



**VOIDLESS HERMETICALLY SEALED
500mW GLASS ZENER DIODES**
Qualified per MIL-PRF-19500/533

Qualified Levels:
JAN, JANTX, JANTXV
and JANS

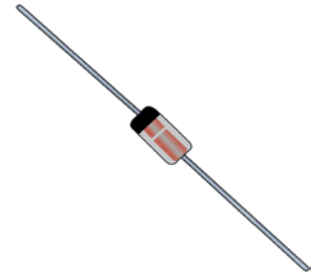
DESCRIPTION

This Zener voltage regulator series is military qualified and is ideal for high-reliability applications where a failure cannot be tolerated. These industry-recognized 0.5 watt Zener voltage regulators are hermetically sealed with voidless-glass construction using an internal metallurgical bond. It includes Zener selections from 2.4 to 200 volts in standard 5% tolerances as well as 1% and 2% tolerances. They are also available in surface-mount packages. Microsemi also offers numerous other Zener products to meet higher and lower power ratings in both thru-hole and surface mount packages.

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FEATURES

- JEDEC registered 1N6309 thru 1N6355 series.
- Voltage tolerances of 1%, 2% and 5% are available. (See [part nomenclature](#).)
- Voidless hermetically sealed glass package.
- Internal “*Category I*” metallurgical bonds for 1N6321 thru 1N6355 and “*Category III*” for 1N6309 thru 1N6320.
- JAN, JANTX, JANTXV, and JANS reliability levels are available per MIL-PRF-19500/533.
- RoHS compliant versions available (commercial grade only).



**DO-35 or
“D” Package**

Also available in:

“B” SQ MELF package
(surface mount)
 [1N6309US – 1N6355DUS](#)

APPLICATIONS / BENEFITS

- Small DO-35 size package (or “D” Package).
- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 2.4 to 200 volts.
- Standard and tight voltage tolerances available.
- Extremely robust construction.
- Flexible axial-lead mounting terminals.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Inherently radiation hard as described in Microsemi “[MicroNote 050](#)”.

MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | Value | Unit |
|---|-------------------------------------|-------------|------|
| Junction and Storage Temperature | T _J and T _{STG} | -65 to +175 | °C |
| Thermal Resistance Junction-to-Lead ⁽¹⁾ | R _{θJL} | 150 | °C/W |
| 1N6309 – 1N6320 1N6321 – 1N6355 | | 95.5 | |
| Thermal Resistance Junction-to-Ambient ⁽²⁾ | R _{θJA} | 240 | °C/W |
| Steady-State Power Dissipation @ T _L = 75 °C | P _D | 0.5 | W |
| Forward Voltage @ 1.0 A | V _F | 1.4 | V |
| Solder Temperature @ 10 s | T _{SP} | 260 | °C |

- Notes:**
1. At 3/8 inch (10 mm) from body. See [Figure 1](#) and [Figure 2](#) for derating.
 2. T_A = +55 °C before derating on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm) 1-layer 1-Oz Cu, horizontal, still air, pads = .092 inch (2.34 mm) diameter, strip = .030 inch (0.76 mm) x 1 inch (25.4 mm) long, axial lead length L ≤ .187 inch (≤ 4.75 mm); R_{θJA} with a defined thermal resistance condition included is measured at I_Z = as defined in the characteristics and ratings table herein.

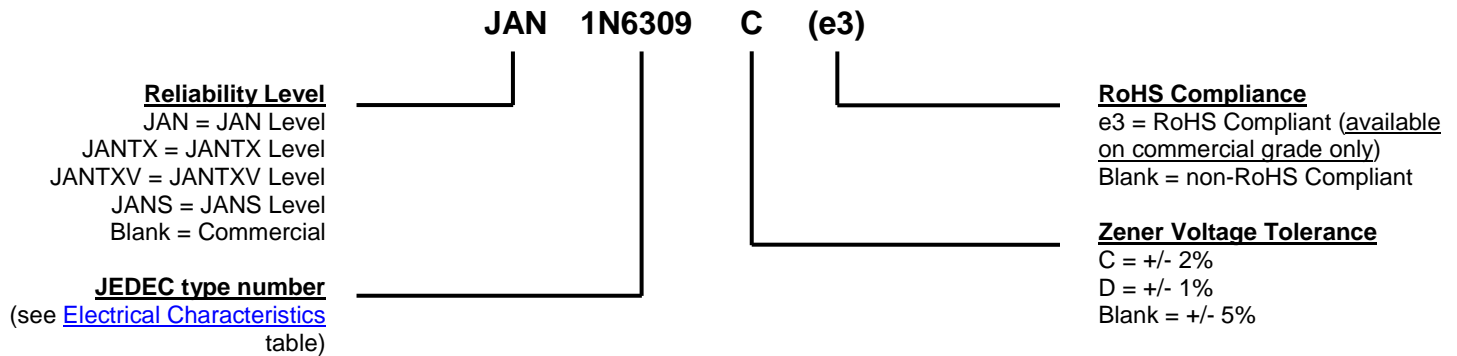
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MECHANICAL and PACKAGING

- CASE: Hermetically sealed voidless hard glass with tungsten slugs.
- TERMINALS: Axial-leads are tin/lead (Sn/Pb) or RoHS compliant matte/tin (commercial grade only) over copper clad steel.
- MARKING: Body painted and part number.
- POLARITY: Cathode indicated by band.
- TAPE & REEL option: Standard per EIA-296. Consult factory for quantities.
- WEIGHT: 150 milligrams.
- 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. |
| I_{ZSM} | Maximum Zener Surge Current: The non-repetitive peak value of Zener surge current at a specified wave form. |
| V_F | Maximum Forward Voltage: The maximum forward voltage the device will exhibit at a specified current. |
| V_{WM} | Working Peak Voltage: The maximum peak voltage that can be applied over the operating temperature range. This is also referred to as Standoff Voltage. |
| 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

| TYPE Note 1 | V _{Z2} NOM. +/-5% @ I _{Z2} | V _{Z1} MIN. @ I _{Z1} 250 µA | Test Current I _{Z2} | Dynamic Impedance Z _Z @ I _{Z2} | Dynamic Impedance Z _{ZK} @ 250 µA | Max. Current I _{ZM} | Voltage Reg. V _{Z(reg)} (ΔV _Z) Note 2 | Surge Current 8.3 ms square Wave I _{ZSM} | Reverse Voltage V _R | Max. Reverse Current I _{R1} @ V _R 25 °C | Max. Reverse Current I _{R2} @ V _R 150 °C | Max. Noise Density N _D @ 250 µA 1 to 3 kHz | Max. Temp. Coeff. of Zener Voltage α _{VZ} |
|----------------|---|--|------------------------------------|--|--|------------------------------------|--|--|--------------------------------------|---|--|--|---|
| | Volts | Volts | mA | ohms | ohms | mA | Volts | Amps | Volts | µA | µA | µV /Hz | %/°C |
| 1N6309 | 2.4 | 1.1 | 20 | 30 | 1,200 | 177 | 1.50 | 2.50 | 1.0 | 100 | 200 | 1 | -.085 |
| 1N6310 | 2.7 | 1.2 | 20 | 30 | 1,300 | 157 | 1.50 | 2.20 | 1.0 | 60 | 150 | 1 | -.080 |
| 1N6311 | 3.0 | 1.3 | 20 | 29 | 1,400 | 141 | 1.50 | 2.00 | 1.0 | 30 | 100 | 1 | -.075 |
| 1N6312 | 3.3 | 1.5 | 20 | 27 | 1,400 | 128 | 1.60 | 1.80 | 1.0 | 5 | 20 | 1 | -.070 |
| 1N6313 | 3.6 | 1.8 | 20 | 25 | 1,400 | 117 | 1.60 | 1.65 | 1.0 | 3 | 12 | 1 | -.065 |
| 1N6314 | 3.9 | 2.0 | 20 | 23 | 1,700 | 108 | 1.60 | 1.50 | 1.0 | 2 | 12 | 1 | -.060 |
| 1N6315 | 4.3 | 2.4 | 20 | 20 | 1,700 | 99 | 0.90 | 1.40 | 1.0 | 2 | 12 | 1 | -.045 +.020 |
| 1N6316 | 4.7 | 2.8 | 20 | 17 | 1,500 | 90 | 0.50 | 1.27 | 1.5 | 5 | 12 | 1 | -.028 +.032 |
| 1N6317 | 5.1 | 3.3 | 20 | 14 | 1,300 | 83 | 0.40 | 1.17 | 2.0 | 5 | 12 | 1 | -.020 +.035 |
| 1N6318 | 5.6 | 4.3 | 20 | 8 | 1,200 | 76 | 0.40 | 1.10 | 2.5 | 5 | 10 | 2 | +.050 |
| 1N6319 | 6.2 | 5.2 | 20 | 3 | 800 | 68 | 0.30 | 0.97 | 3.5 | 5 | 10 | 5 | +.060 |
| 1N6320 | 6.8 | 6.0 | 20 | 3 | 400 | 63 | 0.35 | 1.23 | 4.0 | 2 | 50 | 5 | +.062 |
| 1N6321 | 7.5 | 6.6 | 20 | 4 | 400 | 57 | 0.40 | 1.16 | 5.0 | 2 | 30 | 5 | +.068 |
| 1N6322 | 8.2 | 7.5 | 20 | 5 | 400 | 52 | 0.40 | 1.07 | 6.0 | 1 | 10 | 20 | +.075 |
| 1N6323 | 9.1 | 8.4 | 20 | 6 | 500 | 47 | 0.50 | 0.97 | 7.0 | 1 | 10 | 40 | +.076 |
| 1N6324 | 10.0 | 9.1 | 20 | 6 | 500 | 43 | 0.50 | 0.89 | 8.0 | 1 | 10 | 80 | +.079 |
| 1N6325 | 11.0 | 10.0 | 20 | 7 | 550 | 39 | 0.50 | 0.83 | 8.5 | 1 | 10 | 100 | +.082 |
| 1N6326 | 12.0 | 11.0 | 20 | 7 | 550 | 35 | 0.55 | 0.77 | 9.0 | 1 | 10 | 100 | +.083 |
| 1N6327 | 13.0 | 11.9 | 9.5 | 8 | 550 | 33 | 0.55 | 0.71 | 9.9 | 0.05 | 10 | 100 | +.083 |
| 1N6328 | 15.0 | 13.8 | 8.5 | 10 | 600 | 28 | 0.70 | 0.62 | 11.0 | 0.05 | 10 | 100 | +.084 |
| 1N6329 | 16.0 | 14.7 | 7.8 | 12 | 600 | 27 | 0.75 | 0.58 | 12.0 | 0.05 | 10 | 100 | +.084 |
| 1N6330 | 18.0 | 16.6 | 7.0 | 14 | 600 | 24 | 0.85 | 0.52 | 14.0 | 0.05 | 10 | 100 | +.085 |
| 1N6331 | 20.0 | 18.5 | 6.2 | 18 | 500 | 21 | 0.95 | 0.47 | 15.0 | 0.05 | 10 | 100 | +.086 |
| 1N6332 | 22.0 | 20.4 | 5.6 | 20 | 500 | 19 | 1.05 | 0.43 | 17.0 | 0.05 | 10 | 100 | +.087 |
| 1N6333 | 24.0 | 22.3 | 5.2 | 24 | 500 | 18 | 1.15 | 0.39 | 18.0 | 0.05 | 10 | 100 | +.088 |
| 1N6334 | 27.0 | 25.2 | 4.6 | 27 | 500 | 16 | 1.30 | 0.35 | 21.0 | 0.05 | 10 | 100 | +.090 |
| 1N6335 | 30.0 | 28.0 | 4.2 | 32 | 500 | 14 | 1.45 | 0.31 | 23.0 | 0.05 | 10 | 100 | +.091 |
| 1N6336 | 33.0 | 30.9 | 3.8 | 40 | 600 | 13 | 1.60 | 0.28 | 25.0 | 0.05 | 10 | 100 | +.092 |
| 1N6337 | 36.0 | 33.7 | 3.4 | 50 | 600 | 12 | 1.75 | 0.260 | 27.0 | 0.05 | 10 | 100 | +.093 |
| 1N6338 | 39.0 | 36.6 | 3.2 | 55 | 700 | 11 | 1.90 | 0.240 | 30 | 0.05 | 10 | 100 | +.094 |
| 1N6339 | 43.0 | 40.4 | 3.0 | 65 | 800 | 9.9 | 2.10 | 0.220 | 33 | 0.05 | 10 | 80 | +.095 |
| 1N6340 | 47.0 | 44.2 | 2.7 | 75 | 900 | 9.0 | 2.25 | 0.200 | 36 | 0.05 | 10 | 80 | +.095 |
| 1N6341 | 51.0 | 48.0 | 2.5 | 85 | 1,000 | 8.3 | 2.50 | 0.180 | 39 | 0.05 | 10 | 80 | +.096 |
| 1N6342 | 56.0 | 52.7 | 2.2 | 100 | 1,200 | 7.6 | 2.70 | 0.170 | 43 | 0.05 | 10 | 80 | +.097 |
| 1N6343 | 62.0 | 58.4 | 2.0 | 125 | 1,300 | 6.8 | 2.90 | 0.150 | 47 | 0.05 | 10 | 80 | +.099 |
| 1N6344 | 68.0 | 64.1 | 1.8 | 155 | 1,500 | 6.3 | 3.20 | 0.130 | 52 | 0.05 | 10 | 80 | +.101 |
| 1N6345 | 75.0 | 70.8 | 1.7 | 180 | 1,600 | 5.7 | 3.40 | 0.125 | 56 | 0.05 | 10 | 80 | +.103 |
| 1N6346 | 82.0 | 77.4 | 1.5 | 220 | 1,800 | 5.2 | 3.80 | 0.115 | 62 | 0.05 | 10 | 80 | +.105 |
| 1N6347 | 91.0 | 86.0 | 1.4 | 270 | 2,100 | 4.7 | 4.20 | 0.100 | 69 | 0.05 | 10 | 80 | +.108 |
| 1N6348 | 100.0 | 94.5 | 1.3 | 340 | 2,400 | 4.3 | 4.40 | 0.095 | 76 | 0.05 | 10 | 80 | +.110 |
| 1N6349 | 110.0 | 104.0 | 1.1 | 500 | 2,800 | 3.9 | 4.80 | 0.085 | 84 | 0.05 | 10 | 80 | +.110 |
| 1N6350 | 120.0 | 113.0 | 1.0 | 600 | 3,200 | 3.5 | 5.20 | 0.080 | 91 | 0.05 | 10 | 80 | +.110 |
| 1N6351 | 130.0 | 122 | 0.95 | 850 | 4,100 | 3.3 | 5.60 | 0.070 | 99 | 0.05 | 10 | 80 | +.110 |
| 1N6352 | 150.0 | 141 | 0.85 | 1,000 | 4,500 | 2.8 | 7.00 | 0.065 | 114 | 0.05 | 10 | 80 | +.110 |
| 1N6353 | 160.0 | 151 | 0.80 | 1,200 | 5,000 | 2.7 | 7.50 | 0.060 | 122 | 0.05 | 10 | 80 | +.110 |
| 1N6354 | 180.0 | 170 | 0.68 | 1,500 | 5,600 | 2.4 | 9.00 | 0.050 | 137 | 0.05 | 10 | 80 | +.110 |
| 1N6355 | 200.0 | 189 | 0.65 | 1,800 | 6,500 | 2.1 | 12.00 | 0.045 | 152 | 0.05 | 10 | 80 | +.110 |

NOTES:

- Standard voltage tolerance is 5 percent. Tighter tolerances are available in plus/minus 1 and 2 percent voltage tolerances. (See [part nomenclature](#).)
- Voltage regulation V_{Z(reg)} is the measured voltage change at thermal equilibrium between the current of 10% and 50% of maximum Zener current I_{ZM} when the lead temperature is maintained at 25 °C =+8 °C, -2 °C.

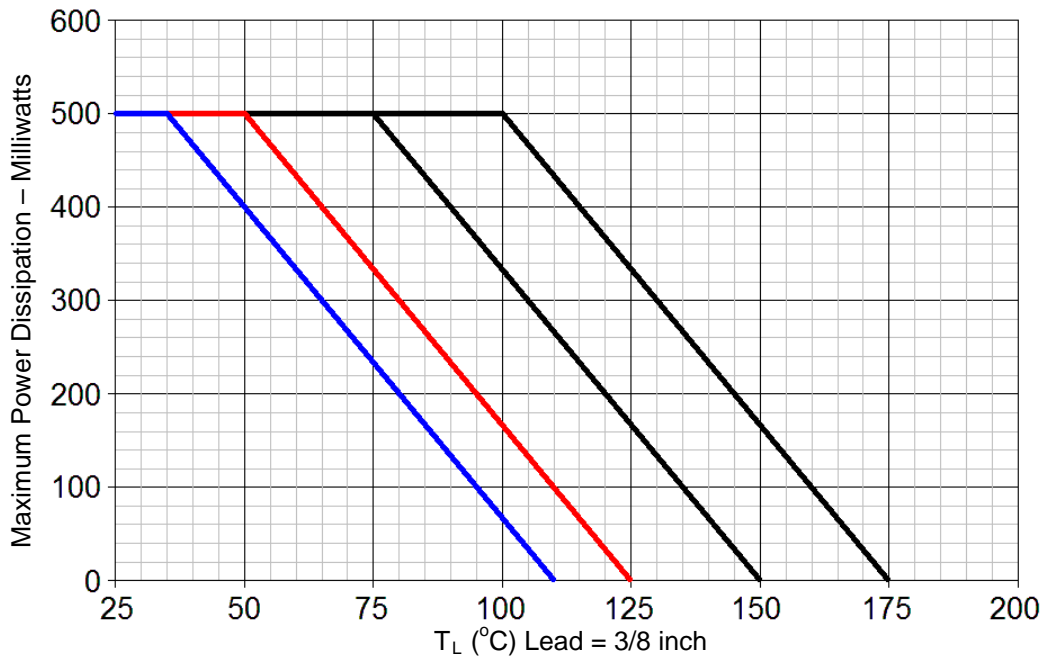
GRAPHS


FIGURE 1 - (1N6309 – 1N6320)
 T_L Temperature-Power Derating Curve
 $R_{\theta JL}$ 3/8 inch = 150 °C/W (dc operation)

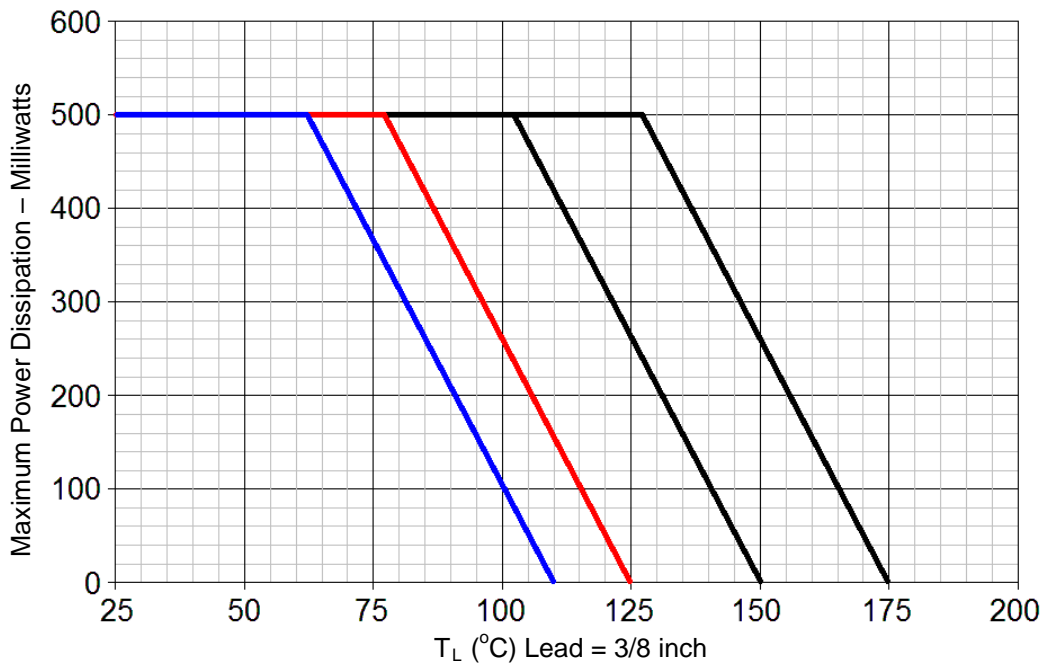


FIGURE 2 - (1N6321 – 1N6355)
 T_L Temperature-Power Derating Curve
 $R_{\theta JL}$ 3/8 inch = 95.5 °C/W (dc operation)

GRAPHS (continued)

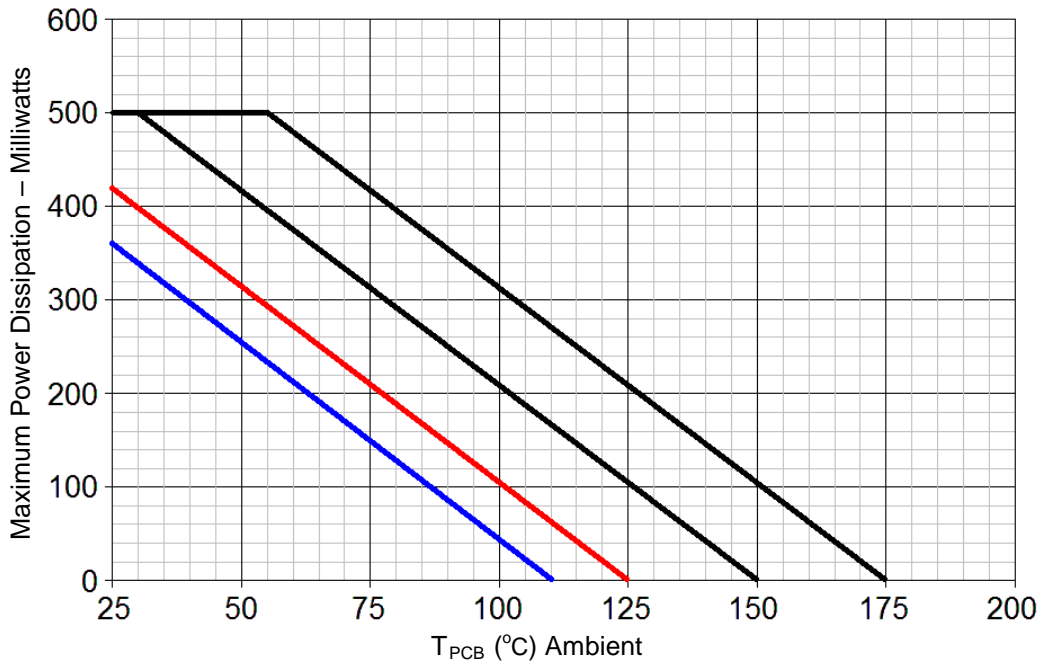
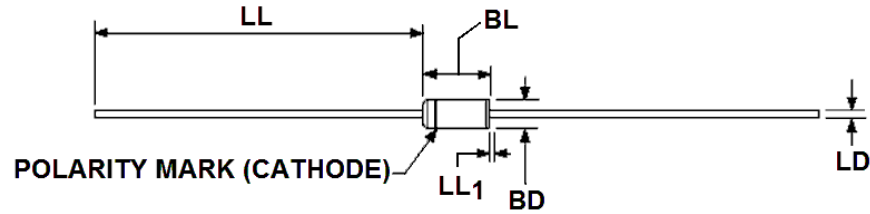


FIGURE 3
Temperature-Power Derating Curve
R_{θJA} = 240 °C/W (dc operation)

PACKAGE DIMENSIONS

NOTE:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Lead diameter not controlled in this zone to allow for flash.
Lead finish build-up and minor irregularities other than slugs.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.
5. The BL dimension shall include the entire body including slugs.

| Ltr | DIMENSIONS | | | | Notes |
|------------|------------|-------|-------------|-------|-------|
| | INCH | | MILLIMETERS | | |
| | Min | Max | Min | Max | |
| BD | .060 | .090 | 1.52 | 2.29 | |
| BL | .120 | .200 | 3.05 | 5.08 | 5 |
| LD | .018 | .022 | 0.46 | 0.56 | |
| LL | 1.000 | 1.500 | 25.40 | 38.10 | |
| LL1 | | .050 | | 1.27 | 3 |

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