



## Axial-Leaded 500 mW Zener Diodes

Screening in  
reference to  
MIL-PRF-19500  
available

### DESCRIPTION

The popular 1N5985B-1 thru 1N6031B-1 series of 0.5 watt Zener voltage regulators provides a selection from 2.4 to 200 volts in 10%, 5%, 2% and 1% tolerances. These axial-leaded, glass, DO-35 packaged Zeners are also available in various military equivalent screening levels by adding a prefix identifier as described in the "part nomenclature" section. 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 1N5985 thru 1N6031 series.
- Similar to operating current conditions of the BZX55 Pro Electron series of Zener products in Europe.
- Multiple voltage tolerances are available (see [part nomenclature](#)).
- Internal metallurgical bonds.
- High-Reliability screened equivalents in reference to MIL-PRF-19500 are available.
- RoHS compliant versions available (commercial grade only).

**DO-35 (DO-204AH)  
Package**

Also available in:



**DO-213AA**  
(surface mount)

[1N5985BUR-1 - 1N6031BUR-1](#)

### APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 2.4 to 200 volts.
- Flexible axial-lead mounting terminals.
- Non-sensitive to ESD (MIL-STD-750, method 1020).
- Minimal capacitance (see [Figure 2](#)).
- Inherently radiation hard as described in Microsemi "[MicroNote 050](#)".

### MAXIMUM RATINGS

| Parameters/Test Conditions                                                                    | Symbol                              | Value       | Unit |
|-----------------------------------------------------------------------------------------------|-------------------------------------|-------------|------|
| Power Dissipation at 25 °C <sup>(1)</sup><br>(Also see derating in <a href="#">Figure 1</a> ) | P <sub>D</sub>                      | 0.5         | W    |
| Junction and Storage Temperature                                                              | T <sub>J</sub> and T <sub>STG</sub> | -65 to +175 | °C   |
| Thermal Resistance Junction-to-Lead <sup>(2)</sup>                                            | R <sub>θJL</sub>                    | 250         | °C/W |
| Thermal Resistance Junction-to-Ambient <sup>(3)</sup>                                         | R <sub>θJA</sub>                    | 310         | °C/W |
| Forward Voltage @ 200 mA                                                                      | V <sub>F</sub>                      | 1.1         | V    |
| Solder Temperature @ 10 s                                                                     | T <sub>SP</sub>                     | 260         | °C   |

- Notes:**
1. At T<sub>L</sub> ≤ 50 °C 3/8 inch (10 mm) from body or 0.48 W at T<sub>A</sub> ≤ 25 °C when mounted on FR4 PC board as described for thermal resistance above.
  2. Junction to lead at 3/8 (10 mm) lead length from body.
  3. Junction to ambient when mounted on FR4 PC board (1 oz Cu) with 4 mm<sup>2</sup> copper pads and track width 1 mm, length 25 mm.

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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed axial-lead glass DO-35 (DO-204AH) package.
- TERMINALS: Tin-lead or RoHS compliant matte-tin (commercial grade only) plating solderable per MIL-STD-750, method 2026.
- POLARITY: Cathode indicated by band. Diode to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- MARKING: Part number.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: 0.2 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**MQ 1N5985 B -1 (e3)**

**Reliability Level**

MQ (reference JAN)  
MX (reference JANTX)  
MV (reference JANTXV)  
CDS (reference JANS)  
Blank = commercial

**JEDEC type number**

See [Electrical Characteristics](#)  
table

**RoHS Compliance**

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

**Metallurgically Bonded**
**Zener Voltage Tolerance**

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

**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 ( $I_{ZK}$ ).                                                                                                                |
| $I_{ZM}$                    | Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating.                                                                                                                                                 |
| $V_F$                       | Maximum Forward Voltage: The maximum forward voltage the device will exhibit at a specified current.                                                                                                                                            |
| $V_Z$                       | Zener Voltage: The Zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.                                                                                                                              |
| $Z_{ZT}$ 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 @ 30°C Lead Temperature. Lead Length 3/8".**

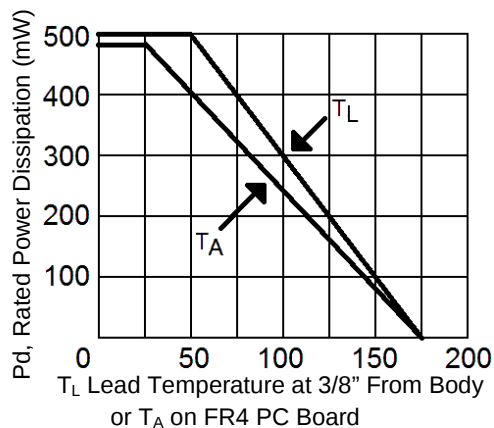
| JEDEC<br>Type<br>Number | Nominal<br>Zener<br>Voltage<br>V <sub>z</sub> @ I <sub>zT</sub><br>(Note 2) | Test<br>Current<br>I <sub>zT</sub><br><br>mA | Max. Zener Impedance<br>(Note 1)  |             |                                             |             | Max. Reverse Leakage Current    |             |                 |             | Max. dc<br>Zener<br>Current<br>I <sub>zM</sub><br>(Note 3)<br><br>mA | Typical<br>Temp.<br>Coeff.<br>of Zener<br>Voltage<br>α <sub>vz</sub><br>%/°C |
|-------------------------|-----------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|-------------|---------------------------------------------|-------------|---------------------------------|-------------|-----------------|-------------|----------------------------------------------------------------------|------------------------------------------------------------------------------|
|                         |                                                                             |                                              | Z <sub>zT</sub> @ I <sub>zT</sub> |             | Z <sub>zK</sub> @ I <sub>zK</sub> = 0.25 mA |             | I <sub>R</sub> @ V <sub>R</sub> |             |                 |             |                                                                      |                                                                              |
|                         |                                                                             |                                              | Ohms                              |             | Ohms                                        |             | μA                              |             | Volts           |             |                                                                      |                                                                              |
|                         |                                                                             |                                              | B,C,D<br>Suffix                   | A<br>Suffix | B,C,D<br>Suffix                             | A<br>Suffix | B,C,D<br>Suffix                 | A<br>Suffix | B,C,D<br>Suffix | A<br>Suffix |                                                                      |                                                                              |
| 1N5985B                 | 2.4                                                                         | 5.0                                          | 100                               | 110         | 1800                                        | 2000        | 100                             | 100         | 1.0             | 0.5         | 208                                                                  | -0.090                                                                       |
| 1N5986B                 | 2.7                                                                         | 5.0                                          | 100                               | 110         | 1900                                        | 2200        | 75                              | 100         | 1.0             | 0.5         | 185                                                                  | -0.075                                                                       |
| 1N5987B                 | 3.0                                                                         | 5.0                                          | 95                                | 100         | 2000                                        | 2300        | 50                              | 100         | 1.0             | 0.5         | 167                                                                  | -0.070                                                                       |
| 1N5988B                 | 3.3                                                                         | 5.0                                          | 95                                | 100         | 2200                                        | 2400        | 25                              | 75          | 1.0             | 0.5         | 152                                                                  | -0.060                                                                       |
| 1N5989B                 | 3.6                                                                         | 5.0                                          | 90                                | 95          | 2300                                        | 2500        | 15                              | 50          | 1.0             | 0.5         | 139                                                                  | -0.055                                                                       |
| 1N5990B                 | 3.9                                                                         | 5.0                                          | 90                                | 95          | 2400                                        | 2500        | 10                              | 25          | 1.0             | 1.0         | 128                                                                  | -0.045                                                                       |
| 1N5991B                 | 4.3                                                                         | 5.0                                          | 88                                | 90          | 2500                                        | 2500        | 5.0                             | 15          | 1.0             | 1.0         | 116                                                                  | -0.010                                                                       |
| 1N5992B                 | 4.7                                                                         | 5.0                                          | 70                                | 90          | 2200                                        | 2500        | 3.0                             | 10          | 1.5             | 1.0         | 106                                                                  | +0.010                                                                       |
| 1N5993B                 | 5.1                                                                         | 5.0                                          | 50                                | 88          | 2050                                        | 2500        | 2.0                             | 5.0         | 2.0             | 1.0         | 98                                                                   | +0.025                                                                       |
| 1N5994B                 | 5.6                                                                         | 5.0                                          | 25                                | 70          | 1800                                        | 2200        | 2.0                             | 3.0         | 3.0             | 1.5         | 89                                                                   | +0.035                                                                       |
| 1N5995B                 | 6.2                                                                         | 5.0                                          | 10                                | 50          | 1300                                        | 2050        | 1.0                             | 2.0         | 4.0             | 2.0         | 81                                                                   | +0.040                                                                       |
| 1N5996B                 | 6.8                                                                         | 5.0                                          | 8.0                               | 25          | 750                                         | 1800        | 1.0                             | 2.0         | 5.2             | 3.0         | 74                                                                   | +0.044                                                                       |
| 1N5997B                 | 7.5                                                                         | 5.0                                          | 7.0                               | 10          | 600                                         | 1300        | 0.5                             | 1.0         | 6.0             | 4.0         | 67                                                                   | +0.051                                                                       |
| 1N5998B                 | 8.2                                                                         | 5.0                                          | 7.0                               | 15          | 600                                         | 750         | 0.5                             | 1.0         | 6.5             | 5.2         | 61                                                                   | +0.055                                                                       |
| 1N5999B                 | 9.1                                                                         | 5.0                                          | 10                                | 18          | 600                                         | 600         | 0.1                             | 0.5         | 7.0             | 6.0         | 55                                                                   | +0.061                                                                       |
| 1N6000B                 | 10                                                                          | 5.0                                          | 15                                | 22          | 600                                         | 600         | 0.1                             | 0.5         | 8.0             | 6.5         | 50                                                                   | +0.065                                                                       |
| 1N6001B                 | 11                                                                          | 5.0                                          | 18                                | 25          | 600                                         | 600         | 0.1                             | 0.1         | 8.4             | 7.0         | 45                                                                   | +0.068                                                                       |
| 1N6002B                 | 12                                                                          | 5.0                                          | 22                                | 32          | 600                                         | 600         | 0.1                             | 0.1         | 9.1             | 8.0         | 42                                                                   | +0.073                                                                       |
| 1N6003B                 | 13                                                                          | 5.0                                          | 25                                | 36          | 600                                         | 600         | 0.1                             | 0.1         | 9.9             | 8.4         | 38                                                                   | +0.075                                                                       |
| 1N6004B                 | 15                                                                          | 5.0                                          | 32                                | 42          | 600                                         | 600         | 0.1                             | 0.1         | 11              | 9.1         | 33                                                                   | +0.079                                                                       |
| 1N6005B                 | 16                                                                          | 5.0                                          | 36                                | 48          | 600                                         | 600         | 0.1                             | 0.1         | 12              | 9.9         | 31                                                                   | +0.080                                                                       |
| 1N6006B                 | 18                                                                          | 5.0                                          | 42                                | 55          | 600                                         | 600         | 0.1                             | 0.1         | 14              | 11          | 28                                                                   | +0.083                                                                       |
| 1N6007B                 | 20                                                                          | 5.0                                          | 48                                | 62          | 600                                         | 600         | 0.1                             | 0.1         | 15              | 12          | 25                                                                   | +0.085                                                                       |
| 1N6008B                 | 22                                                                          | 5.0                                          | 55                                | 70          | 600                                         | 600         | 0.1                             | 0.1         | 17              | 14          | 23                                                                   | +0.087                                                                       |
| 1N6009B                 | 24                                                                          | 5.0                                          | 62                                | 78          | 600                                         | 600         | 0.1                             | 0.1         | 18              | 15          | 21                                                                   | +0.090                                                                       |
| 1N6010B                 | 27                                                                          | 5.0                                          | 70                                | 88          | 600                                         | 700         | 0.1                             | 0.1         | 21              | 17          | 19                                                                   | +0.091                                                                       |
| 1N6011B                 | 30                                                                          | 5.0                                          | 78                                | 95          | 600                                         | 700         | 0.1                             | 0.1         | 23              | 18          | 17                                                                   | +0.093                                                                       |
| 1N6012B                 | 33                                                                          | 5.0                                          | 88                                | 110         | 700                                         | 800         | 0.1                             | 0.1         | 25              | 21          | 15                                                                   | +0.094                                                                       |
| 1N6013B                 | 36                                                                          | 5.0                                          | 95                                | 130         | 700                                         | 900         | 0.1                             | 0.1         | 27              | 23          | 14                                                                   | +0.094                                                                       |
| 1N6014B                 | 39                                                                          | 2.0                                          | 130                               | 170         | 800                                         | 1000        | 0.1                             | 0.1         | 30              | 25          | 13                                                                   | +0.095                                                                       |
| 1N6015B                 | 43                                                                          | 2.0                                          | 150                               | 180         | 900                                         | 1100        | 0.1                             | 0.1         | 33              | 27          | 12                                                                   | +0.095                                                                       |
| 1N6016B                 | 47                                                                          | 2.0                                          | 170                               | 200         | 1000                                        | 1300        | 0.1                             | 0.1         | 36              | 30          | 11                                                                   | +0.096                                                                       |
| 1N6017B                 | 51                                                                          | 2.0                                          | 180                               | 225         | 1300                                        | 1400        | 0.1                             | 0.1         | 39              | 33          | 9.8                                                                  | +0.096                                                                       |
| 1N6018B                 | 56                                                                          | 2.0                                          | 200                               | 240         | 1400                                        | 1600        | 0.1                             | 0.1         | 43              | 36          | 8.9                                                                  | +0.096                                                                       |
| 1N6019B                 | 62                                                                          | 2.0                                          | 225                               | 265         | 1400                                        | 1700        | 0.1                             | 0.1         | 47              | 39          | 8.0                                                                  | +0.097                                                                       |
| 1N6020B                 | 68                                                                          | 2.0                                          | 240                               | 280         | 1600                                        | 2000        | 0.1                             | 0.1         | 52              | 43          | 7.4                                                                  | +0.097                                                                       |
| 1N6021B                 | 75                                                                          | 2.0                                          | 265                               | 300         | 1700                                        | 2300        | 0.1                             | 0.1         | 56              | 47          | 6.7                                                                  | +0.098                                                                       |
| 1N6022B                 | 82                                                                          | 2.0                                          | 280                               | 350         | 2000                                        | 2600        | 0.1                             | 0.1         | 62              | 52          | 6.1                                                                  | +0.098                                                                       |
| 1N6023B                 | 91                                                                          | 2.0                                          | 300                               | 400         | 2300                                        | 3000        | 0.1                             | 0.1         | 69              | 56          | 5.5                                                                  | +0.099                                                                       |
| 1N6024B                 | 100                                                                         | 1.0                                          | 500                               | 800         | 2600                                        | 4000        | 0.1                             | 0.1         | 76              | 62          | 5.0                                                                  | +0.110                                                                       |
| 1N6025B                 | 110                                                                         | 1.0                                          | 650                               | 950         | 3000                                        | 4500        | 0.1                             | 0.1         | 84              | 69          | 4.5                                                                  | +0.110                                                                       |
| 1N6026B                 | 120                                                                         | 1.0                                          | 800                               | 1250        | 4000                                        | 5000        | 0.1                             | 0.1         | 91              | 76          | 4.2                                                                  | +0.110                                                                       |
| 1N6027B                 | 130                                                                         | 1.0                                          | 950                               | 1400        | 4500                                        | 5500        | 0.1                             | 0.1         | 99              | 84          | 3.8                                                                  | +0.110                                                                       |
| 1N6028B                 | 150                                                                         | 1.0                                          | 1250                              | 1700        | 5000                                        | 6000        | 0.1                             | 0.1         | 114             | 91          | 3.3                                                                  | +0.110                                                                       |
| 1N6029B                 | 160                                                                         | 1.0                                          | 1400                              | 2000        | 5500                                        | 7000        | 0.1                             | 0.1         | 122             | 99          | 3.1                                                                  | +0.110                                                                       |
| 1N6030B                 | 180                                                                         | 1.0                                          | 1700                              | 2350        | 6000                                        | 8000        | 0.1                             | 0.1         | 137             | 114         | 2.8                                                                  | +0.110                                                                       |
| 1N6031B                 | 200                                                                         | 1.0                                          | 2000                              | 2700        | 7000                                        | 9000        | 0.1                             | 0.1         | 152             | 122         | 2.5                                                                  | +0.110                                                                       |

**NOTES:**

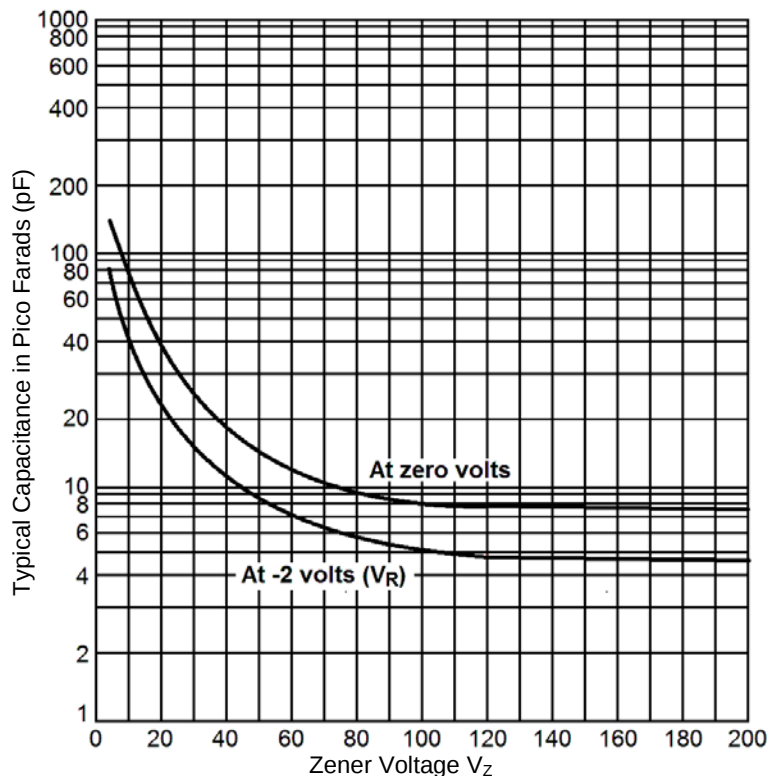
1. Zener impedance is derived from the 1 kHz ac voltage which results when an ac current having an rms value equal to 10% of dc Zener current ( $I_{ZT}$  or  $I_{ZK}$ ) is superimposed on  $I_{ZT}$  or  $I_{ZK}$ . See "MicroNote 202" for dynamic impedance variation with other operating currents.
2. Voltage measurements to be performed 20 seconds after application of the dc test current.
3. The maximum Zener current  $I_{ZM}$  shown is for the nominal voltages. The following formula can be used to determine the worst case current for any tolerance device:

$$I_{ZM} = \frac{P}{V_{ZM}}$$

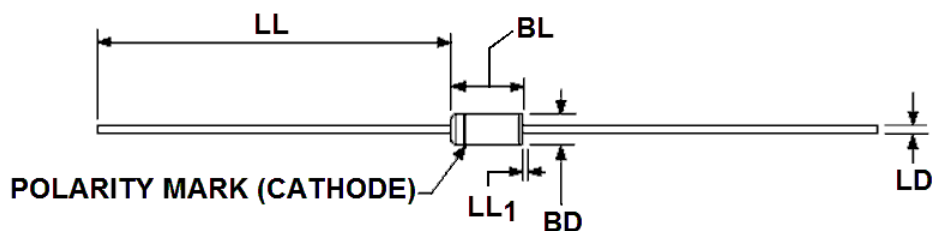
Where  $V_{ZM}$  is the high end of the voltage tolerance specified and P is the rated power of the device.

**GRAPHS**


**FIGURE 1**  
**POWER DERATING CURVE**



**FIGURE 2**  
**CAPACITANCE vs. ZENER VOLTAGE (TYPICAL)**

**PACKAGE DIMENSIONS**


| Ltr             | DIMENSION |       |             |       | Notes |
|-----------------|-----------|-------|-------------|-------|-------|
|                 | INCH      |       | MILLIMETERS |       |       |
|                 | Min       | Max   | Min         | Max   |       |
| BD              | .055      | .090  | 1.40        | 2.29  | 3     |
| BL              | .120      | .200  | 3.05        | 5.08  | 3     |
| LD              | .018      | .022  | 0.46        | 0.56  |       |
| LL              | 1.000     | 1.500 | 25.40       | 38.10 |       |
| LL <sub>1</sub> |           | .050  |             | 1.27  | 4     |

**NOTES:**

1. Dimensions are in inch.
2. Millimeters are given for general information only.
3. Package contour optional within BD and length BL. Heat slugs, if any, shall be included within this cylinder but shall not be subject to minimum limit of BD. The BL dimension shall include the entire body including slugs.
4. Within this zone lead, diameter may vary to allow for lead finishes and irregularities other than heat slugs.
5. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.