# Pull-up Resistor Integrated Hall Effect Latch

## DESCRIPTION

TSH193 Hall-effect sensor is a temperature stable, stress-resistant sensor. Superior high-temperature performance is made possible through a dynamic offset cancellation that utilizes chopper-stabilization. This method reduces the offset voltage normally caused by device over molding, temperature dependencies, and thermal stress.

TSH193 includes the following on a single silicon chip: voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, Pull-up resistor output. Advanced DMOS wafer fabrication processing is used to take advantage of low-voltage requirements, component matching, very low input-offset errors, and small component geometries.

This device requires the presence of both south and north polarity magnetic fields for operation. In the presence of a south polarity field of sufficient strength, the device output sensor on, and only switches off when a north polarity field of sufficient strength is present.

## FEATURES

- Chopper stabilized amplifier stage.
- Optimized for BLDC motor applications.
- Reliable and low shifting on high Temp condition.
- Pull-up resistor integrated
- ESD Protection >4kV HBM
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

## APPLICATION

- High temperature fan motor
- 3 phase BLDC motor application
- Speed sensing, position sensing
- Revolution counting
- Solid-state switch
- Angular position detection
- Proximity detection

Pb-Free RoHS COMPLIANT HALOGEN FREE

**TO-92S**

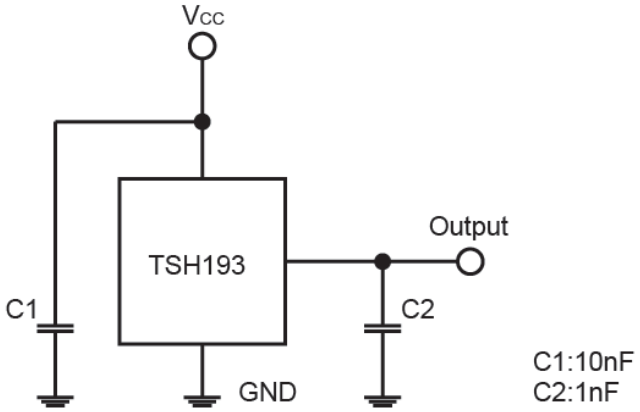

**Pin Definition:**
1. $V_{CC}$
2. Ground
3. Output

**SOT-23**


**Pin Definition:**
1. $V_{CC}$
2. Output
3. Ground

**Notes:** Moisture sensitivity level: level 3. Per J-STD-020

## TYPICAL APPLICATION CIRCUIT



## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C unless otherwise noted)

| PARAMETER | | SYMBOL | LIMIT | UNIT |
|---|---|---|---|---|
| Supply voltage | | $V_{CC}$ | 18 | V |
| Output current | | $I_{OUT}$ | 13 | mA |
| Magnetic flux density | | | Unlimited | Gauss |
| Operating Temperature Range | | $T_{OPR}$ | -40 to +125 | °C |
| Storage temperature range | | $T_{STG}$ | -55 to +150 | °C |
| Maximum Junction Temperature | | $T_J$ | 150 | °C |
| Package Power Dissipation | TO-92S | $P_D$ | 606 | mW |
| | SOT-23 | | 230 | |

## THERMAL PERFORMANCE

| PARAMETER | | SYMBOL | LIMIT | UNIT |
|---|---|---|---|---|
| Thermal Resistance - Junction to Case | TO-92S | $R_{\Theta JC}$ | 206 | °C/W |
| | SOT-23 | | 543 | |
| Thermal Resistance - Junction to Ambient | TO-92S | $R_{\Theta JA}$ | 148 | °C/W |
| | SOT-23 | | 410 | |

**Note:** Considering 6 $cm^2$ of copper board heat-sink

## ELECTRICAL SPECIFICATIONS

(DC Operating Parameters : $T_A$=+25°C, $V_{CC}$=12V)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Supply Voltage | Operating | 2.5 | -- | 16 | V |
| Supply Current | B<$B_{OP}$ | -- | -- | 5 | mA |
| Output Saturation Voltage | B>$B_{OP}$ | -- | -- | 400 | mV |
| Output Leakage Current | $I_{OFF}$ B<$B_{RP}$, $V_{OUT}$=12V | -- | -- | 10 | μA |
| Output Rise Time | $R_L$=1.1KΩ, $C_L$=20pF | -- | 0.04 | 0.45 | μs |
| Output Fall Time | $R_L$=820Ω; $C_L$=20pF | -- | 0.18 | 0.45 | μs |
| ESD | HBM | 4 | -- | -- | kV |
| Pull-up Resistor | | -- | 10 | -- | kΩ |
| Operate Point ($B_{OP}$) | | 5 | -- | 25 | Gauss |
| Release Point ($B_{RP}$) | | -25 | -- | -5 | Gauss |
| Hysteresis ($B_{OP}$ - $B_{RP}$) | | -- | 30 | -- | Gauss |

**Note:** 1G (gauss) = 0.1mT (millitesla)

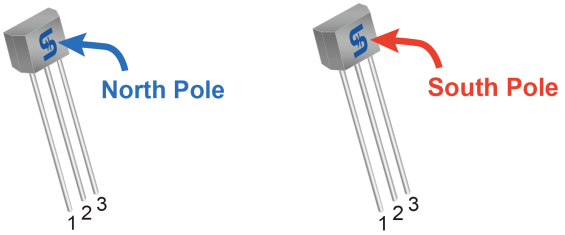
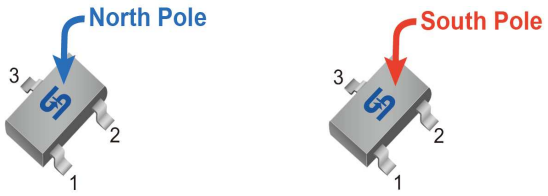
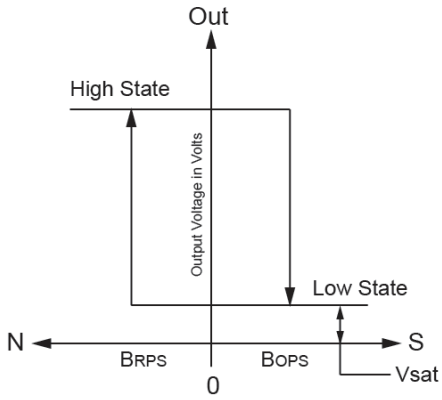
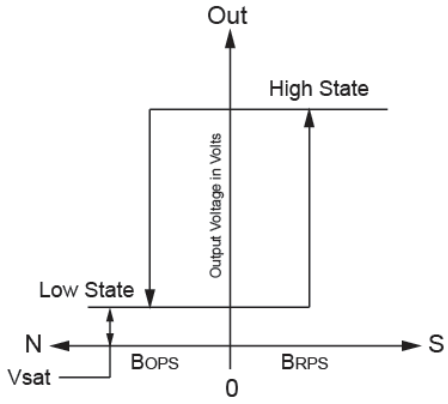
## ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|---|---|---|
| TSH193CT B0G | TO-92S | 1kpcs / Bag |
| TSH193CX RFG | SOT-23 | 3kpcs / 7”Reel |

## OUTPUT BEHAVIOR VERSUS MAGNETIC POLE

DC Operating Parameters: $T_A$ = -40 to 125°C, $V_{CC}$ = 2.5~18V

| Parameter | Test condition | OUT (TO-92S) | OUT (SOT-23) |
|---|---|---|---|
| **North pole** | B>$B_{OP}$ | Hi | Low |
| **South pole** | B<$B_{RP}$ | Low | Hi |

| TO-92S | | SOT-23 | |
|---|---|---|---|
|  | |  | |
| OUT=Hi ($V_{CC}$) | OUT=Low ($V_{DSON}$) | OUT=Low ($V_{DSON}$) | OUT=Hi ($V_{CC}$) |
|  TO-92S - Magnetic Flux Density in Gauss | |  SOT-23 - Magnetic Flux Density in Gauss | |

## CHARACTERISTICS CURVES

($T_C$ = 25°C unless otherwise noted)

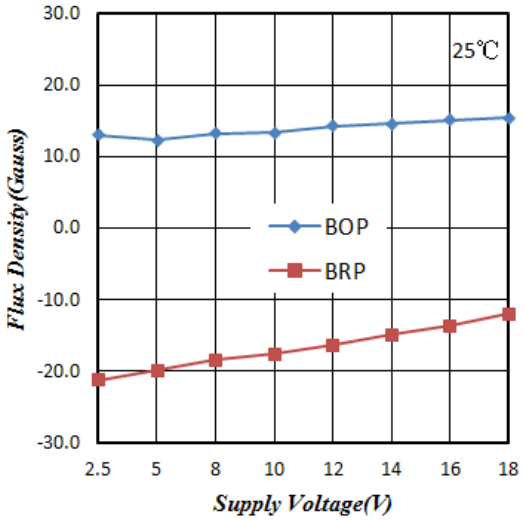



Figure 1. Flux Density vs. Supply Voltage

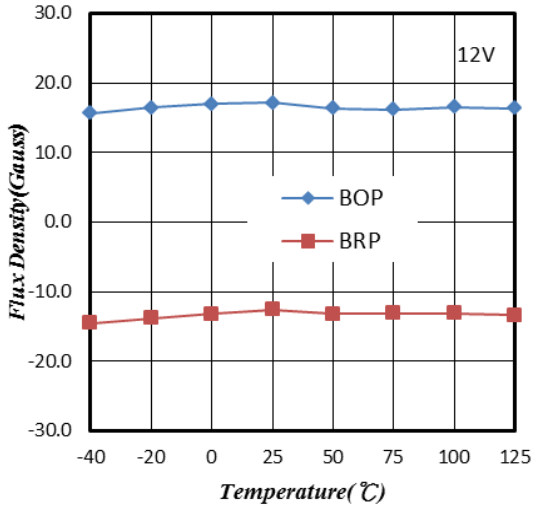



Figure 2. Flux Density vs. Temperature

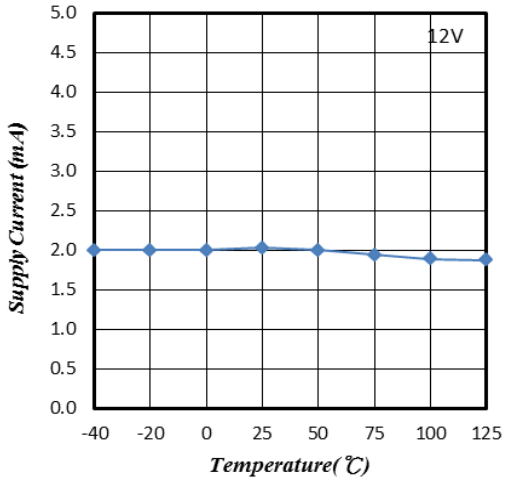



Figure 3. Supply Current vs. Temperature

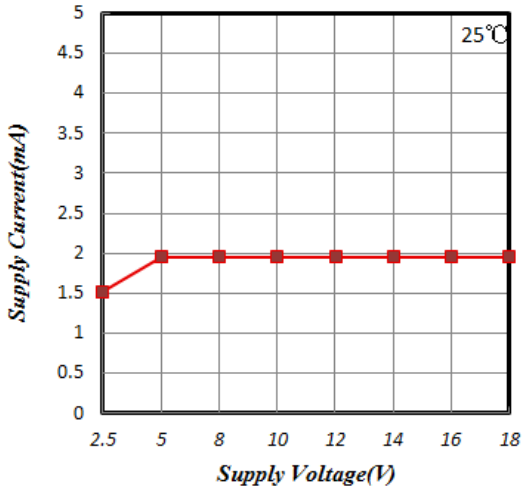



Figure 4. Supply Current vs. Supply Voltage

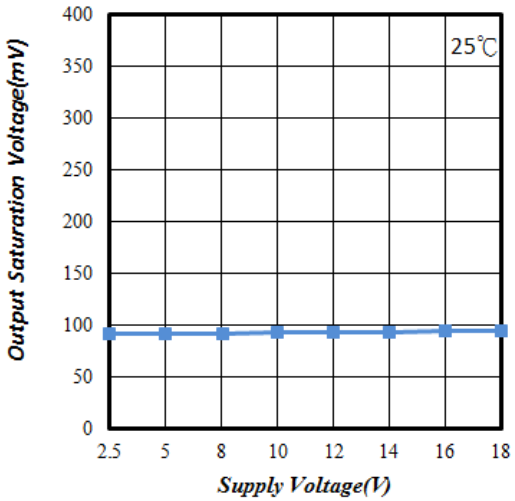



Figure 5. Saturation Voltage vs. Supply Voltage

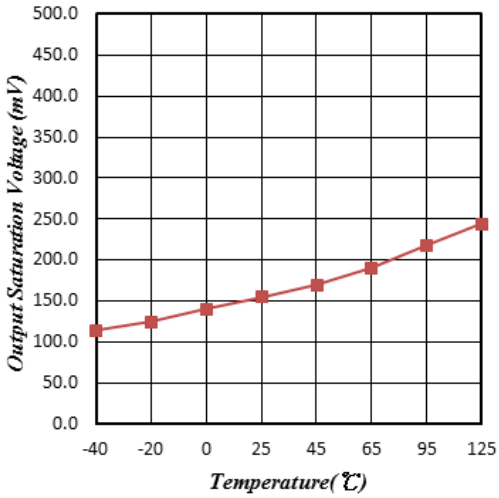



Figure 6. Saturation Voltage vs. Temperature

## CHARACTERISTICS CURVES

($T_C$ = 25°C unless otherwise noted)

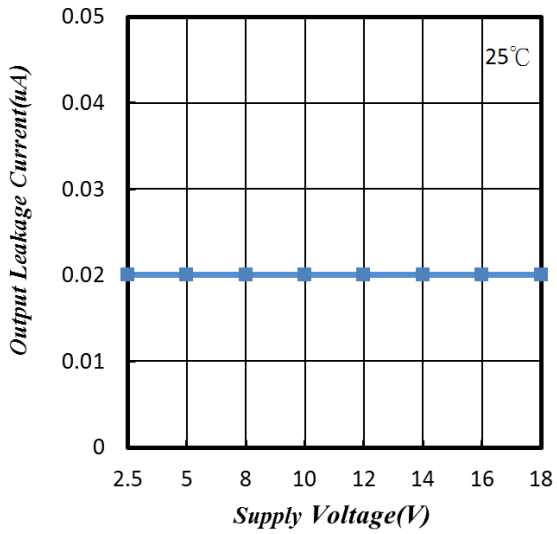



**Figure 7. Leakage Current vs. Supply Voltage**

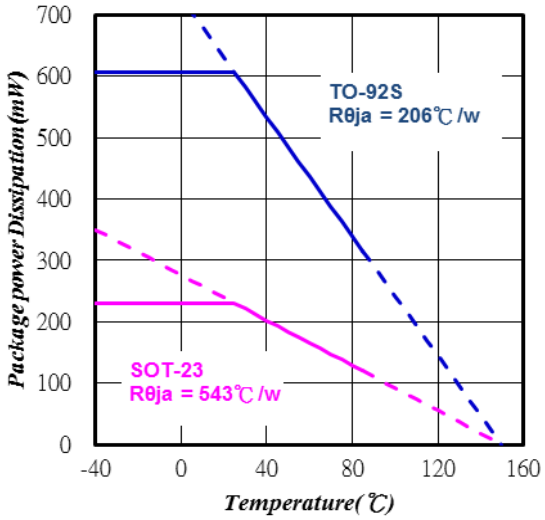
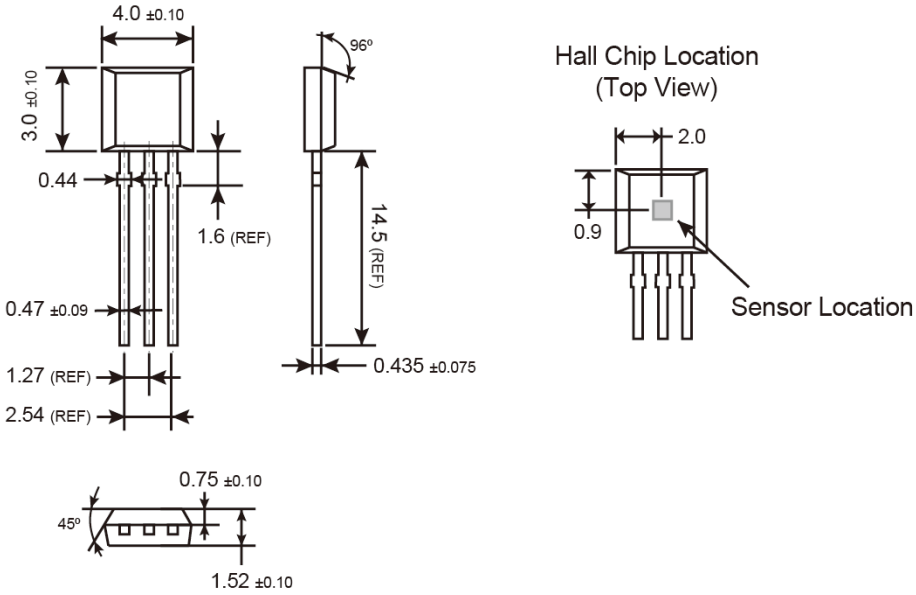


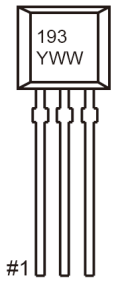

**Figure 8. Power Dissipation vs. Temperature**

## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

**TO-92S**



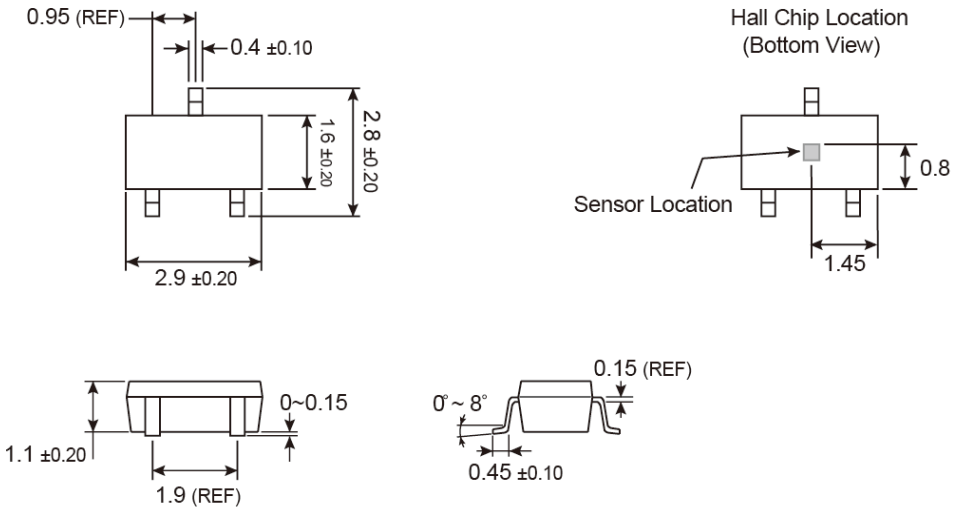

## MARKING DIAGRAM



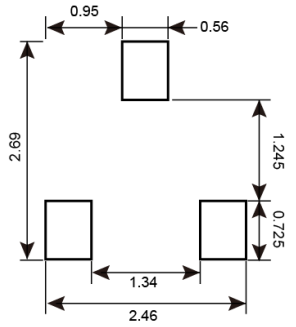

**193** = Device Code
**Y** = Year Code
**WW** = Week Code (01~52)

## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

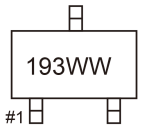
**SOT-23**




## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## MARKING DIAGRAM




**193** = Device Code
**WW** = Week Code Table

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