



## Low Voltage Avalanche 500 mW Zener Diodes

*Qualified per MIL-PRF-19500/437*

Qualified Levels:  
JAN, JANTX and  
JANTXV

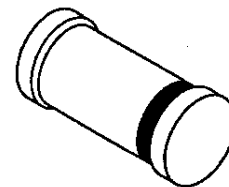
### DESCRIPTION

The 1N5518BUR-1 thru 1N5546BUR-1 series of 0.5 watt glass surface mount Zener voltage regulators provides a selection from 3.3 to 33 volts with tolerances ranging from plus/minus 1% to 20%. The standard tolerance is plus/minus 5% with the B suffix unless ordered otherwise. These glass surface mount devices are available with an internal metallurgical bond option. This type of bonded Zener package construction is also in JAN, JANTX, and JANTXV military qualifications. Microsemi also offers numerous other Zener products to meet higher and lower power applications.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- JEDEC registered 1N5518 thru 1N5546.
- Voltage tolerances of plus/minus 20%, 10%, 5%, 2%, and 1% available. See [Note 1](#) on page 3.
- Internal metallurgical bond.
- JAN, JANTX, and JANTXV qualification per MIL-PRF-19500/437 available.
- RoHS compliant versions available (commercial grade only).



**DO-213AA MELF  
Package**

Also available in:

 **DO-35 (DO-204AH)**  
(axial-leaded)  
[1N5518B-1 thru 1N5546B-1](#)

### APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 3.3 to 33 V.
- Hermetically sealed surface mount package.
- Nonsensitive to ESD per MIL-STD-750 Method 1020.
- Minimal capacitance (see [Figure 3](#)).
- Inherently radiation hard as described in Microsemi's "[MicroNote 050](#)" which is available at [Microsemi.com](http://Microsemi.com).

### MAXIMUM RATINGS

| Parameters/Test Conditions                                                                 | Symbol              | Value       | Unit |
|--------------------------------------------------------------------------------------------|---------------------|-------------|------|
| Junction and Storage Temperature                                                           | $T_J$ and $T_{STG}$ | -65 to +175 | °C   |
| Steady-State Power <sup>(Note 1)</sup><br>(Also see derating in <a href="#">Figure 2</a> ) | $P_D$               | 0.5         | W    |
| Thermal Resistance Junction-to-End Cap <sup>(Note 2)</sup>                                 | $R_{\theta JEC}$    | 100         | °C/W |
| Thermal Resistance Junction-to-Ambient <sup>(Note 2)</sup>                                 | $R_{\theta JA}$     | 300         | °C/W |
| Thermal Impedance                                                                          | $Z_{\theta JX}$     | 35          | °C/W |
| Forward Voltage $\square$ 200mA                                                            | $V_F$               | 1.1         | V    |
| Solder Pad Temperature @ 10 s                                                              | $T_{SP}$            | 260         | °C   |

**Notes:** 1. At end cap temperature  $T_{EC} \leq 125^\circ\text{C}$  or at ambient  $T_A \leq 50^\circ\text{C}$  when mounted on FR4 PC board as described for thermal resistance above (see [Figure 2](#) for derating). Derate to 0 at +175 °C.  
2. When mounted on FR4 PC board (1 oz Cu) with recommended footprint (see last page).

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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed glass DO-213AA (SOD80 or MLL34) MELF style package.
- TERMINALS: End caps tin-lead plated or RoHS compliant matte-Tin plating available (on commercial only) solderable per MIL-STD-750, method 2026.
- POLARITY: Cathode indicated by band where diode is to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- MOUNTING SURFACE SELECTION: The Axial Coefficient of Expansion (COE) of this device is approximately +6 PPM/°C. The COE of the Mounting Surface System should be selected to provide a suitable match with this device.
- MARKING: cathode band only.
- TAPE & REEL option: Standard per EIA-481-1-A with 12 mm tape (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: 0.04 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**JAN 1N5518 B UR -1 (e3)**

**Reliability Level**

JAN = JAN Level  
JANTX = JANTX Level  
JANTXV = JANTXV Level  
Blank = Commercial

**JEDEC type number**

See [Electrical Characteristics](#) table

**Zener Voltage Tolerance**

A = 10%  
B = 5%  
C = 2%  
D = 1%  
Blank = 20%

**RoHS Compliance**

e3 = RoHS compliant (available on commercial grade only)  
Blank = non-RoHS compliant

**Metallurgical Bond**

-1 = Metallurgical bond

**Package type**

UR = surface mount

**SYMBOLS & DEFINITIONS**

| Symbol                | Definition                                                                                                                                                                                                                                      |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_R$                 | Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature.                                                                                                                                 |
| $I_Z, I_{ZT}, I_{ZK}$ | Regulator Current: The dc regulator current ( $I_Z$ ), at a specified test point ( $I_{ZT}$ ), near breakdown knee ( $I_{ZK}$ ).                                                                                                                |
| $I_{ZL}$              | Low Regulator (Zener) Current: The lowest rated dc current for the specified power rating.                                                                                                                                                      |
| $I_{ZM}$              | Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating.                                                                                                                                                 |
| $V_Z$                 | Zener Voltage: The zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.                                                                                                                              |
| $\Delta V_Z$          | Voltage Regulation: The change in zener voltage between two specified currents or percentage of $I_{ZM}$ .                                                                                                                                      |
| $Z_{ZT}$ or $Z_{ZK}$  | Dynamic Impedance: The small signal impedance of the diode when biased to operate in its breakdown region at a specified rms current modulation (typically 10% of $I_{ZT}$ or $I_{ZK}$ ) and superimposed on $I_{ZT}$ or $I_{ZK}$ respectively. |

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted. Based on DC measurements at thermal equilibrium; V<sub>F</sub> = 1.1 Max @ I<sub>F</sub> = 200 mA for all types.)

| JEDEC TYPE<br>NUMBER<br>(Note 1) | NOMINAL<br>ZENER<br>VOLTAGE<br>V <sub>Z</sub> @ I <sub>ZT</sub><br>(Note 2) | TEST<br>CURRENT<br>I <sub>ZT</sub><br><br>mA | MAX. ZENER<br>IMPEDANCE<br>B-C-D SUFFIX<br>Z <sub>ZT</sub> @ I <sub>ZT</sub><br>(Note 3) | MAX. REVERSE CURRENT<br>(Note 4) |                        |                 | B-C-D<br>SUFFIX<br>MAXIMUM<br>DC ZENER<br>CURRENT<br>I <sub>ZM</sub><br>(Note 5) | B-C-D SUFFIX<br>MAX. NOISE<br>DENSITY<br>AT I <sub>Z</sub> = 250 μA<br>N <sub>D</sub><br><br>μV/ √Hz | REGULATION<br>FACTOR<br>ΔV <sub>Z</sub><br>(Note 6) | LOW V <sub>Z</sub><br>CURRENT<br>I <sub>ZL</sub><br>(Note 6) |
|----------------------------------|-----------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------|------------------------|-----------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------|
|                                  |                                                                             |                                              |                                                                                          | I <sub>R</sub><br><br>μA         | V <sub>R</sub> – VOLTS |                 |                                                                                  |                                                                                                      |                                                     |                                                              |
|                                  |                                                                             |                                              |                                                                                          |                                  | NON &<br>A-<br>SUFFIX  | B-C-D<br>SUFFIX |                                                                                  |                                                                                                      |                                                     |                                                              |
|                                  | Volts                                                                       |                                              | Ohms                                                                                     |                                  |                        |                 | mA                                                                               |                                                                                                      | Volts                                               | mA                                                           |
| 1N5518BUR-1                      | 3.3                                                                         | 20                                           | 26                                                                                       | 5.0                              | 0.90                   | 1.0             | 115                                                                              | 0.5                                                                                                  | 0.90                                                | 2.0                                                          |
| 1N5519BUR-1                      | 3.6                                                                         | 20                                           | 24                                                                                       | 3.0                              | 0.90                   | 1.0             | 105                                                                              | 0.5                                                                                                  | 0.90                                                | 2.0                                                          |
| 1N5520BUR-1                      | 3.9                                                                         | 20                                           | 22                                                                                       | 1.0                              | 0.90                   | 1.0             | 98                                                                               | 0.5                                                                                                  | 0.85                                                | 2.0                                                          |
| 1N5521BUR-1                      | 4.3                                                                         | 20                                           | 18                                                                                       | 3.0                              | 1.0                    | 1.5             | 88                                                                               | 0.5                                                                                                  | 0.75                                                | 2.0                                                          |
| 1N5522BUR-1                      | 4.7                                                                         | 10                                           | 22                                                                                       | 2.0                              | 1.5                    | 2.0             | 81                                                                               | 0.5                                                                                                  | 0.60                                                | 1.0                                                          |
| 1N5523BUR-1                      | 5.1                                                                         | 5.0                                          | 26                                                                                       | 2.0                              | 2.0                    | 2.5             | 75                                                                               | 0.5                                                                                                  | 0.65                                                | 0.25                                                         |
| 1N5524BUR-1                      | 5.6                                                                         | 3.0                                          | 30                                                                                       | 2.0                              | 3.0                    | 3.5             | 68                                                                               | 1.0                                                                                                  | 0.30                                                | 0.25                                                         |
| 1N5525BUR-1                      | 6.2                                                                         | 1.0                                          | 30                                                                                       | 1.0                              | 4.5                    | 5.0             | 61                                                                               | 1.0                                                                                                  | 0.20                                                | 0.01                                                         |
| 1N5526BUR-1                      | 6.8                                                                         | 1.0                                          | 30                                                                                       | 1.0                              | 5.5                    | 6.2             | 56                                                                               | 1.0                                                                                                  | 0.10                                                | 0.01                                                         |
| 1N5527BUR-1                      | 7.5                                                                         | 1.0                                          | 35                                                                                       | 0.5                              | 6.0                    | 6.8             | 51                                                                               | 2.0                                                                                                  | 0.05                                                | 0.01                                                         |
| 1N5528BUR-1                      | 8.2                                                                         | 1.0                                          | 40                                                                                       | 0.5                              | 6.5                    | 7.5             | 46                                                                               | 4.0                                                                                                  | 0.05                                                | 0.01                                                         |
| 1N5529BUR-1                      | 9.1                                                                         | 1.0                                          | 45                                                                                       | 0.1                              | 7.0                    | 8.2             | 42                                                                               | 4.0                                                                                                  | 0.05                                                | 0.01                                                         |
| 1N5530BUR-1                      | 10.0                                                                        | 1.0                                          | 60                                                                                       | 0.05                             | 8.0                    | 9.1             | 38                                                                               | 4.0                                                                                                  | 0.10                                                | 0.01                                                         |
| 1N5531BUR-1                      | 11.0                                                                        | 1.0                                          | 80                                                                                       | 0.05                             | 9.0                    | 9.9             | 35                                                                               | 5.0                                                                                                  | 0.20                                                | 0.01                                                         |
| 1N5532BUR-1                      | 12.0                                                                        | 1.0                                          | 90                                                                                       | 0.05                             | 9.5                    | 10.8            | 32                                                                               | 10                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5533BUR-1                      | 13.0                                                                        | 1.0                                          | 90                                                                                       | 0.01                             | 10.5                   | 11.7            | 29                                                                               | 15                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5534BUR-1                      | 14.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 11.5                   | 12.6            | 27                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5535BUR-1                      | 15.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 12.5                   | 13.5            | 25                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5536BUR-1                      | 16.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 13.0                   | 14.4            | 24                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5537BUR-1                      | 17.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 14.0                   | 15.3            | 22                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5538BUR-1                      | 18.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 15.0                   | 16.2            | 21                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5539BUR-1                      | 19.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 16.0                   | 17.1            | 20                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5540BUR-1                      | 20.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 17.0                   | 18.0            | 19                                                                               | 20                                                                                                   | 0.20                                                | 0.01                                                         |
| 1N5541BUR-1                      | 22.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 18.0                   | 19.8            | 17                                                                               | 25                                                                                                   | 0.25                                                | 0.01                                                         |
| 1N5542BUR-1                      | 24.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 20.0                   | 21.6            | 16                                                                               | 30                                                                                                   | 0.30                                                | 0.01                                                         |
| 1N5543BUR-1                      | 25.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 21.0                   | 22.4            | 15                                                                               | 35                                                                                                   | 0.35                                                | 0.01                                                         |
| 1N5544BUR-1                      | 28.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 23.0                   | 25.2            | 14                                                                               | 40                                                                                                   | 0.40                                                | 0.01                                                         |
| 1N5545BUR-1                      | 30.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 24.0                   | 27.0            | 13                                                                               | 45                                                                                                   | 0.45                                                | 0.01                                                         |
| 1N5546BUR-1                      | 33.0                                                                        | 1.0                                          | 100                                                                                      | 0.01                             | 28.0                   | 29.7            | 12                                                                               | 50                                                                                                   | 0.50                                                | 0.01                                                         |

**NOTES:**
**1. TOLERANCE AND VOLTAGE DESIGNATION –**

The JEDEC type numbers without a letter prior to the UR-1 suffix are +/-20% with guaranteed limits for only V<sub>Z</sub>, I<sub>R</sub>, and V<sub>F</sub>. Units with "A" prior to the UR-1 suffix are +/-10% with guaranteed limits for V<sub>Z</sub>, I<sub>R</sub>, and V<sub>F</sub>. Units with guaranteed limits for all six parameters are indicated by a B suffix for +/-5.0% units, C suffix for +/-2.0% and D suffix for +/-1.0% prior to the UR-1 suffix.

**2. ZENER VOLTAGE (V<sub>Z</sub>) MEASUREMENT –**

Nominal zener voltage is measured with the device junction in thermal equilibrium with ambient temperature of 25 °C.

**3. ZENER IMPEDANCE (Z<sub>Z</sub>) MEASUREMENT –**

The zener impedance is derived from the 60 Hz ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (I<sub>ZT</sub>) is superimposed on I<sub>ZT</sub>.

**4. REVERSE CURRENT (I<sub>R</sub>) –**

Reverse currents are guaranteed and are measured at V<sub>R</sub> as shown on the table.

**5. MAXIMUM REGULATOR CURRENT (I<sub>ZM</sub>) –**

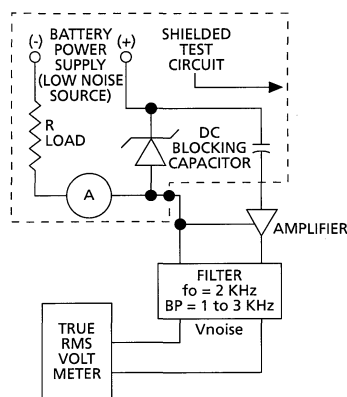
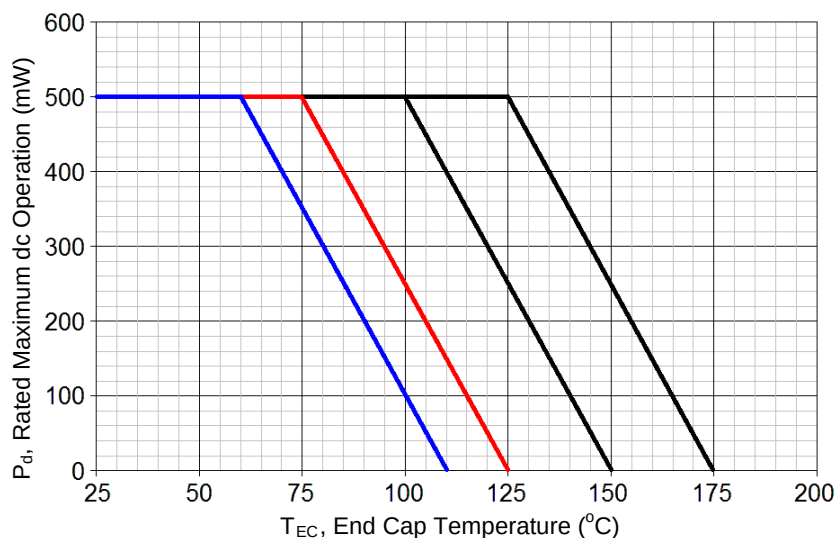
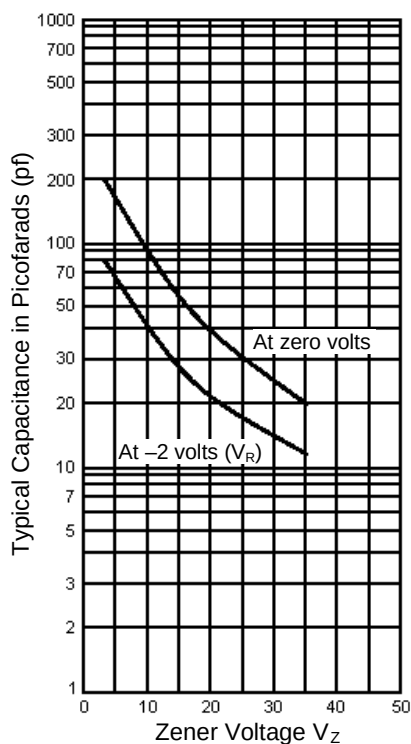
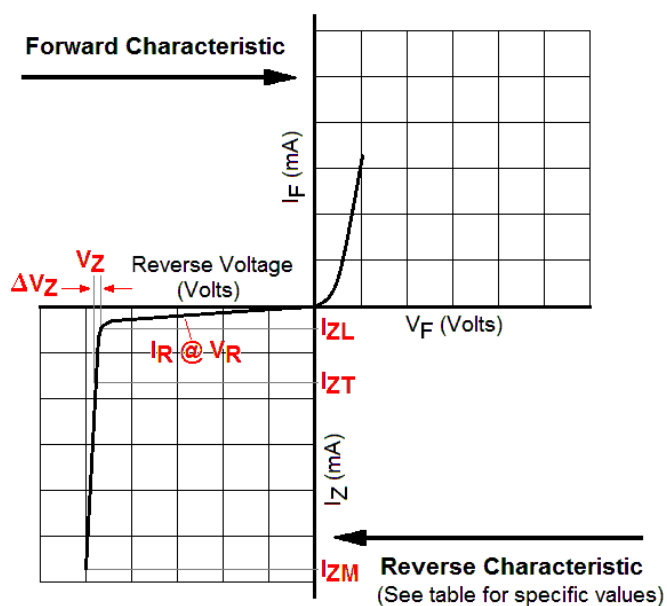
The maximum current shown is as shown in MIL-PRF-19500/437.

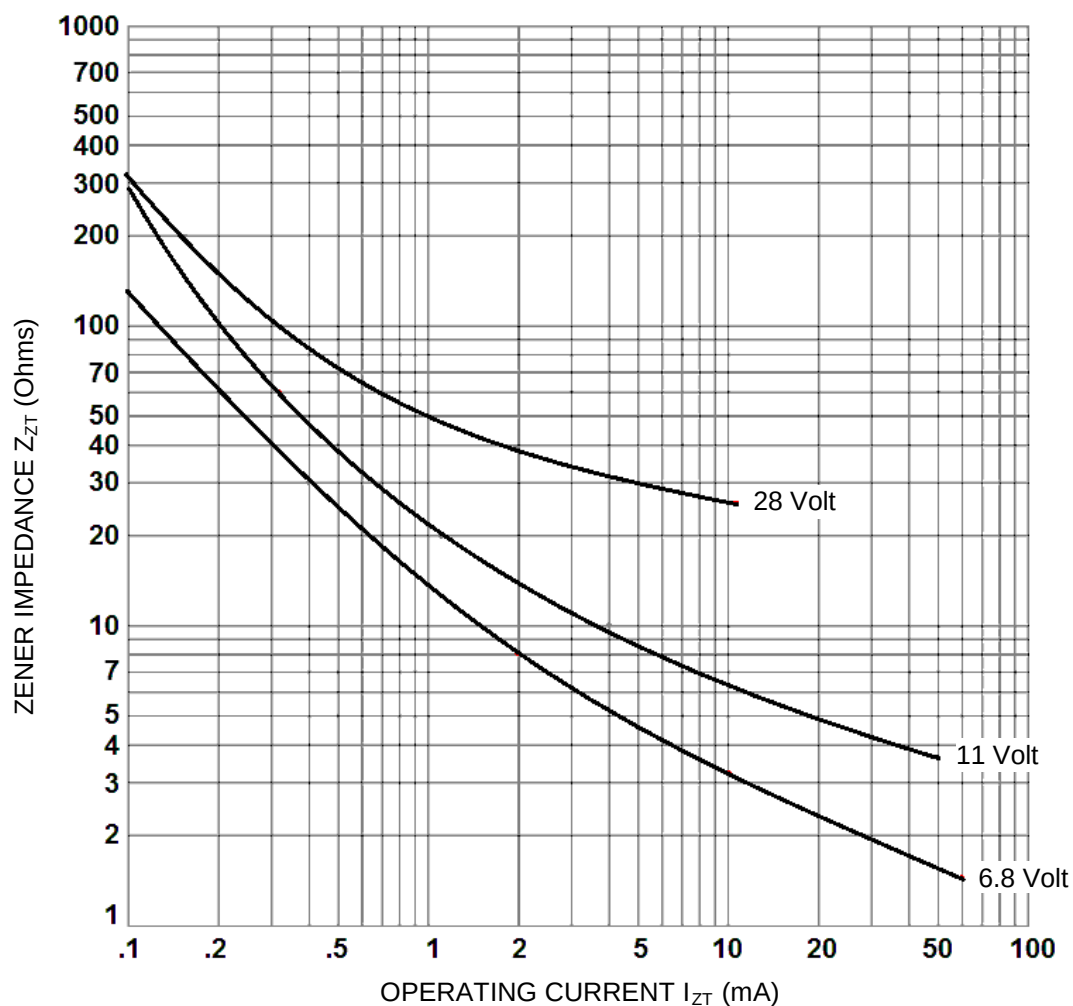
**6. MAXIMUM REGULATION FACTOR (ΔV<sub>Z</sub>) –**

ΔV<sub>Z</sub> is the maximum difference between V<sub>Z</sub> at I<sub>ZT</sub> and V<sub>Z</sub> at I<sub>ZL</sub> measured with the device junction in thermal equilibrium.

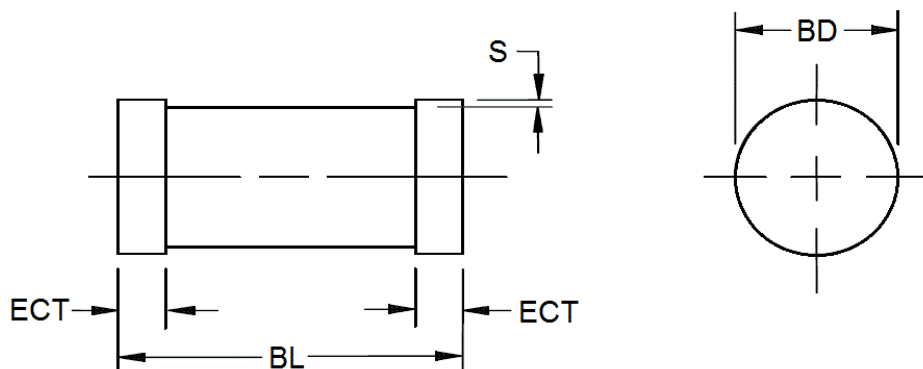
**GRAPHS**

Noise density, ( $N_D$ ) is specified in microvolt-rms per square-root-hertz. Actual measurement is performed using a 1 kHz to 3 kHz frequency bandpass filter at a constant Zener test current ( $I_{ZT}$ ) at 25 °C ambient temperature.


**FIGURE 1 – Noise Density Measurement Circuit**

**FIGURE 2 – Power Derating Curve**

**FIGURE 3 – Capacitance vs. Zener Voltage (Typical)**

**FIGURE 4**  
**Zener Diode Characteristics and Symbol Identification**

**GRAPHS (continued)**


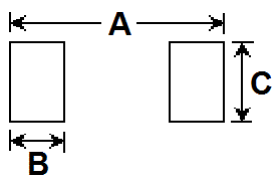
**FIGURE 5**  
 ZENER IMPEDANCE vs. OPERATION CURRENT (typical)

**PACKAGE DIMENSIONS**


| Ltr        | Dimensions |      |            |      |
|------------|------------|------|------------|------|
|            | Inch       |      | Millimeter |      |
|            | Min        | Max  | Min        | Max  |
| <b>BD</b>  | .063       | .067 | 1.60       | 1.70 |
| <b>BL</b>  | .130       | .146 | 3.30       | 3.71 |
| <b>ECT</b> | .016       | .022 | 0.41       | 0.56 |
| <b>S</b>   | .001 min   |      | 0.03 min   |      |

**NOTES:**

1. Dimensions are in inch.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

**PAD LAYOUT**


|          | INCHES | mm   |
|----------|--------|------|
| <b>A</b> | .200   | 5.08 |
| <b>B</b> | .055   | 1.40 |
| <b>C</b> | .080   | 2.03 |

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