Unipolar Hall Effect Switches

FEATURES

- 3.8 to 40V supply voltage
- High transient voltage protection
- 40mA sinking capability
- High ESD rating
- 3-pin SIP, and SOT23-3 packages are available
- Operate/release points symmetrical around zero gauss
- RoHs compliant

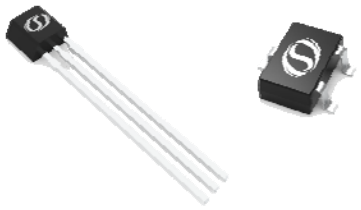
APPLICATIONS

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

DESCRIPTION

The SC1138 Hall-Effect switch series is monolithic integrated circuits with tighter magnetic specifications, designed to operate continuously over extended temperatures to +150 ℃, 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.

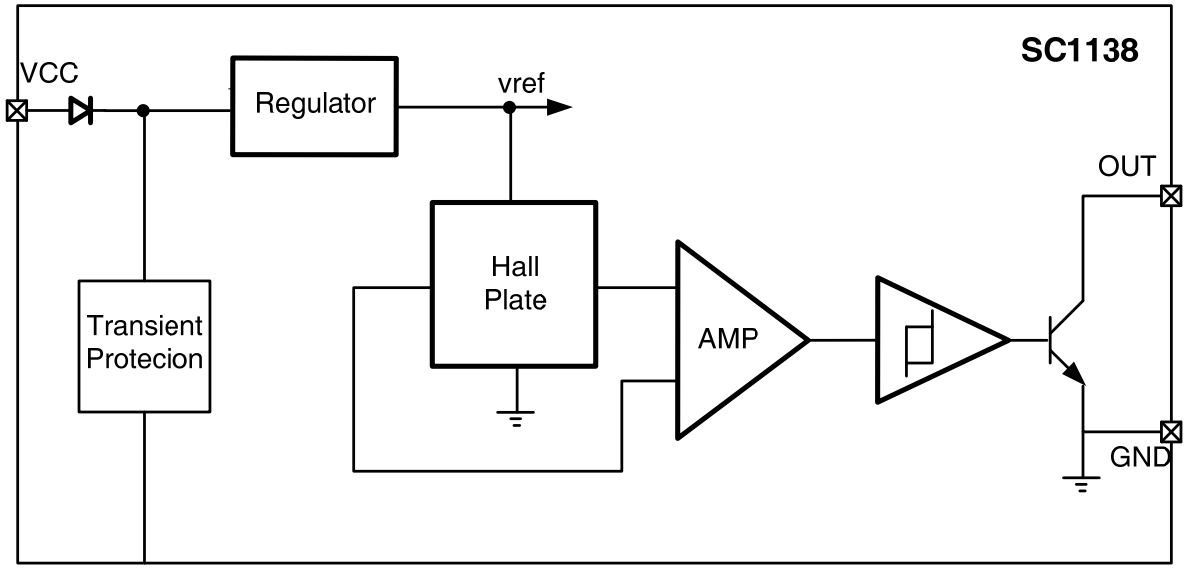
Each device includes a voltage regulator for operation with supply voltages of 3.8 to 40V volts, quadratic Hall-voltage generator, temperature compensation circuitry, small-signal amplifier, Schmitt trigger, and an open-collector output to sink up to 40mA.



CONTENTS

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.

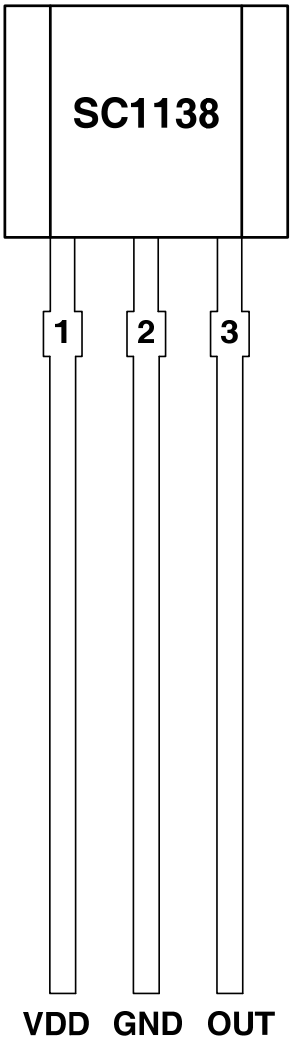


ORDERING INFORMATION

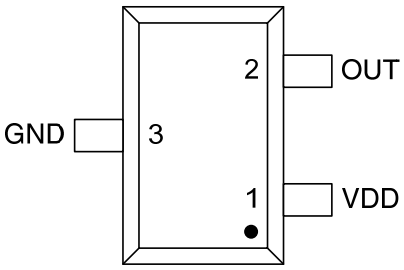
Part Number	Packing	Mounting	Ambient,T_A	Marking
SC1138UA	1000 pieces/Bag	SIP3	-40℃ to 150℃	1138
SC1138SO-N	3000 pieces/Reel	SOT23-3	-40℃ to 150℃	1138

TERMINAL DESCRIPTION

3-Terminal SIP
UA Package
(Top View)



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



Terminal			Type	Description
Name	Number			
	UA	SO		
VDD	1	1	PWR	3.8 to 40 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) [1]

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V_{CC}	-40[2]	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.

[2] Ensured by design.

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

OPERATING CHARACTERISTICS

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

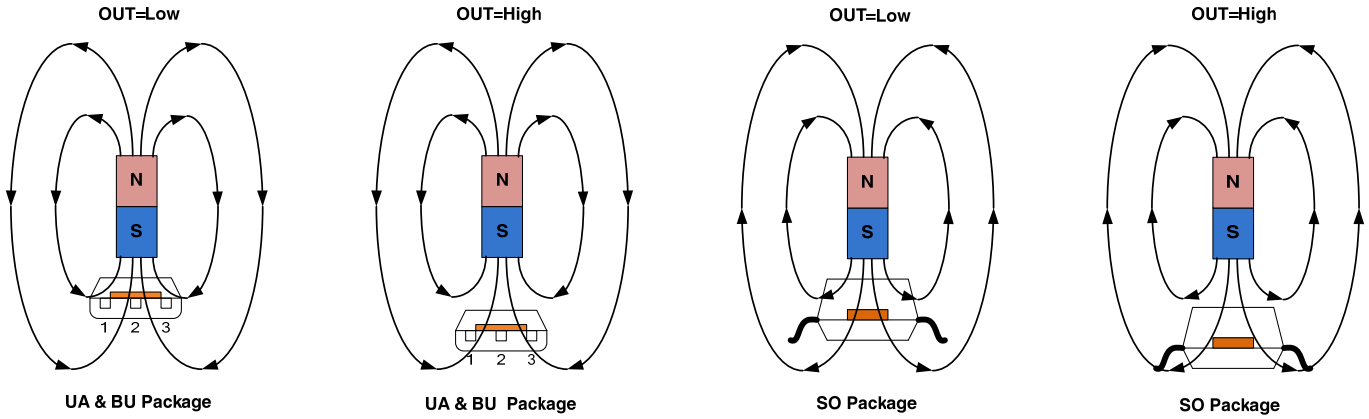
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{CC}	Operating voltage (1)	$T_J < T_{J(Max.)}$	3.8	--	40	V
V_{CCR}	Reverse supply voltage	T_A=25℃	-40	--	--	V
I_{CC}	Operating supply current	V_{CC}=3.8 to 40 V	--	4.0	10	mA
I_{QL}	Off-state leakage current	Output Hi-Z	--	--	1	μA
V_{SAT}	Output saturation voltage	I_Q=20mA, T_A=25℃	100	200	300	mV
t_r	Output rise time	R1=1Kohm Co=20pF	--	--	1.5	μS
t_f	Output fall time	R1=1Kohm Co=20pF	--	--	1.5	μS
Magnetic Characteristics						
f_{BW}	Bandwidth		--	--	100	kHz
B_{OP}	Operated point	T_A=25℃	20.0	26.0	30.0	mT(2)
B_{RP}	Release point		15.0	21.0	25.0	mT
B_{HYS}	Hysteresis	B_{OP} - B_{RP}	--	5.0	--	mT

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

(2) 1mT=10Gs

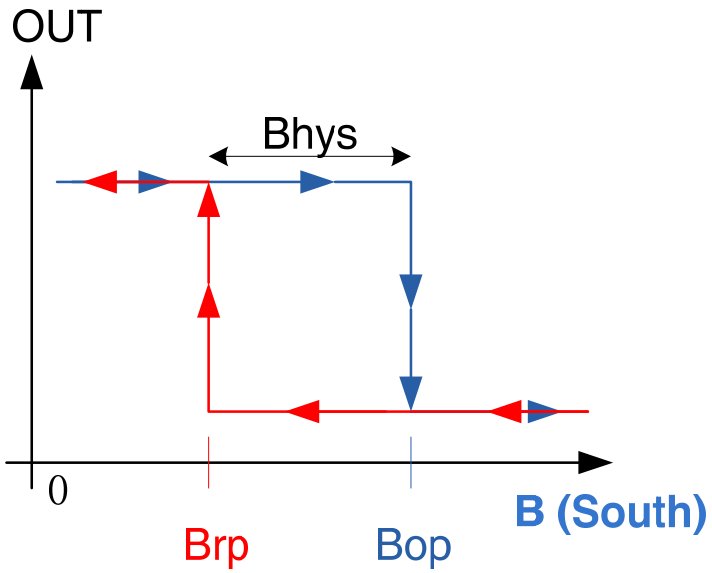
Field Direction Definition

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

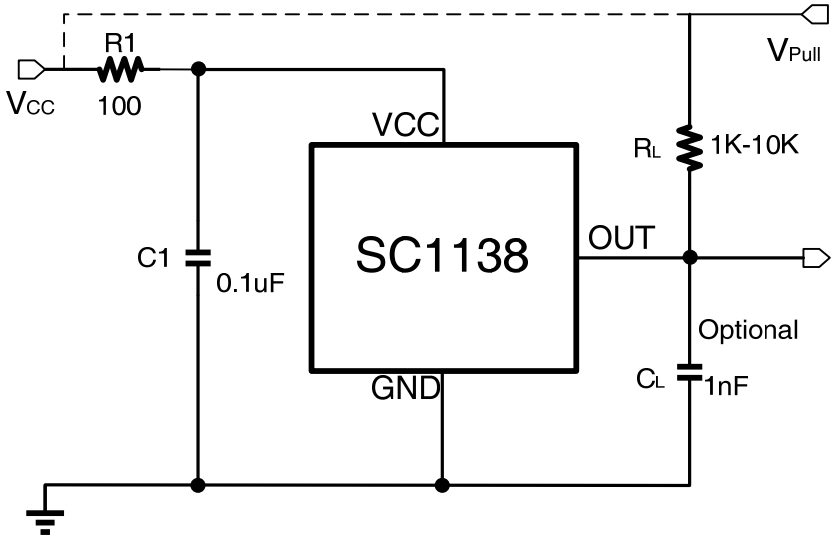


Transfer Function

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



he SC1134 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 that C1 capacitor be connected to the ground in parallel near the VDD power end of the chip, with a typical value of 0.1μF.At the same time in the external optional series resistor R1 and output capacitance C_L used for enhanced protection circuit, its typical values for 100Ω and 1 nF.

The SC1134 device output stage uses an open-drain NMOS, and it is rated to sink up to 20mA 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 value for CL based on the system bandwidth specifications as:

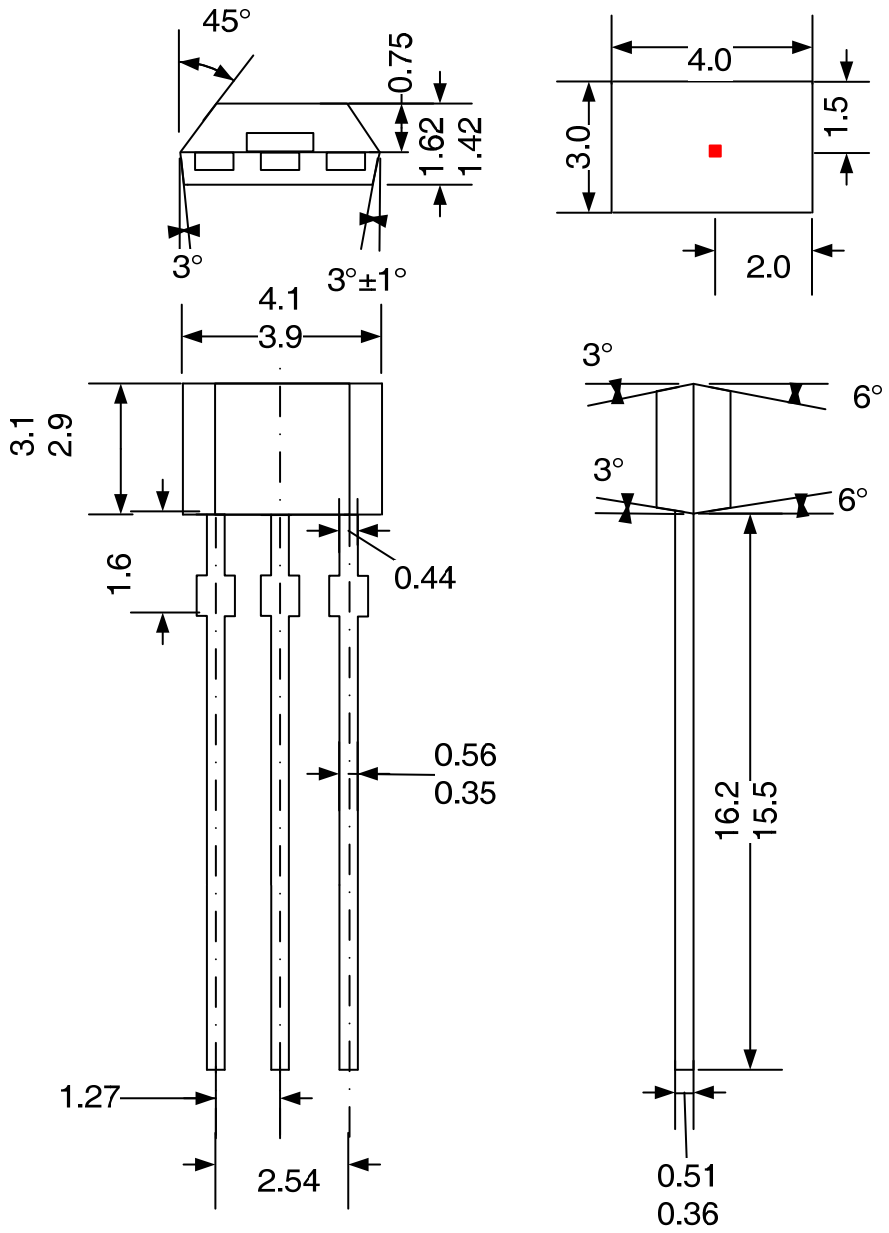
$$CL = \frac{1}{2\pi \times R \times f\ (Hz)}$$

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

PACKAGE INFORMATION(UA)

3-Terminal
UA Package

Dimension:mm



Notes:

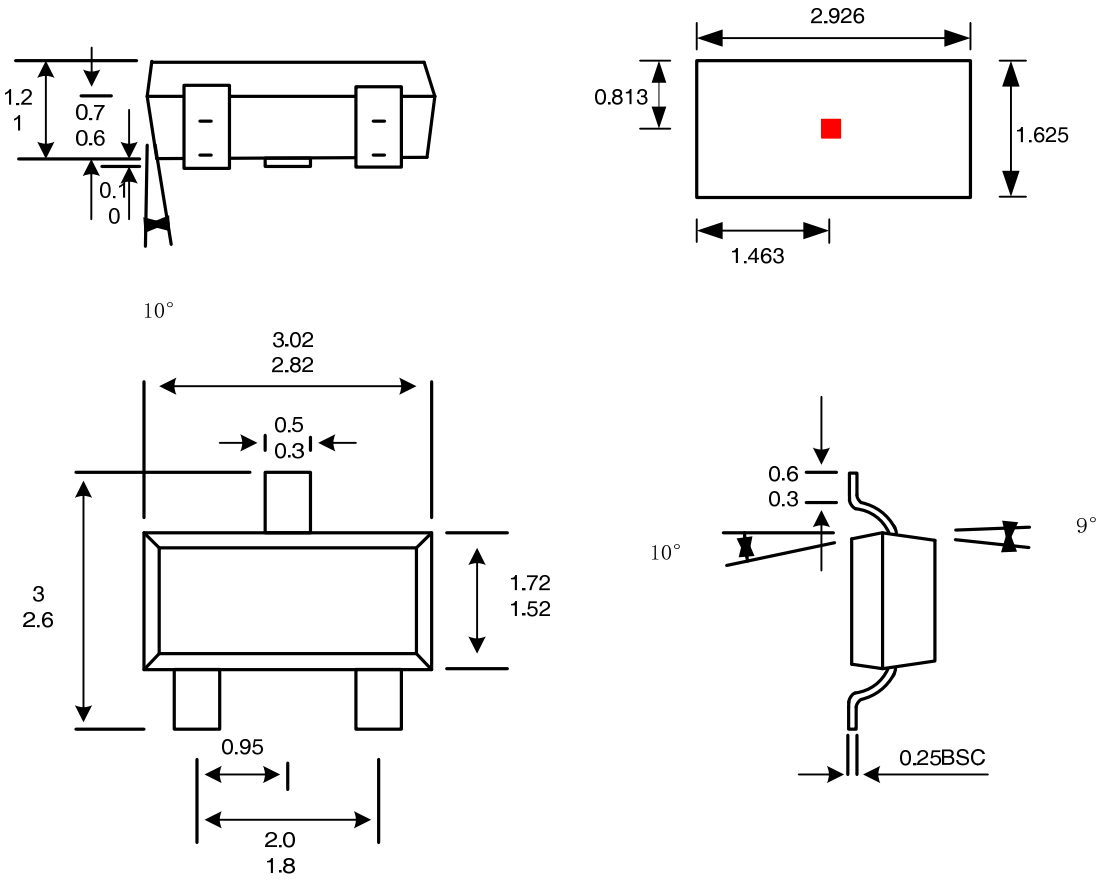
1. *Exact body and lead configuration at vendor's option within limits shown.*
2. *Height does not include mold gate flash.*

Where no tolerance is specified, dimension is nominal.

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.

REVISON HISTORY

Revision	Date	Description
RevA1.0	May-06-2020	Preliminary datasheet
RevA1.1	Nov-19-2020	Update format