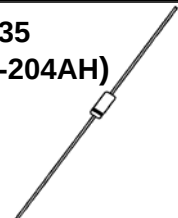


**DESCRIPTION**

The popular 1N5221 thru 1N5281B 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 military screening levels by adding a prefix identifier as described in the Features section. Microsemi also offers numerous other Zener products to meet higher and lower power applications.

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

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

**FEATURES**

- JEDEC registered 1N5221 to 1N5281B
- Internal bonds optionally available with "-1" suffix
- Options for screening in accordance with MIL-PRF-19500 for JAN, JANTX, JANTXV, and JANS are available by adding MQ, MX, MV, or MSP prefixes respectively to part numbers with "-1" suffix.
- Surface mount equivalents available as MLL5221 to MLL5281B in the DO-213AA MELF style package including "-1" suffix options (consult factory for others)
- RoHS Compliant devices available by adding "e3" suffix
- DO-7 glass body axial-leaded Zener equivalents are also available

**APPLICATIONS / BENEFITS**

- Regulates voltage over a broad operating current and temperature range
- Extensive selection from 2.4 to 200 V
- Standard voltage tolerances are plus/minus 5% with B suffix, 10 % with A suffix identification
- Tight tolerances available in plus or minus 2% or 1% with C or D suffix respectively
- Flexible axial-lead mounting terminals
- Nonsensitive to ESD (MIL-STD-750 Method 1020)
- Minimal capacitance (see Figure 2)
- Inherently radiation hard per MicroNote 050

**MAXIMUM RATINGS**

- Power dissipation at 25°C: 0.5 watts (also see derating in Figure 1).
- Operating and Storage temperature: -65°C to +175°C
- Thermal Resistance: 250 °C/W junction to lead at 3/8 (10 mm) lead length from body, or 310 °C/W 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
- Steady-State Power: 0.5 watts at  $T_L \leq 50^\circ\text{C}$  3/8 inch (10 mm) from body or 0.48 W at  $T_A \leq 25^\circ\text{C}$  when mounted on FR4 PC board as described for thermal resistance above (also see Figure1)
- Forward voltage @200 mA: 1.5 volts (maximum)
- Solder Temperatures: 260 °C for 10 s (max)

**MECHANICAL AND PACKAGING**

- CASE: Hermetically sealed axial-lead glass DO-35 (DO-204AH) package
  - FINISH: Tin-Lead or RoHS Compliant annealed matte-Tin 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)
  - WEIGHT: 0.2 grams
- See package dimensions on last page

**ELECTRICAL CHARACTERISTICS @ 25°C**

| JEDEC<br>Type No.<br>Note 1 | Nominal<br>Zener<br>Voltage<br>V <sub>Z</sub> @ I <sub>ZT</sub><br>Volts | Test<br>Current<br>I <sub>ZT</sub><br>mA | Max Zener Impedance<br>A & B Suffix Only<br>Note 2 |                                                        | Max Reverse Current     |      |                         | Max Zener<br>Voltage Temp.<br>Coeff.<br>(A & B Suffix<br>Only)<br><br>α <sub>VZ</sub> (% / °C)<br>Note 3 |                                                            |
|-----------------------------|--------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------|--------------------------------------------------------|-------------------------|------|-------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|                             |                                                                          |                                          |                                                    |                                                        | A, B, C & D Suffix Only |      | Non-Suffix              |                                                                                                          |                                                            |
|                             |                                                                          |                                          | Z <sub>ZT</sub> @ I <sub>ZK</sub><br>Ohms          | Z <sub>ZK</sub> @ I <sub>ZK</sub> = 0.25<br>mA<br>Ohms | I <sub>R</sub><br>μA    | @    | V <sub>R</sub><br>Volts |                                                                                                          | I <sub>R</sub> @ V <sub>R</sub> Used<br>For Suffix A<br>μA |
|                             |                                                                          |                                          |                                                    |                                                        |                         | A    | B,C & D                 |                                                                                                          |                                                            |
| 1N5221                      | 2.4                                                                      | 20                                       | 30                                                 | 1200                                                   | 100                     | 0.95 | 1.0                     | 200                                                                                                      | -0.085                                                     |
| 1N5222                      | 2.5                                                                      | 20                                       | 30                                                 | 1250                                                   | 100                     | 0.95 | 1.0                     | 200                                                                                                      | -0.085                                                     |
| 1N5223                      | 2.7                                                                      | 20                                       | 30                                                 | 1300                                                   | 75                      | 0.95 | 1.0                     | 150                                                                                                      | -0.080                                                     |
| 1N5224                      | 2.8                                                                      | 20                                       | 30                                                 | 1400                                                   | 75                      | 0.95 | 1.0                     | 150                                                                                                      | -0.080                                                     |
| 1N5225                      | 3.0                                                                      | 20                                       | 29                                                 | 1600                                                   | 50                      | 0.95 | 1.0                     | 100                                                                                                      | -0.075                                                     |
| 1N5226                      | 3.3                                                                      | 20                                       | 28                                                 | 1600                                                   | 25                      | 0.95 | 1.0                     | 100                                                                                                      | -0.070                                                     |
| 1N5227                      | 3.6                                                                      | 20                                       | 24                                                 | 1700                                                   | 15                      | 0.95 | 1.0                     | 100                                                                                                      | -0.065                                                     |
| 1N5228                      | 3.9                                                                      | 20                                       | 23                                                 | 1900                                                   | 10                      | 0.95 | 1.0                     | 75                                                                                                       | -0.060                                                     |
| 1N5229                      | 4.3                                                                      | 20                                       | 22                                                 | 2000                                                   | 5.0                     | 0.95 | 1.0                     | 50                                                                                                       | +/-0.055                                                   |
| 1N5230                      | 4.7                                                                      | 20                                       | 19                                                 | 1900                                                   | 50                      | 1.9  | 2.0                     | 50                                                                                                       | +/-0.030                                                   |

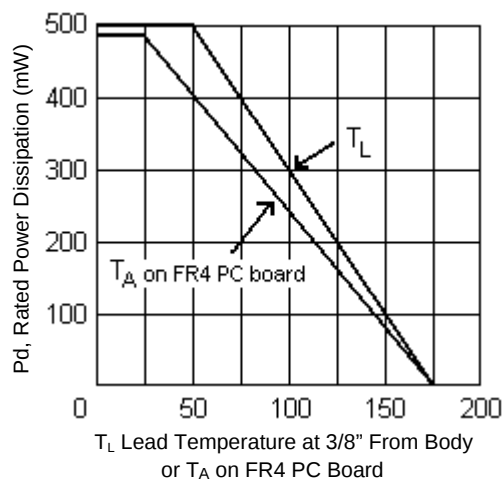
| JEDEC<br>Type No.<br>Note 1 | Nominal<br>Zener<br>Voltage<br>$V_Z$ @ $I_{ZT}$<br>Volts | Test<br>Current<br>$I_{ZT}$<br>mA | Max Zener Impedance<br>A & B Suffix Only<br>Note 2 |                                          | Max Reverse Current     |                     |                                               | Max Zener<br>Voltage Temp.<br>Coeff.<br>(A & B Suffix<br>Only)<br>$\alpha_{VZ}$ (% / °C)<br>Note 3 |
|-----------------------------|----------------------------------------------------------|-----------------------------------|----------------------------------------------------|------------------------------------------|-------------------------|---------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------|
|                             |                                                          |                                   |                                                    |                                          | A, B, C & D Suffix Only |                     | Non-Suffix                                    |                                                                                                    |
|                             |                                                          |                                   | $Z_{ZT}$ @ $I_{ZK}$<br>Ohms                        | $Z_{ZK}$ @ $I_{ZK} = 0.25$<br>mA<br>Ohms | $I_R$<br>$\mu A$        | @<br>$V_R$<br>Volts | $I_R$ @ $V_R$ Used<br>For Suffix A<br>$\mu A$ |                                                                                                    |
|                             |                                                          |                                   |                                                    |                                          |                         | A                   | B, C & D                                      |                                                                                                    |
| 1N5231                      | 5.1                                                      | 20                                | 17                                                 | 1600                                     | 5.0                     | 1.9                 | 2.0                                           | +/-0.030                                                                                           |
| 1N5232                      | 5.6                                                      | 20                                | 11                                                 | 1600                                     | 5.0                     | 2.9                 | 3.0                                           | +0.038                                                                                             |
| 1N5233                      | 6.0                                                      | 20                                | 7.0                                                | 1600                                     | 5.0                     | 3.3                 | 3.5                                           | +0.038                                                                                             |
| 1N5234                      | 6.2                                                      | 20                                | 7.0                                                | 1000                                     | 5.0                     | 3.8                 | 4.0                                           | +0.045                                                                                             |
| 1N5235                      | 6.8                                                      | 20                                | 5.0                                                | 750                                      | 3.0                     | 4.8                 | 5.0                                           | +0.050                                                                                             |
| 1N5236                      | 7.5                                                      | 20                                | 6.0                                                | 500                                      | 3.0                     | 5.7                 | 6.0                                           | +0.058                                                                                             |
| 1N5237                      | 8.2                                                      | 20                                | 8.0                                                | 500                                      | 3.0                     | 6.2                 | 6.5                                           | +0.062                                                                                             |
| 1N5238                      | 8.7                                                      | 20                                | 8.0                                                | 600                                      | 3.0                     | 6.2                 | 6.5                                           | +0.065                                                                                             |
| 1N5239                      | 9.1                                                      | 20                                | 10                                                 | 600                                      | 3.0                     | 6.7                 | 7.0                                           | +0.068                                                                                             |
| 1N5240                      | 10                                                       | 20                                | 17                                                 | 600                                      | 3.0                     | 7.6                 | 8.0                                           | +0.075                                                                                             |
| 1N5241                      | 11                                                       | 20                                | 22                                                 | 600                                      | 2.0                     | 8.0                 | 8.4                                           | +0.076                                                                                             |
| 1N5242                      | 12                                                       | 20                                | 30                                                 | 600                                      | 1.0                     | 8.7                 | 9.1                                           | +0.077                                                                                             |
| 1N5243                      | 13                                                       | 9.5                               | 13                                                 | 600                                      | 0.5                     | 9.4                 | 9.9                                           | +0.079                                                                                             |
| 1N5244                      | 14                                                       | 9.0                               | 15                                                 | 600                                      | 0.1                     | 9.5                 | 10                                            | +0.082                                                                                             |
| 1N5245                      | 15                                                       | 8.5                               | 16                                                 | 600                                      | 0.1                     | 10.5                | 11                                            | +0.082                                                                                             |
| 1N5246                      | 16                                                       | 7.8                               | 17                                                 | 600                                      | 0.1                     | 11.4                | 12                                            | +0.083                                                                                             |
| 1N5247                      | 17                                                       | 7.4                               | 19                                                 | 600                                      | 0.1                     | 12.4                | 13                                            | +0.084                                                                                             |
| 1N5248                      | 18                                                       | 7.0                               | 21                                                 | 600                                      | 0.1                     | 13.3                | 14                                            | +0.085                                                                                             |
| 1N5249                      | 19                                                       | 6.6                               | 23                                                 | 600                                      | 0.1                     | 13.3                | 14                                            | +0.086                                                                                             |
| 1N5250                      | 20                                                       | 6.2                               | 25                                                 | 600                                      | 0.1                     | 14.3                | 15                                            | +0.086                                                                                             |
| 1N5251                      | 22                                                       | 5.6                               | 29                                                 | 600                                      | 0.1                     | 16.2                | 17                                            | +0.087                                                                                             |
| 1N5252                      | 24                                                       | 5.2                               | 33                                                 | 600                                      | 0.1                     | 17.1                | 18                                            | +0.088                                                                                             |
| 1N5253                      | 25                                                       | 5.0                               | 35                                                 | 600                                      | 0.1                     | 18.1                | 19                                            | +0.089                                                                                             |
| 1N5254                      | 27                                                       | 4.6                               | 41                                                 | 600                                      | 0.1                     | 20                  | 21                                            | +0.090                                                                                             |
| 1N5255                      | 28                                                       | 4.5                               | 44                                                 | 600                                      | 0.1                     | 20                  | 21                                            | +0.091                                                                                             |
| 1N5256                      | 30                                                       | 4.2                               | 49                                                 | 600                                      | 0.1                     | 22                  | 23                                            | +0.091                                                                                             |
| 1N5257                      | 33                                                       | 3.8                               | 58                                                 | 700                                      | 0.1                     | 24                  | 25                                            | +0.092                                                                                             |
| 1N5258                      | 36                                                       | 3.4                               | 70                                                 | 700                                      | 0.1                     | 26                  | 27                                            | +0.093                                                                                             |
| 1N5259                      | 39                                                       | 3.2                               | 80                                                 | 800                                      | 0.1                     | 29                  | 30                                            | +0.094                                                                                             |
| 1N5260                      | 43                                                       | 3.0                               | 93                                                 | 900                                      | 0.1                     | 31                  | 33                                            | +0.095                                                                                             |
| 1N5261                      | 47                                                       | 2.7                               | 105                                                | 1000                                     | 0.1                     | 34                  | 36                                            | +0.095                                                                                             |
| 1N5262                      | 51                                                       | 2.5                               | 125                                                | 1100                                     | 0.1                     | 37                  | 39                                            | +0.096                                                                                             |
| 1N5263                      | 56                                                       | 2.2                               | 150                                                | 1300                                     | 0.1                     | 41                  | 43                                            | +0.096                                                                                             |
| 1N5264                      | 60                                                       | 2.1                               | 170                                                | 1400                                     | 0.1                     | 44                  | 46                                            | +0.097                                                                                             |
| 1N5265                      | 62                                                       | 2.0                               | 185                                                | 1400                                     | 0.1                     | 45                  | 47                                            | +0.097                                                                                             |
| 1N5266                      | 68                                                       | 1.8                               | 230                                                | 1600                                     | 0.1                     | 49                  | 52                                            | +0.097                                                                                             |
| 1N5267                      | 75                                                       | 1.7                               | 270                                                | 1700                                     | 0.1                     | 53                  | 56                                            | +0.098                                                                                             |
| 1N5268                      | 82                                                       | 1.5                               | 330                                                | 2000                                     | 0.1                     | 59                  | 62                                            | +0.098                                                                                             |
| 1N5269                      | 87                                                       | 1.4                               | 370                                                | 2200                                     | 0.1                     | 65                  | 68                                            | +0.099                                                                                             |
| 1N5270                      | 91                                                       | 1.4                               | 400                                                | 2300                                     | 0.1                     | 66                  | 69                                            | +0.099                                                                                             |
| 1N5271                      | 100                                                      | 1.3                               | 500                                                | 2600                                     | 0.1                     | 72                  | 76                                            | +0.110                                                                                             |
| 1N5272                      | 110                                                      | 1.1                               | 750                                                | 3000                                     | 0.1                     | 80                  | 84                                            | +0.110                                                                                             |
| 1N5273                      | 120                                                      | 1.0                               | 900                                                | 4000                                     | 0.1                     | 86                  | 91                                            | +0.110                                                                                             |
| 1N5274                      | 130                                                      | 0.95                              | 1100                                               | 4500                                     | 0.1                     | 94                  | 99                                            | +0.110                                                                                             |
| 1N5275                      | 140                                                      | 0.90                              | 1300                                               | 4500                                     | 0.1                     | 101                 | 106                                           | +0.110                                                                                             |
| 1N5276                      | 150                                                      | 0.85                              | 1500                                               | 5000                                     | 0.1                     | 108                 | 114                                           | +0.110                                                                                             |
| 1N5277                      | 160                                                      | 0.80                              | 1700                                               | 5500                                     | 0.1                     | 116                 | 122                                           | +0.110                                                                                             |
| 1N5278                      | 170                                                      | 0.74                              | 1900                                               | 5500                                     | 0.1                     | 123                 | 129                                           | +0.110                                                                                             |
| 1N5279                      | 180                                                      | 0.68                              | 2200                                               | 6000                                     | 0.1                     | 130                 | 137                                           | +0.110                                                                                             |
| 1N5280                      | 190                                                      | 0.66                              | 2400                                               | 6500                                     | 0.1                     | 137                 | 144                                           | +0.110                                                                                             |
| 1N5281                      | 200                                                      | 0.65                              | 2500                                               | 7000                                     | 0.1                     | 144                 | 152                                           | +0.110                                                                                             |

\*JEDEC registered data. JEDEC type numbers listed indicate a tolerance of +/-20% with guaranteed limits on only  $V_Z$ ,  $I_R$ , and  $V_F$ . 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.

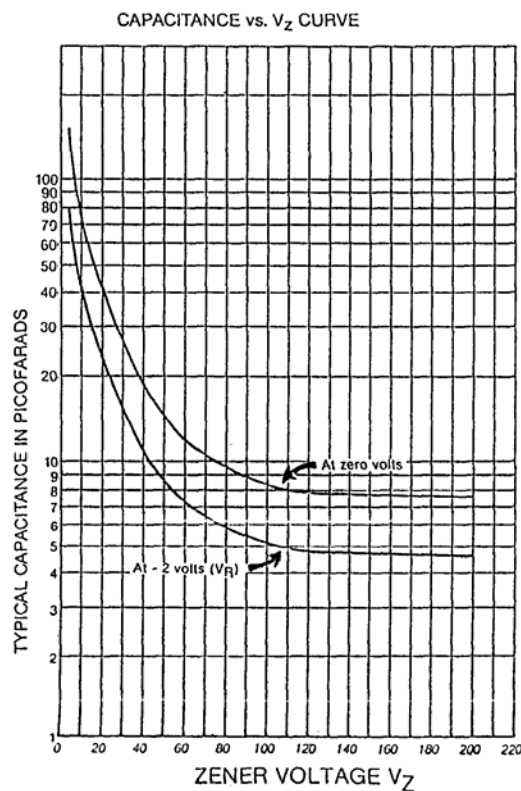
**NOTES:**

- 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.
- 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.
- Temperature coefficient ( $\alpha_{VZ}$ ). Test conditions for temperature coefficient are as follows:
  - $I_{ZT} = 7.5$  mA,  $T_1 = 25^\circ\text{C}$ ,  $T_2 = 125^\circ\text{C}$  (1N5221A, B thru 1N5242A, B).
  - $I_{ZT} = \text{Rated } I_{ZT}$ ,  $T_1 = 25^\circ\text{C}$ ,  $T_2 = 125^\circ\text{C}$  (1N5243A, B thru 1N5281A, B).
 (Device to be temperature stabilized with current applied prior to reading breakdown voltage at the specified ambient temp.)

## GRAPHS

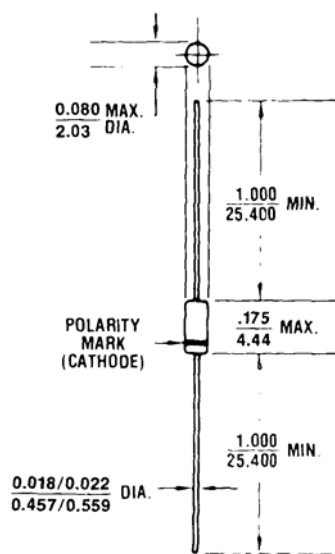


**FIGURE 1**  
POWER DERATING CURVE



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

## PACKAGE DIMENSIONS



All dimensions in INCH  
mm