TMR1212

Bi-stable TMR Bipolar Magnetic Switch
with Passive Memory Effect

General Description

The TMR1212 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, TMR1212 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 TMR1212 draws only 1.5μA 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 TMR1212S), or TO-92S (P/N TMR1212T).

Features and Benefits

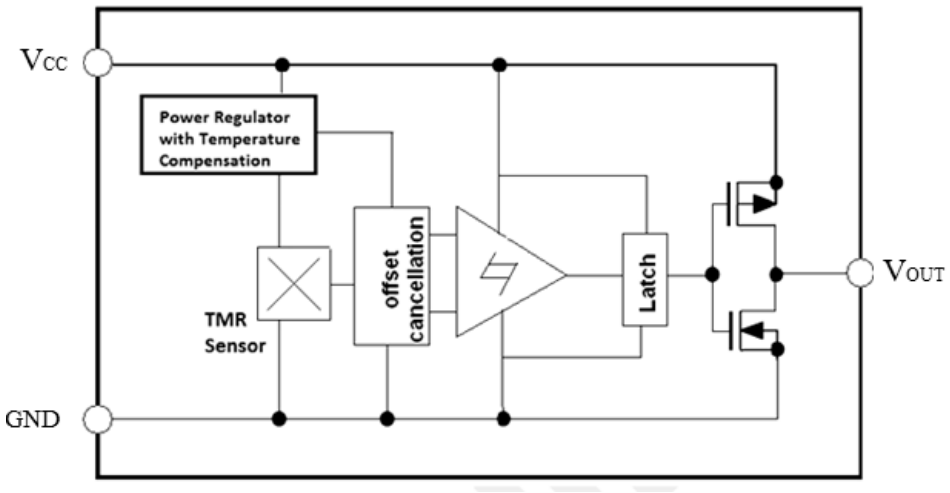
- Tunneling Magnetoresistance (TMR) Technology
- Ultra Low Power Consumption at 1.5uA
- Passive Operation with Magnetic Memory Effect
- High Frequency Response at 1KHz
- Bipolar Latching Operation
- Compatible with a Wide Range of Supply Voltages
- Excellent Thermal Stability
- High Tolerance to External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

TMR1212S(Left), TMR1212T(Right)

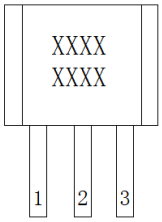
Applications

- 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

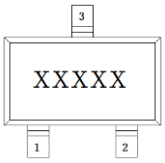
Block Diagram



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°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}		Vcc-0.3		Vcc	V
Output Low Voltage	V_{OL}		0		0.2	V
Supply Current	I_{CC}	Output Open		1.5		μA
Response Frequency	F			1000		Hz

Note: A 0.1μF capacitor is connected between V_{CC} and GND during all tests in the above table.

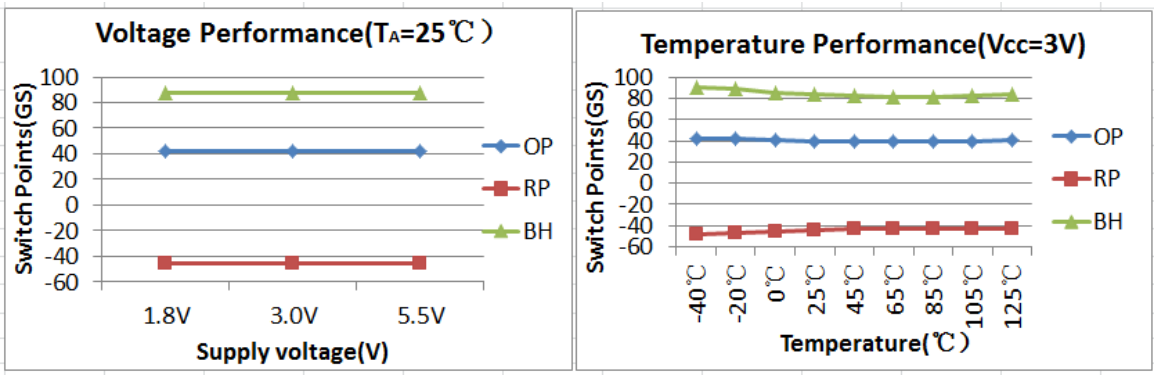
Magnetic Characteristics (V_{CC} = 3.0V, T_A = 25°C)

Parameters	Symbol	Min	Typ.	Max	Units
Operate Point	B_{OP}	35	45	60	G
Release Point	B_{RP}	-60	-45	-35	G
Hysteresis	B_H		90		G
Operate Point for Passive Memory Effect	B_{OPM}	60			G
Release Point for Passive Memory Effect	B_{RPM}			-60	G

Note:

1. 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 >60 Gauss shall be sufficient to guarantee the triggering and storage of the ON state in the passive mode.
2. 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 <-60 Gauss shall be sufficient to guarantee the triggering and storage of the OFF state in the passive mode.

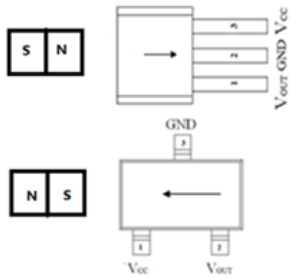
Voltage and Temperature Characteristics



Output Behavior vs. Magnetic Pole

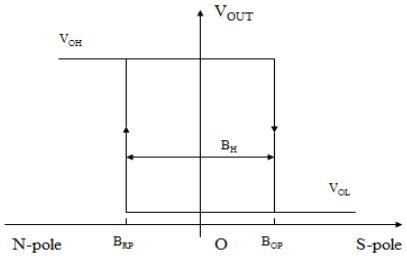
Parameter	Test Conditions	Output
South Pole	B > B_{OP}	Low (On)
North Pole	B < B_{RP}	High (Off)

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



Sensing Direction of Magnetic Field

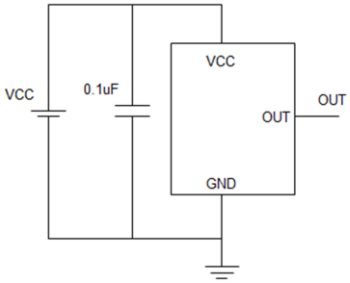
(arrow indicates direction of N->S)



Magnetic Flux

Application Information

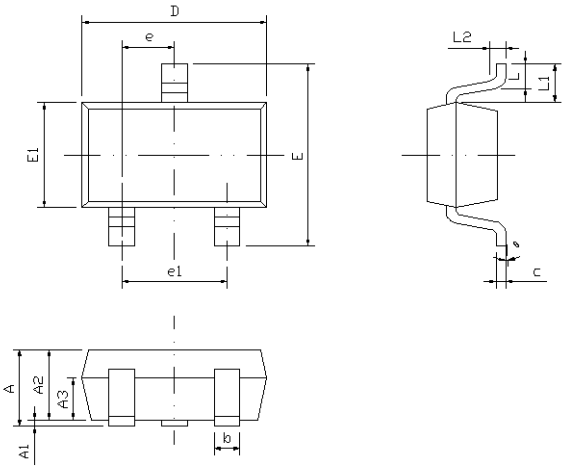
The output of the TMR1212 switches low (turns on) when a magnetic field parallel to the TMR sensor exceeds the operate point threshold, B_{OP}. When the magnetic field is reduced below the release point, B_{RP}, the device output goes high (turns off). The difference between the magnetic operate point 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.

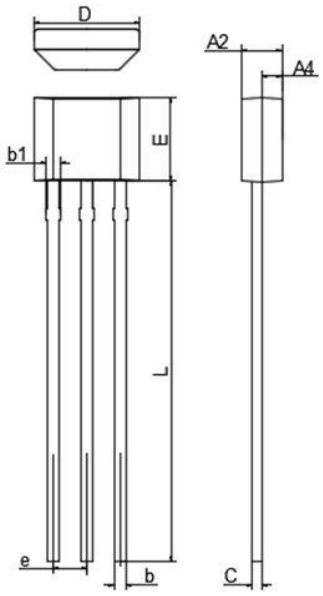
Package Information

SOT23-3 package drawing



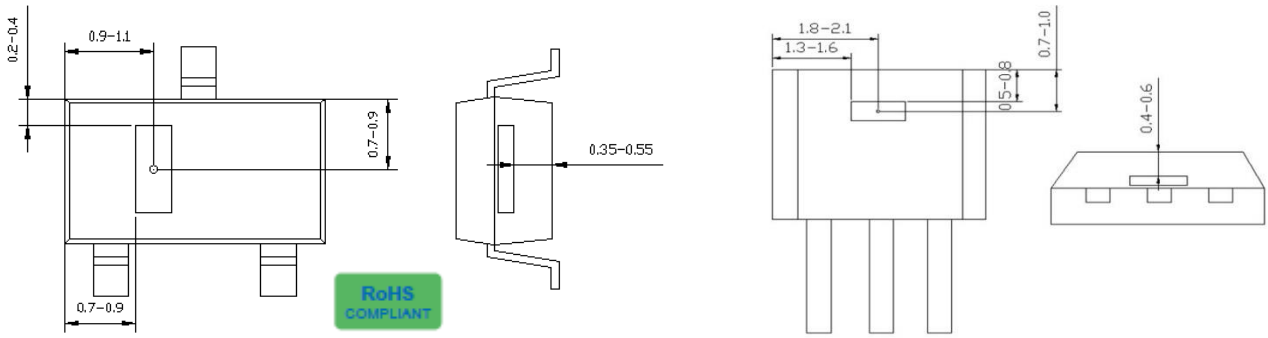
Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	-	1.45	-	-	0.057
A1	0.00	-	0.15	0.000	-	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
A3	0.60	0.65	0.70	0.024	0.026	0.028
b	0.39	-	0.49	0.015	-	0.019
c	0.12	-	0.19	0.005	-	0.007
D	2.85	2.95	3.05	0.112	0.116	0.120
E	2.60	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 Millmeters			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



Top view and side view (unit: mm)

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