

### Packages



3 pin SOT23 (suffix SO)

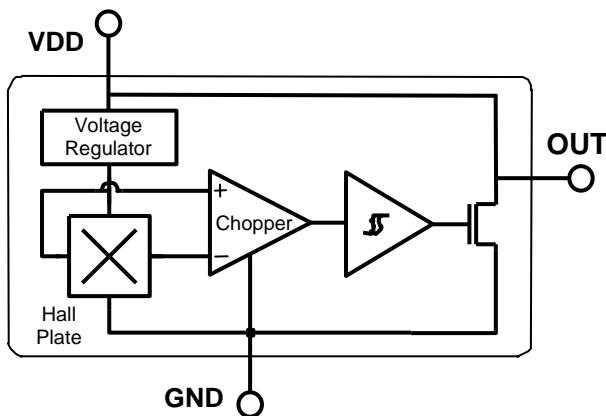


3 pin SIP (suffix UA)

### Features and Benefits

- Wide operating voltage range from 2.5V to 24V
- Medium sensitivity
- CMOS technology
- Chopper-stabilized amplifier stage
- Superior temperature stability
- Insensitive to physical stress
- Open drain output
- Low current consumption
- 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
- Interrupter
- Speed detection
- Angular position detection
- Linear position detection
- Proximity detection

### General Description

The SS109 is a unipolar Hall effect sensor IC fabricated from mixed signal CMOS technology. The device integrates a voltage regulator, Hall sensor with dynamic offset cancellation system, Schmitt trigger and an open-drain output driver, all in a single package.

It incorporates advanced chopper stabilization techniques to provide accurate and stable magnetic switch points. There are many applications for this HED – Hall Electronic Device - in addition to those listed above.

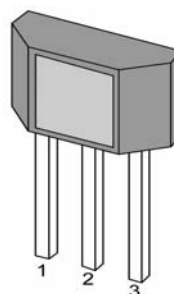
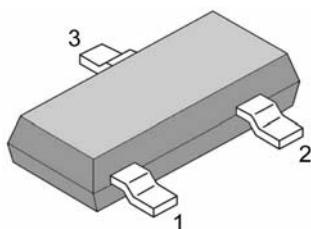
Thanks to its wide operating voltage range and extended choice of temperature range, it is quite suitable for use in automotive, industrial and consumer applications.

The device is delivered in a Small Outline Transistor (SOT) or 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
SOT	Small Outline Transistor (SOT package) - also referred with the package code "SO"
ESD	Electro-Static Discharge
BLDC	Brush-Less Direct-Current
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	$T_S$	-50 to 150	°C
Maximum Junction Temperature	$T_J$	165	°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  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 2.5\text{V}$  to  $24\text{V}$  (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	$V_{DD}$	Operating	2.2		24	V
Supply Current	$I_{DD}$	$B < B_{RP}$			5	mA
Output Saturation Voltage	$V_{DSon}$	$I_{OUT} = 20\text{mA}$ , $B > B_{OP}$			0.5	V
Output Leakage Current	$I_{OFF}$	$B < B_{RP}$ , $V_{OUT} = 24\text{V}$		1	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		$\mu\text{s}$
Maximum Switching Frequency	$F_{SW}$	---		10		KHz
Package Thermal Resistance	$R_{TH}$	Single layer (1S) Jedec board		301		$^\circ\text{C/W}$

Table 3: Electrical Specifications

**Note:** The output of SS109 will be switched after the supply voltage is over 2.2V, but the magnetic characteristics won't be normal until the supply is over 2.5V.

### Magnetic Specifications

DC Operating Parameters  $V_{DD} = 2.5\text{V}$  to  $24\text{V}$  (unless otherwise specified)

SS109

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Point	$B_{OP}$	E spec., $T_A = 85^\circ\text{C}$	-150	-120	-90	G
Release Point	$B_{RP}$		-120	-80	-40	G
Hysteresis	$B_{HYST}$		30	40	50	G
Operating Point	$B_{OP}$	K spec., $T_A = 125^\circ\text{C}$	-160	-120	-85	G
Release Point	$B_{RP}$		-130	-80	-35	G
Hysteresis	$B_{HYST}$		30	40	50	G
Operating Point	$B_{OP}$	L spec., $T_A = 150^\circ\text{C}$	-170	-120	-80	G
Release Point	$B_{RP}$		-140	-80	-30	G
Hysteresis	$B_{HYST}$		30	40	50	G

Table 4: Magnetic Specifications

### Output Behavior versus Magnetic Pole

DC Operating Parameters  $T_A = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ,  $V_{DD} = 2.5\text{V}$  to  $24\text{V}$  (unless otherwise specified)

Parameter	Test Conditions	OUT
South pole (SOT)	$B > B_{OP}$	Low
North pole (TO)	$B > B_{OP}$	Low
Null or weak magnetic field	$B = 0$ or $B < B_{RP}$	High

Table5: Output behavior versus magnetic pole



### Application Information

It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply (VDD Pin) and ground (GND Pin) of the device to reduce both external noise and noise generated by the chopper stabilization technique. As is shown in the two figures in next page, a 0.1μF capacitor is typical.

For reverse voltage protection, it is recommended to connect a resistor or a diode in series with the VDD 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 ( $P_D = V_{CC}^2 / R1$ )

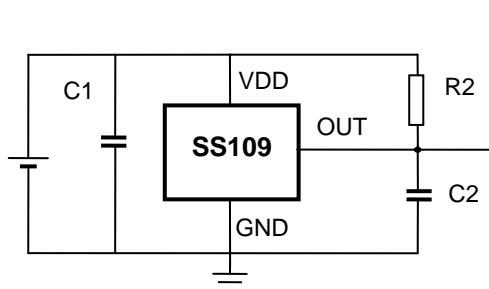
When using a diode, a reverse current cannot flow and the voltage drop is almost constant ( $\approx 0.7\text{V}$ ).

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

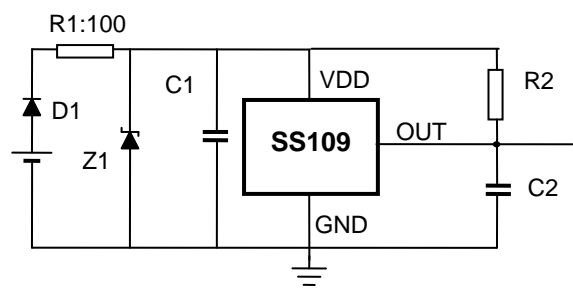
When a weak power supply is used or when the device is intended to be used in noisy environment, it is recommended that the figure 13.3 from the Application Information section is used.

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.

**Typical Three-Wire Application Circuit**



**Automotive and Severe Environment Protection Circuit**



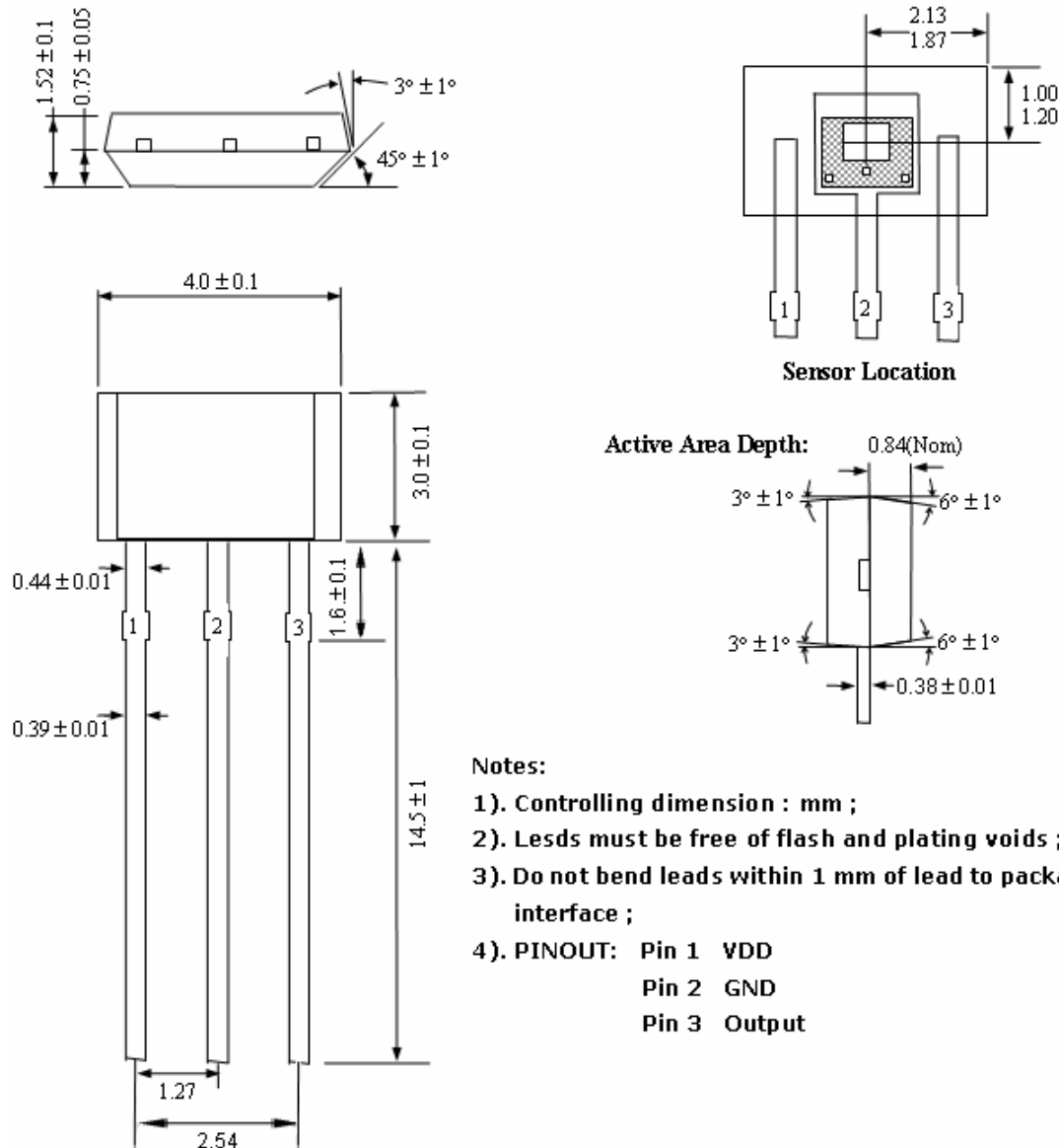
### ESD Precautions

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

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

## Package Information

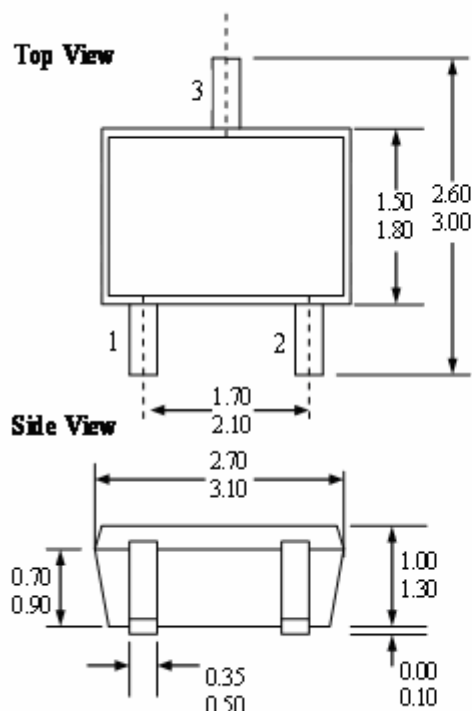
### Package A, 3-Pin SIP:



#### Notes:

- 1). Controlling dimension : mm ;
- 2). Leads must be free of flash and plating voids ;
- 3). Do not bend leads within 1 mm of lead to package interface ;
- 4). PINOUT: Pin 1 VDD  
Pin 2 GND  
Pin 3 Output

### Package AT, 3-Pin SOT-23:



#### Notes:

- 1). PINOUT: Pin 1 VDD  
Pin 2 Output  
Pin 3 GND
- 2). All dimensions are in millimeters ;

### Ordering Information

Part No.	Pb-free	Temperature Code	Package Code	Packing
SS109ESOT	YES	-40°C to 85°C	SOT-23	7-in. reel, 3000 pieces/reel
SS109EUA	YES	-40°C to 85°C	TO-92	Bulk, 1000 pieces/bag
SS109KSOT	YES	-40°C to 125°C	SOT-23	7-in. reel, 3000 pieces/reel
SS109KUA	YES	-40°C to 125°C	TO-92	Bulk, 1000 pieces/bag
SS109LSOT	YES	-40°C to 150°C	SOT-23	7-in. reel, 3000 pieces/reel
SS109LUA	YES	-40°C to 150°C	TO-92	Bulk, 1000 pieces/bag