# LOW SENSITIVITY MICROPOWER OMNIPLOAR HALL-EFFECT SWITCH

## Description

The AH1809 is a low sensitivity micropower Omnipolar Hall Effect switch IC. It is designed for battery powered consumer products, home appliances, and industrial equipment such smart e-meters. Based on two Hall Effect plates and a chopper stabilized architecture the AH1809 provides a reliable solution over the whole operating range. To support battery and low power applications the design has been optimized to operate over the supply range of 2.5V to 5.5V and consumes only 24µW with a supply of 3V.

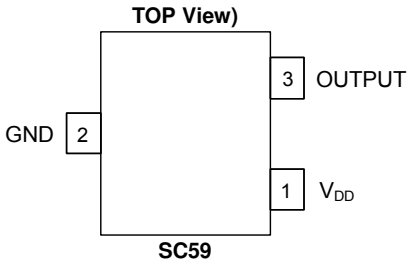
The single open drain output can be switched on with either a North or South pole of sufficient strength. When the magnetic flux density perpendicular to the package (B) is larger than operate point (Bop), the output is switched on (pulled low). The output is turned off when B becomes lower than the release point (Brp). The output will remain off when there is no magnetic field.

The AH1809 is available in SC59, SOT553 and SIP-3L.

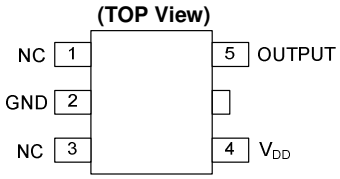
## Features

- Omnipolar (North or South pole) Operation
- Low Sensitivity
- Single Open Drain Output
- Micropower Operation
- 2.5V to 5.5V Operating Range
- Chopper Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- -40℃ to +125℃ Operating Temperature
- High ESD
- Small Low Profile SOT553 and Industry Standard SC59 and SIP-3L Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

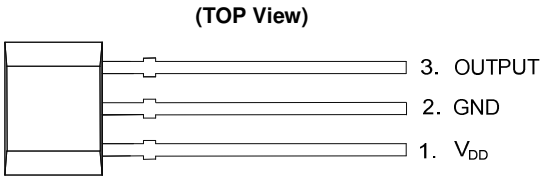
## Pin Assignments




**SC59**




**SOT553**



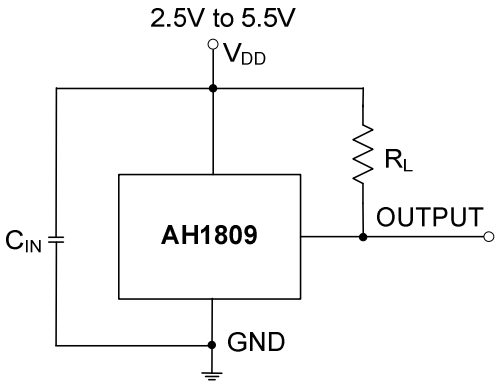

**SIP-3L**

## Applications

- Smart E-Meters
- Tamper Protection Switch
- Door, Lids and Tray Position Switch
- Proximity and Position Switches
- Level Detects
- On/Off Switch Digital Contact-Less Switch in Industrial and Consumer Products

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Typical Applications Circuit




Note: 4. $C_{IN}$ is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF ~ 100nF.
$R_L$ is the pull-up resistor, the recommended resistance is 10kΩ to 100kΩ.

## Pin Descriptions

**Package: SC59 and SIP-3L**

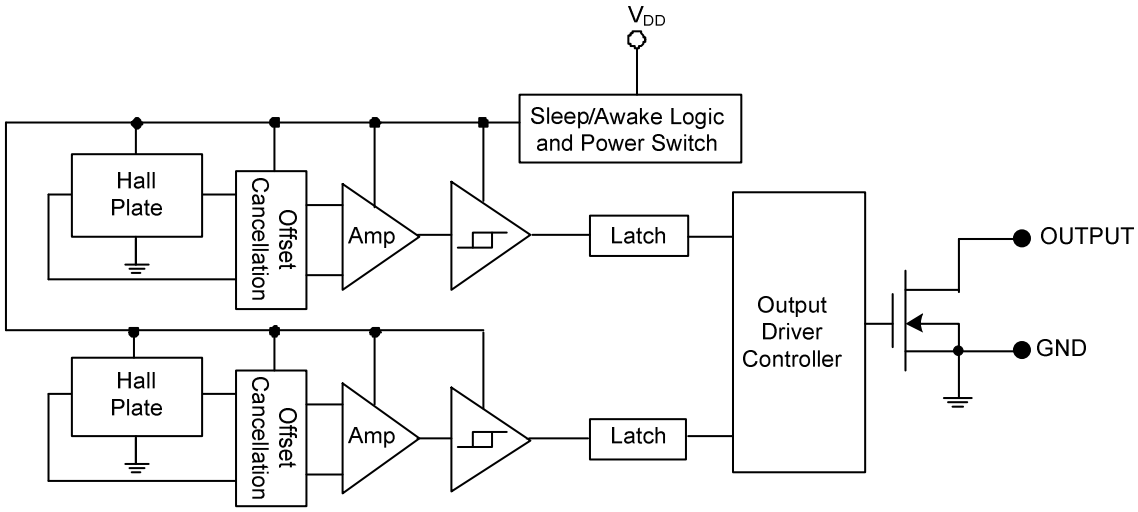
| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | $V_{DD}$ | Power Supply Input |
| 2 | GND | Ground |
| 3 | OUTPUT | Output Pin |

**Package: SOT553**

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | NC | No Connection (Note 5) |
| 2 | GND | Ground |
| 3 | NC | No Connection (Note 5) |
| 4 | $V_{DD}$ | Power Supply Input |
| 5 | OUTPUT | Output |

Note: 5. NC is “No Connection” pin and is not connected internally. This pin can be left open or tied to ground.

## Functional Block Diagram



## Absolute Maximum Ratings (Note 6) (@$T_A$ = +25℃, unless otherwise specified.)

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage (Note 7) | | 7 | V |
| $V_{OUT}$ | Output Pin Voltage (Note 7) | | 7 | V |
| $V_{DD\ REV}$ | Reverse Supply Voltage | | -0.3 | V |
| $V_{OUT\_REV}$ | Reverse Output Pin Voltage | | -0.3 | V |
| $I_{OUTPUT}$ | Output current (source and sink) | | 2.5 | mA |
| B | Magnetic Flux Density | | Unlimited | |
| $P_D$ | Package Power Dissipation | SC59 and SOT553 | 230 | mW |
| | | SIP-3L | 230 | — |
| Ts | Storage Temperature Range | | -65 to +150 | ℃ |
| $T_J$ | Maximum Junction Temperature | | +150 | ℃ |
| ESD HBM | Human Body Model ESD capability | | 6 | kV |

Notes: 6. Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

7. The absolute maximum $V_{DD}$ of 7V is a transient stress rating and is not meant as a functional operating condition. It is not recommended to operate the device at the absolute maximum rated conditions for any period of time.

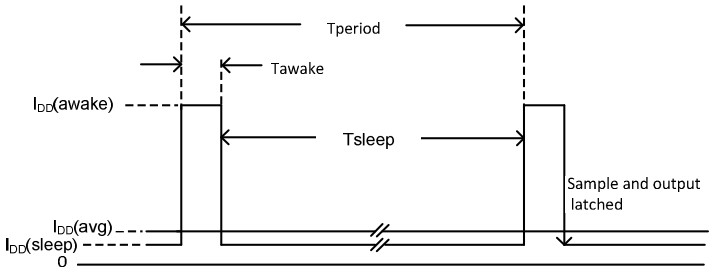
## Recommended Operating Conditions (@$T_A$ = +25℃, unless otherwise specified.)

| Symbol | Parameter | Conditions | Rating | Unit |
|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | Operating | 2.5 to 5.5 | V |
| $V_{OUT\_MAX}$ | Maximum output pin voltage | Operating | 5.5 | V |
| $T_A$ | Operating Temperature Range | Operating | -40 to +125 | ℃ |

## Electrical Characteristics (@$T_A$ = +25℃, VDD = 3V, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT\_ON}$ | Output On Voltage ($V_{OL}$) | $I_{OUT}$ = 1mA | — | 0.1 | 0.3 | V |
| Ioff | Output Leakage Current | $V_{OUT}$ = 5.5V, Output off | — | < 0.1 | 1 | μA |
| $I_{DD}$(awake) | Supply Current | During ‘awake’ period, $T_A$ = +25℃, $V_{DD}$ = 3V | — | 3 | 6 | mA |
| | | During ‘awake’ period, $T_A$ = -40 to +125℃, $V_{DD}$ = 2.5V to 5.5V | — | — | 12 | mA |
| $I_{DD}$(sleep) | | During ‘sleep’ period, $T_A$ = +25℃, $V_{DD}$ = 3V | — | 5 | 10 | μA |
| $I_{DD}$(sleep) | | During ‘sleep’ period, $T_A$ = -40 to +125℃, $V_{DD}$ = 2.5V to 5.5V | — | — | 28 | μA |
| $I_{DD}$(avg) | Average Supply Current | $T_A$ = +25℃, $V_{DD}$ = 3V | — | 8 | 16 | μA |
| | | $T_A$ = -40 to +125℃, $V_{DD}$ = 2.5V to 5.5V | — | — | 40 | μA |
| Tawake | Awake Time | (Note 8) | — | 75 | 125 | μs |
| Tperiod | Period | (Note 8) | — | 75 | 125 | ms |
| D.C. | Duty Cycle | - | — | 0.1 | — | % |

Note: 8. When power is initially turned on, the operating $V_{DD}$ must be within its correct operating range (2.5V to 5.5V) to guaranteed the output sampling. The output state is valid after the second operating cycle (typical 150ms).

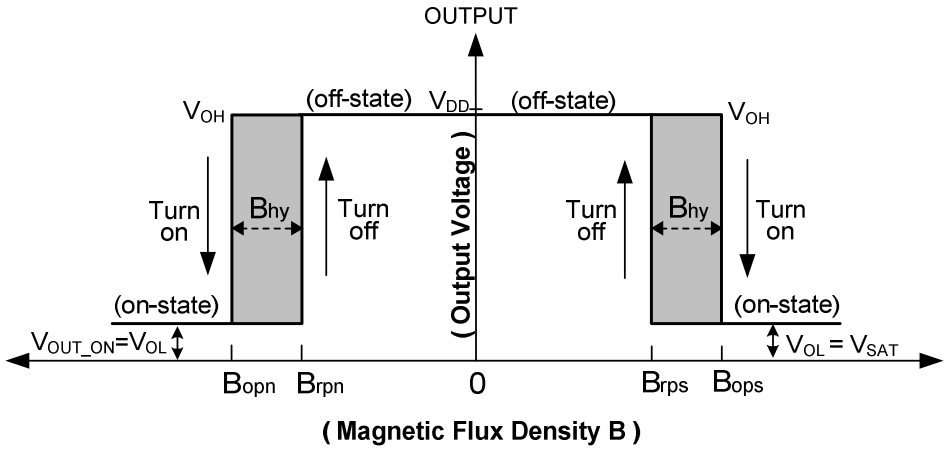



## Magnetic Characteristics (Notes 9 & 10) ($T_A$ = +25°C, $V_{DD}$ = 2.5V to 5.5V, unless otherwise specified.)

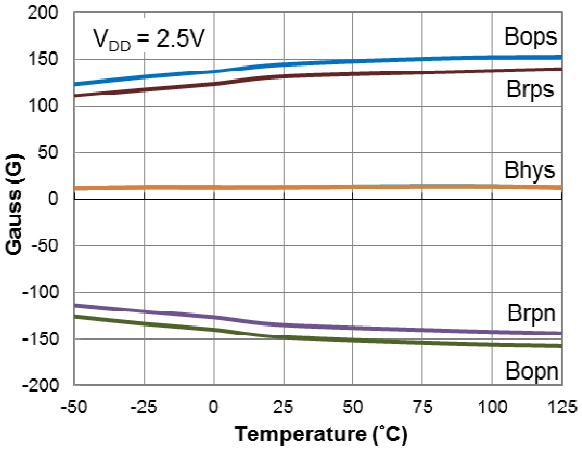
(1mT=10 Gauss)

| Symbol | Characteristics | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Bops (south pole to part marking side) | Operation Point | $T_A$ = +25°C | 100 | 130 | 165 | Gauss |
| | | $T_A$ = -40°C to +125°C | 90 | 130 | 185 | |
| Bopn (north pole to part marking side) | | $T_A$ = +25°C | -165 | -130 | -100 | |
| | | $T_A$ = -40°C to +125°C | -185 | -130 | -90 | |
| Brps (south pole to part marking side) | Release Point | $T_A$ = +25°C | 90 | 115 | 150 | |
| | | $T_A$ = -40°C to +125°C | 80 | 115 | 170 | |
| Brpn (north pole to part marking side) | | $T_A$ = +25°C | -150 | -115 | -90 | |
| | | $T_A$ = -40°C to +125°C | -170 | -115 | -80 | |
| Bhy (\|Bopx\|-\|Brpx\|) | Hysteresis (Note 11) | $T_A$ = +25°C | 10 | 15 | 20 | |
| | | $T_A$ = -40°C to +125°C | 5 | 15 | — | |

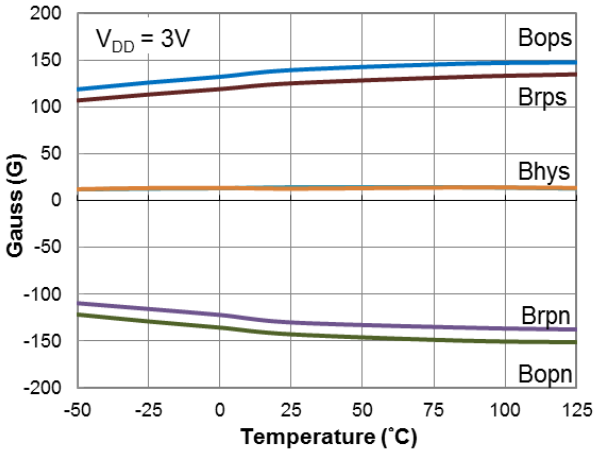
Notes: 9. Typical data is at $T_A$ = +25°C, $V_{DD}$ = 3V.
10. Parameters values over operating temperature range are not tested in production, they are guaranteed by design, process control and characterization. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.
11. Maximum and minimum hysteresis is guaranteed by design and characterization.



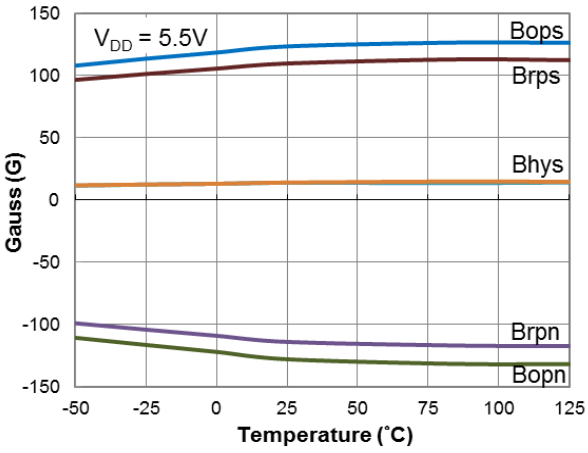
## Typical Operating Characteristics



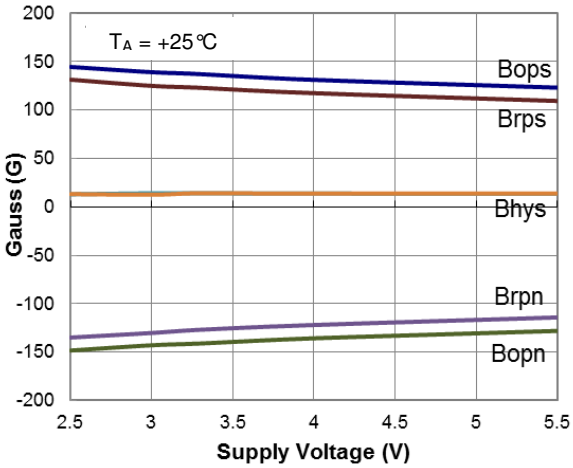

Switch Points vs Temperature



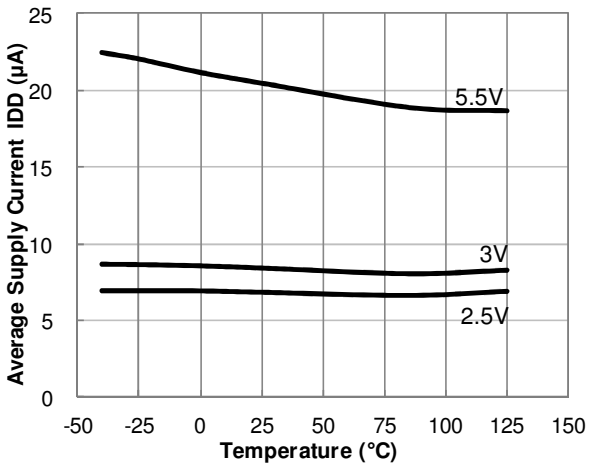

Switch Points vs Temperature



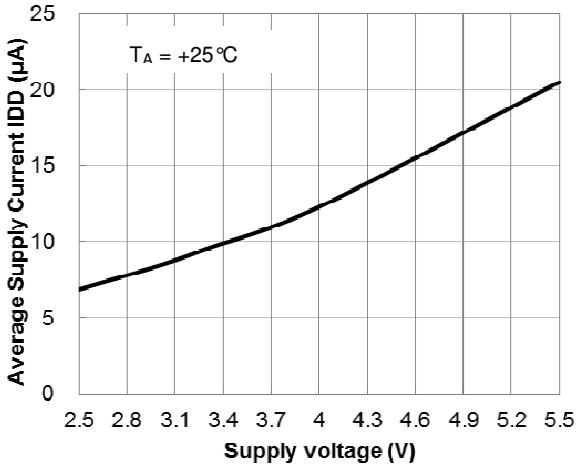

Switch Points vs Temperature




Switch Points vs Supply Voltage




Average Supply Current vs. Temperature

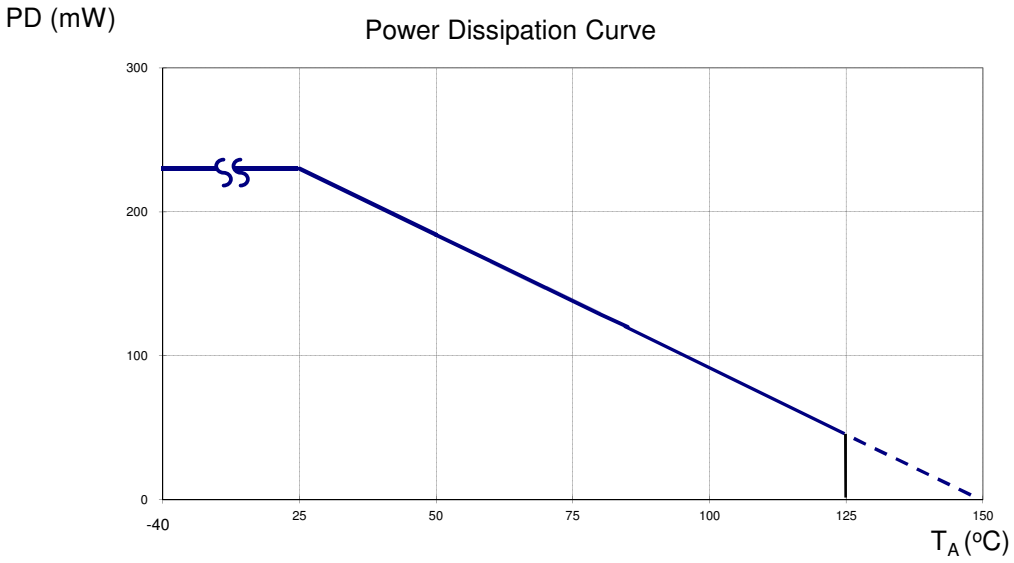



Average Supply Current vs. Supply Voltage

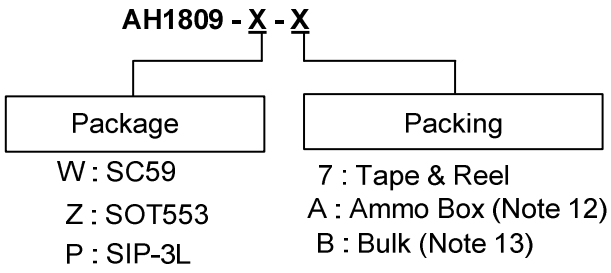
## Thermal Performance Characteristics

**(1) Package type: SC59, SOT553 and SIP-3L**

| $T_A$ (°C) | 25 | 50 | 60 | 70 | 80 | 85 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_D$ (mW) | 230 | 184 | 166 | 147 | 129 | 120 | 110 | 92 | 74 | 55 | 37 | 18 | 0 |




## Ordering Information



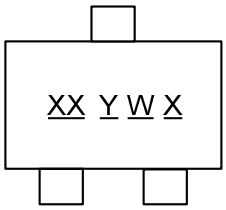

| Part Number | Package Code | Packaging | Bulk | | 7" Tape and Reel | | Ammo Box | |
|---|---|---|---|---|---|---|---|---|
| | | | Quantity | Part Number Suffix | Quantity | Part Number Suffix | Quantity | Part Number Suffix |
| AH1809-W-7 | Z | SC59 | NA | NA | 3,000/Tape & Reel | -7 | NA | NA |
| AH1809-Z-7 | Z | SOT553 | NA | NA | 3,000/Tape & Reel | -7 | NA | NA |
| AH1809-P-B | P | SIP-3L | 1000 | -B | NA | NA | NA | NA |
| AH1809-P-A | P | SIP-3L | NA | NA | NA | NA | 4,000/Box | -A |

Notes: 12. Ammo Box is for SIP-3L Spread Lead.
13. Bulk is for SIP-3L Straight Lead.

## Marking Information

**(1) Package Type: SC59**

**( Top View )**

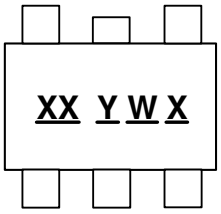



XX : Identification code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents
52 and 53 week
X : Internal Code

| Part Number | Package | Identification Code |
|---|---|---|
| AH1809 | SC59 | F9 |

**(2) Package Type: SOT553**

**( Top View )**

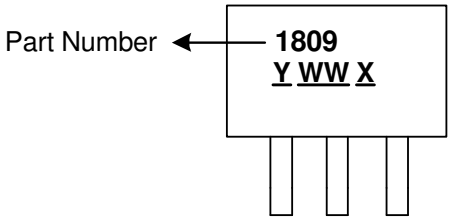



XX : Identification Code
Y : Year : 0 to 9
W : Week : A to Z : 1~26 week;
a to z : 27~52 week; z represents
52 and 53 week
X : Internal code

| Part Number | Package | Identification Code |
|---|---|---|
| AH1809 | SOT553 | H9 |

**(3) Package Type: SIP-3L**

**(Top View)**

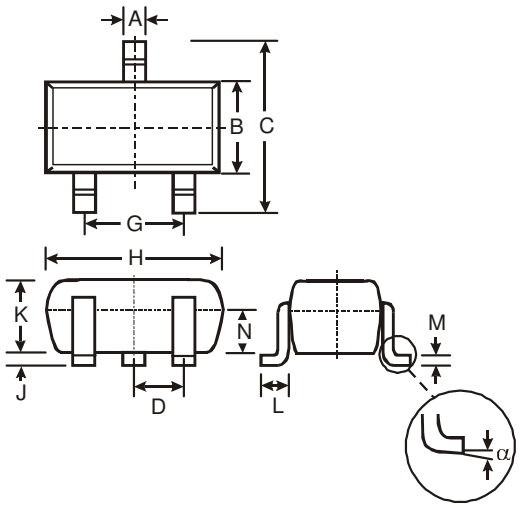



Y : Year : 0~9
WW : Week : 01~52, "52" represents
52 and 53 week
X : Internal Code

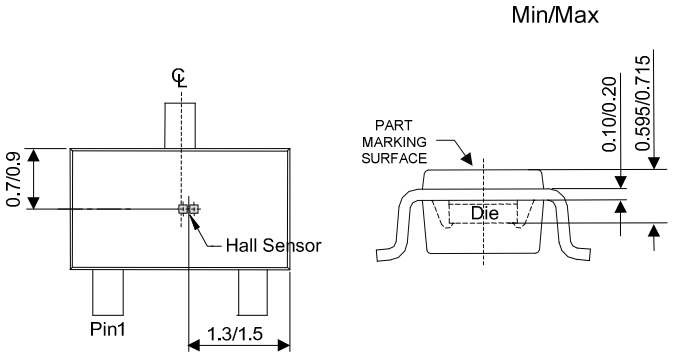
## Package Outline Dimensions (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

**(1) Package Type: SC59**




| SC59 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.35 | 0.50 | 0.38 |
| **B** | 1.50 | 1.70 | 1.60 |
| **C** | 2.70 | 3.00 | 2.80 |
| **D** | - | - | 0.95 |
| **G** | - | - | 1.90 |
| **H** | 2.90 | 3.10 | 3.00 |
| **J** | 0.013 | 0.10 | 0.05 |
| **K** | 1.00 | 1.30 | 1.10 |
| **L** | 0.35 | 0.55 | 0.40 |
| **M** | 0.10 | 0.20 | 0.15 |
| **N** | 0.70 | 0.80 | 0.75 |
| **α** | 0° | 8° | - |
| **All Dimensions in mm** | | | |

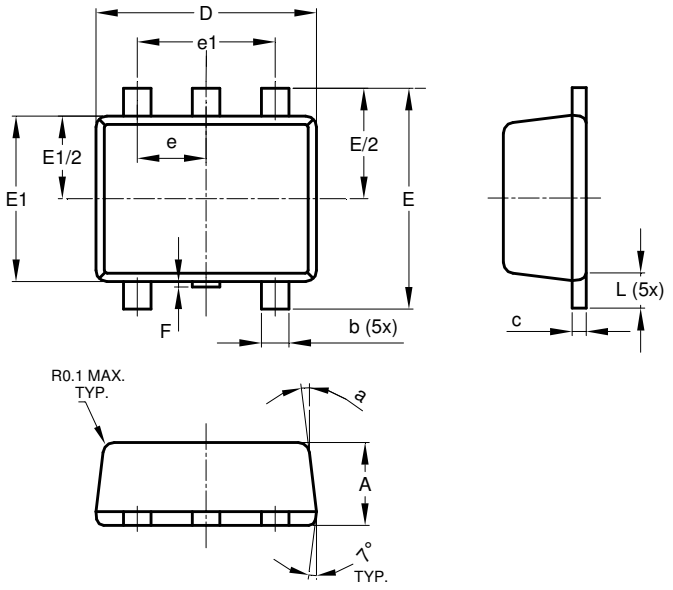



**Sensor Location**

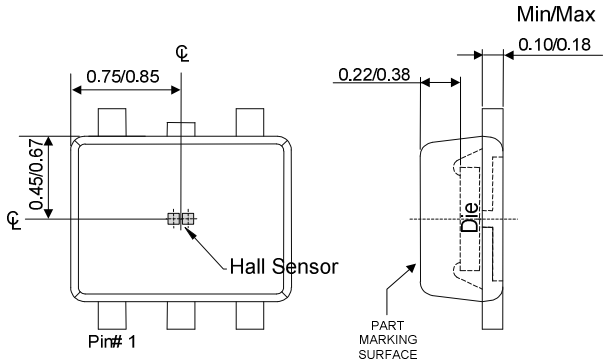
## Package Outline Dimensions (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

**(2) Package Type: SOT553**




| SOT553 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.55 | 0.62 | 0.60 |
| **b** | 0.15 | 0.30 | 0.20 |
| **c** | 0.10 | 0.18 | 0.15 |
| **D** | 1.50 | 1.70 | 1.60 |
| **E** | 1.55 | 1.70 | 1.60 |
| **E1** | 1.10 | 1.25 | 1.20 |
| **e** | 0.50 BSC | | |
| **e1** | 1.00 BSC | | |
| **F** | 0.00 | 0.10 | — |
| **L** | 0.10 | 0.30 | 0.20 |
| **a** | 6° | 8° | 7° |
| **All Dimensions in mm** | | | |

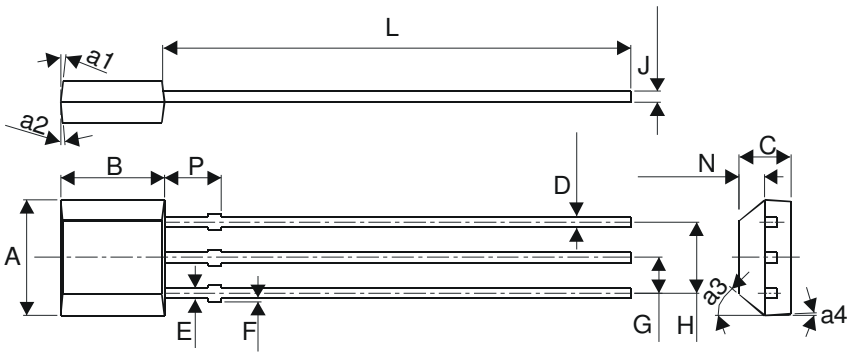



**Sensor Location**

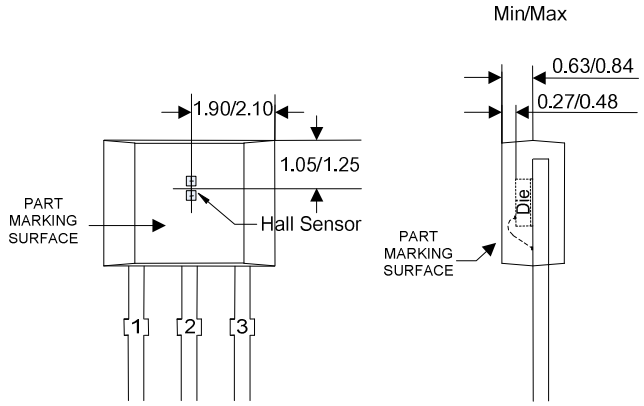
## Package Outline Dimensions (cont.) (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

**(3) Package Type: SIP-3L for Bulk Pack**




| SIP-3 for Bulk Pack | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 3.9 | 4.3 |
| **a1** | 5° Typ | |
| **a2** | 5° Typ | |
| **a3** | 45° Typ | |
| **a4** | 3° Typ | |
| **B** | 2.8 | 3.2 |
| **C** | 1.40 | 1.60 |
| **D** | 0.33 | 0.432 |
| **E** | 0.40 | 0.508 |
| **F** | 0 | 0.2 |
| **G** | 1.24 | 1.30 |
| **H** | 2.51 | 2.57 |
| **J** | 0.35 | 0.43 |
| **L** | 14.0 | 15.0 |
| **N** | 0.63 | 0.84 |
| **P** | 1.55 | - |
| **All Dimensions in mm** | | |

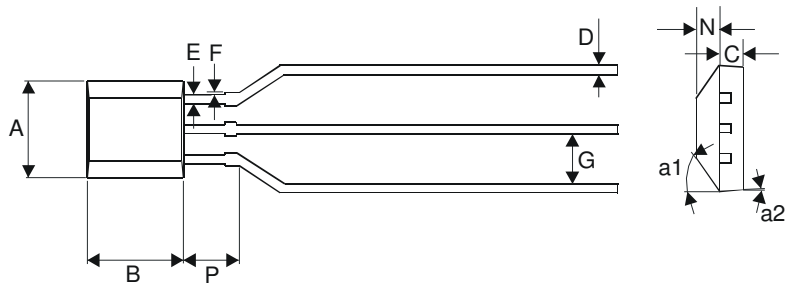



**Sensor location**

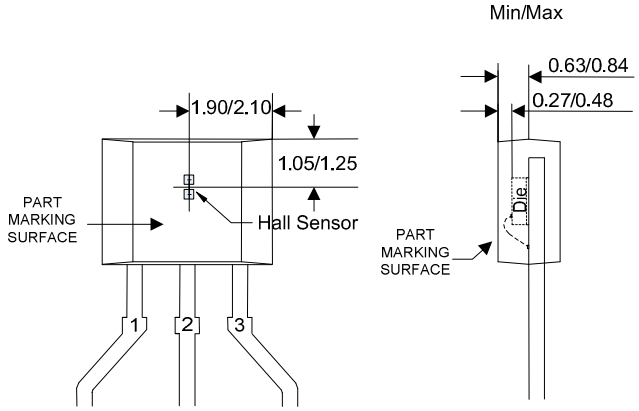
## Package Outline Dimensions (cont.) (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

**(4) Package Type: SIP-3L for Ammo Pack**




| SIP-3 for Ammo Pack only | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 3.9 | 4.3 |
| **a1** | 45° Typ | |
| **a2** | 3° Typ | |
| **B** | 2.8 | 3.2 |
| **C** | 1.40 | 1.60 |
| **D** | 0.35 | 0.41 |
| **E** | 0.43 | 0.48 |
| **F** | 0 | 0.2 |
| **G** | 2.4 | 2.9 |
| **N** | 0.63 | 0.84 |
| **P** | 1.55 | - |
| **All Dimensions in mm** | | |

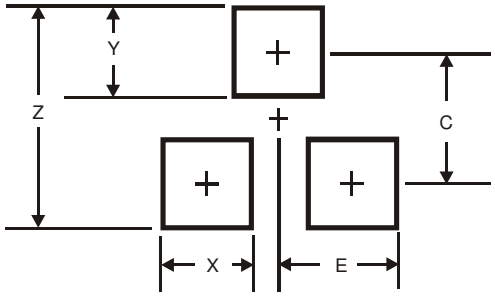



**Sensor location**

## Suggested Pad Layout

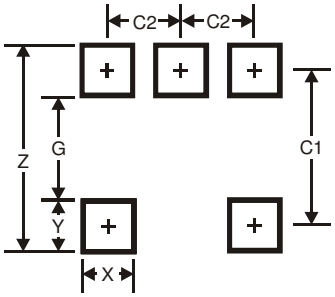
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

**(1) Package Type: SC59**




| Dimensions | Value (in mm) |
|---|---|
| Z | 3.4 |
| X | 0.8 |
| Y | 1 |
| C | 2.4 |
| E | 1.35 |

**(2) Package Type: SOT553**




| Dimensions | Value (in mm) |
|---|---|
| Z | 2.2 |
| G | 1.2 |
| X | 0.375 |
| Y | 0.5 |
| C1 | 1.7 |
| C2 | 0.5 |

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1. are intended to implant into the body, or
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B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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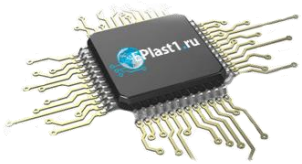
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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