# Small Signal Zener Diodes



## FEATURES

- Very sharp reverse characteristic
- Low reverse current level
- Very high stability
- Low noise
- TZMC - $V_Z$-tolerance ± 5 %
- TZMB - $V_Z$-tolerance ± 2 %
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

HALOGEN FREE

## LINKS TO ADDITIONAL RESOURCES

3D Models | Marking | Parametric Search | Order Samples

## APPLICATION

- Voltage stabilization

| PRIMARY CHARACTERISTICS | | |
|---|---|---|
| PARAMETER | VALUE | UNIT |
| $V_Z$ range nom. | 2.4 to 75 | V |
| Test current $I_{ZT}$ | 2.5; 5 | mA |
| $V_Z$ specification | Pulse current | |
| Circuit configuration | Single | |

| ORDERING INFORMATION | | | |
|---|---|---|---|
| DEVICE NAME | ORDERING CODE | TAPED UNITS PER REEL | MINIMUM ORDER QUANTITY |
| TZM-M-series | TZM-M-series-18 | 10 000 (8 mm tape on 13" reel) | 10 000/box |
| TZM-M-series | TZM-M-series-08 | 2500 (8 mm tape on 7" reel) | 12 500/box |

| PACKAGE | | | | |
|---|---|---|---|---|
| PACKAGE NAME | WEIGHT | MOLDING COMPOUND FLAMMABILITY RATING | MOISTURE SENSITIVITY LEVEL | SOLDERING CONDITIONS |
| MiniMELF (SOD-80) | approx. 31 mg | UL 94 V-0 | MSL level 1 (according J-STD-020) | Peak temperature max. 260 °C |

| ABSOLUTE MAXIMUM RATINGS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Power dissipation | $R_{thJA} \leq$ 300K/W | $P_{tot}$ | 500 | mW |
| Zener current | | $I_Z$ | $P_{tot}/V_Z$ | mA |
| Junction to ambient air | On PC board 50 mm x 50 mm x 1.6 mm | $R_{thJA}$ | 500 | K/W |
| Junction temperature | | $T_j$ | 175 | °C |
| Storage temperature range | | $T_{stg}$ | -65 to +175 | °C |
| Forward voltage (max.) | $I_F$ = 200 mA | $V_F$ | 1.5 | V |



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**ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)

| PART NUMBER | ZENER VOLTAGE RANGE | | | TEST CURRENT | | REVERSE LEAKAGE CURRENT | | | | DYNAMIC RESISTANCE | | TEMPERATURE COEFFICIENT OF ZENER VOLTAGE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_Z$ at $I_{ZT1}$ | | | $I_{ZT1}$ | $I_{ZT2}$ | $I_R$ at $V_R$ | | $I_R$ (1) at $V_R$ | | $Z_Z$ at $I_{ZT1}$ | $Z_{ZK}$ at $I_{ZT2}$ | $TK_{VZ}$ | |
| | V | | | mA | | µA | V | µA | V | Ω | | %/K | |
| | MIN. | NOM. | MAX. | | | | | | | TYP. | TYP. | MIN. | MAX. |
| TZMC2V4-M | 2.28 | 2.4 | 2.56 | 5 | 1 | < 50 | 1 | < 100 | 1 | < 85 | < 600 | -0.09 | -0.06 |
| TZMC2V7-M | 2.5 | 2.7 | 2.9 | 5 | 1 | < 10 | 1 | < 50 | 1 | < 85 | < 600 | -0.09 | -0.06 |
| TZMC3V0-M | 2.8 | 3.0 | 3.2 | 5 | 1 | < 4 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMC3V3-M | 3.1 | 3.3 | 3.5 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMC3V6-M | 3.4 | 3.6 | 3.8 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMC3V9-M | 3.7 | 3.9 | 4.1 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMC4V3-M | 4 | 4.3 | 4.6 | 5 | 1 | < 1 | 1 | < 20 | 1 | < 90 | < 600 | -0.06 | -0.03 |
| TZMC4V7-M | 4.4 | 4.7 | 5 | 5 | 1 | < 0.5 | 1 | < 10 | 1 | < 80 | < 600 | -0.05 | 0.02 |
| TZMC5V1-M | 4.8 | 5.1 | 5.4 | 5 | 1 | < 0.1 | 1 | < 2 | 1 | < 60 | < 550 | -0.02 | 0.02 |
| TZMC5V6-M | 5.2 | 5.6 | 6 | 5 | 1 | < 0.1 | 1 | < 2 | 1 | < 40 | < 450 | -0.05 | 0.05 |
| TZMC6V2-M | 5.8 | 6.2 | 6.6 | 5 | 1 | < 0.1 | 2 | < 2 | 2 | < 10 | < 200 | 0.03 | 0.06 |
| TZMC6V8-M | 6.4 | 6.8 | 7.2 | 5 | 1 | < 0.1 | 3 | < 2 | 3 | < 8 | < 150 | 0.03 | 0.07 |
| TZMC7V5-M | 7 | 7.5 | 7.9 | 5 | 1 | < 0.1 | 5 | < 2 | 5 | < 7 | < 50 | 0.03 | 0.07 |
| TZMC8V2-M | 7.7 | 8.2 | 8.7 | 5 | 1 | < 0.1 | 6.2 | < 2 | 6.2 | < 7 | < 50 | 0.03 | 0.08 |
| TZMC9V1-M | 8.5 | 9.1 | 9.6 | 5 | 1 | < 0.1 | 6.8 | < 2 | 6.8 | < 10 | < 50 | 0.03 | 0.09 |
| TZMC10-M | 9.4 | 10 | 10.6 | 5 | 1 | < 0.1 | 7.5 | < 2 | 7.5 | < 15 | < 70 | 0.03 | 0.1 |
| TZMC11-M | 10.4 | 11 | 11.6 | 5 | 1 | < 0.1 | 8.2 | < 2 | 8.2 | < 20 | < 70 | 0.03 | 0.11 |
| TZMC12-M | 11.4 | 12 | 12.7 | 5 | 1 | < 0.1 | 9.1 | < 2 | 9.1 | < 20 | < 90 | 0.03 | 0.11 |
| TZMC13-M | 12.4 | 13 | 14.1 | 5 | 1 | < 0.1 | 10 | < 2 | 10 | < 26 | < 110 | 0.03 | 0.11 |
| TZMC15-M | 13.8 | 15 | 15.6 | 5 | 1 | < 0.1 | 11 | < 2 | 11 | < 30 | < 110 | 0.03 | 0.11 |
| TZMC16-M | 15.3 | 16 | 17.1 | 5 | 1 | < 0.1 | 12 | < 2 | 12 | < 40 | < 170 | 0.03 | 0.11 |
| TZMC18-M | 16.8 | 18 | 19.1 | 5 | 1 | < 0.1 | 13 | < 2 | 13 | < 50 | < 170 | 0.03 | 0.11 |
| TZMC20-M | 18.8 | 20 | 21.2 | 5 | 1 | < 0.1 | 15 | < 2 | 15 | < 55 | < 220 | 0.03 | 0.11 |
| TZMC22-M | 20.8 | 22 | 23.3 | 5 | 1 | < 0.1 | 16 | < 2 | 16 | < 55 | < 220 | 0.04 | 0.12 |
| TZMC24-M | 22.8 | 24 | 25.6 | 5 | 1 | < 0.1 | 18 | < 2 | 18 | < 80 | < 220 | 0.04 | 0,12 |
| TZMC27-M | 25.1 | 27 | 28.9 | 5 | 1 | < 0.1 | 20 | < 2 | 20 | < 80 | < 220 | 0.04 | 0.12 |
| TZMC30-M | 28 | 30 | 32 | 5 | 1 | < 0.1 | 22 | < 2 | 22 | < 80 | < 220 | 0.04 | 0.12 |
| TZMC33-M | 31 | 33 | 35 | 5 | 1 | < 0.1 | 24 | < 2 | 24 | < 80 | < 220 | 0.04 | 0.12 |
| TZMC36-M | 34 | 36 | 38 | 5 | 1 | < 0.1 | 27 | < 2 | 27 | < 80 | < 220 | 0.04 | 0.12 |
| TZMC39-M | 37 | 39 | 41 | 2.5 | 0.5 | < 0.1 | 30 | < 5 | 30 | < 90 | < 500 | 0.04 | 0.12 |
| TZMC43-M | 40 | 43 | 46 | 2.5 | 0.5 | < 0.1 | 33 | < 5 | 33 | < 90 | < 600 | 0.04 | 0.12 |
| TZMC47-M | 44 | 47 | 50 | 2.5 | 0.5 | < 0.1 | 36 | < 5 | 36 | < 110 | < 700 | 0.04 | 0.12 |
| TZMC51-M | 48 | 51 | 54 | 2.5 | 0.5 | < 0.1 | 39 | < 10 | 39 | < 125 | < 700 | 0.04 | 0.12 |
| TZMC56-M | 52 | 56 | 60 | 2.5 | 0.5 | < 0.1 | 43 | < 10 | 43 | < 135 | < 1000 | 0.04 | 0.12 |
| TZMC62-M | 58 | 62 | 66 | 2.5 | 0.5 | < 0.1 | 47 | < 10 | 47 | < 150 | < 1000 | 0.04 | 0.12 |
| TZMC68-M | 64 | 68 | 72 | 2.5 | 0.5 | < 0.1 | 51 | < 10 | 51 | < 200 | < 1000 | 0.04 | 0.12 |
| TZMC75-M | 70 | 75 | 79 | 2.5 | 0.5 | < 0.1 | 56 | < 10 | 56 | < 250 | < 1500 | 0.04 | 0.12 |

**Notes**

- Additional measurement of voltage group TZMC9V1-M to TZMC75-M, $I_R$ at 95 % $V_{Zmin.}$ ≤ 35 nA at $T_j$ = 25 °C

(1) at $T_j$ = 150 °C


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**ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)

| PART NUMBER | ZENER VOLTAGE RANGE | | | TEST CURRENT | | REVERSE LEAKAGE CURRENT | | | | DYNAMIC RESISTANCE | | TEMPERATURE COEFFICIENT OF ZENER VOLTAGE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_Z$ at $I_{ZT1}$ | | | $I_{ZT1}$ | $I_{ZT2}$ | $I_R$ at $V_R$ | | $I_R$ (1) at $V_R$ | | $Z_Z$ at $I_{ZT1}$ | $Z_{ZK}$ at $I_{ZT2}$ | $TK_{VZ}$ | |
| | V | | | mA | | µA | V | µA | V | Ω | | %/K | |
| | MIN. | NOM. | MAX. | | | | | | | TYP. | TYP. | MIN. | MAX. |
| TZMB2V4-M | 2.35 | 2.4 | 2.45 | 5 | 1 | < 50 | 1 | < 100 | 1 | < 85 | < 600 | -0.09 | -0.06 |
| TZMB2V7-M | 2.64 | 2.7 | 2.76 | 5 | 1 | < 10 | 1 | < 50 | 1 | < 85 | < 600 | -0.09 | -0.06 |
| TZMB3V0-M | 2.94 | 3.0 | 3.06 | 5 | 1 | < 4 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMB3V3-M | 3.24 | 3.3 | 3.36 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMB3V6-M | 3.52 | 3.6 | 3.68 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMB3V9-M | 3.82 | 3.9 | 3.98 | 5 | 1 | < 2 | 1 | < 40 | 1 | < 90 | < 600 | -0.08 | -0.05 |
| TZMB4V3-M | 4.22 | 4.3 | 4.38 | 5 | 1 | < 1 | 1 | < 20 | 1 | < 90 | < 600 | -0.06 | -0.03 |
| TZMB4V7-M | 4.6 | 4.7 | 4.8 | 5 | 1 | < 0.5 | 1 | < 10 | 1 | < 80 | < 600 | -0.05 | 0.02 |
| TZMB5V1-M | 5 | 5.1 | 5.2 | 5 | 1 | < 0.1 | 1 | < 2 | 1 | < 60 | < 550 | -0.02 | 0.02 |
| TZMB5V6-M | 5.48 | 5.6 | 5.72 | 5 | 1 | < 0.1 | 1 | < 2 | 1 | < 40 | < 450 | -0.05 | 0.05 |
| TZMB6V2-M | 6.08 | 6.2 | 6.32 | 5 | 1 | < 0.1 | 2 | < 2 | 2 | < 10 | < 200 | 0.03 | 0.06 |
| TZMB6V8-M | 6.66 | 6.8 | 6.94 | 5 | 1 | < 0.1 | 3 | < 2 | 3 | < 8 | < 150 | 0.03 | 0.07 |
| TZMB7V5-M | 7.35 | 7.5 | 7.65 | 5 | 1 | < 0.1 | 5 | < 2 | 5 | < 7 | < 50 | 0.03 | 0.07 |
| TZMB8V2-M | 8.04 | 8.2 | 8.36 | 5 | 1 | < 0.1 | 6.2 | < 2 | 6.2 | < 7 | < 50 | 0.03 | 0.08 |
| TZMB9V1-M | 8.92 | 9.1 | 9.28 | 5 | 1 | < 0.1 | 6.8 | < 2 | 6.8 | < 10 | < 50 | 0.03 | 0.09 |
| TZMB10-M | 9.8 | 10 | 10.2 | 5 | 1 | < 0.1 | 7.5 | < 2 | 7.5 | < 15 | < 70 | 0.03 | 0.1 |
| TZMB11-M | 10.78 | 11 | 11.22 | 5 | 1 | < 0.1 | 8.2 | < 2 | 8.2 | < 20 | < 70 | 0.03 | 0.11 |
| TZMB12-M | 11.76 | 12 | 12.24 | 5 | 1 | < 0.1 | 9.1 | < 2 | 9.1 | < 20 | < 90 | 0.03 | 0.11 |
| TZMB13-M | 12.74 | 13 | 13.26 | 5 | 1 | < 0.1 | 10 | < 2 | 10 | < 26 | < 110 | 0.03 | 0.11 |
| TZMB15-M | 14.7 | 15 | 15.3 | 5 | 1 | < 0.1 | 11 | < 2 | 11 | < 30 | < 110 | 0.03 | 0.11 |
| TZMB16-M | 15.7 | 16 | 16.3 | 5 | 1 | < 0.1 | 12 | < 2 | 12 | < 40 | < 170 | 0.03 | 0.11 |
| TZMB18-M | 17.64 | 18 | 18.36 | 5 | 1 | < 0.1 | 13 | < 2 | 13 | < 50 | < 170 | 0.03 | 0.11 |
| TZMB20-M | 19.6 | 20 | 20.4 | 5 | 1 | < 0.1 | 15 | < 2 | 15 | < 55 | < 220 | 0.03 | 0.11 |
| TZMB22-M | 21.55 | 22 | 22.45 | 5 | 1 | < 0.1 | 16 | < 2 | 16 | < 55 | < 220 | 0.04 | 0.12 |
| TZMB24-M | 23.5 | 24 | 24.5 | 5 | 1 | < 0.1 | 18 | < 2 | 18 | < 80 | < 220 | 0.04 | 0,12 |
| TZMB27-M | 26.4 | 27 | 27.6 | 5 | 1 | < 0.1 | 20 | < 2 | 20 | < 80 | < 220 | 0.04 | 0.12 |
| TZMB30-M | 29.4 | 30 | 30.6 | 5 | 1 | < 0.1 | 22 | < 2 | 22 | < 80 | < 220 | 0.04 | 0.12 |
| TZMB33-M | 32.4 | 33 | 33.6 | 5 | 1 | < 0.1 | 24 | < 2 | 24 | < 80 | < 220 | 0.04 | 0.12 |
| TZMB36-M | 35.3 | 36 | 36.7 | 5 | 1 | < 0.1 | 27 | < 2 | 27 | < 80 | < 220 | 0.04 | 0.12 |
| TZMB39-M | 38.2 | 39 | 39.8 | 2.5 | 0.5 | < 0.1 | 30 | < 5 | 30 | < 90 | < 500 | 0.04 | 0.12 |
| TZMB43-M | 42.1 | 43 | 43.9 | 2.5 | 0.5 | < 0.1 | 33 | < 5 | 33 | < 90 | < 600 | 0.04 | 0.12 |
| TZMB47-M | 46.1 | 47 | 47.9 | 2.5 | 0.5 | < 0.1 | 36 | < 5 | 36 | < 110 | < 700 | 0.04 | 0.12 |
| TZMB51-M | 50 | 51 | 52 | 2.5 | 0.5 | < 0.1 | 39 | < 10 | 39 | < 125 | < 700 | 0.04 | 0.12 |
| TZMB56-M | 54.9 | 56 | 57.1 | 2.5 | 0.5 | < 0.1 | 43 | < 10 | 43 | < 135 | < 1000 | 0.04 | 0.12 |
| TZMB62-M | 60.8 | 62 | 63.2 | 2.5 | 0.5 | < 0.1 | 47 | < 10 | 47 | < 150 | < 1000 | 0.04 | 0.12 |
| TZMB68-M | 66.6 | 68 | 69.4 | 2.5 | 0.5 | < 0.1 | 51 | < 10 | 51 | < 200 | < 1000 | 0.04 | 0.12 |
| TZMB75-M | 73.5 | 75 | 76.5 | 2.5 | 0.5 | < 0.1 | 56 | < 10 | 56 | < 250 | < 1500 | 0.04 | 0.12 |

**Notes**

- Additional measurement of voltage group TZMB9V1-M to TZMB75-M, $I_R$ at 95 % $V_{Zmin.}$ ≤ 35 nA at $T_j$ = 25 °C

(1) at $T_j$ = 150 °C


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**BASIC CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)

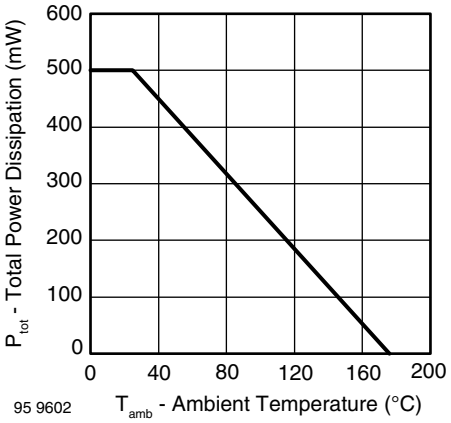



Fig. 1 - Total Power Dissipation vs. Ambient Temperature

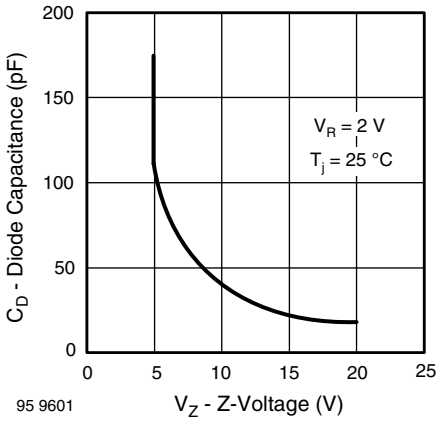



Fig. 4 - Diode Capacitance vs. Z-Voltage

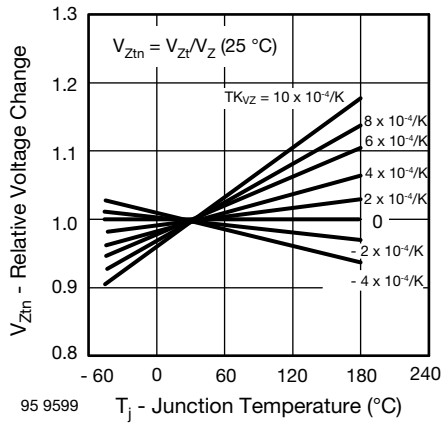



Fig. 2 - Typical Change of Working Voltage vs. Junction Temperature

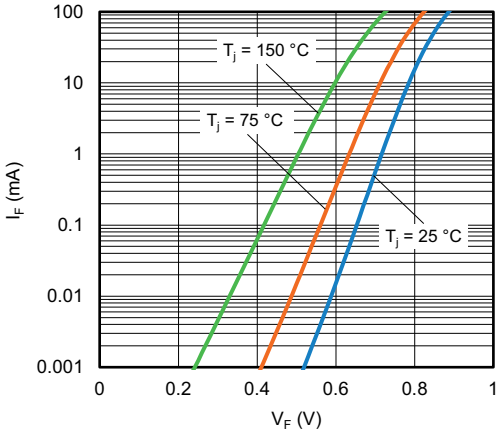



Fig. 5 - Typical Forward Current $I_F$ vs. Forward Voltage $V_F$

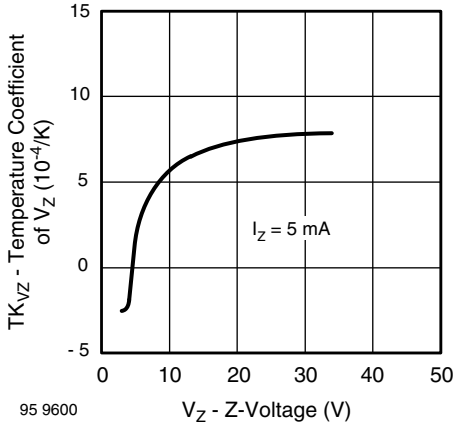



Fig. 3 - Typical Temperature Coefficient of $V_Z$ vs. Z-Voltage

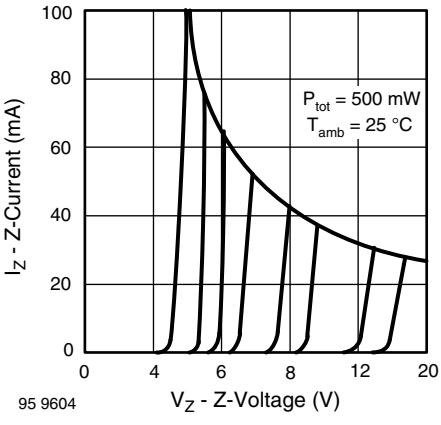



Fig. 6 - Typical Z-Current vs. Z-Voltage


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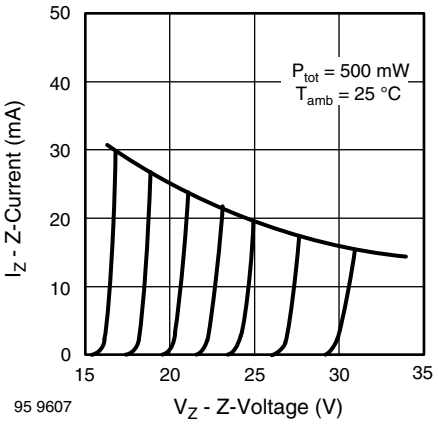



Fig. 7 - Typical Z-Current vs. Z-Voltage

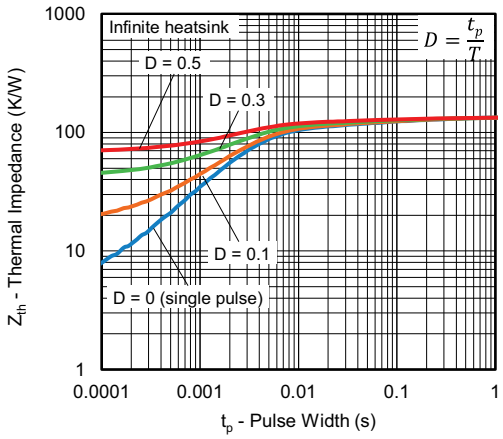
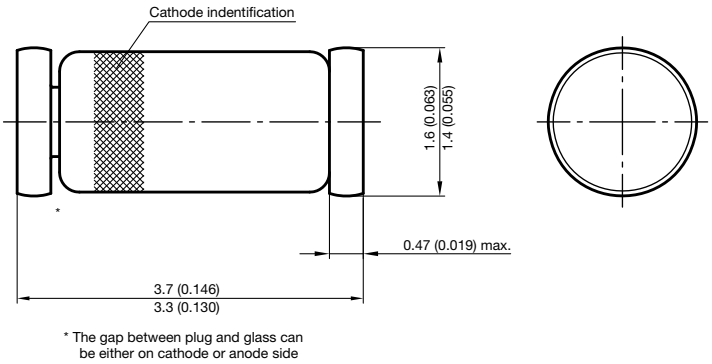
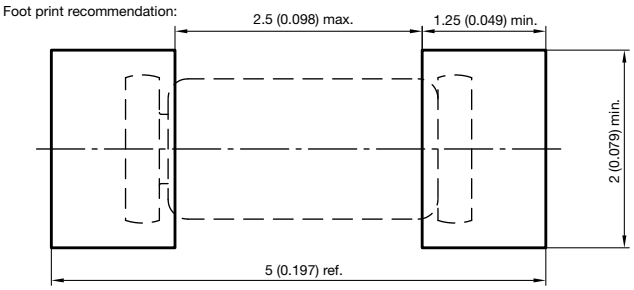



Fig. 8 - Typical Thermal Response

## **PACKAGE DIMENSIONS** in millimeters (inches): **MiniMELF (SOD-80)**




* The gap between plug and glass can be either on cathode or anode side




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