

# TMR1215

Bi-stable TMR Bipolar Magnetic Switch  
with Passive Memory Effect

## General Description

The TMR1215 is a bi-stable digital bipolar magnetic switch that integrates TMR and CMOS technology in order to provide a magnetically triggered digital switch with high sensitivity, high speed, and ultra-low power consumption. It integrates a push-pull half-bridge TMR magnetic sensor and CMOS signal processing circuitry within the same package. Compared with conventional magnetic switch sensors, TMR1215 can detect and store the ON/OFF state triggered by magnetic polarity without power supply, and the latest state can be retrieved immediately after power supply is resumed. Designed for use in applications that are power-critical, performance-demanding, and failsafe, this device includes an on-chip TMR voltage generator for precise magnetic sensing, TMR voltage amplifier and comparator, a Schmitt trigger to provide switching hysteresis for noise rejection, and CMOS push-pull output. An internal band gap regulator is used to provide temperature compensated supply voltage for internal circuits, and it allows a wide range of operating supply voltages. The TMR1215 draws only 1.5 $\mu$ A resulting in ultra-low power operation, additionally it has fast response, accurate switching points, excellent thermal stability, and immunity to stray field interference. It is available in two packaging form factors: SOT23-3 (P/N TMR1215S), or TO-92S (P/N TMR1215T).

## Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- Ultra Low Power Consumption at 1.5 $\mu$ A
- Passive Operation with Magnetic Memory Effect
- High Frequency Response at 1KHz
- Bipolar Latching Operation
- Compatible with a Wide Range of Supply Voltages
- Excellent Thermal Stability
- High Tolerance to External Magnetic Field Interference

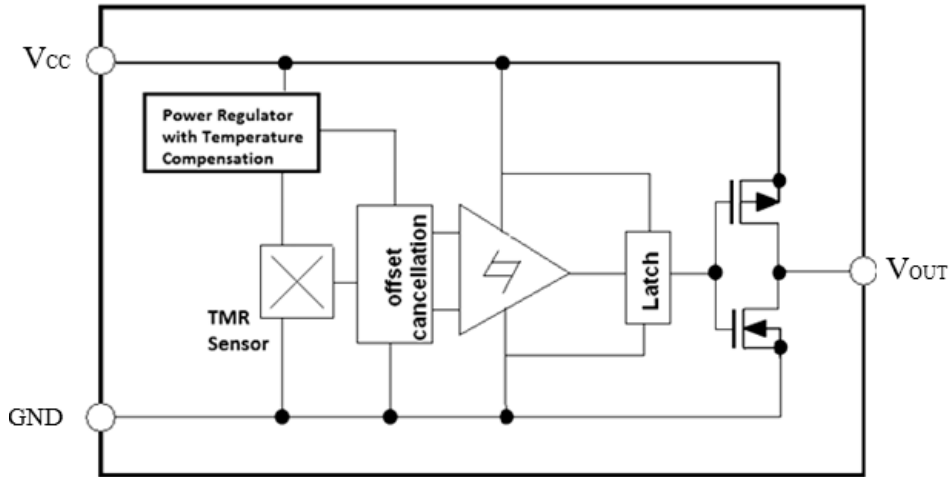
## Applications

- Utility Meters including Water, Gas, and Heat Meters
- Bi-stable Level Switches in Elevator Doors
- Magnetic Flip Level Gauges
- Solid State Switches
- Speed Sensing
- Rotary and Linear Position Sensing



TMR1215S(Left), TMR1215T(Right)

## Block Diagram



## Pin Configuration

TO-92S

SOT23-3

Pin Name	Pin No.		Pin Function
	TO-92S	SOT23-3	
$V_{OUT}$	1	2	Output
GND	2	3	Ground
$V_{CC}$	3	1	Supply Voltage

## Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Supply Voltage	$V_{CC}$	7	V
Reverse Supply Voltage	$V_{RCC}$	0.3	V
Output Current	$I_{OUTSINK}$	9	mA
Magnetic Flux Density	B	4000	G
ESD level(HBM)	$V_{ESD}$	4	kV
Operating Temperature	$T_A$	-40 ~ 125	°C
Storage Temperature	$T_{stg}$	-50 ~ 150	°C

## Electrical Characteristics ( $V_{CC}=3.0V, T_A=25^{\circ}C$ )

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply Voltage	$V_{CC}$	Operating	1.8	3.0	5.5	V
Output High Voltage	$V_{OH}$		$V_{CC}-0.3$		$V_{CC}$	V
Output Low Voltage	$V_{OL}$		0		0.2	V
Supply Current	$I_{CC}$	Output Open		1.5		$\mu A$
Response Frequency	F			1000		Hz

**Note:** A 0.1 $\mu F$  capacitor is connected between  $V_{CC}$  and GND during all tests in the above table.

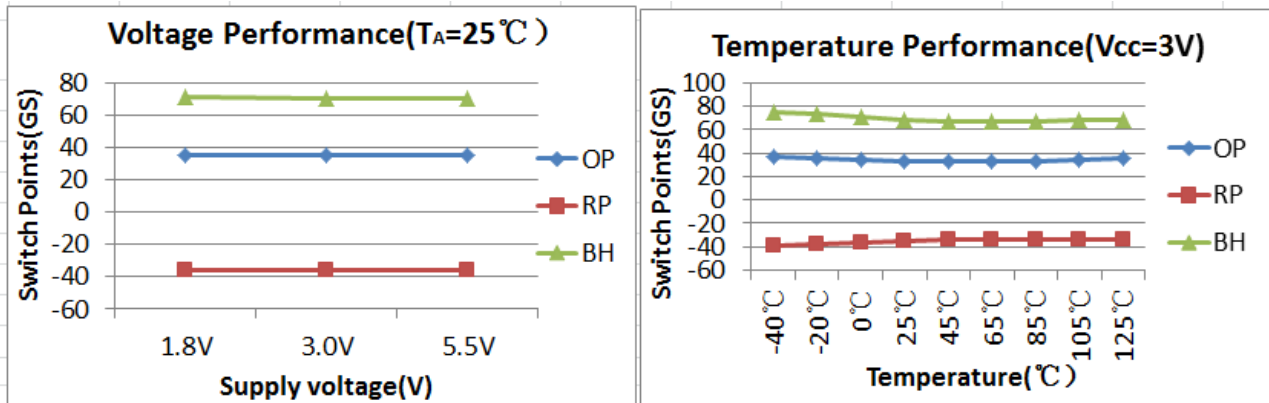
### Magnetic Characteristics ( $V_{CC} = 3.0V, T_A = 25^\circ C$ )

Parameters	Symbol	Min	Typ.	Max	Units
Operate Point	$B_{OP}$	20	35	40	G
Release Point	$B_{RP}$	-40	-35	-20	G
Hysteresis	$B_H$		70		G
Operate Point for Passive Memory Effect	$B_{OPM}$	40			G
Release Point for Passive Memory Effect	$B_{RPM}$			-40	G

**Note:**

- Operate point for passive memory effect: in order to retain a stable passive latching operation without power supply, the applied magnetic field shall be stronger than  $B_{OP}$ . A magnetic field >40 Gauss shall be sufficient to guarantee the triggering and storage of the ON state in the passive mode.
- Release point for passive memory effect: in order to retain a stable passive latching operation without power supply, the applied magnetic field shall be stronger than  $B_{RP}$ . A magnetic field <-40 Gauss shall be sufficient to guarantee the triggering and storage of the OFF state in the passive mode.

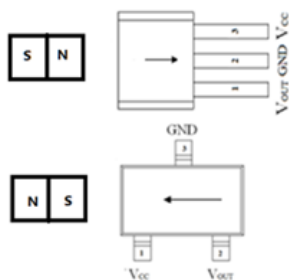
### Voltage and Temperature Characteristics



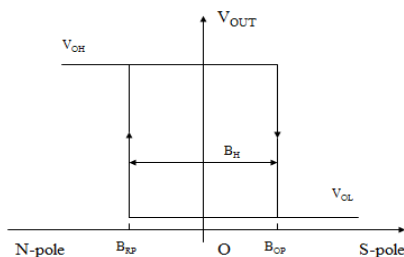
### Output Behavior vs. Magnetic Pole

Parameter	Test Conditions	Output
South Pole	$B > B_{OP}$	Low (On)
North Pole	$B < B_{RP}$	High (Off)

**Note:** when power is turned on under zero magnetic field, the output is "High".



Sensing Direction of Magnetic Field  
(arrow indicates direction of N->S)

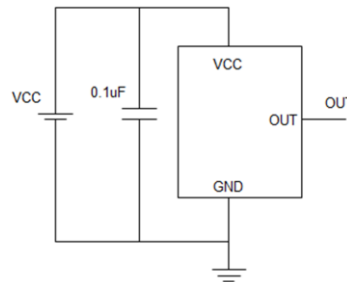


Magnetic Flux

## Application Information

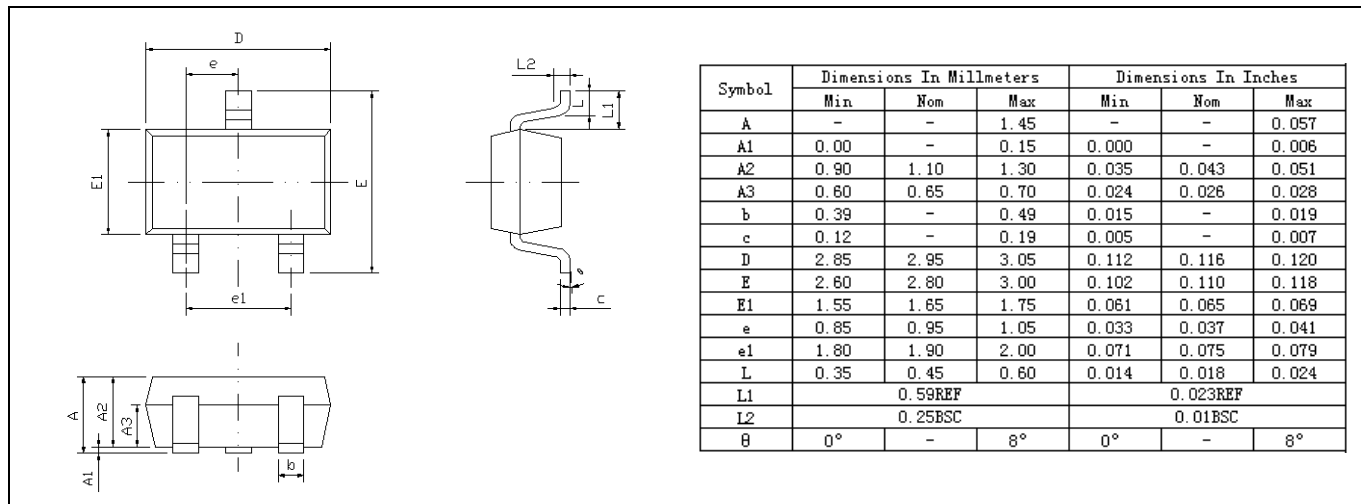
The output of the TMR1215 switches low (turns on) when a magnetic field parallel to the TMR sensor exceeds the operate point threshold,  $B_{OP}$ . When the magnetic field is reduced below the release point,  $B_{RP}$ , the device output goes high (turns off). The difference between the magnetic operate point and release point is the hysteresis  $B_H$  of the device.

It is strongly recommended that an external bypass capacitor be connected in close proximity to the device between the supply and ground to reduce noise. The typical value of the external capacitor is 0.1 $\mu$ F.

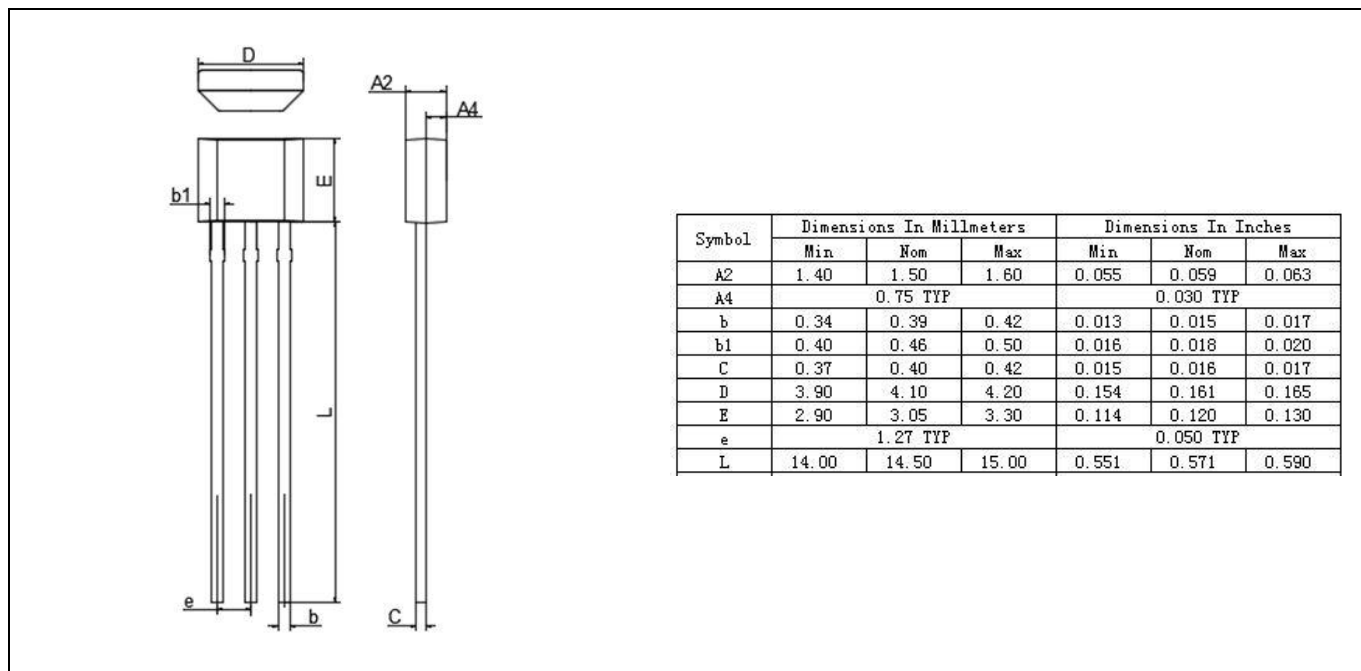


## Package Information

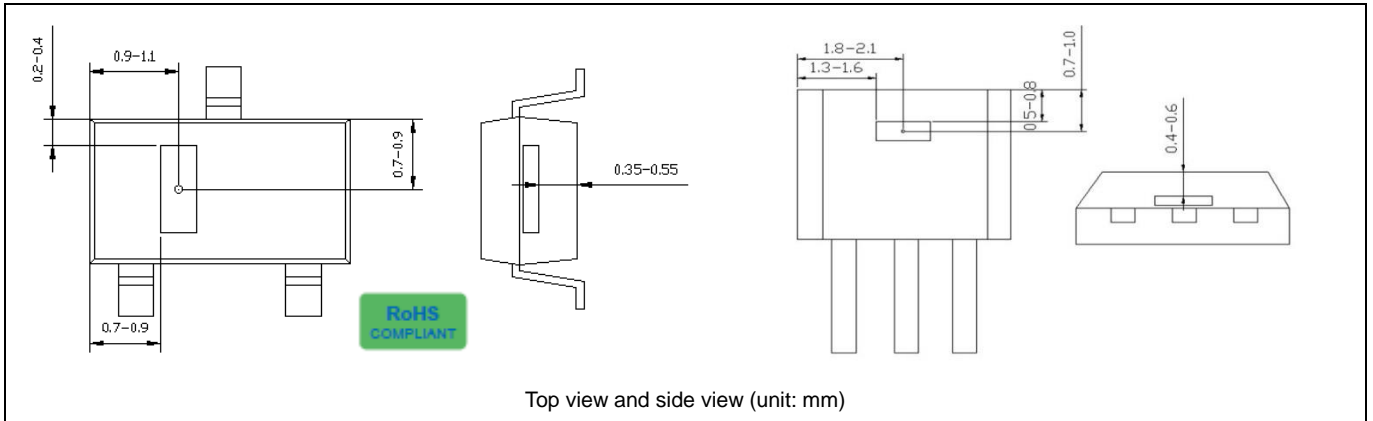
SOT23-3 package drawing



TO-92S package drawing



# TMR Sensor Position





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