# HIGH-SENSITIVITY ULTRA-LOW POWER DIGITAL UNIPOLAR HALL-EFFECT SWITCH

## Description

The AH1381/AH1382/AH1383 are ultra-low power digital Unipolar Hall-effect switch IC from Diodes Incorporated's broad Hall-effect switches family. Thanks to the hibernating clocking system, the average supply current is only 1.6μA at 3V, which makes the AH1381/AH1382/AH1383 perfectly fit battery-powered consumer products, gas or water meters, smoke detectors and IoT devices. The wider range of the supply voltage (1.6V to 5.5V) extends battery operating time and supports low-voltage system microcontrollers, which provides great flexibility for system design. The advanced chopper stabilized design provides superior stability on switch operating point over temperature and supply voltage. The high ESD level up to 8kV helps to improve the system robustness.

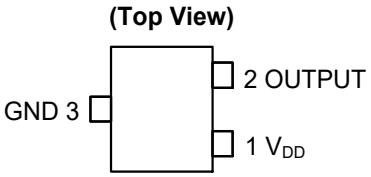
The output is activated with south pole of sufficient magnetic field strength. When the magnetic flux density (B) perpendicular to the package is larger than operate point ($B_{OPS}$), the output will be turned on (pulled low) and held until B is lower than release point ($B_{RPS}$).

The devices are packaged in SOT23 (Type S) and small low profile X2-DFN1410-4 and X2-DFN1010-4 (Type B).

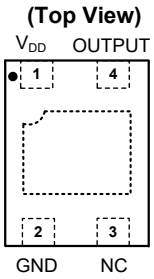
## Features

- Unipolar Operation (South Pole)
- Supply Voltage of 1.6V to 5.5V
- Micro Power Operation
- Chopper Stabilized Design Provides:
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Physical Stress
- No External Pullup Resistors Required
- Good RF Noise Immunity
- -40°C to +85°C Operating Temperature
- High ESD Capability of 8kV (Human Body Model)
- Small Low Profile SOT23 (Type S), X2-DFN1410-4 and X2-DFN1010-4 (Type B) 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 or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

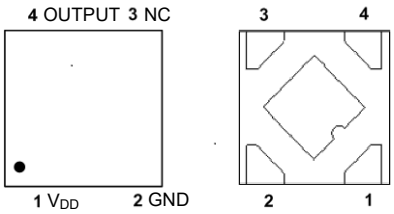
## Pin Assignments




**SOT23 (Type S)**




**X2-DFN1410-4**




**X2-DFN1010-4 (Type B)**

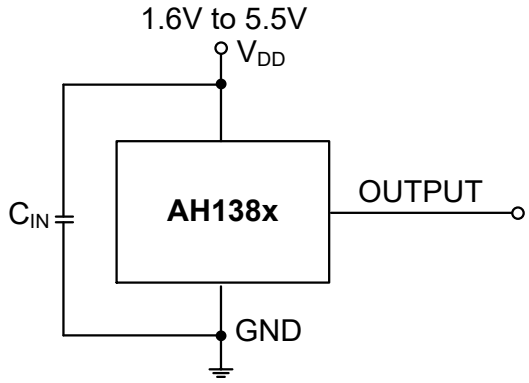
## Applications

- Smart covers for cellular phones, tablets, laptops, Chromebooks
- Open and close detect for TWS, digital still/video cameras and handheld gaming consoles
- Medical devices, IoT systems
- Level, proximity and position switches
- E-locks, smoke detectors, appliances
- Doors, lids and tray position switches
- Home appliances such as washing machines, refrigerators
- Industrial applications such as smart meters, E-meters, power tools

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.


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Typical Applications Circuit




Note: 4. $C_{IN}$ is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 100nF typical and should be placed as close to the supply pin as possible.

## Pin Descriptions

**(1) Package: SOT23 (Type S)**

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

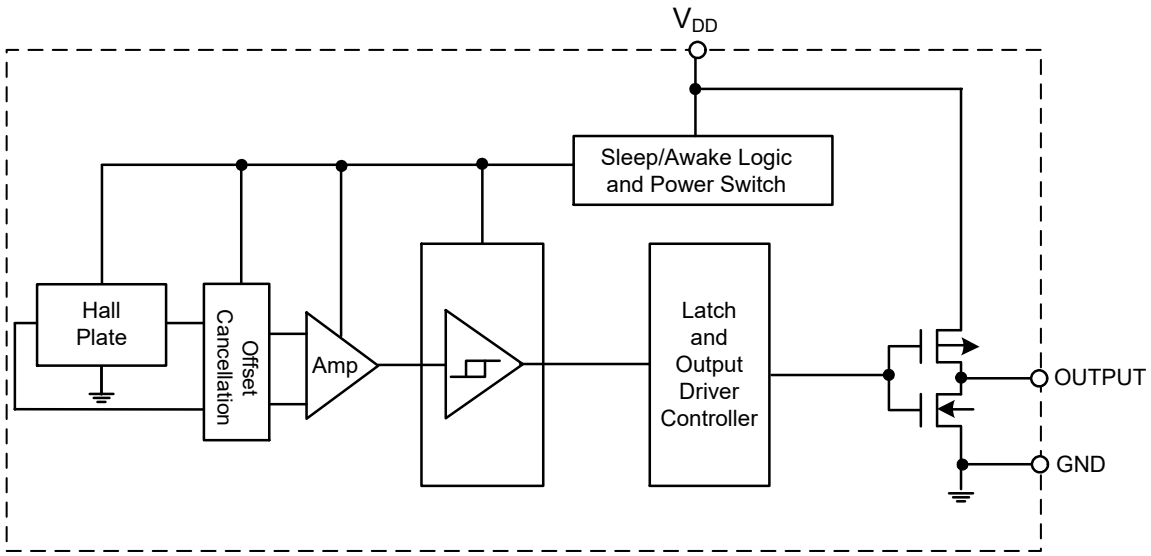
**(2) Packages: X2-DFN1410-4, X2-DFN1010-4 (Type B)**

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | $V_{DD}$ | Power Supply Input |
| 2 | GND | Ground Pin |
| 3 | NC | No Connection (Note 5) |
| 4 | OUTPUT | Output Pin |
| Pad | Pad | The center exposed pad – No connection internally.<br>The exposed pad can be left open (unconnected to) on the PCB layout. |

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


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Functional Block Diagram




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

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage (Note 7) | | 6 | V |
| $V_{DD_REV}$ | Reverse Supply Voltage | | -0.3 | V |
| $I_{OUTPUT}$ | Output Current (Source and Sink) | | 1 | mA |
| B | Magnetic Flux Density | | Unlimited | |
| $P_D$ | Package Power Dissipation | SOT23 (Type S) and X2-DFN1410-4 | 230 | mW |
| | | X2-DN1010-4 (Type B) | 400 | |
| $T_S$ | Storage Temperature Range | | -65 to 150 | °C |
| $T_J$ | Maximum Junction Temperature | | 150 | °C |
| ESD HBM | Human Body Model (HBM) ESD Capability | | 8 | kV |

Notes:
6. 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.
7. The absolute maximum $V_{DD}$ of 6V 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°C, unless otherwise specified.)

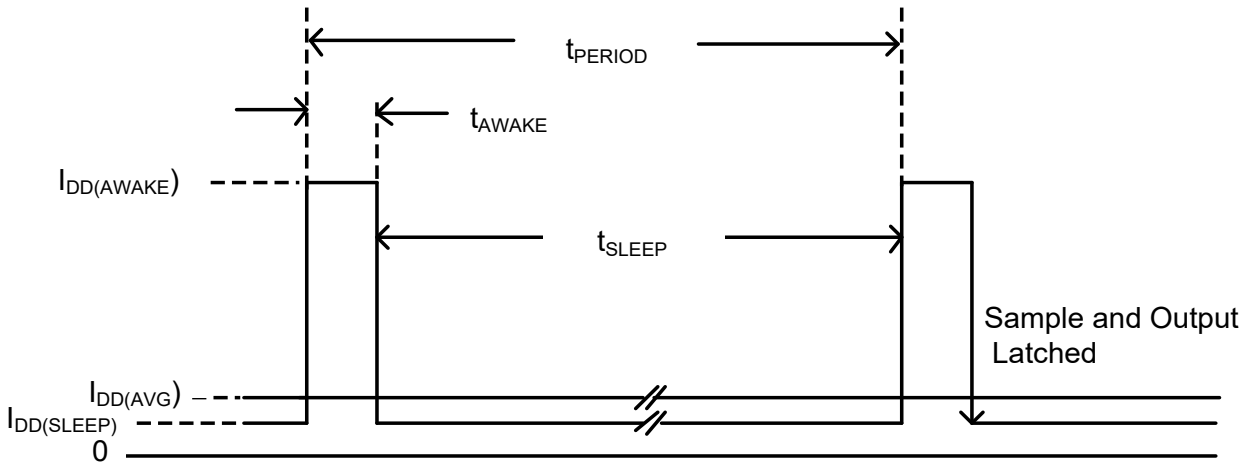
| Symbol | Parameter | Conditions | Rating | Unit |
|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | Operating | 1.6V to 5.5V | V |
| $T_A$ | Operating Temperature Range | Operating | -40 to 85 | °C |


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Electrical Characteristics (@$T_A$ = +25°C, $V_{DD}$ = 3V, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OL}$ | Output Low Voltage (On) | $I_{OUT}$ = 1mA | — | 0.15 | 0.25 | V |
| $V_{OH}$ | Output High Voltage (Off) | $I_{OUT}$ = -1mA | $V_{DD}$-0.25 | $V_{DD}$-0.15 | — | V |
| $I_{DD(AWAKE)}$ | Supply Current | $T_A$ = 25°C, $V_{DD}$ = 3V | — | 1 | 1.5 | mA |
| | | $T_A$ = -40 to 85°C, $V_{DD}$ = 1.6V to 5.5V | — | 1 | 3 | mA |
| $I_{DD(SLEEP)}$ | Supply Current | $T_A$ = 25°C, $V_{DD}$ = 3V | — | 0.6 | 1 | µA |
| | | $T_A$ = -40 to 85°C, $V_{DD}$ = 1.6V to 5.5V | — | 0.6 | 3 | µA |
| $I_{DD(AVG)}$ | Average Supply Current | $T_A$ = 25°C, $V_{DD}$ = 3V | — | 1.6 | 3 | µA |
| | | $T_A$ = -40 to 85°C, $V_{DD}$ = 1.6V to 5.5V (Note 8) | — | 1.6 | 9 | µA |
| $t_{AWAKE}$ | Awake Time | (Note 9) | 30 | 45 | 80 | µs |
| $t_{PERIOD}$ | Period | (Note 9) | 30 | 45 | 80 | ms |
| D.C. | Duty Cycle | — | — | 0.1 | — | % |

Notes: 8. Typical data is at $T_A$ = +25°C, $V_{DD}$ = 3V.
9. When power is initially turned on, the operating $V_{DD}$ (1.6V to 5.5V) must be applied to guarantee the output sampling. The output state is valid after the second operating cycle (typical 90ms).





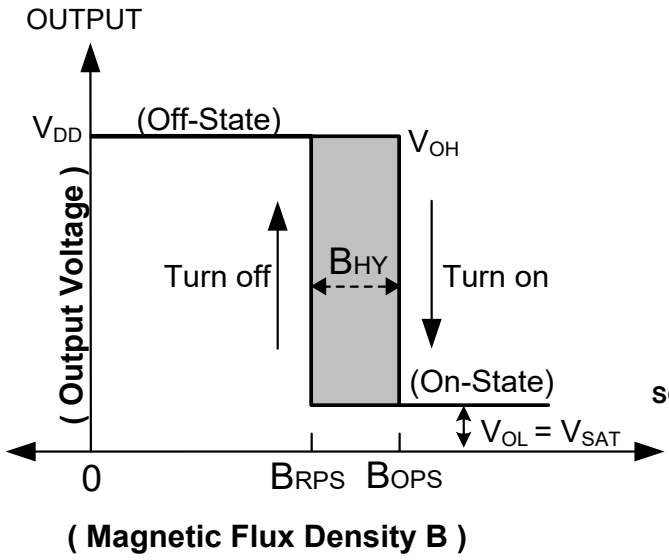
© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

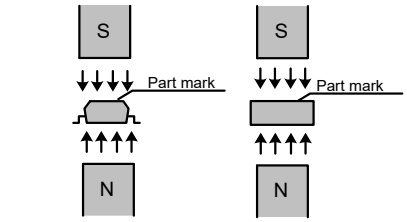
## Magnetic Characteristics (Note 10) ($T_A$ = +25°C, $V_{DD}$ = 3V, unless otherwise specified.)

(1mT=10 Gauss)

| Part Number | Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| AH1381 | $B_{OPS}$ (South Pole to Part Marking Side) | Operating Point | $T_A$ = 25°C | 10 | 18 | 26 | Gauss |
| | | | $T_A$ = -40°C to 85°C | 6 | 18 | 30 | |
| | $B_{RPS}$ (South Pole to Part Marking Side) | Releasing Point | $T_A$ = 25°C | 3 | 11 | 19 | |
| | | | $T_A$ = -40°C to 85°C | 2 | 11 | 24 | |
| | $B_{HY}$ ($\|B_{OPS}\|$-$\|B_{RPS}\|$) | Hysteresis | (Note 10) | 2 | 7 | — | |
| AH1382 | $B_{OPS}$ (South Pole to Part Marking Side) | Operating Point | $T_A$ = 25°C | 22 | 30 | 38 | Gauss |
| | | | $T_A$ = -40°C to 85°C | 18 | 30 | 42 | |
| | $B_{RPS}$ (South Pole to Part Marking Side) | Releasing Point | $T_A$ = 25°C | 12 | 20 | 30 | |
| | | | $T_A$ = -40°C to 85°C | 8 | 20 | 33 | |
| | $B_{HY}$ ($\|B_{OPS}\|$-$\|B_{RPS}\|$) | Hysteresis | (Note 10) | 2 | 10 | — | |
| AH1383 | $B_{OPS}$ (South Pole to Part Marking Side) | Operating Point | $T_A$ = 25°C | 35 | 45 | 55 | Gauss |
| | | | $T_A$ = -40°C to 85°C | 25 | 45 | 60 | |
| | $B_{RPS}$ (South Pole to Part Marking Side) | Releasing Point | $T_A$ = 25°C | 25 | 35 | 45 | |
| | | | $T_A$ = -40°C to 85°C | 20 | 35 | 55 | |
| | $B_{HY}$ ($\|B_{OPS}\|$-$\|B_{RPS}\|$) | Hysteresis | (Note 10) | 2 | 10 | — | |

Note: 10. Maximum and minimum parameters values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.



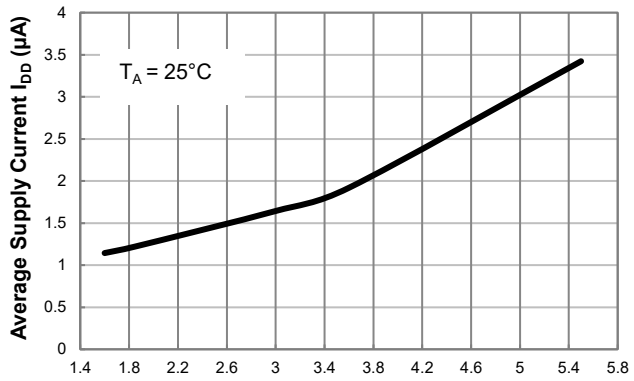




**SOT23 (Type S)** **X2-DFN1410-4**
**X2-DFN1010-4 (Type B)**

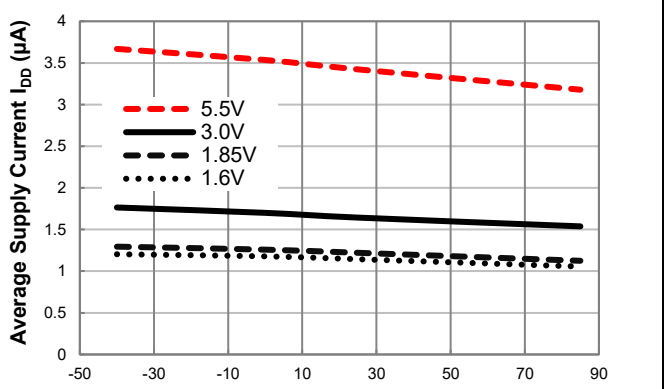

© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Typical Operating Characteristics

### Average Supply Current $I_{DD(AVG)}$

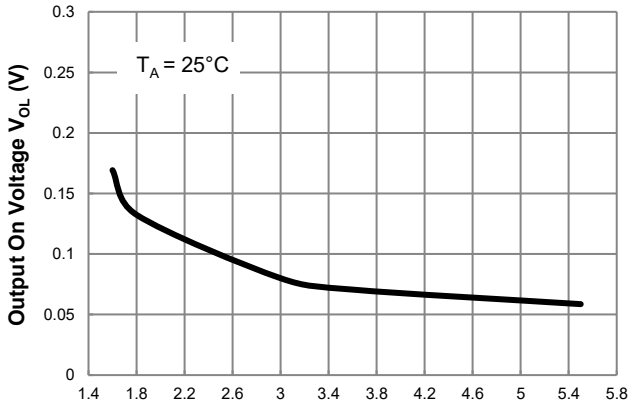



$I_{DD(AVG)}$ vs. Supply Voltage

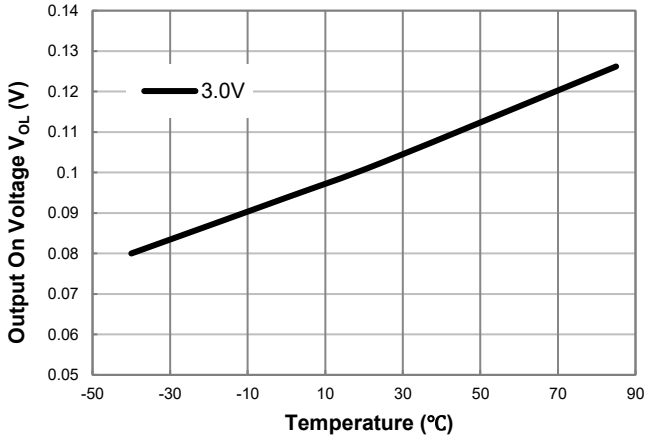



$I_{DD(AVG)}$ vs. Temperature

### Output Low Voltage (On) $V_{OL}$, $I_{OUT}$ = 1mA

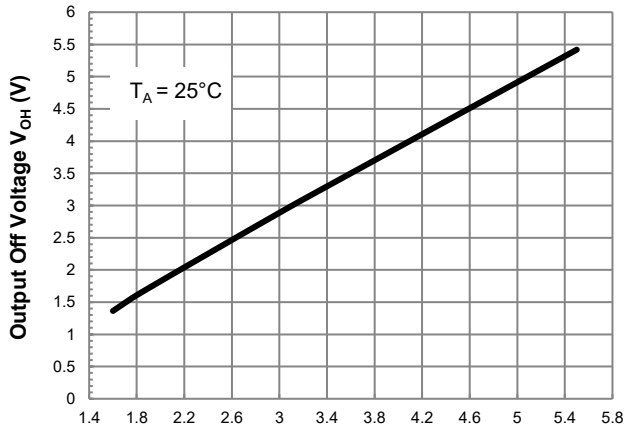



Output On Voltage vs. Supply Voltage

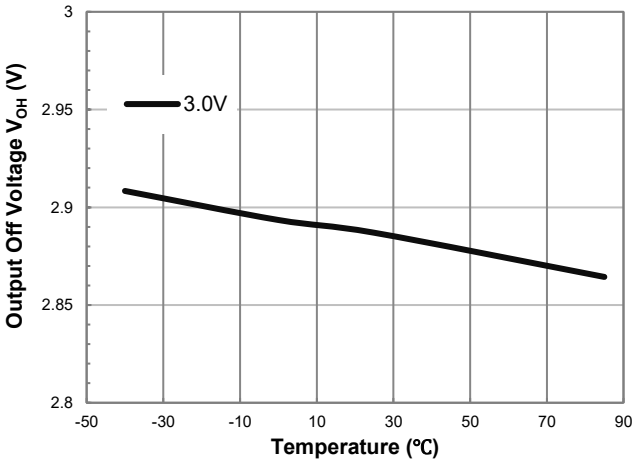



Output On Voltage vs. Temperature

### Output High Voltage (Off) $V_{OH}$, $I_{OUT}$ = -1mA




Output Off Voltage vs. Supply Voltage

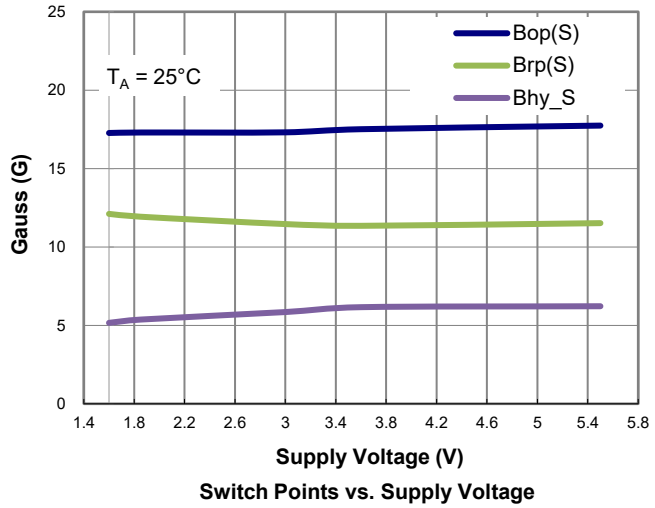



Output Off Voltage vs. Temperature

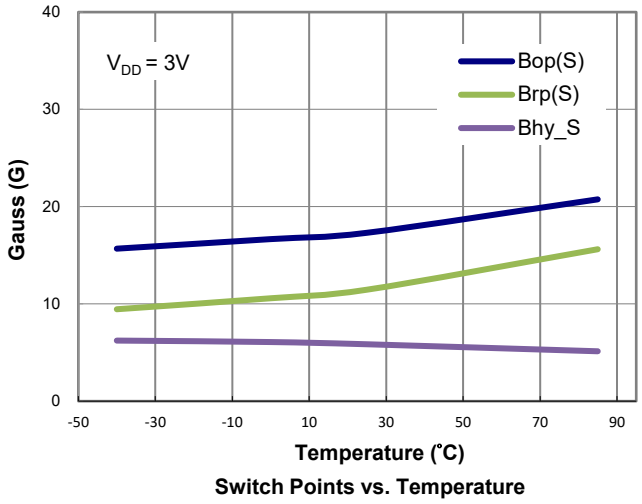

© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Typical Operating Characteristics (continued)

### AH1381–Switch Point $B_{OP}/B_{RP}$ and Hysteresis $B_{HY}$

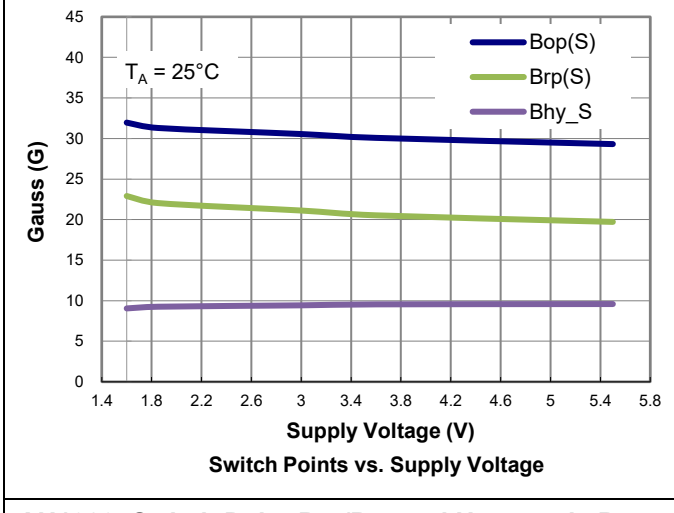



Switch Points vs. Supply Voltage

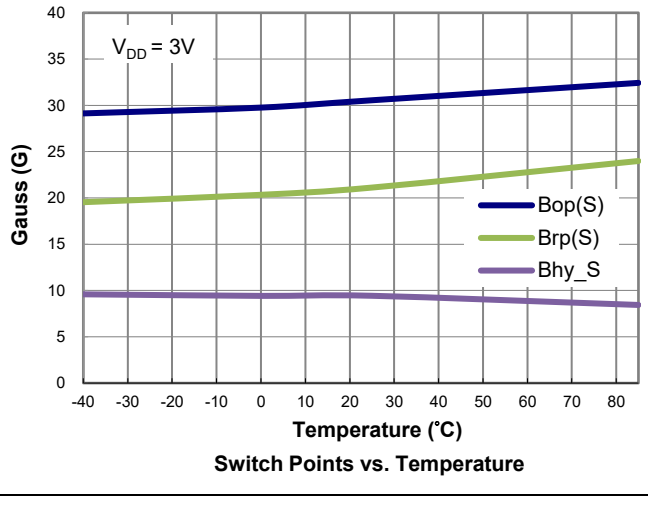



Switch Points vs. Temperature

### AH1382–Switch Point $B_{OP}/B_{RP}$ and Hysteresis $B_{HY}$

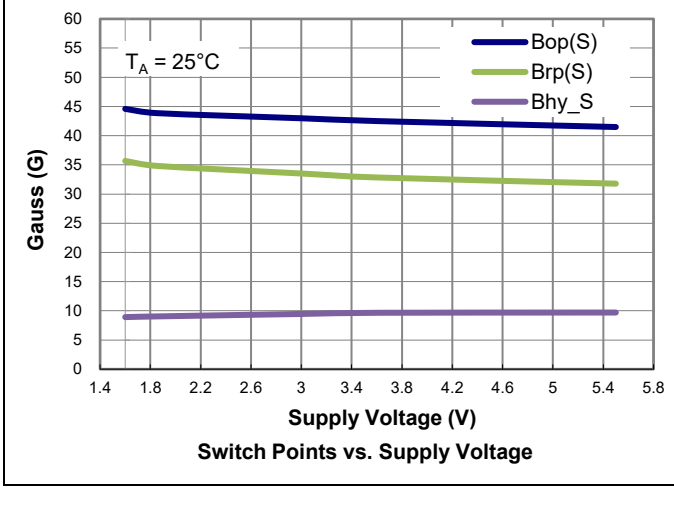



Switch Points vs. Supply Voltage

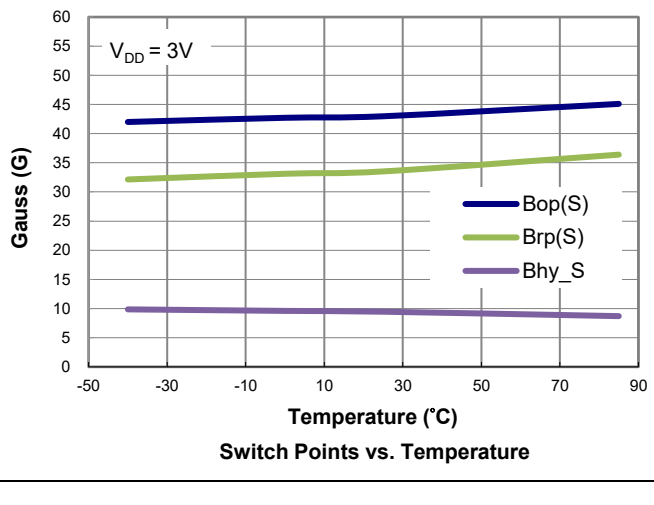



Switch Points vs. Temperature

### AH1383–Switch Point $B_{OP}/B_{RP}$ and Hysteresis $B_{HY}$



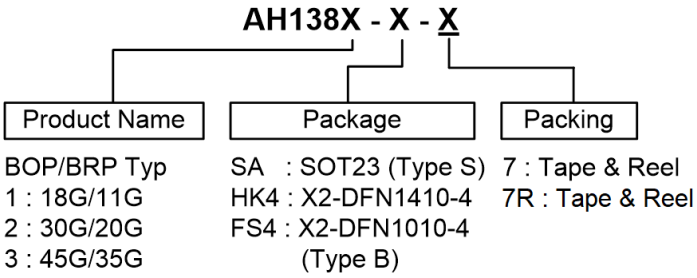

Switch Points vs. Supply Voltage




Switch Points vs. Temperature


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Ordering Information (Note 11)

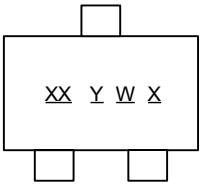



| Orderable Part Number | Package Code | Package | Packing | |
|---|---|---|---|---|
| | | | Qty. | Carrier |
| AH138X-SA-7 | SA | SOT23 (Type S) | 3000 | 7" Tape & Reel |
| AH138X-HK4-7 | HK4 | X2-DFN1410-4 | 4000 | 7" Tape & Reel |
| AH138X-HK4-7R | HK4 | X2-DFN1410-4 | 4000 | 7" Tape & Reel |
| AH138X-FS4-7 | FS4 | X2-DFN1010-4 (Type B) | 5000 | 7" Tape & Reel |

Note: 11. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

## Marking Information

**(1) Package Type: SOT23 (Type S)**

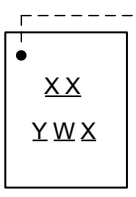



XX : Identification Code
Y : Year : 0 to 9 (ex: 6 = 2026)
W : Week : A to Z : Week 1 to 26;
a to z : Week 27 to 52; z Represents
Week 52 and 53
X : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| AH1381-SA-7 | SOT23 (Type S) | F6 |
| AH1382-SA-7 | | F7 |
| AH1383-SA-7 | | F8 |

**(2) Package Type: X2-DFN1410-4**

**( Top View )**

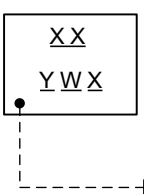



XX : Identification Code
Y : Year : 0 to 9 (ex: 6 = 2026)
W : Week : A to Z : Week 1 to 26;
a to z : Week 27 to 52; z Represents
Week 52 and 53
X : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| AH1381-HK4-7 | X2-DFN1410-4 | F6 |
| AH1381-HK4-7R | | F6 |
| AH1382-HK4-7 | | F7 |
| AH1382-HK4-7R | | F7 |
| AH1383-HK4-7 | | F8 |
| AH1383-HK4-7R | | F8 |

**(3) Package Type: X2-DFN1010-4 (Type B)**

**( Top View )**




XX : Identification Code
Y : Year : 0 to 9 (ex: 6 = 2026)
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

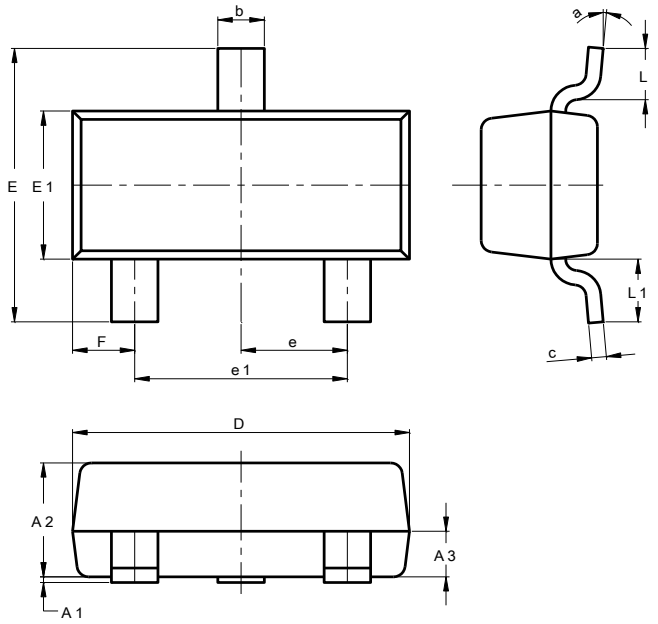
| Orderable Part Number | Package | Identification Code |
|---|---|---|
| AH1381-FS4-7 | X2-DFN1010-4 (Type B) | J6 |
| AH1382-FS4-7 | | J7 |
| AH1383-FS4-7 | | J8 |


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

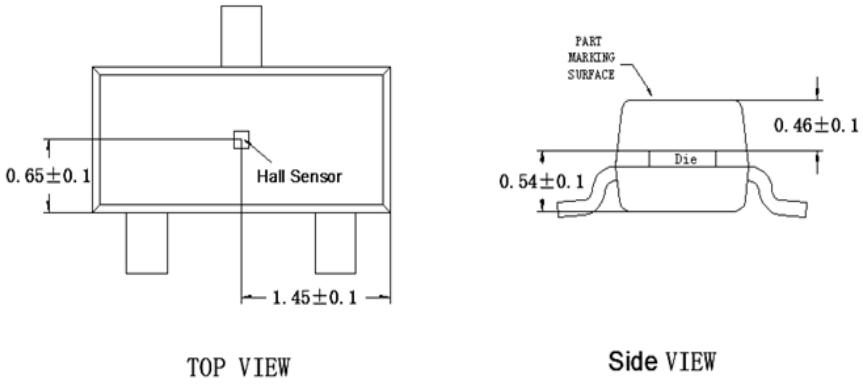
## Package Outline Dimensions

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**

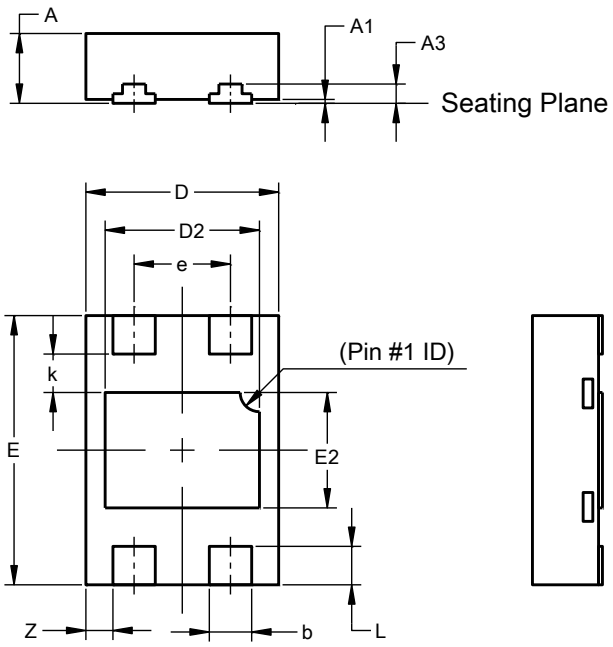

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Downloaded from Arrow.com.

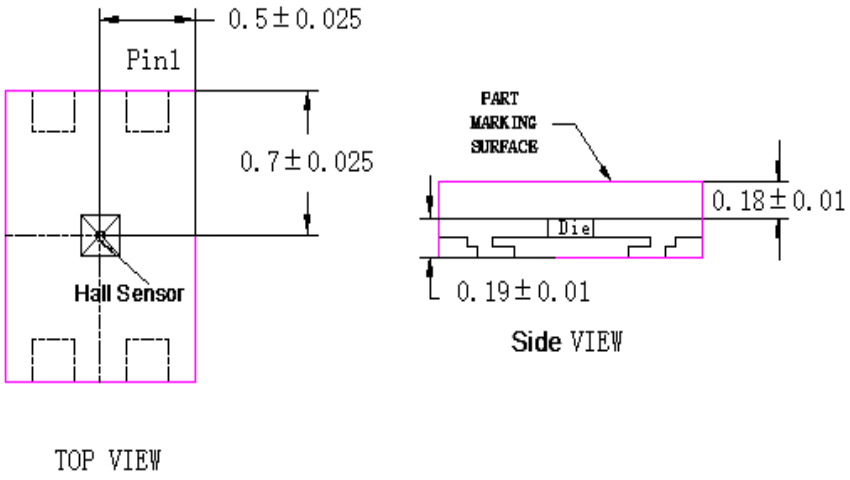
## Package Outline Dimensions (continued)

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

**(2) Package Type: X2-DFN1410-4**




| X2-DFN1410-4 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | -- | 0.40 | 0.37 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | -- | -- | 0.100 |
| **b** | 0.17 | 0.27 | 0.22 |
| **D** | 0.95 | 1.05 | 1.00 |
| **D2** | 0.70 | 0.90 | 0.80 |
| **E** | 1.35 | 1.45 | 1.40 |
| **E2** | 0.50 | 0.70 | 0.60 |
| **e** | 0.50BSC | | |
| **k** | -- | -- | 0.20 |
| **L** | 0.15 | 0.25 | 0.20 |
| **z** | -- | -- | 0.14 |
| **All Dimensions in mm** | | | |




**Sensor Location**

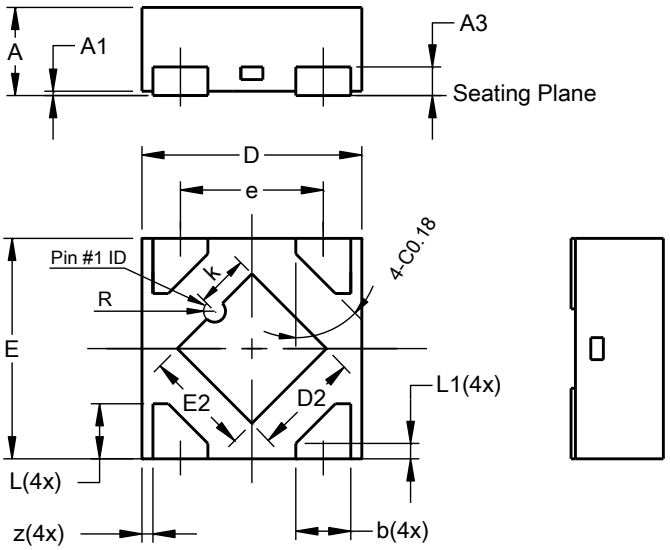

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Downloaded from Arrow.com.

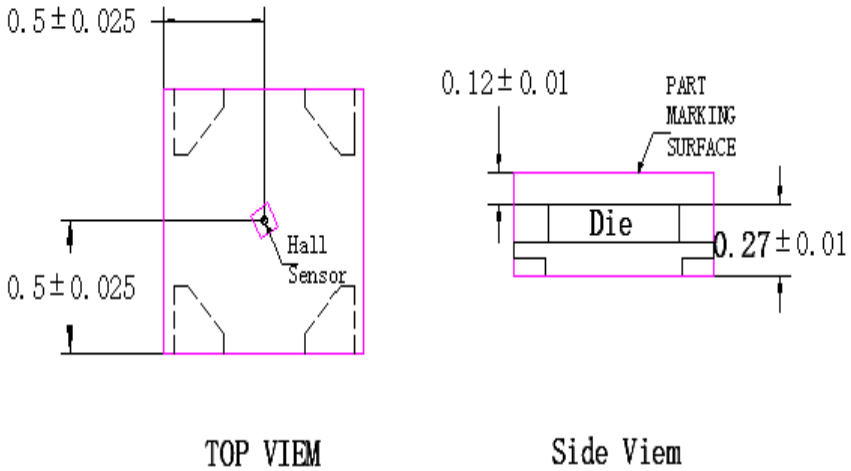
## Package Outline Dimensions (continued)

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

**(3) Package Type: X2-DFN1010-4 (Type B)**




| X2-DFN1010-4 (Type B) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | - | 0.40 | 0.39 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | - | - | 0.13 |
| **b** | 0.20 | 0.30 | 0.25 |
| **D** | 0.95 | 1.05 | 1.00 |
| **D2** | 0.43 | 0.53 | 0.48 |
| **E** | 0.95 | 1.05 | 1.00 |
| **E2** | 0.43 | 0.53 | 0.48 |
| **e** | - | - | 0.65 |
| **k** | 0.19 | 0.29 | 0.24 |
| **L** | 0.20 | 0.30 | 0.25 |
| **L1** | 0.02 | 0.12 | 0.07 |
| **R** | 0.02 | 0.08 | 0.05 |
| **z** | - | - | 0.050 |
| **All Dimensions in mm** | | | |



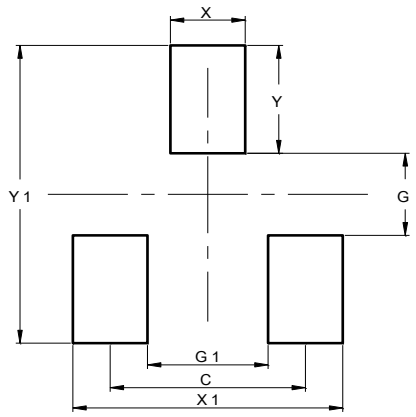

**Sensor Location**


© 2026 Copyright Diodes Incorporated. All Rights Reserved.
Downloaded from Arrow.com.

## Suggested Pad Layout

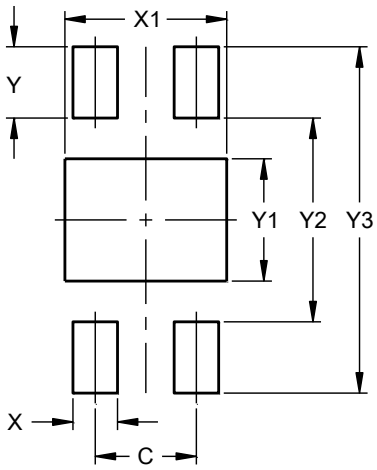
Please see http://www.diodes.com/package-outlines.html for the latest version.

**(1) Package Type: SOT23 (Type S)**



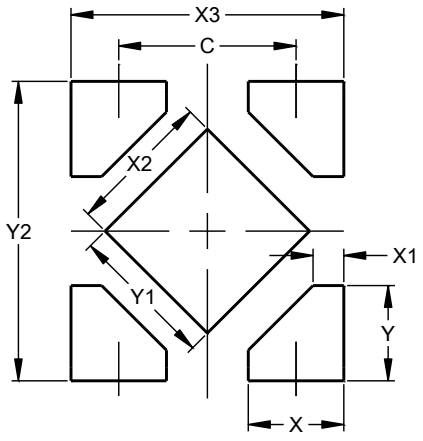

| Dimensions | Value (in mm) |
|---|---|
| C | 1.830 |
| G | 0.800 |
| G1 | 1.130 |
| X | 0.700 |
| X1 | 2.530 |
| Y | 1.050 |
| Y1 | 2.900 |

**(2) Package Type: X2-DFN1410-4**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.50 |
| X | 0.22 |
| X1 | 0.80 |
| Y | 0.35 |
| Y1 | 0.60 |
| Y2 | 1.00 |
| Y3 | 1.70 |

**(3) Package Type: X2-DFN1010-4 (Type B)**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.650 |
| X | 0.350 |
| X1 | 0.112 |
| X2 | 0.530 |
| X3 | 1.00 |
| Y | 0.350 |
| Y1 | 0.530 |
| Y2 | 1.100 |


© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Downloaded from Arrow.com.

## Mechanical Data

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.008 grams (Approximate)


© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Downloaded from Arrow.com.

**IMPORTANT NOTICE**

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

The Diodes logo is a registered trademark of Diodes Incorporated in the United States and other countries.
All other trademarks are the property of their respective owners.
© 2026 Diodes Incorporated. All Rights Reserved.

**www.diodes.com**


© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Downloaded from Arrow.com.