

# ESD7351, SZESD7351 Series



ON Semiconductor®

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

## ESD Protection Diode

The ESD7351 Series is designed to protect voltage sensitive components that require ultra-low capacitance from ESD and transient voltage events. Excellent clamping capability, low capacitance, low leakage, and fast response time, make these parts ideal for ESD protection on designs where board space is at a premium. Because of its low capacitance, it is suited for use in high frequency designs such as USB 2.0 high speed and antenna line applications.

### Features

- Low Capacitance (0.6 pF Max, I/O to GND)
- Low Clamping Voltage
- Stand-off Voltage: 3.3 V
- Low Leakage
- Response Time is < 1 ns
- Low Dynamic Resistance < 1 Ω
- IEC61000-4-2 Level 4 ESD Protection
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- RF Signal ESD Protection
- RF Switching, PA, and Antenna ESD Protection
- Near Field Communications

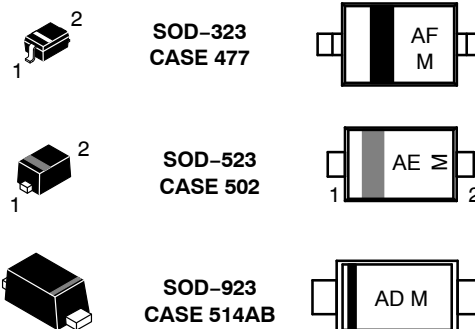
### MAXIMUM RATINGS

| Rating   | Symbol                            | Value       | Unit |
|--|-----------------------------------|-------------|------|
| IEC 61000-4-2 (ESD) Contact Air  |                                   | ±20<br>±20  | kV   |
| Total Power Dissipation on FR-5 Board (Note 1) @ T <sub>A</sub> = 25°C | P <sub>D</sub>                    | 150         | mW   |
| Junction and Storage Temperature Range                                 | T <sub>J</sub> , T <sub>stg</sub> | -55 to +150 | °C   |
| Lead Solder Temperature - Maximum (10 Second Duration)                 | T <sub>L</sub>                    | 260         | °C   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

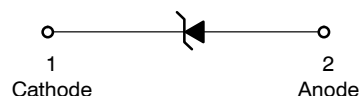
1. FR-5 = 1.0 x 0.75 x 0.62 in.

### MARKING DIAGRAMS



X, XX = Specific Device Code  
M = Date Code

### PIN CONFIGURATION AND SCHEMATIC



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

See Application Note AND8308/D for further description of survivability specs.

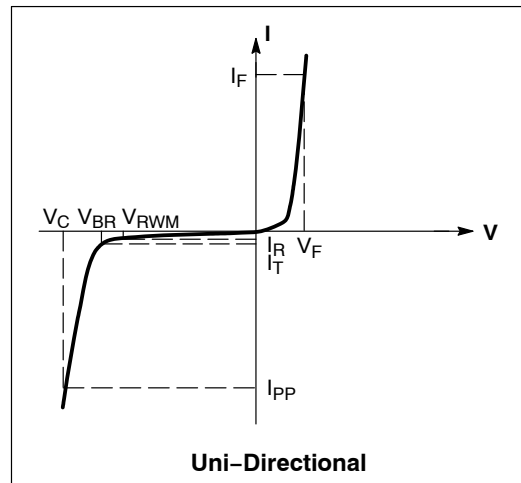
# ESD7351, SZESD7351 Series

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol    | Parameter                                   |
|-----------|---|
| $I_{PP}$  | Maximum Reverse Peak Pulse Current          |
| $V_C$     | Clamping Voltage @ $I_{PP}$                 |
| $V_{RWM}$ | Working Peak Reverse Voltage                |
| $I_R$     | Maximum Reverse Leakage Current @ $V_{RWM}$ |
| $V_{BR}$  | Breakdown Voltage @ $I_T$                   |
| $I_T$     | Test Current                                |

\*See Application Note AND8308/D for detailed explanations of datasheet parameters.



## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                  | Symbol    | Conditions   | Min | Typ          | Max        | Unit     |
|----------------------------|-----------|--|-----|--------------|------------|----------|
| Reverse Working Voltage    | $V_{RWM}$ |  |     |              | 3.3        | V        |
| Breakdown Voltage (Note 2) | $V_{BR}$  | $I_T = 1 \text{ mA}$   | 5.0 |              |            | V        |
| Reverse Leakage Current    | $I_R$     | $V_{RWM} = 3.3 \text{ V}$  |     | < 1.0        | 50         | nA       |
| Clamping Voltage (Note 3)  | $V_C$     | $I_{PP} = 1 \text{ A}$   |     |              | 8.0        | V        |
| Clamping Voltage (Note 3)  | $V_C$     | $I_{PP} = 3 \text{ A}$   |     |              | 10         | V        |
| Junction Capacitance       | $C_J$     | $V_R = 0 \text{ V}, f = 1 \text{ MHz}$<br>$V_R = 0 \text{ V}, f < 1 \text{ GHz}$ |     | 0.43<br>0.43 | 0.6<br>0.6 | pF       |
| Dynamic Resistance         | $R_{DYN}$ | TLP Pulse  |     | 0.35         |            | $\Omega$ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Breakdown voltage is tested from pin 1 to 2.
- Non-repetitive current pulse at  $T_A = 25^\circ\text{C}$ , per IEC61000-4-5 waveform.

# ESD7351, SZESD7351 Series

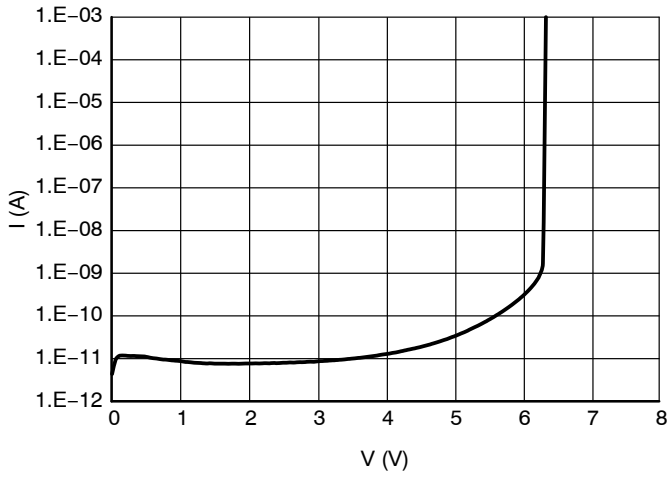


Figure 1. IV Characteristics

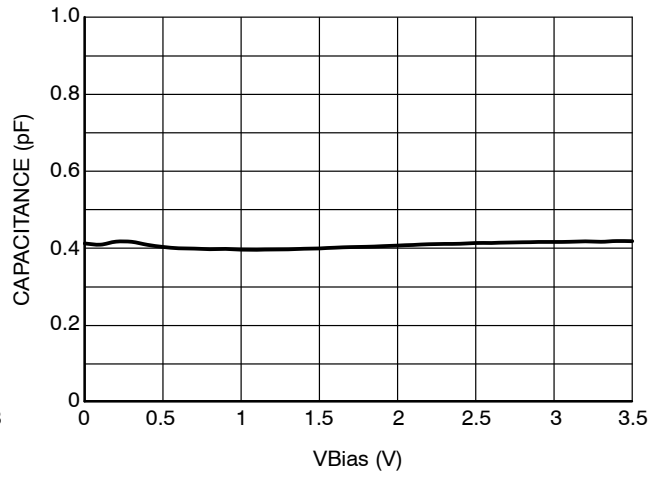


Figure 2. CV Characteristics

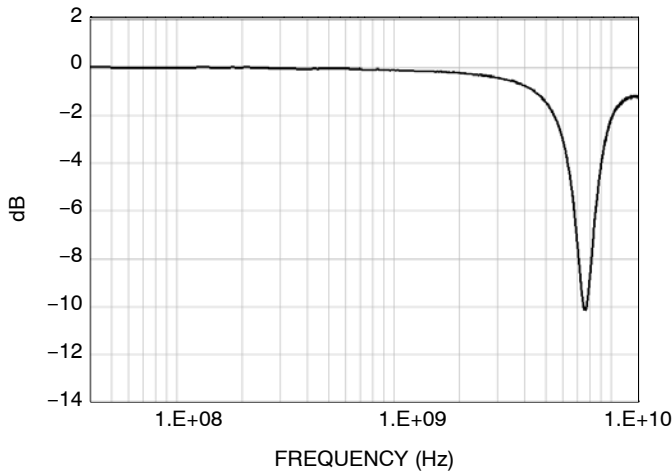


Figure 3. RF Insertion Loss

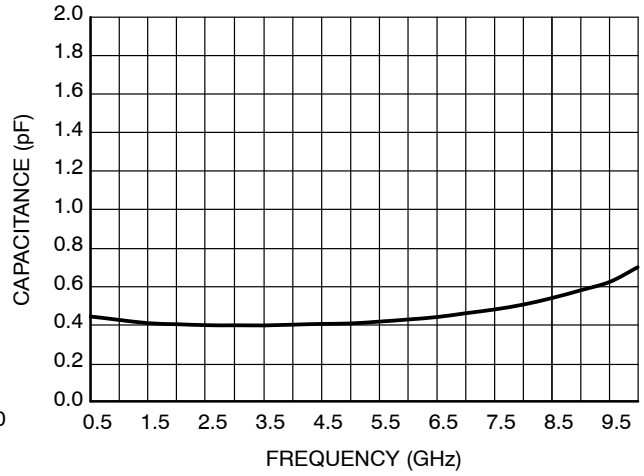


Figure 4. Capacitance over Frequency

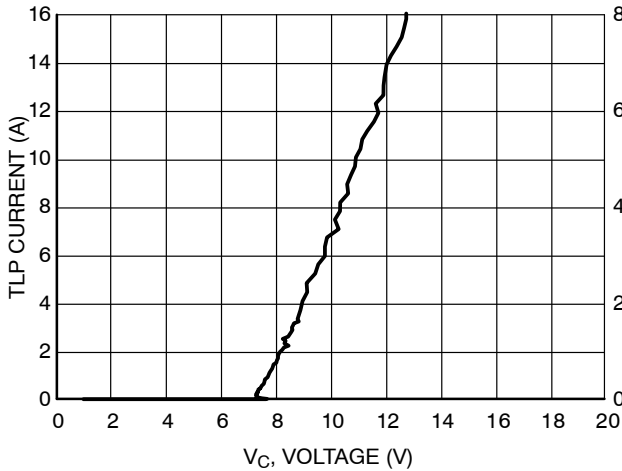


Figure 5. Positive TLP I-V Curve

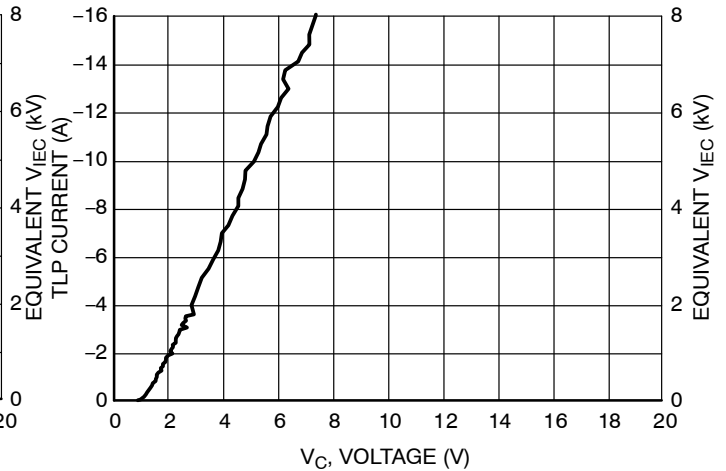


Figure 6. Negative TLP I-V Curve

NOTE: TLP parameter:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 300 \text{ ps}$ , averaging window:  $t_1 = 30 \text{ ns}$  to  $t_2 = 60 \text{ ns}$ .  $V_{IEC}$  is the equivalent voltage stress level calculated at the secondary peak of the IEC 61000-4-2 waveform at  $t = 30 \text{ ns}$  with  $2 \text{ A/kV}$ . See TLP description below for more information.

# ESD7351, SZESD7351 Series

## IEC 61000-4-2 Spec.

| Level | Test Voltage (kV) | First Peak Current (A) | Current at 30 ns (A) | Current at 60 ns (A) |
|-------|-------------------|------------------------|----------------------|----------------------|
| 1     | 2                 | 7.5                    | 4                    | 2                    |
| 2     | 4                 | 15                     | 8                    | 4                    |
| 3     | 6                 | 22.5                   | 12                   | 6                    |
| 4     | 8                 | 30                     | 16                   | 8                    |

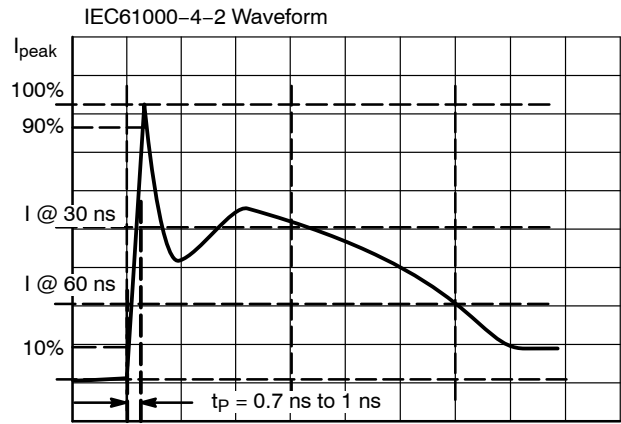


Figure 7. IEC61000-4-2 Spec

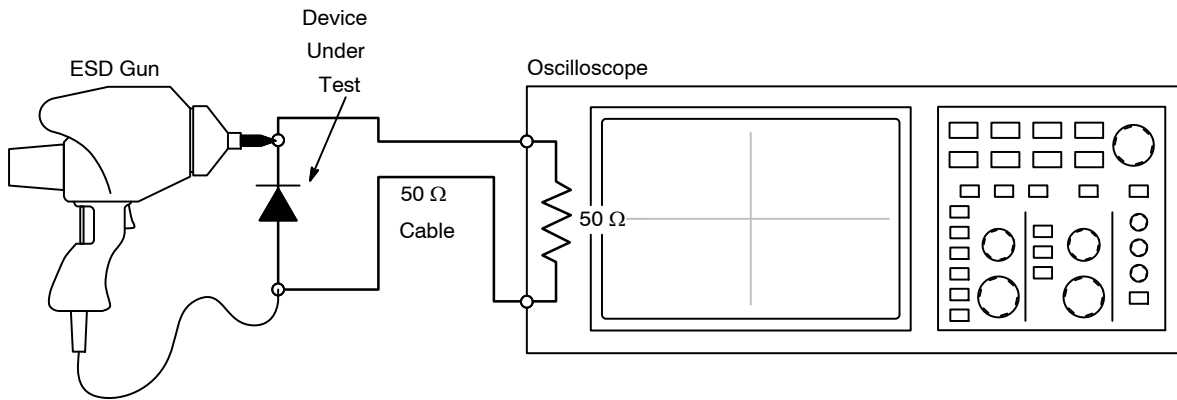


Figure 8. Diagram of ESD Clamping Voltage Test Setup

The following is taken from Application Note AND8308/D – Interpretation of Datasheet Parameters for ESD Devices.

### ESD Voltage Clamping

For sensitive circuit elements it is important to limit the voltage that an IC will be exposed to during an ESD event to as low a voltage as possible. The ESD clamping voltage is the voltage drop across the ESD protection diode during an ESD event per the IEC61000-4-2 waveform. Since the IEC61000-4-2 was written as a pass/fail spec for larger systems such as cell phones or laptop computers it is not clearly defined in the spec how to specify a clamping voltage at the device level. ON Semiconductor has developed a way to examine the entire voltage waveform across the ESD protection diode over the time domain of an ESD pulse in the form of an oscilloscope screenshot, which can be found on the datasheets for all ESD protection diodes. For more information on how ON Semiconductor creates these screenshots and how to interpret them please refer to AND8307/D.

### Transmission Line Pulse (TLP) Measurement

Transmission Line Pulse (TLP) provides current versus voltage (I-V) curves in which each data point is obtained

from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 9. TLP I-V curves of ESD protection devices accurately demonstrate the product’s ESD capability because the 10s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 10 where an 8 kV IEC 61000-4-2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP I-V curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels.

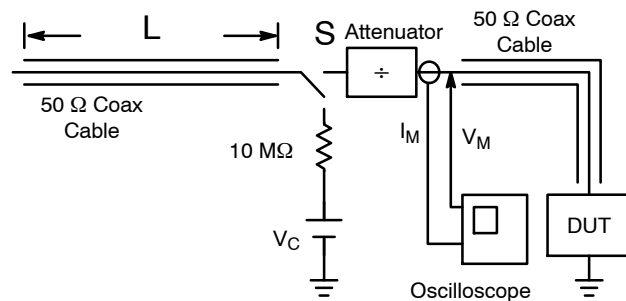
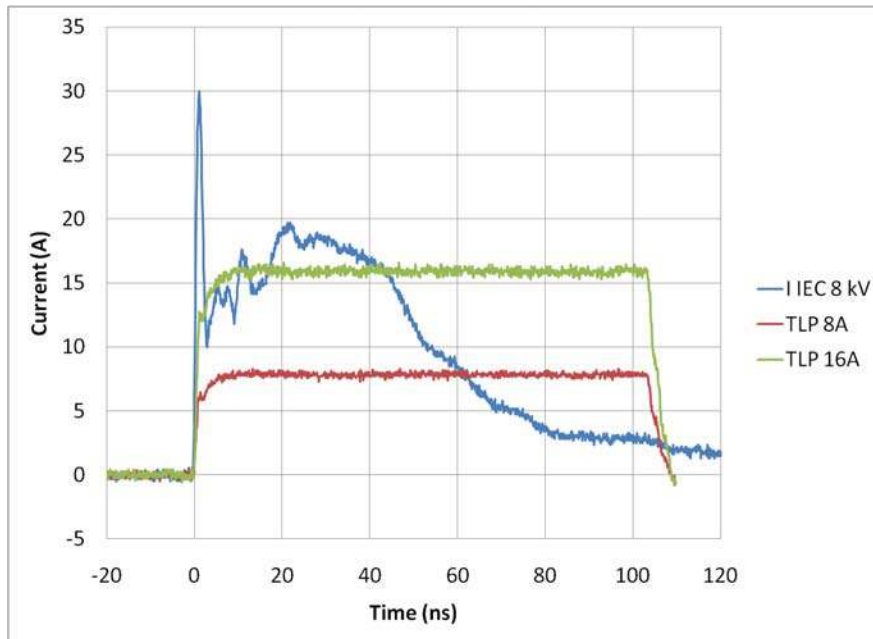


Figure 9. Simplified Schematic of a Typical TLP System

## ESD7351, SZESD7351 Series



**Figure 10. Comparison Between 8 kV IEC 61000-4-2 and 8 A and 16 A TLP Waveforms**

### ORDERING INFORMATION

| Device                             | Package              | Shipping <sup>†</sup> |
|------------------------------------|----------------------|-----------------------|
| ESD7351HT1G,<br>SZESD7351HT1G*     | SOD-323<br>(Pb-Free) | 3000 / Tape & Reel    |
| ESD7351XV2T1G,<br>SZESD7351XV2T1G* | SOD-523<br>(Pb-Free) | 3000 / Tape & Reel    |
| ESD7351XV2T5G,<br>SZESD7351XV2T5G* | SOD-523<br>(Pb-Free) | 8000 / Tape & Reel    |
| ESD7351P2T5G,<br>SZESD7351P2T5G*   | SOD-923<br>(Pb-Free) | 8000 / Tape & Reel    |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE

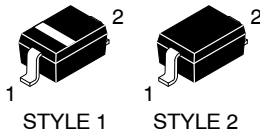
## PACKAGE DIMENSIONS

ON Semiconductor®

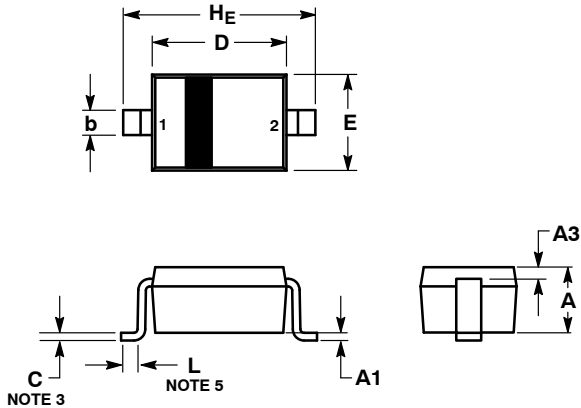


SOD-323  
CASE 477-02  
ISSUE H

DATE 13 MAR 2007



SCALE 4:1

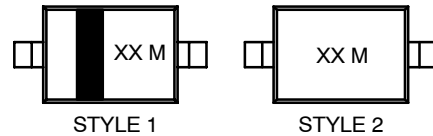


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. LEAD THICKNESS SPECIFIED PER L/F DRAWING WITH SOLDER PLATING.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
5. DIMENSION L IS MEASURED FROM END OF RADIUS.

| DIM | MILLIMETERS |      |       | INCHES    |       |       |
|-----|-------------|------|-------|-----------|-------|-------|
|     | MIN         | NOM  | MAX   | MIN       | NOM   | MAX   |
| A   | 0.80        | 0.90 | 1.00  | 0.031     | 0.035 | 0.040 |
| A1  | 0.00        | 0.05 | 0.10  | 0.000     | 0.002 | 0.004 |
| A3  | 0.15 REF    |      |       | 0.006 REF |       |       |
| b   | 0.25        | 0.32 | 0.4   | 0.010     | 0.012 | 0.016 |
| C   | 0.089       | 0.12 | 0.177 | 0.003     | 0.005 | 0.007 |
| D   | 1.60        | 1.70 | 1.80  | 0.062     | 0.066 | 0.070 |
| E   | 1.15        | 1.25 | 1.35  | 0.045     | 0.049 | 0.053 |
| L   | 0.08        |      |       | 0.003     |       |       |
| HE  | 2.30        | 2.50 | 2.70  | 0.090     | 0.098 | 0.105 |

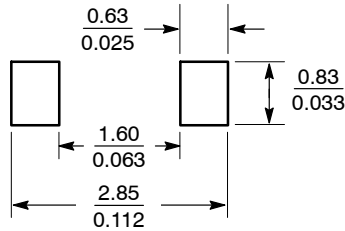
### GENERIC MARKING DIAGRAM\*



XX = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLE 1:  
PIN 1. CATHODE (POLARITY BAND)  
2. ANODE

STYLE 2:  
NO POLARITY

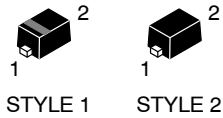
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| DESCRIPTION:     | SOD-323     | PAGE 1 OF 1  |

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

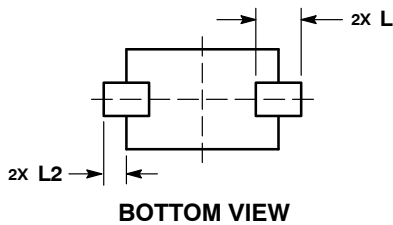
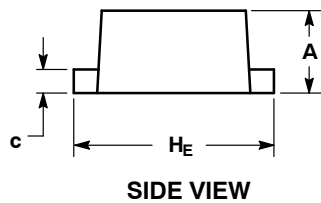
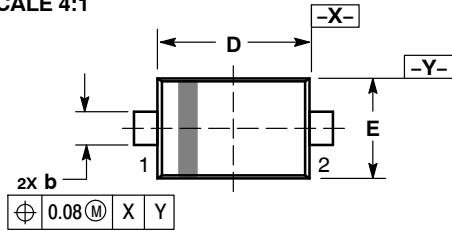
ON Semiconductor®



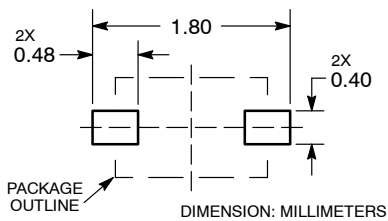
**SOD-523**  
CASE 502-01  
ISSUE E

DATE 28 SEP 2010

SCALE 4:1



**RECOMMENDED  
SOLDERING FOOTPRINT\***

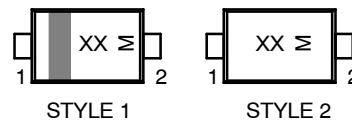


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM            | MILLIMETERS |      |      |
|----------------|-------------|------|------|
|                | MIN         | NOM  | MAX  |
| A              | 0.50        | 0.60 | 0.70 |
| b              | 0.25        | 0.30 | 0.35 |
| c              | 0.07        | 0.14 | 0.20 |
| D              | 1.10        | 1.20 | 1.30 |
| E              | 0.70        | 0.80 | 0.90 |
| H <sub>E</sub> | 1.50        | 1.60 | 1.70 |
| L              | 0.30 REF    |      |      |
| L2             | 0.15        | 0.20 | 0.25 |

**GENERIC  
MARKING DIAGRAM\***



XX = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1:  
PIN 1. CATHODE (POLARITY BAND)  
2. ANODE

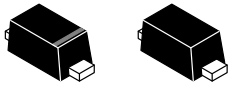
STYLE 2:  
NO POLARITY

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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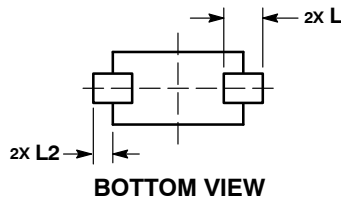
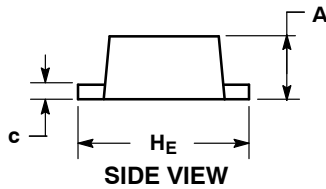
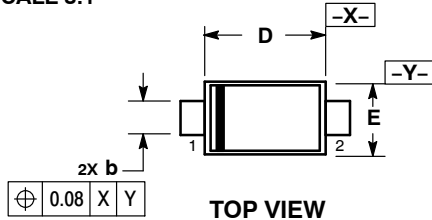
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

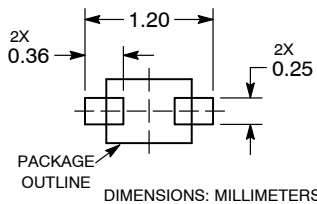


STYLE 1      STYLE 2

SCALE 8:1



**SOLDERING FOOTPRINT\***



**SOD-923  
CASE 514AB  
ISSUE D**

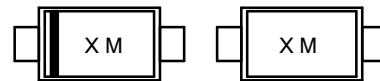
DATE 03 SEP 2020

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. DIMENSION L WILL NOT EXCEED 0.30mm.

| DIM            | MILLIMETERS |      |      | INCHES    |       |       |
|----------------|-------------|------|------|-----------|-------|-------|
|                | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A              | 0.34        | 0.37 | 0.40 | 0.013     | 0.015 | 0.016 |
| b              | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| c              | 0.07        | 0.12 | 0.17 | 0.003     | 0.005 | 0.007 |
| D              | 0.75        | 0.80 | 0.85 | 0.030     | 0.031 | 0.033 |
| E              | 0.55        | 0.60 | 0.65 | 0.022     | 0.024 | 0.026 |
| H <sub>E</sub> | 0.95        | 1.00 | 1.05 | 0.037     | 0.039 | 0.041 |
| L              | 0.19 REF    |      |      | 0.007 REF |       |       |
| L2             | 0.05        | 0.10 | 0.15 | 0.002     | 0.004 | 0.006 |

**GENERIC  
MARKING DIAGRAM\***



STYLE 1

STYLE 2

X = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:  
PIN 1. CATHODE (POLARITY BAND)  
2. ANODE

STYLE 2:  
NO POLARITY

See Application Note AND8455/D for more mounting details

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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| <b>DESCRIPTION:</b>     | <b>SOD-923, 1.0x0.6x0.37, MAX HEIGHT 0.40</b> | <b>PAGE 1 OF 1</b>   |

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