

TMR3636

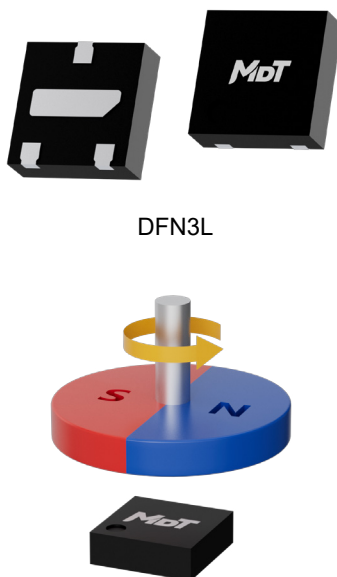
Low Voltage, Low Power TMR Angle Sensor

Description

The TMR3636 is a low-voltage, low-power TMR programmable analog output angle sensor developed by MultiDimension Technology.

This sensor integrates a tunnel magnetoresistance (TMR) sensing element, a low-noise programmable operational amplifier, and a DAC signal conditioning circuit. The built-in signal conditioning circuit allows adjustments to offset, gain, and other parameters of the raw signal detected by the TMR sensor. The sensor outputs a corrected sinusoidal voltage signal that varies with the external magnetic field's angle. As shown in the figure below, the signal period remains constant regardless of the magnetic field strength. The TMR3636 is ideal for various position detection applications, meeting customer requirements for low voltage operation, high resolution, and high signal-to-noise ratio.

This product is available in a DFN3L package (1.6 mm × 1.6 mm × 0.5 mm) and complies with RoHS and other environmental standards.

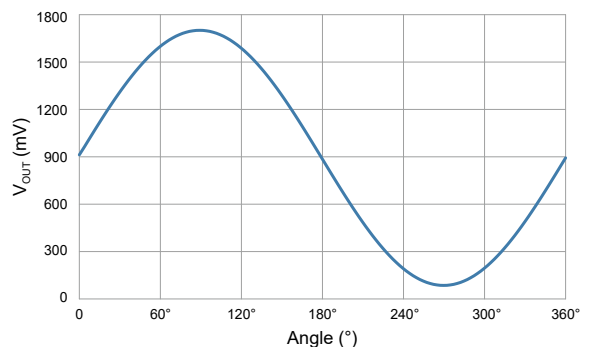


Features and Benefits

- Tunneling magnetoresistance (TMR) technology
- Supply voltage: 1.6 V to 5.0 V
- Static power consumption: < 260 μ A
- Full 360° detection range
- Non-linearity: 1.5% FS ($\pm 30^\circ$)
- Programmable gain: 3x to 30x
- Low noise, low power consumption
- Sin+ / Sin- differential output
- RoHS & REACH compliant

Applications

- Joystick
- Linear displacement sensing

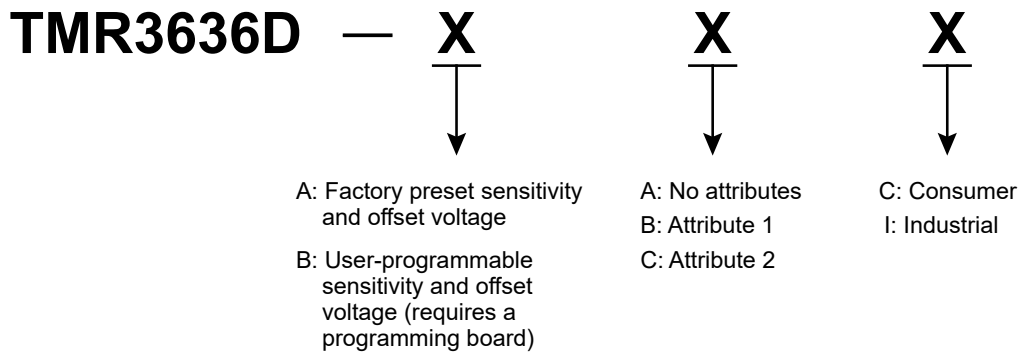


Output curve (1.8V power supply)

Selection Guide

Part Number	Supply Voltage	Operating Temperature	Static Power Consumption	Package	Packing Form
TMR3636D-BAC	1.6 V to 5.0 V	-40 °C to 85 °C	< 260 μA	DFN3L	Tape

Product Model Description



Catalogue

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1. Functional Block Diagram

The TMR3636 is a tunnel magnetoresistance (TMR) angle sensor with an integrated signal conditioning circuit. The TMR sensing element detects magnetic field variations and outputs a differential $Sin+$ / $Sin-$ signal over a 0 to 360° range.

The built-in signal conditioning circuit processes the raw signal by adjusting:

- Offset voltage (Offset)
- Gain (Gain)
- Sensitivity (SEN)

The conditioned signal is then corrected, amplified, and output as an analog voltage signal.

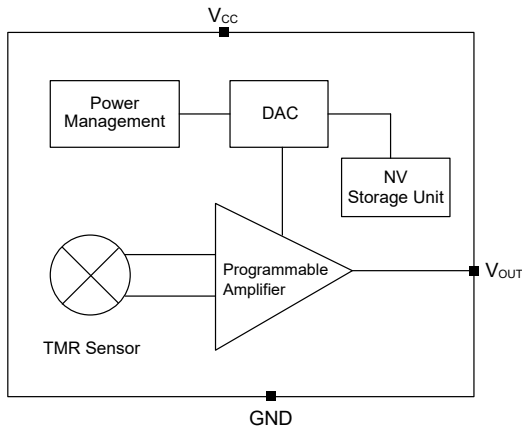


Figure 1. Block diagram

2. Sensing Direction

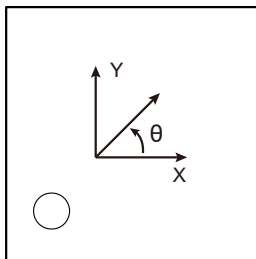


Figure 2. Sensor Sensitivity Direction

3. Pin Configuration

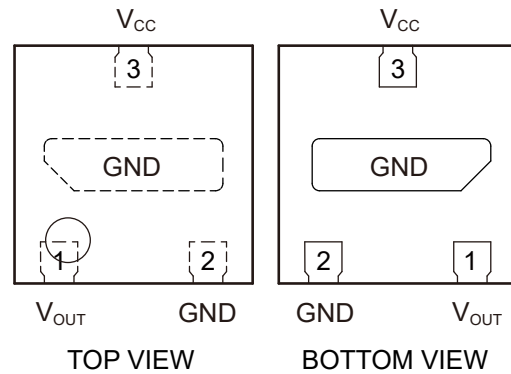


Figure 3. Pin configuration

Number	Name	Function
1	V_{OUT}	Output voltage
2	GND	Ground
3	V_{CC}	Supply voltage

4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	1.6	5.5	V
External magnetic field	B	-	3000	Gs
V_{OUT} current driving capability	-	-	1.5	mA
ESD (HBM)	V_{ESD} (HBM)	-	3000	V
ESD (CDM)	V_{ESD} (CDM)	-	2000	V
Operating ambient temperature	T_A	-40	85	°C
Storage ambient temperature	T_{STG}	-50	150	°C

Note: The absolute maximum ratings define the limits beyond which the sensor may suffer permanent damage. For normal operating conditions, please refer to the “Electrical Performance Characteristics” section.

5. Electrical Specifications

$V_{CC} = 1.6\text{ V to }5\text{ V}$, $T_A = 25\text{ °C}$, 100 nF capacitor connected between V_{CC} and GND unless specified otherwise

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	Normal operation	1.6	-	5.0	V
Supply current	I_{CC}	$V_{CC} = 1.8\text{ V}$, B = 300 Gs (Magnetic field direction: 0°)	-	200	-	μA
		$V_{CC} = 3.3\text{ V}$, B = 300 Gs (Magnetic field direction: 0°)	-	260	-	μA
Bandwidth	BW	-	-	40	-	kHz
Load resistance	R_L	-	10	-	-	kΩ
Load Capacitance	C_L	-	-	-	10	nF
Peak voltage temperature drift	TCV_{PEAK}	$T_A = -40\text{ °C to }85\text{ °C}$	-	1000	-	PPM/°C
Peak voltage	V_{PEAK}	B = 300 Gs, magnification 3X	300	400	450	mV/V
Median voltage	V_{Mid}	-	-	$V_{DD} / 2$	-	mV
Offset Voltage	V_{OFFSET}	B = 300 Gs, magnification 3X	-30	0	30	mV/V
Nonlinearity	NONL	Zero point ±30°	-	1.5	-	%FS
Power-on time	t_{PO}	-	-	-	100	μs

6. Magnetic Specifications

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Magnetic Field	B	-	200	-	800	Gs

Note: 1 Gauss in air = 0.1 millitesla = 79.8 A/m

7. Parameter Definition

The default gain magnification is set to 3X. If the magnification is $\geq 4X$, the peaks and troughs of the output waveform may be clipped.

7.1 Peak voltage V_{PEAK}

$$V_{PEAK} = \frac{V_{MAX} - V_{MIN}}{2} \quad V_{PP} = V_{MAX} - V_{MIN}$$

7.2 Median voltage V_{Mid}

$$V_{Mid} = \frac{V_{MAX} + V_{MIN}}{2}$$

7.3 Offset voltage V_{OFFSET}

$$V_{OFFSET} = V_{Mid} - \frac{V_{CC}}{2}$$

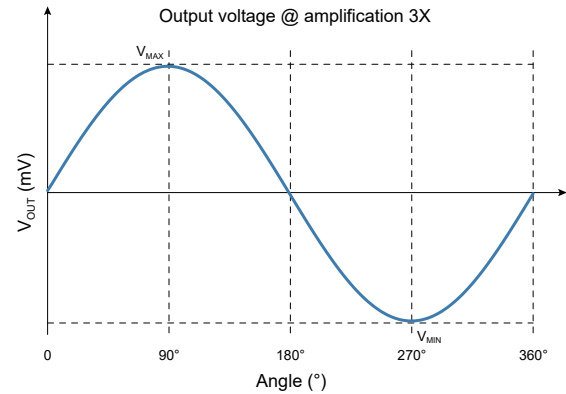


Figure 4. Output signal V_{MIN} and V_{MAX} definition

8. Typical Output

As shown in Figures 5 and 6 below, the output curve of the TMR3636 sensor varies with the angle of the applied in-plane magnetic field.

- When the magnetic field angle is 0° , the V_{OUT} output is equal to $V_{DD} / 2$.
- The actual output curve of the TMR3636 sensor depends on the programmed amplification factor.

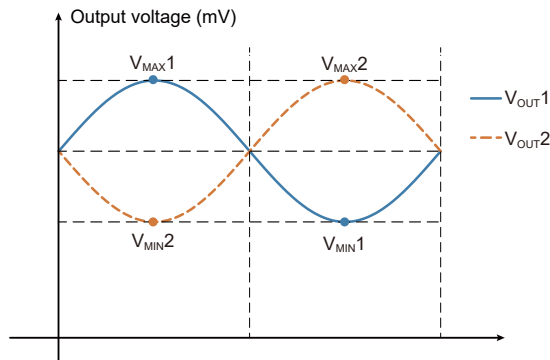


Figure 5. TMR Output Curve

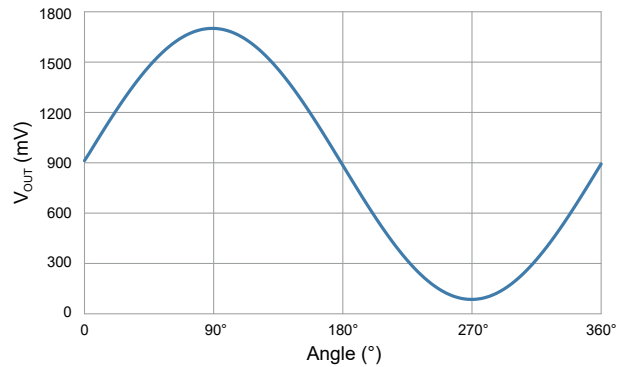


Figure 6. TMR+ASIC V_{OUT} Output Curve
(1.8V power supply, 3X magnification)

9. Application Circuit

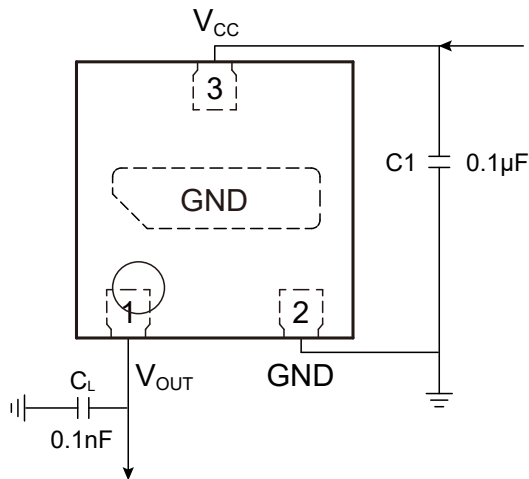


Figure 7. Application circuit diagram

Note: C1 should be placed as close as possible to the V_{CC}/GND pins.

10. Dimensions

DFN3L Package

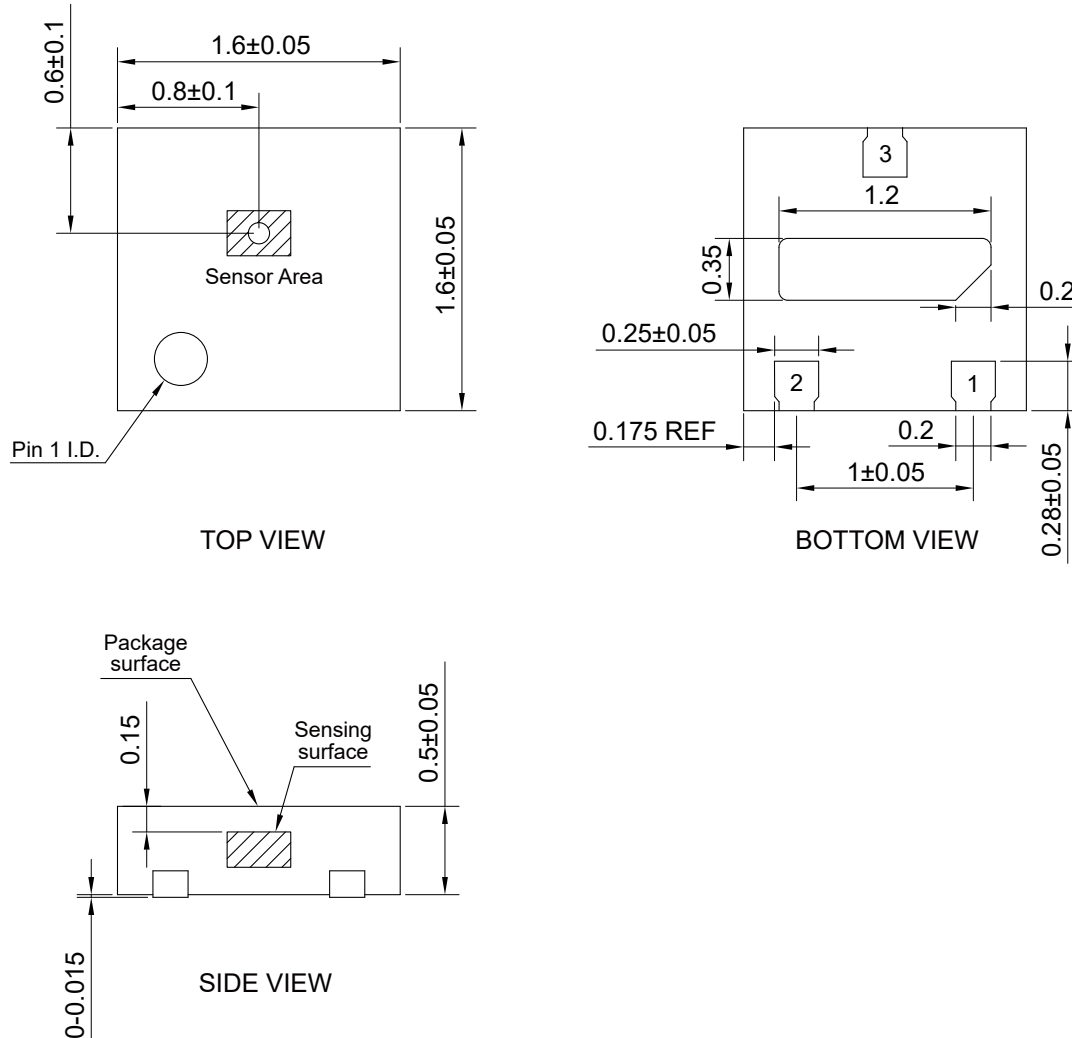


Figure 8. Package outline of DFN3L (unit: mm)

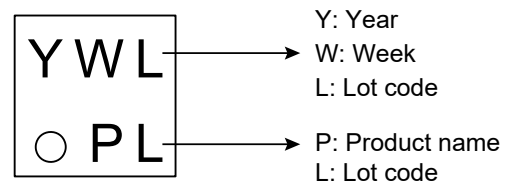
Product Packaging Mark Description

"Y" represents the feeding year, with one character for every half year, and 26 characters for 13 years;

"W" stands for feeding week, and 26 letters represent 26 weeks;

"L" represents the batch, and each wafer is assigned one character each time;

"P" stands for product name.



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