

Corporate Brochure

MultiDimension Technology Co., Ltd. (MDT)

www.multidimensiontech.com

MDT® — The Leading Supplier of TMR Magnetic Sensors

MultiDimension Technology(MDT) was founded in 2010 in Zhangjiagang, Jiangsu Province, China, with branch offices in Shanghai and San Jose, Calif., USA. MDT has developed an unique intellectual property portfolio, and state-of-the-art manufacturing capabilities that can support volume production of high-performance, low-cost TMR magnetic sensors to satisfy the most demanding application needs. Led by its core management team of experts in magnetic sensor technology and engineering services, MDT is committed to creating added value for its customers and ensuring their success. For more information about MDT please visit <http://www.multidimensiontech.com>

MDT 's Service Options Include

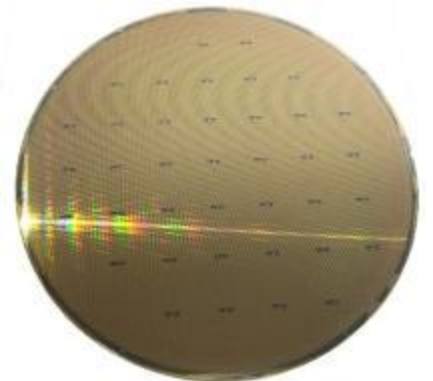
- In-plane and Z-axis TMR sensors, which may be delivered as wafers, bare dice, or packaged devices
- Custom design for TMR/GMR/AMR sensors
- ASIC design for integration with TMR/GMR/AMR sensors
- Foundry service for TMR/GMR/AMR sensors including thin-film deposition, device processing, packaging and testing
- Custom sensor module design and application solutions
- IP licensing, granting customers access to MDT 's technology for use in their products

Summary of MDT's Sensor Products

Product	Applications	Features
Switch Sensors	<ul style="list-style-type: none"> • Flow meters • Proximity switches • Level sensors 	<ul style="list-style-type: none"> • Low power consumption • High speed • Excellent thermal stability
Linear Sensors	<ul style="list-style-type: none"> • Current sensors • Magnetic field sensors • Position sensors 	<ul style="list-style-type: none"> • High sensitivity • Low noise • Low hysteresis
Angle Sensors	<ul style="list-style-type: none"> • Rotary encoders • Potentiometers 	<ul style="list-style-type: none"> • Large output signal • Capability large air-gap
Gear Speed Sensors	<ul style="list-style-type: none"> • Gear tooth detection • Linear and rotary encoders • Speed sensors 	<ul style="list-style-type: none"> • Small pitch detection • High sensitivity • Capability large air-gap
Magnetic Image Sensors	<ul style="list-style-type: none"> • Banknote validation • ATM and vending machines • Magnetic card readers 	<ul style="list-style-type: none"> • High sensitivity • High SNR • Robust design



MULTI DIMENSION 多维科技
Sensing the Future 感知未来



TMR Sensor Wafer Manufactured by MDT

China · ZJG

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US · San Jose

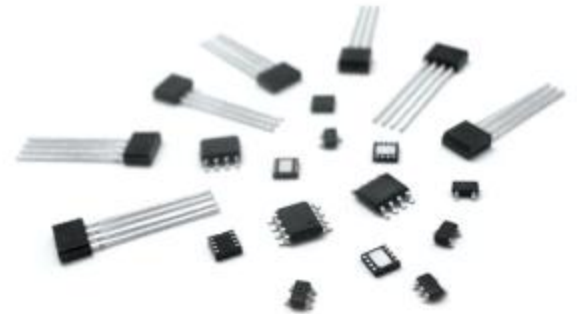
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TMR: New Generation Magnetic Sensor Technology

Magnetic transducers are widely used in modern industry and electronics to sense the magnetic field strength to measure current, position, motion, direction, and other physical parameters. In the technical field of magnetoresistive transducers, there are many different types of sensors for measuring magnetic field and other parameters. Commercially important ones, in order of technical maturity, include: Hall Effect, Anisotropic MagnetoResistance (AMR), Giant MagnetoResistance (GMR), and the latest: Tunneling MagnetoResistance (TMR).

Recently, TMR elements were introduced as a new type of magnetoresistive sensor for industrial applications. They are constructed as a magnetic multilayer film material. TMR magnetic field sensing elements exhibit a greater change in resistivity, as a function of applied magnetic field induction. The term Magnetic Tunnel Junction (MTJ) is used to refer to a TMR sensing element.

Relative to a Hall effect sensing element, a MTJ sensing element has better temperature stability, higher sensitivity, lower power consumption, better linearity, and needs no additional flux concentrator to increase sensitivity. Relative to an AMR sensing element, a MTJ sensing element has better temperature stability, higher sensitivity, wider linear range, and needs no set / reset coil. Relative to a GMR sensing element, a MTJ sensing element has better temperature stability, higher sensitivity, lower power consumption, and wider linear range.



TMR Sensors Manufactured by MDT

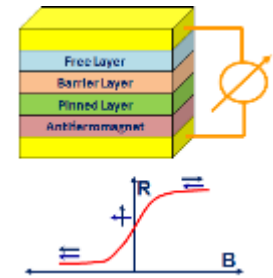
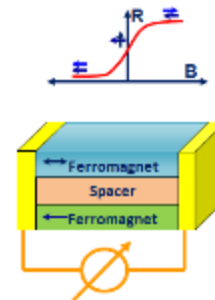
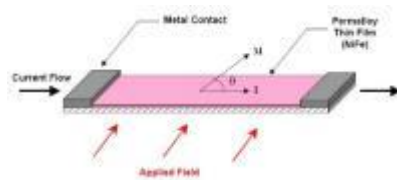
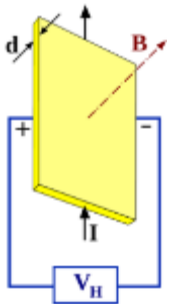
Technology Advancement

● Hall Effect

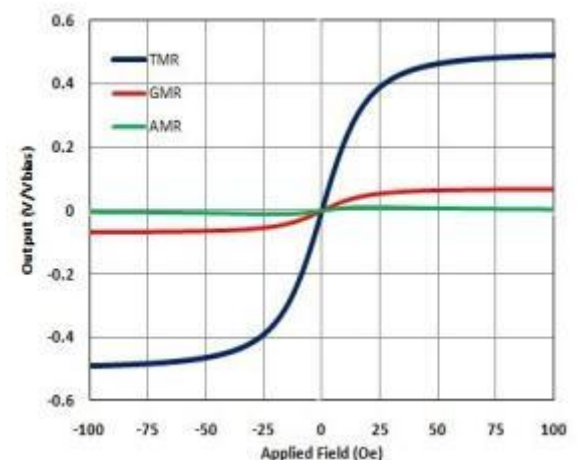
● AMR – Anisotropic MagnetoResistance

● GMR – Giant MagnetoResistance

● TMR – Tunneling MagnetoResistance



Technology	Hall Effect	AMR	GMR	TMR
Power Consumption (mA)	5 ~ 20	1 ~ 10	1 ~ 10	0.001 ~ 0.01
Die Size (mm ²)	1 × 1	1 × 1	1 × 2	0.5 × 0.5
Field Sensitivity (mV/V/Oe)	~ 0.05	~ 1	~ 3	~ 100
Dynamic Range (Oe)	~ 10000	~ 10	~ 100	~ 1000
Resolution (nT/Hz ^{1/2})	>100	0.1 ~ 10	1 ~ 10	0.1 ~ 10
Temperature Performance (°C)	< 150	< 150	< 150	< 200



Equipment

▲ Sputter Deposition System

Ultra high vacuum magnetic sputtering system with 8 inch wafer and angstrom film deposition capability. The system includes 10 cathodes with multi-target deposition capability, and it can process up to 100 layers. Also this system has high temperature capability of up to 700°C.



▲ Magnetic Annealing Oven

High magnetic field up to 4.5 Tesla, and temperature up to 500°C. An 8 inch wafer batch can process 25 wafers and can run continuously process with no interruption. Real time process monitoring of each parameter and high precision angle control.



B-H Looping



Vibrating Sample Magnetometer(VSM)



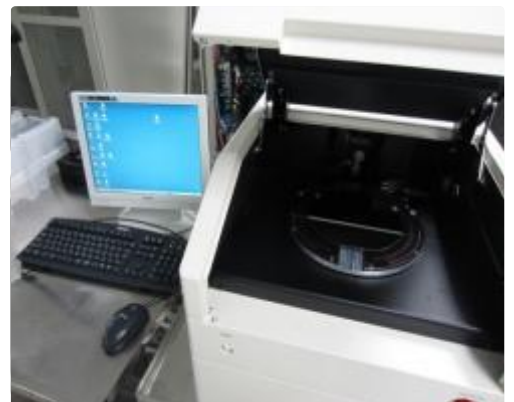
X-ray Fluorescence



Parametric Tester

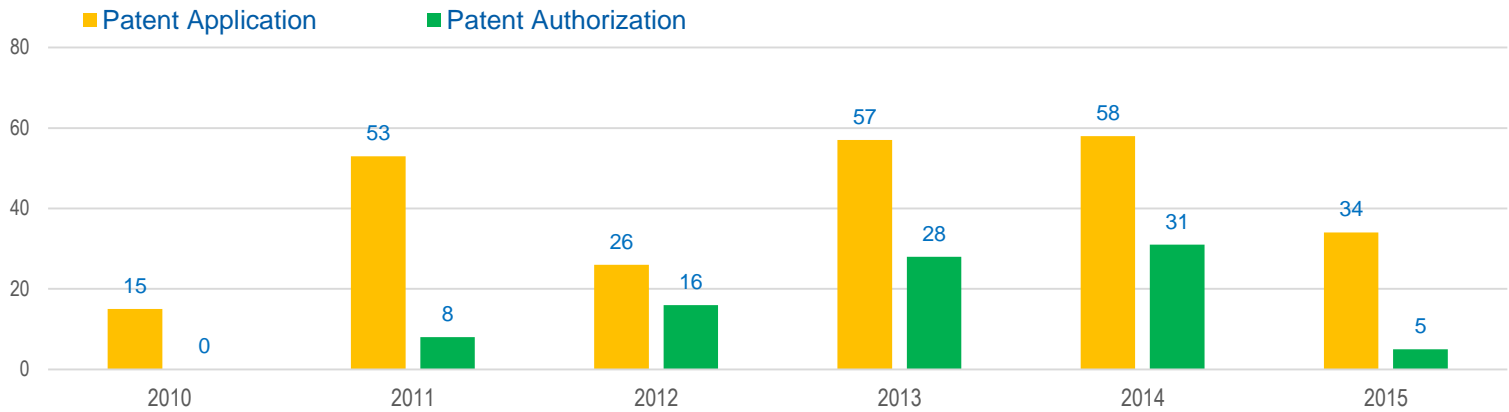


On-Wafer Magnetic Test system



Four-point Resistivity Probe System

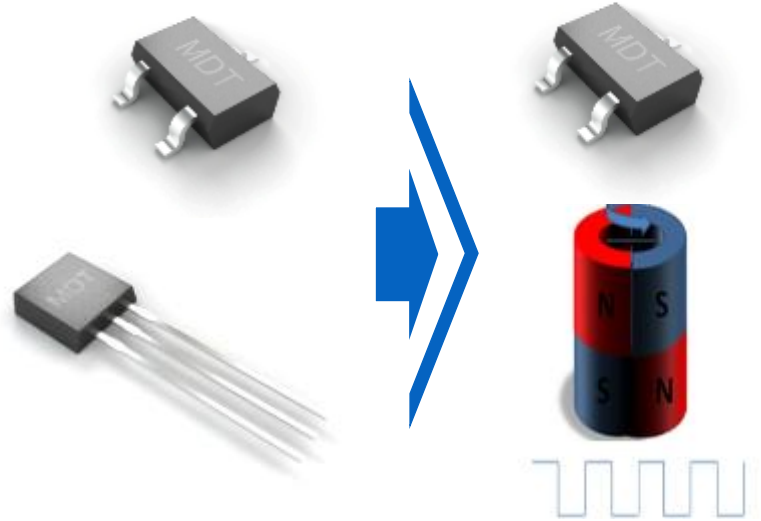
Patents



NO.	Patent Number	Title	Application Date	NO.	Patent Number	Title	Application Date
186	CN104280700A	SINGLE-CHIP DIFFERENTIAL FREELAYER PUSH-PULL MAGNETIC FIELD SENSOR BRIDGE	2014/9/28	93	EP2827165A1	MAGNETORESISTANCE MAGNETIC	2013/1/29
185	CN104197828A	A SINGLE-CHIP OFF-AXIS MR Z-X ANGLE SENSOR	2014/8/20	92	CN103968918A	FIELD GRADIENT SENSOR	2013/1/25
184	CN204043604U	A SINGLE-CHIP OFF-AXIS MR Z-X ANGLE SENSOR	2014/8/20	91	CN203083663U	DIGITAL LIQUID LEVEL SENSOR	2013/1/25
183	CN104197827A	DUAL AXIS MR ANGULAR SENSOR	2014/8/18	90	CN103925933A	DIGITAL LIQUID LEVEL SENSOR	2013/1/11
182	CN204043603U	DUAL AXIS MR ANGULAR SENSOR	2014/8/18	89	CN203203607U	A MULTITURN ABSOLUTE MAGNETIC	2013/1/11
181	WO2015014277 A1	SINGLE CHIP PUSH-PULL BRIDGE MAGNETIC SENSOR	2014/7/29	88	CN103913183A	ENCODER	2013/1/9
180	WO2015014248 A1	A NOVEL MR CURRENT LIMITER	2014/7/25	87	CN203116756U	A MULTITURN ABSOLUTE MAGNETIC	2013/1/9
179	WO2015010649 A1	SINGLE MAGNETORESISTOR TMR SENSOR CHIP FOR CURRENCY VERIFICATION HEAD	2014/7/25	86	CN103915233A	ENCODER	2013/1/5
178	WO2015010620 A1	TMR FREQUENCY MIXER	2014/7/23	85	CN203300354U	AN ANGLE MAGNETIC ENCODER AND	2013/1/5
177	CN104301851A	TMR SENSOR NEAR FIELD MAGNETIC COMMUNICATION SYSTEMS	2014/7/14	84	CN202916902U	ELECTRONIC WATERMETER	2012/10/31
176	WO2014206351 A1	MR IMAGING SENSOR ARRAY	2014/6/27	83	CN203038357U	AN ANGLE MAGNETIC ENCODER	2012/10/31
175	CN204129826U	A COIN DETECTION SYSTEM	2014/6/23	82	CN102968845A	AND ELECTRONIC WATERMETER	2012/10/31
174	CN103995240A	A MR Z AXIS GRADIENT CHIP	2014/6/23	81	2015-503735	THE PM USED IN ANGLE MAGNETIC ENCODER	2012/10/30
173	CN203940940U	T, P, H SENSOR	2014/6/23	80	US20140327437A1	THE PM USED IN ANGLE	2012/10/30
172	CN104021411A	HIDDEN MICR(MAGNETIC INK CHARACTER RECOGNITION) CODE	2014/5/30	79	EP2801834A1	MAGNETIC ENCODER	2012/10/30
171	CN103995240A	A MR Z AXIS GRADIENT CHIP	2014/5/30	78	2014-532883	A MAGNETIC-BIASED CURRENCY	2012/9/26
170	CN203894395U	A MR Z AXIS GRADIENT CHIP	2014/5/30	77	US20140300348A1	VERIFICATION HEAD WITH	2012/9/26
169	WO2014190943 A1	COMPACT ROTARY LEVEL SENSOR	2014/5/30	76	EP2790030A1	SENSITIVE DIRECTION PARALLEL	2012/9/26
168	WO2014190909 A1	THREE AXIS COMPASS	2014/5/28	75	EP2752676A1	TO THE DETECTION SURFACE	2012/8/27
167	WO2014190907 A1	SINGLE CHIP SENSOR	2014/5/28	74	2014-529743	A MAGNETIC-BIASED CURRENCY	2012/8/27
166...104	73...11
103	CN203119864U	SENSOR USED IN HIGH FIELD	2013/3/25	10	CN102208530B	ROTATION SENSORS AND MASS	2011/5/24
102	CN104065367A	A MAGNETIC BARCODE CHIP	2013/3/25	9	CN202230192U	FABRICATION METHOD	2011/5/24
101	CN203133257U	A MAGNETIC BARCODE CHIP	2013/3/18	8	CN202119390U	INDIVIDUALLY PACKAGED	2011/5/19
100	2015-513667	A SINGLE CHIP Z AXIS LINEAR MR SENSOR	2013/2/19	7	CN102297652B	MAGNETORESISTANCE	2011/5/19
99	US20150091560A1	A SINGLE CHIP Z AXIS LINEAR MR	2013/2/19	6	CN102298124B	ANGLE SENSOR	2011/5/19
98	EP2818884A1	SENSOR	2013/2/19	5	CN202119391U	SINGLE-PACKAGE BRIDGE-TYPE	2011/5/19
97	CN103968860A	DIRECT-READING TYPE METERING	2013/2/1	4	CN202121565U	MAGNETIC-FIELD ANGLE SENSOR	2011/5/16
96	CN203083583U	DEVICE AND DIRECT-READING	2013/2/1	3	CN102790613A	SINGLE-PACKAGE BRIDGE-TYPE	2011/5/16
95	US20150130445A1	TYPE WATER METER	2013/1/29	2	CN102169133B	MAGNETIC-FIELD ANGLE SENSOR	2011/4/22
94	2015-511705	MULTI-TURN PULLEY LEVEL SENSOR DEVICE	2013/1/29	1	CN102621504B	SEPARATELY PACKAGED BRIDGE MAGNETIC-FIELD ANGLE SENSOR	2011/4/21

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology;
- High Sensitivity, Low Switching Points;
- Ultra Low Power Consumption at 1.5 μ A;
- Compatible with a Wide Range of Supply Voltages;
(Low Voltage: 1.8~5.5V; High Voltage: 5~40VDC);
- Excellent Consistency at Operating Point;
- Excellent Thermal Stability;
- High-Speed Detection and High Frequency Response;
- High ESD Tolerance;
- Small Form Factor



Applications

- Utility Meters including Water, Gas, and Heat Meters;
- Electricity Meters;
- Contactless Magnetic Switches;
- Motor Controllers;
- Rotary and Linear Position Sensing;
- Brushless DC motor Control;
- Electric Power Window;
- Level Sensing



Intelligent Water Meter



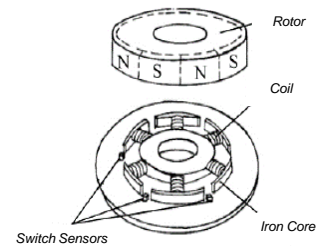
Water Meter



Direct-Read Water Meter



Level Sensor



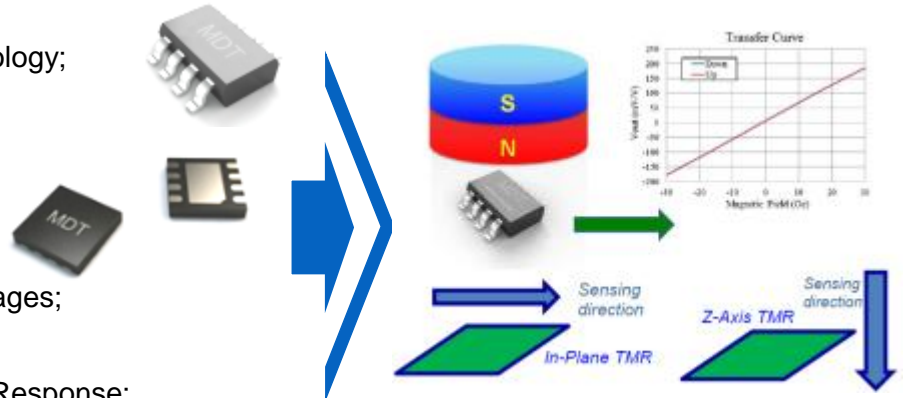
BLDC Control

Products

Part No.	Previous Part No.	Type	Supply Voltage	Power Consumption	Operating Modes	Sensing Direction	B _{op} (Gs,25°C)	B _{rp} (Gs,25°C)	Output Interface	Form Factor	Lead Time
TMR1201	MMS101H	Bipolar	1.5~5.5 V	3.4 μ A	Continuous power, no duty cycling	X-axis	15	-15	CMOS	SOT23-3	3 months
TMR1301	MMS201H	Omnipolar	1.5~5.5 V	4.5 μ A	Continuous power, no duty cycling	X-axis	\pm 15	\pm 10	CMOS	SOT23-3;TO92S	3 months
TMR1202	MMS1X1H	Bipolar	1.5~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	17	-17	CMOS	SOT23-3;TO92S	In stock
TMR1302	MMS2X1H	Omnipolar	1.5~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	\pm 17	\pm 10	CMOS	SOT23-3;TO92S	In stock
TMR1303	—	Omnipolar	1.5~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	\pm 35	\pm 22	CMOS	SOT23-3;TO92S	In stock
TMR1305	—	Omnipolar	1.5~5.5 V	2.0 μ A	Continuous power, no duty cycling	Z-axis	\pm 17	\pm 10	CMOS	SOT23-3;TO92S	3 months
TMR1306	—	Omnipolar	3.0~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	\pm 15	\pm 8	Open Drain	SOT23-3;TO92S	3 months
TMR1308	—	Omnipolar	1.5~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	\pm 5	\pm 4	CMOS	SOT23-3	Custom Order
TMR1309	—	Omnipolar	1.5~5.5 V	1.5 μ A	Continuous power, no duty cycling	X-axis	\pm 5	\pm 4	CMOS	SOT23-3	Custom Order
TMR1250	—	Bipolar	3~40 V	1.3 mA	Continuous power, no duty cycling	Z-axis	60	-60	Open Drain	SOT23-3;TO92S	In stock
TMR1251	—	Bipolar	5~40 V	1.3 mA	Continuous power, no duty cycling	X-axis	30	-30	Open Drain	SOT23-3;TO92S	3 months
TMR1350	—	Omnipolar	3~40 V	1.3 mA	Continuous power, no duty cycling	Z-axis	\pm 60	\pm 40	Open Drain	SOT23-3;TO92S	3 months

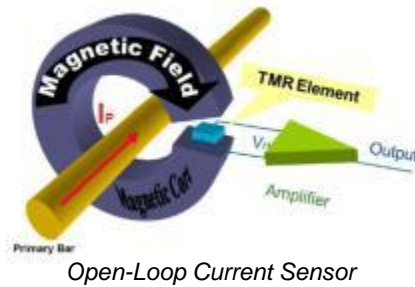
Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology;
- High Sensitivity up to 60mV/V/Oe;
- Very Low Power Consumption;
- Low Hysteresis;
- Large Dynamic Range;
- Compatible with Wide Range of Supply Voltages;
- Excellent Thermal Stability;
- High-Speed Detection and High Frequency Response;
- High ESD Tolerance



Applications

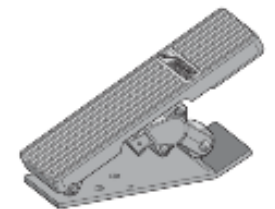
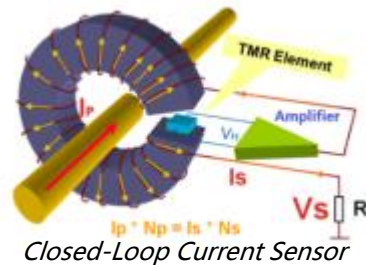
- Magnetometers;
- eCompass;
- Current Sensing;
- Non-Destructive Testing;
- Displacement Sensing;
- Rotary Position Sensing;
- Position Sensing;
- Parking sensors



Non-Destructive Testing



Intelligent Transportation System (ITS)



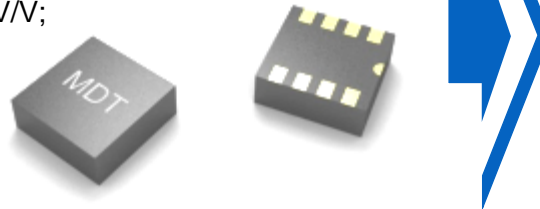
Pedal Position Sensor

Products

Part No.	Previous Part No.	Structure	Supply Voltage	Sensitivity (mV/V/Oe)	Resistance (kΩ)	Saturation Field (Oe)	Sensing Direction	Hysteresis (Oe)	Noise(nT/rt(Hz) @1Hz)	Form Factor	Lead Time
TMR2101	MMLP57H	Half bridge	0~7 V	3	200	±70	X-axis	0.06	~ 10	SOP8;SOT23	In stock
TMR2102	MMLP57F	Full bridge	0~7 V	4.9	90 / 45	±90	X-axis	0.1	~ 10	SOP8;DFN8	In stock
TMR2103	—	Full bridge	0~7 V	6	50	±75	X-axis	0.3	~ 10	SOP8;DFN8	In stock
TMR2501	TMR501	Full bridge	0~7 V	0.3	5	±1000	Z-axis	1	~ 50	TO94;SSIP4	In stock
TMR2503	—	Full bridge	0~8 V	0.7	5	±750	Z-axis	1	~ 50	TO94;SSIP4	In stock
TMR2505	—	Full bridge	0~9 V	2.2	5	±100	Z-axis	1	~ 50	TO94;SSIP4	In stock
TMR2701	MMLH45F	Full bridge	0~7 V	10	80	±50	X-axis	0.3	~ 10	SOP8 ;DFN	In stock
TMR2703	TMR703	Full bridge	0~7 V	13.5	60	±30	X-axis	0.3	~ 10	SOP8 ;DFN8	In stock
TMR2704	TMR703H	Half bridge	0~7 V	5.5	6	±30	X-axis	0.3	~ 20	SOP8;TO92;SOT23	In stock
TMR2705	TMR705	Full bridge	0~7 V	20	65	±25	X-axis	0.3	~ 10	SOP8 ;DFN8	In stock
TMR2905	—	Full bridge	0~7 V	50~60	2~8	±11	Y-axis	<0.8	1~5	SOP8 ;DFN8	In stock
TMR2922	—	Full bridge	0~7 V	5~15	10k	±15	X-axis	<1	~ 1	SOP8	In stock

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology;
- Dual-axis Contactless 360° Measurement;
- High Sensitivity;
- Large Signal Output at 900~1000mV/V;
- Operating in Saturation;
- Wide Air-Gap Tolerance;
- Excellent Thermal Stability;
- Low Hysteresis;
- Very Low Power Consumption

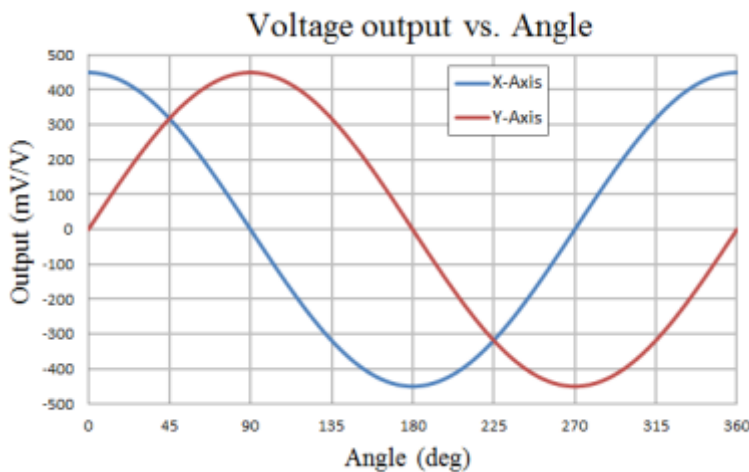


Applications

- Rotary Position Sensors;
- Rotary Encoders;
- BLDC Controllers;
- Contactless Potentiometers;
- Valve Position Sensors;
- Knob Position Sensors



Contactless Potentiometer



Products

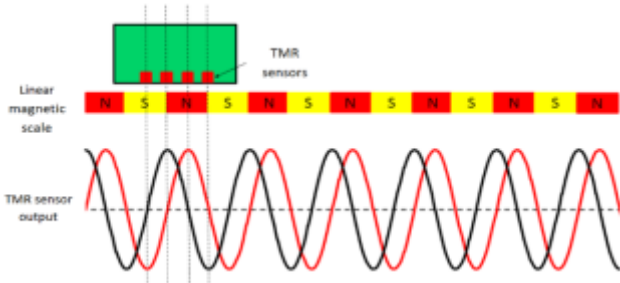
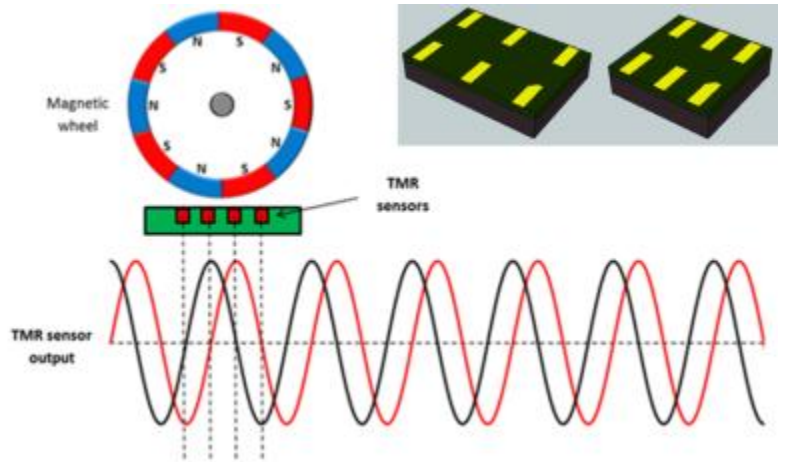
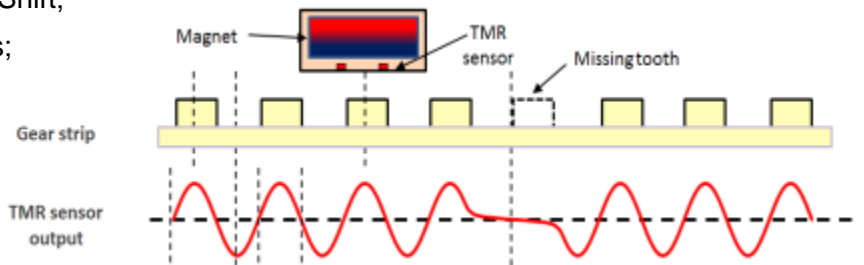
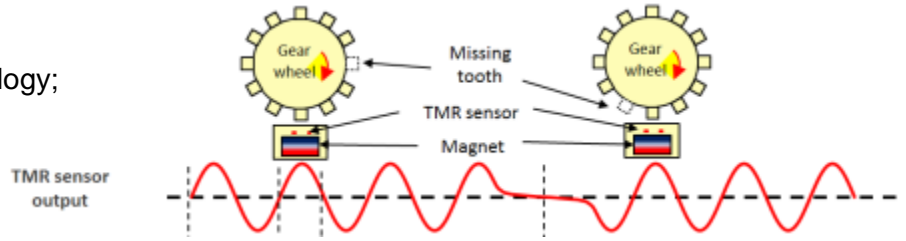
Part No.	Previous Part No.	Type	Supply Voltage	Angle Measurement	Resistance	pp (mV/V)	Angular Error	Output	Form Factor	Lead Time
TMR3001	MMA233F	Dual-Axial TMR Rotation Sensor	0 ~ 7 V	360	4KΩ	900	±2.5	Simulation of differential output	LGA8	In stock
TMR3002	MMA253F	Dual-Axial TMR Rotation Sensor	0 ~ 7 V	360	280KΩ	1000	±2.5	Simulation of differential output	LGA8	In stock

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology;
- High Sensitivity, High Resolution;
- Large Output Signal without Amplification;
- Small Magnet or Larger Air-Gap Capability;
- Capable of Small-Pitch Gear Tooth Detection;
- Sine/Cosine Signal Outputs with Precise Phase Shift;
- Compatible with Wide Range of Supply Voltages;
- High Frequency Response(>20 MHz);
- Excellent Thermal Stability;
- Compact Ultra-Thin Package

Applications

- Gear Tooth Detection;
- Linear Displacement or Rotary Position Sensors;
- Linear Scale or Wheel Speed Sensors;
- Magnetic Encoders;
- Linear Magnetic Scales



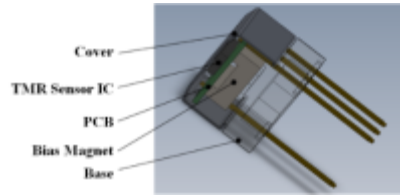
Products

Part No.	Previous Part No.	Single / Double Full	Supply Voltage (V)	TMR Element Spacing (mm)	Gear Tooth Pitch Range	Resistance (kΩ)	Saturation Field (Oe)	Sensing Direction	Form Factor	Lead Time
TMR4001	MMG145F	Single Full	0 ~ 7 V	0.25	0.3 ~ 1.0mm; optimal pitch at 0.5mm	15	±70	X-axis	LGA6L 3x3	In stock
TMR4002	MMG245F	Single Full	0 ~ 7 V	0.5	0.7 ~ 2.0mm; optimal pitch at 1.0mm	15	±70	X-axis	LGA6L 3x3	In stock
TMR4003	MMG345F	Single Full	0 ~ 7 V	0.75	1.0 ~ 3.0mm; optimal pitch at 1.5mm	15	±70	X-axis	LGA6L 3x3	In stock
TMR4004	MMG245D	Double Full	0 ~ 7 V	0.5	0.7 ~ 2.0mm; optimal pitch at 1.0mm	15	±70	X-axis	LGA6L 3x3	In stock
TMR4005	MMG445D	Double Full	0 ~ 7 V	1	1.3 ~ 4.0mm; optimal pitch at 2.0mm	15	±70	X-axis	LGA6L 3x3	In stock
TMR4006	MMG845D	Double Full	0 ~ 7 V	2	2.7 ~ 8.0mm; optimal pitch at 4.0mm	15	±70	X-axis	LGA6L 3x6	In stock
TMR4007	MMGC45D	Double Full	0 ~ 7 V	3	4.0 ~ 12.0mm; optimal pitch at 6.0mm	15	±70	X-axis	LGA6L 3x6	In stock

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology;
- High Saturation Point Permitting Large DC Magnetic Field;
- Wide Air-Gap Tolerance;
- High Sensitivity to Magnetic Field Gradient;
- Excellent Thermal Stability and Low Noise;
- High Tolerance to Magnetic Field Interference;
- Compatible with Existing Products

Structure of a TMR Magnetic Image Sensor



Magnetic Image of MDT's 50DPI Magnetic Image Sensor



Applications

- Banknote Validators;
- Banknote Sorters;
- ATM and Vending Machines;
- Magnetic Card Readers



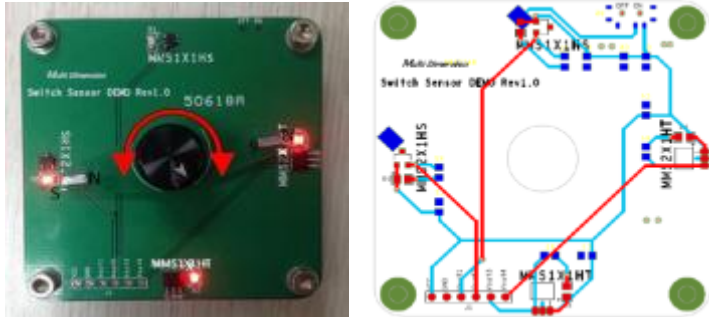
Products

Part No.	Channels	Output	Sensing Length
TMR6201	1 Channel	Analog	5mm
TMR6201D	1 Channel	Digital	5mm
TMR6206	6 Channel	Analog	60mm
TMR6209	9 Channel	Analog	90mm
TMR6218	18 Channel	Analog	180mm
MIS6301	50 DPI / 24 Channel	Analog	12mm
MIS6309	50 DPI / 180 Channel	Analog	90mm
MIS6318	50 DPI / 360 Channel	Analog	180mm



TMR Switch Sensor Demo Board

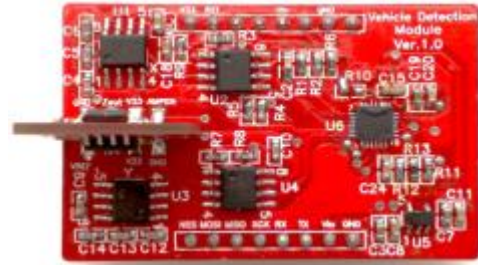
- Products: TMR1202、TMR1302 Switch Sensors
- Benefits: By integrating TMR technology and CMOS signal processing circuitry, MDT's TMR magnetic sensors feature low power, high frequency response, and high sensitivity. They are suitable for a variety of applications that require measurement of magnetic switching signals.



TMR Parking Sensor

The Earth's magnetic field is a uniform magnetic field within a limited space, with the field strength of 0.3~0.7 Gauss. The large amount of ferrous material in a vehicle can cause severe distortions to the earth's magnetic field. TMR magnetic sensors can measure the induced changes in the magnetic field around a parking spot in order to detect the presence of a vehicle.

- Applications: vehicle detection, magnetic field measurement
- Voltage supply: 3.7 ~ 5.5VDC
- Sampling rate: 100 Hz
- Output format: SPI, with vehicle status and 3-axis field reading
- Integrated TMR linear sensor with MCU



TMR Angle and Gear Sensor Demo

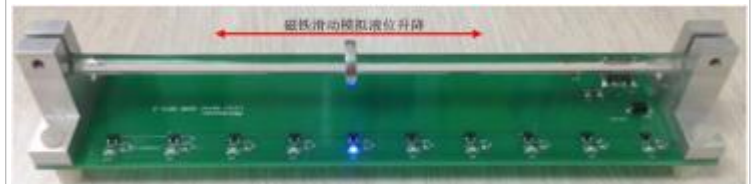
- Voltage supply: USB 5V, 9V battery
- Real-time feedback of angular position or gear count on LCD
- Output format: SPI/UART/ABZ/PWM



TMR Level Sensor

TMR level sensors are widely used in the petroleum industry and for environmental protection, health, water tank, and many civilian applications (such as solar water heaters) and in other fields.

- Products: TMR1302, TMR1306 Switch Sensors
- Benefits: (1) Extremely low power consumption; (2) Open drain output, built-in solid-state switch, contactless, no noise, high reliability; (3) Excellent consistent at switching point; (4) Excellent temperature characteristics; (5) Small size





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