

High Voltage Hall Effect Switch Sensor

Introduction

HK401, designed with Bipolar technology, includes on-chip Hall element voltage generator, a voltage regulator for operation with supply voltages of 3.8 to 60V, reverse voltage protection, temperature compensation circuitry, small-signal amplifier, Schmitt trigger and an open-collector output.

The sensor is designed to respond to North and South poles. While the magnetic flux density(B) is larger than operate point Bop, the output will be turned on with low output level. Then the output is held until the magnetic flux (B) is lower than release point Brp. The output will be turned off with high output level.

HK401 offers a variety of packages, including TO-92, SOT-23. All packages are RoHS compliant.

Features

- Miniature construction
- High sensitivity of +/-55 Gauss (typ.)
- Wide voltage range of 3.8 Vdc to 60 Vdc
- Temperature range of -40 °C to 150 °C
- Highest ESD performance up to ±4 kV
- Open Collector Output

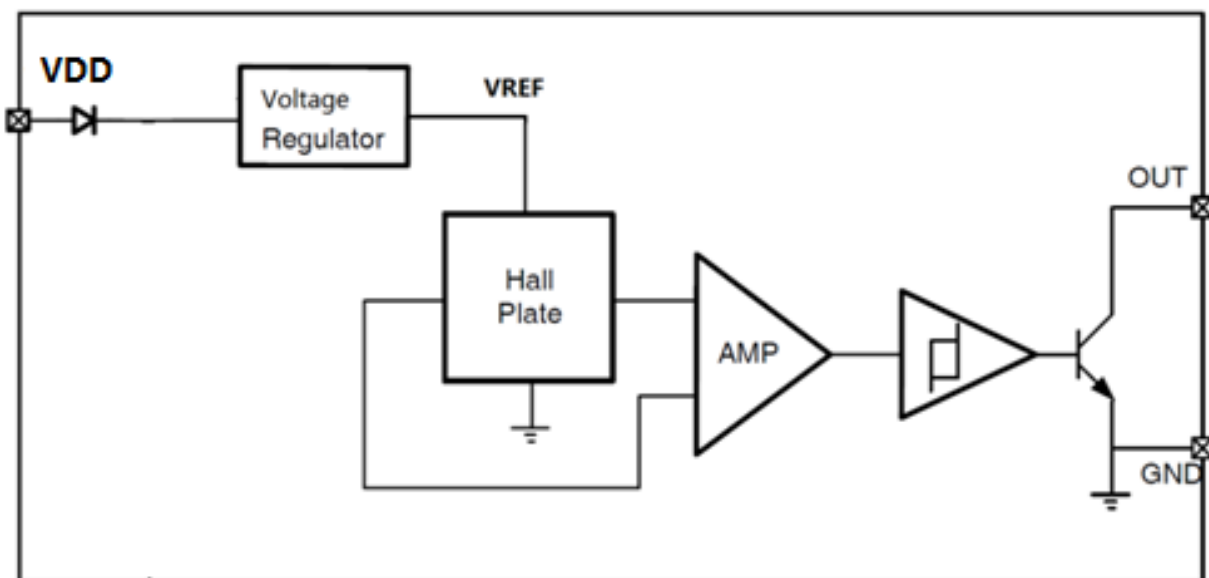
Applications

- BLDC Motor Commutation
- Flow sensor
- Position sensor
- Speed sensor
- Proximity sensor

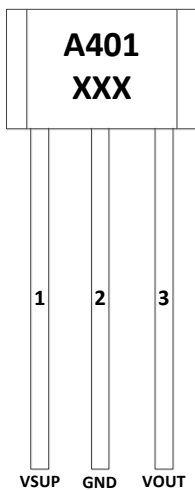
High Voltage Hall Effect Switch Sensor

Function diagram

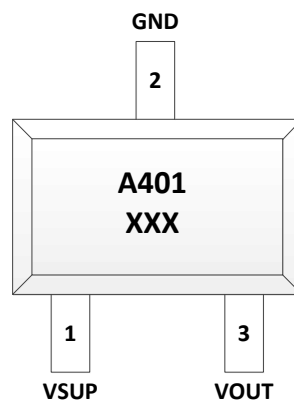
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Pin orientation



TO92S



Sot23-3L

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Ordering information

| Part number | Package | Packing | Ambient, T _A |
|-------------|---------|-----------------------------|-------------------------|
| HK401UA | TO92S | Bulk, 1000 pieces/bag | -40°C to 150°C |
| HK401SU | SOT23 | Tape&Reel, 3000 pieces/reel | -40°C to 150°C |

Pin assignment

| SOT23-3LPin number | TO92SPin number | Name | Function |
|--------------------|-----------------|------|---|
| 1 | 1 | VSUP | Power supply |
| 2 | 2 | GND | Ground |
| 3 | 3 | VOUT | Open collector output with a pull-up resistor |

Absolute Maximum Ratings

The absolute maximum value is the limiting value when the chip is applied, above which the chip can be damaged. Although the function of the chip is not necessarily damaged when the absolute maximum value is exceeded, the reliability of the chip may be affected if the absolute maximum value is exceeded for a certain time.

| Parameter | Symbol | Min | Max | Units |
|-----------------------------|-------------------|------|-----|-------|
| Supply voltage | VDD | -60 | 90 | V |
| Reverse voltage | Vout | -0.5 | 90 | V |
| Output Sink Current | I _{sink} | 0 | 40 | mA |
| Operating temperature range | T _a | -40 | 150 | °C |
| Storage temperature range | T _s | -50 | 165 | °C |

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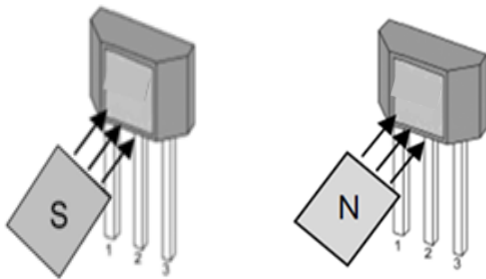
Electrical and magnetic characteristics (Ta=25°C, VDD =5.0V)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|-----------------------------------|---------------------------|--|------|-----|-----|-------|
| Electrical characteristics | | | | | | |
| VDD | Operating voltage | | 3.8 | | 60 | V |
| IDD | Supply current | | | 3.5 | 7 | mA |
| I _{le} | Leakage current | Off condition | | | 10 | uA |
| V _{sat} | Saturation voltage output | I _{out} =20mA, On condition | | | 0.4 | V |
| T _r | Output rising time | Pullup resistor =1kohms, Load cap=20pF | | | 1 | uS |
| T _f | Output falling time | Pullup resistor =1kohms, Load cap=20pF | | | 1.5 | uS |
| Magnetic characteristics | | | | | | |
| B _{op} | Operate point | Pullup resistor =1kohms, Load cap=20pF | 10 | 55 | 100 | Gauss |
| B _{rp} | Release point | Pullup resistor =1kohms, Load cap=20pF | -100 | -55 | -10 | Gauss |
| B _{hys} | Hysteresys | Pullup resistor =1kohms, Load cap=20pF | | 110 | | Gauss |

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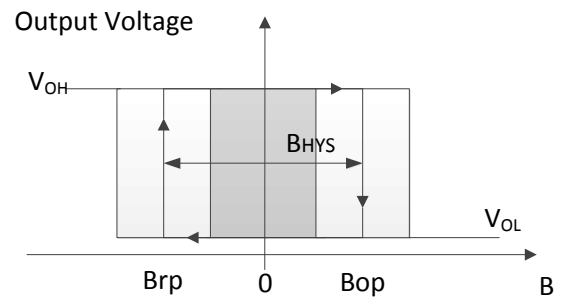
Magnetolectric conversion characteristics

Apply a magnetic field greater than B_{op} on the seal side of TO92S package (near the South Pole), and the output becomes low; Apply a magnetic field less than B_{rp} (near the North Pole) and the output becomes high. When the chip is first powered on, if the magnetic field is between the B_{op} and the B_{rp} , the output state is in an undefined state (high or low). The magnetic field polarity of the operating and releasing points of SOT23-3L package is opposite to that of TO92S. See below.

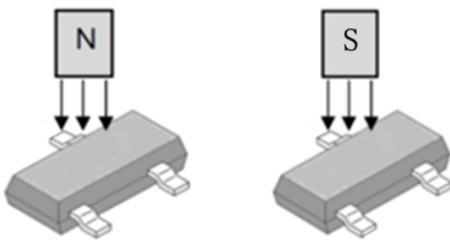


$V_{OUT} = \text{low}$

$V_{OUT} = \text{high}$

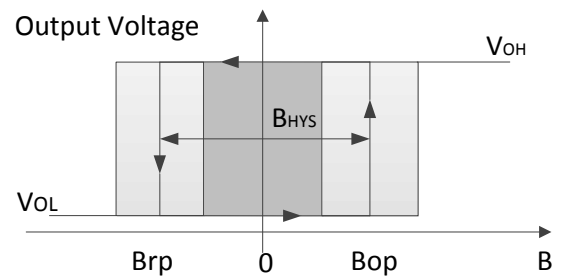


TO92S output state



$V_{OUT} = \text{low}$

$V_{OUT} = \text{high}$

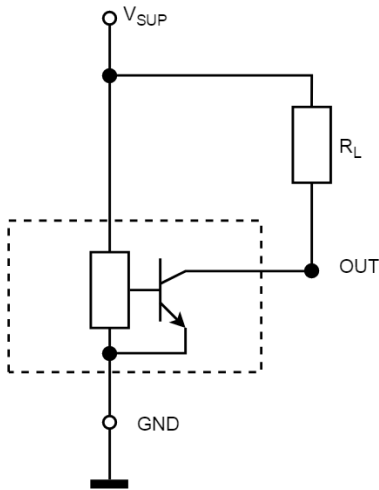


SOT23-3L output state

High Voltage Hall Effect Switch Sensor

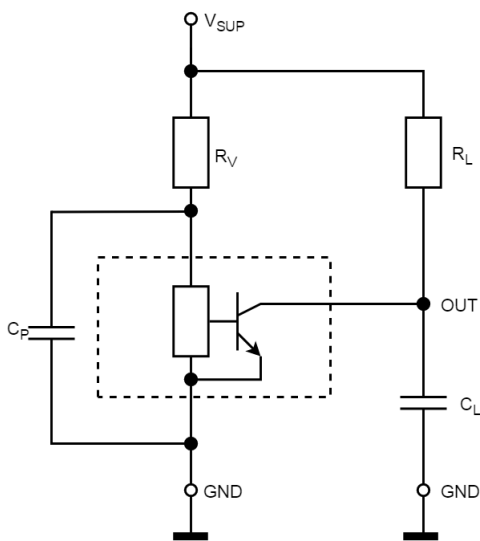
Application Circuits

Typical application circuit (see the following circuit) $R_L = 4700$ ohms



Case 1 of typical application circuit

Automotive and Harsh, Noisy Environments Three-Wire Circuit is show below. Here, $R_V = 100$ ohms, $C_P = 4.7$ nF, and $C_L = 1$ nF.

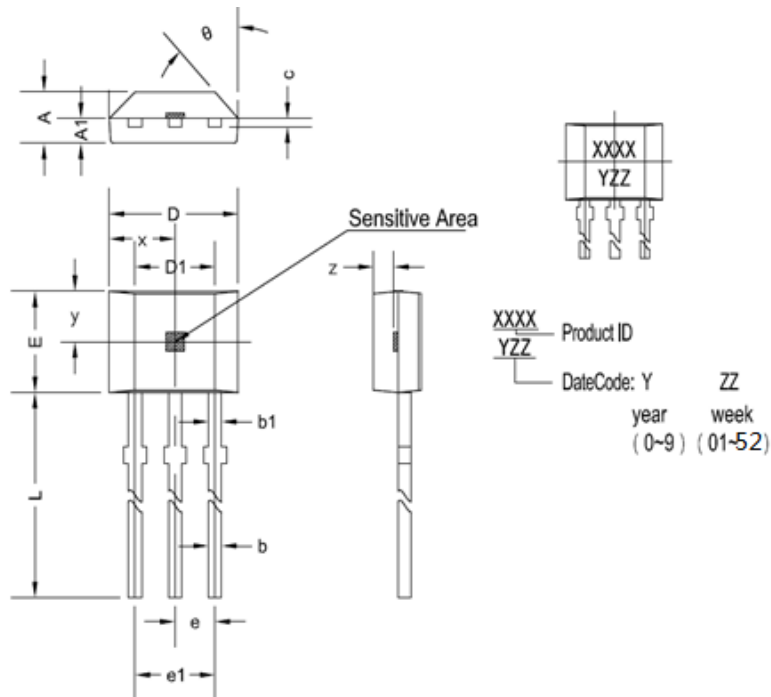


Case 2 of typical application circuit

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Package dimensions

T092S

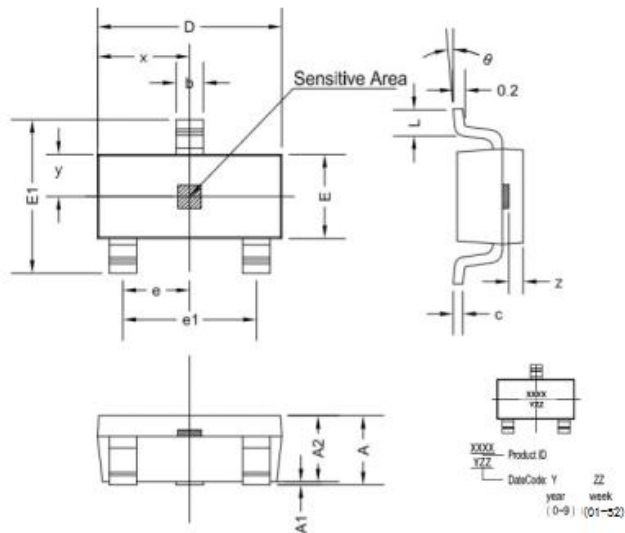


T092S dimensions

| symbol | Size (mm) | | Size (in inches) | |
|----------|-----------|---------|------------------|---------|
| | minimum | maximum | minimum | maximum |
| A | 1.42 | 1.67 | 0.056 | 0.066 |
| A1 | 0.66 | 0.86 | 0.026 | 0.034 |
| b | 0.35 | 0.56 | 0.014 | 0.022 |
| b1 | 0.4 | 0.55 | 0.016 | 0.022 |
| C | 0.36 | 0.51 | 0.014 | 0.02 |
| D | 3.9 | 4.2 | 0.154 | 0.165 |
| D1 | 2.97 | 3.27 | 0.117 | 0.129 |
| E | 2.9 | 3.28 | 0.114 | 0.129 |
| e | 1.270 TYP | | 0.050 TYP | |
| e1 | 2.44 | 2.64 | 0.096 | 0.104 |
| L | 13.5 | 15.5 | 0.531 | 0.61 |
| x | 2.025TYP | | 0.080TYP | |
| y | 1.545TYP | | 0.061TYP | |
| z | 0.500TYP | | 0.020TYP | |
| θ | 45°TYP | | 45°TYP | |

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SOT23



SOT23 dimensions

| symbol | Size (mm) | | Size (in inches) | |
|----------|-----------|---------|------------------|---------|
| | minimum | maximum | minimum | maximum |
| A | 1.05 | 1.25 | 0.041 | 0.049 |
| A1 | 0 | 0.1 | 0 | 0.004 |
| A2 | 1.05 | 1.15 | 0.041 | 0.045 |
| b | 0.3 | 0.5 | 0.012 | 0.02 |
| c | 0.100 | 0.2 | 0.004 | 0.008 |
| D | 2.82 | 3.02 | 0.111 | 0.119 |
| E | 1.5 | 1.7 | 0.059 | 0.067 |
| E1 | 2.65 | 2.95 | 0.104 | 0.116 |
| e | 0.950 TYP | | 0.037 TYP | |
| e1 | 1.8 | 2 | 0.071 | 0.079 |
| L | 0.3 | 0.6 | 0.012 | 0.024 |
| x | 1.460TYP | | 0.057TYP | |
| y | 0.800TYP | | 0.032TYP | |
| z | 0.600TYP | | 0.024TYP | |
| θ | 0° | 8° | 0° | 8° |