

# Ultra-Low Capacitance ESD Protection Diodes

## Micro-Packaged Diodes for ESD Protection

### ESDL3552B

The ESDL3552B is designed to protect voltage sensitive components that require ultra-low capacitance from ESD and transient voltage events. Excellent clamping capability, low capacitance, high breakdown voltage, high linearity, low leakage, and fast response time make these parts ideal for ESD protection on designs where board space is at a premium. It has industry leading capacitance linearity over voltage making it ideal for high-speed data line protection applications.

#### Features

- Industry Leading Capacitance Linearity Over Voltage
- Ultra-Low Capacitance: 0.25 pF
- Insertion Loss: 0.26 dB @ 5 GHz
- 0201 Isolated DSN Package: 0.62 mm x 0.32 mm
- Stand-off Voltage: 5.0 V
- Low Leakage: < 50 nA
- Low Dynamic Resistance: < 1.0  $\Omega$
- These Devices are Pb-Free, Halogen-Free/BFR-Free and are RoHS Compliant

#### Typical Applications

- High Speed Data Line Protection
- USB 2.0, USB 3.0, USB 3.1

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

| Rating   | Symbol                   | Value                | Unit                            |
|--|--------------------------|----------------------|---------------------------------|
| IEC 61000-4-2 Level 4 (Contact) (Note 1)<br>IEC 61000-4-2 Level 4 (Air) (Note 1)                       | ESD                      | $\pm 20$<br>$\pm 20$ | kV                              |
| Maximum Peak Pulse Current<br>IEC 61000-4-5 8/20 $\mu\text{s}$ (Lightning) (Note 2)                    | $I_{PP}$                 | 2.0                  | A                               |
| Total Power Dissipation (Note 3) @ $T_A = 25^\circ\text{C}$<br>Thermal Resistance, Junction-to-Ambient | $P_D$<br>$R_{\theta JA}$ | 300<br>400           | mW<br>$^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature Range   | $T_J, T_{stg}$           | -55 to<br>+150       | $^\circ\text{C}$                |
| Lead Solder Temperature – Maximum<br>(10 Second Duration)  | $T_L$                    | 260                  | $^\circ\text{C}$                |

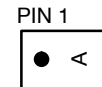
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Non-repetitive current pulse at  $T_A = 25^\circ\text{C}$ , per IEC61000-4-2 waveform.
2. Non-repetitive current pulse at  $T_A = 25^\circ\text{C}$ , per IEC61000-4-5 waveform.
3. Mounted with recommended minimum pad size, DC board FR-4

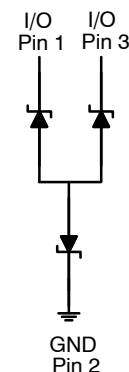


X4DFN3  
CASE 718AB

#### MARKING DIAGRAM



A = Specific Device Code



#### ORDERING INFORMATION

| Device          | Package                                | Shipping <sup>†</sup>  |
|-----------------|--|------------------------|
| ESDL3552BPFCT5G | X4DFN3<br>(Pb-Free/<br>Halide<br>Free) | 10000 / Tape<br>& Reel |

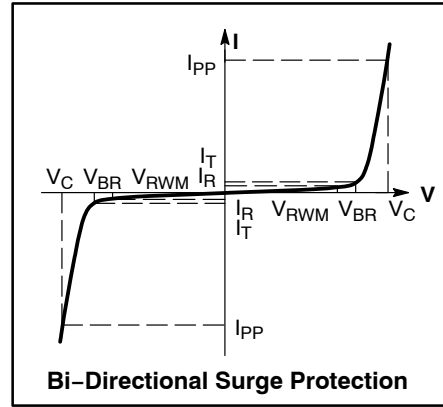
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

# ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise noted)

| Symbol           | Parameter  |
|------------------|--|
| I <sub>PP</sub>  | Maximum Reverse Peak Pulse Current                 |
| V <sub>C</sub>   | Clamping Voltage @ I <sub>PP</sub>                 |
| V <sub>RWM</sub> | Working Peak Reverse Voltage                       |
| I <sub>R</sub>   | Maximum Reverse Leakage Current @ V <sub>RWM</sub> |
| V <sub>BR</sub>  | Breakdown Voltage @ I <sub>T</sub>                 |
| I <sub>T</sub>   | Test Current                                       |

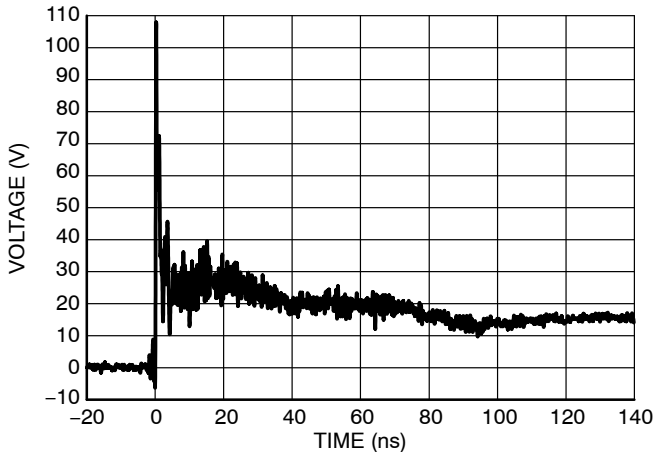
\*See Application Note [AND8308/D](#) for detailed explanations of datasheet parameters.



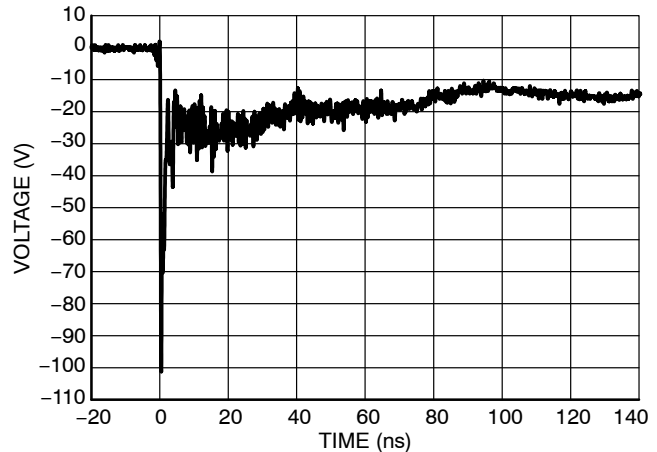
# ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

| Parameter                  | Symbol           | Condition  | Min | Typ   | Max  | Unit |
|----------------------------|------------------|--|-----|-------|------|------|
| Reverse Working Voltage    | V <sub>RWM</sub> | Between any two pins (–40°C to +85°C)  |     |       | 5.0  | V    |
| Breakdown Voltage          | V <sub>BR</sub>  | I <sub>T</sub> = 10 mA, Between any two pins (–40°C to +85°C)  | 6.5 | 10.2  | 11.5 | V    |
|                            |                  | I <sub>T</sub> = 1 mA, Between any two pins  | 7.0 | 9.3   | 11   |      |
| Reverse Leakage Current    | I <sub>R</sub>   | V <sub>RWM</sub> = 5.0 V, T <sub>A</sub> = 25°C  |     | 0.001 | 0.05 | μA   |
|                            |                  | V <sub>RWM</sub> = 5.0 V, T <sub>A</sub> = 85°C  |     | 0.001 | 0.25 | μA   |
| Clamping Voltage TLP       | V <sub>C</sub>   | I <sub>PP</sub> = 4 A } IEC 61000–4–2 Level 1 equivalent<br>(±2 kV Contact, ±4 kV Air)<br>Pin 1 to Pin 2, Pin 3 to Pin 2   |     | 14.5  |      | V    |
|                            |                  | I <sub>PP</sub> = 16 A } IEC 61000–4–2 Level 4 equivalent<br>(±8 kV Contact, ±16 kV Air)<br>Pin 1 to Pin 2, Pin 3 to Pin 2 |     | 21.5  |      | V    |
| Reverse Peak Pulse Current | I <sub>PP</sub>  | IEC61000–4–5 (8x20 μs), Between any two pins   | 2.0 | 3.0   |      | A    |
| Clamping Voltage (8x20 μs) | V <sub>C</sub>   | I <sub>PP</sub> = 2 A  |     | 14    | 18   | V    |
| Dynamic Resistance         | R <sub>DYN</sub> | 100 ns TLP, Pin 1 to Pin 2, Pin 3 to Pin 2   |     | 0.58  |      | Ω    |
| Junction Capacitance       | C <sub>J</sub>   | V <sub>R</sub> = 0 V, f = 1 MHz, Between any two pins  |     | 0.25  | 0.30 | pF   |
| Capacitance Linearity      | C <sub>Δ</sub>   | V <sub>R</sub> = 0 V to 5 V, f = 1 MHz   |     | 0.03  |      | pF   |
| Insertion Loss             | I <sub>L</sub>   | f = 2.5 GHz  |     | 0.16  |      | dB   |
|                            |                  | f = 5.0 GHz  |     | 0.26  |      |      |
|                            |                  | f = 10.0 GHz   |     | 0.41  |      |      |

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.



**Figure 1. ESD Clamping Voltage Screenshot**  
Positive 8 kV Contact per IEC61000–4–2



**Figure 2. ESD Clamping Voltage Screenshot**  
Negative 8 kV Contact per IEC61000–4–2

TYPICAL CHARACTERISTICS

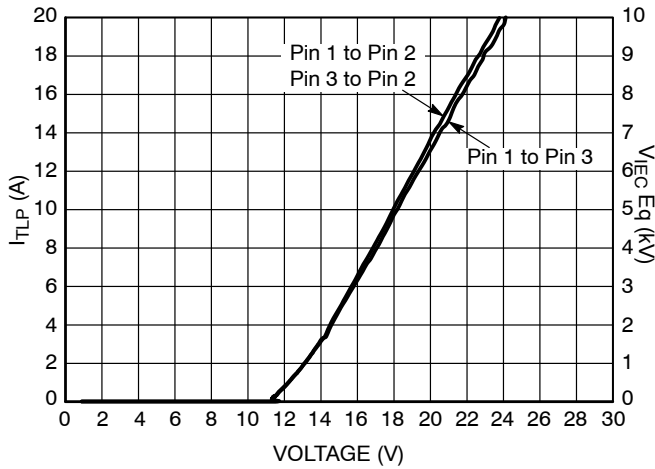


Figure 3. Positive TLP I-V Curve

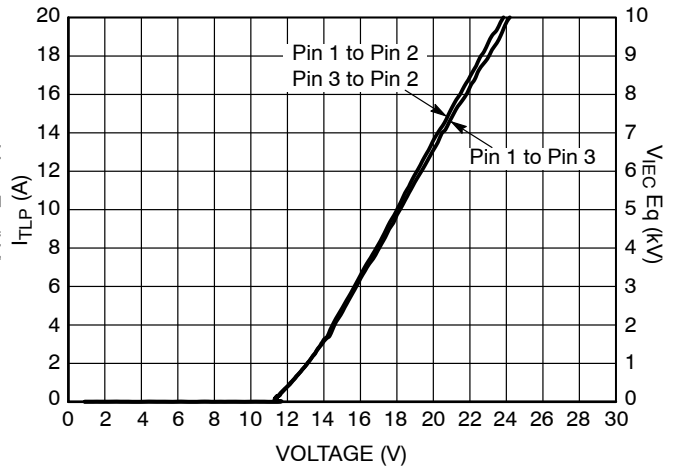


Figure 4. Negative TLP I-V Curve

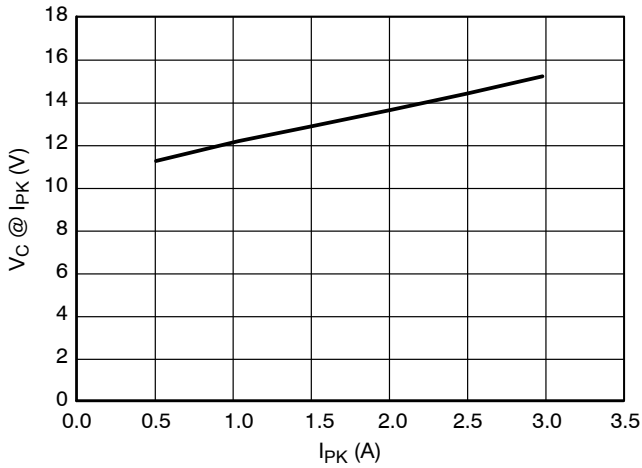


Figure 5. Positive Clamping Voltage vs. Peak Pulse Current ( $t_p = 8/20 \mu s$ )

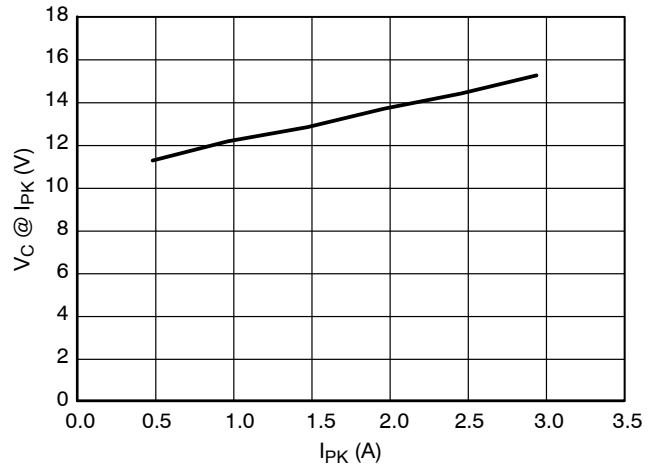


Figure 6. Negative Clamping Voltage vs. Peak Pulse Current ( $t_p = 8/20 \mu s$ )

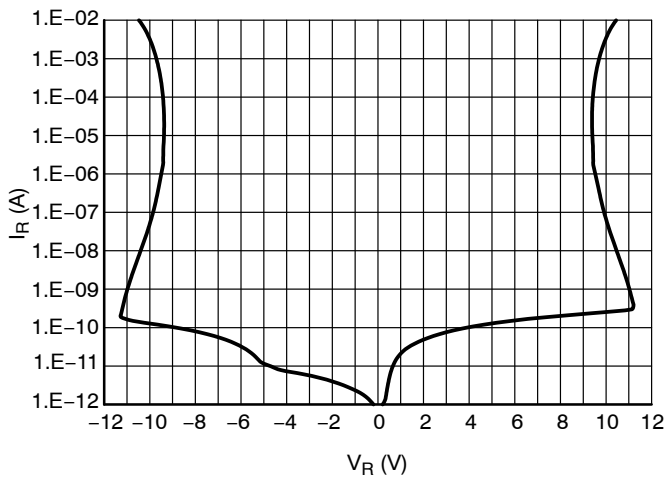


Figure 7. Breakdown Voltage

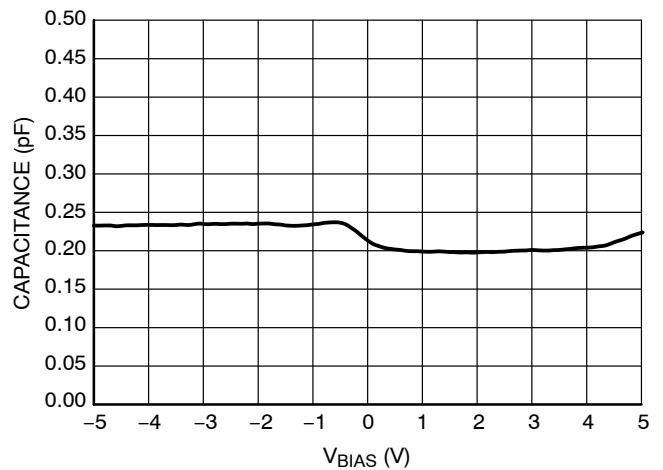
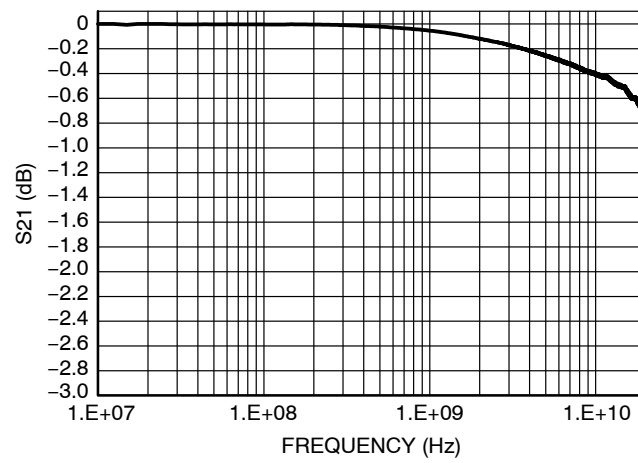


Figure 8. Line Capacitance,  $f = 1 \text{ MHz}$

## ESDL3552B

### TYPICAL CHARACTERISTICS



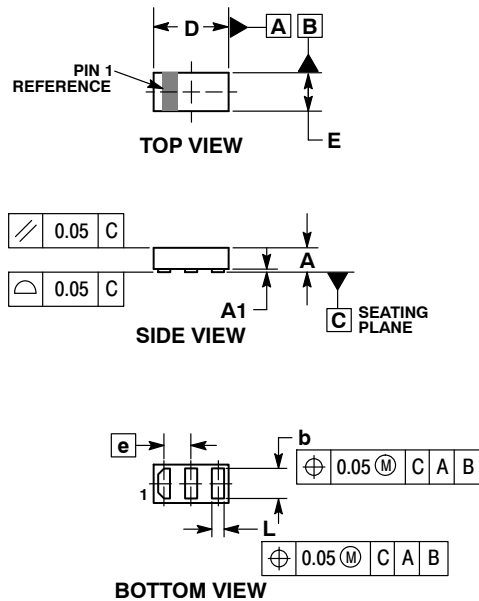
**Figure 9. Insertion Loss**



SCALE 8:1

**X4DFN3 0.62x0.32, 0.225P**  
CASE 718AB  
ISSUE A

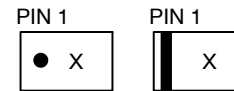
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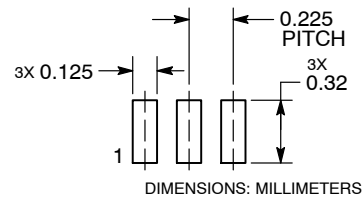
## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.

| MILLIMETERS |           |       |       |
|-------------|-----------|-------|-------|
| DIM         | MIN       | NOM   | MAX   |
| A           | 0.175     | 0.20  | 0.225 |
| A1          | 0.000     | 0.015 | 0.030 |
| b           | 0.23      | 0.25  | 0.27  |
| D           | 0.595     | 0.620 | 0.645 |
| E           | 0.295     | 0.320 | 0.345 |
| e           | 0.225 BSC |       |       |
| L           | 0.08      | 0.10  | 0.12  |

**GENERIC MARKING DIAGRAMS\***


X = Specific Device Code

**RECOMMENDED MOUNTING FOOTPRINT\***


See Application Note AND8398/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>X4DFN3 0.62x0.32, 0.225P</b> | <b>PAGE 1 OF 1</b>   |

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