# 1N5221 thru 1N5281B, e3 DO-35

Microsemi
SCOTTSDALE DIVISION

500 mW GLASS AXIAL-LEAD ZENER DIODES

ALSO AVAILABLE IN SURFACE MOUNT

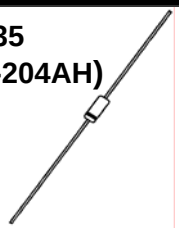
## DESCRIPTION

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

DatasheetCloud

## 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 $mm^2$ copper pads and track width 1 mm, length 25 mm
- Steady-State Power: 0.5 watts at $T_L \leq 50°C$ 3/8 inch (10 mm) from body or 0.48 W at $T_A \leq 25°C$ 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 Type No. Note 1 | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts | Test Current $I_{ZT}$ mA | Max Zener Impedance A & B Suffix Only Note 2 | | Max Reverse Current | | | | Max Zener Voltage Temp. Coeff. (A & B Suffix Only) $\alpha_{VZ}$ (% / °C) Note 3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | A, B, C & D Suffix Only | | | Non-Suffix | |
| | | | $Z_{ZT}$ @ $I_{ZK}$ Ohms | $Z_{ZK}$ @ $I_{ZK}$ = 0.25 mA Ohms | $I_R$ µA | @ $V_R$ Volts A | @ $V_R$ Volts B,C & D | $I_R$ @ $V_R$ Used For Suffix A µA | |
| 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 |



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| JEDEC Type No. Note 1 | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts | Test Current $I_{ZT}$ mA | Max Zener Impedance A & B Suffix Only Note 2 | | Max Reverse Current | | | | Max Zener Voltage Temp. Coeff. (A & B Suffix Only) $\alpha_{VZ}$ (% / °C) Note 3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | A, B, C & D Suffix Only | | | Non-Suffix | |
| | | | $Z_{ZT}$ @ $I_{ZK}$ Ohms | $Z_{ZK}$ @ $I_{ZK}$ = 0.25 mA Ohms | $I_R$ µA | @ $V_R$ Volts A | @ $V_R$ Volts B,C & D | $I_R$ @ $V_R$ Used For Suffix A µA | |
| 1N5231 | 5.1 | 20 | 17 | 1600 | 5.0 | 1.9 | 2.0 | 50 | +/-0.030 |
| 1N5232 | 5.6 | 20 | 11 | 1600 | 5.0 | 2.9 | 3.0 | 50 | +0.038 |
| 1N5233 | 6.0 | 20 | 7.0 | 1600 | 5.0 | 3.3 | 3.5 | 50 | +0.038 |
| 1N5234 | 6.2 | 20 | 7.0 | 1000 | 5.0 | 3.8 | 4.0 | 50 | +0.045 |
| 1N5235 | 6.8 | 20 | 5.0 | 750 | 3.0 | 4.8 | 5.0 | 30 | +0.050 |
| 1N5236 | 7.5 | 20 | 6.0 | 500 | 3.0 | 5.7 | 6.0 | 30 | +0.058 |
| 1N5237 | 8.2 | 20 | 8.0 | 500 | 3.0 | 6.2 | 6.5 | 30 | +0.062 |
| 1N5238 | 8.7 | 20 | 8.0 | 600 | 3.0 | 6.2 | 6.5 | 30 | +0.065 |
| 1N5239 | 9.1 | 20 | 10 | 600 | 3.0 | 6.7 | 7.0 | 30 | +0.068 |
| 1N5240 | 10 | 20 | 17 | 600 | 3.0 | 7.6 | 8.0 | 30 | +0.075 |
| 1N5241 | 11 | 20 | 22 | 600 | 2.0 | 8.0 | 8.4 | 30 | +0.076 |
| 1N5242 | 12 | 20 | 30 | 600 | 1.0 | 8.7 | 9.1 | 10 | +0.077 |
| 1N5243 | 13 | 9.5 | 13 | 600 | 0.5 | 9.4 | 9.9 | 10 | +0.079 |
| 1N5244 | 14 | 9.0 | 15 | 600 | 0.1 | 9.5 | 10 | 10 | +0.082 |
| 1N5245 | 15 | 8.5 | 16 | 600 | 0.1 | 10.5 | 11 | 10 | +0.082 |
| 1N5246 | 16 | 7.8 | 17 | 600 | 0.1 | 11.4 | 12 | 10 | +0.083 |
| 1N5247 | 17 | 7.4 | 19 | 600 | 0.1 | 12.4 | 13 | 10 | +0.084 |
| 1N5248 | 18 | 7.0 | 21 | 600 | 0.1 | 13.3 | 14 | 10 | +0.085 |
| 1N5249 | 19 | 6.6 | 23 | 600 | 0.1 | 13.3 | 14 | 10 | +0.086 |
| 1N5250 | 20 | 6.2 | 25 | 600 | 0.1 | 14.3 | 15 | 10 | +0.086 |
| 1N5251 | 22 | 5.6 | 29 | 600 | 0.1 | 16.2 | 17 | 10 | +0.087 |
| 1N5252 | 24 | 5.2 | 33 | 600 | 0.1 | 17.1 | 18 | 10 | +0.088 |
| 1N5253 | 25 | 5.0 | 35 | 600 | 0.1 | 18.1 | 19 | 10 | +0.089 |
| 1N5254 | 27 | 4.6 | 41 | 600 | 0.1 | 20 | 21 | 10 | +0.090 |
| 1N5255 | 28 | 4.5 | 44 | 600 | 0.1 | 20 | 21 | 10 | +0.091 |
| 1N5256 | 30 | 4.2 | 49 | 600 | 0.1 | 22 | 23 | 10 | +0.091 |
| 1N5257 | 33 | 3.8 | 58 | 700 | 0.1 | 24 | 25 | 10 | +0.092 |
| 1N5258 | 36 | 3.4 | 70 | 700 | 0.1 | 26 | 27 | 10 | +0.093 |
| 1N5259 | 39 | 3.2 | 80 | 800 | 0.1 | 29 | 30 | 10 | +0.094 |
| 1N5260 | 43 | 3.0 | 93 | 900 | 0.1 | 31 | 33 | 10 | +0.095 |
| 1N5261 | 47 | 2.7 | 105 | 1000 | 0.1 | 34 | 36 | 10 | +0.095 |
| 1N5262 | 51 | 2.5 | 125 | 1100 | 0.1 | 37 | 39 | 10 | +0.096 |
| 1N5263 | 56 | 2.2 | 150 | 1300 | 0.1 | 41 | 43 | 10 | +0.096 |
| 1N5264 | 60 | 2.1 | 170 | 1400 | 0.1 | 44 | 46 | 10 | +0.097 |
| 1N5265 | 62 | 2.0 | 185 | 1400 | 0.1 | 45 | 47 | 10 | +0.097 |
| 1N5266 | 68 | 1.8 | 230 | 1600 | 0.1 | 49 | 52 | 10 | +0.097 |
| 1N5267 | 75 | 1.7 | 270 | 1700 | 0.1 | 53 | 56 | 10 | +0.098 |
| 1N5268 | 82 | 1.5 | 330 | 2000 | 0.1 | 59 | 62 | 10 | +0.098 |
| 1N5269 | 87 | 1.4 | 370 | 2200 | 0.1 | 65 | 68 | 10 | +0.099 |
| 1N5270 | 91 | 1.4 | 400 | 2300 | 0.1 | 66 | 69 | 10 | +0.099 |
| 1N5271 | 100 | 1.3 | 500 | 2600 | 0.1 | 72 | 76 | 10 | +0.110 |
| 1N5272 | 110 | 1.1 | 750 | 3000 | 0.1 | 80 | 84 | 10 | +0.110 |
| 1N5273 | 120 | 1.0 | 900 | 4000 | 0.1 | 86 | 91 | 10 | +0.110 |
| 1N5274 | 130 | 0.95 | 1100 | 4500 | 0.1 | 94 | 99 | 10 | +0.110 |
| 1N5275 | 140 | 0.90 | 1300 | 4500 | 0.1 | 101 | 106 | 10 | +0.110 |
| 1N5276 | 150 | 0.85 | 1500 | 5000 | 0.1 | 108 | 114 | 10 | +0.110 |
| 1N5277 | 160 | 0.80 | 1700 | 5500 | 0.1 | 116 | 122 | 10 | +0.110 |
| 1N5278 | 170 | 0.74 | 1900 | 5500 | 0.1 | 123 | 129 | 10 | +0.110 |
| 1N5279 | 180 | 0.68 | 2200 | 6000 | 0.1 | 130 | 137 | 10 | +0.110 |
| 1N5280 | 190 | 0.66 | 2400 | 6500 | 0.1 | 137 | 144 | 10 | +0.110 |
| 1N5281 | 200 | 0.65 | 2500 | 7000 | 0.1 | 144 | 152 | 10 | +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:**

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. $I_{ZT}$ = 7.5 mA, $T_1$ = 25°C, $T_2$ = 125°C (1N5221A, B thru 1N5242A, B).
   b. $I_{ZT}$ = Rated $I_{ZT}$, $T_1$ = 25°C, $T_2$ = 125°C (1N5243A, B thru 1N5281A, B).

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

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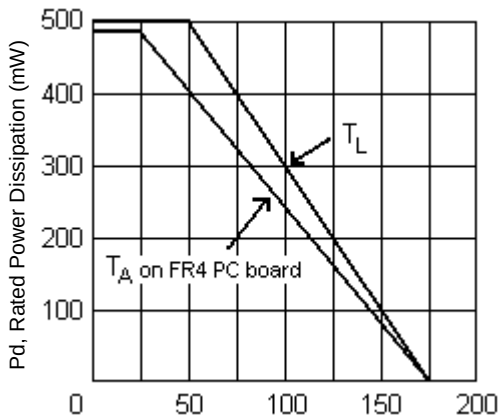
## GRAPHS




$T_L$ Lead Temperature at 3/8" From Body
or $T_A$ on FR4 PC Board

**FIGURE 1**
POWER DERATING CURVE

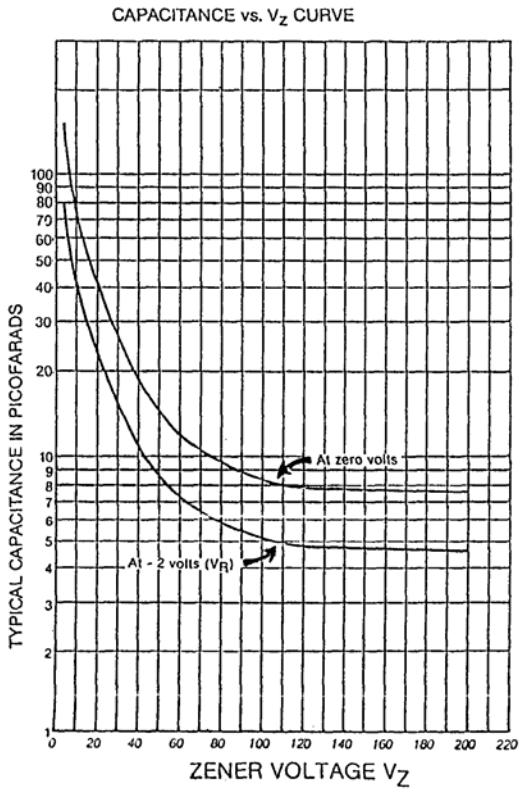
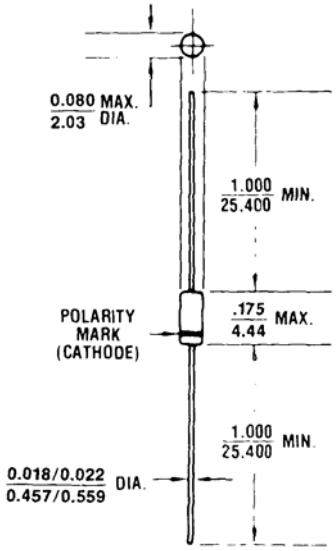



**FIGURE 2**
CAPACITANCE vs. ZENER VOLTAGE
(TYPICAL)

## PACKAGE DIMENSIONS




All dimensions in INCH
mm

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