

Description

The AH3522/AH3524 is a high-voltage high-sensitivity Hall-effect Omnipolar switch IC designed for proximity, position and level sensing in consumer home appliances, office equipment, smart home to industrial applications. To support the wide range of the demanding applications, the design has been 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 AH3522/AH3524 provides a reliable solution over the whole operating range. For robustness and protection, the device has a reverse blocking diode with a Zener clamp on the supply. The output has an over current limit and a Zener clamp.

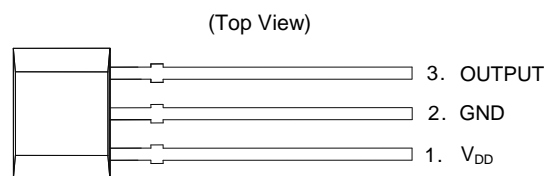
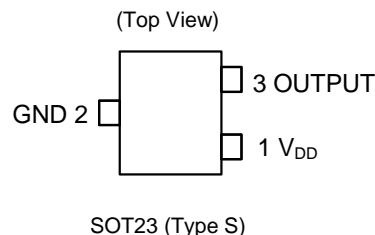
The single open-drain output can be switched on with South or North pole of sufficient strength. When the magnetic flux density (B) perpendicular to the package is larger than the operate point (B_{OP}) the output is switched on (pulled low) and is held on until magnetic flux density B is lower than the release point (B_{RP}).

Features

- Omnipolar Operation
- High Sensitivity: B_{OP} and B_{RP} of ±20G to ±40G and ±10G to ±25G Typical
- Single Open-Drain Output with Overcurrent Limit
- Resistant to Physical Stress
- 3.0V to 28V Operating Voltage Range
- Chopper Stabilized Design Provides
 - Superior Temperature Stability
 - Minimal Switch Point Drift
 - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Reverse Blocking Diode
- Zener Clamp on Supply and Output Pins
- -40°C to +125°C Operating Temperature
- High ESD HBM: 8kV
- Industry Standard SOT23 (Type S), SIP-3 (Ammo Pack), and SIP-3 (Bulk Pack) Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> 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.

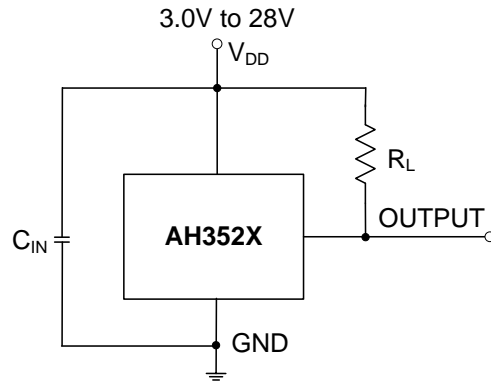
Pin Assignments



Applications

- Position and proximity sensing in home appliances, building automation, office equipment and Industrial applications
- Open and close detection
- Position detection
- Level detection
- Flow meters
- Contactless switches

Typical Applications Circuit



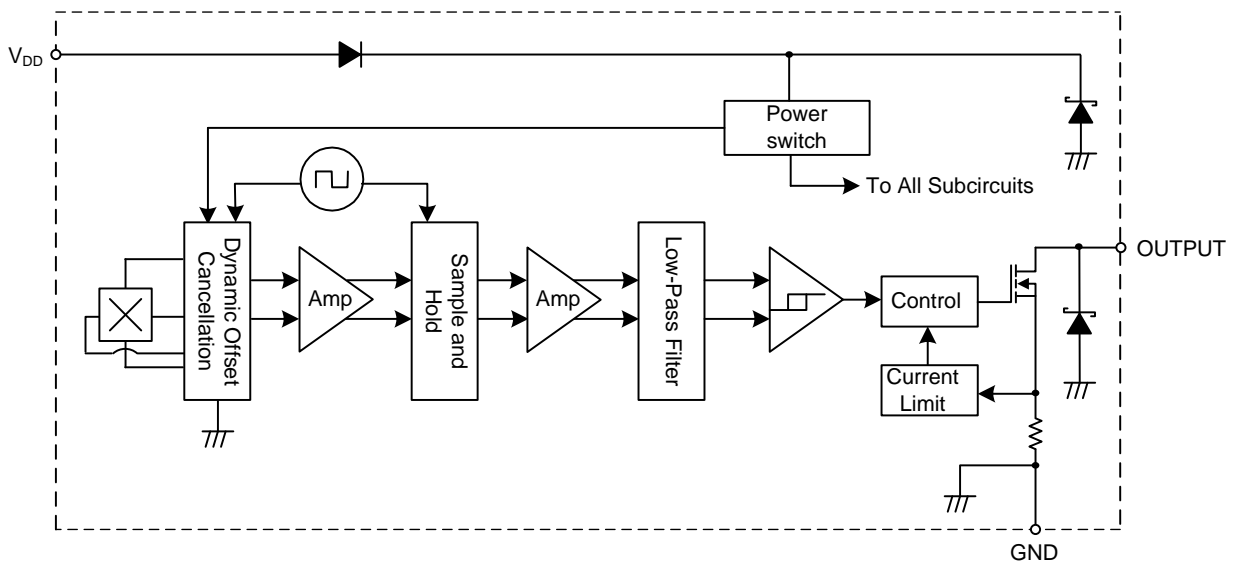
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity. The recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

Pin Descriptions

Packages: SOT23 (Type S), SIP-3 (Ammo Pack), and SIP-3 (Bulk Pack)

| 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 | -18 | V | |
| V _{OUT_MAX} | Output Pin Off Voltage (Note 6) | 32 | V | |
| I _{OUT} | Continuous Output Current | 60 | mA | |
| I _{OUT_R} | Reverse Output Current | -50 | mA | |
| B | Magnetic Flux Density | Unlimited | | |
| P _D | Package Power Dissipation | SIP-3 (Ammo Pack) | 550 | mW |
| | | SIP-3 (Bulk Pack) | | |
| | | SOT23 (Type S) | 230 | |
| T _S | Storage Temperature Range | -65 to +165 | °C | |
| T _J | Maximum Junction Temperature | +150 | °C | |
| ESD HBM | Electrostatic Discharge Withstand Capability—Human Body Model | 8 | kV | |

- Notes:
- Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.
 - 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 | Supply voltage, between V _{DD} and GND pins | 3.0 to 28 | V |
| T _A | Operating Temperature Range | Operating ambient temperature range | -40 to +125 | °C |

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

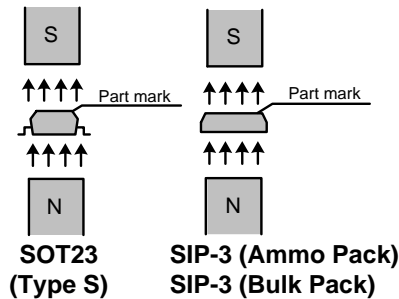
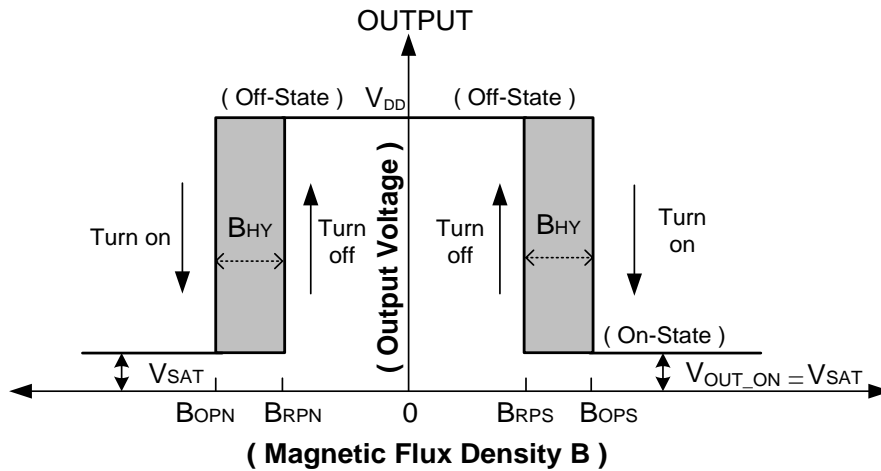
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------|--|--|-----|-------|-----|------|
| V _{OUT_ON} | Output On Voltage | I _{OUT} = 20mA, B > B _{OP} | — | 0.2 | 0.4 | V |
| I _{OUT_OFF} | Output Leakage Current (When Output Is Off) | V _{OUT} = 28V, B < B _{RP} , output off | — | < 0.1 | 10 | μA |
| I _{DD} | Supply Current | Output open, T _A = +25°C | — | 3 | 4 | mA |
| | | Output open, T _A = -40°C to +125°C | — | — | 5 | mA |
| I _{DD_R} | Reverse Supply Current | V _{DD} = -18V, T _A = +25°C | — | -0.01 | — | mA |
| | | V _{DD} = -18V, T _A = -40°C to +125°C | — | -0.01 | 1.5 | mA |
| t _{P_ON} | Device Power-On Time (Startup Time) | V _{DD} ≥ 3V, B > B _{OP} (Note 7) | — | 10 | — | μs |
| f _C | Chopping Frequency | V _{DD} ≥ 3V | — | 500 | — | kHz |
| t _D | Response Time Delay (Time from Magnetic Threshold Reached to the Start of the Output Rise or Fall) | (Note 9) | — | 4 | — | μs |
| t _R | Output Rising Time (External Pullup Resistor R _L and Load Capacitance Dependent) | R _L = 1kΩ, C _L = 20pF (Note 9) | — | 0.2 | 1 | μs |
| t _F | Output Falling Time (Internal Switch Resistance and Load Capacitance Dependent) | R _L = 1kΩ, C _L = 20pF (Note 9) | — | 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, T _A = +25°C | 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 startup 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 limits 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)

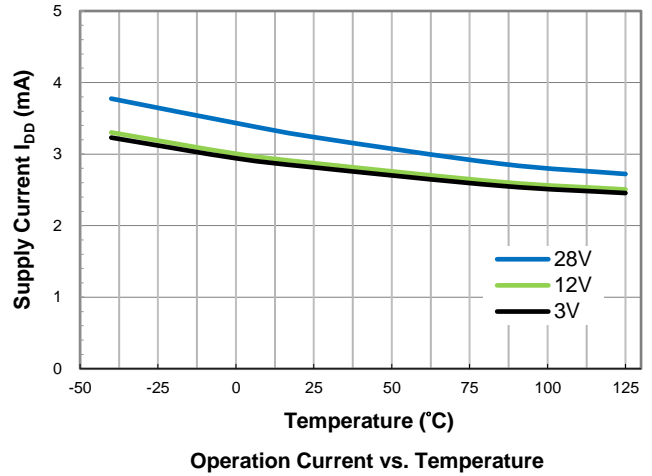
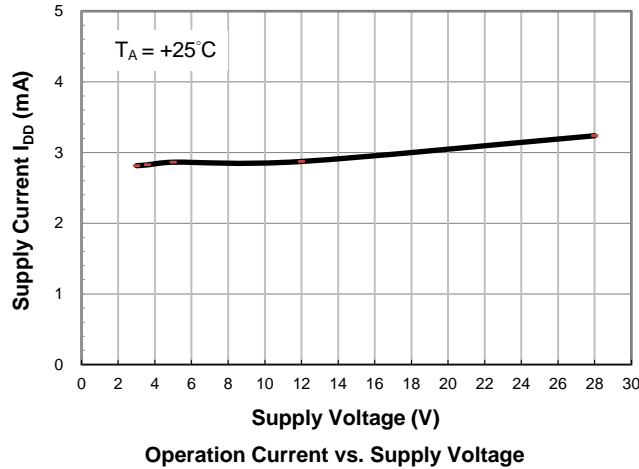
| Part Number | Symbol | Parameter | Min | Typ | Max | Unit | Output Type |
|-------------|---|----------------------|-----|-----|-----|-------|-------------|
| AH3522 | BOPS (South Pole to the Part Marking Side) | Operation Point | 8 | 20 | 30 | Gauss | Open-Drain |
| | BOPN (North Pole to the Part Marking Side) | | -30 | -20 | -8 | | |
| | BRPS (South Pole to the Part Marking Side) | Release Point | 2 | 10 | 25 | | |
| | BRPN (North Pole to the Part Marking Side) | | -25 | -10 | -2 | | |
| | BHY (BOPX - BRPX) | Hysteresis (Note 13) | 2 | 10 | 19 | | |
| AH3524 | BOPS (South Pole to the Part Marking Side) | Operation Point | 20 | 40 | 60 | Gauss | Open-Drain |
| | BOPN (North Pole to the Part Marking Side) | | -60 | -40 | -20 | | |
| | BRPS (South Pole to the Part Marking Side) | Release Point | 10 | 25 | 45 | | |
| | BRPN (North Pole to the Part Marking Side) | | -45 | -25 | -10 | | |
| | BHY (BOPX - BRPX) | Hysteresis (Note 13) | 9 | 15 | 22 | | |

- 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 startup time of 10 μs 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.

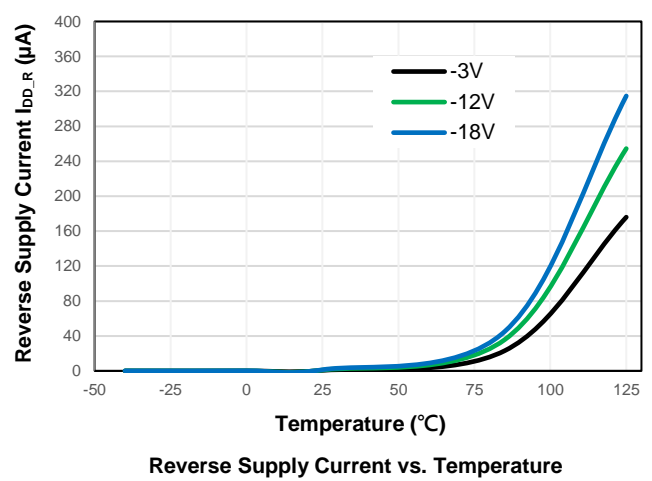
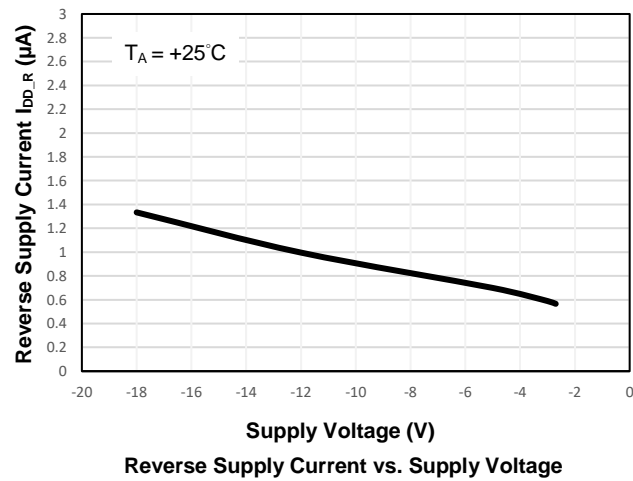


Typical Operating Characteristics

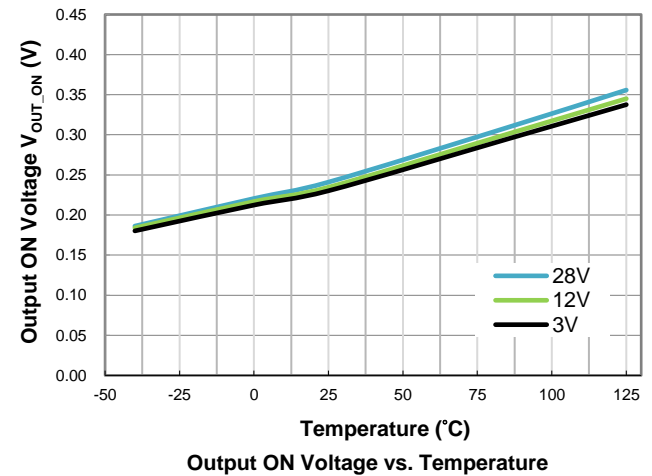
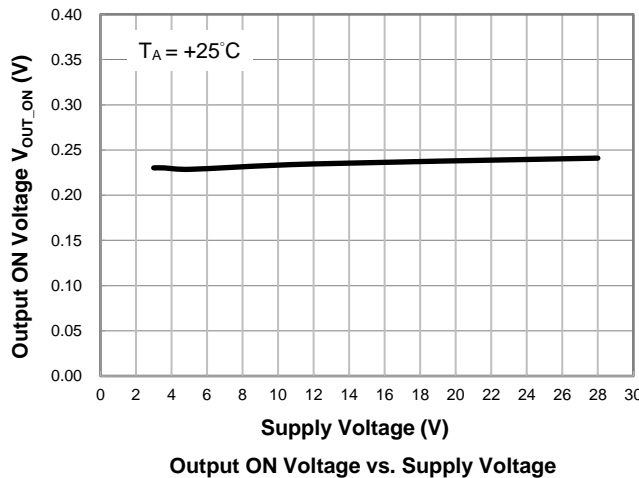
Supply Current



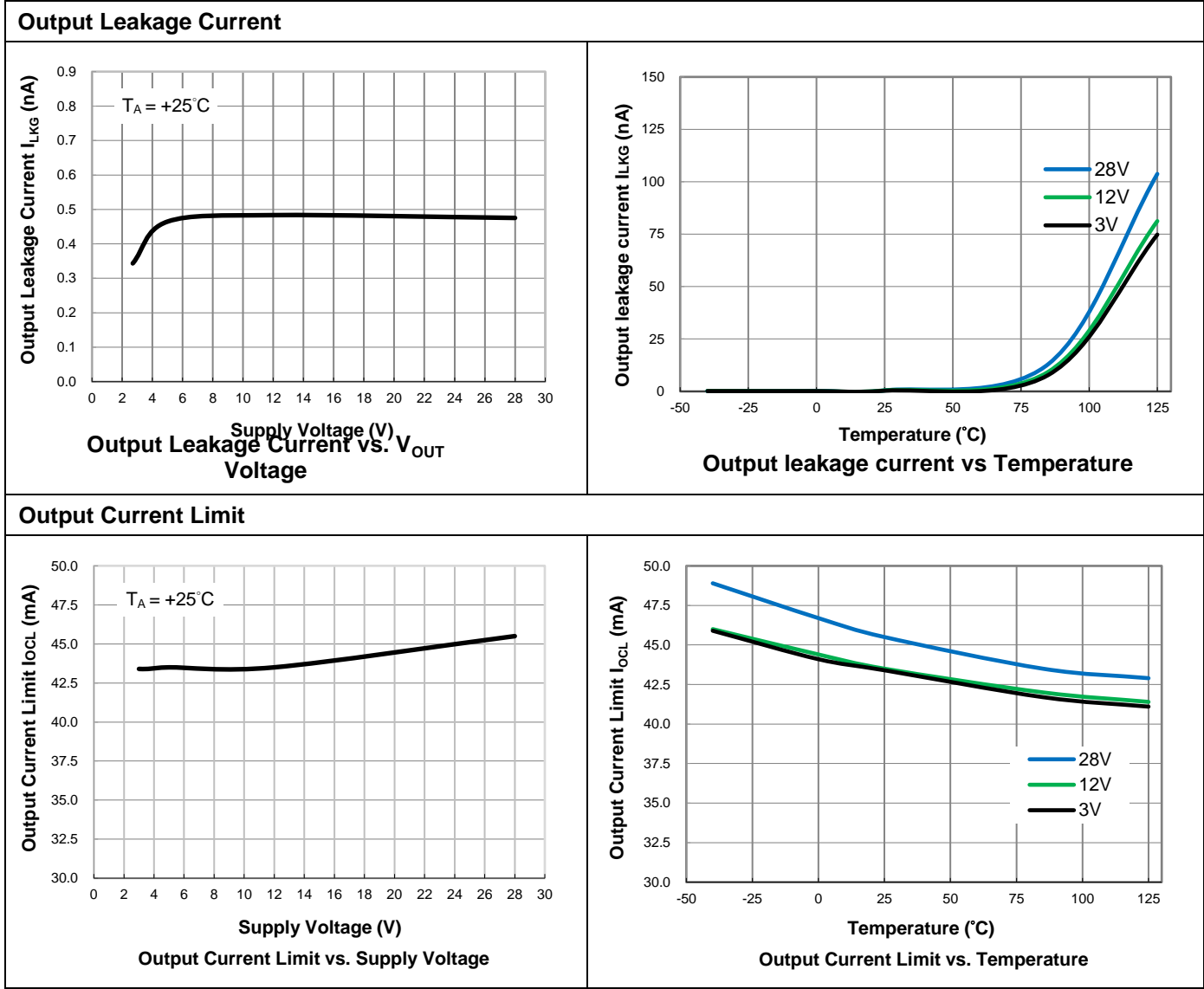
Reverse Supply Current



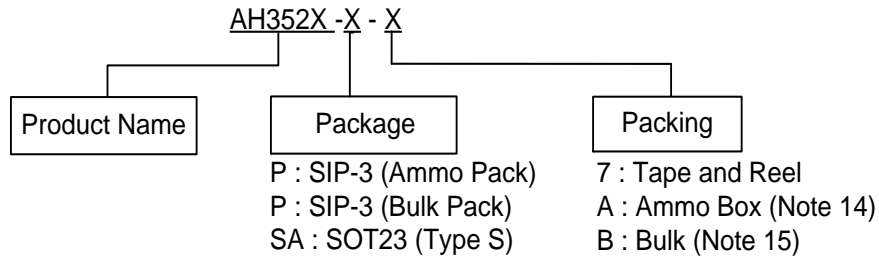
Output Switch On Voltage, $I_{OUT} = 20\text{mA}$



Typical Operating Characteristics (continued)



Ordering Information



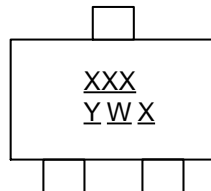
| Part Number | Package Code | Package | Part Number Suffix | Packing | |
|-------------|--------------|-------------------|--------------------|---------|----------------|
| | | | | Qty. | Carrier |
| AH3522-P-A | P | SIP-3 (Ammo Pack) | -A | 4,000 | Ammo Box |
| AH3522-P-B | P | SIP-3 (Bulk Pack) | -B | 1,000 | Bulk |
| AH3522-SA-7 | SA | SOT23 (Type S) | -7 | 3,000 | 7" Tape & Reel |
| AH3524-P-A | P | SIP-3 (Ammo Pack) | -A | 4,000 | Ammo Box |
| AH3524-P-B | P | SIP-3 (Bulk Pack) | -B | 1,000 | Bulk |
| AH3524-SA-7 | SA | SOT23 (Type S) | -7 | 3,000 | 7" Tape & Reel |

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

Marking Information

(1) Package Type: SOT23 (Type S)

(Top View)



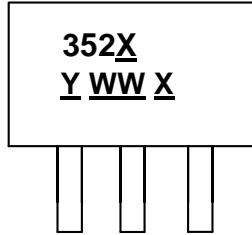
XXX : Identification Code
 Y : Year 0 to 9 (ex: 3 = 2023)
 W : Week : A to Z : week 1 to 26;
 a to z : week 27 to 52; z represents week 52 and 53
 X : Internal Code

| Part Number | Package | Identification Code |
|-------------|----------------|---------------------|
| AH3522-SA-7 | SOT23 (Type S) | S6A |
| AH3524-SA-7 | SOT23 (Type S) | S6C |

Marking Information (continued)

(2) Package Type: SIP-3 (Ammo Pack)/SIP-3 (Bulk Pack)

(Top View)



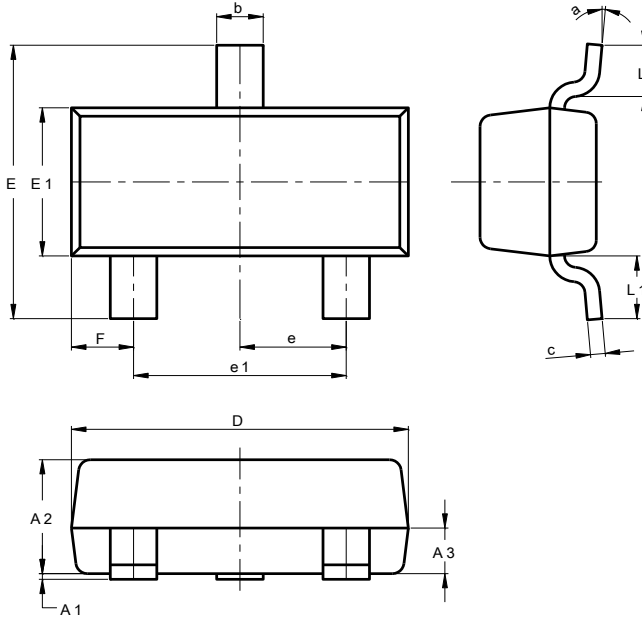
352X : Identification Code
Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52, "52" represents week 52 and 53
X : Internal Code

| Part Number | Package | Identification Code |
|-------------|-------------------|---------------------|
| AH3522-P-A | SIP-3 (Ammo Pack) | 3522 |
| AH3522-P-B | SIP-3 (Bulk Pack) | 3522 |
| AH3524-P-A | SIP-3 (Ammo Pack) | 3524 |
| AH3524-P-B | SIP-3 (Bulk Pack) | 3524 |

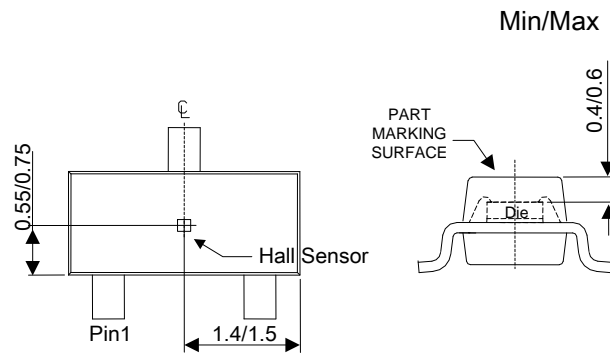
Package Outline Dimensions (All dimensions in mm.)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOT23 (Type S)



| SOT23 (Type S) | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A1 | 0.013 | 0.10 | 0.05 |
| A2 | 0.90 | 1.025 | 1.00 |
| A3 | 0.375 | 0.425 | 0.40 |
| b | 0.37 | 0.51 | 0.40 |
| c | 0.10 | 0.18 | 0.125 |
| D | 2.80 | 3.00 | 2.90 |
| E | 2.30 | 2.50 | 2.40 |
| E1 | 1.20 | 1.40 | 1.30 |
| e | 0.89 | 1.03 | 0.915 |
| e1 | 1.78 | 2.05 | 1.83 |
| F | 0.45 | 0.60 | 0.535 |
| L1 | 0.45 | 0.61 | 0.55 |
| L | 0.25 | 0.55 | 0.40 |
| a | 0° | 8° | -- |
| All Dimensions in mm | | | |

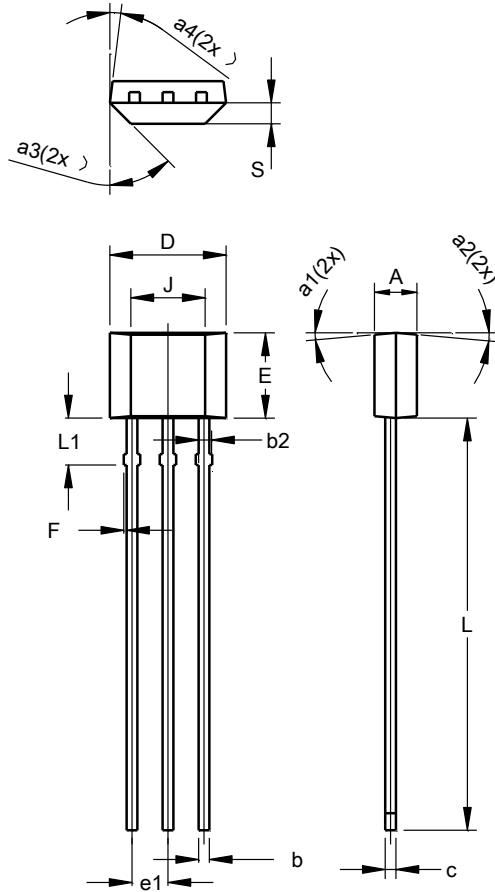


Sensor Location

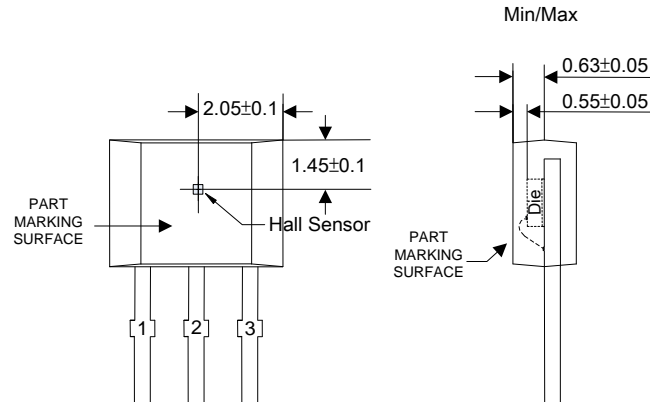
Package Outline Dimensions (All dimensions in mm.) (continued)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(2) Package Type: SIP-3 (Bulk Pack)



| SIP-3 (Bulk Pack) | | | |
|----------------------|----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 1.40 | 1.60 | 1.50 |
| b | 0.33 | 0.43 | 0.38 |
| b2 | 0.40 | 0.508 | 0.46 |
| c | 0.35 | 0.41 | 0.38 |
| D | 3.90 | 4.30 | 4.10 |
| E | 2.80 | 3.20 | 3.00 |
| e1 | 1.24 | 1.30 | 1.27 |
| F | 0.00 | 0.20 | -- |
| J | 2.62 REF | | |
| L | 14.00 | 15.00 | 14.50 |
| L1 | 1.55 | 1.75 | 1.65 |
| S | 0.63 | 0.84 | 0.74 |
| a1 | -- | -- | 5° |
| a2 | -- | -- | 5° |
| a3 | -- | -- | 45° |
| a4 | -- | -- | 3° |
| All Dimensions in mm | | | |

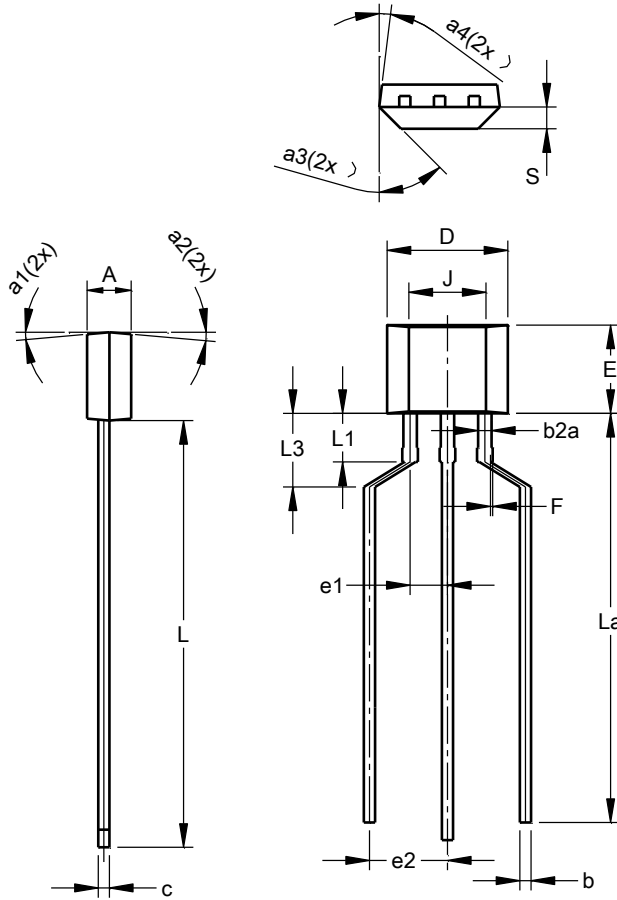


Sensor Location

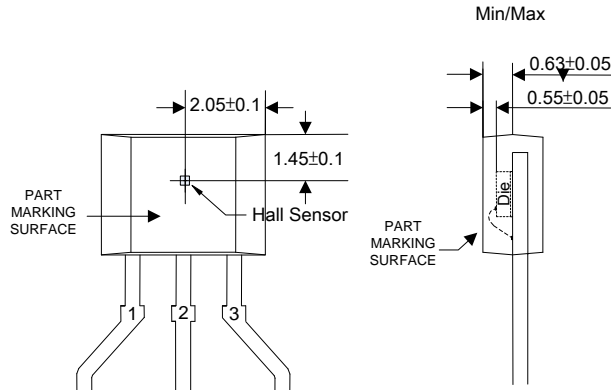
Package Outline Dimensions (All dimensions in mm.) (continued)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(3) Package Type: SIP-3 (Ammo Pack)



| SIP-3 (Ammo Pack) | | | |
|----------------------|----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 1.40 | 1.60 | 1.50 |
| b | 0.33 | 0.43 | 0.38 |
| b2a | 0.40 | 0.52 | 0.46 |
| c | 0.35 | 0.41 | 0.38 |
| D | 3.90 | 4.30 | 4.10 |
| E | 2.80 | 3.20 | 3.00 |
| e1 | 1.24 | 1.30 | 1.27 |
| e2 | 2.40 | 2.90 | 2.65 |
| F | 0.00 | 0.20 | -- |
| J | 2.62 REF | | |
| L | 14.00 | 15.00 | 14.50 |
| La | 12.90 | 14.90 | 13.90 |
| L1 | 1.55 | 1.75 | 1.65 |
| L3 | 2.00 | 3.00 | 2.50 |
| S | 0.63 | 0.84 | 0.74 |
| a1 | -- | -- | 5° |
| a2 | -- | -- | 5° |
| a3 | -- | -- | 45° |
| a4 | -- | -- | 3° |
| All Dimensions in mm | | | |

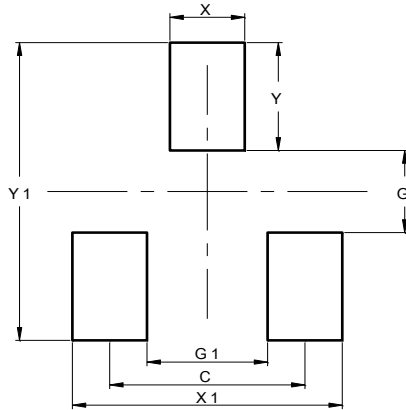


Sensor Location

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

Package Type: SOT23 (Type S)



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 1.830 |
| G | 0.800 |
| G1 | 1.130 |
| X | 0.700 |
| X1 | 2.530 |
| Y | 1.050 |
| Y1 | 2.900 |

Mechanical Data

- Moisture Sensitivity: SOT23 (Type S) – Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (A3)
- Weight: SIP-3 (Ammo Pack)/SIP-3 (Bulk Pack) – 0.077 grams (Approximate)
SOT23 (Type S) – 0.009 grams (Approximate)

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