TMR1162

Nano-Ampere TMR Unipolar Switch

General Description

The TMR1162 is a 200nA ultra-low power magnetic switch sensor. It is a unipolar 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. 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 open-drain 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 TMR1162 features ultra-low power consumption at 200nA with a fast internal switching frequency at 50Hz. Other important features include accurate switching points, excellent thermal stability, and a wide range of supply voltages. It is available in two packaging form factors: SOT23-3 (P/N TMR1162S), or TO-92S (P/N TMR1162T).

Features and Benefits

- Tunneling Magnetoresistance (TMR) Technology
- Nano-Ampere Ultra-low Power Consumption at 200nA
- Fast Internal Switching Frequency at 50Hz
- Unipolar Operation with High Sensitivity
- Operating Temperature Range from -40°C to 125°C
- Wide Range of Supply Voltages from 1.8V to 5.5V
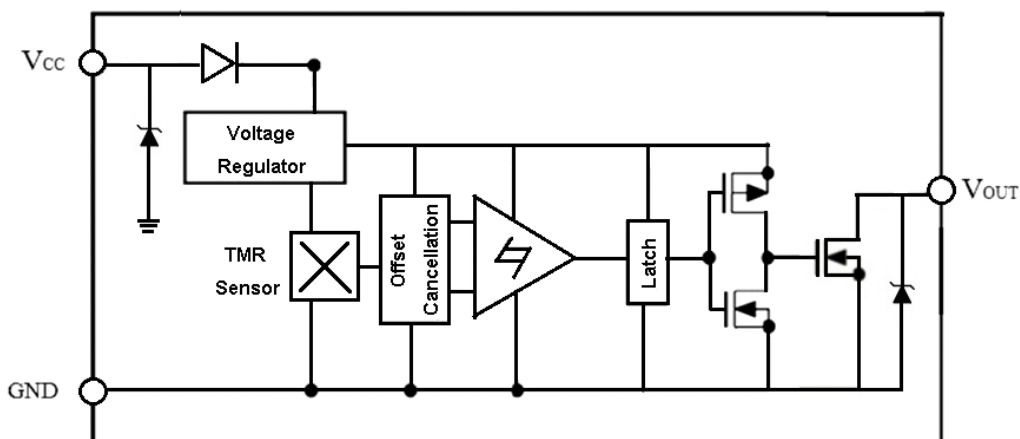- Open-drain Output
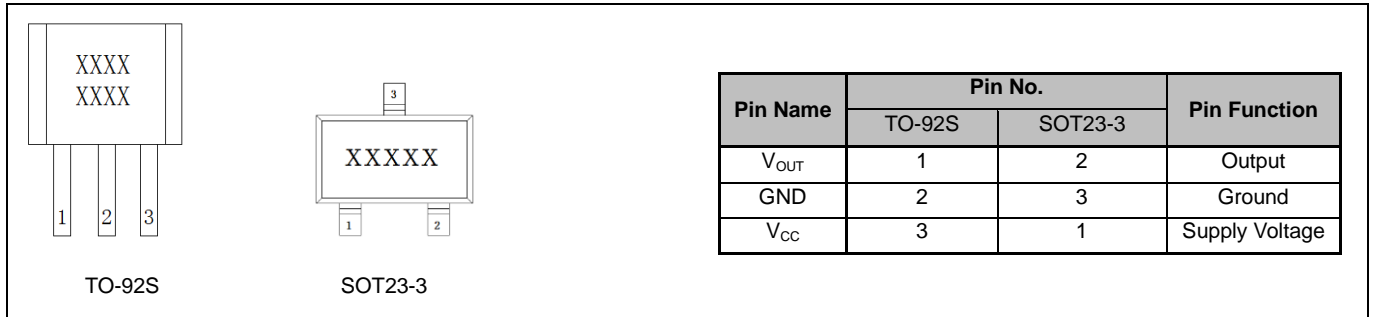

TMR1162S (Left), TMR1162T (Right)

Applications

- Utility Meters including Water, Gas, and Heat Meters
- Speed Sensing and Position Sensing
- Motor and Fan Control
- Power Window

Block Diagram

Pin Configuration

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

Characteristic	Symbol	Rating	Units
Supply Voltage	V_{CC}	7	V
Reverse Supply Voltage	V_{RCC}	0.3	V
Output Current	$I_{OUTSINK}$	20	mA
Magnetic Flux Density	B	4000	G
ESD Level (HBM)	V_{ESD}	2	kV
Operating Ambient Temperature	T_A	-40~125	℃
Storage Temperature	T_{stg}	-50~150	℃

Electrical Characteristics (V_{CC}=3.0V, T_A=25℃)

| Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}	Operating	1.8	3.0	5.5	V
Output Stress Voltage	V_{stress}				5.5	V
Output leak Current	I_{leak}	OUT=High，V_{cc}=3V，V_{out}=3V			1	µA
Output Turn-off Resistance	R_{off}	OUT=High		10		MΩ
Output Low Voltage	V_{ol}	OUT=Low，V_{cc}=3V，I_{sink}=3mA			0.1	V
Output Turn-on Resistance	R_{on}	OUT=Low			10	Ω
Supply Current	I_{cc}	Output open		200		nA
Switching Frequency	F			50		Hz

Note: A 1kOhm pull-up resistor is connected between VCC and VOUT, and a 0.1µF capacitor is connected between VCC and GND during all tests in the table above.

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

Characteristic	Symbol	Min.	Typ.	Max.	Units
Operate Point	B_{OP}		17		G
Release Point	B_{RP}		13		G
Hysteresis	B_H		4		G

Note: A 1kOhm pull-up resistor is connected between VCC and VOUT, and a 0.1µF capacitor is connected between VCC and GND during all tests in the table above.
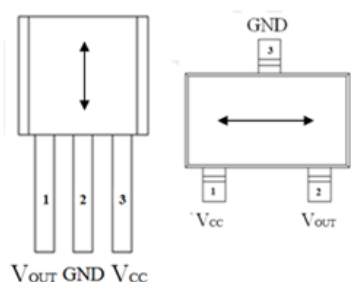
Voltage and Temperature Characteristics

Voltage Characteristics

Temperature Characteristics
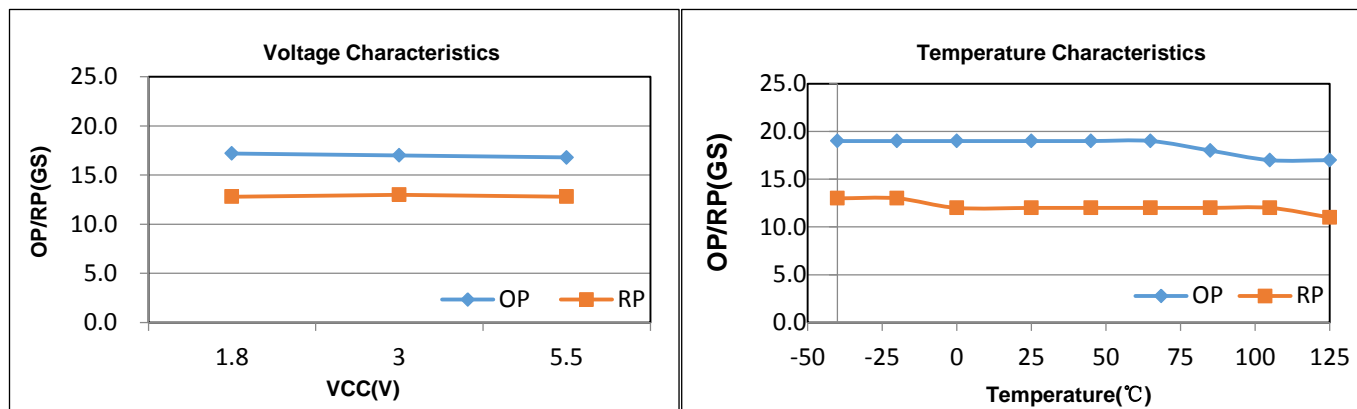
Output Behavior vs. Magnetic Polarity

Magnetic Polarity	Test Conditions	Output
South Pole for TO92 Package	$B > B_{OP}$	Low (On)
	$B < B_{RP}$	High (Off)
North Pole for SOT23 Package	$B > B_{OP}$	Low (On)
	$B < B_{RP}$	High (Off)

Note: The output is "High" when power is turned on under zero magnetic field.


Sensing Direction
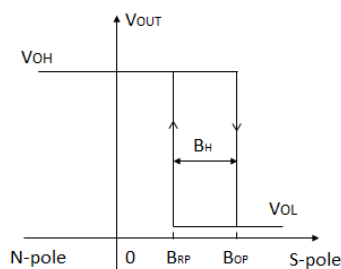
Switching Behavior of TMR1162

Application Information

The output of the TMR1162 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.
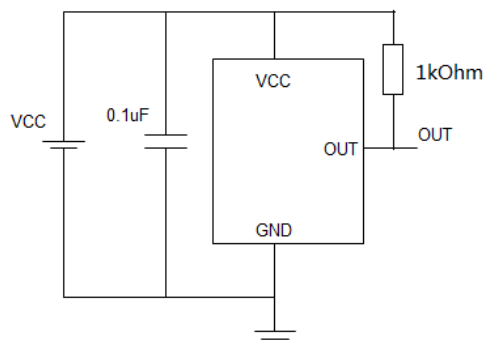
Package Information

SOT23-3 Package

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

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 and side view（unit: mm）

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