ChenYang
Technologies GmbH & Co. KG

CYD8945 High Reliability Hall Effect Bipolar Switch IC

The CYD8945 Hall-Effect switch, produced with ultra-high voltage bipolar technology, has been designed specifically for automotive and industrial applications etc. 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 voltage of 3.8 to 60V volts, quadratic Hall-Voltage generator, temperature compensation circuity, small-signal amplifier, Schmitt trigger, and an output driver to sink up to 60mA. Internal integrated output filter can improve the EMC capability.

FEATURES

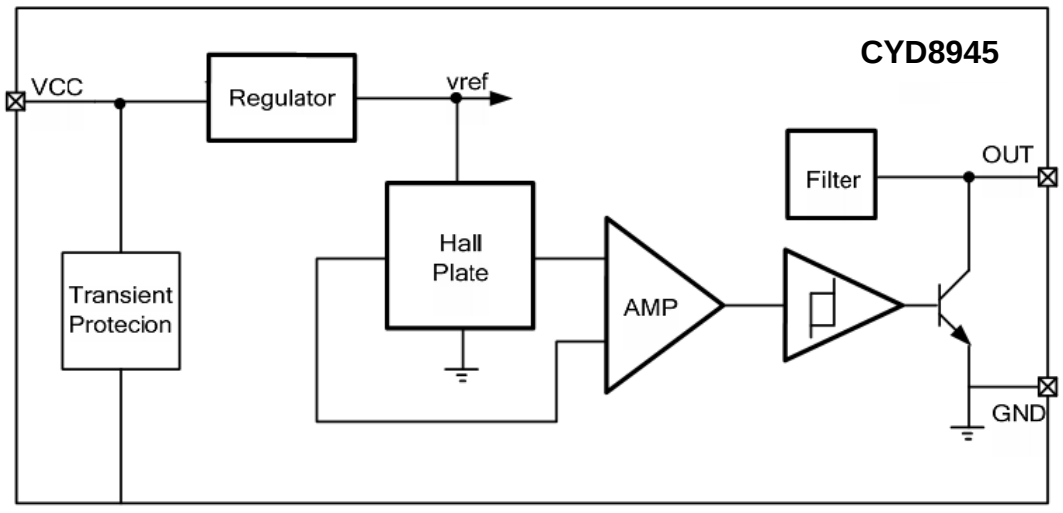
- High transient voltage protection
- Integrated output filter
- 60mA sinking capability
- High ESD rating
- RoHs compliant

TYPICAL APPLICATION

- High Sensitive Non-contact Switch
- DC Brushless Motor
- DC Brushless Fan
- Auto-motive transmission position

Functional 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 output driver. The output is protected against electrical disturbances by using of the filter block which can remove the output voltage pulse.



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ABSOLUTE MAXIMUM RATINGS

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

Parameter	Symbol	Value		Unit
		Min	Max	
Supply Voltage	Vcc	-0.5	100	V
Output terminal voltage	V_{OUT}	-0.5	100	V
Output terminal current sink	I_{SINK}	0	60	mA
Operating Temperature Range	T_A	-50	150	°C
Maximum junction temperature	T_J	-55	165	°C
Storage Temperature Range	T_S	-65	175	°C

(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.

ELECTRICAL CHARACTERISTICS

Over operating free-air temperature range (VCC =5V, unless otherwise noted)

Parameter	Test Condition	Symbol	Value			Unit
			Min	Typ	Max	
Supply Voltage (1)	$T_J < T_{J\,(Max.)}$	V_{CC}	3.8	-	60	V
Supply current	Vcc=3.8V～60V open-collector	I_{CC}	-	4.0	10	mA
Output Low Voltage	I_Q=20mA, T_A=25°C	V_{OL}	0.1	0.15	0.2	V
Output Leakage Current	Vo=Vccmax, B≤B_{RP}	I_{OH}	-	-	1.0	μA
Output Rise time	Vcc=12V, R_L=820Ω C_L=20pF	t_r	-	-	1.5	μs
Output Fall time		t_f	-	-	1.5	μs
Frequency Bandwidth		f_{BW}	-	-	100	kHz

Magnetic Characteristics (Unit: mT)

Parameter	Test condition	Value			Unit
		Min	Typ	Max	
Operate Point (B_{OP})	UA Package, TA=25℃	2.5	10	18.5	mT(2)
Release Point (B_{RP})		-18.5	-10	-2.5	
Hysteresis (B_H)		-	20	-	

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

(2) 1mT=10Gs

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ESD Protection

Human Body Model (HBM) tests according to: standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	Unit
ESD-Protection	V_{ESD}	-8	8	kV

Thermal Characteristics

Parameter	Symbol	Test Conditions	Rating	Unit
UA Package thermal resistance	R_{QJA}	Single-layer PCB, with copper limited to solder pads	166	°C/W

Field Direction Definition

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

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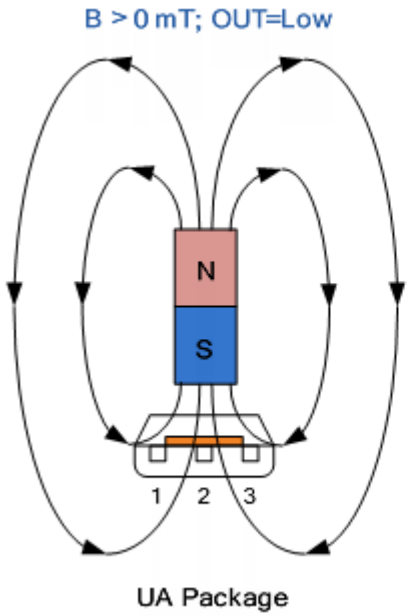
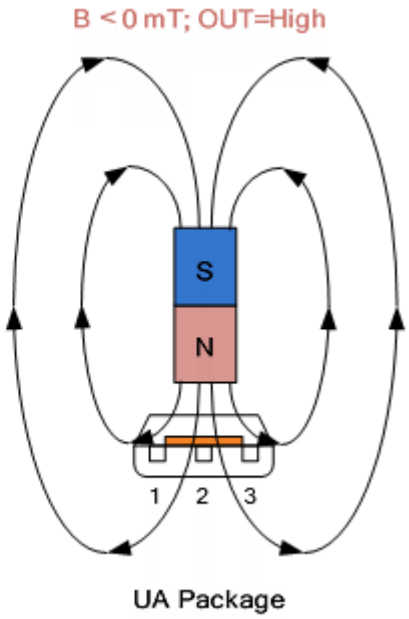


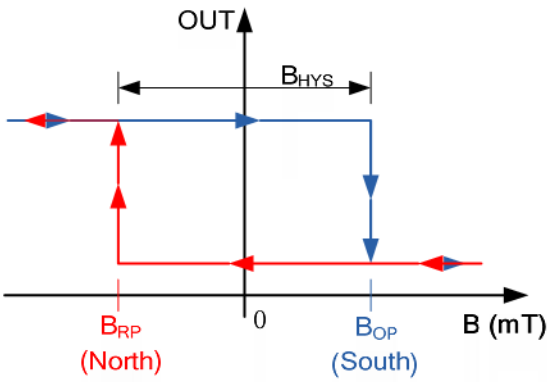
UA Package



UA Package

Transfer Function

Powering-on the device in the hysteresis region, less than BOP and higher than BRP, allows an indeterminate output state. The correct state is attained after the first excursion beyond BOP or BRP. If the field strength is greater than BOP, then the output is pulled low. If the field strength is less than BRP, the output is released.



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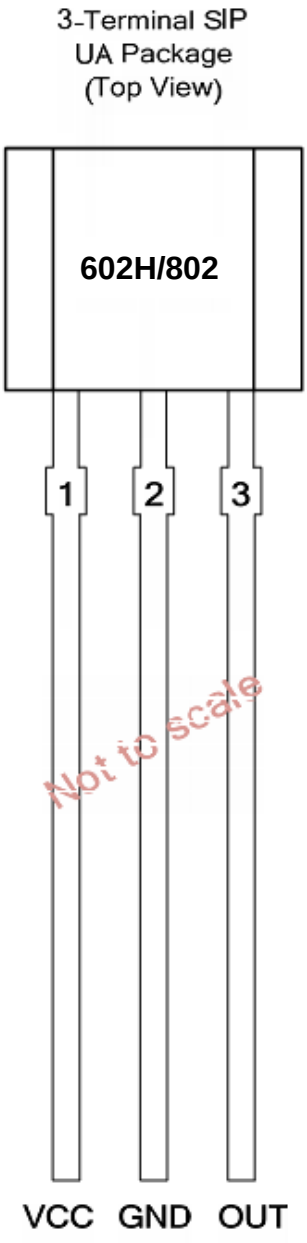
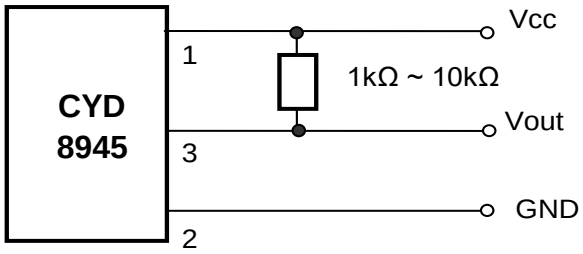
Pin Description and Sensor Connection



Sensor Connection



Cautions:

1) It is possible that outside mechanical stress affects the operating point and the release point of Hall-effect circuit, therefore, mechanical stress should be lessened as far as possible in the process of assembly;
2) Pay attention to the soldering temperature (<260°C) at the leads; keep it lower in a short time (<3s) to guarantee good soldering quality.

Pin number	Symbol	Type	Description
1	Vcc	Power	3.8 to 60 V power supply
2	GND	Ground	Ground terminal
3	OUT	Output	Open-collector output required a pull-up resistor

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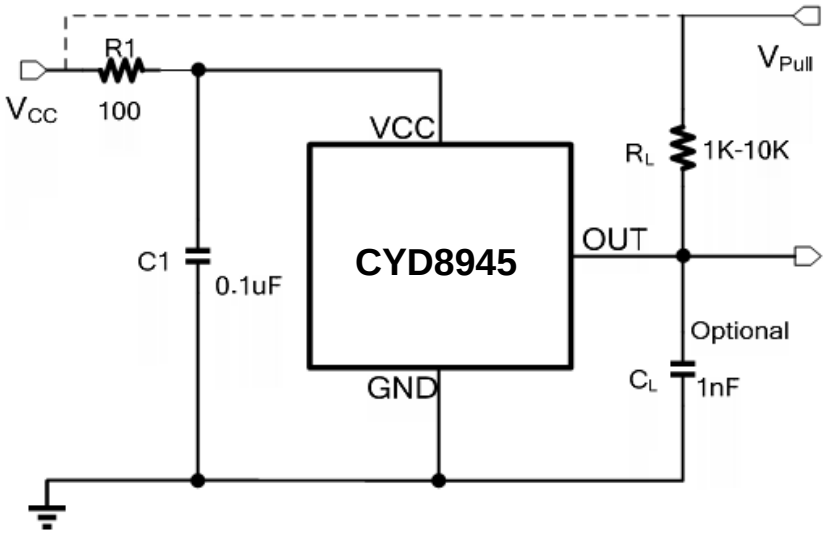
Typical Application



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The CYD8945 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 CYD8945 device output stage uses an open-drain NPN transistor, and it is rated to sink up to 50mA 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 C_L based on the system bandwidth specifications as:

$$2 \times f\ (Hz) = 1 / (2\pi \times R \times C)$$

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.

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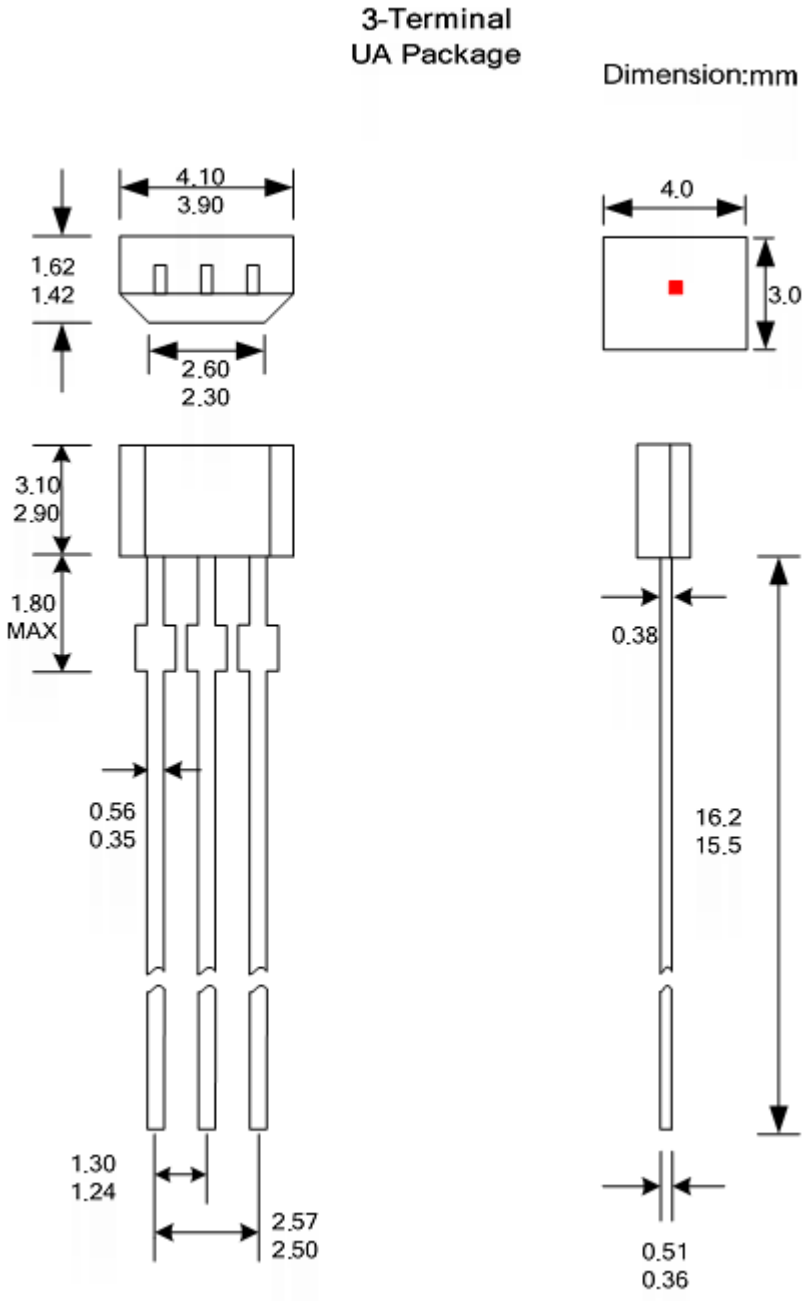
Package Outline Drawing (Unit: mm)



Notes

1. Exact body and lead configuration at vender's option within limits shown.
2. Height doesn't include mold gate flash
   Where no tolerance is specified, dimension is normal.

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