

## Packages



3 pin SOT23 (suffix SO)

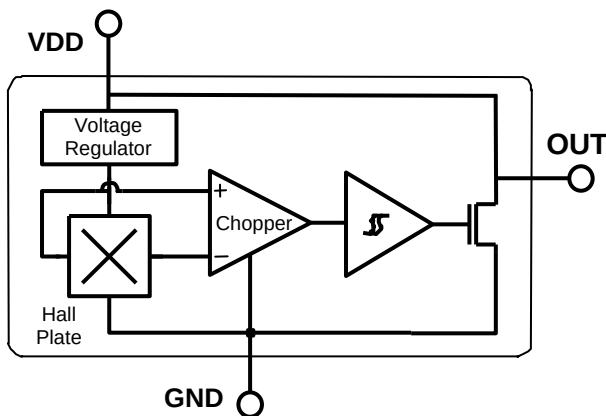


3 pin SIP (suffix UA)

## Features and Benefits

- 3.5V to 24V Operation
  - -40°C to 150°C Superior temperature operation
  - CMOS technology
  - Low current consumption
  - Chopper-stabilized amplifier stage
  - Open drain output
  - Low sensitivity
  - Small Size-SOT23 3L or SIP 3L
- both RoHS compliant packages

## Functional Block Diagram



| SIP Package             | SOT Package             |
|-------------------------|-------------------------|
| Pin 1 – V <sub>DD</sub> | Pin 1 – V <sub>DD</sub> |
| Pin 2 – GND             | Pin 2 – OUT             |
| Pin 3 – OUT             | Pin 3 – GND             |

## Application Examples

- Automotive, Consumer and Industrial
- Solid-state switch
- Brushless DC motor commutation
- Speed detection
- Angular position detection
- Proximity detection
- Current detector

## General Description

The SS159 is a unipolar Hall-effect sensor IC fabricated from CMOS technology. The device integrates a voltage regulator, Hall sensor with dynamic offset cancellation system, small signal amplifier, Schmitt trigger and an open-drain output driver. With suitable output pull up, they can be used with bipolar or CMOS logic circuits.

These Hall-effect switches are monolithic integrated circuits with tighter magnetic specifications, designed to operate continuously over extended temperatures to +150°C, and are more stable with both temperature and supply voltage changes. The unipolar switching characteristic makes these devices ideal for use with a simple bar or rod magnet.

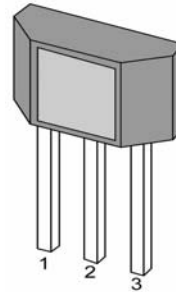
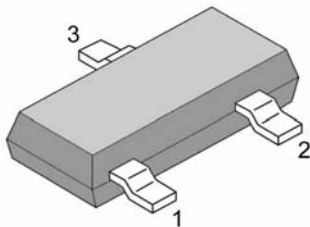
Thanks to its wide operating voltage range and extended choice of temperature range, it is quite suitable for use in automotive, industrial and consumer applications.

The device is delivered in a Small Outline Transistor (SOT) and in a Plastic Single In Line (SIP 3L flat). Both 3-lead packages are RoHS compliant.

### Glossary of Terms

|                              |                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| MilliTesla (mT), Gauss       | Units of magnetic flux density: 1mT = 10 Gauss                                                                                 |
| RoHS                         | Restriction of Hazardous Substances                                                                                            |
| Operating Point ( $B_{OP}$ ) | Magnetic flux density applied on the branded side of the package which turns the output driver ON ( $V_{OUT} = V_{DSon}$ )     |
| Release Point ( $B_{RP}$ )   | Magnetic flux density applied on the branded side of the package which turns the output driver OFF ( $V_{OUT} = \text{high}$ ) |

### Pin Definitions and Descriptions



| SOT Pin № | SIP Pin № | Name | Type   | Function              |
|-----------|-----------|------|--------|-----------------------|
| 1         | 1         | VDD  | Supply | Supply Voltage pin    |
| 2         | 3         | OUT  | Output | Open Drain Output pin |
| 3         | 2         | GND  | Ground | Ground pin            |

Table 1: Pin definitions and descriptions

### Absolute Maximum Ratings

| Parameter                 | Symbol    | Value      | Units |
|---------------------------|-----------|------------|-------|
| Supply Voltage            | $V_{DD}$  | 28         | V     |
| Supply Current            | $I_{DD}$  | 50         | mA    |
| Output Voltage            | $V_{OUT}$ | 28         | V     |
| Output Current            | $I_{OUT}$ | 50         | mA    |
| Storage Temperature Range | $T_S$     | -65 to 170 | °C    |

Table 2: Absolute maximum ratings

| Operating Temperature Range | Symbol | Value      | Units |
|-----------------------------|--------|------------|-------|
| Temperature Suffix "E"      | $T_A$  | -40 to 85  | °C    |
| Temperature Suffix "K"      | $T_A$  | -40 to 125 | °C    |
| Temperature Suffix "L"      | $T_A$  | -40 to 150 | °C    |

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## General Electrical Specifications

DC Operating Parameters  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 3.5\text{V to } 24\text{V}$  (unless otherwise specified)

| Parameter                 | Symbol     | Test Conditions                               | Min | Typ  | Max | Units         |
|---------------------------|------------|-----------------------------------------------|-----|------|-----|---------------|
| Supply Voltage            | $V_{DD}$   | Operating                                     | 3.5 |      | 24  | V             |
| Supply Current            | $I_{DD}$   | $B < B_{RP}$                                  | 1.5 | 2.5  | 5   | mA            |
| Output Saturation Voltage | $V_{DSon}$ | $I_{OUT} = 20\text{mA}$ , $B > B_{OP}$        |     | 0.4  | 0.5 | V             |
| Output Leakage Current    | $I_{OFF}$  | $B < B_{RP}$ , $V_{OUT} = 24\text{V}$         |     | 0.01 | 10  | $\mu\text{A}$ |
| Output Rise Time          | $t_r$      | $R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$ |     | 0.25 |     | $\mu\text{s}$ |
| Output Fall Time          | $t_f$      | $R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$ |     | 0.25 |     | $\mu\text{s}$ |

Table 3: Electrical Specifications

## Magnetic Specifications

DC Operating Parameters  $V_{DD} = 3.5\text{V to } 24\text{V}$  (unless otherwise specified)

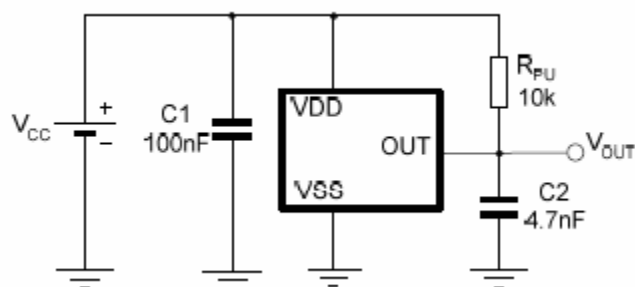
SS159

| Parameter       | Symbol     | Test Conditions                                     | Min | Typ | Max | Units |
|-----------------|------------|-----------------------------------------------------|-----|-----|-----|-------|
| Operating Point | $B_{OP}$   | $T_A = 25^\circ\text{C}$ , $V_{DD} = 12\text{V DC}$ | 100 | 125 | 150 | G     |
| Release Point   | $B_{RP}$   |                                                     | 60  | 85  | 110 | G     |
| Hysteresis      | $B_{HYST}$ |                                                     |     | 40  |     | G     |

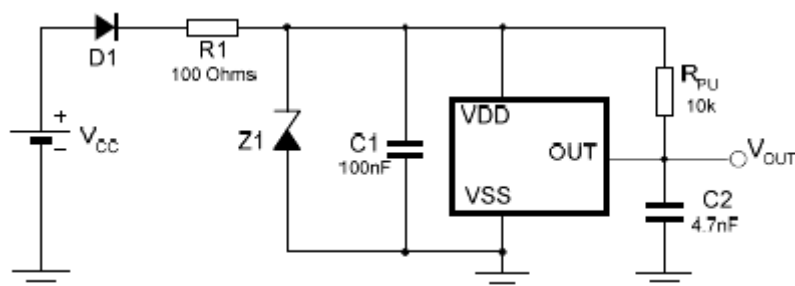
Table 4: Magnetic Specifications

## Application Information

### Typical Three-Wire Application Circuit



### Automotive and Harsh, Noisy Environments Three-Wire Circuit



### Application Comments

For proper operation, a 100nF bypass capacitor should be placed as close as possible to the device between the  $V_{DD}$  and ground pin.

For reverse voltage protection, it is recommended to connect a resistor or a diode in series with the  $V_{DD}$  pin.

When using a resistor, three points are important:

- the resistor has to limit the reverse current to 50mA maximum ( $V_{CC} / R1 \leq 50\text{mA}$ )
- the resulting device supply voltage  $V_{DD}$  has to be higher than  $V_{DD \text{ min}}$  ( $V_{DD} = V_{CC} - R1 \cdot I_{DD}$ )
- the resistor has to withstand the power dissipated in reverse voltage condition ( $P_D = V_{CC}^2 / R1$ )

When using a diode, a reverse current cannot flow and the voltage drop is almost constant ( $\approx 0.7\text{V}$ ).

Therefore, a 100  $\Omega$  / 0.25W resistor for 5V application and a diode for higher supply voltage are recommended. Both solutions provide the required reverse voltage protection.

When a weak power supply is used or when the device is intended to be used in noisy environment, it is recommended that figure 13.3 from the Application Information section is used.

The low-pass filter formed by R1 and C1 and the Zener diode Z1 bypass the disturbances or voltage spikes occurring on the device supply voltage  $V_{DD}$ . The diode D1 provides additional reverse voltage protection.

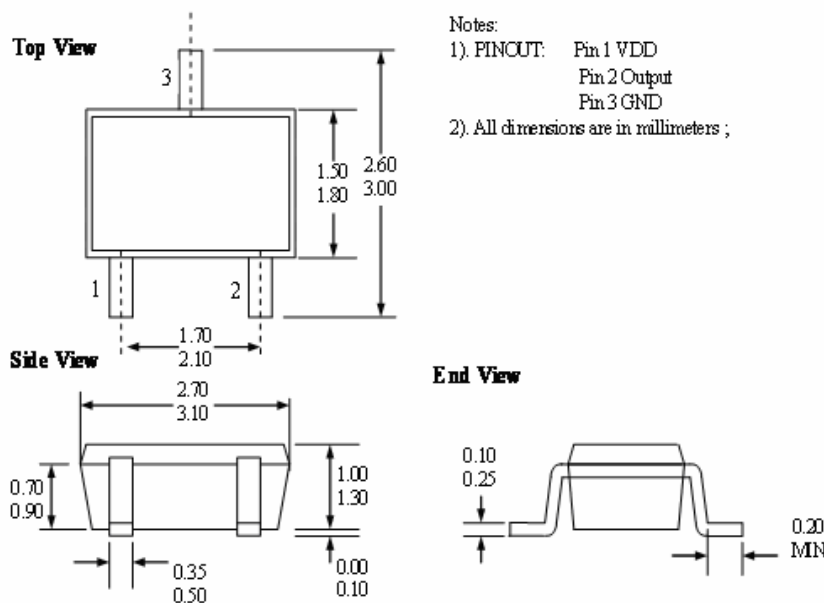
### ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).

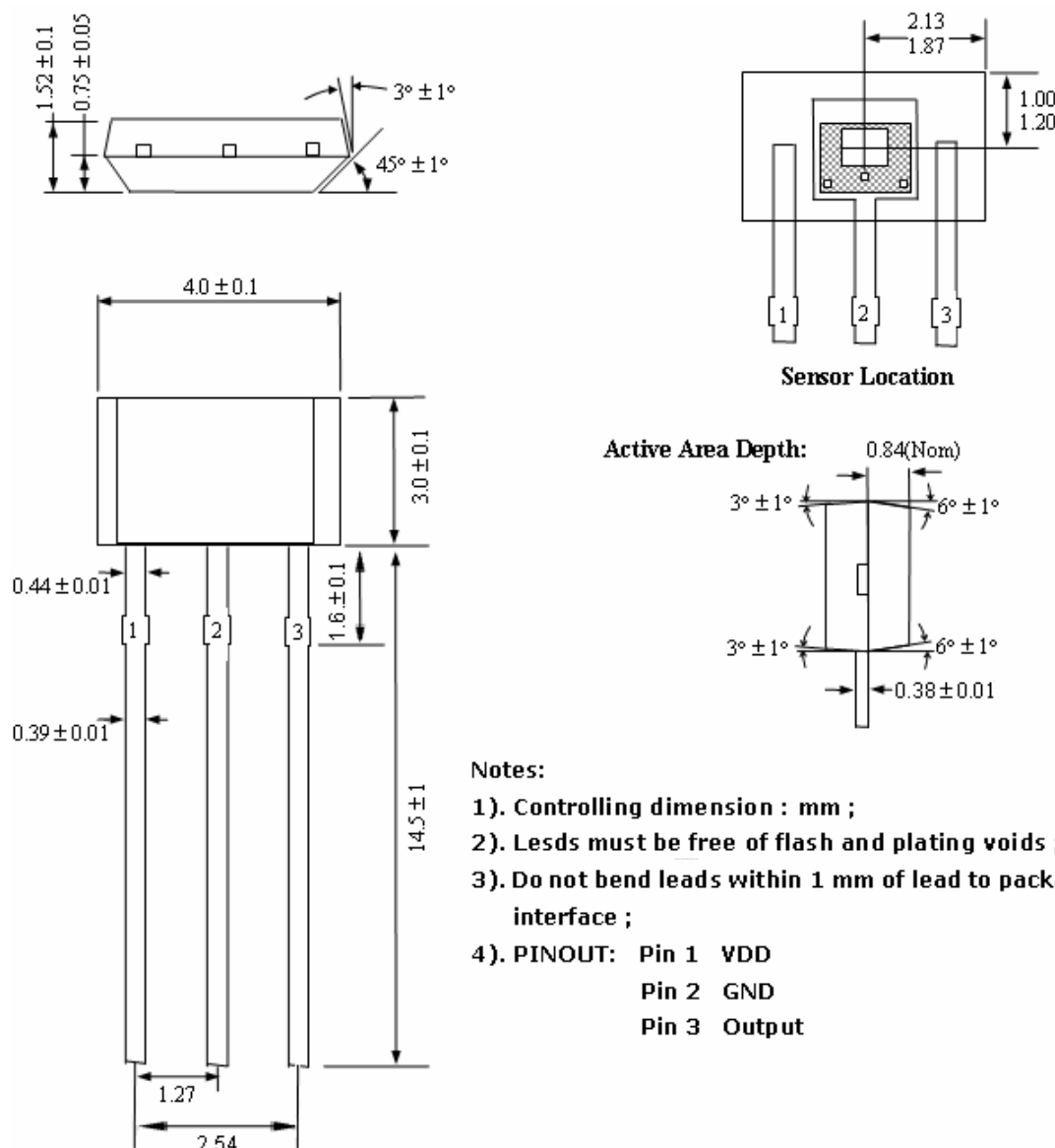
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

### Package Information

Package LH, 3-Pin SOT-23:



### Package UA, 3-Pin SIP:



### Ordering Information

| Part No.  | Pb-free | Temperature Code | Package Code | Packing                      |
|-----------|---------|------------------|--------------|------------------------------|
| SS159ESOT | YES     | -40°C to 85°C    | SOT-23       | 7-in. reel, 3000 pieces/reel |
| SS159EUA  | YES     | -40°C to 85°C    | TO-92        | Bulk, 1000 pieces/bag        |
| SS159KSOT | YES     | -40°C to 125°C   | SOT-23       | 7-in. reel, 3000 pieces/reel |
| SS159KUA  | YES     | -40°C to 125°C   | TO-92        | Bulk, 1000 pieces/bag        |
| SS159LSOT | YES     | -40°C to 150°C   | SOT-23       | 7-in. reel, 3000 pieces/reel |
| SS159LUA  | YES     | -40°C to 150°C   | TO-92        | Bulk, 1000 pieces/bag        |