High-voltage bipolar latching/built-in pull-up resistor/high sensitivity Hall Switch CYD402F

The CYD402F is a high-voltage bipolar latching switch IC. The chip consists of a voltage regulator unit, a Hall voltage generator, a differential amplification circuit, a temperature compensation circuit, and open collector output with a built-in pull-up resistor (10kΩ) etc. The input is magnetic induction strength and the output is a digital voltage signal. It is resistant to high voltage shocks and has excellent noise resistance. Operating temperatures range is -40°C to 150°C and operating voltages from 3.8V to 60VDC, driving current up to 30mA. It is suitable for a variety of consumer electronics, automotive and industrial control and other fields. It is available in both TO92S and SOT23-3L packages, all of which are RoHS compliant.

Features

- Operating voltages range 3.8V~ 60V
- Overvoltage protection capacity 80V
- ESD performance up to ±4kV
- Built-in pull-up resistor 10kΩ
- Operating temperature -40°C~150°C
- Suitable for automotive and extreme industrial environments
- TO92S and SOT23-3L packages

Applications

- Brushless DC motors
- Speed measurement
- Counting
- Angle position detection
- Proximity detection
- Home applications
- Home safety etc.

Specifications

Absolute Maximum Ratings (T_A=25°C)

Parameter	Symbol	minimum	maximum	Unit
Maximum supply voltage	V_{DD}	-0.5	80	V
Output voltage	V_{OUT}	-0.5	80	V
Output current	I_{OUT}	0	40	mA
Operating temperature	T_A	-40	150	°C
Storage temperature	T_S	-50	165	°C

Electrical Characteristics (T_A=25°C, V_{SUP}=5VDC)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}		3.8		60	V
Supply current	I_{DD}	Output open		4.8	8	mA
Output Leakage current	I_{OLEAK}				10	μA
Saturation output voltage	V_{SAT}	I_{OUT}=20mA			0.4	V
Output current	I_{OUT}				30	mA
Output rise time	T_r	C_L=20pF			1.0	μs
Output fall time	T_f	C_L=20pF			1.5	μs

Magnetic Characteristics (T_A=25°C, V_{SUP}=5VDC)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Operating point	B_{OP}	C_L=20pF	10	25	40	G
Release point	B_{RP}	C_L=20pF	-40	-25	-10	G
Hysteresis	B_{HYS}			50		G

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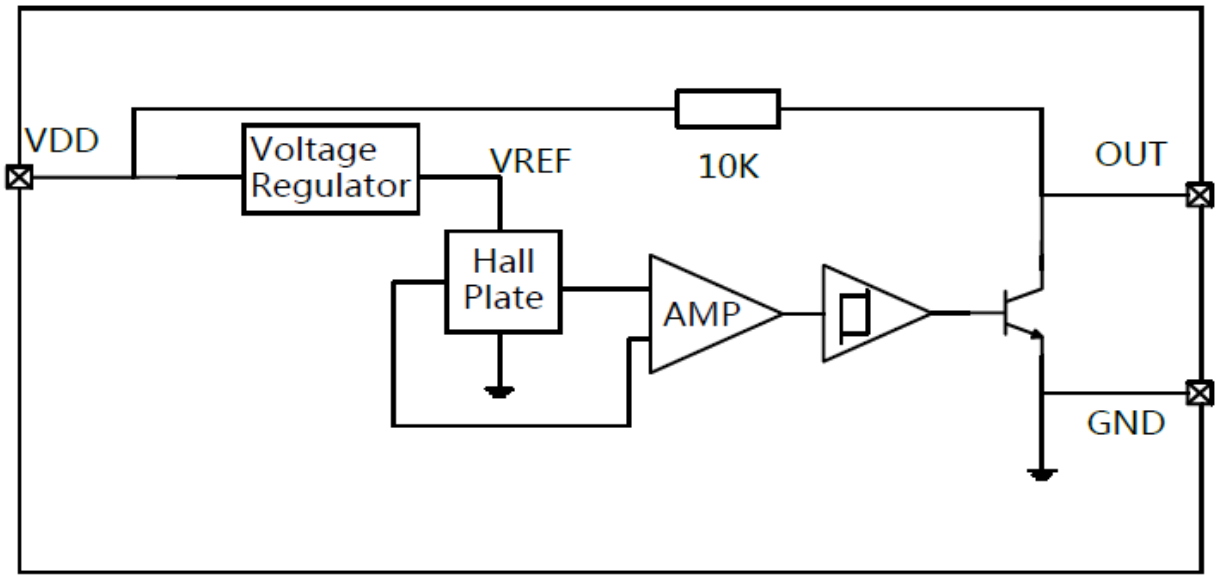
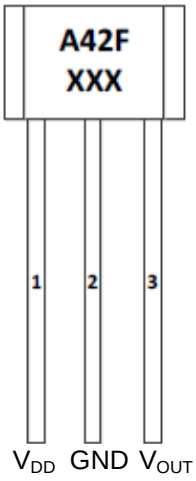
Functional Diagram

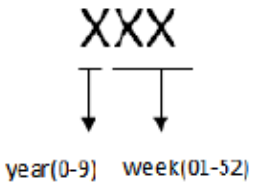
The magnetic sensor includes a voltage modulation circuit, a Hall plate, a signal amplification circuit, and a Schmitt trigger circuit. Among them, the voltage modulation circuit provides a reference voltage for the Hall plate, which senses a magnetic field perpendicular to the surface of the sensor to generate the Hall voltage, which is amplified and converted into an impulse output signal by the Schmitt trigger. Additionally a pull-up resistor is integrated inside the chip. The architecture block diagram is shown below.

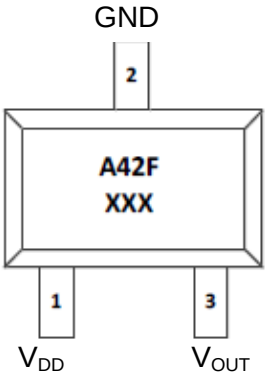


Pin Arrangement



TO92S





SOT23-3L

TO92S pin	SOT23-3L pin	Name	description
1	1	V_{DD}	Power supply
2	2	GND	Ground
3	3	V_{OUT}	Open collector output with a pull-up resistor 1okΩ

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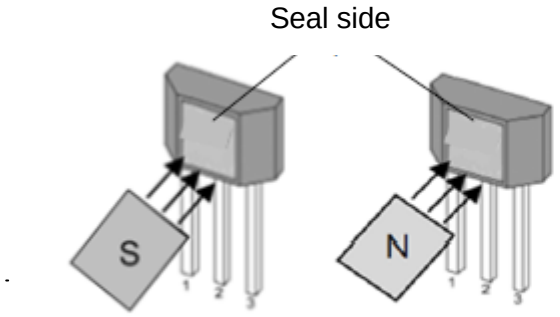
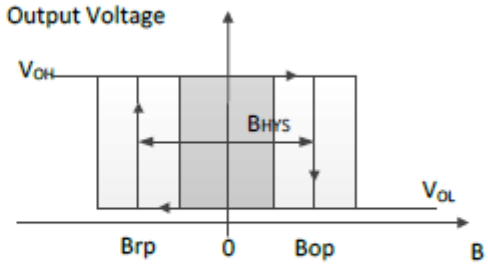
Magnetic conversion instructions

Applying a South Pole magnetic field greater than Bop (Antarctic proximity) to the seal side of the TO92S package, the output becomes low; while a North Pole field near to the seal side the output becomes high. When the IC is first powered on, if the magnetic field is between Bop and Brp, the output state will be in an undefined state (high or low).

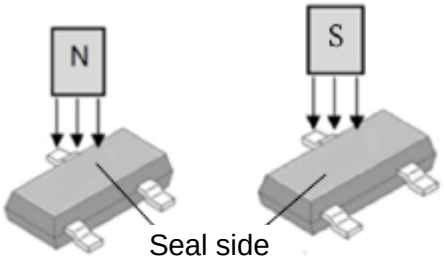
The magnetic field polarity of the SOT23-3L package is the opposite of that of the TO92S. See figure below.



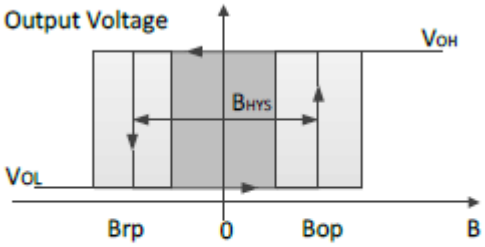
V_{OUT} = Low V_{OUT} = High



Output of TO92S package



V_{OUT} = Low V_{OUT} = High



Output of SOT23-3L package

Note:

Hall switch IC is a sensitive device and should be used and stored with care for electrostatic protection. The mechanical stress applied to the device housing and leads should be minimized during installation and use. It is recommended that the welding temperature should not exceed 350°C and the duration should not exceed 5 seconds. In order to ensure the safety and stability of Hall IC, it is not recommended to use out of parameter range for a long time.

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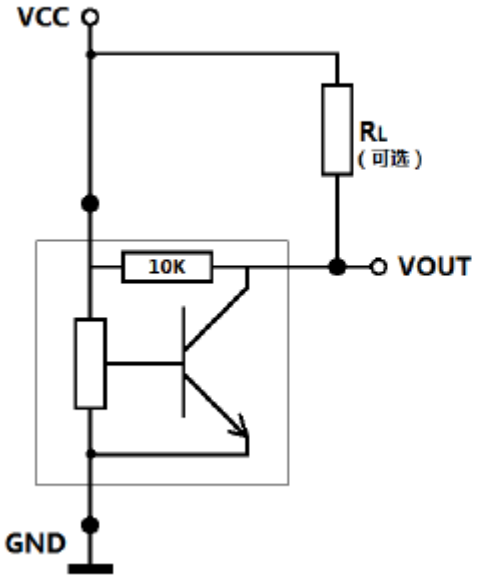
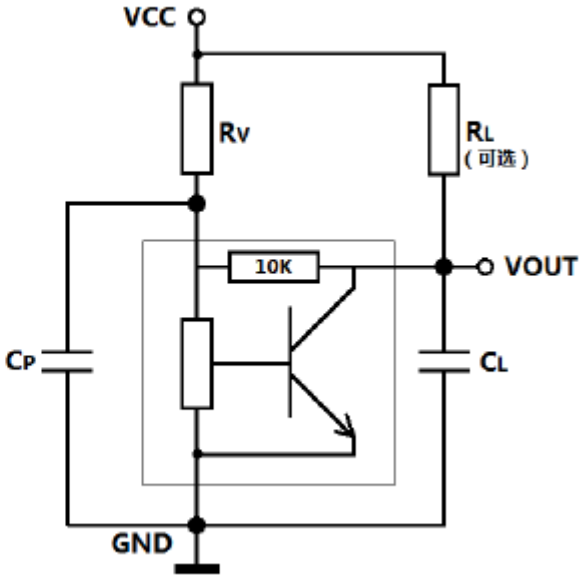
Application Circuits

Typical application circuits are shown in the following figures. For application circuit 1 R_L is optional. For applications with interference or radiation interference on the power supply line, build the series resistor R_V and the two capacitors C_P and C_L, which are placed as close to the sensor as possible, as shown in the figure below.





NOTE: **Recommend values**

RV: 100Ω
C_P: 4.7nF
C_L: 1nF
R_L: optional

Order Information

Part number	Package	Packing	Working temperature
CYD402FUA	TO92S	1000pcs/bag	-40°C ~ 150°C
CYD402FLH	SOT23-3L	3000pcs/reel	-40°C ~ 150°C

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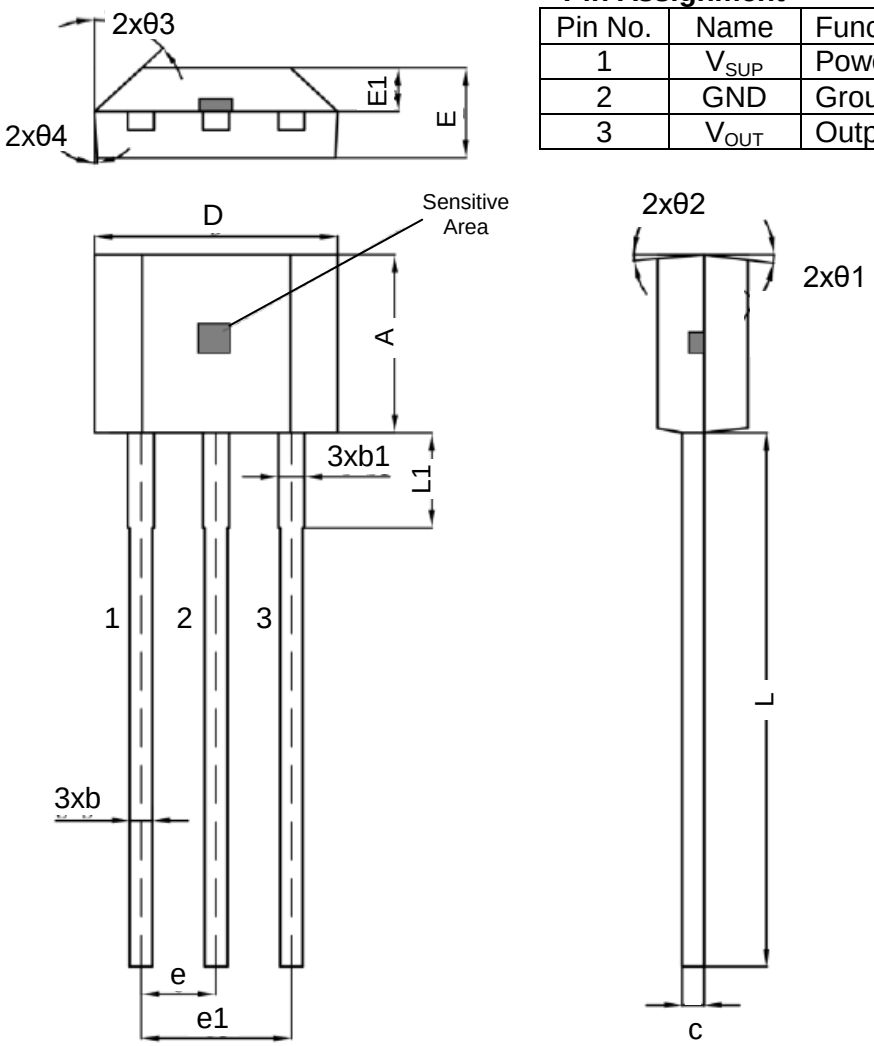
Package Outline TO92S (UA)



Pin Assignment

Pin No.	Name	Function
1	V_{SUP}	Power supply
2	GND	Ground
3	V_{OUT}	Output

Symbol	Size (mm)			Size (in inches)		
	Min.	typ.	Max.	Min.	typ.	Max.
A	2.90	3.00	3.10	0.114	0.118	0.122
b	0.35	0.39	0.40	0.014	0.015	0.016
b1		0.44			0.017	
c	0.36	0.38	0.40	0.014	0.015	0.016
D	4.00	4.10	4.20	0.157	0.161	0.165
E	1.42	1.52	1.62	0.056	0.060	0.064
E1		0.75			0.030	
e		1.27			0.050	
e1		1.27			0.050	
L1		2.54			0.100	
L	13.5	14.5	15.5	0.531	0.571	0.610
θ1		6°			6°	
θ2		3°			3°	
θ3		45°			45°	
θ4		3°			3°	

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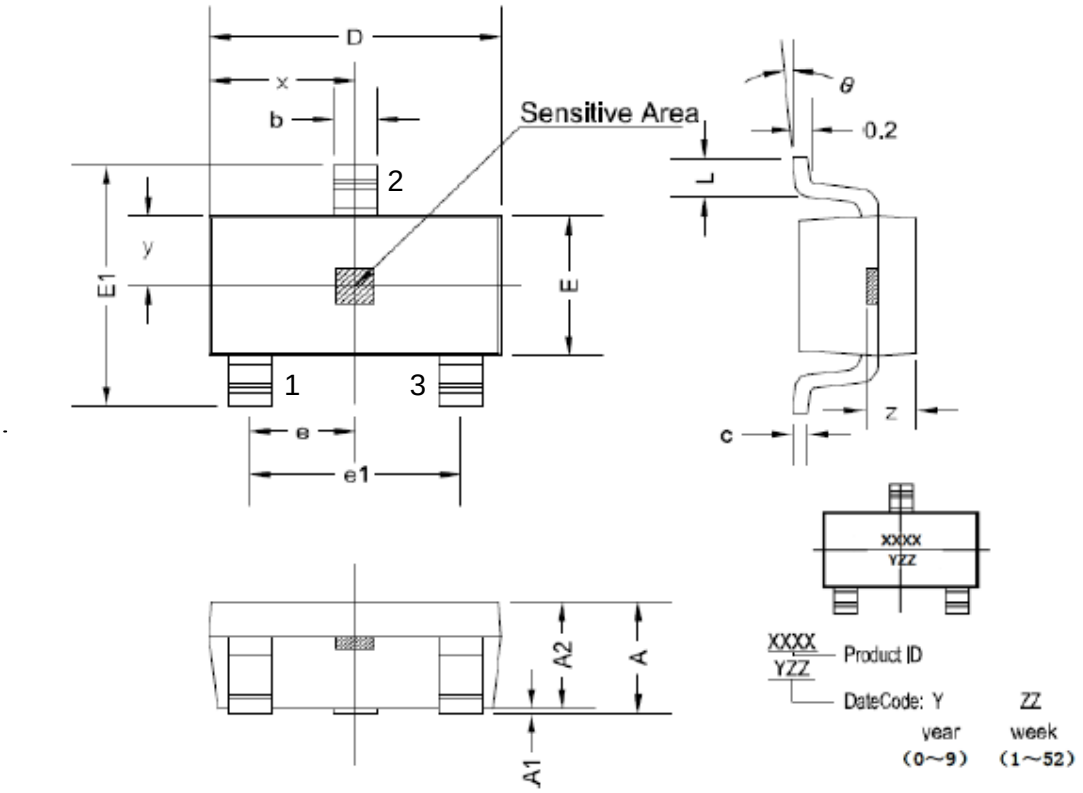
Package Outline
SOT23-3L(LH)

Pin Assignment

Pin No.	Name	Function
1	Vcc	Power supply
2	GND	Ground
3	V_{OUT}	Output



Symbol	Size (mm)		Size (in inches)	
	Min.	Max.	Min.	Max.
A	1.05	1.25	0.041	0.049
A1	0	0.10	0	0.004
A2	1.05	1.15	0.041	0.045
b	0.30	0.50	0.012	0.020
c	0.10	0.20	0.004	0.008
D	2.82	3.02	0.111	0.119
E	1.50	1.70	0.059	0.067
E1	2.65	2.95	0.104	0.116
e	0.95 typ.		0.037 typ.	
e1	1.80	2.00	0.071	0.079
L	0.30	0.60	0.012	0.024
x	1.46 typ.		0.057 typ.	
y	0.80 typ.		0.032 typ.	
z	0.60 typ.		0.024 typ.	
θ	0°	8°	0°	8°

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