

# ESDR0502B, SZESDR0502B

## ESD Protection Diode

### Ultra-Low Capacitance

The ESDR0502B is designed to protect voltage sensitive components from damage due to ESD in applications that require ultra low capacitance to preserve signal integrity. Excellent clamping capability, low leakage and fast response time are combined with an ultra low diode capacitance of 0.5 pF to provide best in class protection from IC damage due to ESD. The small SC-75 package is ideal for designs where board space is at a premium. The ESDR0502B can be used to protect two uni-directional lines or one bi-directional line. When used to protect one bi-directional line, the effective capacitance is 0.25 pF. Because of its low capacitance, it is well suited for protecting high frequency signal lines such as USB2.0 high speed and antenna line applications.

#### Specification Features:

- Low Capacitance 0.5 pF Typical
- Low Clamping Voltage, Low Leakage
- Small Body Outline Dimensions:  
0.063" x 0.063" (1.60 mm x 1.60 mm)
- Stand-off Voltage: 5 V
- Response Time is Typically < 1.0 ns
- IEC61000-4-2 Level 4 ESD Protection  
ISO10605 330 pF/2 kΩ ±17 kV (Contact)
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- This is a Pb-Free Device

#### Mechanical Characteristics:

**CASE:** Void-free, transfer-molded, thermosetting plastic

Epoxy Meets UL 94 V-0

**LEAD FINISH:** 100% Matte Sn (Tin)

**MOUNTING POSITION:** Any

**QUALIFIED MAX REFLOW TEMPERATURE:** 260°C

Device Meets MSL 1 Requirements

#### MAXIMUM RATINGS

| Rating  | Symbol           | Value       | Unit |
|---|------------------|-------------|------|
| IEC 61000-4-2 Contact (ESD)<br>IEC 61000-4-2 Air (ESD)                    | ESD              | ±11<br>±15  | kV   |
| Peak Surge Power (8 x 20 μs)  | P <sub>pk</sub>  | 20          | W    |
| Peak Surge Current (8 x 20 μs)  | I <sub>pp</sub>  | 2.0         | A    |
| Total Power Dissipation on FR-5 Board<br>(Note 1) @ T <sub>A</sub> = 25°C | P <sub>D</sub>   | 150         | mW   |
| Storage Temperature Range   | T <sub>stg</sub> | -55 to +150 | °C   |
| Junction Temperature Range  | T <sub>J</sub>   | -55 to +150 | °C   |
| Lead Solder Temperature - Maximum<br>(10 Second Duration)                 | T <sub>L</sub>   | 260         | °C   |

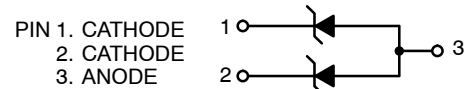
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

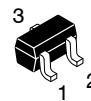


ON Semiconductor®

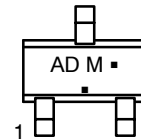
[www.onsemi.com](http://www.onsemi.com)



#### MARKING DIAGRAM



SC-75  
CASE 463  
STYLE 4



AD = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

#### ORDERING INFORMATION

| Device         | Package            | Shipping†        |
|----------------|--------------------|------------------|
| ESDR0502BT1G   | SC-75<br>(Pb-Free) | 3000/Tape & Reel |
| SZESDR0502BT1G | SC-75<br>(Pb-Free) | 3000/Tape & Reel |

†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.

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

#### DEVICE MARKING INFORMATION

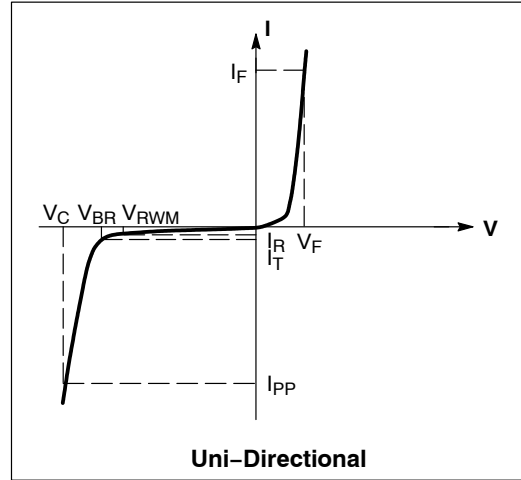
See specific marking information in the device marking column of the Electrical Characteristics tables starting on page 2 of this data sheet.

# ESDR0502B, SZESDR0502B

## 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                                |
| $I_F$     | Forward Current                             |
| $V_F$     | Forward Voltage @ $I_F$                     |
| $P_{pk}$  | Peak Power Dissipation                      |
| C         | Capacitance @ $V_R = 0$ and $f = 1.0$ MHz   |



## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted, $V_F = 1.1$ V Max. @ $I_F = 10$ mA for all types)

| Device*   | Device Marking | $V_{RWM}$ (V) | $I_R$ ( $\mu\text{A}$ ) @ $V_{RWM}$ | $V_{BR}$ (V) @ $I_T$ (Note 2) | $I_T$ (mA) | C (pF), uni-directional (Note 3) |     | C (pF), bi-directional (Note 4) |      | $V_C$ (V) @ $I_{PP} = 1$ A (Note 5) | $V_C$ Per IEC61000-4-2 (Note 6) |
|-----------|----------------|---------------|-------------------------------------|-------------------------------|------------|----------------------------------|-----|---------------------------------|------|-------------------------------------|---------------------------------|
|           |                | Max           | Max                                 | Min                           |            | Typ                              | Max | Typ                             | Max  | Max                                 |                                 |
| ESDR0502B | AD             | 5.0           | 1.0                                 | 5.8                           | 1.0        | 0.5                              | 0.9 | 0.25                            | 0.45 | 15                                  | Figures 1 and 2                 |

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.

\*Include SZ-prefix devices where applicable.

- $V_{BR}$  is measured with a pulse test current  $I_T$  at an ambient temperature of  $25^\circ\text{C}$ .
- Uni-directional capacitance at  $f = 1$  MHz,  $V_R = 0$  V,  $T_A = 25^\circ\text{C}$  (pin1 to pin 3; pin 2 to pin 3).
- Bi-directional capacitance at  $f = 1$  MHz,  $V_R = 0$  V,  $T_A = 25^\circ\text{C}$  (pin1 to pin 2).
- Surge current waveform per Figure 5.
- Typical waveform. For test procedure see Figures 3 and 4 and Application Note AND8307/D.

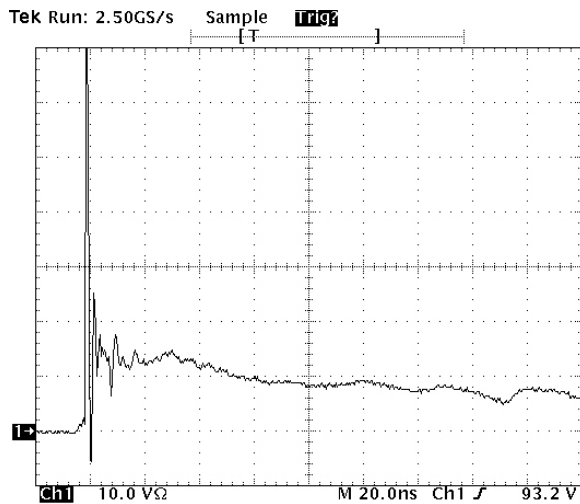


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV contact per IEC 61000-4-2

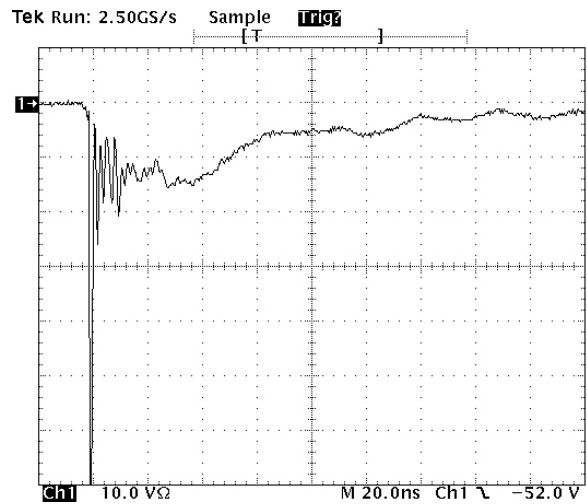


Figure 2. ESD Clamping Voltage Screenshot Negative 8 kV contact per IEC 61000-4-2

# ESDR0502B, SZESDR0502B

## 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 3. IEC61000-4-2 Spec

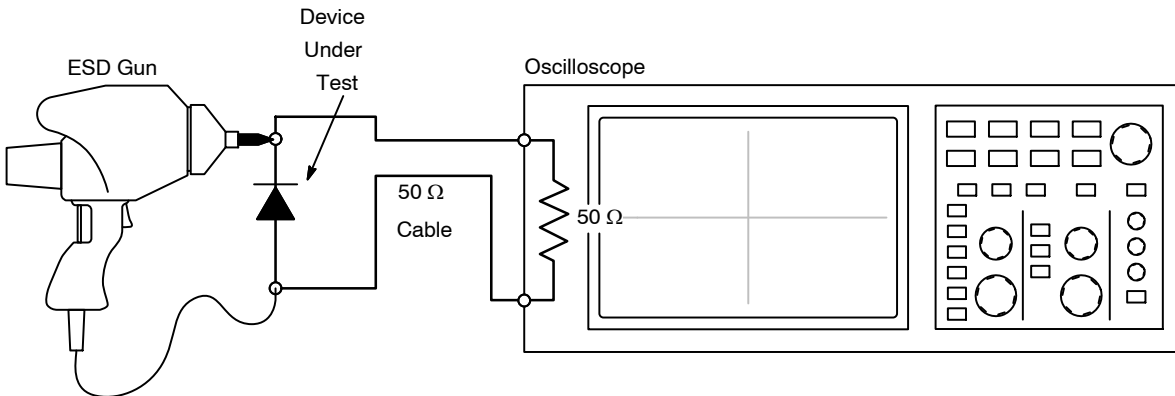


Figure 4. Diagram of ESD Test Setup

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.

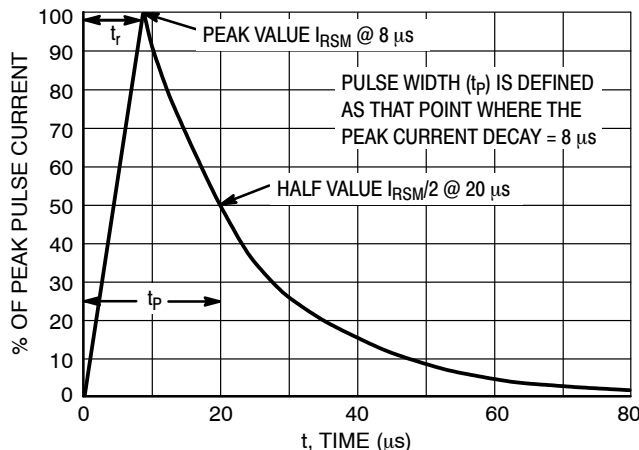


Figure 5. 8 x 20 μs Pulse Waveform

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

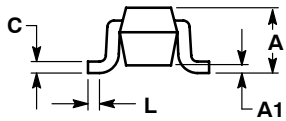
ON Semiconductor®



**SC-75/SOT-416**  
CASE 463-01  
ISSUE G

DATE 07 AUG 2015

SCALE 4:1



STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 2:  
PIN 1. ANODE  
2. N/C  
3. CATHODE

STYLE 3:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

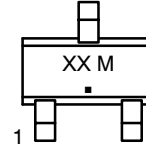
STYLE 4:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 5:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |      |      | INCHES   |       |       |
|-----|-------------|------|------|----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN      | NOM   | MAX   |
| A   | 0.70        | 0.80 | 0.90 | 0.027    | 0.031 | 0.035 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000    | 0.002 | 0.004 |
| b   | 0.15        | 0.20 | 0.30 | 0.006    | 0.008 | 0.012 |
| C   | 0.10        | 0.15 | 0.25 | 0.004    | 0.006 | 0.010 |
| D   | 1.55        | 1.60 | 1.65 | 0.061    | 0.063 | 0.065 |
| E   | 0.70        | 0.80 | 0.90 | 0.027    | 0.031 | 0.035 |
| e   | 1.00 BSC    |      |      | 0.04 BSC |       |       |
| L   | 0.10        | 0.15 | 0.20 | 0.004    | 0.006 | 0.008 |
| HE  | 1.50        | 1.60 | 1.70 | 0.060    | 0.063 | 0.067 |

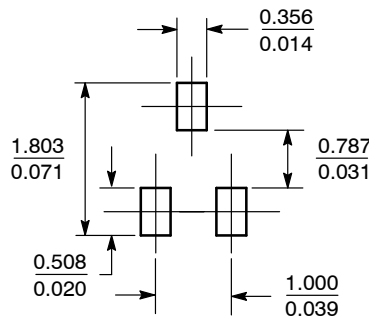
### GENERIC MARKING DIAGRAM\*



- XX = Specific Device Code
- M = Date Code
- = Pb-Free Package

\*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\*



SCALE 10:1 (mm/inches)

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

|                         |                      |  |
|-------------------------|----------------------|--|
| <b>DOCUMENT NUMBER:</b> | <b>98ASB15184C</b>   | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| <b>DESCRIPTION:</b>     | <b>SC-75/SOT-416</b> | <b>PAGE 1 OF 1</b>   |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

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

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for [ESD Suppressors / TVS Diodes](#) category:*

*Click to view products by [ON Semiconductor](#) manufacturer:*

Other Similar products are found below :

[60KS200C](#) [D12V0H1U2WS-7](#) [D18V0L1B2LP-7B](#) [82356050220](#) [D5V0M5U6V-7](#) [NTE4902](#) [P4KE27CA](#) [P6KE11CA](#) [P6KE39CA-TP](#)  
[P6KE8.2A](#) [SA110CA](#) [SA60CA](#) [SA64CA](#) [SMBJ12CATR](#) [SMBJ8.0A](#) [SMLJ30CA-TP](#) [ESD101-B1-02ELS E6327](#) [ESD112-B1-02EL E6327](#)  
[ESD119B1W01005E6327XTSA1](#) [ESD5V0J4-TP](#) [ESD5V0L1B02VH6327XTSA1](#) [ESD7451N2T5G](#) [19180-510](#) [CPDT-5V0USP-HF](#)  
[3.0SMCJ33CA-F](#) [3.0SMCJ36A-F](#) [HSPC16701B02TP](#) [D3V3Q1B2DLP3-7](#) [D55V0M1B2WS-7](#) [DESD5V0U1BL-7B](#) [DRTR5V0U4SL-7](#)  
[SCM1293A-04SO](#) [ESD200-B1-CSP0201 E6327](#) [ESD203-B1-02EL E6327](#) [SM12-7](#) [SMF8.0A-TP](#) [SMLJ45CA-TP](#) [CEN955 W/DATA](#)  
[82350120560](#) [82356240030](#) [VESD12A1A-HD1-GS08](#) [CPDUR5V0R-HF](#) [CPDUR24V-HF](#) [CPDQC5V0U-HF](#) [CPDQC5V0USP-HF](#)  
[CPDQC5V0-HF](#) [D1213A-01LP4-7B](#) [D1213A-02WL-7](#) [ESDLIN1524BJ-HQ](#) [5KP100A](#)