

HIGH-VOLTAGE HIGH-SENSITIVITY HALL EFFECT LATCH WITH INTERNAL PULL-UP RESISTOR

Description

The AH3781 is a high-voltage, high-sensitivity Hall Effect latch IC with internal pull-up resistor designed for commutation of brushless DC motors, flow meters, linear encoders and position sensors in industrial, consumer home appliance and personal care applications. To support a wide range of demanding applications, the design is optimized to operate over the supply range of 3.0V to 28V. With chopper stabilized architecture and an internal bandgap regulator to provide temperature compensated supply for internal circuits, the AH3781 provides a reliable solution over the whole operating range. For robustness and protection, the device has a Zener clamp on the supply. The output has an overcurrent limit and a Zener clamp.

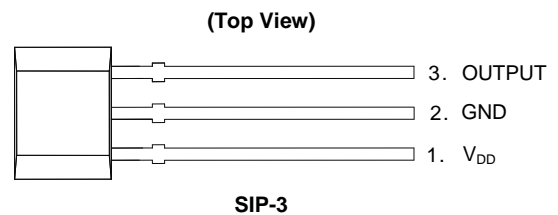
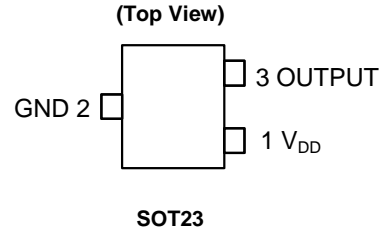
The internally pulled-up output can be switched on with South pole of sufficient strength and switched off with North pole of sufficient strength. When the magnetic flux density (B) perpendicular to the part marking surface is larger than the operate point (B_{OP}) the output is switched on (pulled low). The output is held latched until magnetic flux density reverses and becomes lower than the release point (B_{RP}).

Features

- Bipolar Latch Operation (South Pole: On, North Pole: off)
- 3.0V to 28V Operating Voltage Range
- High Sensitivity: B_{OP} and B_{RP} of +25G and -25G Typical
- Internally Pull-up Resistor on the Output Pin
- Output Overcurrent Limit
- Chopper Stabilized Design Provides
 - Superior Temperature Stability
 - Minimal Switch Point Drift
 - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Zener Clamp on Supply and Output Pins
- -40°C to +125°C Operating Temperature
- ESD (HBM): 6kV
- Industry Standard SOT23 and SIP-3 Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- 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.

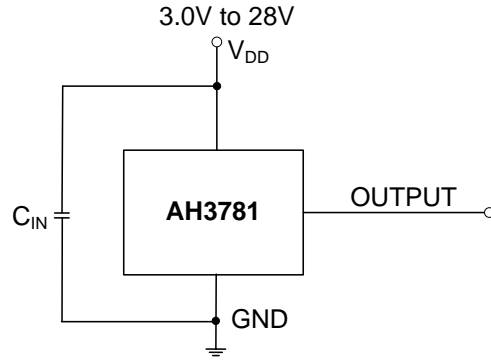
Pin Assignments



Applications

- Brushless DC Motor Commutation
- Revolution Per Minute (RPM) Measurement
- Flow Meters
- Angular and Linear Encoder and Position Sensors
- Contactless Commutation, Speed Measurement and Angular Position Sensing/Indexing in Consumer Home Appliances, Office Equipments and Industrial Applications

Typical Applications Circuit



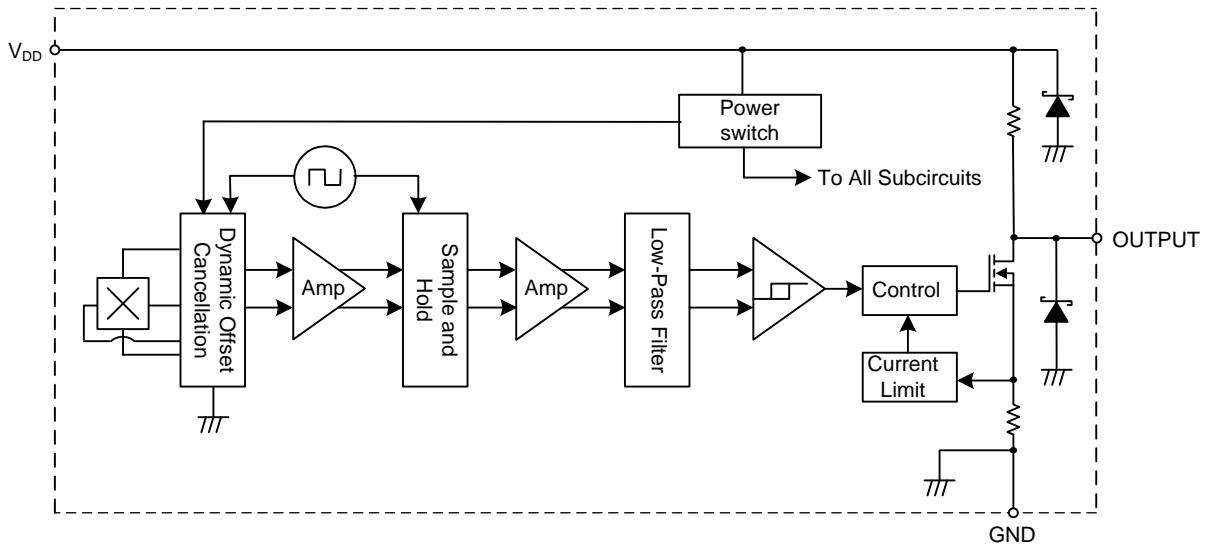
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF ~ 100nF. R_L is the pull-up resistor.

Pin Descriptions

Package: SOT23

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

Functional Block Diagram



Absolute Maximum Ratings (Notes 5 & 6) (@T_A = +25°C, unless otherwise specified.)

| Symbol | Characteristic | Value | Unit | |
|----------------------|---|-------------|------|----|
| V _{DD} | Supply Voltage (Note 6) | 32 | V | |
| V _{DDR} | Reverse Supply Voltage | -0.3 | V | |
| V _{OUT_MAX} | Output Off Voltage (Note 6) | 32V | V | |
| I _{OUT} | Continuous Output Current | 60 | mA | |
| B | Magnetic Flux Density | Unlimited | | |
| P _D | Package Power Dissipation | SIP-3 | 550 | mW |
| | | SOT23 | 230 | mW |
| T _S | Storage Temperature Range | -65 to +165 | °C | |
| T _J | Maximum Junction Temperature | +150 | °C | |
| ESD | Electrostatic Discharge Withstand Capability - Human Body Model | 6 | kV | |

- Notes:
- 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.
 - The absolute maximum V_{DD} of 32V 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 = -40°C to +125°C, unless otherwise specified.)

| Symbol | Parameter | Conditions | Rating | Unit |
|-----------------|-----------------------------|------------|-------------|------|
| V _{DD} | Supply Voltage | Operating | 3.0 to 28 | V |
| T _A | Operating Temperature Range | Operating | -40 to +125 | °C |

Electrical Characteristics (Note 7 & 8) (@T_A = -40°C to +125°C, V_{DD} = 3V to 28V, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------|--|--|-----|------|-----|------|
| V _{OUT_ON} | Output On Voltage | I _{OUT} = 20mA, B > B _{OP} | - | 0.2 | 0.4 | V |
| I _{OUT_OFF} | Output Leakage Current | V _{OUT} = 28V, B < B _{RP} , Output off | - | <0.1 | 15 | µA |
| I _{DD} | Supply Current | Output open, V _{DD} = 12V, T _A = +25°C | - | 3.8 | 4.9 | mA |
| | | Output open, T _A = -40°C to +125°C | - | 3.8 | 5.8 | mA |
| R _{PU} | Internal Pull-Up Resistance | T _A = -40°C to +125°C | 10 | 14 | 18 | kΩ |
| t _{ST} | Device Start-Up Time | V _{DD} ≥ 3V, B > B _{OP} (Note 7) | - | 10 | - | µs |
| f _c | Chopping Frequency | V _{DD} = 3V to 28V | - | 800 | - | kHz |
| t _d | The time delay from magnetic threshold reached to the start of the output rise or fall | (Note 9) | - | 3.75 | - | µs |
| t _r | Output Rising Time (external pull-up resistor R _L and load capacitance dependent) | R _L = 1kΩ, C _L = 20pF | - | 0.2 | 1 | µs |
| t _f | Output Falling Time (Internal switch resistance and load capacitance dependent) | R _L = 1kΩ, C _L = 20pF | - | 0.1 | 1 | µs |
| I _{OCL} | Output Current Limit | B > B _{OP} , (Note 10) | 30 | - | 55 | mA |
| V _Z | Zener Clamp Voltage | I _{DD} = 5mA | 28 | - | - | V |

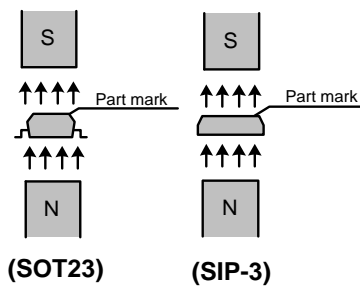
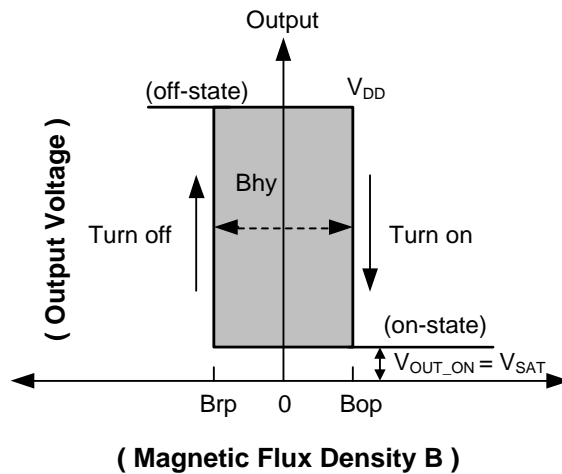
- Notes:
- When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the start-up time of 10µs typical from the operating voltage reaching 3V.
 - Typical values are defined at T_A = +25°C, V_{DD} = 12V. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization
 - Guaranteed by design, process control and characterization. Not tested in production.
 - The device will limit the output current I_{OUT} to current limit of I_{OCL}.

Magnetic Characteristics (Notes 11 & 12) ($T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{DD} = 3.0\text{V}$ to 28V , unless otherwise specified)

(1mT=10 Gauss)

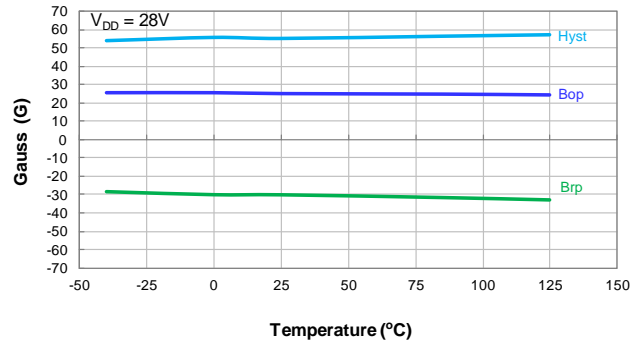
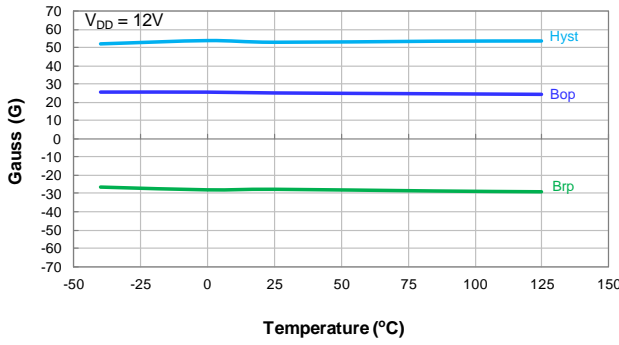
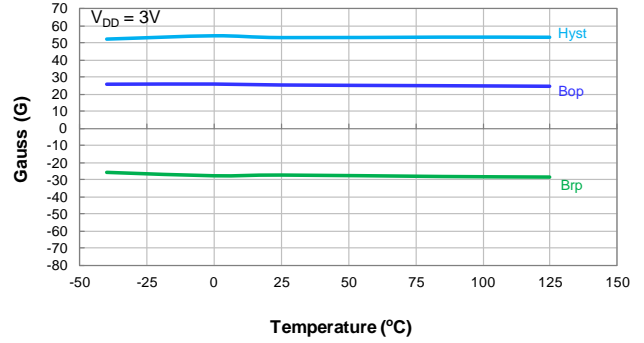
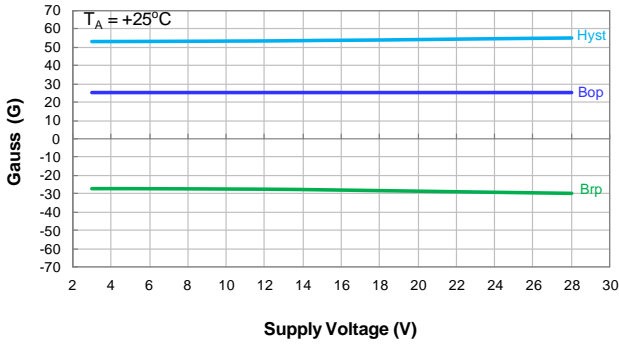
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|----------------------|---|-----|-----|-----|-------|
| B_{OP} (South pole to part marking side) | Operation Point | $V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$ | - | 25 | - | Gauss |
| | | $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ | 10 | 25 | 40 | |
| B_{RP} (North pole to part marking side) | Release Point | $V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$ | - | -25 | - | |
| | | $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ | -40 | -25 | -10 | |
| B_{HY} ($ B_{OPX} - B_{RPX} $) | Hysteresis (Note 13) | $V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$ | - | 50 | - | |
| | | $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ | 20 | 50 | 80 | |

- Notes:
- When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the start-up time of $10\mu\text{s}$ typical from the operating voltage reaching 3V.
 - Typical values are defined at $T_A = +25^\circ\text{C}$, $V_{DD} = 12\text{V}$. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization
 - Maximum and minimum hysteresis is guaranteed by design, process control and characterization.

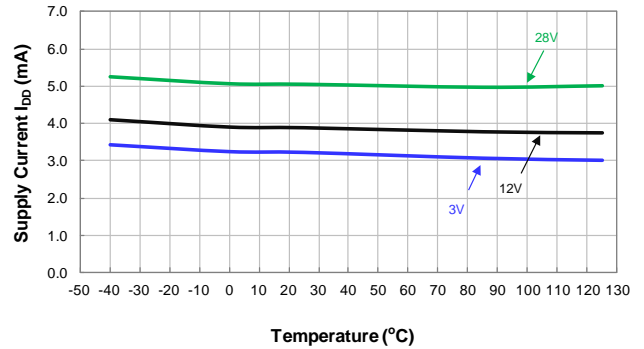
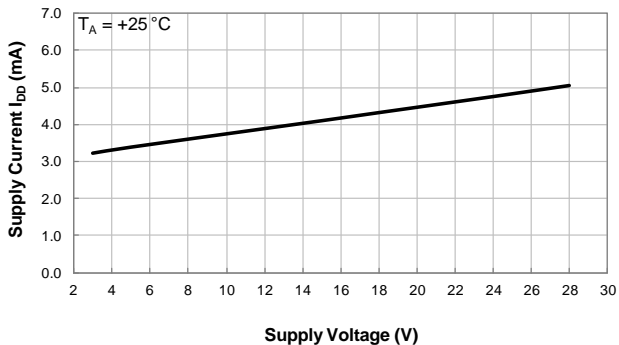


Typical Operating Characteristics

Magnetic Operating Switch Points – B_{OP} and B_{RP}

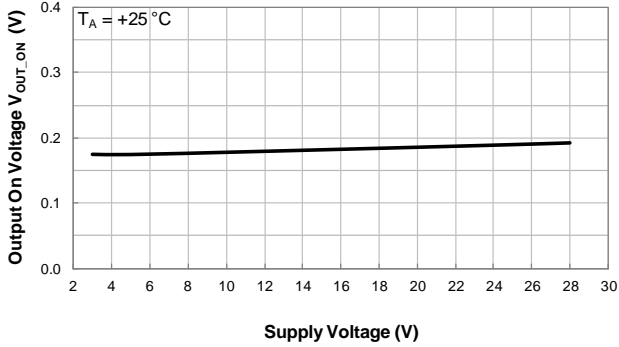


Supply Current

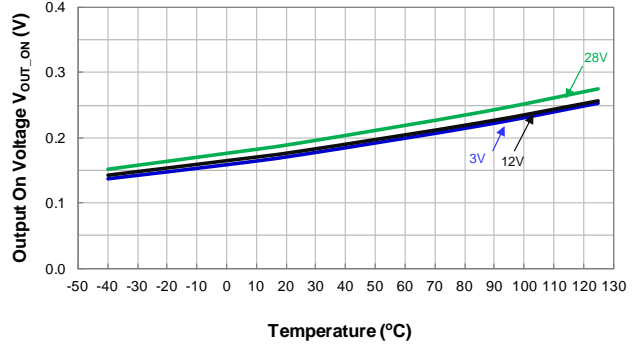


Typical Operating Characteristics

Output Switch On Voltage

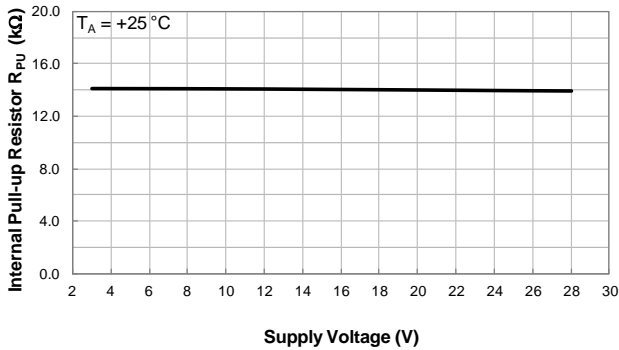


Output On Voltage vs Supply Voltage

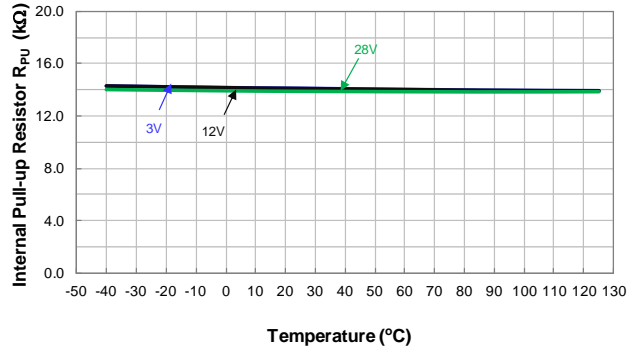


Output On Voltage vs Temperature

Output Pull-Up Resistor (Internal)

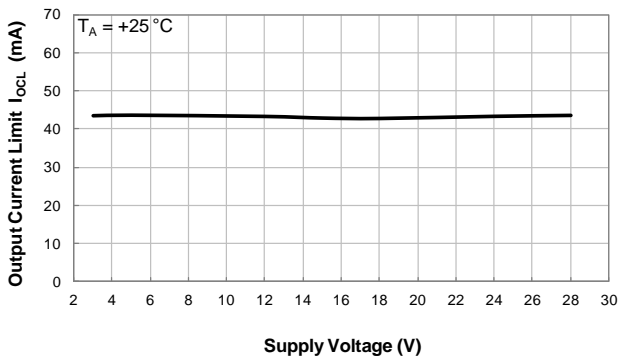


Internal Output Pull-up Resistor vs Supply Voltage

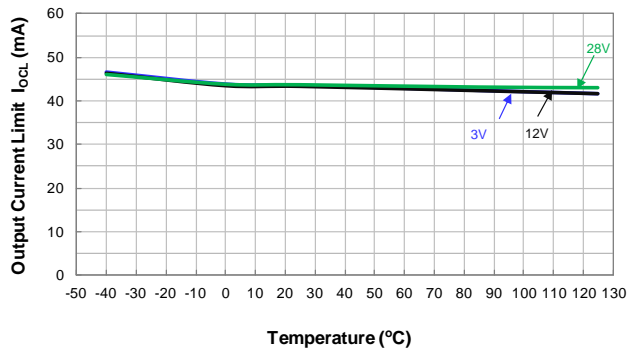


Internal Output Pull-up Resistor vs Temperature

Output Current Limit



Output Current Limit vs Supply Voltage

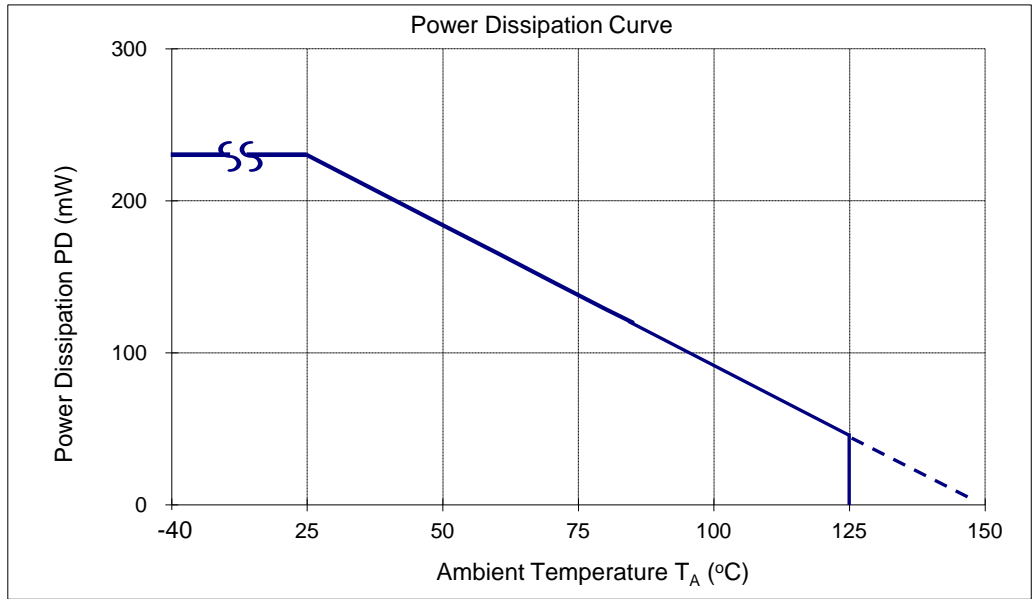


Output Current Limit vs Temperature

Thermal Performance Characteristics

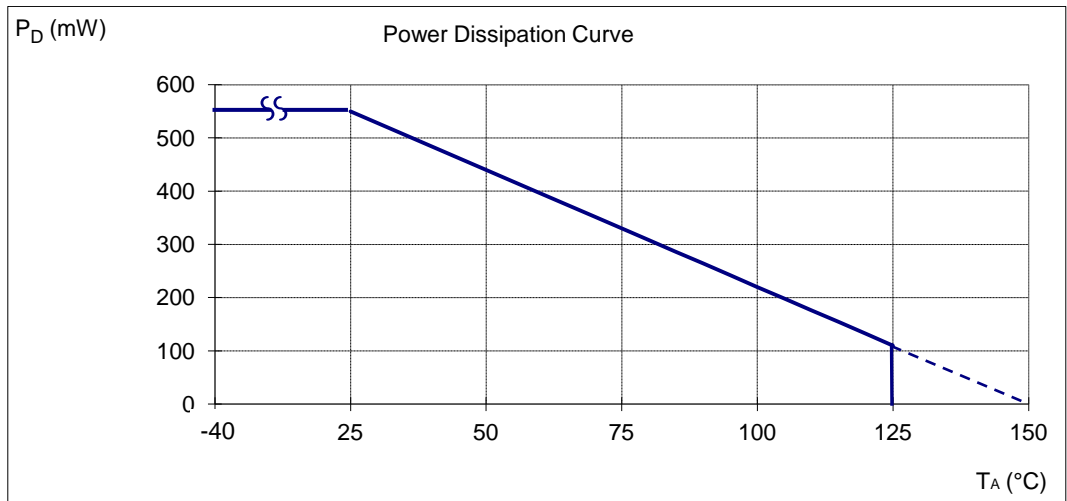
(1) Package Type: SOT23

| T _A (°C) | 25 | 50 | 60 | 70 | 80 | 85 | 90 | 100 | 105 | 110 | 120 | 125 | 130 | 140 | 150 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| P _D (mW) | 230 | 184 | 166 | 147 | 129 | 120 | 110 | 92 | 83 | 74 | 55 | 46 | 37 | 18 | 0 |

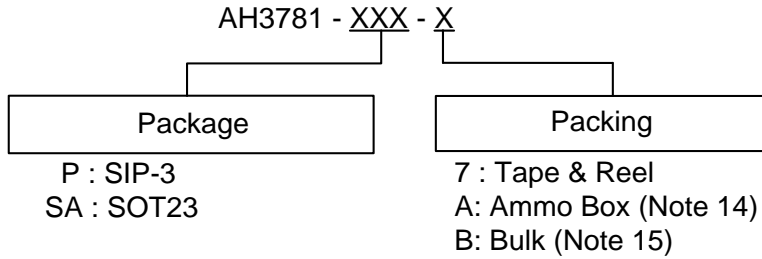


(2) Package type: SIP-3

| T _A (°C) | 25 | 50 | 60 | 70 | 80 | 85 | 90 | 100 | 105 | 110 | 120 | 125 | 130 | 140 | 150 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| P _D (mW) | 550 | 440 | 396 | 362 | 308 | 286 | 264 | 220 | 198 | 176 | 132 | 110 | 88 | 44 | 0 |



Ordering Information



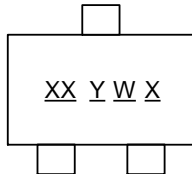
| Part Number | Package Code | Packaging | Bulk | | 7" Tape and Reel | | Ammo Box | |
|-------------|--------------|-----------|----------|--------------------|-------------------|--------------------|-----------|--------------------|
| | | | Quantity | Part Number Suffix | Quantity | Part Number Suffix | Quantity | Part Number Suffix |
| AH3781-P-A | P | SIP-3 | NA | NA | NA | NA | 4,000/Box | -A |
| AH3781-P-B | P | SIP-3 | 1,000 | -B | NA | NA | NA | NA |
| AH3781-SA-7 | SA | SOT23 | NA | NA | 3,000/Tape & Reel | -7 | NA | NA |

Notes: 14. Ammo Box is for SIP-3 Spread Lead.
15. Bulk is for SIP-3 Straight Lead.

Marking Information

(1) Package Type: SOT23

(Top View)

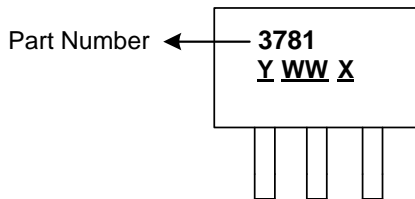


XX : Identification code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents
52 and 53 week
X : Internal code

| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH3781 | SOT23 | WX |

(2) Package Type: SIP-3

(Top View)



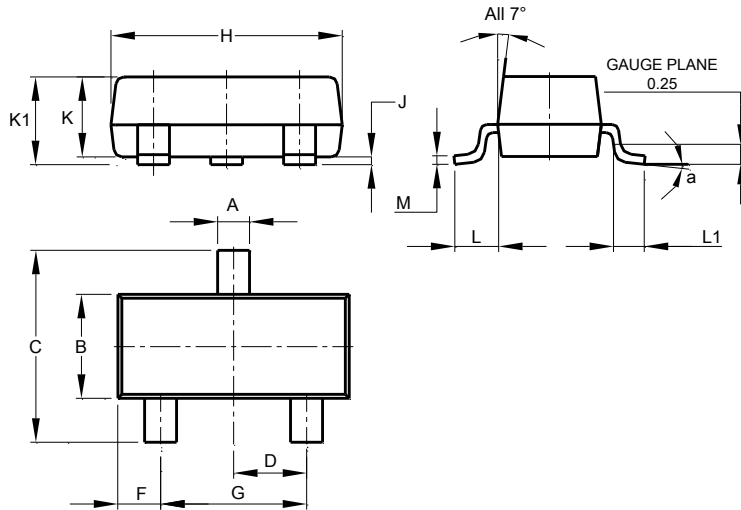
Y : Year : 0~9
WW : Week : 01~52, "52" represents
52 and 53 week
X : Internal Code

| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH3781 | SIP-3 | 3781 |

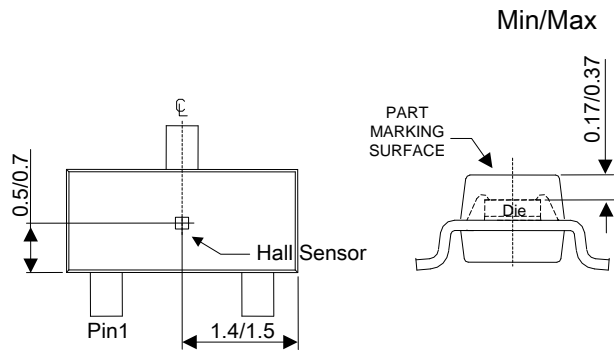
Package Outline Dimensions (All dimensions in mm.)

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

(1) Package Type: SOT23



| SOT23 | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.37 | 0.51 | 0.40 |
| B | 1.20 | 1.40 | 1.30 |
| C | 2.30 | 2.50 | 2.40 |
| D | 0.89 | 1.03 | 0.915 |
| F | 0.45 | 0.60 | 0.535 |
| G | 1.78 | 2.05 | 1.83 |
| H | 2.80 | 3.00 | 2.90 |
| J | 0.013 | 0.10 | 0.05 |
| K | 0.890 | 1.00 | 0.975 |
| K1 | 0.903 | 1.10 | 1.025 |
| L | 0.45 | 0.61 | 0.55 |
| L1 | 0.25 | 0.55 | 0.40 |
| M | 0.085 | 0.150 | 0.110 |
| a | 8° | | |
| All Dimensions in mm | | | |

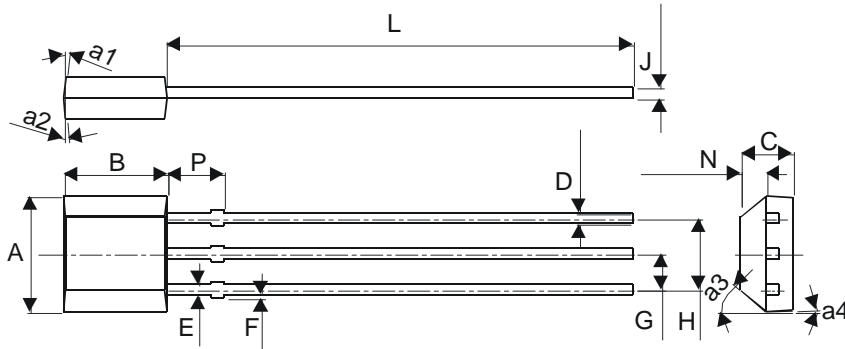


Sensor Location

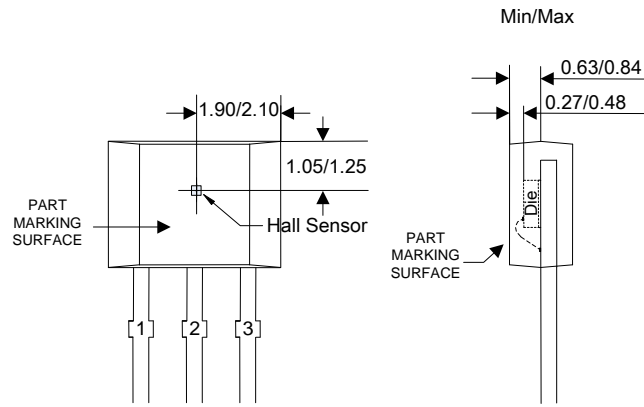
Package Outline Dimensions (cont.) (All dimensions in mm.)

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

(2) Package Type: SIP-3 Bulk



| SIP-3 (Bulk) | | |
|-----------------------------|---------|-------|
| 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 | | |

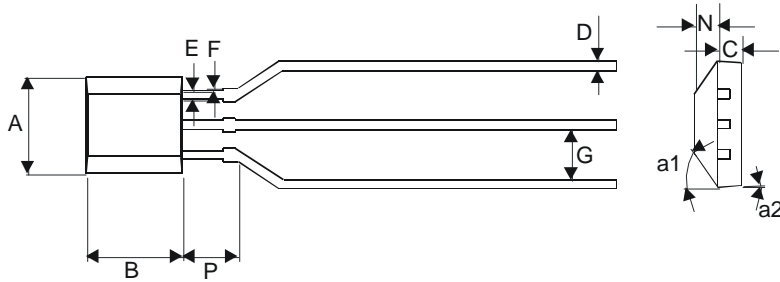


Sensor Location

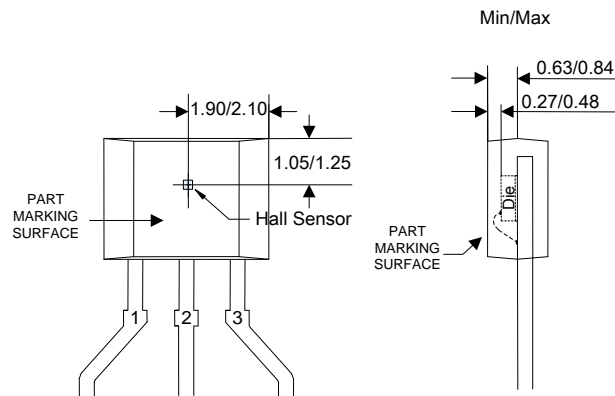
Package Outline Dimensions (cont.) (All dimensions in mm.)

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

(3) Package Type: SIP-3 Ammo Pack



| SIP-3 (Ammo Pack) | | |
|----------------------|---------|------|
| 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 | | |

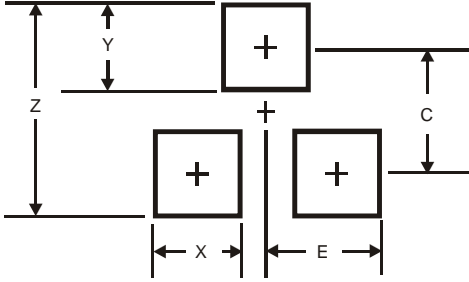


Sensor Location

Suggested Pad Layout

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

(1) Package Type: SOT23



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 2.9 |
| X | 0.8 |
| Y | 0.9 |
| C | 2.0 |
| E | 1.35 |

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- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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