*Available on commercial versions*

# METALLURGICALLY BONDED GLASS SURFACE MOUNT 0.5 WATT ZENERS

***Qualified per MIL-PRF-19500/435***

*Qualified Levels:*
*JAN, JANTX, JANTXV and JANS*

## DESCRIPTION

The 1N4099UR-1 thru 1N4135UR-1 and 1N4614UR-1 thru 1N4627UR-1 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% tolerance. 1% and 2% tolerance versions are also available (see part nomenclature). These also have an internal metallurgical bond. This type of internally bonded Zener package construction is also military qualified up to a JANS level for higher reliability applications. Microsemi also offers numerous other Zener products to meet higher and lower power applications.

**Important:** For the latest information, visit our website http://www.microsemi.com.

**DO-213AA Package**

Also available in:

**DO-35 package**
(axial-leaded)
**1N4099 – 1N4135 and 1N4614 – 1N4627**

**DO-216 package**
(tabbed surface mount)
**1PMT4100 – 1PMT4135 and 1PMT4621 – 1PMT4627**

## FEATURES

- Surface mount equivalent to JEDEC registered 1N4099 thru 1N4135 and 1N4614 thru 1N4627 series.
- Internal metallurgical bond.
- JAN, JANTX, JANTXV and JANS qualifications are available per MIL-PRF-19500/435.
- RoHS compliant versions available (commercial grade only).

## APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 1.8 to 100 volts.
- Standard voltage tolerance is plus or minus 5% with tighter tolerances available at plus or minus 2% or 1%.
- Hermetically sealed surface mount package.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Minimal capacitance (see Figure 3).
- Inherently radiation hard as described in Microsemi MicroNote 050.

## MAXIMUM RATINGS @ $T_C$ = +25 ºC unless otherwise specified

| Parameters/Test Conditions | Symbol | Value | Unit |
|---|---|---|---|
| Junction and Storage Temperature | $T_J$ and $T_{STG}$ | -65 to +175 | °C |
| Thermal Resistance Junction-to-Ambient (1) | $R_{\Theta JA}$ | 300 | °C/W |
| Thermal Resistance Junction-to-End Cap | $R_{\Theta JEC}$ | 100 | °C/W |
| Steady-State Power Dissipation (2) | $P_D$ | 0.5 | W |
| Forward Voltage @ 200 mA | $V_F$ | 1.1 | V |
| Solder Temperature @ 10 s | $T_{SP}$ | 260 | °C |

**Notes:** 1. When mounted on FR4 PC board (1 oz Cu) with recommended footprint (see last page).
2. At end cap temperature $T_{EC} \leq 125$ °C or at ambient $T_A \leq 50$ °C when mounted on FR4 PC board as described for thermal resistance above (see Figure 2 for derating).

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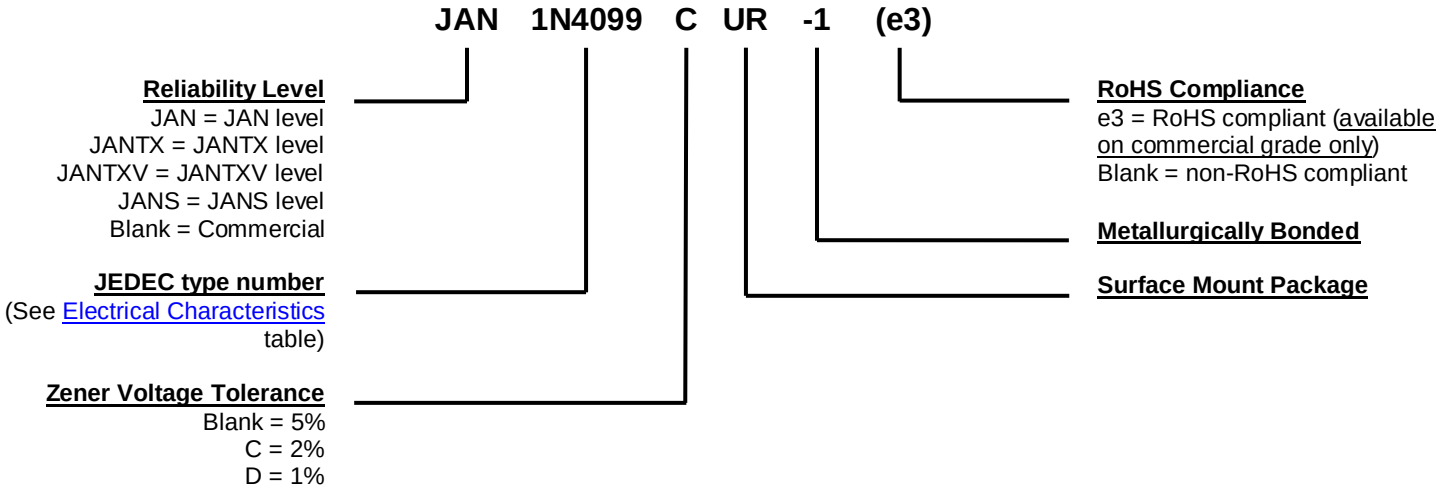
## MECHANICAL and PACKAGING

- CASE: Hermetically sealed glass DO-213AA (SOD80 or CDLL34) MELF style package.
- TERMINALS: End caps tin-lead (Sn/Pb) or RoHS compliant annealed matte-tin (on commercial grade only) plating solderable per MIL-STD-750, method 2026.
- POLARITY: Cathode indicated by banded end. 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 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: 0.04 grams.
- See Package Dimensions on last page.

## PART NOMENCLATURE




## SYMBOLS & DEFINITIONS

| Symbol | Definition |
|---|---|
| $I_R$ | Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature. |
| $I_Z$, $I_{ZT}$, $I_{ZK}$ | Regulator Current: The dc regulator current ($I_Z$), at a specified test point ($I_{ZT}$), near breakdown knee ($I_{ZK}$). |
| $I_{ZM}$ | Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating. |
| $N_D$ | Noise Density: The noise generated over a specified frequency bandwidth usually specified in terms of mV/ √Hz. |
| $V_R$ | Reverse Voltage: The reverse voltage dc value, no alternating component. |
| $V_Z$ | Zener Voltage: The Zener voltage the device will exhibit at a specified current ($I_Z$) in its breakdown region. |
| $Z_{ZT}$ or $Z_{ZK}$ | Dynamic Impedance: The small signal impedance of the diode when biased to operate in its breakdown region at a specified rms current modulation (typically 10% of $I_{ZT}$ or $I_{ZK}$) and superimposed on $I_{ZT}$ or $I_{ZK}$ respectively. |

## ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise stated

| INDUSTRY PART NUMBER (Note 1) | MICROSEMI PART NUMBER (Note 1) | NOMINAL ZENER VOLTAGE $V_Z$ @ $I_{ZT}$ (Note 2) | ZENER TEST CURRENT $I_{ZT}$ | MAXIMUM ZENER IMPEDANCE $Z_{ZT}$ (Note 3) | MAXIMUM REVERSE CURRENT $I_R$ @ $V_R$ | | MAXIMUM NOISE DENSITY $N_D$ @ $I_{ZT}$ | MAXIMUM ZENER CURRENT $I_{ZM}$ | TYPICAL TEMP.COEFF. OF ZENER VOLTAGE $\alpha_{VZ}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | Volts | µA | Ohms | µA | Volts | µV/√Hz | mA | %/°C |
| 1N4614UR-1 | CDLL4614-1 | 1.8 | 250 | 1200 | 3.5 | 1 | 1 | 120 | -0.075 |
| 1N4615UR-1 | CDLL4615-1 | 2.0 | 250 | 1250 | 2.5 | 1 | 1 | 110 | -0.075 |
| 1N4616UR-1 | CDLL4616-1 | 2.2 | 250 | 1300 | 2.0 | 1 | 1 | 100 | -0.075 |
| 1N4617UR-1 | CDLL4617-1 | 2.4 | 250 | 1400 | 1.0 | 1 | 1 | 95 | -0.075 |
| 1N4618UR-1 | CDLL4618-1 | 2.7 | 250 | 1500 | 0.5 | 1 | 1 | 90 | -0.075 |
| 1N4619UR-1 | CDLL4619-1 | 3.0 | 250 | 1600 | 0.4 | 1 | 1 | 87 | -0.075 |
| 1N4620UR-1 | CDLL4620-1 | 3.3 | 250 | 1650 | 3.5 | 1 | 1 | 85 | -0.075 |
| 1N4621UR-1 | CDLL4621-1 | 3.6 | 250 | 1700 | 3.5 | 2 | 1 | 83 | -0.065 |
| 1N4622UR-1 | CDLL4622-1 | 3.9 | 250 | 1650 | 2.5 | 2 | 1 | 80 | -0.060 |
| 1N4623UR-1 | CDLL4623-1 | 4.3 | 250 | 1600 | 2.0 | 2 | 1 | 77 | -0.050 |
| 1N4624UR-1 | CDLL4624-1 | 4.7 | 250 | 1550 | 5.0 | 3 | 1 | 75 | -0.040,+0.020 |
| 1N4625UR-1 | CDLL4625-1 | 5.1 | 250 | 1500 | 5.0 | 3 | 2 | 70 | -0.045,+0.030 |
| 1N4626UR-1 | CDLL4626-1 | 5.6 | 250 | 1400 | 5.0 | 4 | 4 | 65 | -0.020,+0.040 |
| 1N4627UR-1 | CDLL4627-1 | 6.2 | 250 | 1200 | 5.0 | 5 | 5 | 61 | -0.010,+0.050 |
| 1N4099UR-1 | CDLL4099-1 | 6.8 | 250 | 200 | 1.0 | 5.17 | 40 | 56 | 0.040 |
| 1N4100UR-1 | CDLL4100-1 | 7.5 | 250 | 200 | 1.0 | 5.70 | 40 | 51 | 0.045 |
| 1N4101UR-1 | CDLL4101-1 | 8.2 | 250 | 200 | 0.5 | 6.24 | 40 | 46 | 0.048 |
| 1N4102UR-1 | CDLL4102-1 | 8.7 | 250 | 200 | 0.5 | 6.61 | 40 | 44 | 0.049 |
| 1N4103UR-1 | CDLL4103-1 | 9.1 | 250 | 200 | 0.5 | 6.92 | 40 | 42 | 0.050 |
| 1N4104UR-1 | CDLL4104-1 | 10 | 250 | 200 | 0.5 | 7.60 | 40 | 38 | 0.055 |
| 1N4105UR-1 | CDLL4105-1 | 11 | 250 | 200 | 0.05 | 8.44 | 40 | 35 | 0.060 |
| 1N4106UR-1 | CDLL4106-1 | 12 | 250 | 200 | 0.05 | 9.12 | 40 | 32 | 0.065 |
| 1N4107UR-1 | CDLL4107-1 | 13 | 250 | 200 | 0.05 | 9.87 | 40 | 29 | 0.065 |
| 1N4108UR-1 | CDLL4108-1 | 14 | 250 | 200 | 0.05 | 10.65 | 40 | 27 | 0.070 |
| 1N4109UR-1 | CDLL4109-1 | 15 | 250 | 100 | 0.05 | 11.40 | 40 | 25 | 0.070 |
| 1N4110UR-1 | CDLL4110-1 | 16 | 250 | 100 | 0.05 | 12.15 | 40 | 24 | 0.070 |
| 1N4111UR-1 | CDLL4111-1 | 17 | 250 | 100 | 0.05 | 12.92 | 40 | 22 | 0.075 |
| 1N4112UR-1 | CDLL4112-1 | 18 | 250 | 100 | 0.05 | 13.67 | 40 | 21 | 0.075 |
| 1N4113UR-1 | CDLL4113-1 | 19 | 250 | 150 | 0.05 | 14.44 | 40 | 20 | 0.075 |
| 1N4114UR-1 | CDLL4114-1 | 20 | 250 | 150 | 0.01 | 15.20 | 40 | 19 | 0.075 |
| 1N4115UR-1 | CDLL4115-1 | 22 | 250 | 150 | 0.01 | 16.72 | 40 | 17 | 0.080 |
| 1N4116UR-1 | CDLL4116-1 | 24 | 250 | 150 | 0.01 | 18.25 | 40 | 16 | 0.080 |
| 1N4117UR-1 | CDLL4117-1 | 25 | 250 | 150 | 0.01 | 19.00 | 40 | 15 | 0.080 |
| 1N4118UR-1 | CDLL4118-1 | 27 | 250 | 150 | 0.01 | 20.45 | 40 | 14 | 0.085 |
| 1N4119UR-1 | CDLL4119-1 | 28 | 250 | 200 | 0.01 | 21.28 | 40 | 14 | 0.085 |
| 1N4120UR-1 | CDLL4120-1 | 30 | 250 | 200 | 0.01 | 22.80 | 40 | 13 | 0.085 |
| 1N4121UR-1 | CDLL4121-1 | 33 | 250 | 200 | 0.01 | 25.08 | 40 | 12 | 0.085 |
| 1N4122UR-1 | CDLL4122-1 | 36 | 250 | 200 | 0.01 | 27.38 | 40 | 11 | 0.090 |
| 1N4123UR-1 | CDLL4123-1 | 39 | 250 | 200 | 0.01 | 29.65 | 40 | 9.8 | 0.090 |
| 1N4124UR-1 | CDLL4124-1 | 43 | 250 | 250 | 0.01 | 32.65 | 40 | 8.9 | 0.090 |
| 1N4125UR-1 | CDLL4125-1 | 47 | 250 | 250 | 0.01 | 35.75 | 40 | 8.1 | 0.090 |
| 1N4126UR-1 | CDLL4126-1 | 51 | 250 | 300 | 0.01 | 38.76 | 40 | 7.5 | 0.090 |
| 1N4127UR-1 | CDLL4127-1 | 56 | 250 | 300 | 0.01 | 42.60 | 40 | 6.7 | 0.090 |
| 1N4128UR-1 | CDLL4128-1 | 60 | 250 | 400 | 0.01 | 45.60 | 40 | 6.4 | 0.090 |
| 1N4129UR-1 | CDLL4129-1 | 62 | 250 | 500 | 0.01 | 47.10 | 40 | 6.1 | 0.090 |
| 1N4130UR-1 | CDLL4130-1 | 68 | 250 | 700 | 0.01 | 51.68 | 40 | 5.6 | 0.095 |
| 1N4131UR-1 | CDLL4131-1 | 75 | 250 | 700 | 0.01 | 57.00 | 40 | 5.1 | 0.095 |
| 1N4132UR-1 | CDLL4132-1 | 82 | 250 | 800 | 0.01 | 62.32 | 40 | 4.6 | 0.095 |
| 1N4133UR-1 | CDLL4133-1 | 87 | 250 | 1000 | 0.01 | 66.12 | 40 | 4.4 | 0.095 |
| 1N4134UR-1 | CDLL4134-1 | 91 | 250 | 1200 | 0.01 | 69.16 | 40 | 4.2 | 0.095 |
| 1N4135UR-1 | CDLL4135-1 | 100 | 250 | 1500 | 0.01 | 76.00 | 40 | 3.8 | 0.095 |

***SEE NOTES ON NEXT PAGE.***

**NOTE 1:** These may be ordered as either 1N4614UR-1 thru 1N4627UR-1 and 1N4099UR-1 thru 1N4135UR-1 or CDLL4614-1 thru CDLL4627-1 and CDLL4099-1 thru CDLL4135-1. For military types, add the JAN, JANTX, JANTXV prefix for required screening to the industry part number.

**NOTE 2:** The JEDEC type numbers shown above have a standard tolerance of +/-5% on the nominal Zener voltage. Tighter tolerances are also available with C or D suffix for 2% or 1% tolerance respectively, e.g. 1N4105CUR-1 for 2%. $V_Z$ is measured with the diode in thermal equilibrium (still air) at 25 °C for end-cap terminations.

**NOTE 3:** Zener impedance is derived by superimposing on $I_{ZT}$ a 60 Hz rms ac current at 10% of $I_{ZT}$. See MicroNote 202 for $Z_{ZT}$ variation with $I_Z$.

## GRAPHS

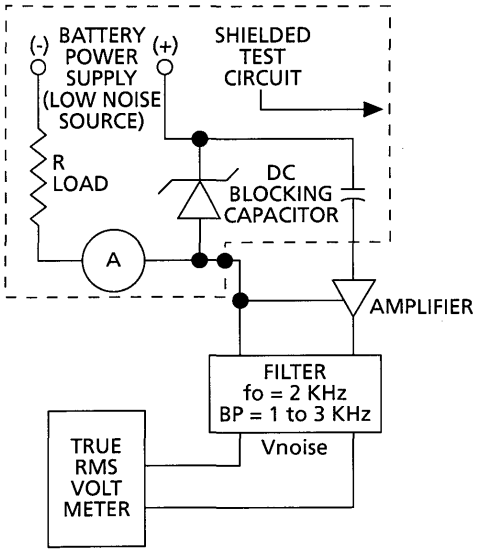



**FIGURE 1** – Noise Density Measurement Circuit

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.

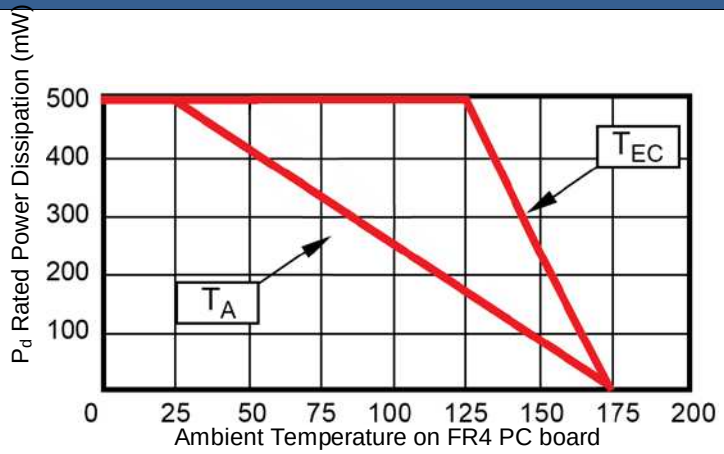



**FIGURE 2 –** Power Derating Curve

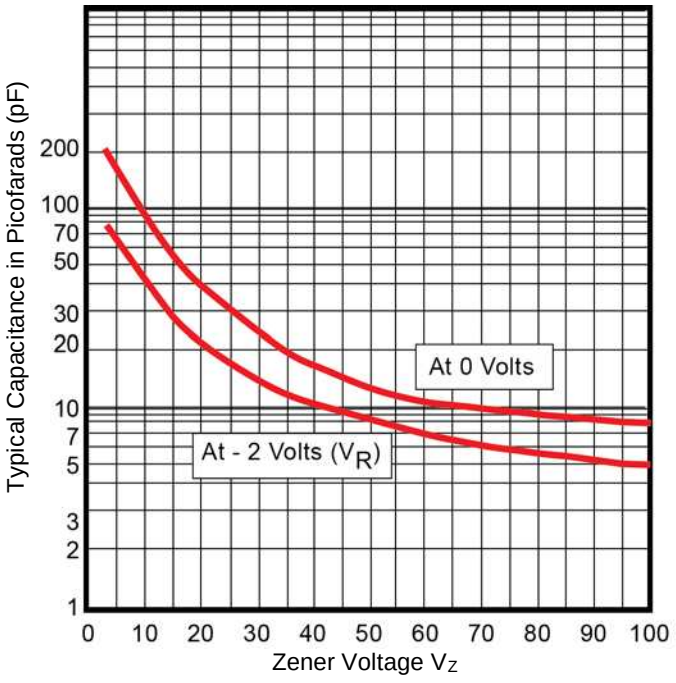
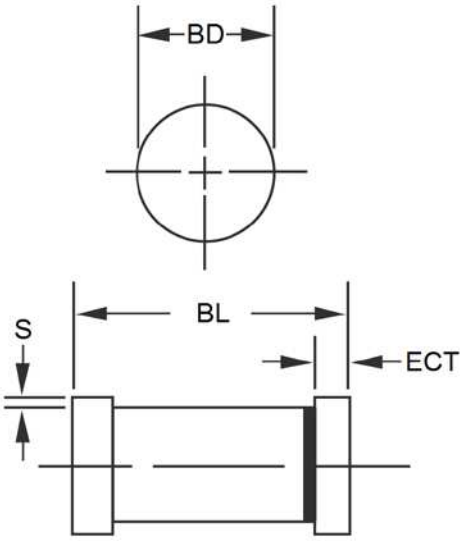


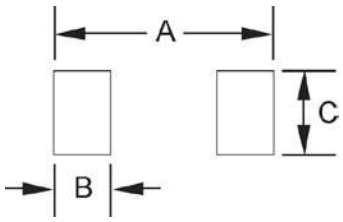

**FIGURE 3 –** Capacitance vs. Zener Voltage (Typical)

## PACKAGE DIMENSIONS




| DIM | INCH | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| BD | 0.063 | 0.067 | 1.60 | 1.70 |
| BL | 0.130 | 0.146 | 3.30 | 3.71 |
| ECT | 0.016 | 0.022 | 0.41 | 0.56 |
| S | .001 min | | 0.03 min | |

## PAD LAYOUT




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