



## VOIDLESS HERMETICALLY SEALED SURFACE MOUNT 1.5 WATT GLASS ZENER DIODES

*Qualified per MIL-PRF-19500/406*

Qualified Levels:  
JAN, JANTX,  
JANTXV and JANS

### DESCRIPTION

This surface mount, Zener voltage regulator series is military qualified to MIL-PRF-19500/406 and is ideal for high-reliability applications where a failure cannot be tolerated. These industry-recognized 1.5 watt Zener voltage regulators are hermetically sealed with void-less glass construction using an internal metallurgical bond. It includes Zener selections from 3.3 to 200 volts in standard 5% tolerance. 1% and 2% tolerance versions are also available. Microsemi also offers numerous other Zener products to meet higher and lower power ratings in both thru-hole and surface mount packages.

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

### FEATURES

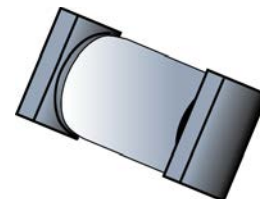
- Surface mount equivalent of popular JEDEC registered series.
- Void-less hermetically sealed glass package.
- Triple-layer passivation.
- Extremely robust construction.
- Internal "Category 1" metallurgical bonds for 1N4462US thru 1N4496US and "Category III" for 1N6485US thru 1N6491US as well as 1N4460US and 1N4461US.
- JAN, JANTX, JANTXV and JANS qualifications are available per MIL-PRF-19500/406.
- RoHS compliant versions available (commercial grade only).

### APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Extensive selection from 3.3 to 200 V.
- Standard voltage tolerances are plus/minus 5% with no suffix.
- Tighter tolerances available in plus or minus 2% or 1%.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Inherently radiation hard as described in Microsemi [MicroNote 050](#).

### MAXIMUM RATINGS @ $T_A = 25^\circ\text{C}$ unless otherwise specified

| Parameters/Test Conditions                                | Symbol            | Value                                                                            | Unit               |
|-----------------------------------------------------------|-------------------|----------------------------------------------------------------------------------|--------------------|
| Junction and Storage Temperature                          | $T_J$ & $T_{STG}$ | -65 to +175                                                                      | $^\circ\text{C}$   |
| Steady State Power Dissipation @ $T_A = 25^\circ\text{C}$ | $P_D$             | 1.5                                                                              | W                  |
| Thermal Resistance Junction-to-End Cap                    | $R_{\theta JEC}$  | 20                                                                               | $^\circ\text{C/W}$ |
| Thermal Impedance @ 10 ms                                 | $Z_{\theta JX}$   | <a href="#">Figure 3</a><br><a href="#">Figure 4</a><br><a href="#">Figure 4</a> | $^\circ\text{C/W}$ |
| Forward Voltage @ 200 mA<br>@ 1.0 A                       | $V_F$             | 1.0<br>1.5                                                                       | V                  |
| Solder Temperature @ 10 s                                 | $T_{SP}$          | 260                                                                              | $^\circ\text{C}$   |



### "A" (D-5A) MELF Package

Also available in:

 **DO-41 Package**  
(axial-lead)  
[1N4460 – 1N4496 and](#)  
[1N6485 – 1N6491](#)

#### MSC – Lawrence

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

#### MSC – Ireland

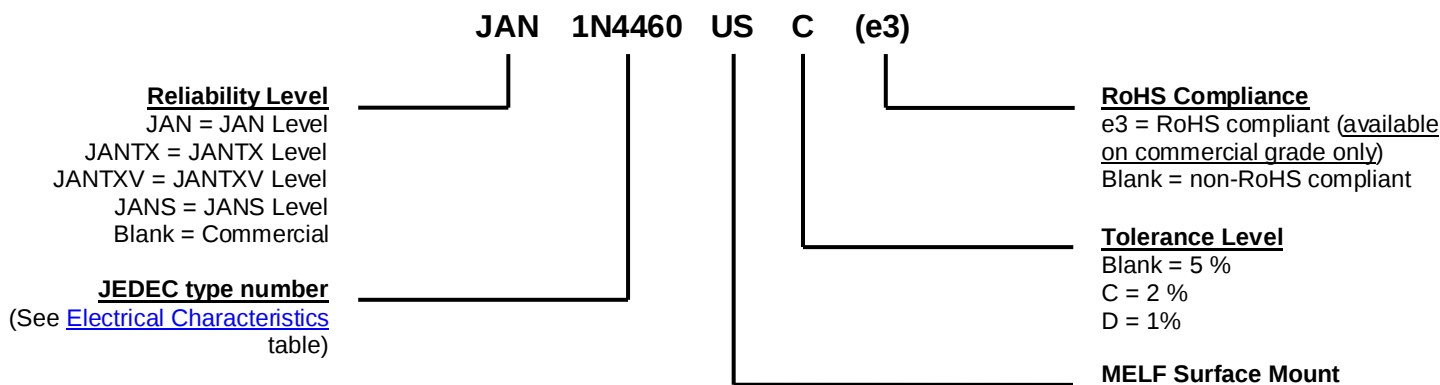
Gort Road Business Park,  
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**Website:**  
[www.microsemi.com](http://www.microsemi.com)

### MECHANICAL and PACKAGING

- CASE: Hermetically sealed voidless hard glass with tungsten slugs.
- TERMINALS: Tin/lead (Sn/Pb) or RoHS compliant matte/tin (commercial grade only) over copper.
- MARKING: Polarity band only.
- POLARITY: Cathode indicated by band.
- TAPE & REEL option: Standard per EIA-481-B. Consult factory for quantities.
- WEIGHT: 193 milligrams.
- See [Package Dimensions](#) on last page.

### PART NOMENCLATURE



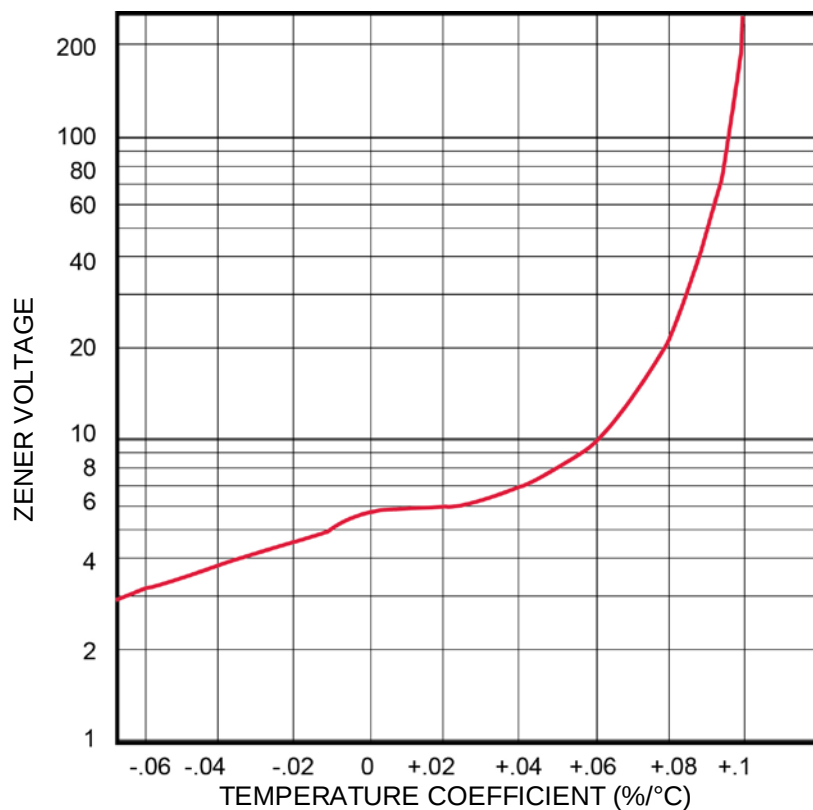
### SYMBOLS & DEFINITIONS

| Symbol                | Definition                                                                                                                                                                                                                                      |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $V_Z$                 | Zener Voltage: The Zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.                                                                                                                              |
| $I_Z, I_{ZT}, I_{ZK}$ | Regulator Current: The dc regulator current ( $I_Z$ ), at a specified test point ( $I_{ZT}$ ), near breakdown knee ( $I_{ZK}$ ).                                                                                                                |
| $Z_{ZT}$ 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. |
| $V_F$                 | Maximum Forward Voltage: The maximum forward voltage the device will exhibit at a specified current.                                                                                                                                            |
| $I_R$                 | Maximum Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature.                                                                                                                         |
| $I_{ZM}$              | 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.                                                                                                                                     |

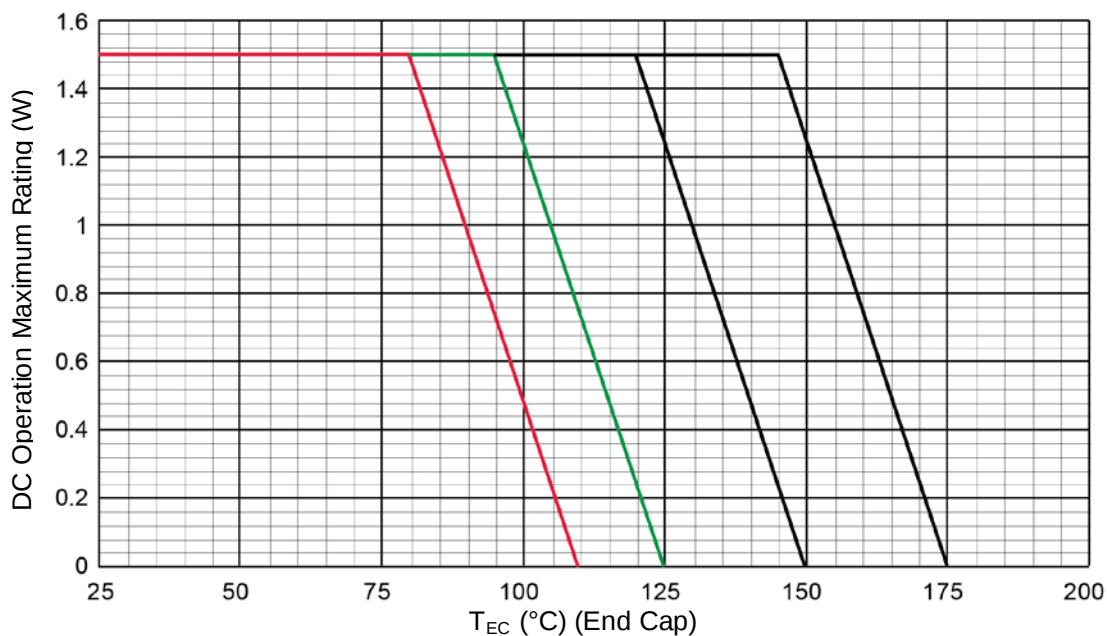
**ELECTRICAL CHARACTERISTICS @ 25 °C Case temperature**

| TYPE     | NOMINAL<br>ZENER<br>VOLTAGE<br>$V_Z$ | TEST<br>CURRENT<br>$I_{ZT}$ | MAXIMUM<br>DYNAMIC<br>IMPEDANCE<br>$Z_{ZT} @ I_{ZT}$ | MAXIMUM KNEE<br>IMPEDANCE<br>$Z_{ZK} @ I_{ZK}$ |     | MAXIMUM<br>REVERSE<br>CURRENT<br>$I_R @ V_R$ |       | MAXIMUM<br>CONTINUOUS<br>CURRENT<br>$I_{ZM}$<br>(Note 1) | SURGE<br>CURRENT<br>@ 8.3 ms<br>square wave<br>$I_{ZSM}$ |
|----------|--------------------------------------|-----------------------------|------------------------------------------------------|------------------------------------------------|-----|----------------------------------------------|-------|----------------------------------------------------------|----------------------------------------------------------|
|          | Volts                                | mA                          | Ohms                                                 | Ohms                                           | mA  | $\mu A$                                      | Volts | mA                                                       | Amps                                                     |
| 1N4460US | 6.2                                  | 40.0                        | 4                                                    | 200                                            | 1.0 | 10.0                                         | 3.72  | 230                                                      | 2.3                                                      |
| 1N4461US | 6.8                                  | 37.0                        | 2.5                                                  | 200                                            | 1.0 | 5.0                                          | 4.08  | 210                                                      | 2.1                                                      |
| 1N4462US | 7.5                                  | 34.0                        | 2.5                                                  | 400                                            | .5  | 1.0                                          | 4.50  | 191                                                      | 1.9                                                      |
| 1N4463US | 8.2                                  | 31.0                        | 3                                                    | 400                                            | .5  | .50                                          | 4.92  | 174                                                      | 1.7                                                      |
| 1N4464US | 9.1                                  | 28.0                        | 4                                                    | 500                                            | .5  | .30                                          | 5.46  | 157                                                      | 1.6                                                      |
| 1N4465US | 10.0                                 | 25.0                        | 5                                                    | 500                                            | .25 | .30                                          | 8.00  | 143                                                      | 1.4                                                      |
| 1N4466US | 11.0                                 | 23.0                        | 6                                                    | 550                                            | .25 | .30                                          | 8.80  | 130                                                      | 1.3                                                      |
| 1N4467US | 12.0                                 | 21.0                        | 7                                                    | 550                                            | .25 | .20                                          | 9.60  | 119                                                      | 1.2                                                      |
| 1N4468US | 13.0                                 | 19.0                        | 8                                                    | 550                                            | .25 | .05                                          | 10.4  | 110                                                      | 1.1                                                      |
| 1N4469US | 15.0                                 | 17.0                        | 9                                                    | 600                                            | .25 | .05                                          | 12.0  | 95                                                       | .95                                                      |
| 1N4470US | 16.0                                 | 15.5                        | 10                                                   | 600                                            | .25 | .05                                          | 12.8  | 90                                                       | .90                                                      |
| 1N4471US | 18.0                                 | 14.0                        | 11                                                   | 650                                            | .25 | .05                                          | 14.4  | 79                                                       | .79                                                      |
| 1N4472US | 20.0                                 | 12.5                        | 12                                                   | 650                                            | .25 | .05                                          | 16.0  | 71                                                       | .71                                                      |
| 1N4473US | 22.0                                 | 11.5                        | 14                                                   | 650                                            | .25 | .05                                          | 17.6  | 65                                                       | .65                                                      |
| 1N4474US | 24.0                                 | 10.5                        | 16                                                   | 700                                            | .25 | .05                                          | 19.2  | 60                                                       | .60                                                      |
| 1N4475US | 27.0                                 | 9.5                         | 18                                                   | 700                                            | .25 | .05                                          | 21.6  | 53                                                       | .53                                                      |
| 1N4476US | 30.0                                 | 8.5                         | 20                                                   | 750                                            | .25 | .05                                          | 24.0  | 48                                                       | .48                                                      |
| 1N4477US | 33.0                                 | 7.5                         | 25                                                   | 800                                            | .25 | .05                                          | 26.4  | 43                                                       | .43                                                      |
| 1N4478US | 36.0                                 | 7.0                         | 27                                                   | 850                                            | .25 | .05                                          | 28.8  | 40                                                       | .40                                                      |
| 1N4479US | 39.0                                 | 6.5                         | 30                                                   | 900                                            | .25 | .05                                          | 31.2  | 37                                                       | .37                                                      |
| 1N4480US | 43.0                                 | 6.0                         | 40                                                   | 950                                            | .25 | .05                                          | 34.4  | 33                                                       | .33                                                      |
| 1N4481US | 47.0                                 | 5.5                         | 50                                                   | 1000                                           | .25 | .05                                          | 37.6  | 30                                                       | .30                                                      |
| 1N4482US | 51.0                                 | 5.0                         | 60                                                   | 1100                                           | .25 | .05                                          | 40.8  | 28                                                       | .28                                                      |
| 1N4483US | 56.0                                 | 4.5                         | 70                                                   | 1300                                           | .25 | .25                                          | 44.8  | 26                                                       | .26                                                      |
| 1N4484US | 62.0                                 | 4.0                         | 80                                                   | 1500                                           | .25 | .25                                          | 49.6  | 23                                                       | .23                                                      |
| 1N4485US | 68.0                                 | 3.7                         | 100                                                  | 1700                                           | .25 | .25                                          | 54.4  | 21                                                       | .21                                                      |
| 1N4486US | 75.0                                 | 3.3                         | 130                                                  | 2000                                           | .25 | .25                                          | 60.0  | 19                                                       | .19                                                      |
| 1N4487US | 82.0                                 | 3.0                         | 160                                                  | 2500                                           | .25 | .25                                          | 65.6  | 17                                                       | .17                                                      |
| 1N4488US | 91.0                                 | 2.8                         | 200                                                  | 3000                                           | .25 | .25                                          | 72.8  | 16                                                       | .16                                                      |
| 1N4489US | 100.0                                | 2.5                         | 250                                                  | 3100                                           | .25 | .25                                          | 80.0  | 14                                                       | .14                                                      |
| 1N4490US | 110.0                                | 2.3                         | 300                                                  | 4000                                           | .25 | .25                                          | 88.0  | 13                                                       | .13                                                      |
| 1N4491US | 120.0                                | 2.0                         | 400                                                  | 4500                                           | .25 | .25                                          | 96.0  | 12                                                       | .12                                                      |
| 1N4492US | 130.0                                | 1.9                         | 500                                                  | 5000                                           | .25 | .25                                          | 104.0 | 11                                                       | .11                                                      |
| 1N4493US | 150.0                                | 1.7                         | 700                                                  | 6000                                           | .25 | .25                                          | 120.0 | 9.5                                                      | .095                                                     |
| 1N4494US | 160.0                                | 1.6                         | 1000                                                 | 6500                                           | .25 | .25                                          | 128.0 | 8.9                                                      | .089                                                     |
| 1N4495US | 180.0                                | 1.4                         | 1300                                                 | 7000                                           | .25 | .25                                          | 144.0 | 7.9                                                      | .079                                                     |
| 1N4496US | 200.0                                | 1.2                         | 1500                                                 | 8000                                           | .25 | .25                                          | 160.0 | 7.2                                                      | .072                                                     |
| 1N6485US | 3.3                                  | 76.0                        | 10                                                   | 400                                            | 1.0 | 50                                           | 1.0   | 433                                                      | 4.2                                                      |
| 1N6486US | 3.6                                  | 69.0                        | 10                                                   | 400                                            | 1.0 | 50                                           | 1.0   | 397                                                      | 3.9                                                      |
| 1N6487US | 3.9                                  | 64.0                        | 9                                                    | 400                                            | 1.0 | 35                                           | 1.0   | 366                                                      | 3.6                                                      |
| 1N6488US | 4.3                                  | 58.0                        | 9                                                    | 400                                            | 1.0 | 5.0                                          | 1.0   | 332                                                      | 3.3                                                      |
| 1N6489US | 4.7                                  | 53.0                        | 8                                                    | 500                                            | 1.0 | 4.0                                          | 1.0   | 304                                                      | 3.0                                                      |
| 1N6490US | 5.1                                  | 49.0                        | 7                                                    | 500                                            | 1.0 | 1.0                                          | 1.0   | 280                                                      | 2.7                                                      |
| 1N6491US | 5.6                                  | 45.0                        | 5                                                    | 600                                            | 1.0 | 0.5                                          | 2.0   | 255                                                      | 2.5                                                      |

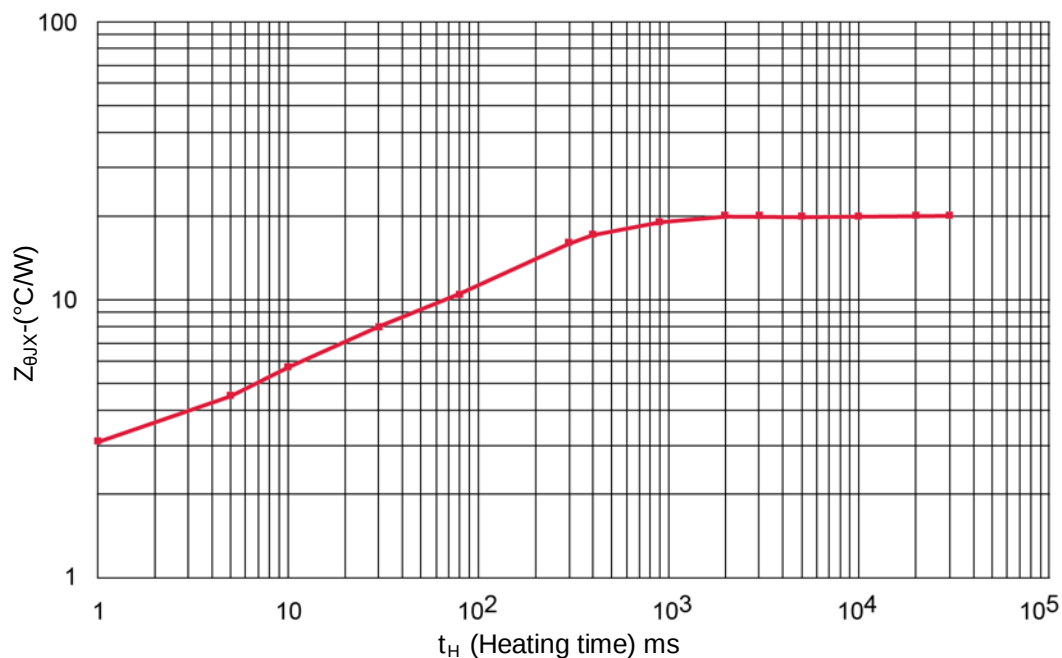
**NOTE:** 1. See "[Maximum Ratings](#)" for  $P_D$  temperature conditions for end-cap package where  $I_{ZM}$  is applicable.

**GRAPHS**


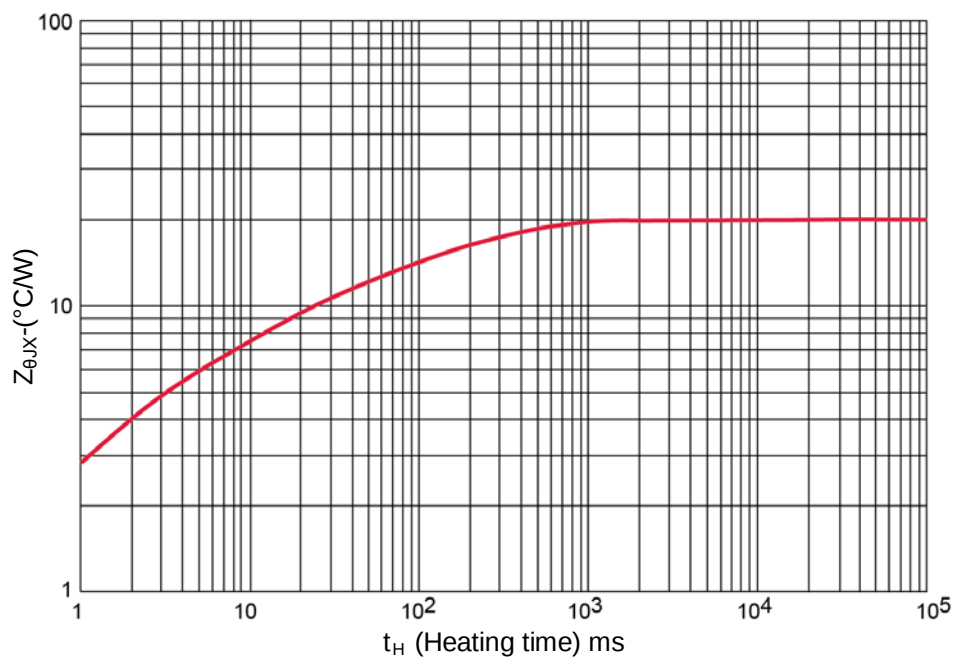
**FIGURE 1**  
Temperature Coefficient Characteristics



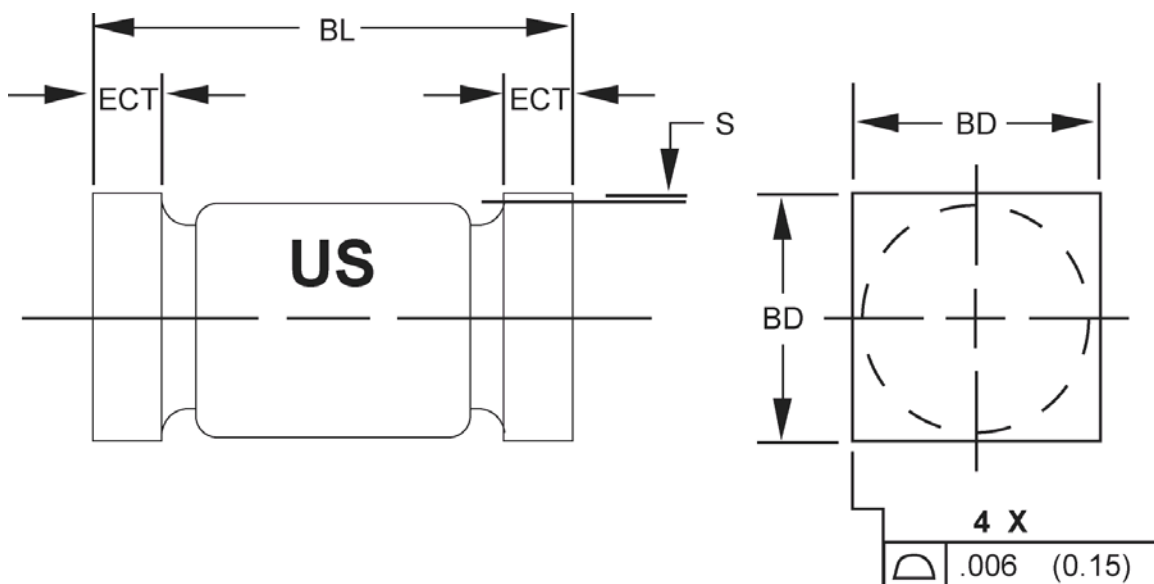
**FIGURE 2**  
Temperature-Power Derating Curve

**GRAPHS (continued)**


**FIGURE 3**  
Thermal Impedance Curve for 1N4462US through 1N4496US

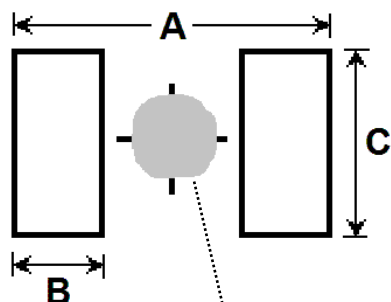


**FIGURE 4**  
Thermal Impedance Curve for 1N6485US through 1N6491US and 1N4460US through 1N4461US

**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions are pre-solder dip.
4. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

| Ltr        | DIMENSIONS |      |             |      |
|------------|------------|------|-------------|------|
|            | INCH       |      | MILLIMETERS |      |
|            | Min        | Max  | Min         | Max  |
| <b>BD</b>  | .091       | .103 | 2.31        | 2.62 |
| <b>BL</b>  | .168       | .200 | 4.28        | 5.08 |
| <b>ECT</b> | .019       | .028 | 0.48        | 0.71 |
| <b>S</b>   | .003       |      | 0.08        |      |
|            |            |      |             |      |

**PAD LAYOUT**


| DIM      | INCH  | MILLIMETERS |
|----------|-------|-------------|
| <b>A</b> | 0.288 | 7.32        |
| <b>B</b> | 0.070 | 1.78        |
| <b>C</b> | 0.155 | 3.94        |

**NOTE:** If mounting requires adhesive separate from the solder, an additional 0.080 inch diameter contact may be placed in the center between the pads as an optional spot for cement.

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[JAN1N4464CUS](#) [JAN1N4476DUS](#) [JAN1N4465DUS](#) [JAN1N4486DUS](#) [JAN1N4492CUS](#) [JAN1N4466CUS](#)  
[JAN1N4495DUS](#) [JAN1N4481DUS](#) [JAN1N4496DUS](#) [JAN1N4462CUS](#) [JAN1N4468CUS](#) [JAN1N4493CUS](#)  
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[JAN1N4488CUS](#) [JAN1N4461CUS](#) [JAN1N4482CUS](#) [JAN1N4473CUS](#) [JAN1N4480CUS](#) [JAN1N4485DUS](#)  
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[1N4467US/TR](#)