

## CYS1157 High Sensitive Unipolar TMR Switch IC

CYS1157 is a digital 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 is designed for applications that are both power-critical and performance-demanding. It contains a push-pull full-bridge TMR magnetic sensor and CMOS signal processing circuitry within the same package, including an on-chip TMR voltage generator for precise magnetic sensing, a TMR voltage amplifier and comparator plus a Schmitt trigger to provide switching hysteresis for noise rejection, and CMOS push-pull output. An internal band gap regulator is used to provide a temperature compensated supply voltage for internal circuits, permitting a wide range of supply voltages up to 40V. The CYS1157 draws only 0.6mA resulting in low power operation. It has fast response, accurate switching points, excellent thermal stability, and immunity to stray field interference. It is available in the SOT23-3 package (P/N CYS1157S) or the TO-92S package (P/N CYS1157T).



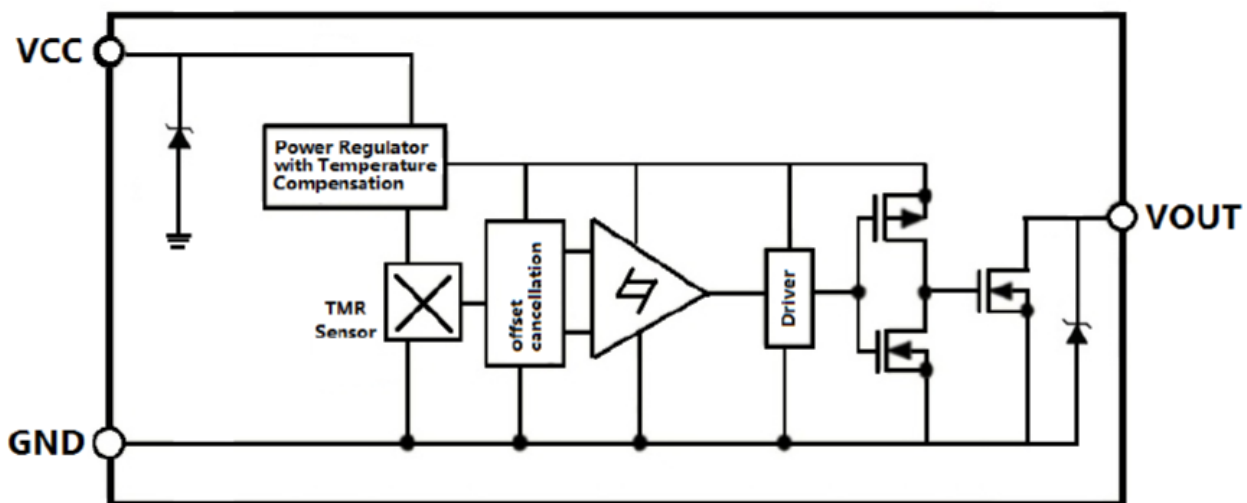
### Features

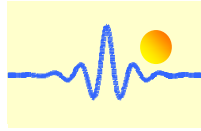
- Unipolar latching operation
- Low power consumption (<0.6mA)
- Z-axis sensing direction compatible with Hall Effect Switch ICs
- High tolerance to external magnetic field interference
- Excellent thermal stability

### Typical Applications

- Water, gas and heat meters
- High Sensitive Non-contact Switch
- DC Brushless Motor
- DC Brushless Fan
- Position and speed sensing

### Functional Block Diagram





## Absolute Maximum Ratings

| Parameter                     | Symbol        | Limit     | Unit |
|-------------------------------|---------------|-----------|------|
| Supply Voltage                | $V_{CC}$      | 40        | V    |
| Reverse Supply Voltage        | $V_{RCC}$     | 30        | V    |
| Output Current                | $I_{OUTSINK}$ | 25        | mA   |
| Magnetic Flux Density         | B             | 4000      | G    |
| ESD level(HBM)                | $V_{ESD}$     | 2         | kV   |
| Operating Ambient Temperature | $T_A$         | -40 ~ 125 | °C   |
| Storage Temperature           | $T_{stg}$     | -50 ~ 150 | °C   |

## Electrical Characteristics ( $V_{CC}=24V$ , $T_A=25^\circ C$ )

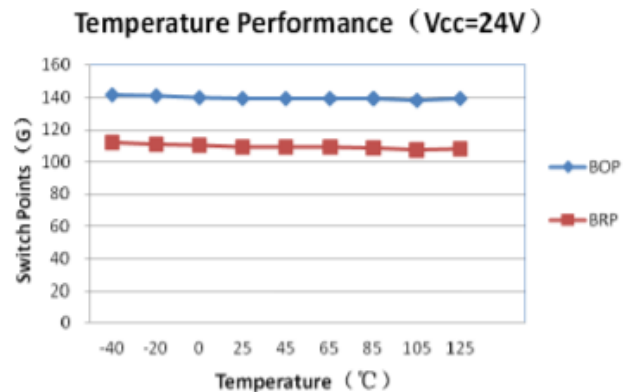
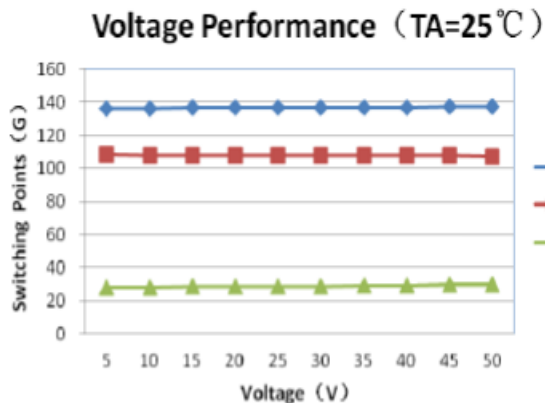
| Parameter                     | Symbol       | Conditions                            | Min | Typ. | Max | Unit       |
|-------------------------------|--------------|---------------------------------------|-----|------|-----|------------|
| Supply Voltage                | $V_{CC}$     | Operating                             | 3   | 24   | 40  | V          |
| Output Stress Voltage         | $V_{stress}$ |                                       |     |      | 40  | V          |
| Output leak Current           | $I_{leak}$   | OUT=H, $V_{CC}=24V$ , $V_{out}=24V$   |     | 26   |     | $\mu A$    |
| Output Resistance of Turn off | $R_{off}$    | OUT=H                                 |     | 10   |     | M $\Omega$ |
| Output Low Voltage            | VOL          | OUT=L, $V_{CC}=24V$ , $I_{sink}=25mA$ |     |      | 0.3 | V          |
| Output Resistance of Turn on  | $R_{on}$     | OUT=L                                 |     |      | 10  | $\Omega$   |
| Supply Current                | $I_{CC}$     | Output Open                           | 0.4 | 0.5  | 0.6 | mA         |
| Response Frequency            | F            |                                       |     | 1    | 100 | KHz        |

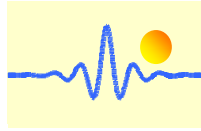
## Magnetic Characteristics ( $V_{CC} = 24V$ , $T_A = 25^\circ C$ )

| Parameters    | Symbol   | Min | Typ. | Max | Unit |
|---------------|----------|-----|------|-----|------|
| Operate Point | $B_{OP}$ |     | 140  |     | G    |
| Release Point | $B_{RP}$ |     | 110  |     | G    |
| Hysteresis    | $B_H$    |     | 30   |     | G    |

**Note:** a 1k $\Omega$  pull-up resistor is connected between  $V_{CC}$  and  $V_{OUT}$ , and a 100nF capacitor is connected between  $V_{CC}$  and GND during all tests in the above table.

## Voltage and Temperature Characteristics

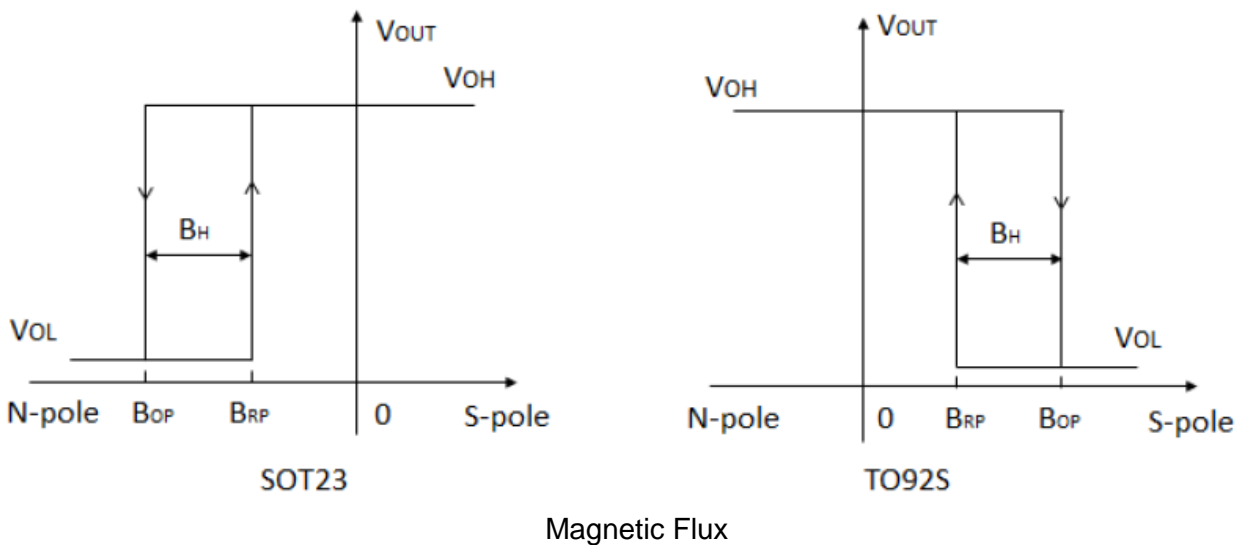




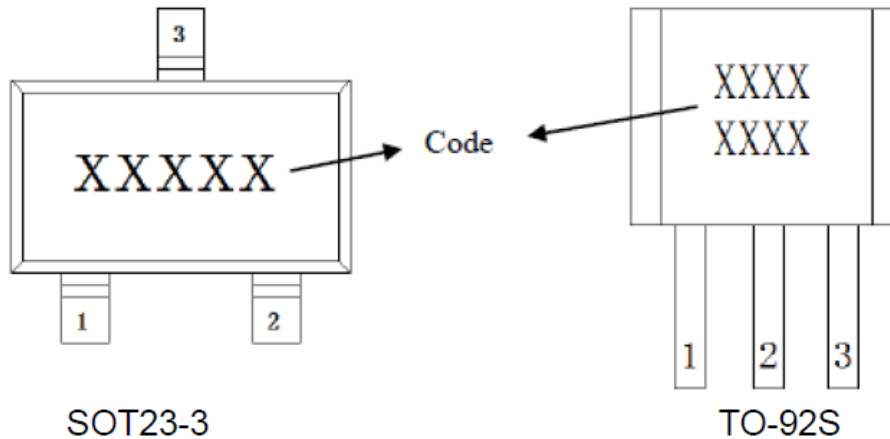
### Output Behavior vs. Magnetic Pole (Sensing direction: Z-Axis)

| Parameter                      | Test Conditions | Output     |
|--------------------------------|-----------------|------------|
| South Pole applicable to TO92S | $B > B_{OP}$    | Low (On)   |
|                                | $B < B_{OP}$    | High (Off) |
| North Pole applicable to SOT23 | $B > B_{OP}$    | Low (On)   |
|                                | $B < B_{OP}$    | High (Off) |

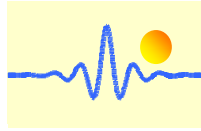
**Note:** when power is turned on under zero magnetic field, the output is “High”.



### Pin Configuration



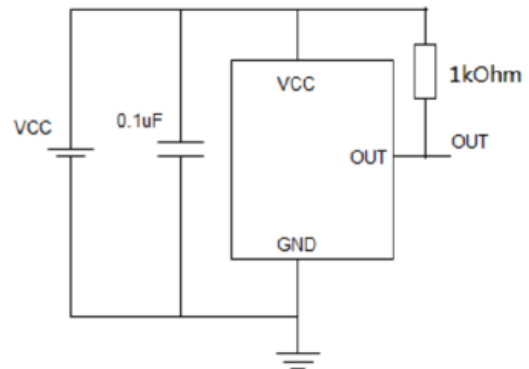
| Pin Name | Pin No. |         | Pin Function   |
|----------|---------|---------|----------------|
|          | TO-92S  | SOT23-3 |                |
| VCC      | 1       | 1       | Supply Voltage |
| GND      | 2       | 3       | Ground         |
| VOUT     | 3       | 2       | Output         |



## Application Information

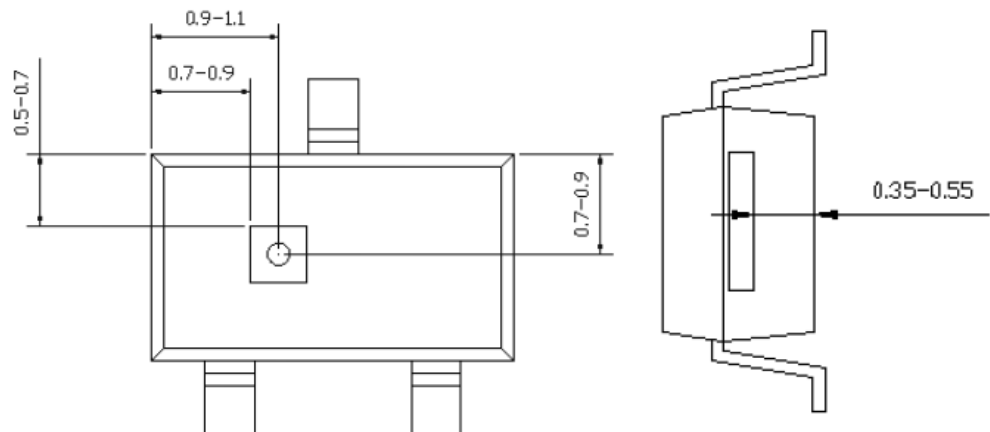
The output of the CYS1157 switches low (turns on) when a magnetic field to the sensing axis exceeds the operate point threshold,  $B_{OP}$ . When the magnetic field is reduced below the release point,  $B_{RP}$ , the device output switches high (turns off). The difference between the  $B_{OP}$  and  $B_{RP}$  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 pins to reduce noise. The recommended value for the external bypass capacitor is  $0.1\mu F$ .  $1k\Omega$  is a pull-up resistor.

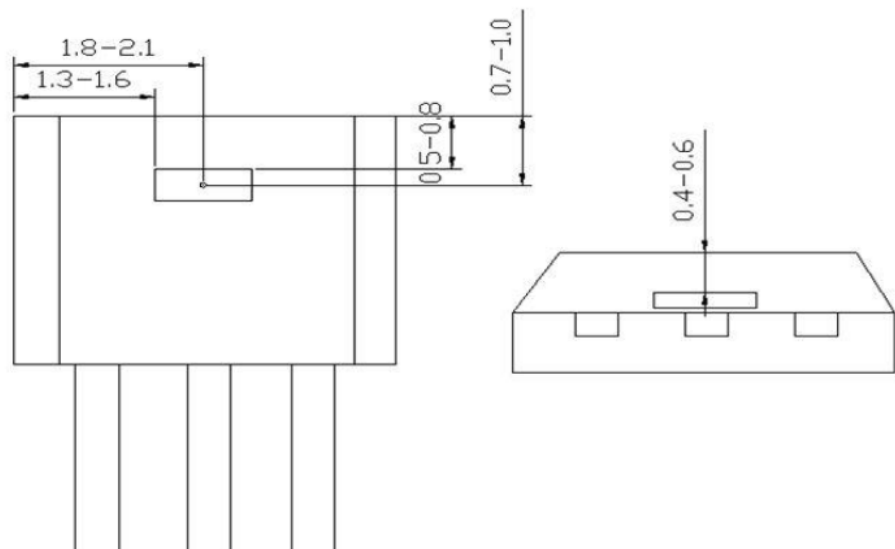


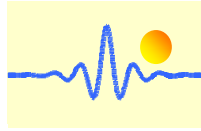
## TMR Sensor Position (unit: mm)

### SOT23-3



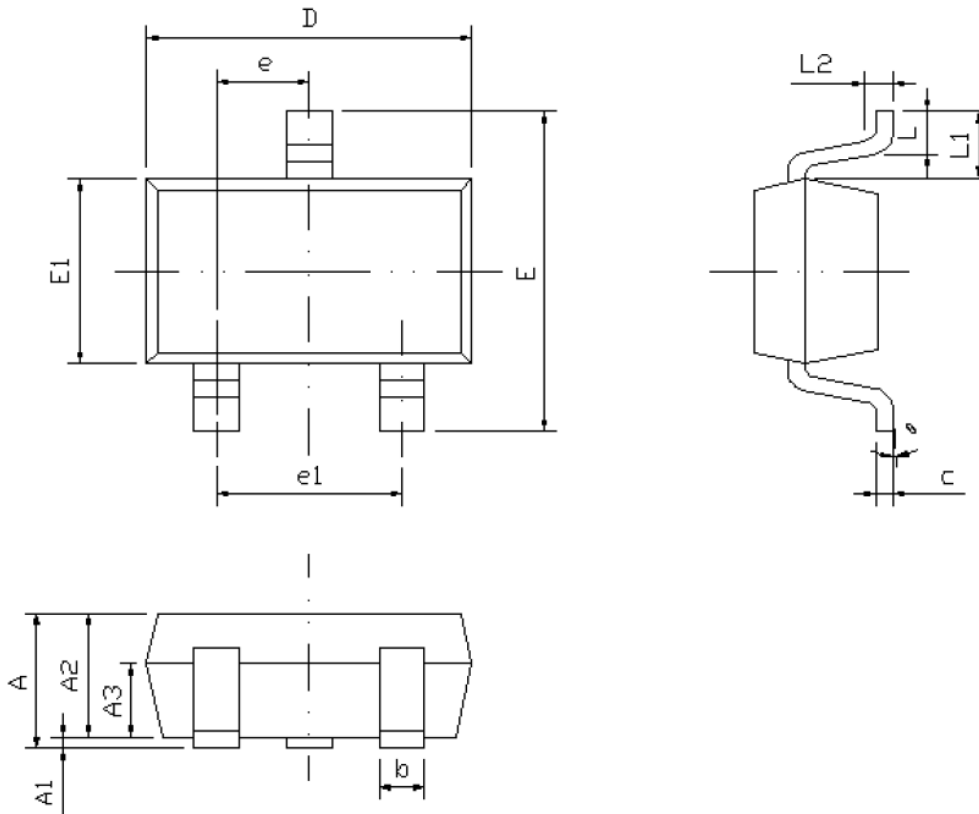
### TO-92S



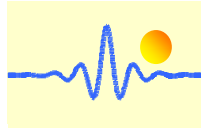


## Package Information

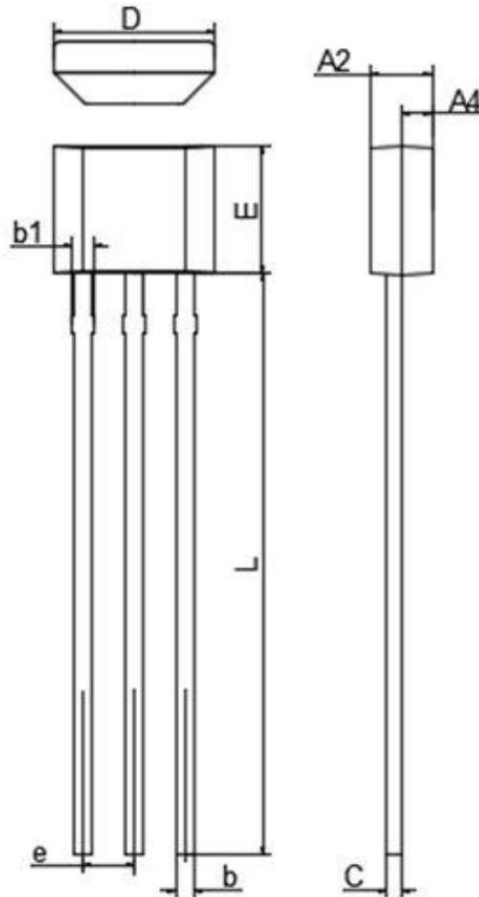
### SOT23-3 Package Drawing



| Symbol    | Dimensions in mm |      |      | Dimensions in inches |       |       |
|-----------|------------------|------|------|----------------------|-------|-------|
|           | min              | nom  | max  | min                  | nom   | max   |
| <b>A</b>  | -                | -    | 1.45 | -                    | -     | 0.057 |
| <b>A1</b> | 0.00             | -    | 0.15 | 0.000                | -     | 0.006 |
| <b>A2</b> | 0.90             | 1.10 | 1.30 | 0.035                | 0.043 | 0.051 |
| <b>A3</b> | 0.60             | 0.65 | 0.70 | 0.024                | 0.026 | 0.028 |
| <b>b</b>  | 0.39             | -    | 0.49 | 0.015                | -     | 0.019 |
| <b>c</b>  | 0.12             | -    | 0.19 | 0.005                | -     | 0.007 |
| <b>D</b>  | 2.85             | 2.95 | 3.05 | 0.112                | 0.116 | 0.120 |
| <b>E</b>  | 2.60             | 2.80 | 3.00 | 0.102                | 0.110 | 0.118 |
| <b>E1</b> | 1.55             | 1.65 | 1.75 | 0.061                | 0.065 | 0.069 |
| <b>e</b>  | 0.85             | 0.95 | 1.05 | 0.033                | 0.037 | 0.041 |
| <b>e1</b> | 1.80             | 1.90 | 2.00 | 0.071                | 0.075 | 0.079 |
| <b>L</b>  | 0.35             | 0.45 | 0.60 | 0.014                | 0.018 | 0.024 |
| <b>L1</b> | 0.59REF          |      |      | 0.023REF             |       |       |
| <b>L2</b> | 0.25BSC          |      |      | 0.010BSC             |       |       |
| <b>θ</b>  | 0°               | -    | 8°   | 0°                   | -     | 8°    |



### TO-92S Package Drawing



| Symbol    | Dimensions in mm |      |      | Dimensions in inches |       |       |
|-----------|------------------|------|------|----------------------|-------|-------|
|           | min              | nom  | max  | min                  | nom   | max   |
| <b>A2</b> | 1.40             | 1.50 | 1.60 | 0.055                | 0.059 | 0.063 |
| <b>A4</b> | 0.75 TYP         |      |      | 0.030 TYP            |       |       |
| <b>b</b>  | 0.34             | 0.39 | 0.42 | 0.013                | 0.015 | 0.017 |
| <b>b1</b> | 0.40             | 0.46 | 0.50 | 0.016                | 0.018 | 0.020 |
| <b>C</b>  | 0.37             | 0.40 | 0.42 | 0.015                | 0.016 | 0.017 |
| <b>D</b>  | 3.90             | 4.10 | 4.20 | 0.154                | 0.161 | 0.165 |
| <b>E</b>  | 2.90             | 3.05 | 3.30 | 0.114                | 0.120 | 0.130 |
| <b>e</b>  | 1.27 TYP         |      |      | 0.050 TYP            |       |       |
| <b>L</b>  | 14.0             | 14.5 | 15.0 | 0.551                | 0.571 | 0.590 |

### Part number

| Part number | Response Frequency | Operating Temperature | Package |
|-------------|--------------------|-----------------------|---------|
| CYS1157S    | 1000Hz             | -40°C ~ 125°C         | SOT23-3 |
| CYS1157T    | 1000Hz             | -40°C ~ 125°C         | TO-92S  |