

### 1. Introduction

AH402F Hall-Effect bipolar sensor, employed with high voltage bipolar technology, has been designed purposely for automotive and industrial applications, and operates with supply voltages from 4.5 V to 60 V in temperature range from -40 °C up to 150 °C. AH402F is available in SMD-package SOT23 and in the leaded version T092S.

### 2. Features

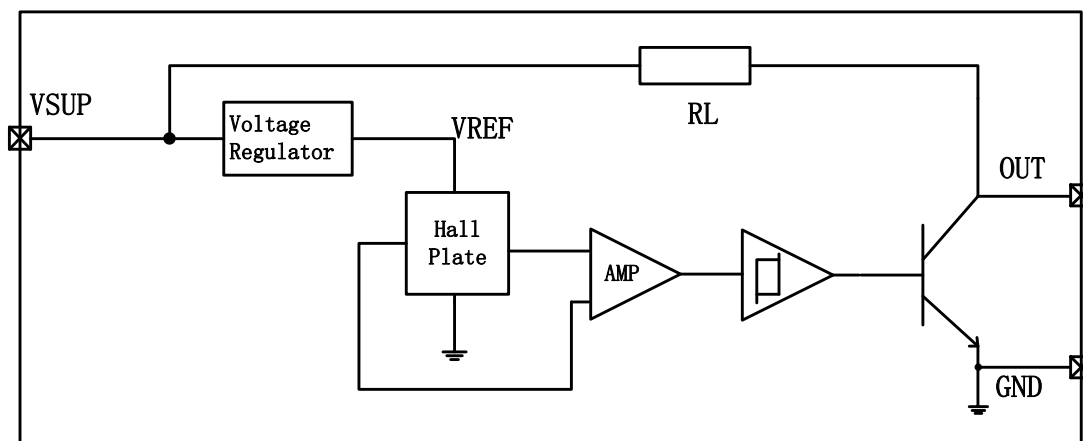
- Operates from 4.5 V to 60 V supply voltage
- Overvoltage protection capability up to 80 V
- Highest ESD performance up to  $\pm 6\text{kV}$
- Short-circuit protected open-drain output
- Wide temperature range from -40 °C to 150 °C
- Ideal sensor for applications in extreme automotive and industrial environments
- Tiny SOT23 package and T092S package

### 3. Potential Applications

- Brushless DC motor commutation
- Speed measurement
- Revolution counting
- Angular position detection
- Proximity detection

### 4. Block Diagram

The circuit includes temperature compensated voltage regular, Hall plate, signal amplifier and hysteresis comparator in single silicon chip. The regulated voltage provides the reference voltage for the hall plate. A magnetic field perpendicular to the sensor surface generates a hall voltage, which is amplified and then sent to a hysteresis comparator.



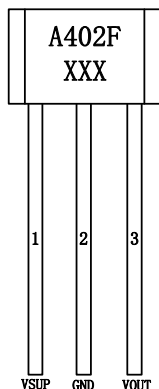
# AH402F

## High Voltage Hall Effect Switch

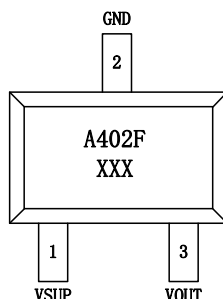
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### 5. Pin Description



TO92S



SOT23

### 6. Ordering information

| Partnumber | package | Packing               | Ambient, T <sub>A</sub> |
|------------|---------|-----------------------|-------------------------|
| AH402FUA   | TO92S   | Bulk, 1000 pieces/bag | -40°C to 150°C          |
| AH402FSU   | SOT23   | Reel, 3000pieces/reel | -40°C to 150°C          |

### 7. Pin assignment

| SOT23-3LPin number | TO92SPin number | Name | Function  |
|--------------------|-----------------|------|---|
| 1                  | 1               | VSUP | Power supply between 4.5V and 60V               |
| 2                  | 2               | GND  | Ground  |
| 3                  | 3               | VOUT | Open collector with a internal pull-up resistor |

### 8. Absolute Maximum Ratings

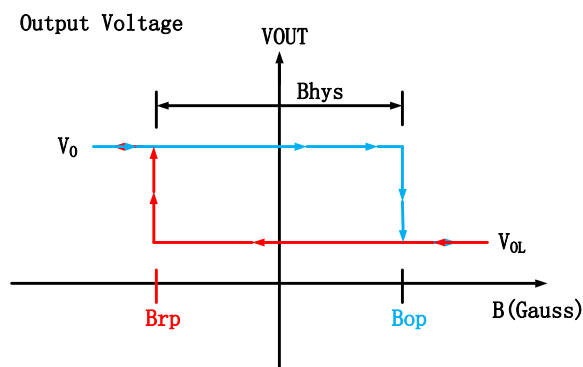
| Parameters                    | Symbol           | Min  | Max | Units |
|-------------------------------|------------------|------|-----|-------|
| Power supply Voltage          | VSUP             | -0.5 | 80  | V     |
| Output voltage                | VOUT             | -0.5 | 80  | V     |
| Output current sink           | Isink            | 0    | 40  | mA    |
| Operating ambient temperature | T <sub>a</sub>   | -40  | 150 | °C    |
| Storage temperature           | T <sub>stg</sub> | -50  | 165 | °C    |

### 9. Electrical and magnetic characteristics(Ta=25°C)

| Symbol                     | Parameter                 | Test conditions            | Min. | Typ. | Max. | Units |
|----------------------------|---------------------------|----------------------------|------|------|------|-------|
| Electrical characteristics |                           |                            |      |      |      |       |
| VSUP                       | Supply voltage            |                            | 4.5  |      | 60   | V     |
| ISUP                       | Supply current            |                            |      | 4.8  | 8    | mA    |
| Ile                        | Leakage current           | Off state                  |      |      | 10   | uA    |
| Vsat                       | Output saturation voltage | On state                   |      |      | 0.4  | V     |
| Tr                         | Output rise time          | Rload=1kohms<br>Cload=20pF |      |      | 1    | uS    |
| Tf                         | Output fall time          | Rload=1kohms<br>Cload=20pF |      |      | 1.5  | uS    |
| RL                         | Built-in pull-up resistor |                            |      | 100  |      | Kohm  |
| Magnetic characteristics   |                           |                            |      |      |      |       |
| Bop                        | Operate point             | Rload=1kohms<br>Cload=20pF | 10   | 25   | 40   | Gauss |
| Brp                        | Release point             |                            | -40  | -25  | -10  | Gauss |
| Bhys                       | Hysteresis                |                            |      | 50   |      | Gauss |

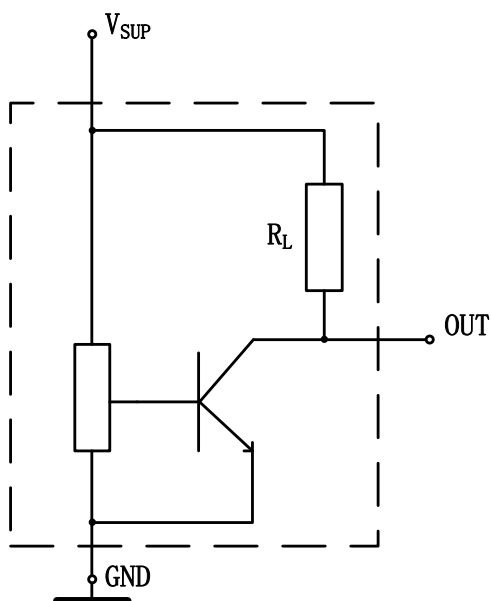
### 10. Switching behavior

The output turns low with the magnetic south pole on the branded side of the package and turns high with the magnetic north pole on the branded side. The output state is not defined if the magnetic field is between Bop and Brp.



### 11. Application Circuit

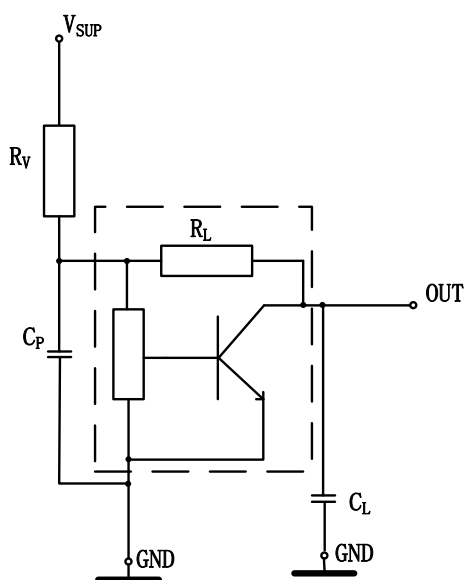
Typical application circuit (see Fig. below)



An example of typical application circuit

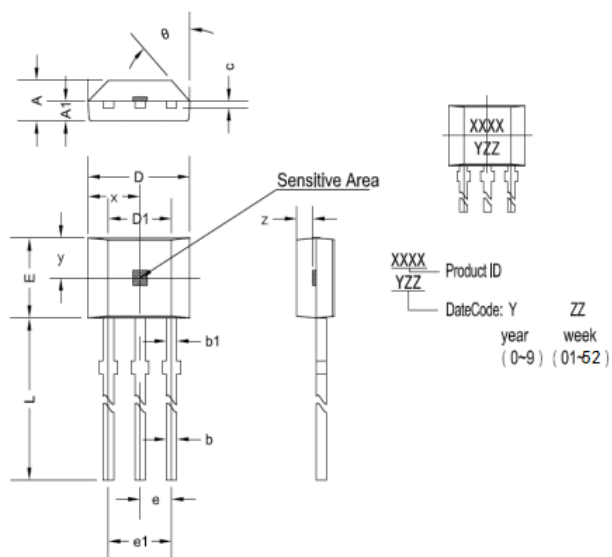
For applications with disturbances on the supply line or radiated disturbances, a series resistor  $R_V$  and two capacitors  $C_P$  and  $C_L$  all placed close to the sensor are recommended (see Fig. below).

For example:  $R_V = 100$  ohms,  $C_P = 4.7$  nF, and  $C_L = 1$  nF.



Example of application circuit 2

### 12. Outline dimensions



### AH402FUA package outline

| 符号       | 尺寸 (毫米)   |      | 尺寸 (英尺)   |       |
|----------|-----------|------|-----------|-------|
|          | 最小        | 最大   | 最小        | 最大    |
| 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  |       |
| $\theta$ | 45°TYP    |      | 45°TYP    |       |

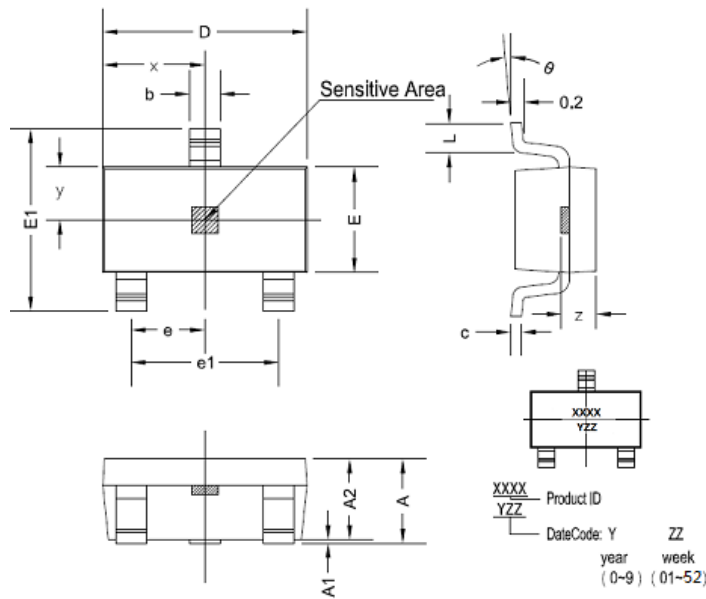
# AH402F

## High Voltage Hall Effect Switch

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### AH402FSU package outline



| symbol | Size (mm) |      | Size (inches) |       |
|--------|-----------|------|---------------|-------|
|        | Min.      | Max. | Min.          | Max.  |
| 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°    |

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