



## 500 mW GLASS AXIAL-LEAD ZENER DIODES

Screening in reference to MIL-PRF-19500 available

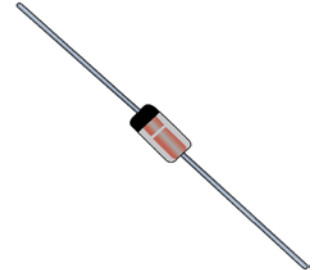
### DESCRIPTION

The popular 1N5221B-1 thru 1N5281B-1 series of 0.5 watt Zener voltage regulators provides a selection from 2.4 to 200 volts in standard 5% or 10% tolerances as well as tighter tolerances identified by different suffix letters on the part number. These glass, axial-leaded DO-35 Zeners are also available in various up-screening levels by adding a prefix identifier as described in the "Part Nomenclature" section of this datasheet. 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 1N5221 thru 1N5281 series.
- Voltage tolerances of 10%, 5%, 2%, and 1% available.
- Internal metallurgical bond.
- Up-screening in reference to MIL-PRF-19500 is available. (See [part nomenclature](#) for all available options.)
- RoHS compliant versions available (commercial grade only).



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

Also available in:

 **DO-213AA MELF**  
(surface mount)  
[1N5221BUR-1 thru 1N5281BUR-1](#)

### APPLICATIONS / BENEFITS

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

### MAXIMUM RATINGS

| Parameters/Test Conditions                            | Symbol                              | Value       | Unit |
|---|-------------------------------------|-------------|------|
| Junction and Storage Temperature                      | T <sub>J</sub> and T <sub>STG</sub> | -65 to +175 | °C   |
| Thermal Resistance Junction-to-Lead <sup>(1)</sup>    | R <sub>θJL</sub>                    | 250         | °C/W |
| Thermal Resistance Junction-to-Ambient <sup>(2)</sup> | R <sub>θJA</sub>                    | 310         | °C/W |
| Steady-State Power Dissipation <sup>(3)</sup>         | P <sub>D</sub>                      | 0.5         | W    |
| Forward Voltage @ 200 mA                              | V <sub>F</sub>                      | 1.5         | V    |
| Solder Temperature @ 10 s                             | T <sub>SP</sub>                     | 260         | °C   |

- Notes:**
1. At 3/8 (10 mm) lead length from body.
  2. 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.
  3. 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 (also see [Figure 1](#)).

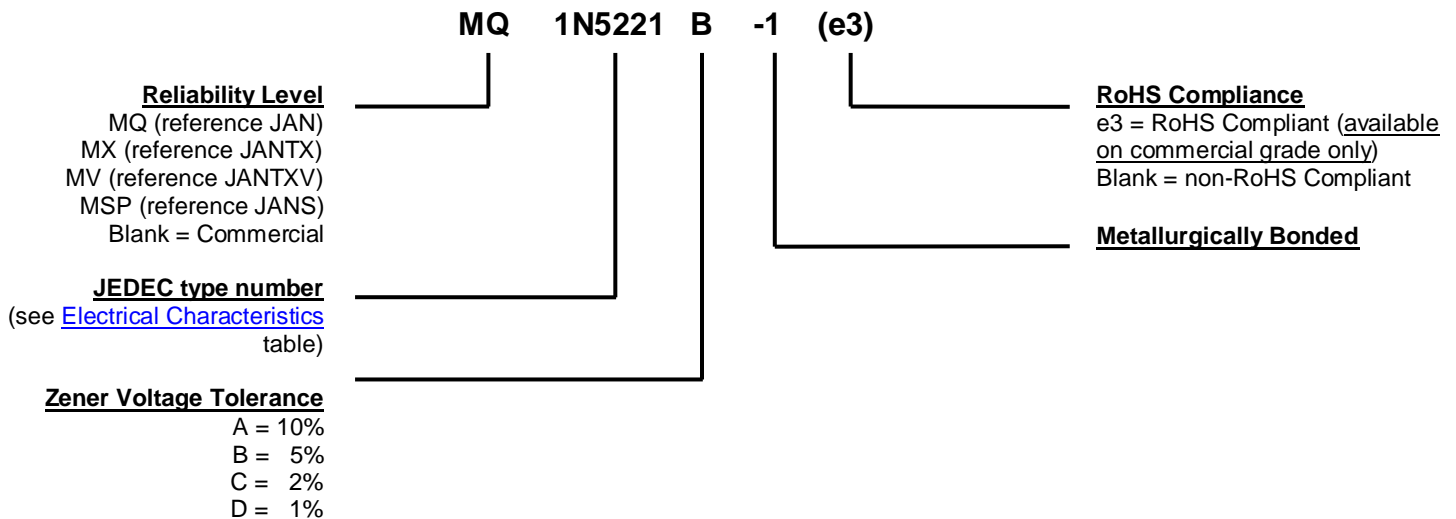
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**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed axial-lead glass DO-35 (DO-204AH) package.
- TERMINALS: Tin-lead or RoHS compliant annealed matte-tin plating (commercial grade only) solderable per MIL-STD-750, method 2026.
- MARKING: Part number.
- POLARITY: Cathode indicated by band. Diode to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- 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**

**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.   |
| $T_{SP}$              | Temperature Solder Pad: The maximum solder temperature that can be safely applied to the terminal.  |
| $V_R$                 | Reverse Voltage: The reverse voltage dc value, no alternating component.  |
| $V_Z$                 | 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 @ 25 °C unless otherwise noted.\***

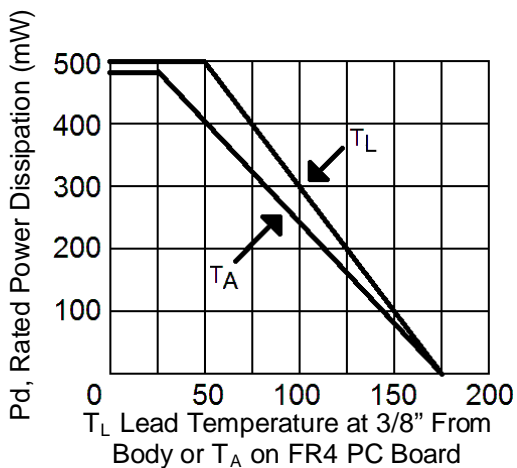
| JEDEC Type No. (Note 1) | Nominal Zener Voltage $V_Z @ I_{ZT}$ | Test Current $I_{ZT}$ | Max Zener Impedance (Note 2) |                                     | Max Reverse Leakage Current |         |          | Max Zener Voltage Temp. Coeff. (Note 3)<br>$\alpha_{VZ} (\% / ^\circ C)$ |
|-------------------------|--------------------------------------|-----------------------|------------------------------|-------------------------------------|-----------------------------|---------|----------|--|
|                         |                                      |                       | $Z_{ZT} @ I_{ZT}$            | $Z_{ZK} @ I_{ZK} = 0.25 \text{ mA}$ | $I_R$                       | @ $V_R$ |          |  |
|                         |                                      |                       |                              |                                     |                             | Volts   |          |  |
|                         |                                      |                       | Ohms                         | Ohms                                | $\mu A$                     | A       | B, C & D |  |
| 1N5221B-1               | 2.4                                  | 20                    | 30                           | 1200                                | 100                         | 0.95    | 1.0      | -0.085   |
| 1N5222B-1               | 2.5                                  | 20                    | 30                           | 1250                                | 100                         | 0.95    | 1.0      | -0.085   |
| 1N5223B-1               | 2.7                                  | 20                    | 30                           | 1300                                | 75                          | 0.95    | 1.0      | -0.080   |
| 1N5224B-1               | 2.8                                  | 20                    | 30                           | 1400                                | 75                          | 0.95    | 1.0      | -0.080   |
| 1N5225B-1               | 3.0                                  | 20                    | 29                           | 1600                                | 50                          | 0.95    | 1.0      | -0.075   |
| 1N5226B-1               | 3.3                                  | 20                    | 28                           | 1600                                | 25                          | 0.95    | 1.0      | -0.070   |
| 1N5227B-1               | 3.6                                  | 20                    | 24                           | 1700                                | 15                          | 0.95    | 1.0      | -0.065   |
| 1N5228B-1               | 3.9                                  | 20                    | 23                           | 1900                                | 10                          | 0.95    | 1.0      | -0.060   |
| 1N5229B-1               | 4.3                                  | 20                    | 22                           | 2000                                | 5.0                         | 0.95    | 1.0      | +/-0.055   |
| 1N5230B-1               | 4.7                                  | 20                    | 19                           | 1900                                | 50                          | 1.9     | 2.0      | +/-0.030   |
| 1N5231B-1               | 5.1                                  | 20                    | 17                           | 1600                                | 5.0                         | 1.9     | 2.0      | +/-0.030   |
| 1N5232B-1               | 5.6                                  | 20                    | 11                           | 1600                                | 5.0                         | 2.9     | 3.0      | +0.038   |
| 1N5233B-1               | 6.0                                  | 20                    | 7.0                          | 1600                                | 5.0                         | 3.3     | 3.5      | +0.038   |
| 1N5234B-1               | 6.2                                  | 20                    | 7.0                          | 1000                                | 5.0                         | 3.8     | 4.0      | +0.045   |
| 1N5235B-1               | 6.8                                  | 20                    | 5.0                          | 750                                 | 3.0                         | 4.8     | 5.0      | +0.050   |
| 1N5236B-1               | 7.5                                  | 20                    | 6.0                          | 500                                 | 3.0                         | 5.7     | 6.0      | +0.058   |
| 1N5237B-1               | 8.2                                  | 20                    | 8.0                          | 500                                 | 3.0                         | 6.2     | 6.5      | +0.062   |
| 1N5238B-1               | 8.7                                  | 20                    | 8.0                          | 600                                 | 3.0                         | 6.2     | 6.5      | +0.065   |
| 1N5239B-1               | 9.1                                  | 20                    | 10                           | 600                                 | 3.0                         | 6.7     | 7.0      | +0.068   |
| 1N5240B-1               | 10                                   | 20                    | 17                           | 600                                 | 3.0                         | 7.6     | 8.0      | +0.075   |
| 1N5241B-1               | 11                                   | 20                    | 22                           | 600                                 | 2.0                         | 8.0     | 8.4      | +0.076   |
| 1N5242B-1               | 12                                   | 20                    | 30                           | 600                                 | 1.0                         | 8.7     | 9.1      | +0.077   |
| 1N5243B-1               | 13                                   | 9.5                   | 13                           | 600                                 | 0.5                         | 9.4     | 9.9      | +0.079   |
| 1N5244B-1               | 14                                   | 9.0                   | 15                           | 600                                 | 0.1                         | 9.5     | 10       | +0.082   |
| 1N5245B-1               | 15                                   | 8.5                   | 16                           | 600                                 | 0.1                         | 10.5    | 11       | +0.082   |
| 1N5246B-1               | 16                                   | 7.8                   | 17                           | 600                                 | 0.1                         | 11.4    | 12       | +0.083   |
| 1N5247B-1               | 17                                   | 7.4                   | 19                           | 600                                 | 0.1                         | 12.4    | 13       | +0.084   |
| 1N5248B-1               | 18                                   | 7.0                   | 21                           | 600                                 | 0.1                         | 13.3    | 14       | +0.085   |
| 1N5249B-1               | 19                                   | 6.6                   | 23                           | 600                                 | 0.1                         | 13.3    | 14       | +0.086   |
| 1N5250B-1               | 20                                   | 6.2                   | 25                           | 600                                 | 0.1                         | 14.3    | 15       | +0.086   |
| 1N5251B-1               | 22                                   | 5.6                   | 29                           | 600                                 | 0.1                         | 16.2    | 17       | +0.087   |
| 1N5252B-1               | 24                                   | 5.2                   | 33                           | 600                                 | 0.1                         | 17.1    | 18       | +0.088   |
| 1N5253B-1               | 25                                   | 5.0                   | 35                           | 600                                 | 0.1                         | 18.1    | 19       | +0.089   |
| 1N5254B-1               | 27                                   | 4.6                   | 41                           | 600                                 | 0.1                         | 20      | 21       | +0.090   |
| 1N5255B-1               | 28                                   | 4.5                   | 44                           | 600                                 | 0.1                         | 20      | 21       | +0.091   |
| 1N5256B-1               | 30                                   | 4.2                   | 49                           | 600                                 | 0.1                         | 22      | 23       | +0.091   |
| 1N5257B-1               | 33                                   | 3.8                   | 58                           | 700                                 | 0.1                         | 24      | 25       | +0.092   |
| 1N5258B-1               | 36                                   | 3.4                   | 70                           | 700                                 | 0.1                         | 26      | 27       | +0.093   |
| 1N5259B-1               | 39                                   | 3.2                   | 80                           | 800                                 | 0.1                         | 29      | 30       | +0.094   |
| 1N5260B-1               | 43                                   | 3.0                   | 93                           | 900                                 | 0.1                         | 31      | 33       | +0.095   |
| 1N5261B-1               | 47                                   | 2.7                   | 105                          | 1000                                | 0.1                         | 34      | 36       | +0.095   |
| 1N5262B-1               | 51                                   | 2.5                   | 125                          | 1100                                | 0.1                         | 37      | 39       | +0.096   |
| 1N5263B-1               | 56                                   | 2.2                   | 150                          | 1300                                | 0.1                         | 41      | 43       | +0.096   |
| 1N5264B-1               | 60                                   | 2.1                   | 170                          | 1400                                | 0.1                         | 44      | 46       | +0.097   |
| 1N5265B-1               | 62                                   | 2.0                   | 185                          | 1400                                | 0.1                         | 45      | 47       | +0.097   |
| 1N5266B-1               | 68                                   | 1.8                   | 230                          | 1600                                | 0.1                         | 49      | 52       | +0.097   |
| 1N5267B-1               | 75                                   | 1.7                   | 270                          | 1700                                | 0.1                         | 53      | 56       | +0.098   |
| 1N5268B-1               | 82                                   | 1.5                   | 330                          | 2000                                | 0.1                         | 59      | 62       | +0.098   |
| 1N5269B-1               | 87                                   | 1.4                   | 370                          | 2200                                | 0.1                         | 65      | 68       | +0.099   |
| 1N5270B-1               | 91                                   | 1.4                   | 400                          | 2300                                | 0.1                         | 66      | 69       | +0.099   |
| 1N5271B-1               | 100                                  | 1.3                   | 500                          | 2600                                | 0.1                         | 72      | 76       | +0.110   |
| 1N5272B-1               | 110                                  | 1.1                   | 750                          | 3000                                | 0.1                         | 80      | 84       | +0.110   |
| 1N5273B-1               | 120                                  | 1.0                   | 900                          | 4000                                | 0.1                         | 86      | 91       | +0.110   |
| 1N5274B-1               | 130                                  | 0.95                  | 1100                         | 4500                                | 0.1                         | 94      | 99       | +0.110   |
| 1N5275B-1               | 140                                  | 0.90                  | 1300                         | 4500                                | 0.1                         | 101     | 106      | +0.110   |
| 1N5276B-1               | 150                                  | 0.85                  | 1500                         | 5000                                | 0.1                         | 108     | 114      | +0.110   |
| 1N5277B-1               | 160                                  | 0.80                  | 1700                         | 5500                                | 0.1                         | 116     | 122      | +0.110   |
| 1N5278B-1               | 170                                  | 0.74                  | 1900                         | 5500                                | 0.1                         | 123     | 129      | +0.110   |
| 1N5279B-1               | 180                                  | 0.68                  | 2200                         | 6000                                | 0.1                         | 130     | 137      | +0.110   |
| 1N5280B-1               | 190                                  | 0.66                  | 2400                         | 6500                                | 0.1                         | 137     | 144      | +0.110   |
| 1N5281B-1               | 200                                  | 0.65                  | 2500                         | 7000                                | 0.1                         | 144     | 152      | +0.110   |

\*JEDEC registered data. JEDEC type numbers listed indicate a tolerance of +/- 5%. Devices with guaranteed limits on all six parameters are indicated by suffix A for +/- 10% tolerance and suffix B for +/- 5% tolerance. Also available with suffix C or D which indicates 2% and 1% tolerance respectively.

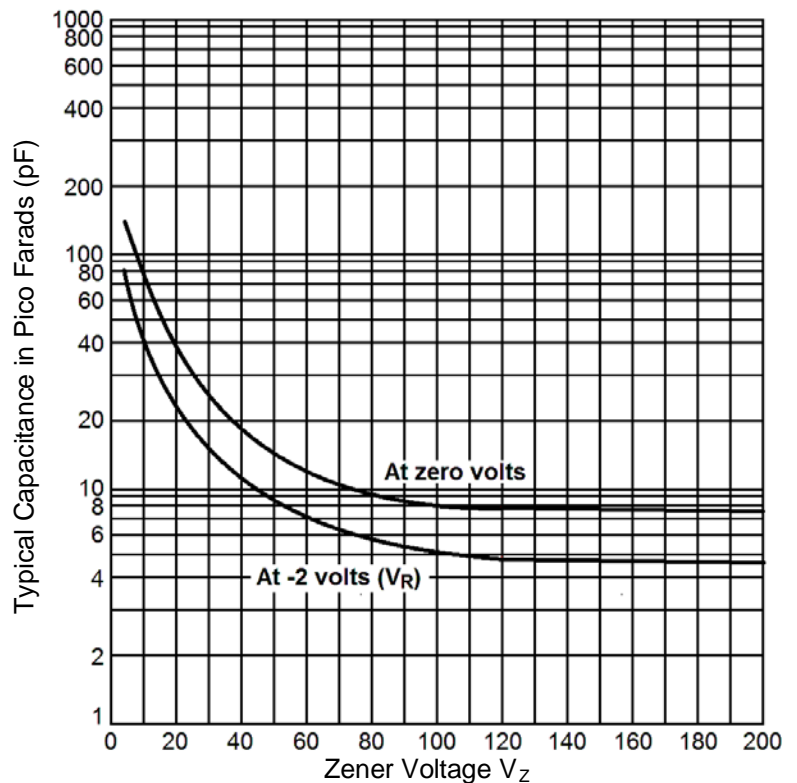
**NOTES:**

1. The electrical characteristics are measured after allowing the device to stabilize for 20 seconds when mounted with a 3/8" (10 mm) minimum lead length from the case.
2. The Zener impedance is derived from the 60 Hz ac voltage that results when an ac current having an rms value equal to 10% of the dc Zener current ( $I_{ZT}$  or  $I_{ZK}$ ) is superimposed on  $I_{ZT}$  or  $I_{ZK}$ . Zener impedance is measured at two points to ensure a sharp knee on the breakdown curve, thereby eliminating unstable units. Also see "[MicroNote 202](#)" for variation in dynamic impedance with different operating currents.
3. Temperature coefficient ( $\alpha_{VZ}$ ). Test conditions for temperature coefficient are as follows:
  - a.  $I_{ZT} = 20 \text{ mA}$ ,  $T_1 = 25 \text{ }^\circ\text{C}$ ,  $T_2 = 125 \text{ }^\circ\text{C}$  (1N5221A, B thru 1N5242A, B).
  - b.  $I_{ZT} = \text{Rated } I_{ZT}$ ,  $T_1 = 25 \text{ }^\circ\text{C}$ ,  $T_2 = 125 \text{ }^\circ\text{C}$  (1N5243A, B thru 1N5281A, B).

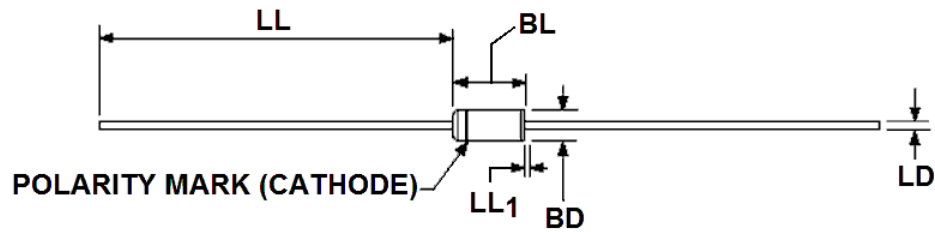
(Device to be temperature stabilized with current applied prior to reading breakdown voltage at the specified ambient temp.)

**GRAPHS**


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



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

**PACKAGE DIMENSIONS**


| Ltr             | Dimensions |       |             |       | 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.