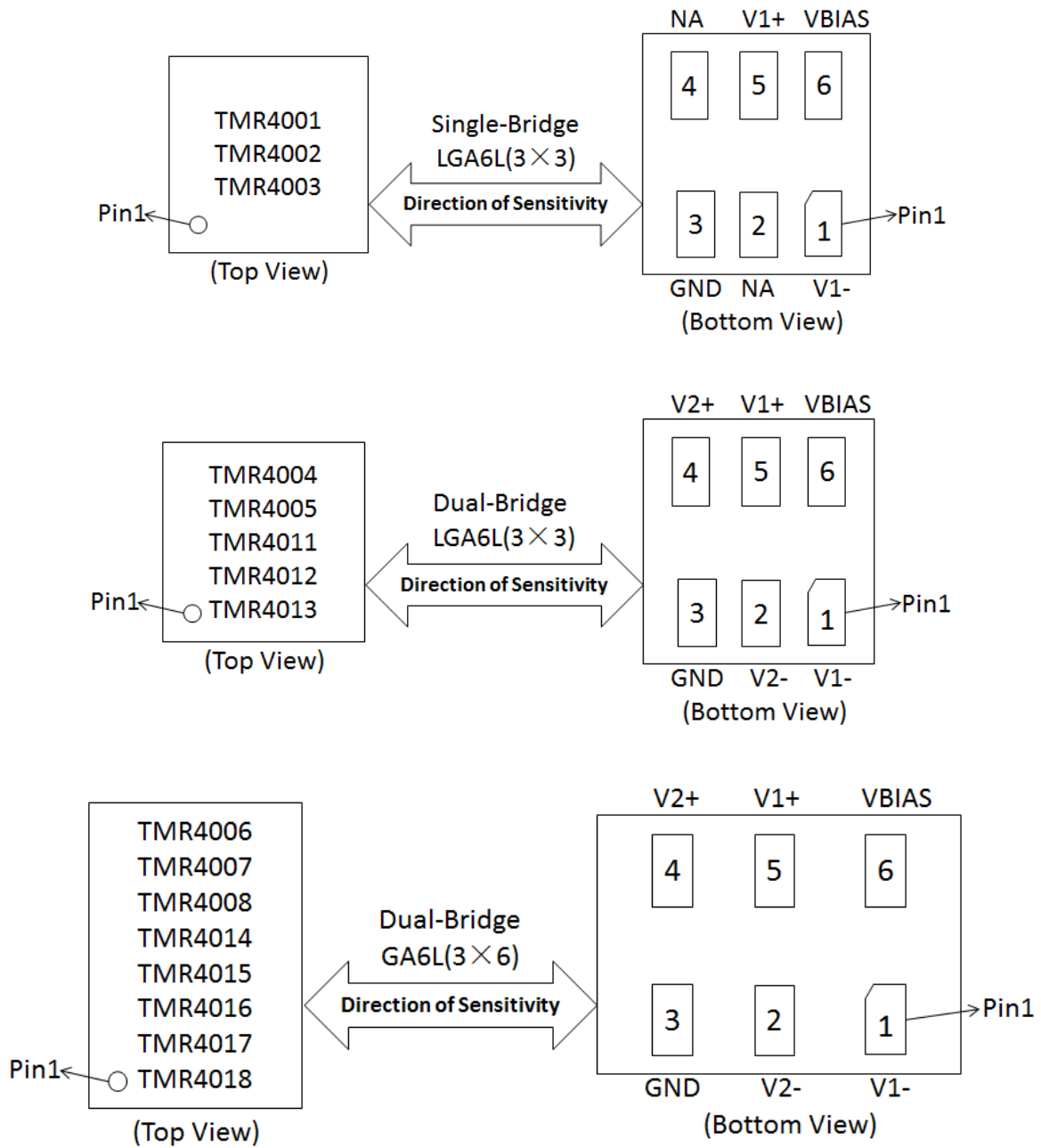
Single-Bridge



Dual-Bridge

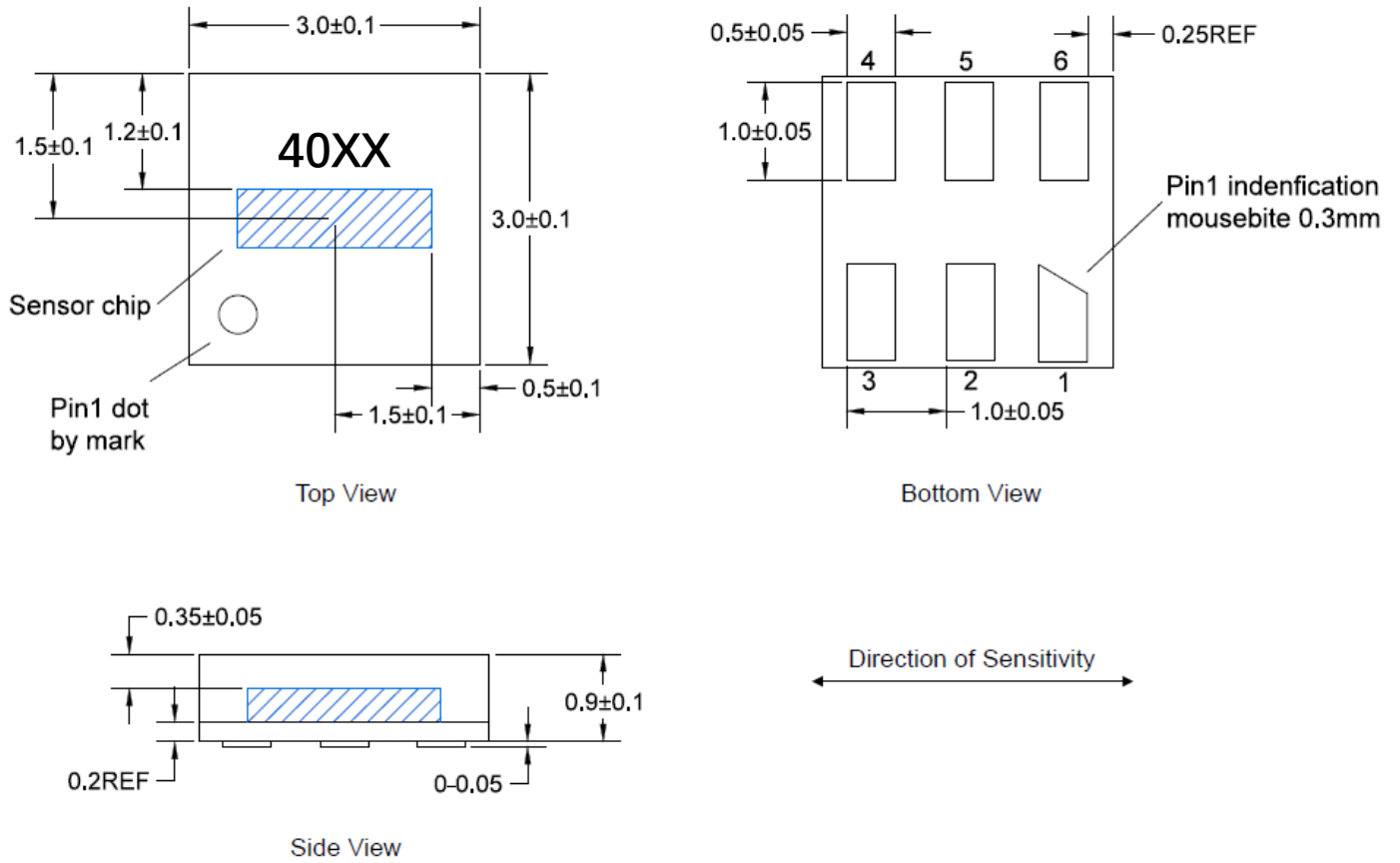
PART NUMBER	SINGLE/DUAL BRIDGE	TMR ELEMENT SPACING p(mm)	GEAR TOOTH PITCH P(mm)	PACKAGE FORMAT
TMR4001	SINGLE	0.25	About 0.5	LGA6L(3×3×0.9)
TMR4002	SINGLE	0.5	About 1.0	LGA6L(3×3×0.9)
TMR4003	SINGLE	0.75	About 1.5	LGA6L(3×3×0.9)
TMR4004	DUAL	0.5	About 1.0	LGA6L(3×3×0.9)
TMR4005	DUAL	1	About 2.0	LGA6L(3×3×0.9)
TMR4006	DUAL	2	About 4.0	LGA6L(3×6×0.9)
TMR4007	DUAL	3	About 6.0	LGA6L(3×6×0.9)
TMR4008	DUAL	4	About 8.0	LGA6L(3×6×0.9)
TMR4011	DUAL	0.4	About 0.8	LGA6L(3×3×0.9)
TMR4012	DUAL	0.6	About 1.2	LGA6L(3×3×0.9)
TMR4013	DUAL	0.8	About 1.6	LGA6L(3×3×0.9)
TMR4014	DUAL	1	About 2.0	LGA6L(3×6×0.9)
TMR4015	DUAL	1.2	About 2.4	LGA6L(3×6×0.9)
TMR4016	DUAL	1.4	About 2.8	LGA6L(3×6×0.9)
TMR4017	DUAL	1.6	About 3.2	LGA6L(3×6×0.9)
TMR4018	DUAL	1.8	About 3.6	LGA6L(3×6×0.9)

Pin Configuration

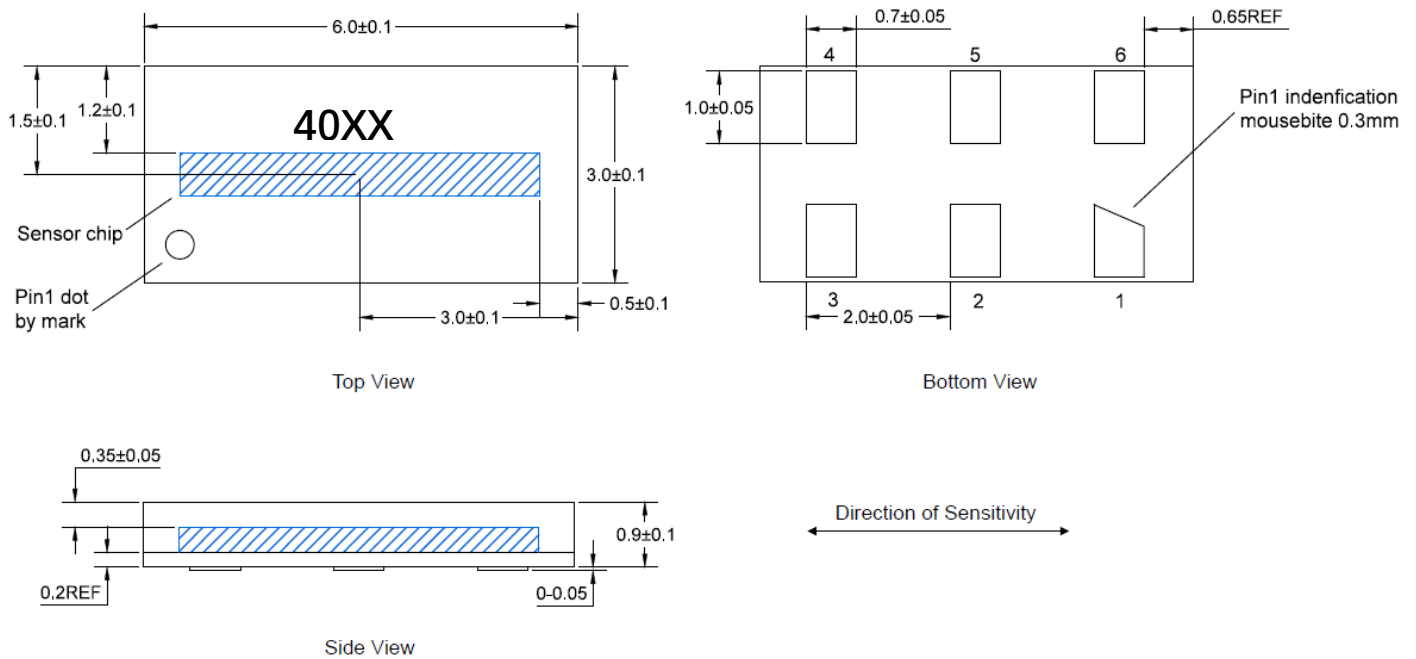


Package Information (Unit: mm) and TMR Sensor Position (Blue shadow)

LGA6L(3×3×0.9) Package Drawing



LGA6L(3×6×0.9) Package Drawing





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