

**60V DUAL N-CHANNEL SELF-PROTECTED ENHANCEMENT MODE  
IntelliFET MOSFET**
**Product Summary**

- Continuous Drain-Source Voltage      60V
- On-State Resistance                      700mΩ
- Nominal Load Current ( $V_{IN} = 5V$ )    1.1A
- Clamping Energy                            210mJ

**Description**

The ZXMS6008DN8 is a dual self-protected low-side IntelliFET<sup>®</sup> MOSFET with logic-level input. It integrates overtemperature, overcurrent, overvoltage (active clamp) and ESD protected logic-level functionality. The ZXMS6008DN8 is ideal as a general-purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

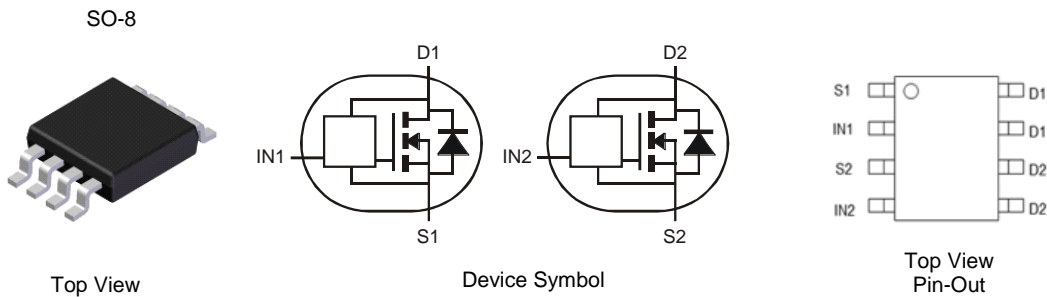
- Lamp drivers
- Motor drivers
- Relay drivers
- Solenoid drivers

**Features and Benefits**

- Compact High Power Dissipation Package
- Low Input Current
- Logic-Level Input (3.3V and 5V)
- Short-Circuit Protection with Auto Restart
- Overvoltage Protection (Active Clamp)
- Thermal Shutdown with Auto Restart
- Overcurrent Protection
- Input Protection (ESD)
- High Continuous Current Rating
- **Lead-Free Finish; 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 refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. <https://www.diodes.com/quality/product-definitions/>**

**Mechanical Data**

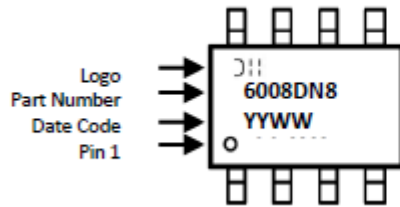
- Package: SO-8
- Package Material: Molded Plastic, “Green” Molding Compound  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish Ⓔ3
- Weight: 0.117 grams (Approximate)


**Ordering Information** (Note 4)

| Part Number    | Package | Marking | Reel Size (inches) | Tape Width (mm) | Packing |         |
|----------------|---------|---------|--------------------|-----------------|---------|---------|
|                |         |         |                    |                 | Qty.    | Carrier |
| ZXMS6008DN8-13 | SO-8    | 6008DN8 | 13                 | 12              | 2,500   | Reel    |

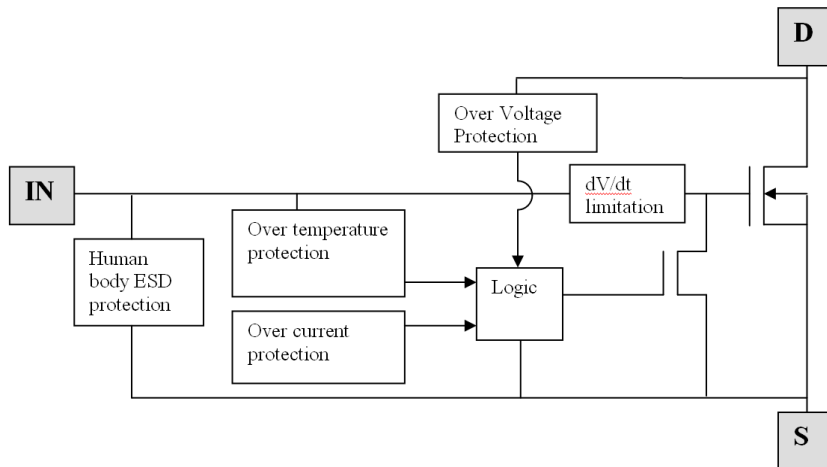
Notes: 1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.  
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.  
 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.  
 4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



D = Manufacturer's Marking  
 6008DN8 = Product Type Marking Code  
 YY: Year (ex: 23 = 2023)  
 WW: Week 01 to 52  
 52 Represents Week 52 and 53

## Functional Block Diagram



## Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic  | Symbol              | Value     | Units |
|---|---------------------|-----------|-------|
| Continuous Drain-Source Voltage   | V <sub>DS</sub>     | 60        | V     |
| Drain-Source Voltage for Short-Circuit Protection   | V <sub>DS(SC)</sub> | 36        | V     |
| Continuous Input Voltage  | V <sub>IN</sub>     | -0.5 to 6 | V     |
| Continuous Input Current @ -0.2V ≤ V <sub>IN</sub> ≤ 6V   | I <sub>IN</sub>     | No Limit  | mA    |
| Continuous Input Current @ V <sub>IN</sub> < -0.2V or V <sub>IN</sub> > 6V                                      |                     |           |       |
| Pulsed Drain Current @ V <sub>IN</sub> = 3.3V (Note 5)  | I <sub>DM</sub>     | 1.4       | A     |
| Pulsed Drain Current @ V <sub>IN</sub> = 5V (Note 5)  | I <sub>DM</sub>     | 1.8       | A     |
| Continuous Source Current (Body Diode) (Note 6)   | I <sub>S</sub>      | 0.7       | A     |
| Pulsed Source Current (Body Diode)  | I <sub>SM</sub>     | 3.5       | A     |
| Unclamped Single Pulse Inductive Energy<br>T <sub>J</sub> = +25°C, I <sub>D</sub> = 0.5A, V <sub>DD</sub> = 24V | E <sub>AS</sub>     | 210       | mJ    |
| Electrostatic Discharge (Human Body Model)  | V <sub>ESD</sub>    | 4000      | V     |
| Charged Device Model  | V <sub>CDM</sub>    | 1000      | V     |

Notes: 5. Repetitive rating 25mm x 25mm FR4 PCB, D = 0.02, pulse width = 300µs – pulse width limited by junction temperature. Refer to *Transient Thermal Impedance* graph.  
 6. For a dual device surface mounted on a 25mm x 25mm single sided 1oz weight copper split down the middle on 1.6mm FR4 board, in still air conditions.

## Thermal Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic  | Symbol           | Value        | Units      |
|---|------------------|--------------|------------|
| Power Dissipation at T <sub>A</sub> = +25°C (Notes 6 & 7)<br>Linear Derating Factor | P <sub>D</sub>   | 1.16<br>9.28 | W<br>mW/°C |
| Power Dissipation at T <sub>A</sub> = +25°C (Notes 6 & 8)<br>Linear Derating Factor | P <sub>D</sub>   | 1.67<br>13.3 | W<br>mW/°C |
| Power Dissipation at T <sub>A</sub> = +25°C (Notes 7 & 9)<br>Linear Derating Factor | P <sub>D</sub>   | 2.13<br>17   | W<br>mW/°C |
| Thermal Resistance, Junction to Ambient (Notes 6 & 7)                               | R <sub>θJA</sub> | 108          | °C/W       |
| Thermal Resistance, Junction to Ambient (Notes 6 & 8)                               | R <sub>θJA</sub> | 75           | °C/W       |
| Thermal Resistance, Junction to Case (Notes 7 & 9)                                  | R <sub>θJC</sub> | 58.7         | °C/W       |
| Thermal Resistance, Junction to Case (Note 10)                                      | R <sub>θJC</sub> | 26.5         | °C/W       |
| Operating Temperature Range   | T <sub>J</sub>   | -40 to +150  | °C         |
| Storage Temperature Range   | T <sub>STG</sub> | -55 to +150  | °C         |

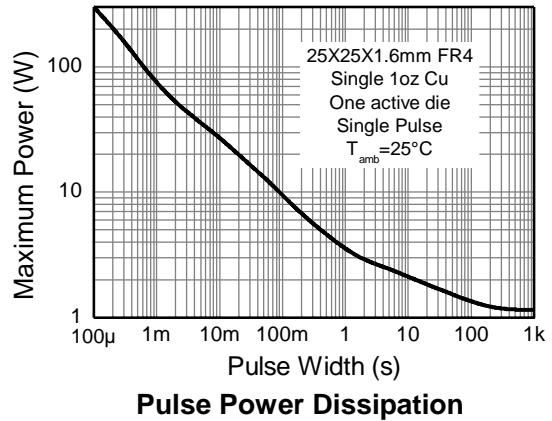
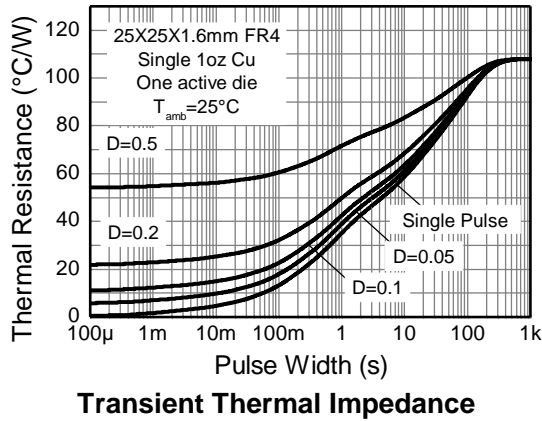
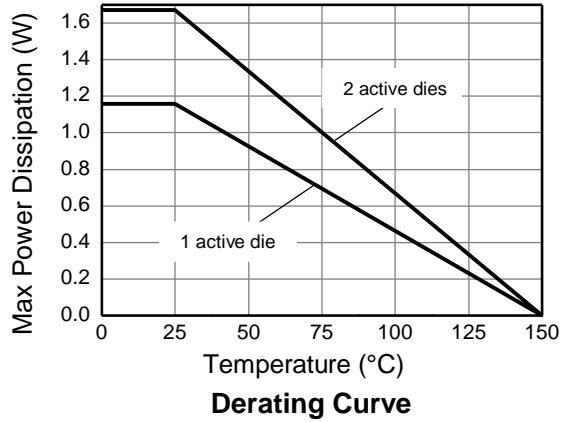
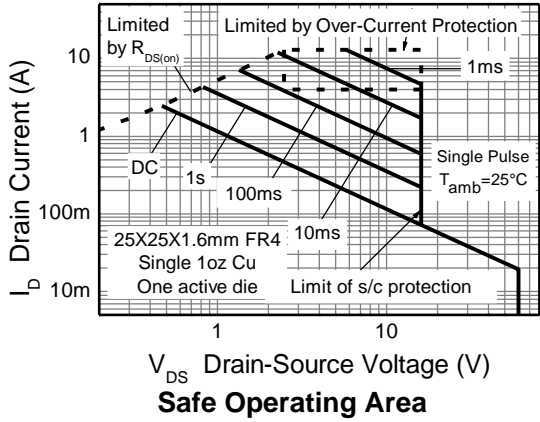
- Notes:
6. For a dual device surface mounted on a 25mm x 25mm single sided 1oz weight copper split down the middle on 1.6mm FR4 board, in still air conditions.
  7. For a dual device with one active die.
  8. For a dual device with two active dies running at equal power.
  9. For a dual device surface mounted on FR4 PCB measured at t ≤ 10sec
  10. Thermal resistance from junction to the mounting surface of the drain pin.

## Recommended Operating Conditions

The ZXMS6008DN8 is optimized for use with μC operating from 3.3V and 5V supplies.

| Characteristic  | Symbol          | Min | Max  | Unit |
|---|-----------------|-----|------|------|
| Input Voltage Range   | V <sub>IN</sub> | 0   | 5.5  | V    |
| Ambient Temperature Range                                     | T <sub>A</sub>  | -40 | +125 | °C   |
| High Level Input Voltage for MOSFET to Be On                  | V <sub>IH</sub> | 3   | 5.5  | V    |
| Low Level Input Voltage for MOSFET to Be Off                  | V <sub>IL</sub> | 0   | 0.7  | V    |
| Peripheral Supply Voltage (Voltage to Which Load is Referred) | V <sub>P</sub>  | 0   | 16   | V    |

**Thermal Characteristics**

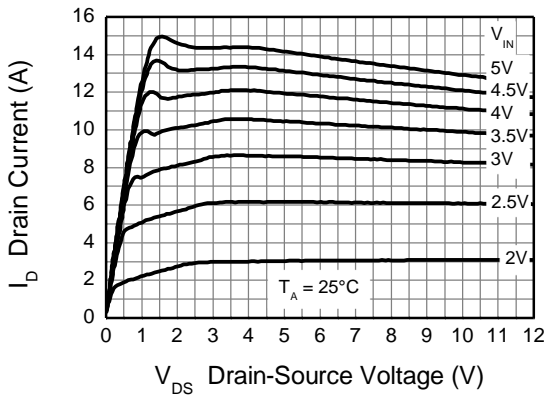


**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

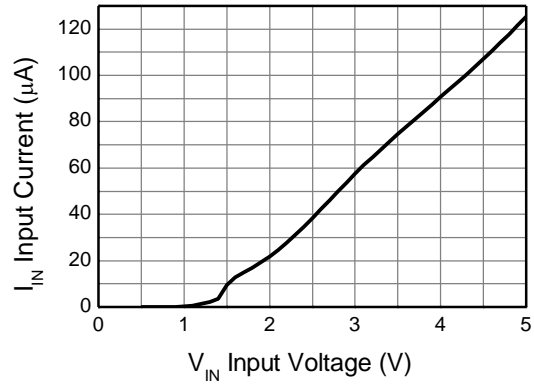
| Characteristic                              | Symbol              | Min  | Typ  | Max | Unit | Test Condition   |
|---|---------------------|------|------|-----|------|--|
| <b>Static Characteristics</b>               |                     |      |      |     |      |  |
| Drain-Source Clamp Voltage                  | V <sub>DS(AZ)</sub> | 60   | 65   | 70  | V    | I <sub>D</sub> = 10mA  |
| Off-State Drain Current                     | I <sub>DSS</sub>    | —    | —    | 1   | μA   | V <sub>DS</sub> = 12V, V <sub>IN</sub> = 0V                      |
|   |                     | —    | —    | 2   |      | V <sub>DS</sub> = 36V, V <sub>IN</sub> = 0V                      |
| Input Threshold Voltage                     | V <sub>IN(th)</sub> | 0.7  | 1.2  | 1.5 | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1mA         |
| Input Current                               | I <sub>IN</sub>     | —    | 60   | 100 | μA   | V <sub>IN</sub> = +3V  |
|   |                     | —    | 120  | 200 |      | V <sub>IN</sub> = +5V  |
| Input Current While Overtemperature Active  | —                   | —    | —    | 350 | μA   | V <sub>IN</sub> = +5V  |
| Static Drain-Source On-State Resistance     | R <sub>DS(on)</sub> | —    | 550  | 800 | mΩ   | V <sub>IN</sub> = +3V, I <sub>D</sub> = 1A                       |
|   |                     | —    | 500  | 700 |      | V <sub>IN</sub> = +5V, I <sub>D</sub> = 1A                       |
| Continuous Drain Current (Notes 6 & 8)      | I <sub>D</sub>      | 0.6  | —    | —   | A    | V <sub>IN</sub> = 3V, T <sub>A</sub> = +25°C                     |
|   |                     | 0.7  | —    | —   |      | V <sub>IN</sub> = 5V, T <sub>A</sub> = +25°C                     |
| Continuous Drain Current (Notes 6 & 7)      |                     | 0.8  | —    | —   |      | V <sub>IN</sub> = 3V, T <sub>A</sub> = +25°C                     |
|   |                     | 0.9  | —    | —   |      | V <sub>IN</sub> = 5V, T <sub>A</sub> = +25°C                     |
| Current Limit (Note 11)                     | I <sub>D(LIM)</sub> | 0.5  | 1.2  | —   | A    | V <sub>IN</sub> = +3V  |
|   |                     | 0.7  | 1.6  | —   |      | V <sub>IN</sub> = +5V  |
| <b>Dynamic Characteristics</b>              |                     |      |      |     |      |  |
| Turn On Delay Time                          | t <sub>d(on)</sub>  | —    | 5    | —   | μs   | V <sub>DD</sub> = 12V, I <sub>D</sub> = 1A, V <sub>GS</sub> = 5V |
| Rise Time                                   | t <sub>r</sub>      | —    | 10   | —   | μs   |  |
| Turn Off Delay Time                         | t <sub>d(off)</sub> | —    | 45   | —   | μs   |  |
| Fall Time                                   | t <sub>f</sub>      | —    | 15   | —   | μs   |  |
| <b>Overtemperature Protection</b>           |                     |      |      |     |      |  |
| Thermal Overload Trip Temperature (Note 12) | T <sub>JT</sub>     | +150 | +175 | —   | °C   | —  |
| Thermal Hysteresis (Note 12)                | ΔT <sub>JT</sub>    | —    | +10  | —   | °C   | —  |

- Notes:
11. The drain current is restricted only when the device is in saturation (see graph *Typical Output Characteristic*). This allows the device to be used in the fully on state without interference from the current limit. The device is fully protected at all drain currents, as the low power dissipation generated outside saturation makes current limit unnecessary.
  12. Overtemperature protection is designed to prevent device destruction under fault conditions. Fault conditions are considered as "outside" normal operating range, so this part is not designed to withstand overtemperature for an extended period.

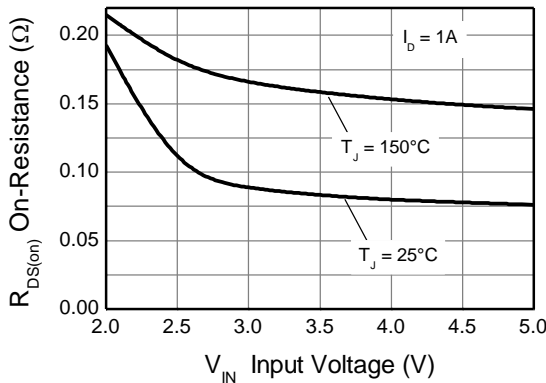
**Typical Characteristics**



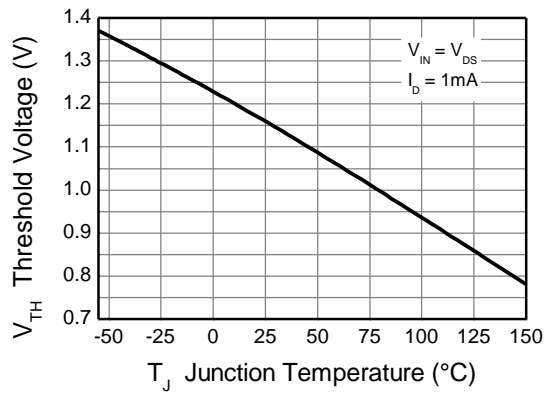
**Typical Output Characteristic**



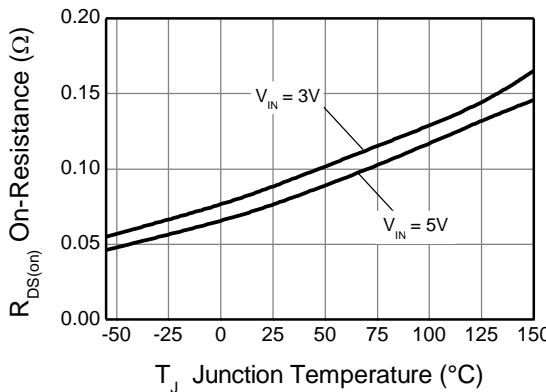
**Input Current vs Input Voltage**



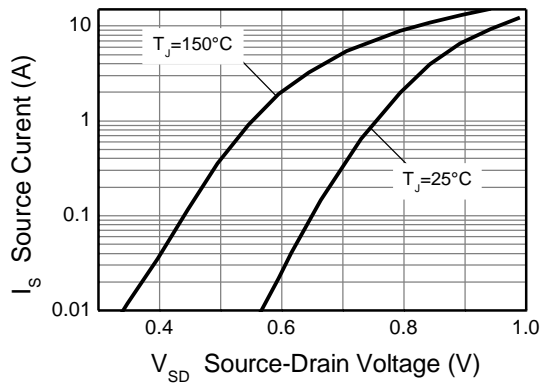
**On-Resistance vs Input Voltage**



**Threshold Voltage vs Temperature**

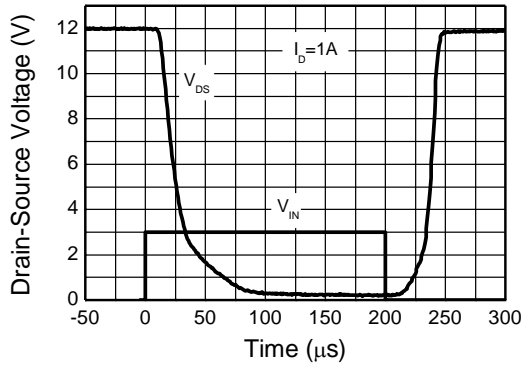


**On-Resistance vs Temperature**

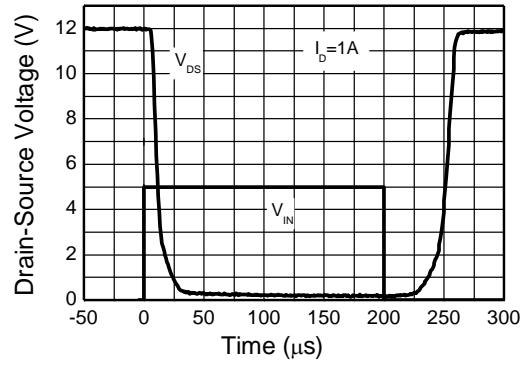


**Reverse Diode Characteristic**

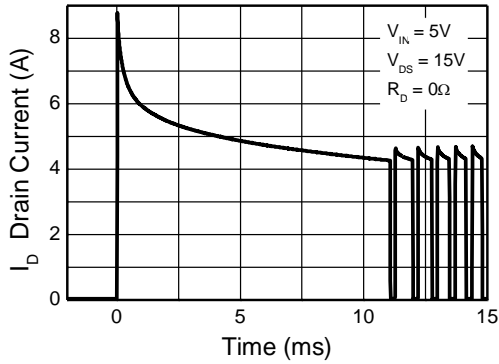
**Typical Characteristics** (continued)



**Switching Speed**



**Switching Speed**

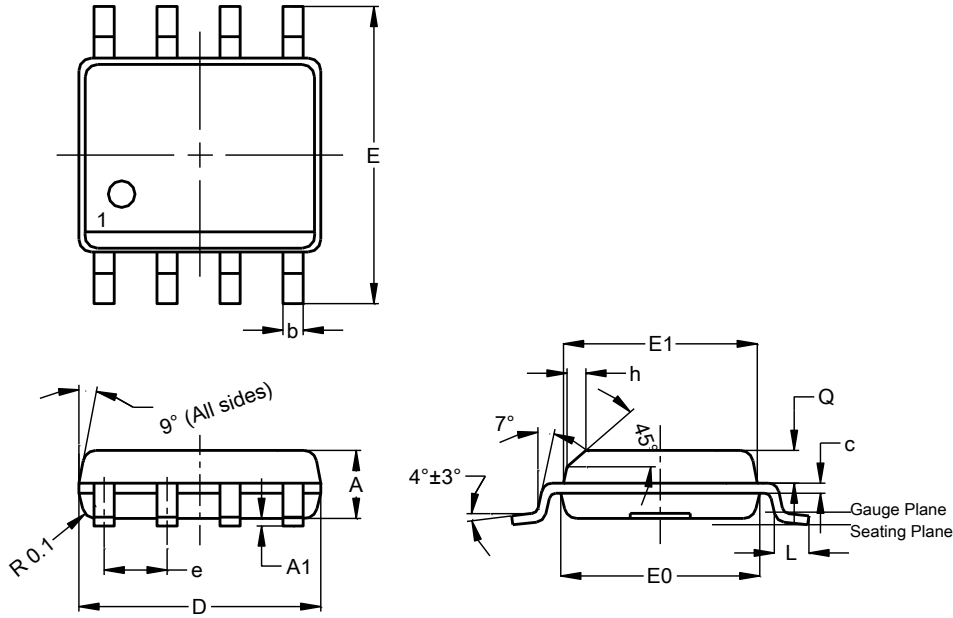


**Typical Short Circuit Protection**

**Package Outline Dimensions**

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

**SO-8**

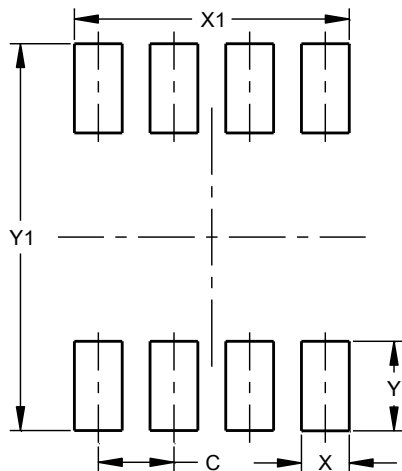


| SO-8                        |      |      |      |
|-----------------------------|------|------|------|
| Dim                         | Min  | Max  | Typ  |
| <b>A</b>                    | 1.40 | 1.50 | 1.45 |
| <b>A1</b>                   | 0.10 | 0.20 | 0.15 |
| <b>b</b>                    | 0.30 | 0.50 | 0.40 |
| <b>c</b>                    | 0.15 | 0.25 | 0.20 |
| <b>D</b>                    | 4.85 | 4.95 | 4.90 |
| <b>E</b>                    | 5.90 | 6.10 | 6.00 |
| <b>E1</b>                   | 3.80 | 3.90 | 3.85 |
| <b>E0</b>                   | 3.85 | 3.95 | 3.90 |
| <b>e</b>                    | --   | --   | 1.27 |
| <b>h</b>                    | -    | --   | 0.35 |
| <b>L</b>                    | 0.62 | 0.82 | 0.72 |
| <b>Q</b>                    | 0.60 | 0.70 | 0.65 |
| <b>All Dimensions in mm</b> |      |      |      |

**Suggested Pad Layout**

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

**SO-8**



| Dimensions | Value (in mm) |
|------------|---------------|
| <b>C</b>   | 1.27          |
| <b>X</b>   | 0.802         |
| <b>X1</b>  | 4.612         |
| <b>Y</b>   | 1.505         |
| <b>Y1</b>  | 6.50          |



**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.  
© 2023 Diodes Incorporated. All Rights Reserved.

[www.diodes.com](http://www.diodes.com)