

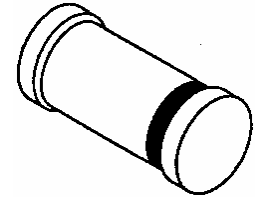
**500 mW GLASS SURFACE MOUNT  
ZENER DIODES**

**DESCRIPTION**

The 1N5221BUR thru 1N5281BUR series of 0.5 watt Zener Voltage Regulators provides a surface mount equivalent to the popular JEDEC registered 1N5221B to 1N5281B for 2.4 to 200 volts in standard 5% tolerances as well as tighter tolerances identified by different suffix letters on the part number. These are also available with an internal-metallurgical-bond option by adding a "-1" suffix (see separate data sheet). 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-213AA**

**FEATURES**

- Surface mount equivalents to the JEDEC registered 1N5221 thru 1N5281B series
- Hermetically sealed surface mount package
- RoHS Compliant devices available by adding "e3" suffix
- Internal metallurgical bond option available by adding a "-1" suffix (see separate data sheet for same part numbers with "-1" suffix)
- DO-7 or DO-35 glass body axial-leaded Zener equivalents also available per JEDEC registration (see separate data sheet for part numbers 1N5221 thru 1N5281B series)

**MAXIMUM RATINGS**

- Operating and Storage temperature: -65°C to +175°C
- Thermal Resistance: 150°C/W junction to end cap and 300°C/W junction to ambient when mounted on FR4 PC board (1 oz Cu) with recommended footprint (see last page)
- Steady-State Power: 0.5 watts at end cap temperature  $T_{EC} \leq 100^{\circ}\text{C}$  or ambient temperature  $T_A \leq 25^{\circ}\text{C}$  when mounted on FR4 PC board as described for thermal resistance above (see Figure 2 for derating)
- Forward voltage @200 mA: 1.1 volts (maximum)
- Solder Temperatures: 260°C for 10 seconds (max)

**APPLICATIONS / BENEFITS**

- Regulates voltage over a broad operating current and temperature range
- Selection from 2.4 to 200 V
- Standard voltage tolerances are plus/minus 5% with B suffix identification and 10% with A suffix
- Tight tolerances available in plus or minus 2% or 1% with C or D suffix respectively
- Nonsensitive to ESD per MIL-STD-750 Method 1020
- Minimal capacitance (see Figure 3)
- Inherently radiation hard as described in Microsemi MicroNote 050

**MECHANICAL AND PACKAGING**

- CASE: Hermetically sealed glass DO-213AA (SOD80 or MLL34) MELF style package
- FINISH: End caps Tin-Lead or RoHS Compliant annealed matte-Tin plating solderable per MIL-STD-750, method 2026
- POLARITY: Cathode indicated by band where diode is to be operated with the banded end positive with respect to the opposite end for Zener regulation
- MARKING: cathode band only
- TAPE & REEL option: Standard per EIA-481-B with 12 mm tape, 2000 per 7 inch reel or 5000 per 13 inch reel (add "TR" suffix to part number)
- WEIGHT: 0.04 grams
- See package dimensions on last page

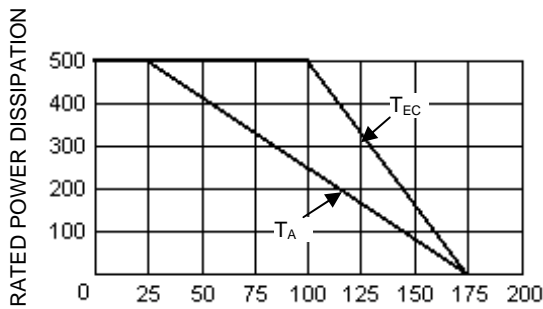
**ELECTRICAL CHARACTERISTICS\***

| INDUSTRY PART NUMBER (NOTES 1 & 4) | Nominal Zener Voltage $V_Z @ I_{ZT}$ (Note 2) | Test Current $I_{ZT}$ | Max Zener Impedance<br>A and B suffix only |                                 | Max Reverse Leakage Current |               |                                       | Max Zener Voltage Temperature Coeff. (A and B Suffix only) (Note 3) |                      |
|------------------------------------|---|-----------------------|--|---------------------------------|-----------------------------|---------------|---------------------------------------|---|----------------------|
|                                    |   |                       |  |                                 | A and B Suffix only         |               | Non-Suffix                            |   |                      |
|                                    |   |                       |  |                                 | $I_R$ $\mu A$               | @ $V_R$ Volts | $I_R @ V_R$ Used for Suffix A $\mu A$ |   | $\alpha_{VZ}$ (%/°C) |
|                                    | Volts   | mA                    | $Z_{ZT} @ I_{ZT}$ Ohms                     | $Z_{ZK} @ I_{ZK} = 0.25Ma$ Ohms | A                           | B             |                                       |   |                      |
| 1N5221UR                           | 2.4   | 20                    | 30   | 1200                            | 100                         | 0.95          | 1.0                                   | 200   | -0.085               |
| 1N5222UR                           | 2.5   | 20                    | 30   | 1250                            | 100                         | 0.95          | 1.0                                   | 200   | -0.085               |
| 1N5223UR                           | 2.7   | 20                    | 30   | 1300                            | 75                          | 0.95          | 1.0                                   | 150   | -0.080               |
| 1N5224UR                           | 2.8   | 20                    | 30   | 1400                            | 75                          | 0.95          | 1.0                                   | 150   | -0.080               |
| 1N5225UR                           | 3.0   | 20                    | 29   | 1600                            | 50                          | 0.95          | 1.0                                   | 100   | -0.075               |
| 1N5226UR                           | 3.3   | 20                    | 28   | 1600                            | 25                          | 0.95          | 1.0                                   | 100   | -0.070               |
| 1N5227UR                           | 3.6   | 20                    | 24   | 1700                            | 15                          | 0.95          | 1.0                                   | 100   | -0.065               |
| 1N5228UR                           | 3.9   | 20                    | 23   | 1900                            | 10                          | 0.95          | 1.0                                   | 75  | -0.060               |
| 1N5229UR                           | 4.3   | 20                    | 22   | 2000                            | 5.0                         | 0.95          | 1.0                                   | 50  | +/-0.055             |
| 1N5230UR                           | 4.7   | 20                    | 19   | 1900                            | 5.0                         | 1.9           | 2.0                                   | 50  | +/-0.030             |
| 1N5231UR                           | 5.1   | 20                    | 17   | 1600                            | 5.0                         | 1.9           | 2.0                                   | 50  | +/-0.030             |
| 1N5232UR                           | 5.6   | 20                    | 11   | 1600                            | 5.0                         | 2.9           | 3.0                                   | 50  | +0.038               |
| 1N5233UR                           | 6.0   | 20                    | 7.0  | 1600                            | 5.0                         | 3.3           | 3.5                                   | 50  | +0.038               |
| 1N5234UR                           | 6.2   | 20                    | 7.0  | 1000                            | 5.0                         | 3.8           | 4.0                                   | 50  | +0.045               |
| 1N5235UR                           | 6.8   | 20                    | 5.0  | 750                             | 3.0                         | 4.8           | 5.0                                   | 30  | +0.050               |
| 1N5236UR                           | 7.5   | 20                    | 6.0  | 500                             | 3.0                         | 5.7           | 6.0                                   | 30  | +0.058               |
| 1N5237UR                           | 8.2   | 20                    | 8.0  | 500                             | 3.0                         | 6.2           | 6.5                                   | 30  | +0.062               |
| 1N5238UR                           | 8.7   | 20                    | 8.0  | 600                             | 3.0                         | 6.2           | 6.5                                   | 30  | +0.065               |
| 1N5239UR                           | 9.1   | 20                    | 10   | 600                             | 3.0                         | 6.7           | 7.0                                   | 30  | +0.068               |
| 1N5240UR                           | 10  | 20                    | 17   | 600                             | 3.0                         | 7.6           | 8.0                                   | 30  | +0.075               |
| 1N5241UR                           | 11  | 20                    | 22   | 600                             | 2.0                         | 8.0           | 8.4                                   | 30  | +0.076               |
| 1N5242UR                           | 12  | 20                    | 30   | 600                             | 1.0                         | 8.7           | 9.1                                   | 10  | +0.077               |
| 1N5243UR                           | 13  | 9.5                   | 13   | 600                             | 0.5                         | 9.4           | 9.9                                   | 10  | +0.079               |
| 1N5244UR                           | 14  | 9.0                   | 15   | 600                             | 0.1                         | 9.5           | 10                                    | 10  | +0.082               |
| 1N5245UR                           | 15  | 8.5                   | 16   | 600                             | 0.1                         | 10.5          | 11                                    | 10  | +0.082               |
| 1N5246UR                           | 16  | 7.8                   | 17   | 600                             | 0.1                         | 11.4          | 12                                    | 10  | +0.083               |
| 1N5247UR                           | 17  | 7.4                   | 19   | 600                             | 0.1                         | 12.4          | 13                                    | 10  | +0.084               |
| 1N5248UR                           | 18  | 7.0                   | 21   | 600                             | 0.1                         | 13.3          | 14                                    | 10  | +0.085               |
| 1N5249UR                           | 19  | 6.6                   | 23   | 600                             | 0.1                         | 13.3          | 14                                    | 10  | +0.086               |
| 1N5250UR                           | 20  | 6.2                   | 25   | 600                             | 0.1                         | 14.3          | 15                                    | 10  | +0.086               |
| 1N5251UR                           | 22  | 5.6                   | 29   | 600                             | 0.1                         | 16.2          | 17                                    | 10  | +0.087               |
| 1N5252UR                           | 24  | 5.2                   | 33   | 600                             | 0.1                         | 17.1          | 18                                    | 10  | +0.088               |
| 1N5253UR                           | 25  | 5.0                   | 35   | 600                             | 0.1                         | 18.1          | 19                                    | 10  | +0.089               |
| 1N5254UR                           | 27  | 4.6                   | 41   | 600                             | 0.1                         | 20            | 21                                    | 10  | +0.090               |
| 1N5255UR                           | 28  | 4.5                   | 44   | 600                             | 0.1                         | 20            | 21                                    | 10  | +0.091               |
| 1N5256UR                           | 30  | 4.2                   | 49   | 600                             | 0.1                         | 22            | 23                                    | 10  | +0.091               |
| 1N5257UR                           | 33  | 3.8                   | 58   | 700                             | 0.1                         | 24            | 25                                    | 10  | +0.092               |
| 1N5258UR                           | 36  | 3.4                   | 70   | 700                             | 0.1                         | 26            | 27                                    | 10  | +0.093               |
| 1N5259UR                           | 39  | 3.2                   | 80   | 800                             | 0.1                         | 29            | 30                                    | 10  | +0.094               |
| 1N5260UR                           | 43  | 3.0                   | 93   | 900                             | 0.1                         | 31            | 33                                    | 10  | +0.095               |
| 1N5261UR                           | 47  | 2.7                   | 105  | 1000                            | 0.1                         | 34            | 36                                    | 10  | +0.095               |
| 1N5262UR                           | 51  | 2.5                   | 125  | 1100                            | 0.1                         | 37            | 39                                    | 10  | +0.096               |
| 1N5263UR                           | 56  | 2.2                   | 150  | 1300                            | 0.1                         | 41            | 43                                    | 10  | +0.096               |
| 1N5264UR                           | 60  | 2.1                   | 170  | 1400                            | 0.1                         | 44            | 46                                    | 10  | +0.097               |
| 1N5265UR                           | 62  | 2.0                   | 185  | 1400                            | 0.1                         | 45            | 47                                    | 10  | +0.097               |
| 1N5266UR                           | 68  | 1.8                   | 230  | 1600                            | 0.1                         | 49            | 52                                    | 10  | +0.097               |
| 1N5267UR                           | 75  | 1.7                   | 270  | 1700                            | 0.1                         | 53            | 56                                    | 10  | +0.098               |
| 1N5268UR                           | 82  | 1.5                   | 330  | 2000                            | 0.1                         | 59            | 62                                    | 10  | +0.098               |
| 1N5269UR                           | 87  | 1.4                   | 370  | 2200                            | 0.1                         | 65            | 68                                    | 10  | +0.099               |
| 1N5270UR                           | 91  | 1.4                   | 400  | 2300                            | 0.1                         | 66            | 69                                    | 10  | +0.099               |
| 1N5271UR                           | 100   | 1.3                   | 500  | 2600                            | 0.1                         | 72            | 76                                    | 10  | +0.0110              |
| 1N5272UR                           | 110   | 1.1                   | 750  | 3000                            | 0.1                         | 80            | 84                                    | 10  | +0.0110              |
| 1N5273UR                           | 120   | 1.0                   | 900  | 4000                            | 0.1                         | 86            | 91                                    | 10  | +0.0110              |
| 1N5274UR                           | 130   | .95                   | 1100                                       | 4500                            | 0.1                         | 94            | 99                                    | 10  | +0.0110              |
| 1N5275UR                           | 140   | .90                   | 1300                                       | 4500                            | 0.1                         | 101           | 106                                   | 10  | +0.0110              |
| 1N5276UR                           | 150   | .85                   | 1500                                       | 5000                            | 0.1                         | 108           | 114                                   | 10  | +0.0110              |
| 1N5277UR                           | 160   | .80                   | 1700                                       | 5500                            | 0.1                         | 116           | 122                                   | 10  | +0.0110              |
| 1N5278UR                           | 170   | .74                   | 1900                                       | 5500                            | 0.1                         | 123           | 129                                   | 10  | +0.0110              |
| 1N5279UR                           | 180   | .68                   | 2200                                       | 6000                            | 0.1                         | 130           | 137                                   | 10  | +0.0110              |
| 1N5280UR                           | 190   | .66                   | 2400                                       | 6500                            | 0.1                         | 137           | 144                                   | 10  | +0.0110              |
| 1N5281UR                           | 200   | .65                   | 2500                                       | 7000                            | 0.1                         | 144           | 152                                   | 10  | +0.0110              |

\*  $T_A = 25^\circ C$  unless otherwise noted. Based on dc measurements at thermal equilibrium; case temperature maintained at  $30 \pm 2^\circ C$ .  $V_F = 1.1V$  max @  $I_F = 200$  mA for all types. See further Notes on following page.

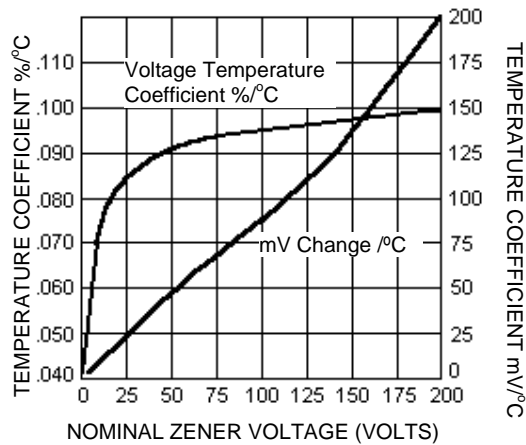
- NOTE 1:** Table as shown lists type numbers, which indicate a tolerance of +/-20% with guaranteed limits on only  $V_Z$ ,  $I_R$ , and  $V_F$ . Devices with guaranteed limits on all six parameters are indicated by suffix "A" for +/-10%, "B" for +/-5%, "C" for +/-2%, and "D" for +/-1% tolerance.
- NOTE 2:** The electrical characteristics are measured after allowing the device to stabilize for 20 seconds.
- NOTE 3:** Temperature coefficient ( $\alpha_{VZ}$ ). Test conditions for temperature coefficient are as follows:
- $I_{ZT} = 7.5 \text{ mA}$ ,  $T_1 = 25^\circ\text{C}$ ,  
 $T_2 = 125^\circ\text{C}$  (1N5221AUR & BUR thru 1N5242AUR & BUR)
  - $I_{ZT} = \text{Rated } I_{ZT}$ ,  $T_1 = 25^\circ\text{C}$ ,  
 $T_2 = 125^\circ\text{C}$  (1N5243AUR & BUR thru 1N5281AUR & BUR)
- Device to be temperature stabilized with current applied prior to reading breakdown voltage at the specified ambient temperature.
- NOTE 4:** These devices may be ordered as either 1N5221UR thru 1N5281BUR or as MLL5221 thru MLL5281B part numbers.

**GRAPHS**

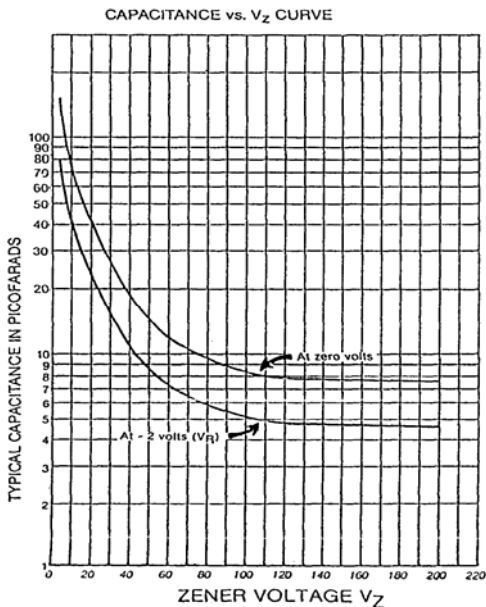


$T_{EC}$  – End Cap Temperature ( $^\circ\text{C}$ ), or  
 $T_A$  Ambient Temperature on FR4 PC BOARD

**FIGURE 1**  
POWER DERATING CURVE

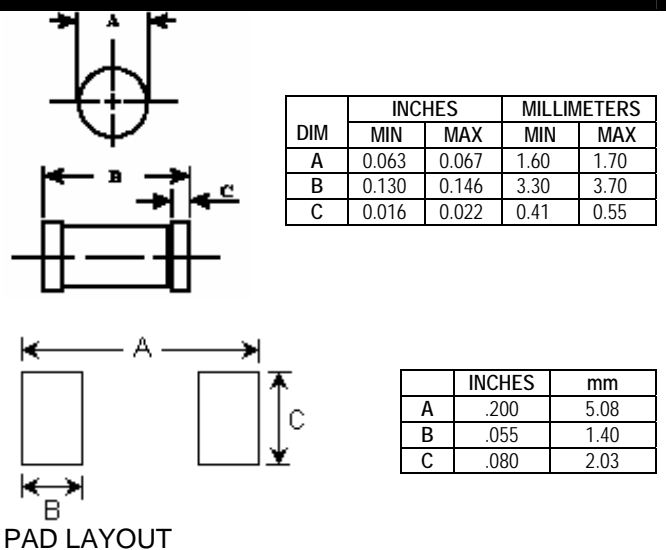


**FIGURE 2**  
ZENER VOLTAGE TEMPERATURE  
COEFFICIENT vs. ZENER VOLTAGE



**FIGURE 3**  
CAPACITANCE vs. ZENER VOLTAGE  
(TYPICAL)

**PACKAGE DIMENSIONS**



**PAD LAYOUT**