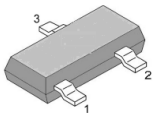
CH92

High-performance unipolar Hall switch sensors

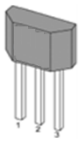
Features

- Unipolar respond to a single pole: North (CH92S) or South (CH92T and CH92E).
- Enhanced sensitivity: will operate from Brp 100 Gauss to Bop 150 Gauss typical with very good temperature-stable and stress-resistant, allowing the use of smaller, potentially lower-cost magnets or high robust application
- Wide operating voltage range of 3.3V to 30V makes these sensors useable in a wide range of applications
- Built-in reverse voltage capability enhances the protection of the sensor and the circuits with which it is used
- Robust design: will operate up to 150 °C

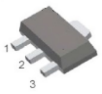
Package



SOT-23-3L

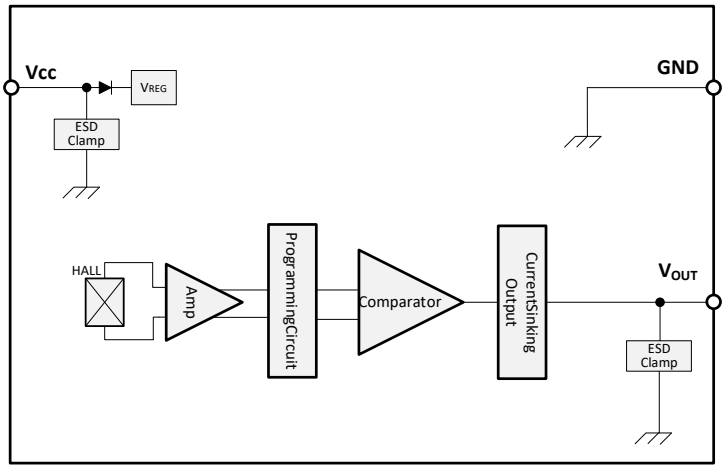


TO-92S



SOT-89

Functional Block Diagram



Applications

- Door or lid closure detection
- Printer head position sensing
- Flow-rate sensing
- Valve and solenoid valve status
- Position sensing
- Speed and RPM (revolutions per minute)

Description

The CH92S, CH92E and CH92T are small, versatile digital Hall-effect devices that are operated by the magnetic field from a permanent magnet or an electromagnet.

This unipolar sensors are designed to meet the requirements of a wide range of potential applications. These economical unipolar sensors are well suited for simple, high-volume, cost-sensitive position and motion sensing applications.

The 3.3Vdc to 30 Vdc supply voltage range allows this device to be used in very wide voltage applications.

These sensors are available in two package styles: the CH92S in the subminiature SOT-23-3L surface mount package, the CH92E in the subminiature SOT-89-3L surface mount package, the CH92T is available in the leaded, flat TO-92-style package.

The CH92S and CH92E are available on tape and reel (CH92S 3000 units per reel, CH92E 1000 units per reel), the CH92T is available in a bulk package (1000 units per bag).

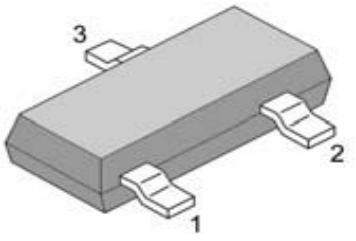
Table of Contents

1. Product Family Members

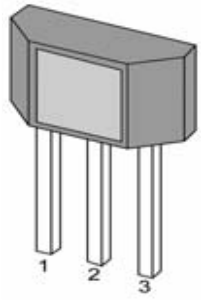
Part Number	Marking ID	Description
CH92TB	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, flat, TO-92S package, bulk packing (1000 units per bag)
CH92TB-A1	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, flat, TO-92S-A1 package, bulk packing (1000 units per bag)
CH92TB-A2	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, flat, TO-92S-A2 package, bulk packing (1000 units per bag)
CH92TB-B2	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, flat, TO-92S-B2 package, bulk packing (1000 units per bag)
CH92SR	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, SOT-23-3L package, tape and reel packing (3000 units per reel)
CH92ER	CH92	Uni-polar, Open Collector Output, Hall-effect digital sensor IC, SOT-89-3L package, tape and reel packing (1000 units per reel)

2. Pin Definitions and Descriptions

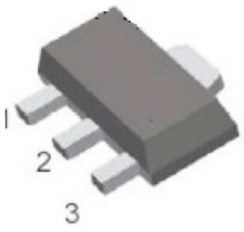
SOT-23-3L(S)	TO-92S(T)	SOT-89-3L(E)	Name	Type	Function
1	1	1	VDD	Supply	Supply Voltage pin
2	3	3	OUT	Output	Open Collector Output pin
3	2	2	GND	Ground	Ground pin



SOT-23-3L



TO-92S



SOT-89-3L

3. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Supply Voltage	V_{DD}	-	40	V
Reverse Voltage	V_{RDD}	-	-40	V
Supply Current	I_{DD}	-	20	mA
Output Voltage	V_{OUT}	-	40	V
Output Current	I_{OUT}	-	20	mA
Operating Ambient Temperature	T_A	-40	150	°C
Storage Temperature	T_S	-50	150	°C
Junction temperature	T_J	-50	165	°C
Magnetic Flux	B	No Limit		Gauss

Note 1: Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum- rated conditions for extended periods may affect device reliability.

4. ESD Protections

Parameter	Value	Unit
All pins [1)]	+/-3000	V
All pins [2)]	+/-200	V
All pins [3)]	+/-750	V

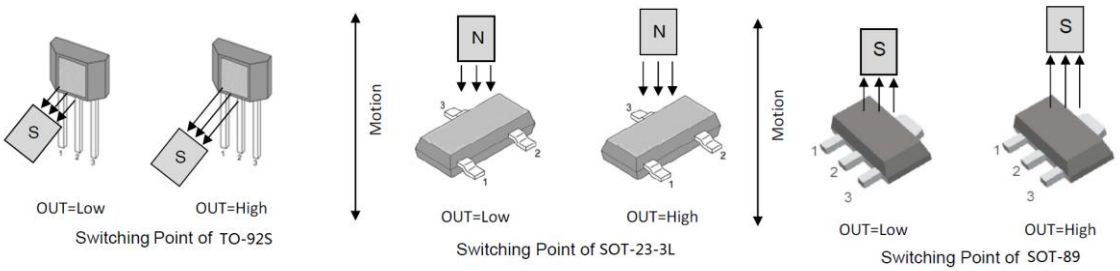
1) HBM (human body mode, 100pF, 1.5 kohm) according to MIL-STD-883H Method 3015.8
2) MM (Machine Mode C=200pF, R=0Ω) according to JEDEC EIA/JESD22-A115
3) CDM (charged device mode) according to JEDEC EIA/JESD22-C101F

5. Function Description

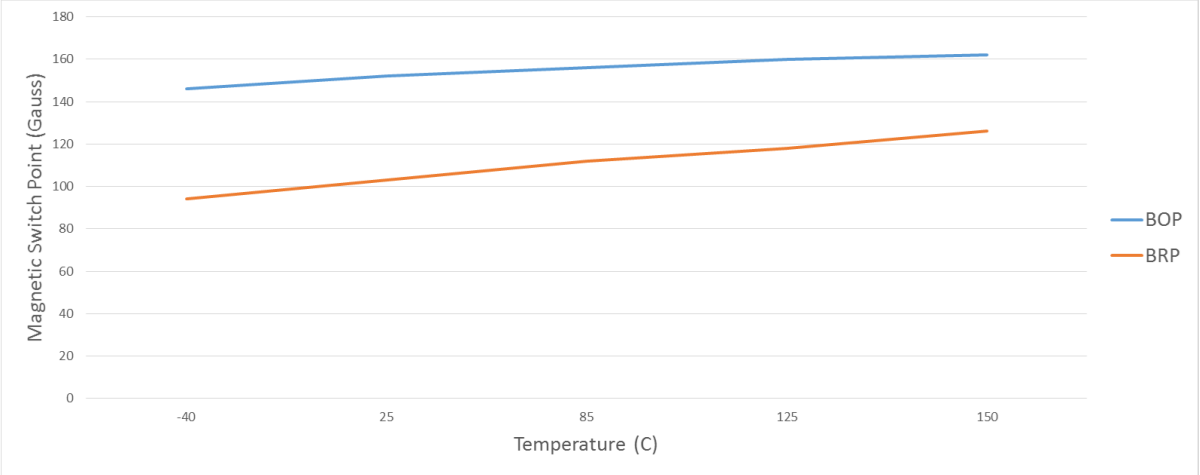
The CH92S/CH92T/CH92E exhibits unipolar magnetic switching characteristics. Therefore, it requires south or north poles to operate properly.

The device behaves as a unipolar with asymmetric operating and release switching points. This means While the magnetic flux density(B) is larger than operate point (Bop), the output will be turned on (Low), while the magnetic flux density(B) is lower than release point (Brp), then turn off (High).

6. Magnetic Activation



7. Temperature Characteristics



8. Parameters Specification

(At 3.3V to 30V supply, 20mA load, TA= -40 °C to 150 °C except where otherwise specified.)

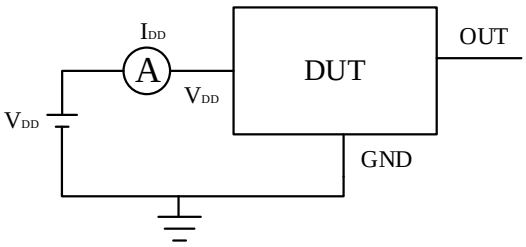
Symbol	Parameter	Test Condition	Min	Typ.	Max	Units
V_{DD}	Supply voltage	-40 °C to 150 °C	3.3	-	30	V
I_{DD}	Supply Current	V_{DD} = 5V	-	3.5	8	mA
V_{DSon}	Output saturation voltage	at 20mA, Gauss >200	-	-	0.4	V
I_{OFF}	Output Leakage Current	B<50GS	-	-	10	uA
T_R	Output rise time	V_{DD} =12V at 25 °C C_L= 20 pF	-	-	1.5	uS
T_F	Output fall time	V_{DD} =12V at 25 °C C_L= 20 pF	-	-	1.5	uS
R_{TH}	Thermal resistance: CH92S (SOT-23-3L) CH92T (TO-92S) CH92E(SOT-89-3L)	-	- - -	303 203 230	- - -	°C /W °C/W °C/W
B_{OP}	Magnetic operating point	TA=25°C	90	150	220	Gauss
B_{RP}	Magnetic release point	TA=25°C	70	100	150	Gauss
B_{HYST}	Magnetic hysteresis window	T_A=25°C $\lvert B_{OP}-B_{RP}\rvert$	20	50	70	Gauss
F_{SW}	Maximum Switching Frequency				100	KHz
T	Operating temperature		-40	-	150	°C
T_S	Storage temperature:	-	-40	-	150	°C

NOTICE
Bipolar Hall-effect sensor ICs may have an initial output in either the ON or OFF state if powered up with an applied magnetic field in the differential zone (applied magnetic field >Brp and <Bop). Cosemitech recommends allowing 10 µs for output voltage to stabilize after supply voltage has reached 5V.

NOTICE
The magnetic field strength (Gauss) required to cause the switch to change state (operate and release) will be as specified in the magnetic characteristics. To test the switch against the specified magnetic characteristics, the switch must be placed in a uniform magnetic field.

9. Test Conditions

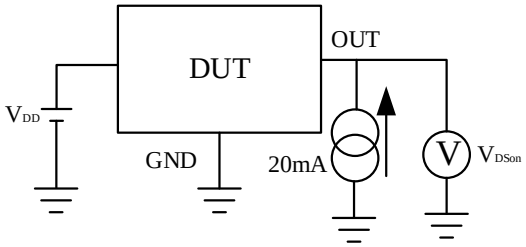
Supply Current



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 $B<B_{RP}$

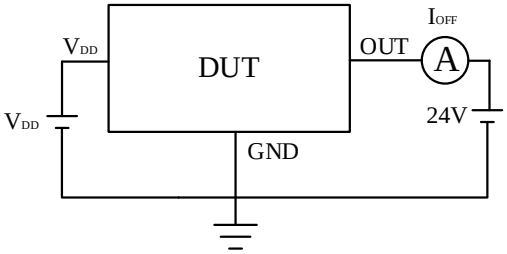
Output Saturation Voltage



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

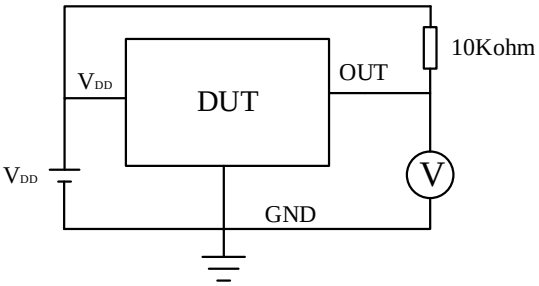
Note 2 - The device is put under magnetic field with $B>B_{OP}$

Output Leakage Current



Note 1 - The device is put under magnetic field with $B<B_{RP}$

Magnetic Thresholds



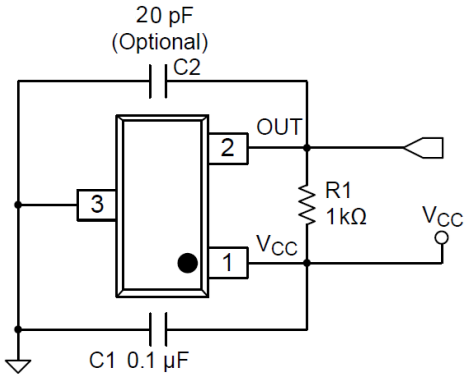
Note 1 - Bop is determined by putting the device under magnetic field swept from B_{RPmin} up to B_{OPmax} until the output is switched on.

Note 2 - BRP is determined by putting the device under magnetic field swept from B_{OPmax} down to B_{RPmin} until the output is switched off.

10. Application Information

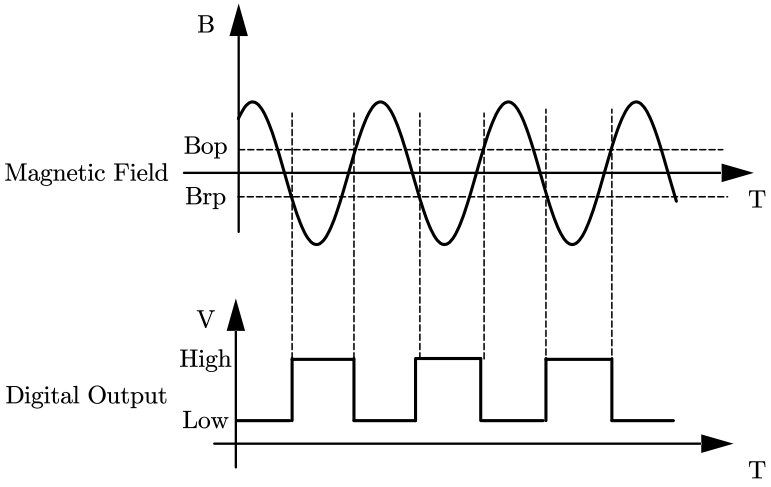
10.1. Typical Application

It is recommended that an external capacitor C1 is connected to the supply. This can reduce the noise injected into the device. Normal 0.1uF is suggested.



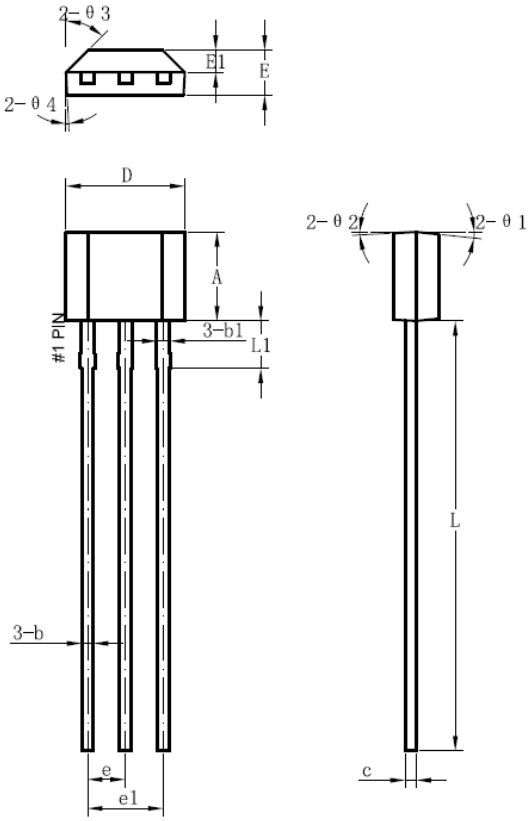
10.2. Typical Output Waveform

(The TO-92S package as an example)



11. Package Information

Package Designator
TO-92S



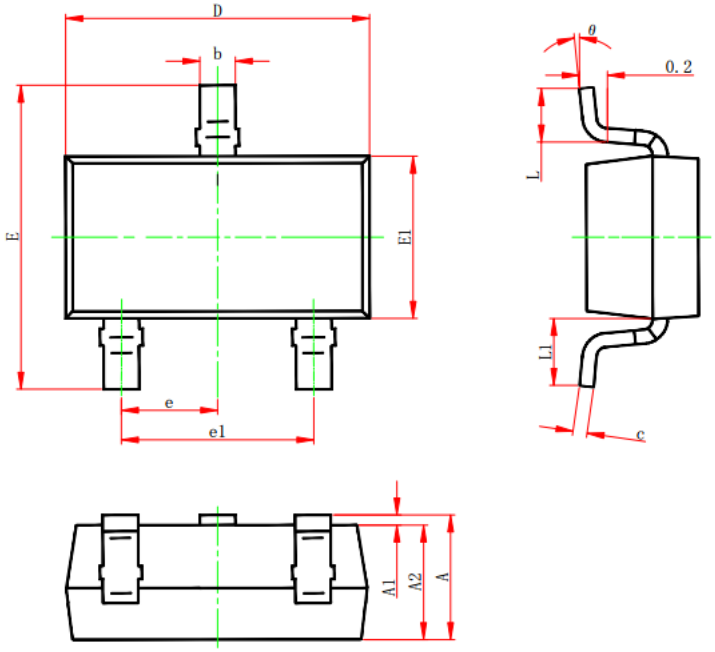
TO-92S Dimensions			
Symbol	Dimensions In Millimeters		
	Min	Typ	Max
A	2.9	3.0	3.1
b	0.35	0.39	0.56
b1		0.44	
c	0.36	0.38	0.51
D	3.9	4.0	4.1
E	1.42	1.52	1.62
E1		0.75	
e		1.27	
e1		2.54	
L	13.5	14.5	15.5
L1		1.6	
θ1		6°	
θ2		3°	
θ3		45°	
θ4		3°	

TO-92S-A1 Dimensions			
Symbol	Dimensions In Millimeters		
	Min	Typ	Min
A	3.08	3.18	3.28
b	0.38	0.44	0.56
b1		0.44	
c	0.36	0.38	0.51
D	4.0	4.1	4.2
E	1.47	1.57	1.67
E1		0.76	
e		1.27	
e1		2.54	
L	13.5	14.5	15.5
L1		2.8	
θ1		6°	
θ2		3°	
θ3		45°	
θ4		3°	

TO-92S-A2 Dimensions			
Symbol	Dimensions In Millimeters		
	Min	Typ	Min
A	3.08	3.18	3.28
b	0.38	0.44	0.56
b1		0.44	
c	0.36	0.38	0.51
D	4.0	4.1	4.2
E	1.47	1.57	1.67
E1		0.76	
e		1.27	
e1		2.54	
L	15.5	15.7	16.2
L1		2.8	
θ1		6°	
θ2		3°	
θ3		45°	
θ4		3°	

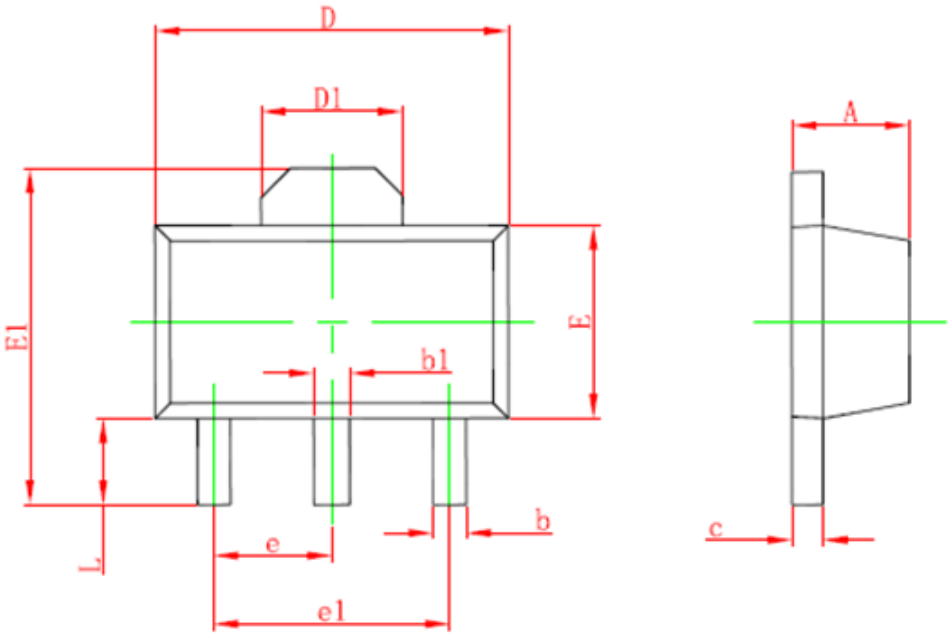
TO-92S-B2 Dimensions			
Symbol	Dimensions In Millimeters		
	Min	Typ	Min
A	2.9	3.0	3.1
b	0.35	0.39	0.56
b1		0.44	
c	0.36	0.38	0.51
D	3.9	4.0	4.1
E	1.42	1.52	1.62
E1		0.75	
e		1.27	
e1		2.54	
L	15.5	15.7	16.2
L1		1.6	
θ1		6°	
θ2		3°	
θ3		45°	
θ4		3°	

Package Designator
SOT-23-3L



SOT-23-3L Dimensions				
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



SOT-89-3L Dimensions				
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	1.550REF		0.061REF	
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

12. Revision History

Date	Revision	Change
Mar 2021	preliminary	Initial release
Mar 2022	1.0	Update Format
Jul 2023	1.1	Update Package、Functional Block Diagram、Format

13. Disclaimer

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