

HC 41 family Bipolar Hall Effect Switch IC

DESCRIPTION

The HC 41 family is a Hall-effect latch designed in bipolar technology. The Hall IC internally includes an on-chip Hall voltage generator, a voltage regulator for operation with supply voltages of 3.8 to 30V, reverse protection diode, temperature compensation circuitry, small-signal amplifier, Schmitt trigger and an output driver with a pull-up resistor, all in a single package.

HC S41 is designed to respond to alternating North and South poles. While the magnetic flux density(B) is larger than operate point (Bop), the output will be turned on (Low), the output is held until the magnetic flux density(B) is lower than release point (Brp), then turn off (High).

HC N41 is designed to respond to alternating North and South poles. While the magnetic flux density(B) is lower than operate point (Bop), the output will be turned on (Low), the output is held until the magnetic flux density(B) is larger than release point (Brp), then turn off (High).

Thanks to its wide operating voltage range 3.8 to 30V and extended temperature range to +150°C, it is quite suitable for use in automotive, industrial and consumer applications.

The HC 41 family is delivered in variety of packages to customers: SOT-23-3L and SOT-89-3L for surface mount and TO-92S flat for through-hole mount, all are lead-free packages and RoHS compliant.

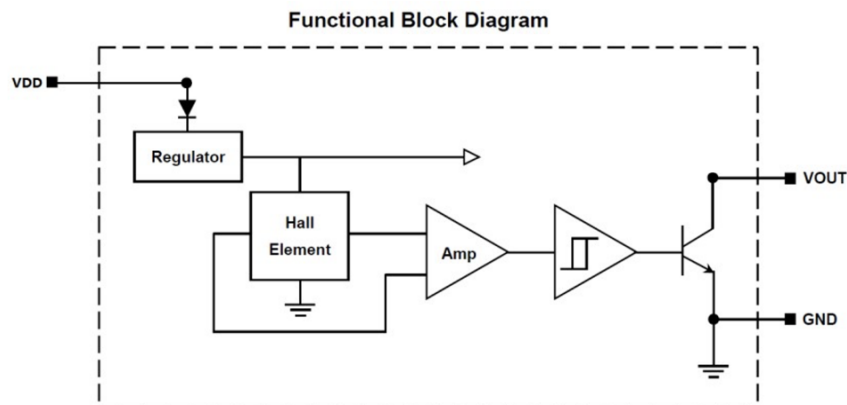
FEATURES

- Bipolar technology
- Reverse battery protection
- 3.8V to 30V operation voltage
- -40 °C to 150 °C superior temperature operation
- Collector output with 20 mA capability
- Small size lead-free SOT-23-3L, SOT-89-3L or TO-92S
- Internal pull-up resistor
- Solid-state reliability
- Resistant to physical stress
- Activate with small, commercially available permanent magnets

APPLICATIONS

- Brushless DC motor commutation
- Automotive, Consumer and Industrial
- Solid-state switch
- Speed measurement
- Revolution counting
- Angular position detection
- Magnetic Encoder

FUNCTIONAL DIAGRAM



1. Product Family Members

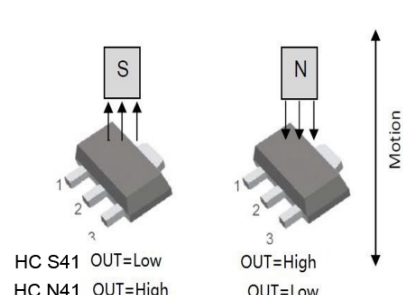
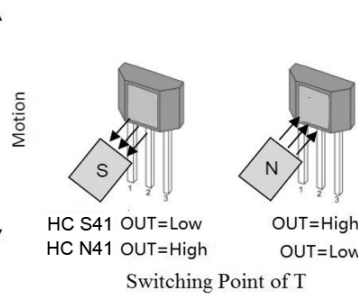
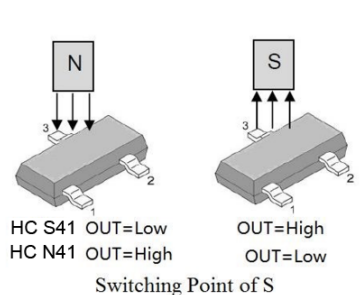
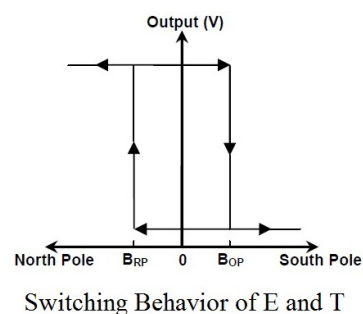
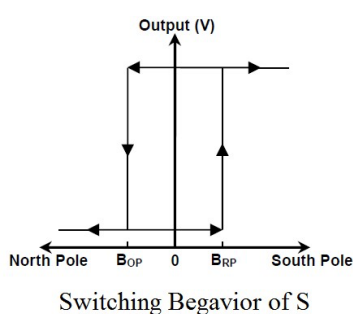
Part Number	Marking ID	Description
HC S41TB	S41	Flat TO-92S package, bulk packing (1000pcs/bag)
HC S41SR	S41	SOT-23-3L package, tape and reel packing (3000pcs/reel)
HC S41ER	S41	SOT-89-3L package, tape and reel packing (1000pcs/reel)
HC N41TB	N41	Flat TO-92S package, bulk packing (1000pcs/bag)
HC N41SR	N41	SOT-23-3L package, tape and reel packing (3000pcs/reel)
HC N41ER	N41	SOT-89-3L package, tape and reel packing (1000pcs/reel)

2. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Supply Voltage	VDD	-	40	V
Reverse Voltage	VRCC	-	-40	V
Supply Current	IDD	-	50	mA
Output Voltage	VOUT	-	40	V
Output Current	IOUT	-	50	mA
Operating Ambient Temperature	TA	-40	150	°C
Storage Temperature	TS	-50	150	°C
Junction Temperature	TJ		165	°C
Magnetic Flux	B	No Limit		Gauss

Note: Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolutemaximum-rated conditions for extended periods may affect device reliability.

3. Definition of Switching Function



Note: ← Direction of magnetic flux

4. HC S41/N41 Parameters Specification

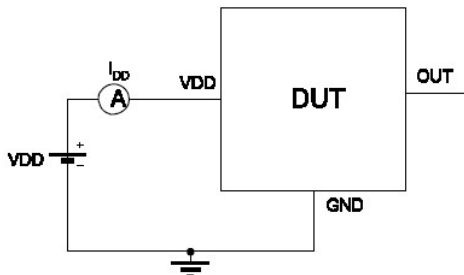
The voltages are referred to GND. $3.8V < V_{DD} < 30V$; $T_J = -40$ to $150^\circ C$, unless otherwise specified.

Symbol	Parameter	Test Condition	Min	Typ.	Max	Units	
VDD	Supply Voltage	Operating	3.8	5	30	V	
IDD	Supply Current	$B < BRP$		5	10	mA	
VDSon	Output Saturation Voltage	$I_{out} = 15mA, B > BOP$			0.4	V	
I _{OFF}	Output Leakage Current	$B < BRP, V_{OUT} = 30V$			10	uA	
T _R	Output Rise Time	$R_L = 1Kohm, C_L = 20pF$			1.5	uS	
T _F	Output Fall Time	$R_L = 1Kohm, C_L = 20pF$			1.5	uS	
F _{SW}	Maximum Switching Frequency				100	KHz	
R _{PU}	Internal Pull Up Resistor			20		Kohm	
HC S41	BOP	Magnetic Operating Point	$T_A = 25^\circ C$	5	45	100	Gauss
	BRP	Magnetic Release Point	$T_A = 25^\circ C$	-100	-45	-5	Gauss
HC N41	BOP	Magnetic Operating Point	$T_A = 25^\circ C$	-100	-45	-5	Gauss
	BRP	Magnetic Release Point	$T_A = 25^\circ C$	5	45	100	Gauss
B _{HYST}	Magnetic Hysteresis Window	$T_A = 25^\circ C, B_{OP} - B_{RP} $	50	100	130	Gauss	

5. Test Conditions

Note: DUT=Device Under Test

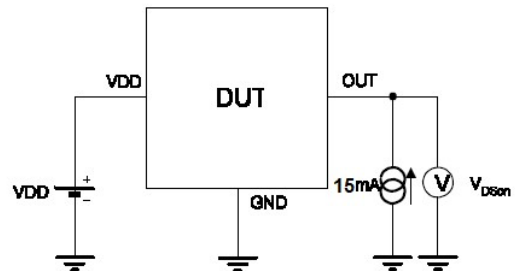
Supply Current



Note 1 - The supply current I_{DD} represents the static supply current. OUT is left open during measurement

Note 2 - The device is put under magnetic field with $B < BRP$

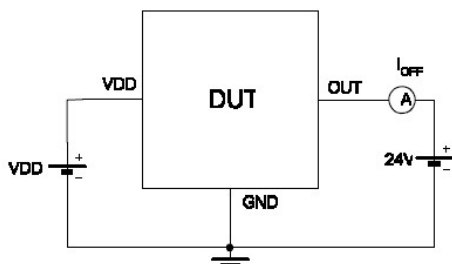
Output Saturation Voltage



Note 1 - The output saturation voltage V_{DSon} is measured at $V_{DD} = 3.8V$ and $V_{DD} = 24V$

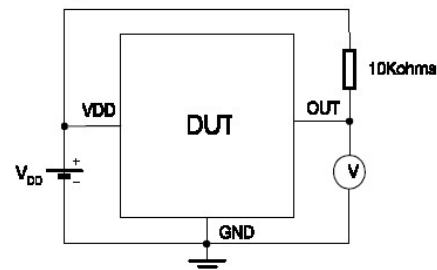
Note 2 - The device is put under magnetic field with $B > BOP$

Output Leakage Current



Note 1 - The device is put under magnetic field with $B < BRP$

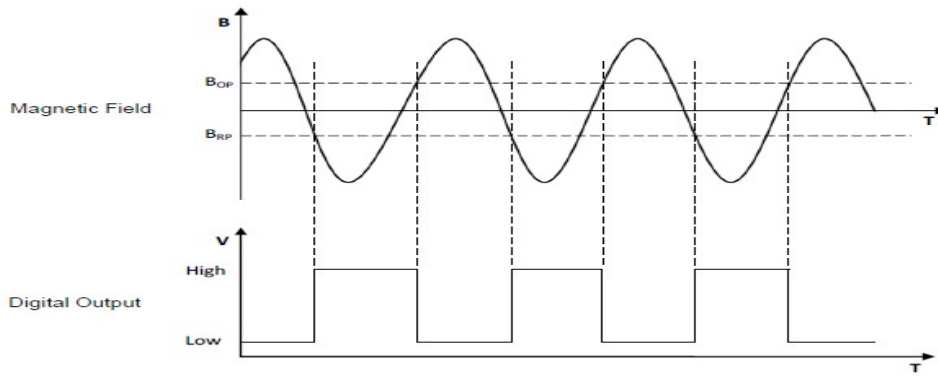
Magnetic Thresholds



Note 1 - BOP is determined by putting the device under magnetic field swept from BRP_{min} up to BOP_{max} until the output is switched on.

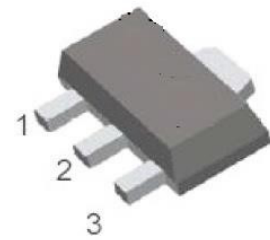
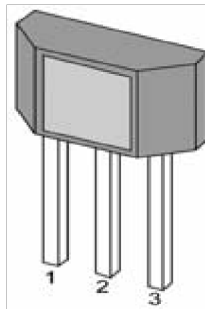
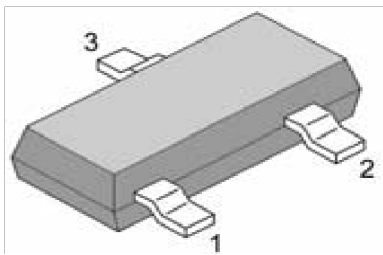
Note 2 - BRP is determined by putting the device under magnetic field swept from BOP_{max} down to BRP_{min} until the output is switched off.

6. Typical Output Waveform (The TO-92S package as an example)



7. Pin Definitions and Descriptions:

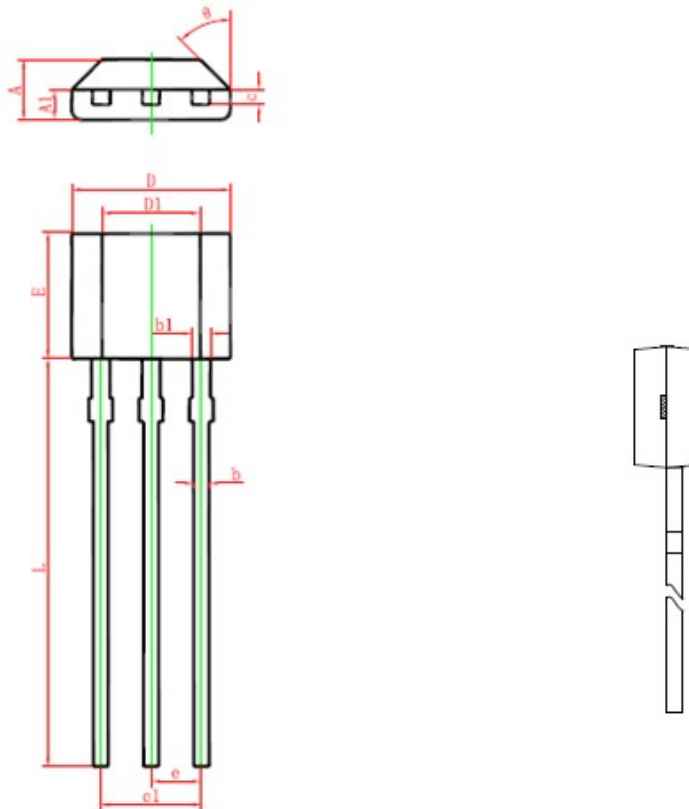
SOT-23-3L (S)	TO-92S(T)	SOT-89-3L(E)	Name	Type	Function
1	1	1	VDD	Supply	Supply Voltage pin
2	3	3	OUT	Output	Collector Output pin (include pull-up resistor)
3	2	2	GND	Ground	Ground pin



8. Package Information:

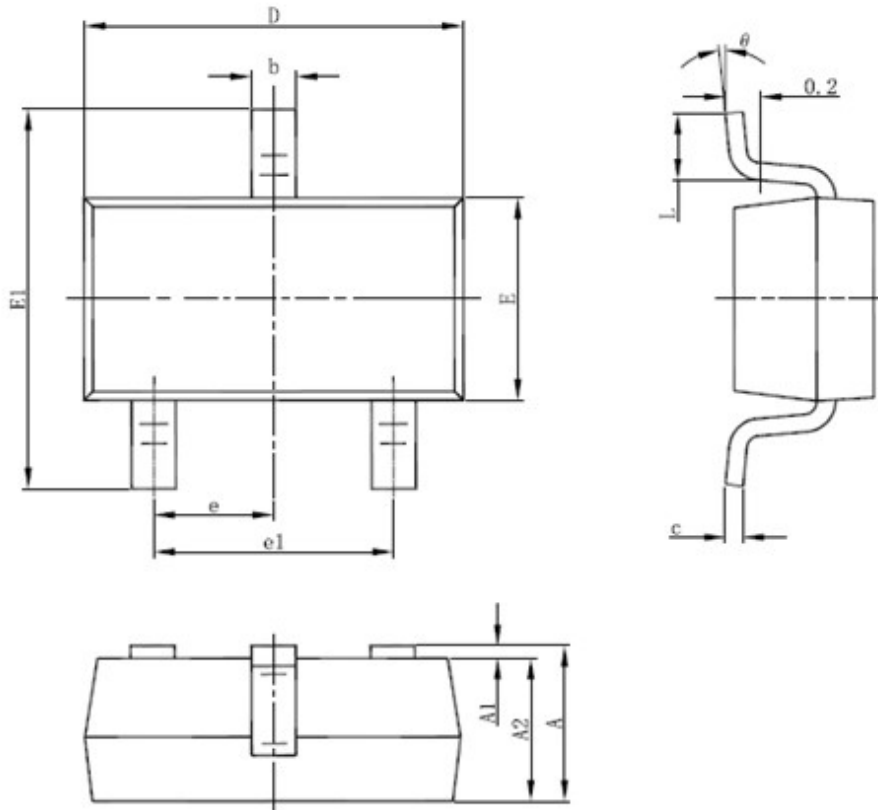
Symbol	Parameter	Test Condition	Min	Typ	Max	Units
RTH	SOT-23-3L Package Thermal Resistance			301		°C/W
	TO-92S Package Thermal Resistance			230		°C/W
	SOT-89-3L Package Thermal Resistance			230		°C/W

PACKAGE DESIGNATOR TO-92S



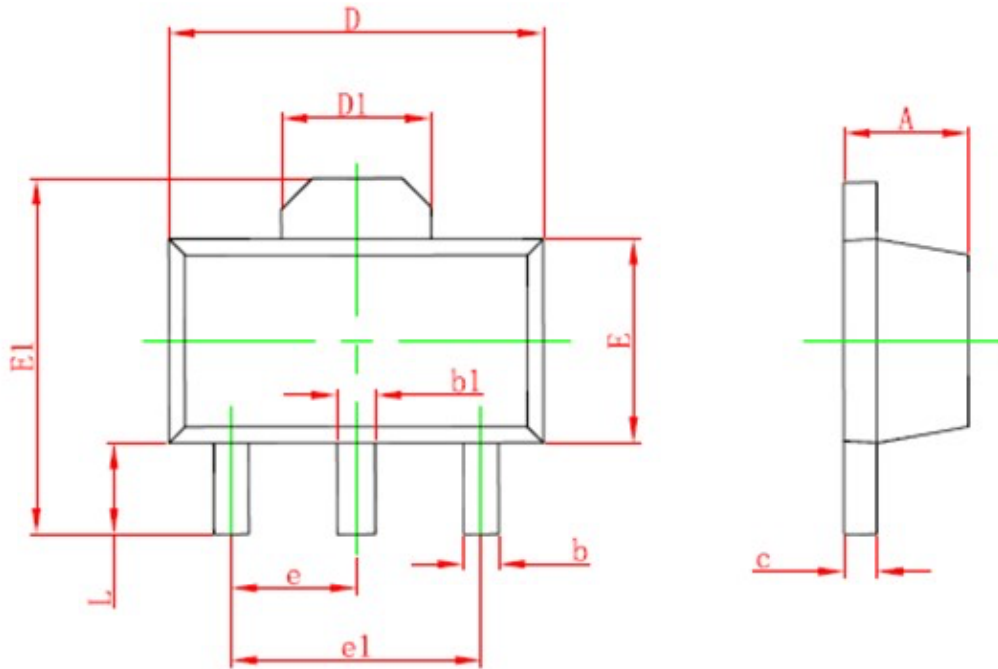
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.420	1.620	0.056	0.064
A1	0.660	0.860	0.026	0.034
b	0.350	0.480	0.014	0.019
b1	0.400	0.550	0.016	0.022
c	0.360	0.510	0.014	0.020
D	3.900	4.100	0.154	0.161
D1	2.280	2.680	0.090	0.106
E	3.050	3.250	0.120	0.128
e	1.270 TYP.		0.050 TYP.	
e1	2.440	2.640	0.096	0.104
L	15.100	15.500	0.594	0.610
θ	45° TYP.		45° TYP.	

PACKAGE DESIGNATOR
SOT-23-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

PACKAGE DESIGNATOR
SOT-89-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047