

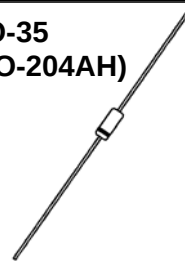
## DESCRIPTION

The popular 1N957B thru 1N992B series of 0.5 watt Zener Voltage Regulators provides a selection from 6.8 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 optionally available with an internal-metallurgical-bond option by adding a "-1" suffix as well as RoHS Compliant by adding an "e3" suffix. 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 1N957B(-1) to 1N992B(-1) series
- Internal metallurgical bond option available by adding a "-1" suffix (similar to military product)
- Surface Mount equivalents available as MLL957B to MLL992B or with "-1" suffix for bonded in the DO-213AA MELF style package (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 6.8 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 per MIL-STD-750 Method 1020
- Minimal capacitance (see Figure 3)
- Inherently radiation hard as described in Microsemi MicroNote 050

## MAXIMUM RATINGS

- 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: 1.1 volts (maximum) for 1N957B – 1N985B and 1.3 V for 1N985 – 1N992B
- Solder Temperatures: 260 °C for 10 s (max)

## MECHANICAL AND PACKAGING

- CASE: Hermetically sealed axial-lead glass DO-35 (DO-204AH) package
- TERMINALS: Tin-Lead (Sn/Pb) 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<br>NUMBER<br>(Note 1) | NOMINAL<br>ZENER<br>VOLTAGE<br>(Note 2) | ZENER<br>TEST<br>CURRENT | MAX. ZENER IMPEDANCE<br>(Note 3) |                   |     | MAX. DC<br>ZENER<br>CURRENT<br>(Note 4) | MAX. SURGE<br>CURRENT<br>(Note 5) | MAX. REVERSE<br>LEAKAGE<br>CURRENT |       | MAX. TEMP.<br>COEFFICIENT |
|-------------------------------------|-----------------------------------------|--------------------------|----------------------------------|-------------------|-----|-----------------------------------------|-----------------------------------|------------------------------------|-------|---------------------------|
|                                     | $V_Z$                                   | $I_{ZT}$                 | $Z_{ZT} @ I_{ZT}$                | $Z_{ZK} @ I_{ZK}$ |     | $I_{ZM}$                                | $I_{ZSM}$                         | $I_R @ V_R$                        |       | $\alpha_{VZ}$             |
|                                     | VOLTS                                   | mA                       | OHMS                             | OHMS              | mA  | mA                                      | mA                                | $\mu A$                            | VOLTS | %/°C                      |
| 1N957B                              | 6.8                                     | 18.5                     | 4.5                              | 700               | 1.0 | 55                                      | 300                               | 150                                | 5.2   | +0.05                     |
| 1N958B                              | 7.5                                     | 16.5                     | 5.5                              | 700               | .5  | 50                                      | 275                               | 75                                 | 5.7   | +0.058                    |
| 1N959B                              | 8.2                                     | 15.0                     | 6.5                              | 700               | .5  | 45                                      | 250                               | 50                                 | 6.2   | +0.065                    |
| 1N960B                              | 9.1                                     | 14.0                     | 7.5                              | 700               | .5  | 41                                      | 225                               | 25                                 | 6.9   | +0.068                    |
| 1N961B                              | 10                                      | 12.5                     | 8.5                              | 700               | .25 | 38                                      | 200                               | 10                                 | 7.6   | +0.075                    |
| 1N962B                              | 11                                      | 11.5                     | 9.5                              | 700               | .25 | 32                                      | 175                               | 5                                  | 8.4   | +0.076                    |
| 1N963B                              | 12                                      | 10.5                     | 11.5                             | 700               | .25 | 31                                      | 160                               | 5                                  | 9.1   | +0.077                    |
| 1N964B                              | 13                                      | 9.5                      | 13.0                             | 700               | .25 | 28                                      | 150                               | 5                                  | 9.9   | +0.079                    |
| 1N965B                              | 15                                      | 8.5                      | 16                               | 700               | .25 | 25                                      | 130                               | 5                                  | 11.4  | +0.082                    |
| 1N966B                              | 16                                      | 7.8                      | 17                               | 700               | .25 | 24                                      | 120                               | 5                                  | 12.2  | +0.083                    |
| 1N967B                              | 18                                      | 7.0                      | 21                               | 750               | .25 | 20                                      | 110                               | 5                                  | 13.7  | +0.085                    |
| 1N968B                              | 20                                      | 6.2                      | 25                               | 750               | .25 | 18                                      | 100                               | 5                                  | 15.2  | +0.086                    |
| 1N969B                              | 22                                      | 5.6                      | 29                               | 750               | .25 | 16                                      | 90                                | 5                                  | 16.7  | +0.087                    |
| 1N970B                              | 24                                      | 5.2                      | 33                               | 750               | .25 | 15                                      | 80                                | 5                                  | 18.2  | +0.088                    |
| 1N971B                              | 27                                      | 4.6                      | 41                               | 750               | .25 | 13                                      | 70                                | 5                                  | 20.6  | +0.090                    |
| 1N972B                              | 30                                      | 4.2                      | 49                               | 1000              | .25 | 12                                      | 65                                | 5                                  | 22.8  | +0.091                    |
| 1N973B                              | 33                                      | 3.8                      | 58                               | 1000              | .25 | 11                                      | 60                                | 5                                  | 25.1  | +0.092                    |
| 1N974B                              | 36                                      | 3.4                      | 70                               | 1000              | .25 | 10                                      | 55                                | 5                                  | 27.4  | +0.093                    |
| 1N975B                              | 39                                      | 3.2                      | 80                               | 1000              | .25 | 9.5                                     | 46                                | 5                                  | 29.7  | +0.094                    |
| 1N976B                              | 43                                      | 3.0                      | 93                               | 1500              | .25 | 8.8                                     | 44                                | 5                                  | 32.7  | +0.095                    |
| 1N977B                              | 47                                      | 2.7                      | 105                              | 1500              | .25 | 7.9                                     | 40                                | 5                                  | 35.8  | +0.095                    |
| 1N978B                              | 51                                      | 2.5                      | 125                              | 1500              | .25 | 7.4                                     | 37                                | 5                                  | 38.8  | +0.096                    |
| 1N979B                              | 56                                      | 2.2                      | 150                              | 2000              | .25 | 6.8                                     | 35                                | 5                                  | 42.6  | +0.096                    |
| 1N980B                              | 62                                      | 2.0                      | 185                              | 2000              | .25 | 6.0                                     | 30                                | 5                                  | 47.1  | +0.097                    |
| 1N981B                              | 68                                      | 1.8                      | 230                              | 2000              | .25 | 5.5                                     | 28                                | 5                                  | 51.7  | +0.097                    |
| 1N982B                              | 75                                      | 1.7                      | 270                              | 2000              | .25 | 5.0                                     | 26                                | 5                                  | 56.0  | +0.098                    |
| 1N983B                              | 82                                      | 1.5                      | 330                              | 3000              | .25 | 4.6                                     | 23                                | 5                                  | 62.2  | +0.098                    |
| 1N984B                              | 91                                      | 1.4                      | 400                              | 3000              | .25 | 4.1                                     | 21                                | 5                                  | 69.2  | +0.099                    |
| 1N985B                              | 100                                     | 1.3                      | 500                              | 3000              | .25 | 3.7                                     | 18                                | 5                                  | 76.0  | +0.11                     |
| 1N986B                              | 110                                     | 1.1                      | 750                              | 4000              | .25 | 3.3                                     | 16                                | 5                                  | 83.6  | +0.11                     |
| 1N987B                              | 120                                     | 1.0                      | 900                              | 4500              | .25 | 3.1                                     | 15                                | 5                                  | 91.2  | +0.11                     |
| 1N988B                              | 130                                     | 0.95                     | 1100                             | 5000              | .25 | 2.7                                     | 13                                | 5                                  | 98.8  | +0.11                     |
| 1N989B                              | 150                                     | 0.85                     | 1500                             | 6000              | .25 | 2.4                                     | 12                                | 5                                  | 114.0 | +0.11                     |
| 1N990B                              | 160                                     | 0.80                     | 1700                             | 6500              | .25 | 2.2                                     | 11                                | 5                                  | 121.6 | +0.11                     |
| 1N991B                              | 180                                     | 0.68                     | 2200                             | 7100              | .25 | 2.0                                     | 10                                | 5                                  | 136.8 | +0.11                     |
| 1N992B                              | 200                                     | 0.65                     | 2500                             | 8000              | .25 | 1.8                                     | 9                                 | 5                                  | 152.0 | +0.11                     |

**\* JEDEC Registered Data**

**NOTE 1:** The JEDEC type numbers shown (B suffix) have a +/-5% tolerance on nominal Zener voltage. The suffix A is used to identify +/-10% tolerance; suffix C is used to identify +/-2%; and suffix D is used to identify +/-1% tolerance; no suffix indicates +/-20% tolerance.

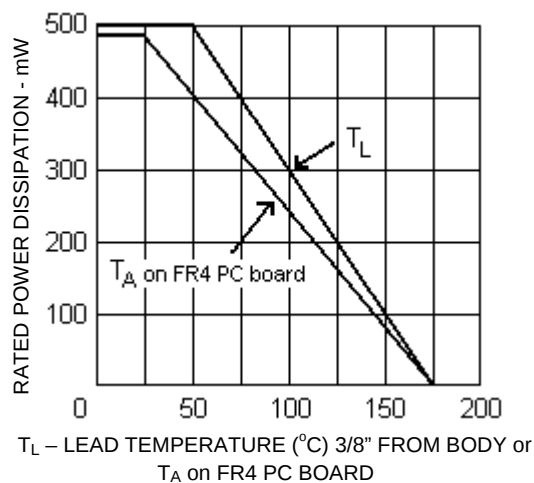
**NOTE 2:** Zener voltage ( $V_Z$ ) is measured after the test current has been applied for 20 +/- 5 seconds. The device shall be suspended by its leads with the inside edge of the mounting clips between .375" and .500" from the body. Mounting clips shall be maintained at a temperature of 25 +/- 2°C.

**NOTE 3:** The zener impedance is derived when a 60 cycle 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 2 points to ensure a sharp knee on the breakdown curve and to eliminate unstable units. See MicroNote 202 for variation in dynamic impedance with different zener currents.

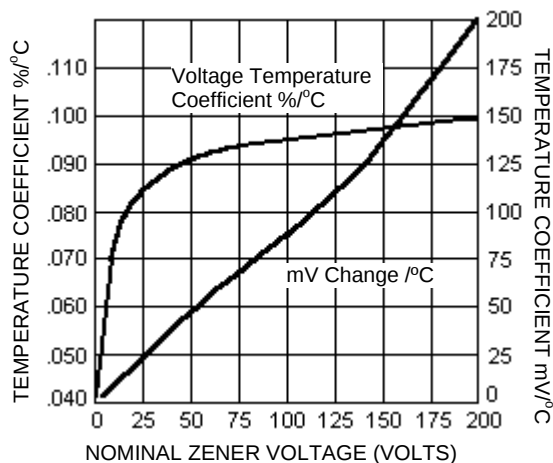
**NOTE 4:** The values of  $I_{ZM}$  are calculated for a +/- 5% tolerance on nominal zener voltage. Allowance has been made for the rise in zener voltage above  $V_{ZT}$  which results from zener impedance and the increase in junction temperature as power dissipation approaches 400 mW. In the case of individual diodes  $I_{ZM}$  is that value of current which results in a dissipation of 400 mW at 75°C lead temperature at 3/8" from body.

**NOTE 5:** The surge for  $I_{ZSM}$  is a square wave or equivalent half-sine wave pulse of 1/120 sec. duration.

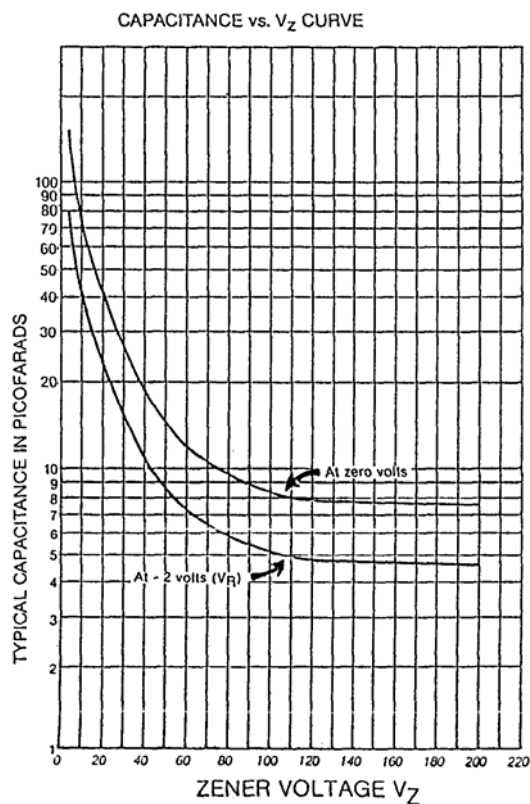
## GRAPHS



**FIGURE 1**  
POWER DERATING CURVE



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



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

## PACKAGE DIMENSIONS

