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## Unipolar Hall Effect Switches

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### Description

The SC44E Hall-Effect switch series is 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 negative compensation slope is optimized to match the negative temperature coefficient of low cost magnets.

Each device includes a voltage regulator for operation with supply voltages of 3.8 to 40V volts, quadratic Hall-voltage generator, temperature compensation circuitry, small-signal amplifier, Schmitt trigger, and an open-collector output to sink up to 40mA.

### Features and Benefits

- 3.8 to 40V supply voltage
- High transient voltage protection
- 40mA sinking capability
- High ESD rating
- 3-pin SIP package
- RoHs compliant

### Potential Applications

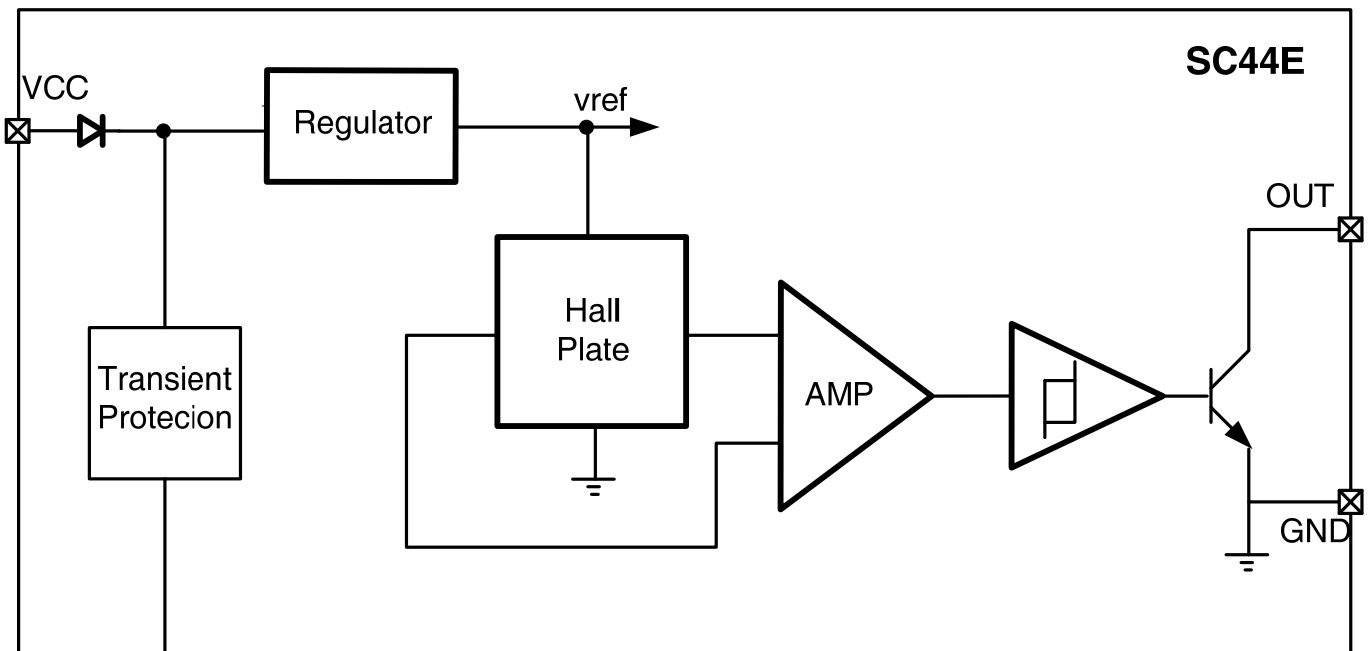
- Brushless DC motor
- Position sensor
- Motor and fan control
- Auto-motive transmission position

### Device Information

Part Number	Packing	Mounting	Ambient, T <sub>A</sub>	Marking
SC44E	1000 pieces/Bag	SIP3	-40°C to 150°C	44E

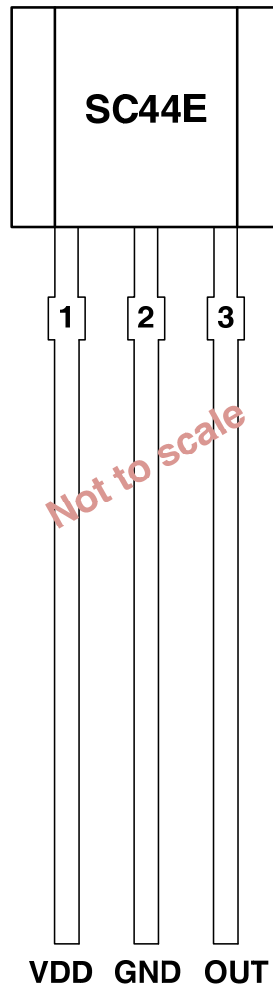
## Block Diagram

The circuit includes Hall generator, amplifier and Schmitt-Trigger on one chip. The internal reference provides the supply voltage for the components. A magnetic field perpendicular to the chip surface induces a voltage at the Hall probe. This voltage is amplified and switches as a Schmitt-Trigger with open-collector output. A protection diode against reverse power supply is integrated.



## Pin Description

3-Terminal SIP  
 UA Package  
 (Top View)



Terminal		Type	Description
Name	Number		
VDD	1	PWR	3.8 to 40 V power supply
GND	2	Ground	Ground terminal
OUT	3	Output	Open-drain output

## 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>CC</sub>	-40 <sup>(2)</sup>	60	V
Output terminal voltage	V <sub>OUT</sub>	-0.5	60	V
Output terminal current sink	I <sub>SINK</sub>	0	50	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.*

*<sup>(2)</sup>Ensured by design.*

## Electrical and magnetic Specifications

over operating free-air temperature range ( $V_{CC} = 5V$ , unless otherwise noted)

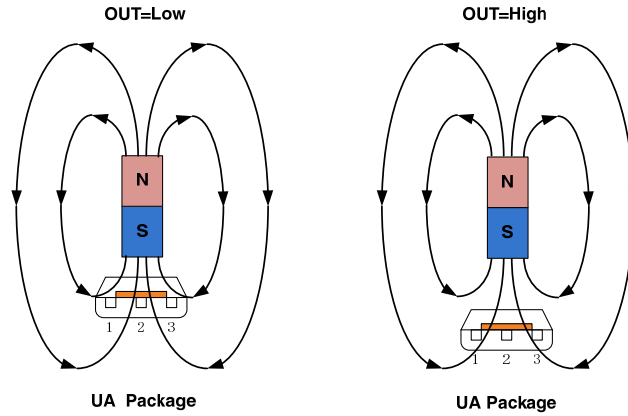
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{CC}$	Operating voltage <sup>(1)</sup>	$T_J < T_{J(Max.)}$	3.8	--	40	V
$V_{CCR}$	Reverse supply voltage	$T_A = 25^\circ C$	-40	--	--	V
$I_{CC}$	Operating supply current	$V_{CC} = 3.8$ to 40 V	--	4.0	10	mA
$I_{QL}$	Off-state leakage current	Output Hi-Z	--	--	3	$\mu A$
$V_{SAT}$	Output saturation voltage	$I_O = 20mA$ , $T_A = 25^\circ C$	--	--	300	mV
$t_r$	Output rise time	$R_1 = 1Kohm$ $C_o = 20pF$	--	--	1.5	$\mu S$
$t_f$	Output fall time	$R_1 = 1Kohm$ $C_o = 20pF$	--	--	1.5	$\mu S$
Magnetic Characteristics						
$f_{BW}$	Bandwidth		--	--	100	kHz
$B_{OP}$	Operated point	$T_A = 25^\circ C$	9.5	12.0	16.5	$mT^{(2)}$
$B_{RP}$	Release point		5.5	9.5	14.0	mT
$B_{HYS}$	Hysteresis	$B_{OP} - B_{RP}$	--	2.5	--	mT

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

<sup>(2)</sup>  $1mT = 10Gs$

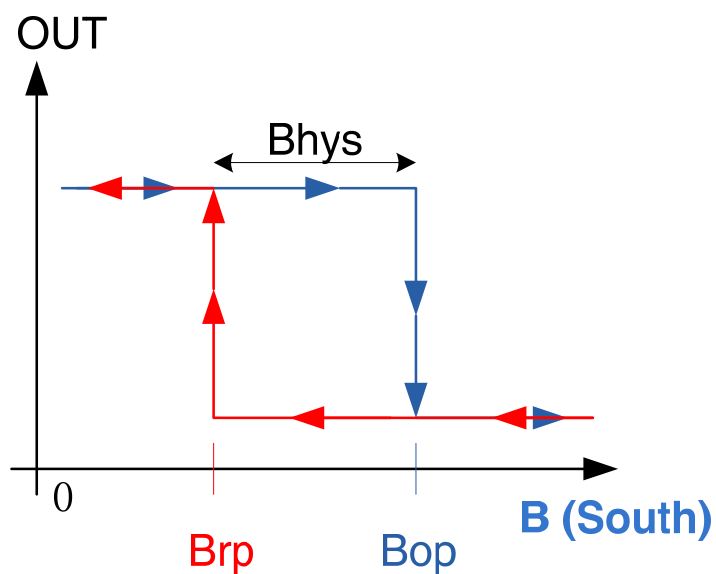
## Field Direction Definition

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

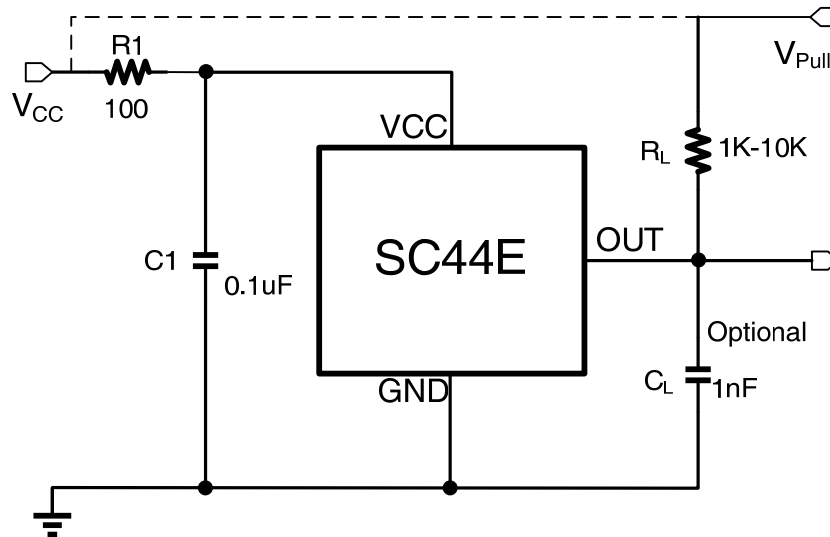


## Transfer Function

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 SC44E 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. R1 is for improved CI performance, and could be 100 or 200  $\Omega$  typically.

The SC44E device output stage uses an open-drain NPN transistor, and it is rated to sink up to 40mA of current. For proper operation, calculate the value of the pull-up resistor  $R_L$  is required. The size of  $R_L$  is a tradeoff between OUT rise time and the load capacity when OUT is pulled low. A lower current is generally better, however faster transitions and bandwidth require a smaller resistor for faster switching.

Select a vaule for  $C_L$  based on the system bandwidth specifications as:

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

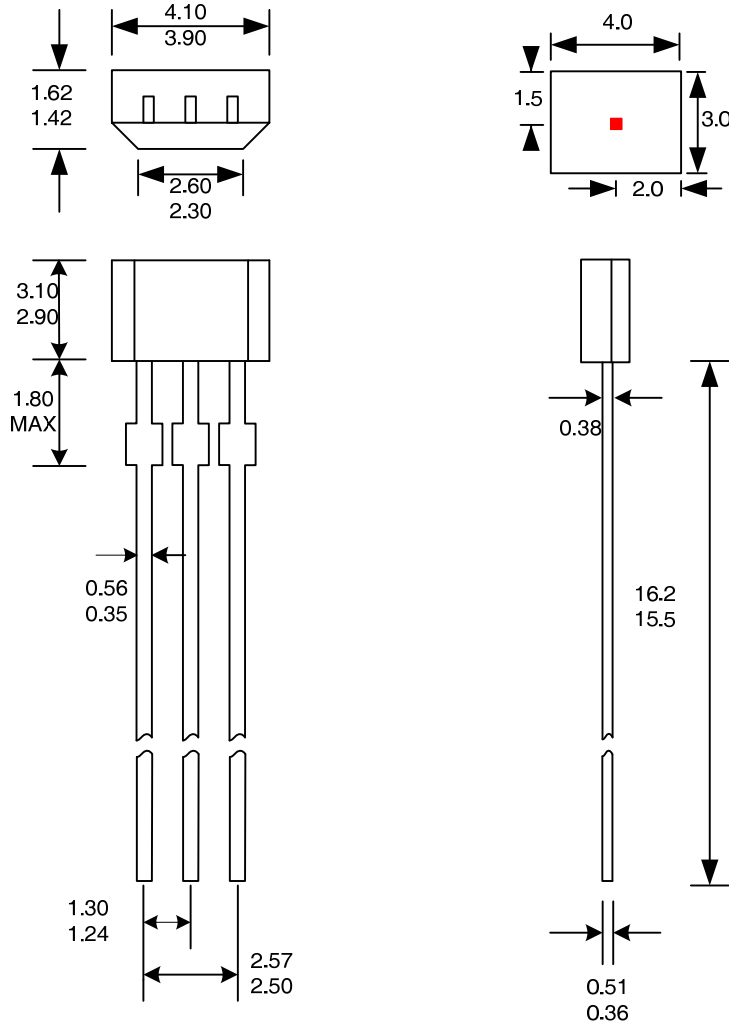
Most applications do not require this  $C_L$  filtering capacitor.

$V_{PULL}$  is not restricted to  $V_{CC}$ , and could be connected to other voltage reference. The allowable voltage range of this terminal is specified in the Absolute Maximum Ratings.

## Mechanical Dimensions

### 3-Terminal UA 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.



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