



Silicon 500 mW Zener Diodes

Qualified per MIL-PRF-19500/117

Qualified Levels:*
JAN, JANTX, and JANTXV

DESCRIPTION

The popular 1N957B-1 through 1N992B-1 series of 0.5 watt Zener voltage regulators provides a selection from 6.8 to 200 volts in a standard 5%, 2% and 1% tolerance versions. These axial-leaded glass DO-35 Zeners feature an internal metallurgical bond and are available in military qualified and commercial RoHS compliant versions. Military qualified versions are available on the 1N962B-1 through 1N992B-1 range of part numbers.

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

FEATURES

- JEDEC registered 1N957B to 1N992B number series.
- Internal metallurgical bond.
- *JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/117 for part numbers 1N962B-1 thru 1N992B-1.
- Upscreening is available in reference to MIL-PRF-19500 for the range of 1N957B-1 through 1N961B-1.
(See [part nomenclature](#) for all available options.)
- RoHS compliant versions available (commercial grade only).

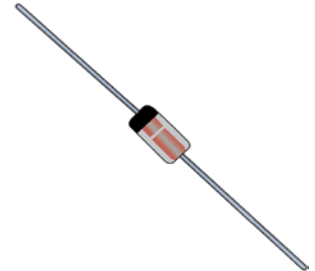
APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 6.8 to 200 V.
- Standard voltage tolerance is $\pm 5\%$ with optional tighter tolerances of $\pm 2\%$ or 1% .
- Flexible axial-lead mounting terminals.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Minimal capacitance.
- Inherently radiation hard as described in Microsemi [MicroNote 050](#).

MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | Value | Unit |
|---|---------------------|-------------|---------------|
| Operating and Storage Temperature | T_J and T_{STG} | -65 to +175 | $^{\circ}C$ |
| Thermal Resistance Junction-to-Lead @ .375 inch (9.53 mm) lead length from body | $R_{\theta JL}$ | 250 | $^{\circ}C/W$ |
| Thermal Resistance Junction-to-Ambient when mounted on PCB ⁽¹⁾ | $R_{\theta JA}$ | 300 | $^{\circ}C/W$ |
| Steady-State Power Dissipation @ $T_L = +50^{\circ}C$.375 inch (9.53 mm) from body ⁽²⁾ @ $T_A = 55^{\circ}C$ mounted on PCB | P_D | 0.5 0.4 | W |
| Forward Voltage @ $I_F = 200$ mA 1N957 – 1N985 1N986 – 1N992 | V_F | 1.1 1.3 | V |
| Solder Temperature @ 10 s | T_{SP} | 260 | $^{\circ}C$ |


- NOTES:**
1. See [figures 1 and 2](#) for derating curves. $T_A = +75^{\circ}C$ on an FR4 PC board with 1 oz copper metalization.
 2. Both ends of case or diode body to heat sink at $L = .375$ inch (9.53 mm). Derate I_Z to 0.0 mA at $+175^{\circ}C$.



**DO-35 (DO-204AH)
Package**

Also available in:

DO-213AA package
(MELF surface mount)

 [1N957BUR-1 – 1N992BUR-1](#)

MSC – Lawrence

6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
Fax: (978) 689-0803

MSC – Ireland

Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:

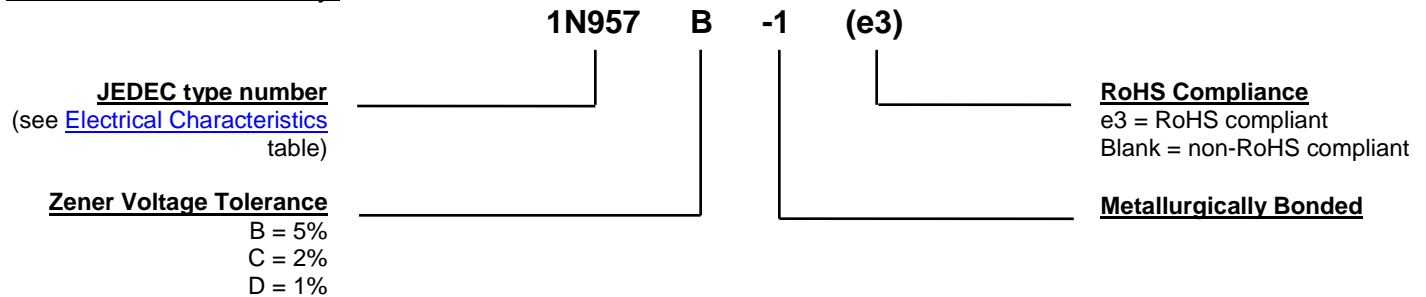
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MECHANICAL and PACKAGING

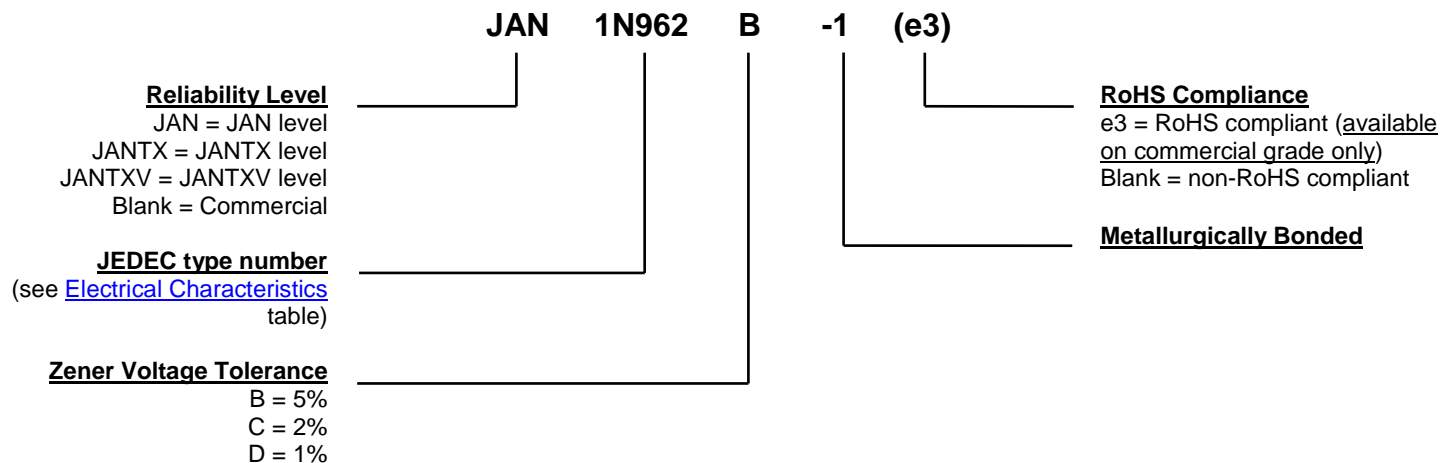
- CASE: Hermetically sealed axial-lead glass DO-35 (DO-204 AH) package.
- TERMINALS: Tin-lead (Sn/Pb) or RoHS compliant annealed matte-tin plating (on commercial grade only). Solderable per MIL-STD-750, method 2026.
- MARKING: Part number.
- POLARITY: Cathode indicated by band. Diode to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: 0.2 grams
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE

1N957B-1 – 1N961B-1 only:



1N962B-1 – 1N992B-1 only:



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_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

| JEDEC TYPE NUMBER (NOTE 1) | NOMINAL ZENER VOLTAGE (NOTE 2) | ZENER TEST CURRENT | MAXIMUM ZENER IMPEDANCE Z_{ZT} | | | MAXIMUM DC ZENER CURRENT (NOTE 4) | MAXIMUM SURGE CURRENT (NOTE 5) | MAXIMUM REVERSE LEAKAGE CURRENT | | MAXIMUM TEMPERATURE COEFFICIENT |
|----------------------------|--------------------------------|--------------------|----------------------------------|----------|------------|-----------------------------------|--------------------------------|---------------------------------|---------|---------------------------------|
| | V_Z | I_{ZT} | Z_Z | Z_{ZK} | @ I_{ZK} | I_{ZM} | I_{ZSM} | I_R | @ V_R | α_{vz} |
| | Volts | mA | Ohms | Ohms | μA | mA | mA | μA | Volts | %/°C |
| 1N957B-1 | 6.8 | 18.5 | 4.5 | 700 | 250 | 55 | 300 | 150 | 5.2 | +0.050 |
| 1N958B-1 | 7.5 | 16.5 | 5.5 | 700 | 250 | 50 | 275 | 75 | 5.7 | +0.058 |
| 1N959B-1 | 8.2 | 15.0 | 6.5 | 700 | 250 | 45 | 250 | 50 | 6.2 | +0.065 |
| 1N960B-1 | 9.1 | 14.0 | 7.5 | 700 | 250 | 41 | 225 | 25 | 6.9 | +0.068 |
| 1N961B-1 | 10 | 12.5 | 8.5 | 700 | 250 | 38 | 200 | 10 | 7.6 | +0.075 |
| 1N962B-1 | 11 | 11.5 | 9.5 | 700 | 250 | 35 | 590 | 1.0 | 8.4 | +0.073 |
| 1N963B-1 | 12 | 10.5 | 11.5 | 700 | 250 | 32 | 540 | 1.0 | 9.1 | +0.076 |
| 1N964B-1 | 13 | 9.5 | 13.0 | 700 | 250 | 30 | 500 | 0.5 | 9.9 | +0.079 |
| 1N965B-1 | 15 | 8.5 | 16 | 700 | 250 | 26 | 433 | 0.5 | 11 | +0.082 |
| 1N966B-1 | 16 | 7.8 | 17 | 700 | 250 | 25 | 406 | 0.5 | 12 | +0.083 |
| 1N967B-1 | 18 | 7.0 | 21 | 750 | 250 | 21 | 361 | 0.5 | 14 | +0.085 |
| 1N968B-1 | 20 | 6.2 | 25 | 750 | 250 | 19 | 325 | 0.5 | 15 | +0.086 |
| 1N969B-1 | 22 | 5.6 | 29 | 750 | 250 | 17 | 295 | 0.5 | 17 | +0.087 |
| 1N970B-1 | 24 | 5.2 | 33 | 750 | 250 | 16 | 271 | 0.5 | 18 | +0.088 |
| 1N971B-1 | 27 | 4.6 | 41 | 750 | 250 | 14 | 240 | 0.5 | 21 | +0.090 |
| 1N972B-1 | 30 | 4.2 | 49 | 1000 | 250 | 13 | 216 | 0.5 | 23 | +0.091 |
| 1N973B-1 | 33 | 3.8 | 58 | 1000 | 250 | 12 | 197 | 0.5 | 25 | +0.092 |
| 1N974B-1 | 36 | 3.4 | 70 | 1000 | 250 | 11 | 180 | 0.5 | 27 | +0.093 |
| 1N975B-1 | 39 | 3.2 | 80 | 1000 | 250 | 9.1 | 166 | 0.5 | 30 | +0.094 |
| 1N976B-1 | 43 | 3.0 | 93 | 1000 | 250 | 8.8 | 151 | 0.5 | 33 | +0.095 |
| 1N977B-1 | 47 | 2.7 | 105 | 1500 | 250 | 7.9 | 138 | 0.5 | 36 | +0.095 |
| 1N978B-1 | 51 | 2.5 | 125 | 1500 | 250 | 7.4 | 127 | 0.5 | 39 | +0.096 |
| 1N979B-1 | 56 | 2.2 | 150 | 2000 | 250 | 6.9 | 116 | 0.5 | 43 | +0.096 |
| 1N980B-1 | 62 | 2.0 | 185 | 2000 | 250 | 6.0 | 105 | 0.5 | 47 | +0.097 |
| 1N981B-1 | 68 | 1.8 | 230 | 2000 | 250 | 5.5 | 95 | 0.5 | 52 | +0.097 |
| 1N982B-1 | 75 | 1.7 | 270 | 2000 | 250 | 5.1 | 86 | 0.5 | 56 | +0.098 |
| 1N983B-1 | 82 | 1.5 | 330 | 3000 | 250 | 4.6 | 79 | 0.5 | 62 | +0.098 |
| 1N984B-1 | 91 | 1.4 | 400 | 3000 | 250 | 4.2 | 71 | 0.5 | 69 | +0.099 |
| 1N985B-1 | 100 | 1.3 | 500 | 3000 | 250 | 3.7 | 65 | 0.5 | 76 | +0.110 |
| 1N986B-1 | 110 | 1.1 | 750 | 4000 | 250 | 3.3 | 59 | 0.5 | 84 | +0.110 |
| 1N987B-1 | 120 | 1.0 | 900 | 4500 | 250 | 3.1 | 54 | 0.5 | 91 | +0.110 |
| 1N988B-1 | 130 | 0.95 | 1100 | 5000 | 250 | 2.7 | 50 | 0.5 | 99 | +0.110 |
| 1N989B-1 | 150 | 0.85 | 1500 | 6000 | 250 | 2.4 | 43 | 0.5 | 114 | +0.110 |
| 1N990B-1 | 160 | 0.80 | 1700 | 6500 | 250 | 2.2 | 40 | 0.5 | 122 | +0.110 |
| 1N991B-1 | 180 | 0.68 | 2200 | 7100 | 250 | 2.0 | 36 | 0.5 | 137 | +0.110 |
| 1N992B-1 | 200 | 0.65 | 2500 | 8000 | 250 | 1.8 | 32 | 0.5 | 152 | +0.110 |

NOTES:

- The JEDEC type numbers shown (B suffix) have a $\pm 5\%$ tolerance on nominal Zener voltage. The suffix C will have $\pm 2\%$ tolerance; and suffix D will have $\pm 1\%$ tolerance.
- 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 0.375" and 0.500" from the body. Mounting clips shall be maintained at temperature of $25 \pm 8/ - 2^\circ C$.
- 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.
- The values of I_{ZM} are calculated for a $\pm 5\%$ 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 $75^\circ C$ lead temperature at 3/8" from body.
- The surge for I_{ZSM} is a square wave or equivalent half-sine wave pulse of 1/120 sec. duration.

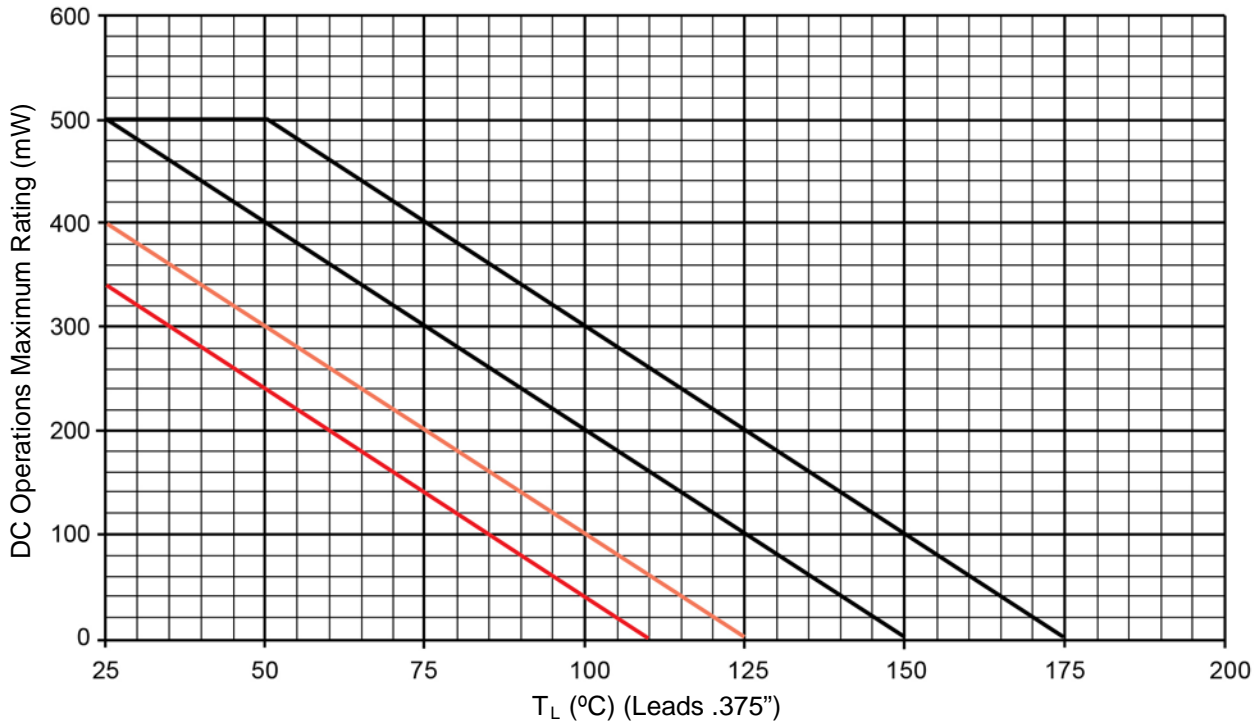
GRAPHS


FIGURE 1
Temperature-Power Derating Curve

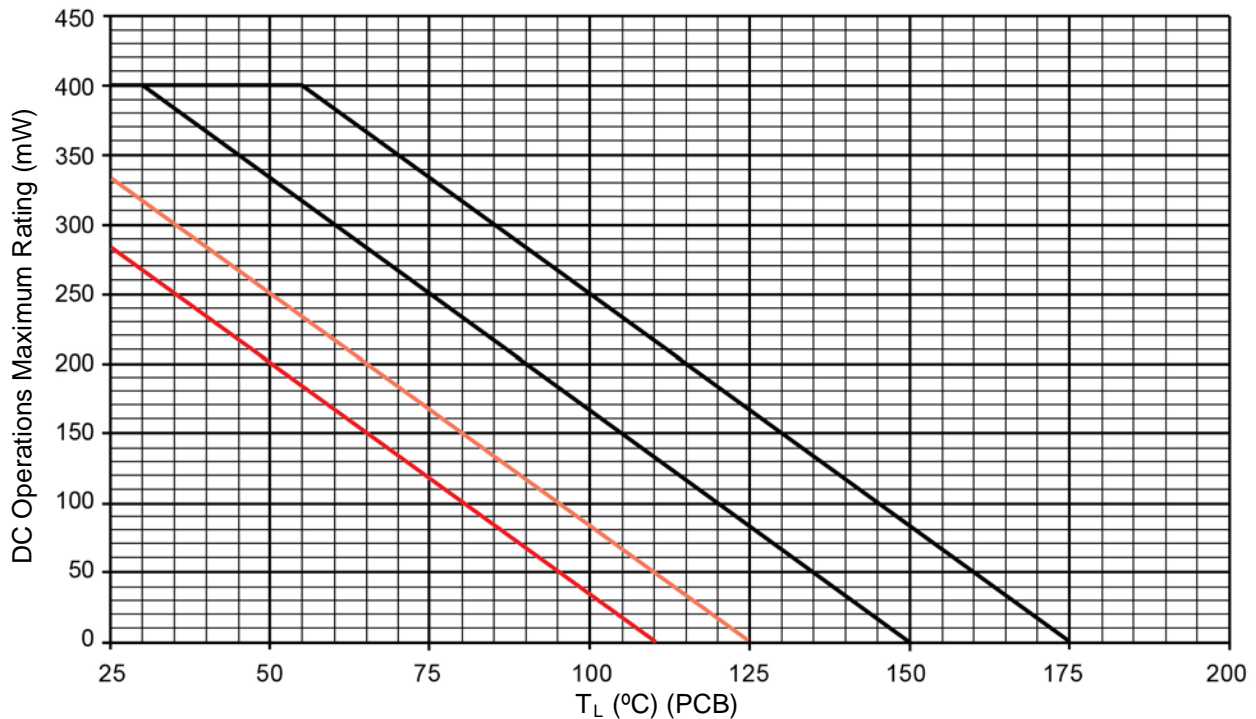


FIGURE 2
Temperature-Power Derating Curve (PCB mount)

GRAPHS

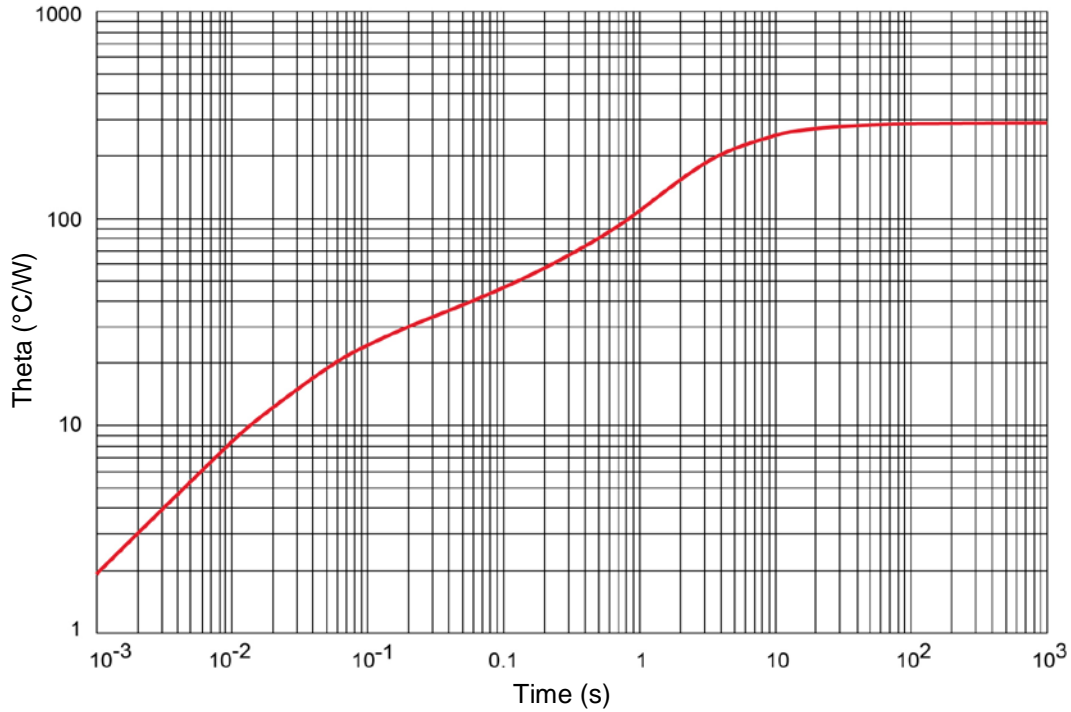


FIGURE 3
Thermal Impedance PCB mount

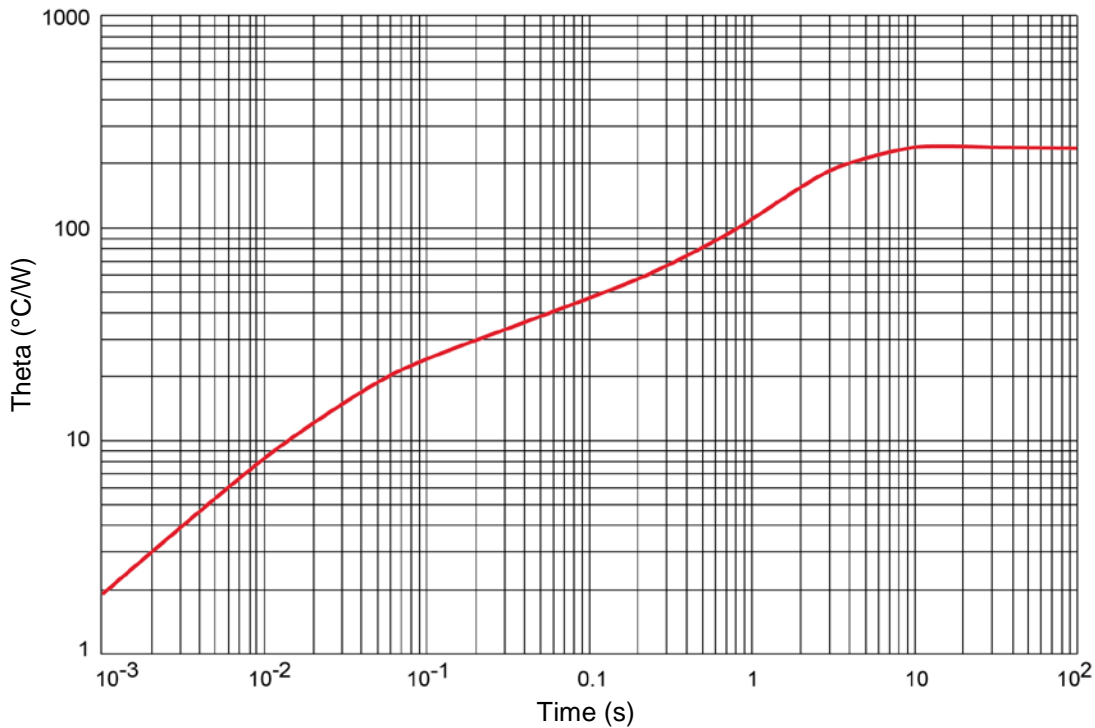
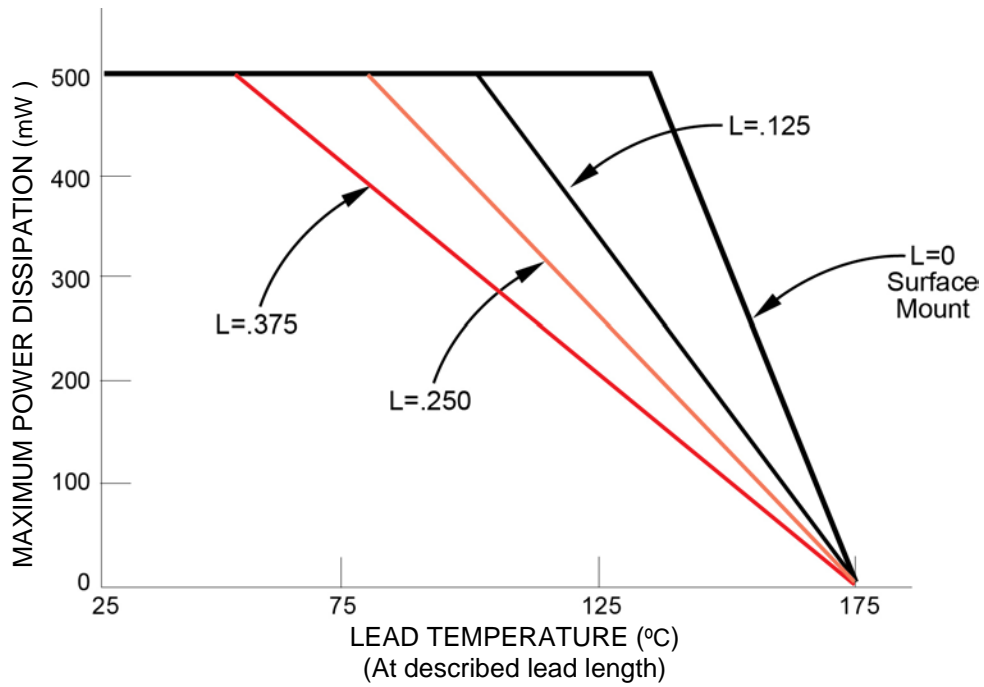


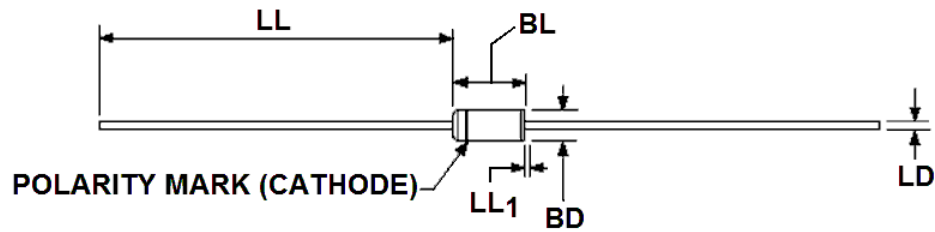
FIGURE 4
Thermal Impedance

GRAPHS



| Inches | Millimeters |
|--------|-------------|
| .000 | 0.00 |
| .125 | 3.18 |
| .250 | 6.35 |
| .375 | 9.53 |

FIGURE 5
Maximum Power vs Lead Temperature And Lead Length.

PACKAGE DIMENSIONS


| Ltr | Dimensions | | | | Notes |
|-----------------------|------------|-------|-------------|-------|-------|
| | Inch | | Millimeters | | |
| | Min | Max | Min | Max | |
| BD | .055 | .090 | 1.40 | 2.29 | 3 |
| BL | .120 | .200 | 3.05 | 5.08 | 3 |
| LD | .018 | .022 | 0.46 | 0.56 | |
| LL | 1.000 | 1.500 | 25.40 | 38.10 | |
| LL₁ | | .050 | | 1.27 | 4 |

NOTES:

1. Dimensions are in inch.
2. Millimeters are given for general information only.
3. Package contour optional within BD and length BL. Heat slugs, if any, shall be included within this cylinder but shall not be subject to minimum limit of LD. The BL dimension shall include the entire body including slugs.
4. Within LL₁ lead, diameter may vary to allow for flash, lead finish build-up, and minor irregularities other than heat slugs.
5. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.