

## General Description

The TMR1302HT is a digital omnipolar magnetic switch that integrates TMR and CMOS technology in order to provide a magnetically triggered digital switch with high sensitivity, high speed, high response frequency and ultra-low power consumption. It integrates a push-pull half-bridge TMR magnetic sensor and CMOS signal processing circuitry within the same package. Designed for use in applications that are both power-critical and performance-demanding, 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 TMR1302HT draws only 1.5µA resulting in ultra-low power operation, additionally it has fast response at 5kHz, accurate switching points, a wide range of supply voltages, and excellent thermal stability from -40 ~ 150°C. It is available in two packaging form factors: SOT23-3 (P/N TMR1302HTS), or TO-92S (P/N TMR1302HTT).

## Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- Ultra-low Power Consumption at 1.5uA
- High Frequency Response at 5kHz
- Operation with North or South Pole
- Low Operate Points for High Sensitivity
- Compatible with a Wide Range of Supply Voltages
- Excellent Thermal Stability from -40 ~ 150°C

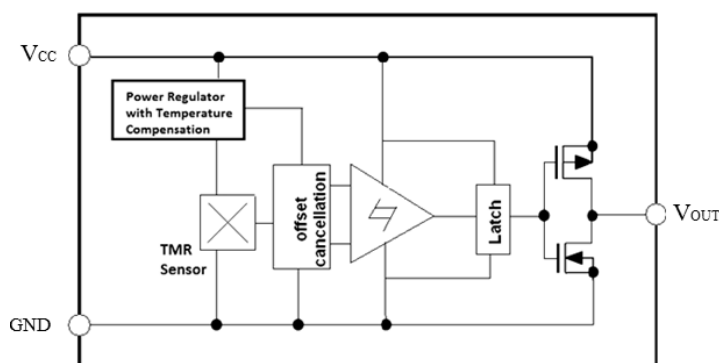
## Applications

- Utility Meters including Water, Gas, and Heat Meters
- Proximity Switches
- Speed Sensing
- Rotary and Linear Position Sensing

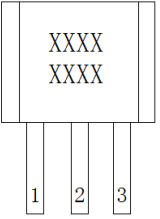
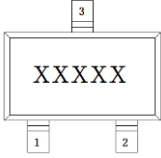


TMR1302HTS (Left), TMR1302HTT (Right)

## Block Diagram



## Pin Configuration

 <p>TO-92S</p>	 <p>SOT23-3</p>	<table border="1"> <thead> <tr> <th rowspan="2">Pin Name</th> <th colspan="2">Pin No.</th> <th rowspan="2">Pin Function</th> </tr> <tr> <th>TO-92S</th> <th>SOT23-3</th> </tr> </thead> <tbody> <tr> <td>V<sub>OUT</sub></td> <td>1</td> <td>2</td> <td>Output</td> </tr> <tr> <td>GND</td> <td>2</td> <td>3</td> <td>Ground</td> </tr> <tr> <td>V<sub>CC</sub></td> <td>3</td> <td>1</td> <td>Supply Voltage</td> </tr> </tbody> </table>	Pin Name	Pin No.		Pin Function	TO-92S	SOT23-3	V <sub>OUT</sub>	1	2	Output	GND	2	3	Ground	V <sub>CC</sub>	3	1	Supply Voltage
Pin Name	Pin No.			Pin Function																
	TO-92S	SOT23-3																		
V <sub>OUT</sub>	1	2	Output																	
GND	2	3	Ground																	
V <sub>CC</sub>	3	1	Supply Voltage																	

## Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Supply Voltage	V <sub>CC</sub>	7	V
Reverse Supply Voltage	V <sub>RCC</sub>	0.3	V
Output Current	I <sub>OUTSINK</sub>	9	mA
Magnetic Flux Density	B	2800	G
ESD level(HBM)	V <sub>ESD</sub>	4	kV
Operating Ambient Temperature	T <sub>A</sub>	-40 ~ 150	°C
Storage Temperature	T <sub>stg</sub>	-50 ~ 150	°C

## Electrical Characteristics (V<sub>CC</sub>=3.0V, T<sub>A</sub>=25°C)

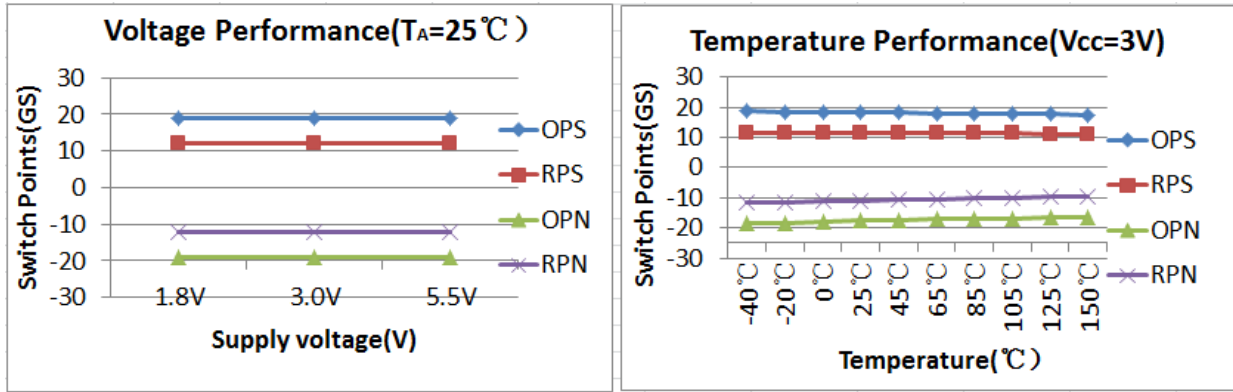
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply Voltage	V <sub>CC</sub>	Operating	1.8	3.0	5.5	V
Output High Voltage	V <sub>OH</sub>		V <sub>CC</sub> -0.3		V <sub>CC</sub>	V
Output Low Voltage	V <sub>OL</sub>		0		0.2	V
Supply Current	I <sub>CC</sub>	Output Open		1.5		μA
Response Frequency	F				5000	Hz

**Note:** a 100nF capacitor is connected between V<sub>CC</sub> and GND during all tests in the above table.

## Magnetic Characteristics (V<sub>CC</sub> = 3.0V, T<sub>A</sub> = 25°C)

Parameters	Symbol	Min	Typ.	Max	Units
Operate Point	B <sub>OPS</sub>		17		G
	B <sub>OPN</sub>		-17		G
Release Point	B <sub>RPS</sub>		10		G
	B <sub>RPN</sub>		-10		G
Hysteresis	B <sub>H</sub>		7		G

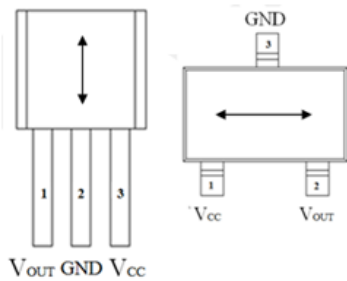
## Voltage and Temperature Characteristics



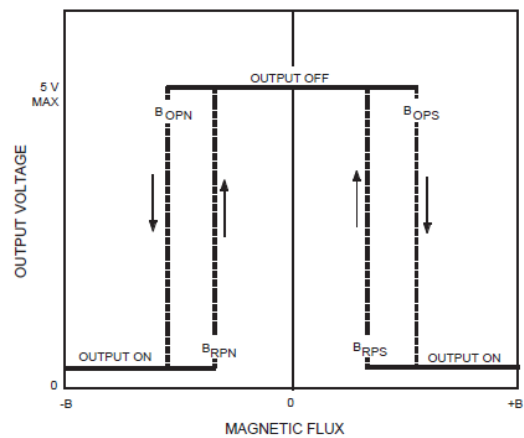
## Output Behavior vs. Magnetic Polarity

Magnetic Polarity	Test Conditions	Output
South	$B > B_{OPS}$	Low (On)
	$0 < B < B_{RPS}$	High (Off)
North	$B < B_{OPN}$	Low (On)
	$0 > B > B_{RPN}$	High (Off)

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



Sensing Direction of Magnetic Field

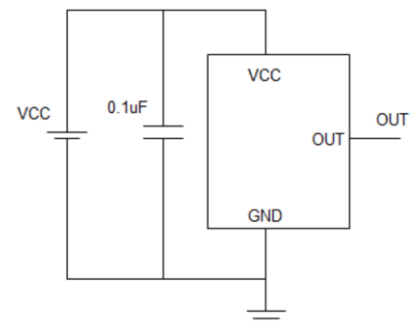


Magnetic Flux

## Application Information

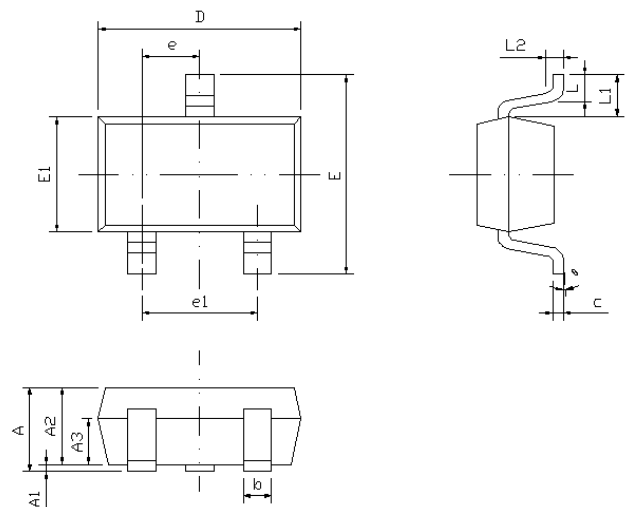
The output of the TMR1302HT switches low (turns on) when a magnetic field parallel to the TMR sensor exceeds the operate point threshold,  $B_{OP}$ . When the magnetic field is reduced below the release point,  $B_{RP}$ , the device output goes high (turns off). The difference between the magnetic operate 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 0.1µF.



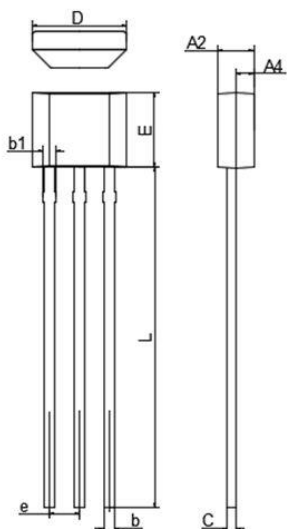
## Package Information

SOT23-3 package drawing



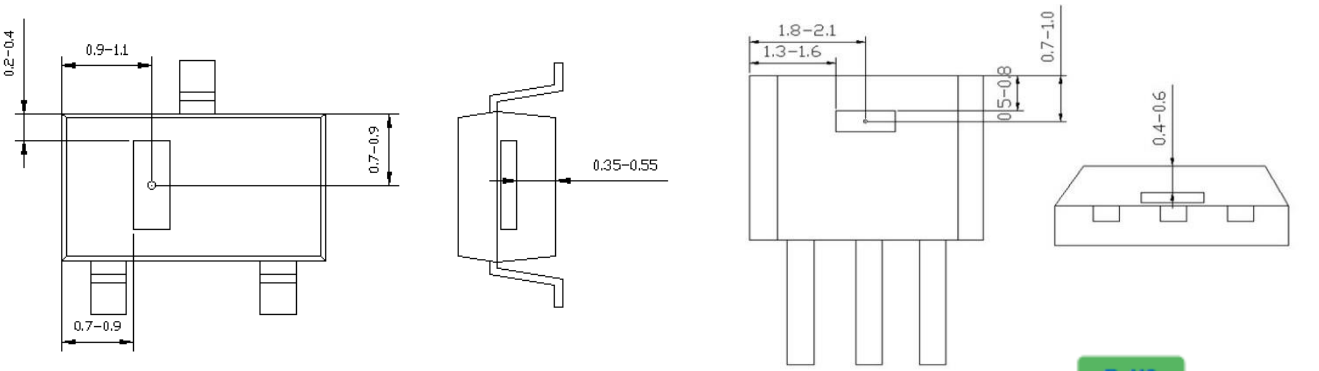
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	1.45	-	-	0.057
A1	0.00	-	0.15	0.000	-	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39	-	0.49	0.015	-	0.019
c	0.12	-	0.19	0.005	-	0.007
D	2.85	2.95	3.05	0.112	0.116	0.120
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.55	1.65	1.75	0.061	0.065	0.069
e	0.85	0.95	1.05	0.033	0.037	0.041
e1	1.80	1.90	2.00	0.071	0.075	0.079
L	0.35	0.45	0.60	0.014	0.018	0.024
L1	0.59REF			0.023REF		
L2	0.25BSC			0.01BSC		
θ	0°	-	8°	0°	-	8°

TO-92S package drawing




Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A2	1.40	1.50	1.60	0.055	0.059	0.063
A4	0.75 TYP			0.030 TYP		
b	0.34	0.39	0.42	0.013	0.015	0.017
b1	0.40	0.46	0.50	0.016	0.018	0.020
C	0.37	0.40	0.42	0.015	0.016	0.017
D	3.90	4.10	4.20	0.154	0.161	0.165
E	2.90	3.05	3.30	0.114	0.120	0.130
e	1.27 TYP			0.050 TYP		
L	14.00	14.50	15.00	0.551	0.571	0.590

## TMR Sensor Position



0.2-0.4, 0.9-1.1, 0.7-0.9, 0.35-0.55, 1.8-2.1, 1.3-1.6, 0.5-0.8, 0.7-1.0, 0.4-0.6

Top view and side view (unit: mm)





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