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## High Sensitive Digital-Bipolar Hall Effect Sensor

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### FEATURES

- Ultra-high sensitivity
- Built-in Pull-up resistor
- High chopping frequency
- Supports a wide voltage range
  - 2.5 to 24V
  - Operation from unregulated supply
- Wide operating temperature range
- Solid-state reliability
- Small package
  - 3-pin SIP -(UA)
  - 3-pin SOT23 -(SO)

### APPLICATIONS

- Power tools
- Flow meters
- Valve and solenoid status
- BLDC motors with sensors
- Proximity sensing
- Tachometers

### DESCRIPTION

The SC2202 is a Hall-effect latch designed in mixed signal BiCMOS 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.

The low operating voltage and extended choice of temperature range make it suitable for use in automotive, industrial and consumer low voltage applications.

An onboard regulator permits with supply voltages of 2.5 to 24V which makes the device suitable for a wide range of industrial and automotive applications

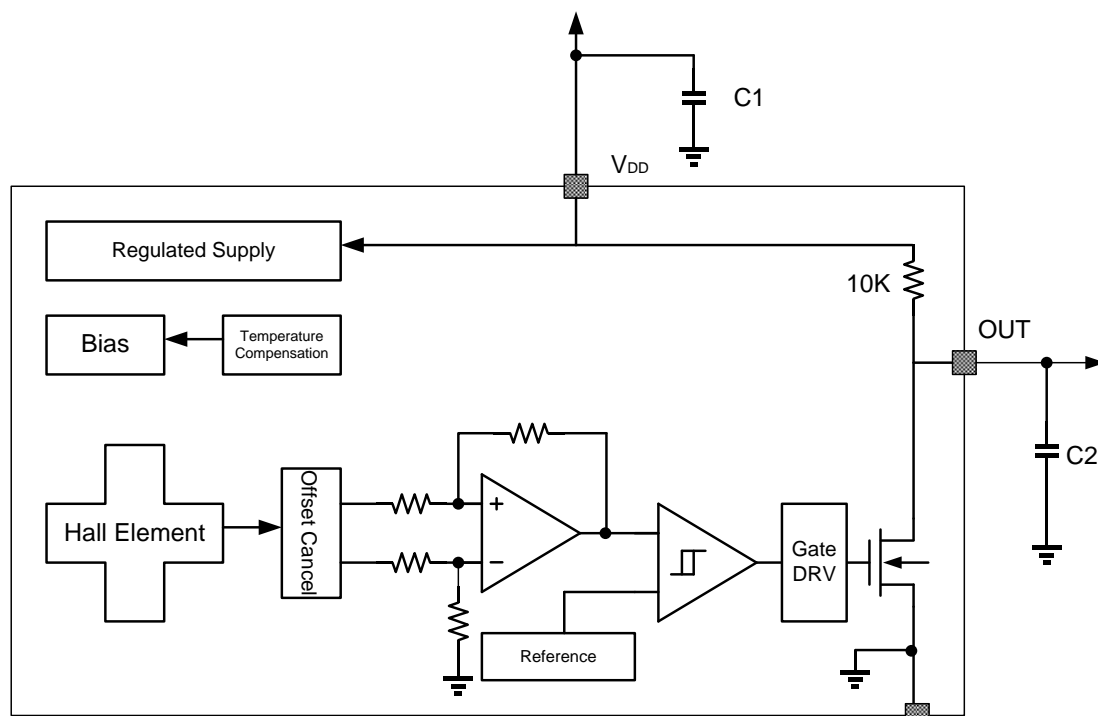
The device is available in a 3-pin SIP package (UA) and a 3-pin SOT-23 style package (SO). Both are lead (Pb) free, with 100% matte tin leadframe plating.



## CONTENTS

<b>FEATURES</b> .....	- 1 -	<i>Magnetic Characteristics</i> .....	- 6 -
<b>APPLICATIONS</b> .....	- 1 -	<b>TYPICAL CHARACTERISTIC</b> .....	- 7 -
<b>DESCRIPTION</b> .....	- 1 -	<b>TYPICAL CHARACTERISTIC (Continued)</b> .....	- 8 -
<b>BLOCK DIAGRAM</b> .....	- 3 -	<b>FUNCTION DESCRIPTION</b> .....	- 9 -
<b>ORDERING INFORMATION</b> .....	- 3 -	<i>Field Direction Definition</i> .....	- 9 -
<b>TERMINAL CONFIGURATION</b> .....	- 4 -	<i>Transfer Function</i> .....	- 10 -
<b>ABSOLUTE MAXIMUM RATINGS</b> .....	- 5 -	<b>TYPICAL APPLICATION</b> .....	- 11 -
<b>ESD PROTECTION</b> .....	- 5 -	<b>PACKAGE INFORMATION“ UA”</b> .....	- 12 -
<b>THERMAL CHARACTERISTICS</b> .....	- 5 -	<b>PACKAGE INFORMATION“ SO”</b> .....	- 13 -
<b>OPERATING CHARACTERISTICS</b> .....	- 6 -	<b>REVISION HISTORY</b> .....	- 14 -
<i>Electrical Characteristics</i> .....	- 6 -		

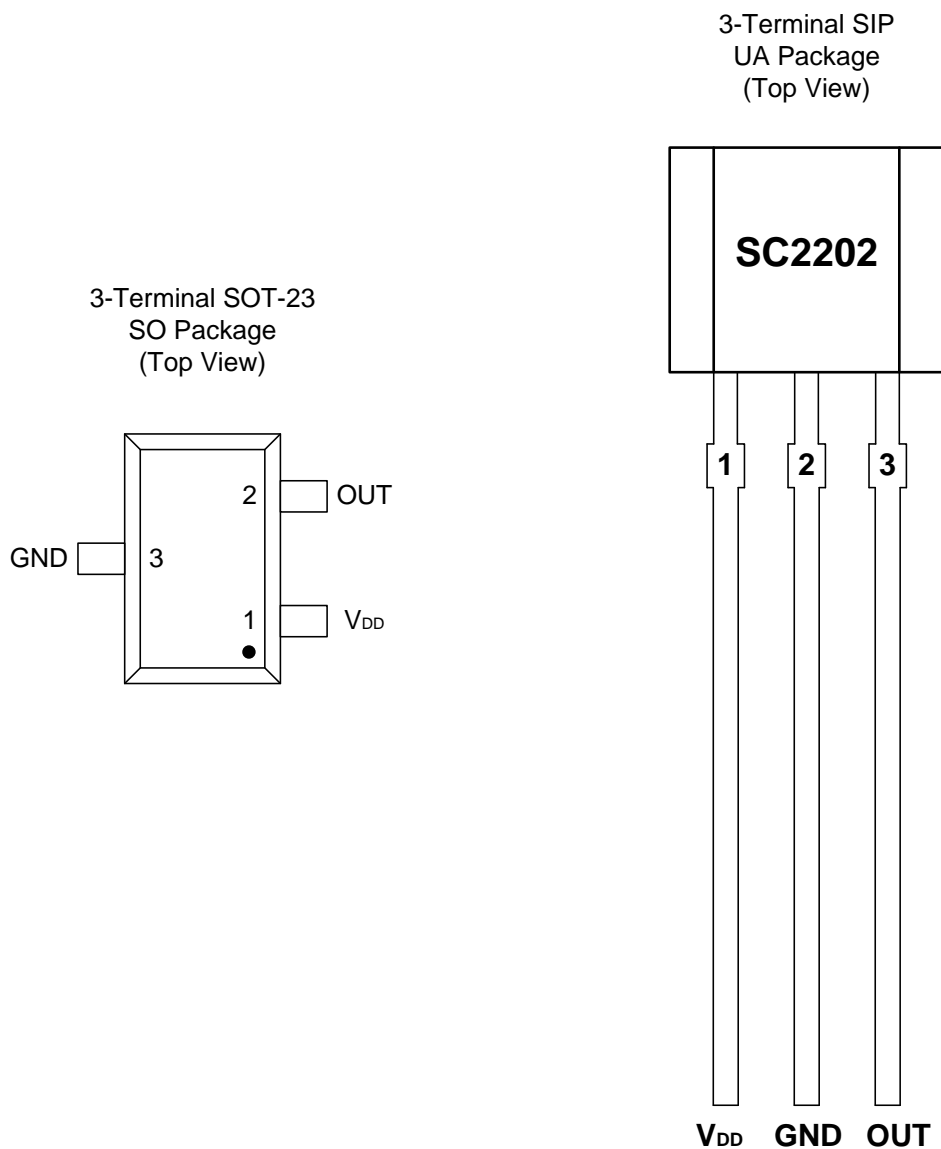
## BLOCK DIAGRAM



## ORDERING INFORMATION

Part Number	Packing	Mounting	Ambient, $T_A$	$B_{OP}(Typ.)$	$B_{RP}(Typ.)$
SC2202UA	Bulk, 1000 pieces/bag	3-pin SIP	-40°C to 150°C	+1.8mT	-1.8mT
SC2202SO-N	Reel, 3000pieces/reel	3-pin SOT23		-1.8mT	+1.8mT

## TERMINAL CONFIGURATION



Terminal		Type	Description
Name	Number		
	UA	SO	
V <sub>DD</sub>	1	1	PWR 2.5V~24 V power supply
GND	2	3	Ground Ground terminal
OUT	3	2	Output Open-drain output. The open drain requires a pull-up resistor

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V <sub>DD</sub>	-0.5	28	V
Output terminal voltage	V <sub>OUT</sub>	-0.5	28	V
Output terminal current sink	I <sub>SINK</sub>	0	30	mA
Operating ambient temperature	T <sub>A</sub>	-40	150	°C
Maximum junction temperature	T <sub>J</sub>	-55	165	°C
Storage temperature	T <sub>STG</sub>	-65	175	°C

<sup>(1)</sup> Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ESD PROTECTION

Human Body Model (HBM) tests according to: standard AEC-Q100-002

Parameter	Symbol	Min.	Max.	Units
ESD-Protection	V <sub>ESD</sub>	-3	+3	KV

## THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
R <sub>θJA</sub>	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	166	°C/W
R <sub>θJA</sub>	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	228	°C/W

## OPERATING CHARACTERISTICS

### Electrical Characteristics

over operating free-air temperature range ( $V_{DD} = 5.0V$ , unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{DD}$	Operating voltage <sup>(1)</sup>	$T_J < T_{J(Max.)}$	2.5	--	24	V
$I_{DD (off)}$	Operating supply current	$V_{DD}=2.5$ to $24$ V, $T_A=25^\circ C$	0.8	1.3	2.0	mA
$I_{DD (on)}$		$V_{DD}=2.5$ to $24$ V, $T_A=25^\circ C$	0.8	1.4	2.0	mA
$t_{on}$	Power-on time		--	35	50	$\mu S$
$R_{UP}$	Internal pull-up resistor		5.0	10	15	k $\Omega$
$I_{QL}$	Off-state leakage current	Output Hi-Z	--	--	3	$\mu A$
$R_{DS (on)}$	FET on-resistance	$V_{DD}=5V$ , $I_o=10mA$ , $T_A=25^\circ C$	--	20	--	$\Omega$
		$V_{DD}=5V$ , $I_o=10mA$ , $T_A=125^\circ C$	--	30	--	$\Omega$
$t_d$	Output delay time	$B=B_{RP}$ to $B_{OP}$	--	15	25	$\mu S$
$t_r$	Output rise time (10% to 90%)	$R1=1Kohm$ $C_o=50pF$	--	--	0.5	$\mu S$
$t_f$	Output fall time (90% to 10%)	$R1=1Kohm$ $C_o=50pF$	--	--	0.2	$\mu S$

<sup>(1)</sup> Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

### Magnetic Characteristics

over operating free-air temperature range (unless otherwise noted)

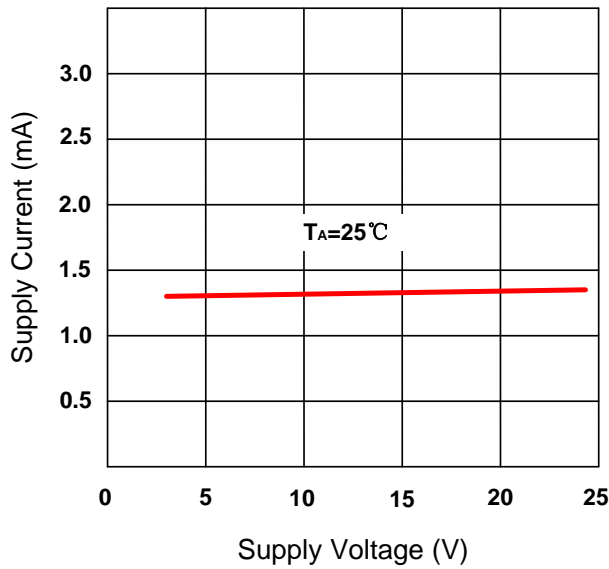
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$f_{BW}$	Bandwidth		20	--	--	kHz
$B_{OP}$	Operated point	$T_A=-40^\circ C$ to $150^\circ C$	--	+1.5	+3.0	mT
$B_{RP}$	Release point		-3.0	-1.5	--	mT
$B_{HYS}$	Hysteresis		--	3.0	--	mT

1mT=10Gs

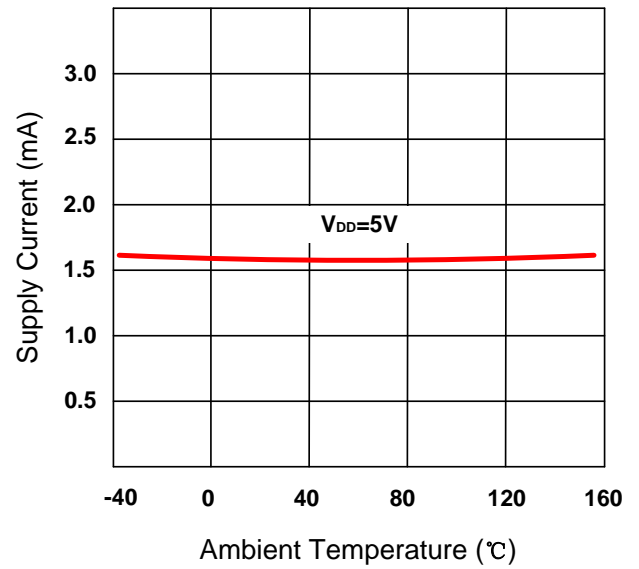
Magnetic flux density,  $B$ , is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

## TYPICAL CHARACTERISTIC

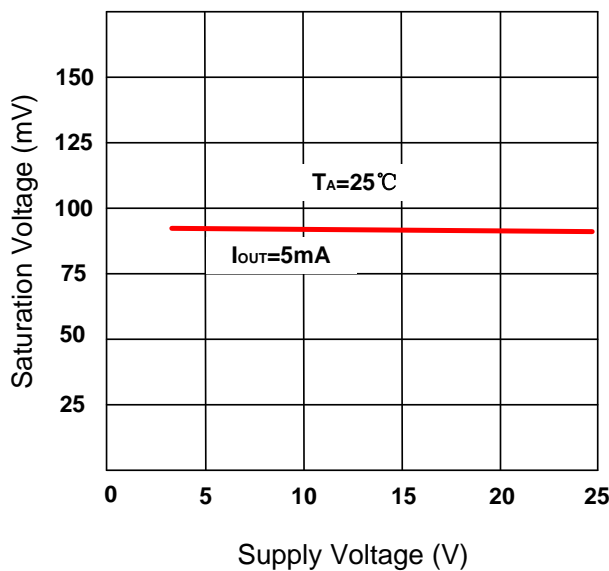
**$I_{DD}$  VS  $V_{DD}$**



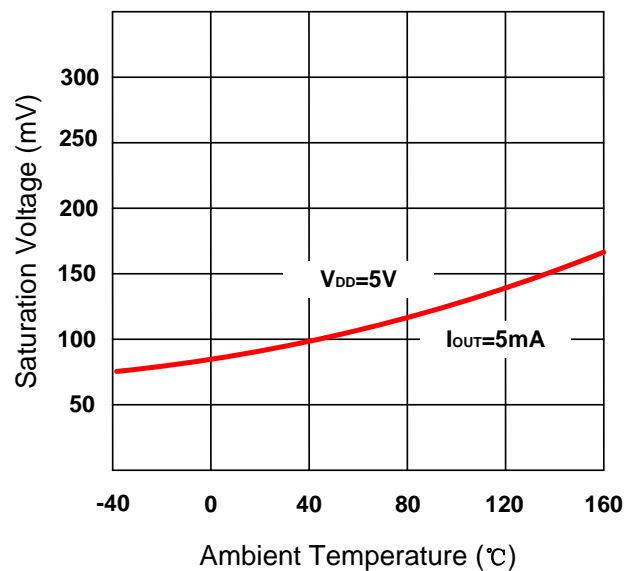
**$I_{DD}$  VS  $T_A$**



**$V_{Q(sat)}$  VS  $V_{DD}$**

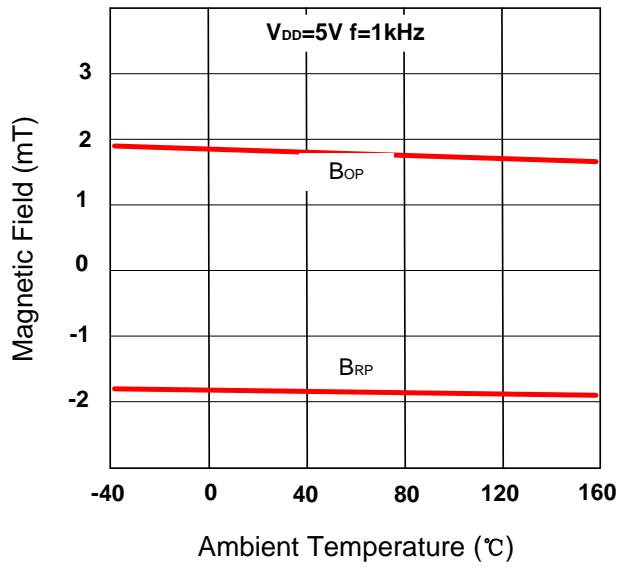


**$V_{Q(sat)}$  VS  $T_A$**

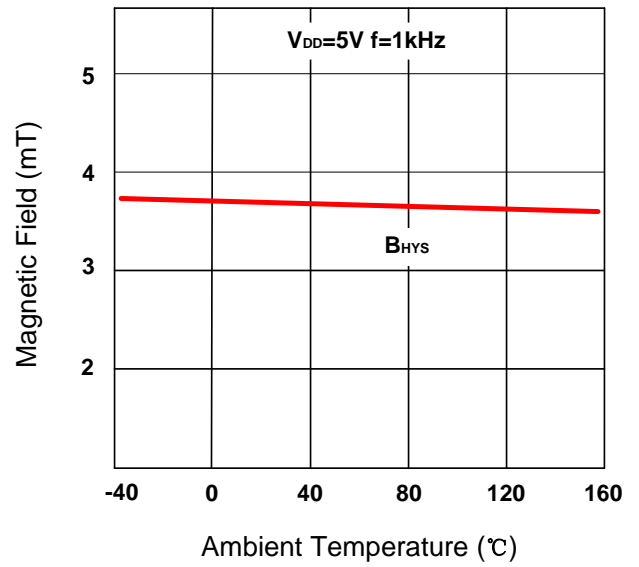


## TYPICAL CHARACTERISTIC (Continued)

**B<sub>OP</sub> and B<sub>RP</sub> vs T<sub>A</sub>**



**B<sub>HYS</sub> vs T<sub>A</sub>**





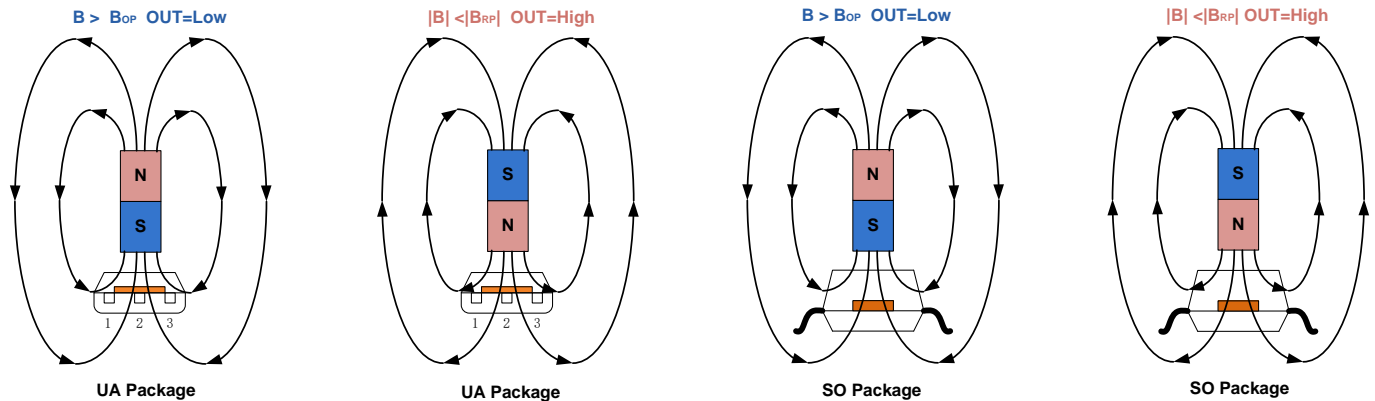
## FUNCTION DESCRIPTION

The SC2202 device is a chopper-stabilized Hall sensor with a digital latched output for magnetic sensing applications. The device can be powered with a supply voltage between 2.5 and 24V.

The output of SC2202 switches low (turns on) when a magnetic field (South polarity) perpendicular to the Hall element exceeds the operate point threshold,  $B_{OP}$ . After turn-on, the output is capable of sinking 20mA and the output voltage is  $V_{Q(sat)}$ . When the magnetic field is reduced below the release point,  $B_{RP}$ , the device output goes high (turns off). The difference in the magnetic operate and release points is the hysteresis,  $B_{HYS}$ , of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

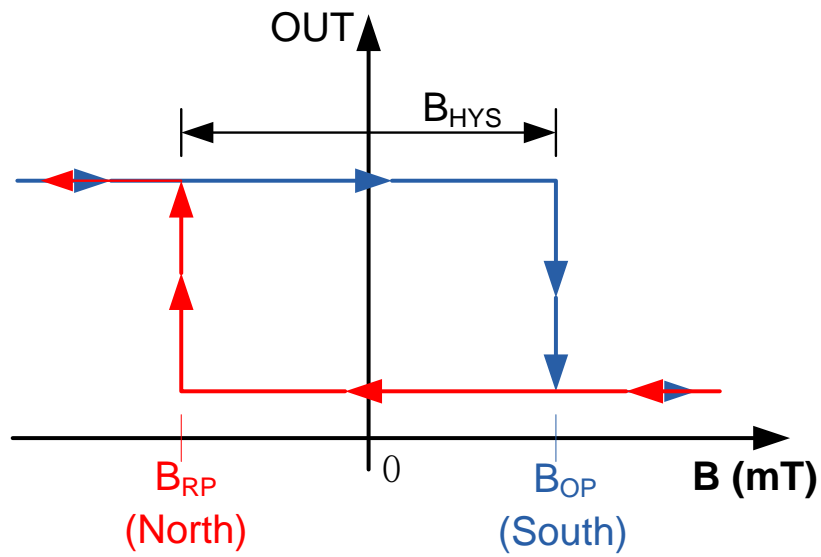
### Field Direction Definition

A positive magnetic field is defined as a South pole near the marked side of the package.

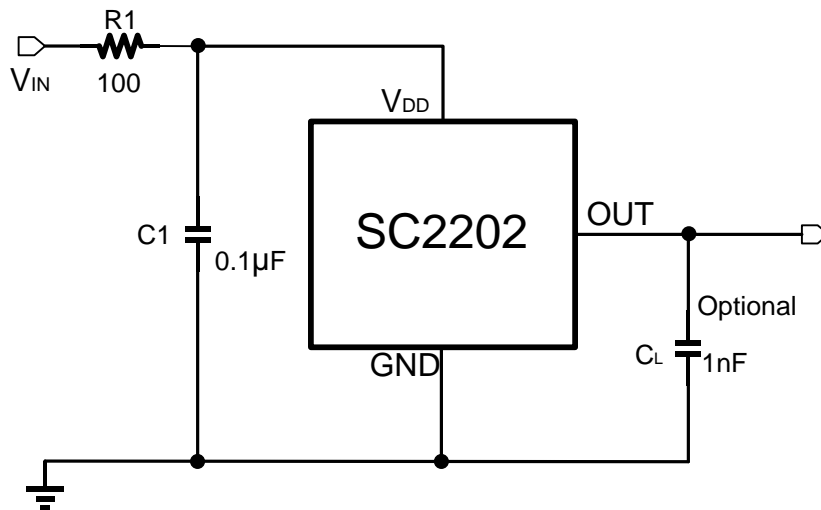


## Transfer Function

Powering-on the device in the hysteresis region, less than  $B_{OP}$  and higher than  $B_{RP}$ , allows an indeterminate output state. The correct state is attained after the first excursion beyond  $B_{OP}$  or  $B_{RP}$ . If the field strength is greater than  $B_{OP}$ , then the output is pulled low. If the field strength is less than  $B_{RP}$ , the output is released.



## TYPICAL APPLICATION

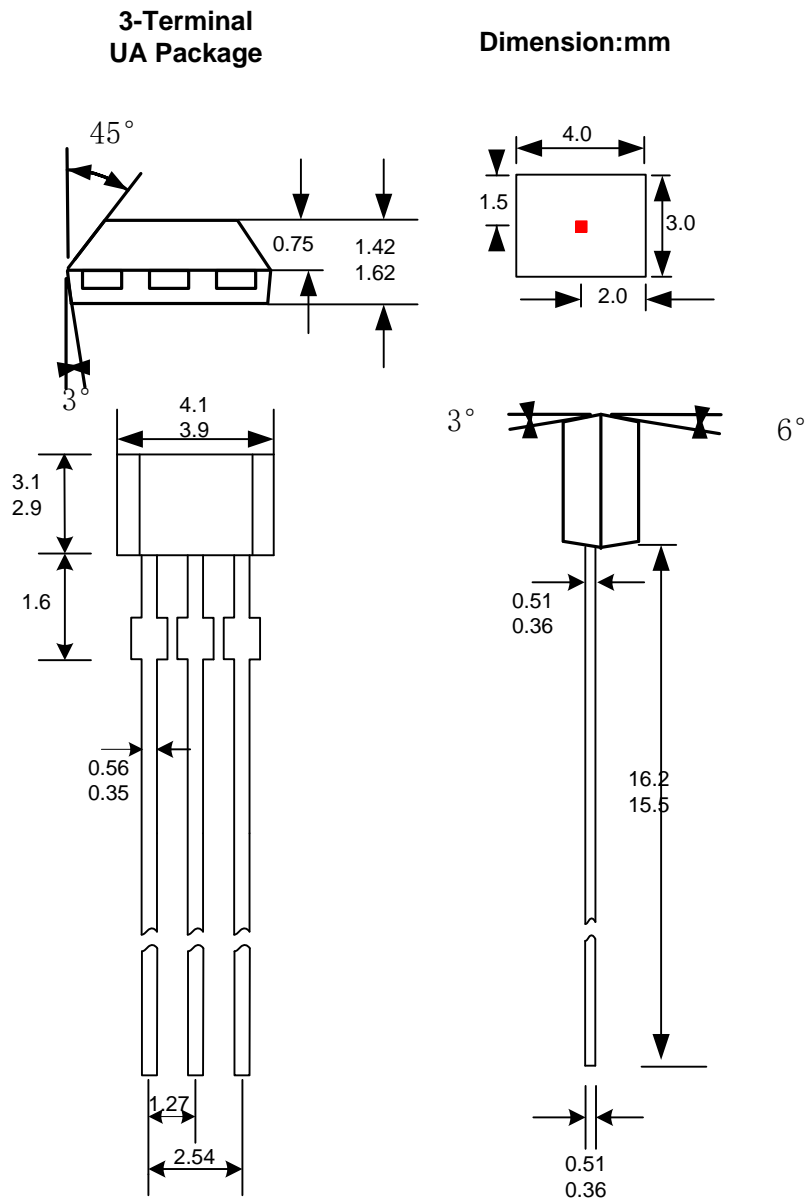


The SC2202 contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required. It is recommended to shunt C1 capacitors to the ground near the chip V<sub>DD</sub> power supply, with a typical value of 0.1 μF. At the same time in the external optional series resistor R1 their typical values for 100 Ω. The output capacitor C<sub>L</sub> is used as the output filter, typically 1 nF.

Select a value for C<sub>L</sub> based on the system bandwidth specifications as ,R=10kΩ :

$$C_L = \frac{1}{2\pi \times R \times f \text{ (Hz)}}$$

## PACKAGE INFORMATION “UA”



**Notes:**

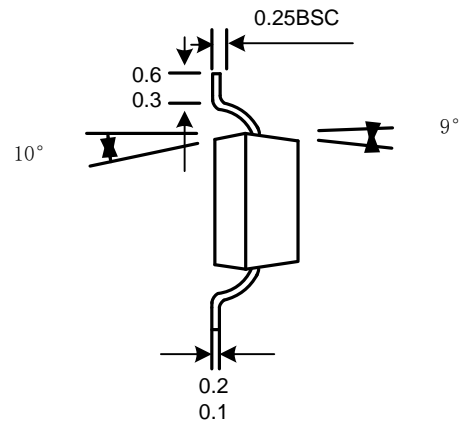
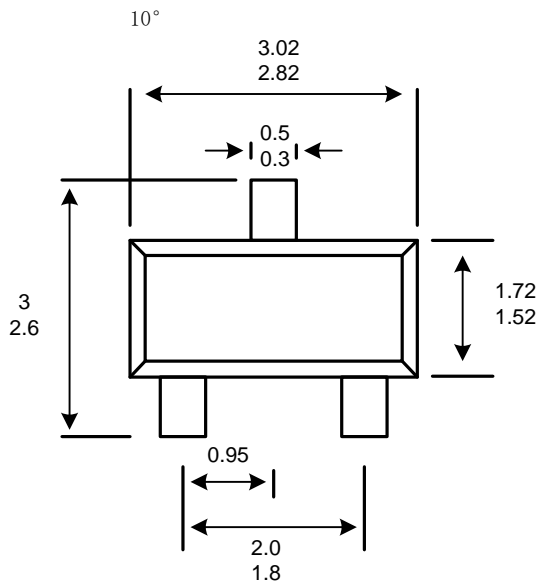
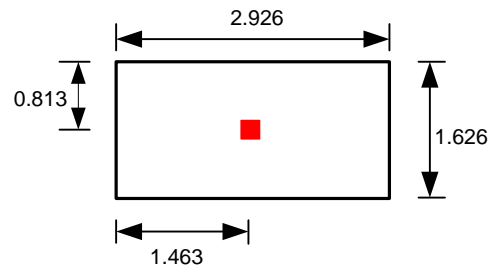
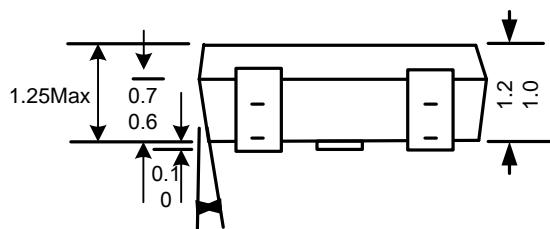
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

## PACKAGE INFORMATION “SO”

**3-Terminal  
SO Package**

**Dimension:mm**



**Notes:**

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

## REVISION HISTORY

<b>Revision</b>	<b>Date</b>	<b>Description</b>
Rev0.1	2016-08-21	Preliminary datasheet
Rev2.3	2018-04-15	The final revision of old datasheet
RevA/1.0	2020-11-19	Unified datasheet format