High Sensitive Hall Effect Bipolar Switches

Description

The SC1245 Hall-Effect switch, produced with high voltage Bipolar technology, has been designed specifically for automotive and industrial applications. New considerations are given not only to protect the IC from the high voltage transients, but also achieving a high degree of noise immunity.

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, SOT-23 and SOT-89 packages are available
- Operate/release points symmetrical around zero gauss
- RoHs compliant

Potential Applications

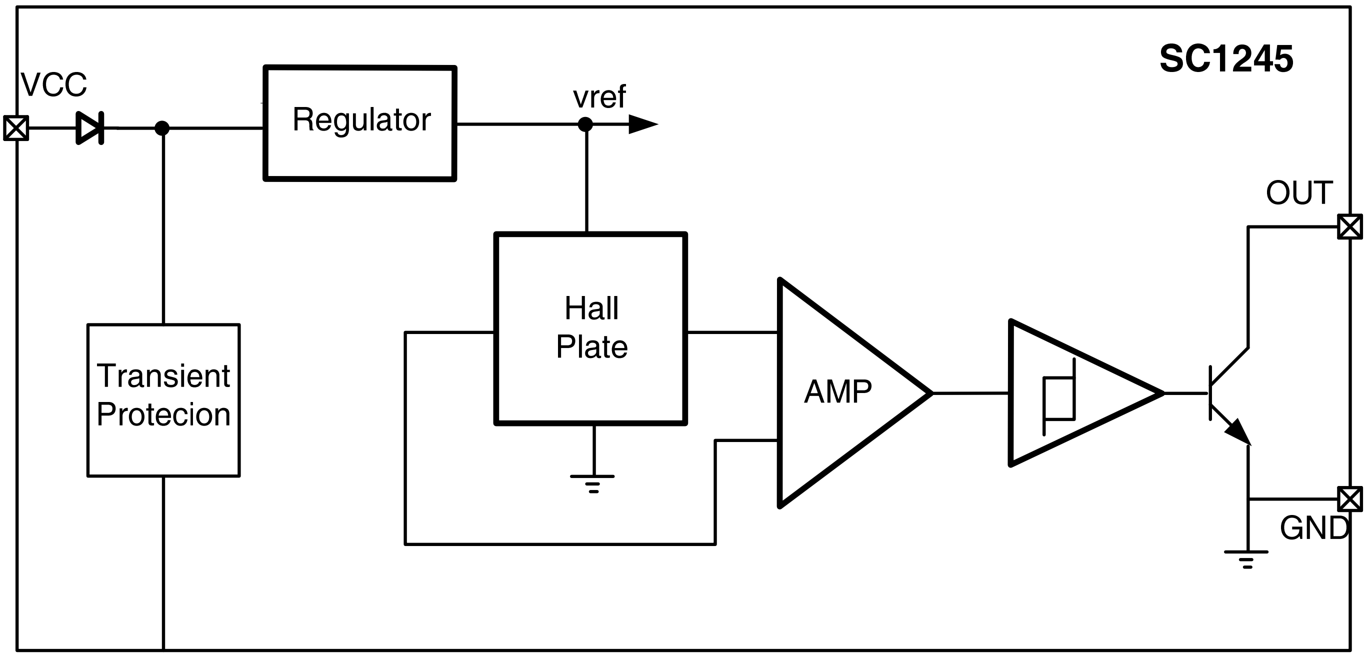
- Brushless DC motor
- Motor and fan control
- Automotive transmission position

Device Information

Part Number	Packing	Mounting	Ambient, T_A	Marking
SC1245UA	1000 pieces/Bag	SIP3	-40℃ to 150℃	1245
SC1245BU	1000 pieces/Reel	SOT-89	-40℃ to 150℃	1245
SC1245SO-N	3000 pieces/Reel	SOT-23	-40℃ to 150℃	1245

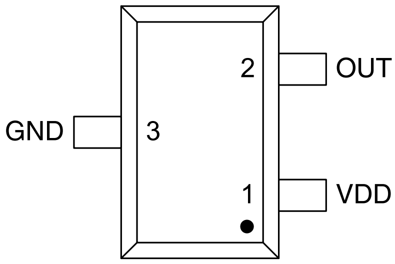
Function Description

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.

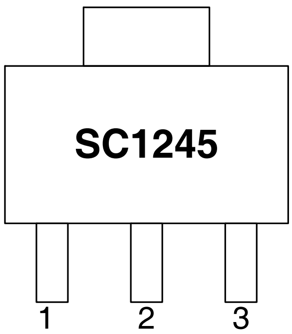


Pin Description

3-Terminal SOT-23
SO Package
(Top View)

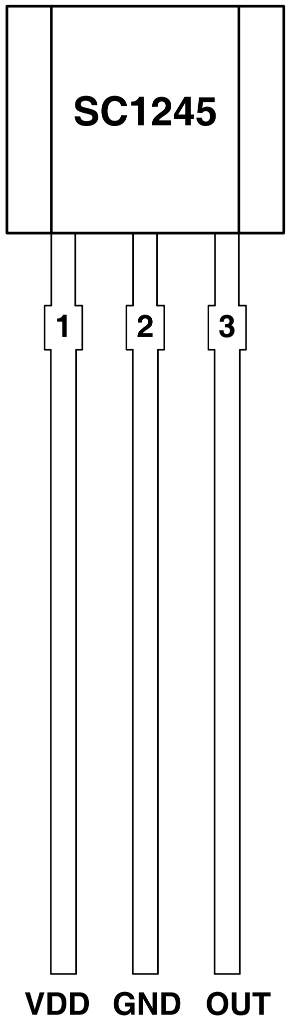


3-Terminal SOT-89
BU Package
(Top View)



Not to scale

3-Terminal SIP
UA Package
(Top View)



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

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V_{CC}	-40	60	V
Output terminal voltage	V_{OUT}	-0.5	60	V
Output terminal current sink	I_{SINK}	0	50	mA
Operating ambient temperature	T_A	-40	150	℃
Maximum junction temperature	T_J	-55	165	℃
Storage temperature	T_{STG}	-65	175	℃

(1)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 EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	Units
ESD-Protection	V_{ESD}	-2	2	KV

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(1)	$T_J < T_{J\,(Max.)}$	3.8	--	40	V
I_{CC}	Operating supply current	V_{CC}=3.8 to 40 V, T_A=25℃	--	4.0	10	mA
I_{QL}	Off-state leakage current	Output Hi-Z	--	--	3	uA
V_{SAT}	Output saturation voltage	I_Q=20mA, T_A=25℃	--	--	300	mV
t_r	Output rise time	R1=1Kohm Co=20pF	--	--	1.5	uS
t_f	Output fall time	R1=1Kohm Co=20pF	--	0.5	1.5	uS
Magnetic Characteristics						
f_{BW}	Bandwidth		--	--	100	kHz
B_{OP}	Operated point	T_A=25℃	0.5	+5.0	9.5	mT(2)
B_{RP}	Release point		-9.5	-5.0(3)	-0.5	mT
B_{HYS}	Hysteresis		--	10.0	--	mT

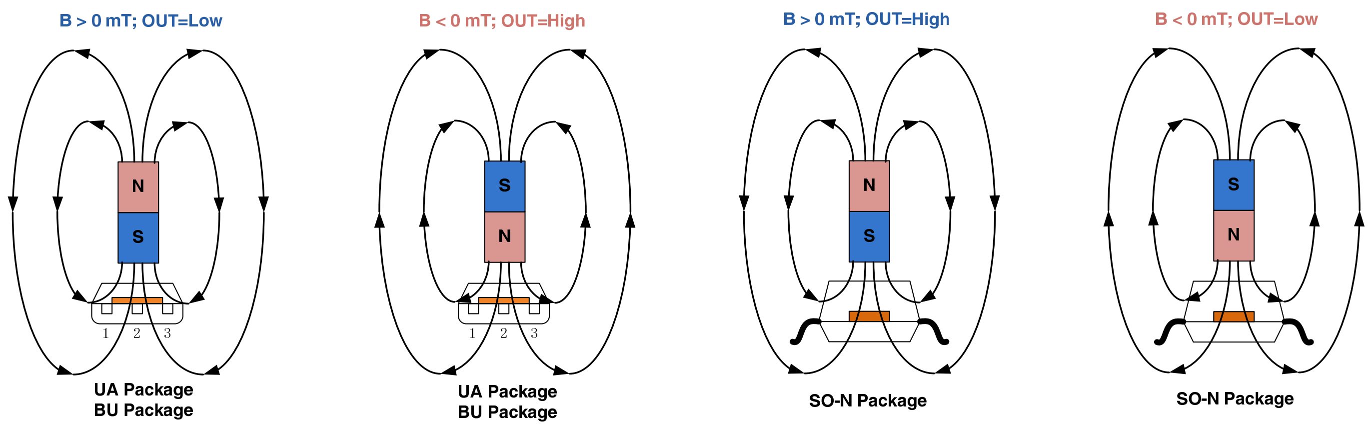
(1) Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

(2) 1mT=10Gs

(3) 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.

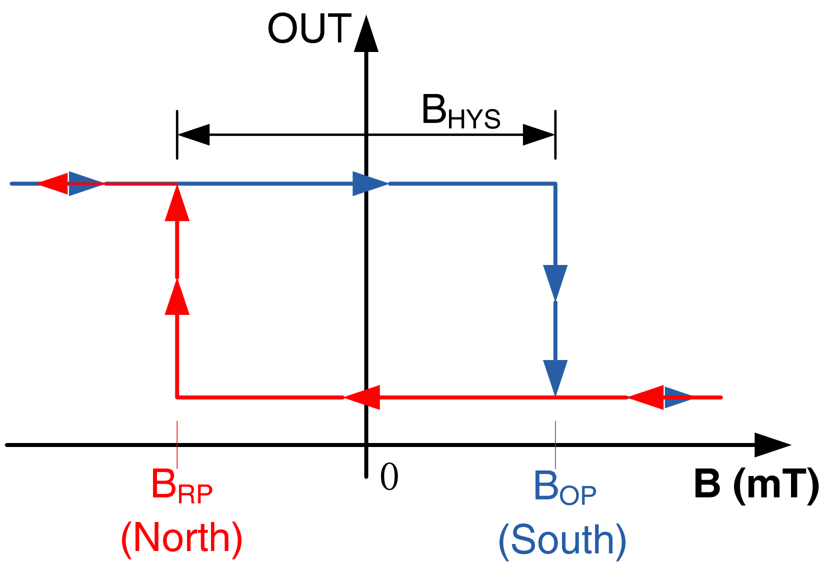
Field Direction Definition

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

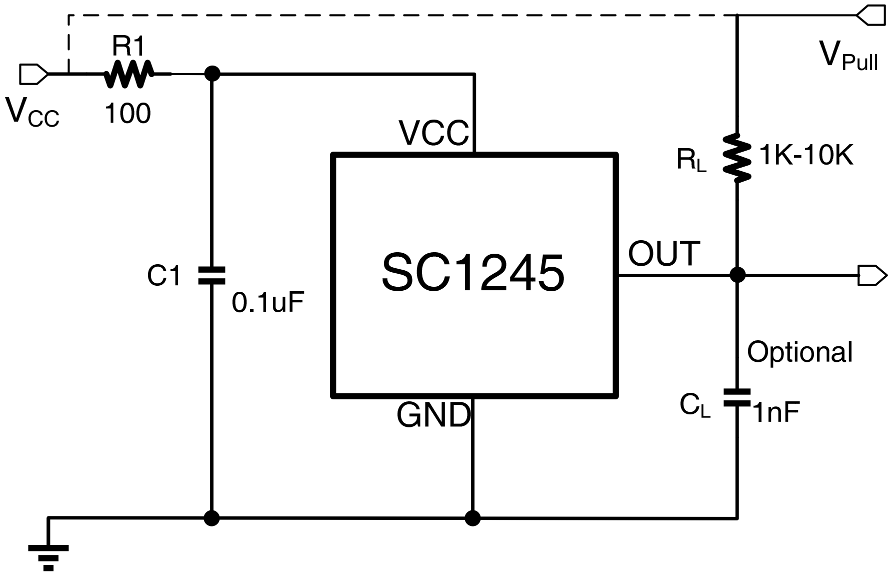


Transfer Function

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 SC1245 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 Ω typically.

The SC1245 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:

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

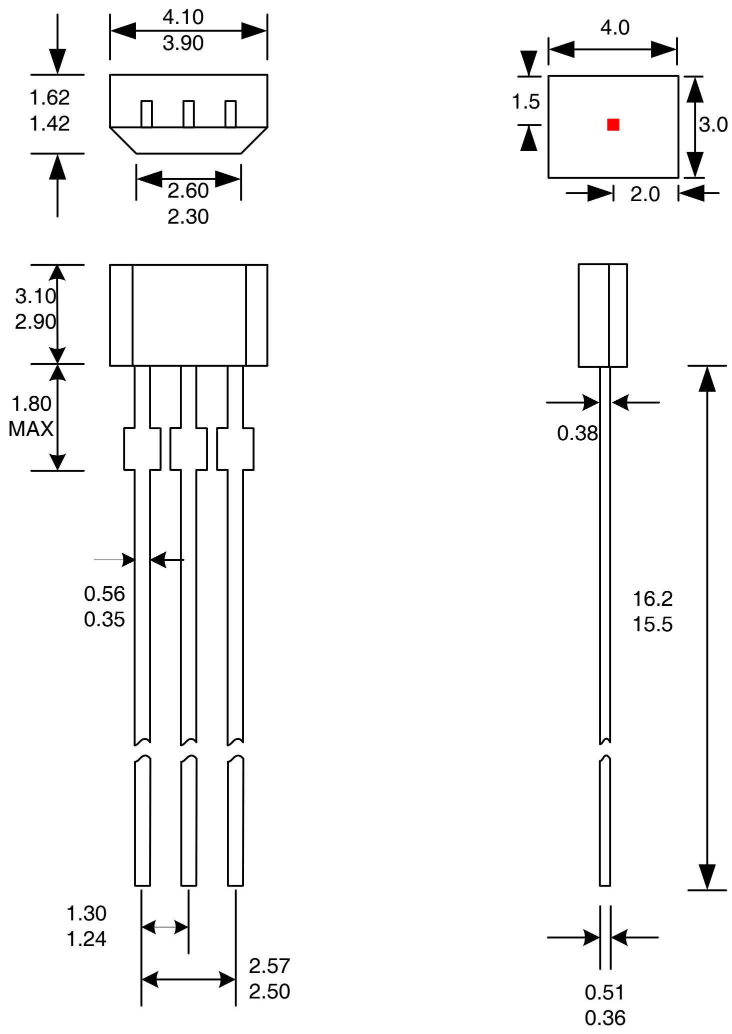
Most applications do not require this C_L filtering capacitor.

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:

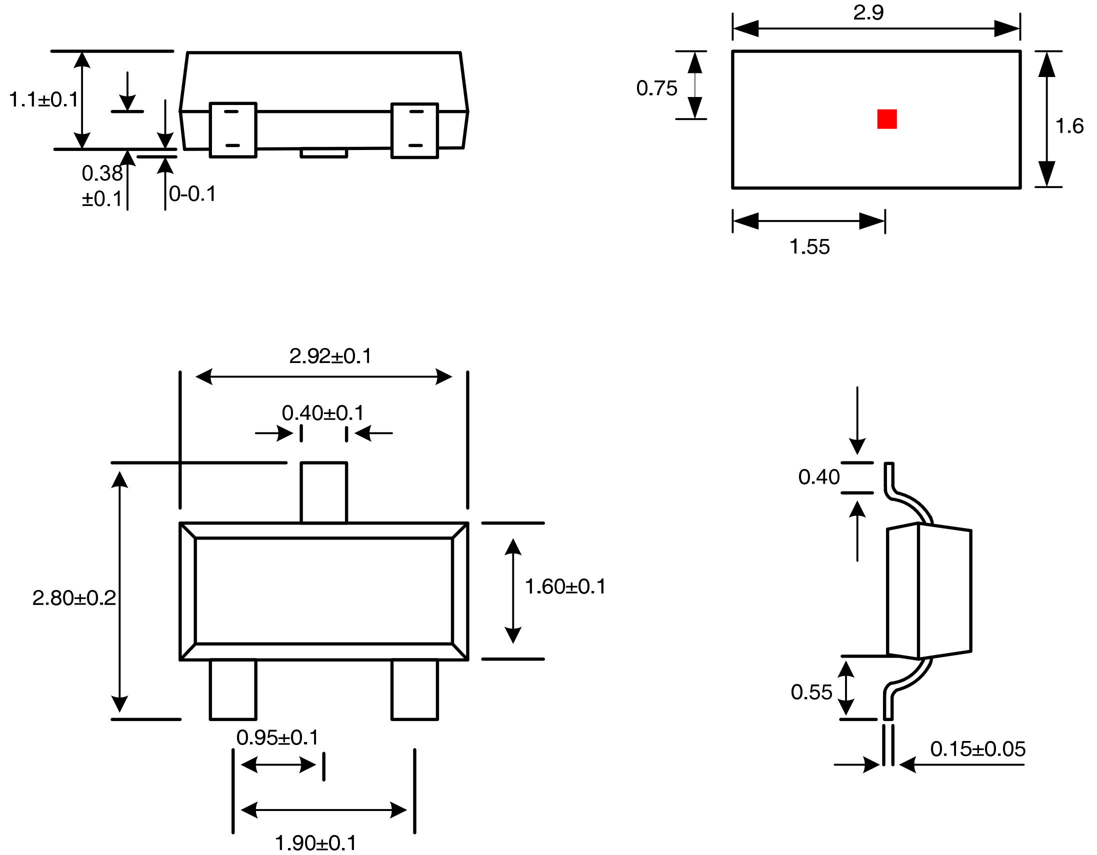
1. *Exact body and lead configuration at vendor's option within limits shown.*
2. *Height does not include mold gate flash.*

Where no tolerance is specified, dimension is nominal.

Mechanical Dimensions

3-Terminal
SO Package

Dimension:mm



Notes:

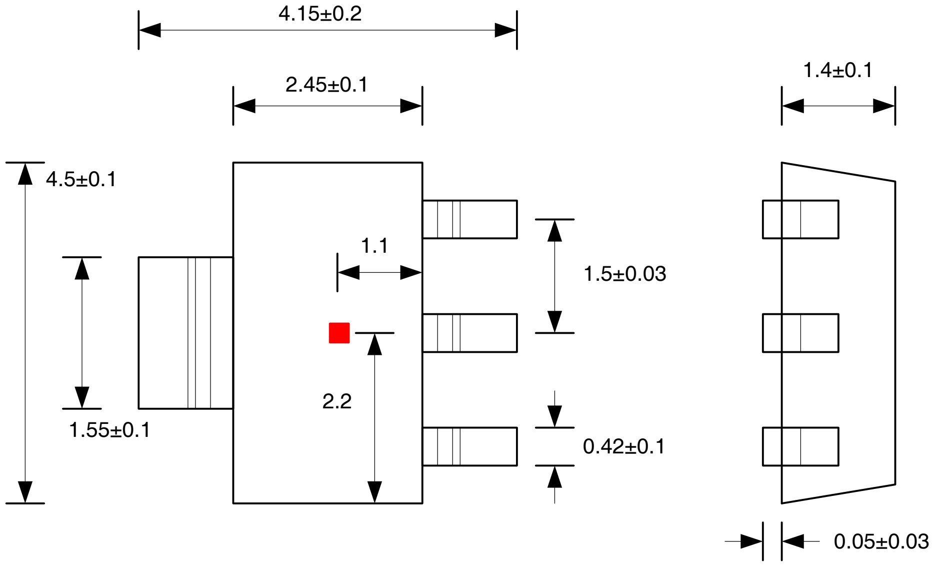
1. *Exact body and lead configuration at vendor's option within limits shown.*
2. *Height does not include mold gate flash.*

Where no tolerance is specified, dimension is nominal.

Mechanical Dimensions

3-Terminal
BU Package

Dimention: mm



Notes:

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