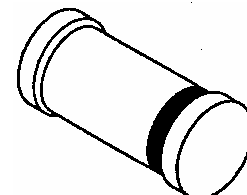


## DESCRIPTION

The 1N4099UR thru 1N4135UR and 1N4614UR thru 1N4627UR series of 0.5 watt glass surface mount DO-213AA Zener voltage regulators provides a selection from 1.8 to 100 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) including JAN, JANTX, and JANTXV military qualifications. Microsemi also offers numerous other Zener products to meet higher and lower power applications.

## APPEARANCE



DO-213AA

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

## FEATURES

- Surface mount equivalent to JEDEC registered 1N4099 thru 1N4135 and 1N4614 thru 1N4627 series
- Internal metallurgical bond option available by adding a "-1" suffix (see separate data sheet for part numbers 1N4099UR-1 thru 1N4135UR-1, and 1N4614UR-1 thru 1N4627UR-1 series)
- DO-7 or DO-35 glass body axial-leaded Zener equivalents also available per JEDEC registration (see separate data sheet for part numbers 1N4099 thru 1N4135 and 1N4614 thru 1N4627 series)
- RoHS Compliant devices available by adding "e3" suffix

## APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range
- Extensive selection from 1.8 to 100 V
- Standard voltage tolerances are plus/minus 5% with no suffix
- Tight tolerances available in plus or minus 2% or 1% with C or D suffix respectively
- Hermetically sealed surface mount package
- 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: 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
- Solder Temperatures: 260°C for 10 s (max)

## MECHANICAL AND PACKAGING

- CASE: Hermetically sealed glass DO-213AA (SOD80 or MLL34) MELF style package
- FINISH: End caps Tin-Lead (Sn/Pb) 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-481-1-A 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 @ 25°C**

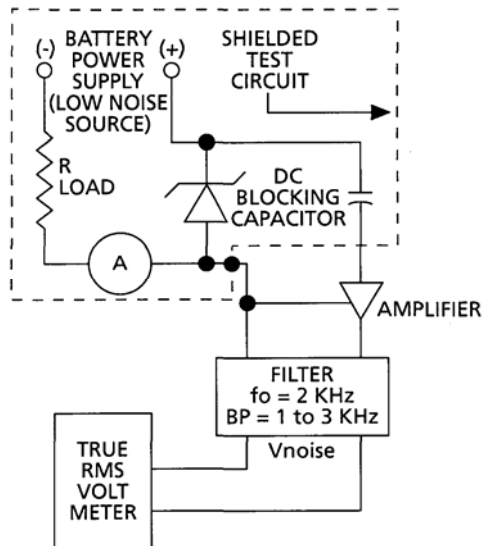
| INDUSTRY<br>PART NUMBER<br>(NOTE 1) | MICROSEMI<br>PART<br>NUMBER<br>(NOTE 1) | NOMINAL<br>ZENER<br>VOLTAGE<br>$V_Z @ I_{ZT}$<br>(NOTE 2) | ZENER<br>TEST<br>CURRENT<br>$I_{ZT}$ | MAXIMUM<br>ZENER<br>IMPEDANCE<br>$Z_{ZT}$<br>(Note 3) | MAXIMUM<br>REVERSE<br>CURRENT<br>$I_R @ V_R$ |       | MAXIMUM<br>NOISE<br>DENSITY<br>$N_D @ I_{ZT}$ | MAXIMUM<br>ZENER<br>CURRENT<br>$I_{ZM}$ | TYPICAL<br>TEMP. COEFF.<br>OF ZENER<br>VOLTAGE<br>$\alpha_{VZ}$ |
|-------------------------------------|-----------------------------------------|-----------------------------------------------------------|--------------------------------------|-------------------------------------------------------|----------------------------------------------|-------|-----------------------------------------------|-----------------------------------------|-----------------------------------------------------------------|
|                                     |                                         | VOLTS                                                     | $\mu A$                              | OHMS                                                  | $\mu A$                                      | Volts | $\mu V/\sqrt{Hz}$                             | mA                                      | %/°C                                                            |
| 1N4614UR                            | MLL4614                                 | 1.8                                                       | 250                                  | 1200                                                  | 3.5                                          | 1.0   | 1                                             | 120                                     | -0.075                                                          |
| 1N4615UR                            | MLL4615                                 | 2.0                                                       | 250                                  | 1250                                                  | 2.5                                          | 1.0   | 1                                             | 110                                     | -0.075                                                          |
| 1N4616UR                            | MLL4616                                 | 2.2                                                       | 250                                  | 1300                                                  | 2.0                                          | 1.0   | 1                                             | 100                                     | -0.075                                                          |
| 1N4617UR                            | MLL4617                                 | 2.4                                                       | 250                                  | 1400                                                  | 1.0                                          | 1.0   | 1                                             | 95                                      | -0.075                                                          |
| 1N4618UR                            | MLL4618                                 | 2.7                                                       | 250                                  | 1500                                                  | 0.5                                          | 1.0   | 1                                             | 90                                      | -0.075                                                          |
| 1N4619UR                            | MLL4619                                 | 3.0                                                       | 250                                  | 1600                                                  | 0.4                                          | 1.0   | 1                                             | 87                                      | -0.075                                                          |
| 1N4620UR                            | MLL4620                                 | 3.3                                                       | 250                                  | 1650                                                  | 3.5                                          | 1.5   | 1                                             | 85                                      | -0.075                                                          |
| 1N4621UR                            | MLL4621                                 | 3.6                                                       | 250                                  | 1700                                                  | 3.5                                          | 2.0   | 1                                             | 83                                      | -0.065                                                          |
| 1N4622UR                            | MLL4622                                 | 3.9                                                       | 250                                  | 1650                                                  | 2.5                                          | 2.0   | 1                                             | 80                                      | -0.060                                                          |
| 1N4623UR                            | MLL4623                                 | 4.3                                                       | 250                                  | 1600                                                  | 2.0                                          | 2.0   | 1                                             | 77                                      | -0.050                                                          |
| 1N4624UR                            | MLL4624                                 | 4.7                                                       | 250                                  | 1550                                                  | 5.0                                          | 3.0   | 1                                             | 75                                      | -0.040,+0.020                                                   |
| 1N4625UR                            | MLL4625                                 | 5.1                                                       | 250                                  | 1500                                                  | 5.0                                          | 3.0   | 2                                             | 70                                      | -0.045,+0.030                                                   |
| 1N4626UR                            | MLL4626                                 | 5.6                                                       | 250                                  | 1400                                                  | 5.0                                          | 4.0   | 4                                             | 65                                      | -0.020,+0.040                                                   |
| 1N4627UR                            | MLL4627                                 | 6.2                                                       | 250                                  | 1200                                                  | 5.0                                          | 5.0   | 5                                             | 61                                      | -0.010,+0.050                                                   |
| 1N4099UR                            | MLL4099                                 | 6.8                                                       | 250                                  | 200                                                   | 1.0                                          | 5.17  | 40                                            | 56                                      | 0.040                                                           |
| 1N4100UR                            | MLL4100                                 | 7.5                                                       | 250                                  | 200                                                   | 1.0                                          | 5.70  | 40                                            | 51                                      | 0.045                                                           |
| 1N4101UR                            | MLL4101                                 | 8.2                                                       | 250                                  | 200                                                   | 0.5                                          | 6.24  | 40                                            | 46                                      | 0.048                                                           |
| 1N4102UR                            | MLL4102                                 | 8.7                                                       | 250                                  | 200                                                   | 0.5                                          | 6.61  | 40                                            | 44                                      | 0.049                                                           |
| 1N4103UR                            | MLL4103                                 | 9.1                                                       | 250                                  | 200                                                   | 0.5                                          | 6.92  | 40                                            | 42                                      | 0.050                                                           |
| 1N4104UR                            | MLL4104                                 | 10                                                        | 250                                  | 200                                                   | 0.5                                          | 7.60  | 40                                            | 38                                      | 0.055                                                           |
| 1N4105UR                            | MLL4105                                 | 11                                                        | 250                                  | 200                                                   | .05                                          | 8.44  | 40                                            | 35                                      | 0.060                                                           |
| 1N4106UR                            | MLL4106                                 | 12                                                        | 250                                  | 200                                                   | .05                                          | 9.12  | 40                                            | 32                                      | 0.065                                                           |
| 1N4107UR                            | MLL4107                                 | 13                                                        | 250                                  | 200                                                   | .05                                          | 9.87  | 40                                            | 29                                      | 0.065                                                           |
| 1N4108UR                            | MLL4108                                 | 14                                                        | 250                                  | 200                                                   | .05                                          | 10.65 | 40                                            | 27                                      | 0.070                                                           |
| 1N4109UR                            | MLL4109                                 | 15                                                        | 250                                  | 100                                                   | .05                                          | 11.40 | 40                                            | 25                                      | 0.070                                                           |
| 1N4110UR                            | MLL4110                                 | 16                                                        | 250                                  | 100                                                   | .05                                          | 12.15 | 40                                            | 24                                      | 0.070                                                           |
| 1N4111UR                            | MLL4111                                 | 17                                                        | 250                                  | 100                                                   | .05                                          | 12.92 | 40                                            | 22                                      | 0.075                                                           |
| 1N4112UR                            | MLL4112                                 | 18                                                        | 250                                  | 100                                                   | .05                                          | 13.67 | 40                                            | 21                                      | 0.075                                                           |
| 1N4113UR                            | MLL4113                                 | 19                                                        | 250                                  | 150                                                   | .05                                          | 14.44 | 40                                            | 20                                      | 0.075                                                           |
| 1N4114UR                            | MLL4114                                 | 20                                                        | 250                                  | 150                                                   | .01                                          | 15.20 | 40                                            | 19                                      | 0.075                                                           |
| 1N4115UR                            | MLL4115                                 | 22                                                        | 250                                  | 150                                                   | .01                                          | 16.72 | 40                                            | 17                                      | 0.080                                                           |
| 1N4116UR                            | MLL4116                                 | 24                                                        | 250                                  | 150                                                   | .01                                          | 18.25 | 40                                            | 16                                      | 0.080                                                           |
| 1N4117UR                            | MLL4117                                 | 25                                                        | 250                                  | 150                                                   | .01                                          | 19.00 | 40                                            | 15                                      | 0.080                                                           |
| 1N4118UR                            | MLL4118                                 | 27                                                        | 250                                  | 150                                                   | .01                                          | 20.45 | 40                                            | 14                                      | 0.085                                                           |
| 1N4119UR                            | MLL4119                                 | 28                                                        | 250                                  | 200                                                   | .01                                          | 21.28 | 40                                            | 14                                      | 0.085                                                           |
| 1N4120UR                            | MLL4120                                 | 30                                                        | 250                                  | 200                                                   | .01                                          | 22.80 | 40                                            | 13                                      | 0.085                                                           |
| 1N4121UR                            | MLL4121                                 | 33                                                        | 250                                  | 200                                                   | .01                                          | 25.08 | 40                                            | 12                                      | 0.085                                                           |
| 1N4122UR                            | MLL4122                                 | 36                                                        | 250                                  | 200                                                   | .01                                          | 27.38 | 40                                            | 11                                      | 0.090                                                           |
| 1N4123UR                            | MLL4123                                 | 39                                                        | 250                                  | 200                                                   | .01                                          | 29.65 | 40                                            | 9.8                                     | 0.090                                                           |
| 1N4124UR                            | MLL4124                                 | 43                                                        | 250                                  | 250                                                   | .01                                          | 32.65 | 40                                            | 8.9                                     | 0.090                                                           |
| 1N4125UR                            | MLL4125                                 | 47                                                        | 250                                  | 250                                                   | .01                                          | 35.75 | 40                                            | 8.1                                     | 0.090                                                           |
| 1N4126UR                            | MLL4126                                 | 51                                                        | 250                                  | 300                                                   | .01                                          | 38.76 | 40                                            | 7.5                                     | 0.090                                                           |
| 1N4127UR                            | MLL4127                                 | 56                                                        | 250                                  | 300                                                   | .01                                          | 42.60 | 40                                            | 6.7                                     | 0.090                                                           |
| 1N4128UR                            | MLL4128                                 | 60                                                        | 250                                  | 400                                                   | .01                                          | 45.60 | 40                                            | 6.4                                     | 0.090                                                           |
| 1N4129UR                            | MLL4129                                 | 62                                                        | 250                                  | 500                                                   | .01                                          | 47.10 | 40                                            | 6.1                                     | 0.090                                                           |
| 1N4130UR                            | MLL4130                                 | 68                                                        | 250                                  | 700                                                   | .01                                          | 51.68 | 40                                            | 5.6                                     | 0.095                                                           |
| 1N4131UR                            | MLL4131                                 | 75                                                        | 250                                  | 700                                                   | .01                                          | 57.00 | 40                                            | 5.1                                     | 0.095                                                           |
| 1N4132UR                            | MLL4132                                 | 82                                                        | 250                                  | 800                                                   | .01                                          | 62.32 | 40                                            | 4.6                                     | 0.095                                                           |
| 1N4133UR                            | MLL4133                                 | 87                                                        | 250                                  | 1000                                                  | .01                                          | 66.12 | 40                                            | 4.4                                     | 0.095                                                           |
| 1N4134UR                            | MLL4134                                 | 91                                                        | 250                                  | 1200                                                  | .01                                          | 69.16 | 40                                            | 4.2                                     | 0.095                                                           |
| 1N4135UR                            | MLL4135                                 | 100                                                       | 250                                  | 1500                                                  | .01                                          | 76.00 | 40                                            | 3.8                                     | 0.095                                                           |

**NOTE 1:** These may be ordered as either 1N4614UR-1N4627UR, 1N4099UR-1N4135UR or as the MLL4614-MLL4627, MLL4099-MLL4135.

**NOTE 2:** The JEDEC type numbers shown above have a standard tolerance of +/-5% for nominal Zener voltage and are also available in 2% and 1% tolerance with suffix C and D respectively.  $V_Z$  is measured with the diode in thermal equilibrium (still air) at 25°C for end-cap terminations.

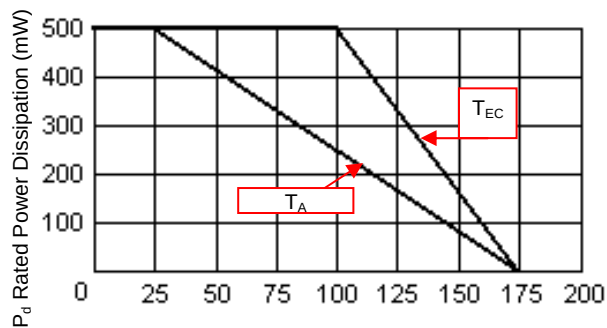
**NOTE 3:** The zener impedance is derived by superimposing on  $I_{ZT}$ , a 60 Hz rms ac current equal to 10% of  $I_{ZT}$  (25 $\mu A$ ). See MicroNote 202 for zener impedance variation with different operating currents.

## GRAPHS and CIRCUIT

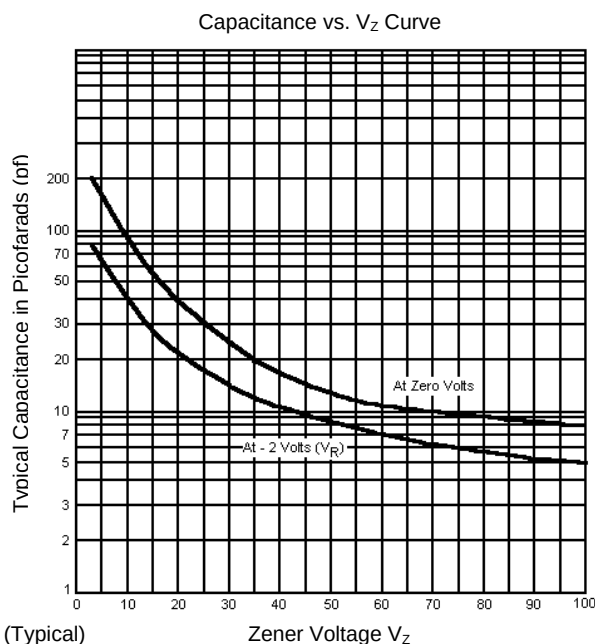


**FIGURE 1** Noise Density Measurement Circuit

Noise density, ( $N_D$ ) is specified in microvolt-rms per square-root-hertz. Actual measurement is performed using a 1 KHz to 3 KHz frequency bandpass filter at a constant Zener test current ( $I_{ZT}$ ) AT 25°C ambient temperature.  $N_D$  is calculated from the formula.

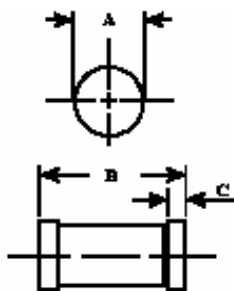


$T_{EC}$ , End Cap Temperature (°C) or  $T_A$   
Ambient temperature on FR4 PC board  
**FIGURE 2** Power Derating Curve

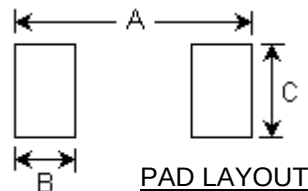


**FIGURE 3** Capacitance vs. Zener Voltage (Typical)

## PACKAGE DIMENSIONS



| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.063  | 0.067 | 1.60        | 1.70 |
| B   | 0.130  | 0.146 | 3.30        | 3.70 |
| C   | 0.016  | 0.022 | 0.41        | 0.55 |



|   | INCHES | mm   |
|---|--------|------|
| A | .200   | 5.08 |
| B | .055   | 1.40 |
| C | .080   | 2.03 |