

## Small Signal Zener Diodes



### FEATURES

- Very sharp reverse characteristic
- Low reverse current level
- Very high stability
- Low noise
- High reliability
- AEC-Q101 qualified
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### PRIMARY CHARACTERISTICS

| PARAMETER                    | VALUE         | UNIT |
|------------------------------|---------------|------|
| V <sub>Z</sub> range nom.    | 2.4 to 56     | V    |
| Test current I <sub>ZT</sub> | 5 to 20       | mA   |
| V <sub>Z</sub> specification | Pulse current |      |
| Int. construction            | Single        |      |

### APPLICATIONS

- Voltage stabilization

### ORDERING INFORMATION

| DEVICE NAME | ORDERING CODE   | TAPED UNITS PER REEL           | MINIMUM ORDER QUANTITY |
|-------------|-----------------|--------------------------------|------------------------|
| TLZ-series  | TLZ-series-GS18 | 10 000 (8 mm tape on 13" reel) | 10 000/box             |
| TLZ-series  | TLZ-series-GS08 | 2500 (8 mm tape on 7" reel)    | 12 500/box             |

### PACKAGE

| PACKAGE NAME    | WEIGHT | MOLDING COMPOUND<br>FLAMMABILITY RATING | MOISTURE SENSITIVITY<br>LEVEL        | SOLDERING<br>CONDITIONS  |
|-----------------|--------|-----------------------------------------|--------------------------------------|--------------------------|
| MiniMELF SOD-80 | 31 mg  | -                                       | MSL level 1<br>(according J-STD-020) | 260 °C/10 s at terminals |

### ABSOLUTE MAXIMUM RATINGS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

| PARAMETER                 | TEST CONDITION                     | SYMBOL            | VALUE                            | UNIT |
|---------------------------|------------------------------------|-------------------|----------------------------------|------|
| Power dissipation         | R <sub>thJA</sub> ≤ 300 K/W        | P <sub>tot</sub>  | 500                              | mW   |
| Zener current             |                                    | I <sub>Z</sub>    | P <sub>tot</sub> /V <sub>Z</sub> | mA   |
| Junction to ambient air   | On PC board 50 mm x 50 mm x 1.6 mm | R <sub>thJA</sub> | 500                              | K/W  |
| Junction temperature      |                                    | T <sub>j</sub>    | 175                              | °C   |
| Storage temperature range |                                    | T <sub>stg</sub>  | - 65 to + 175                    | °C   |
| Forward voltage (max.)    | I <sub>F</sub> = 200 mA            | V <sub>F</sub>    | 1.5                              | V    |

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PART NUMBER | MARKING CODE | ZENER VOLTAGE RANGE |      |       | TEST CURRENT |           | REVERSE LEAKAGE CURRENT |      | DYNAMIC RESISTANCE |                       |
|-------------|--------------|---------------------|------|-------|--------------|-----------|-------------------------|------|--------------------|-----------------------|
|             |              | $V_Z$ at $I_{ZT1}$  |      |       | $I_{ZT1}$    | $I_{ZT2}$ | $I_R$ at $V_R$          |      | $Z_Z$ at $I_{ZT1}$ | $Z_{ZK}$ at $I_{ZT2}$ |
|             |              | V                   |      |       | mA           |           | $\mu\text{A}$           | V    | $\Omega$           |                       |
|             |              | MIN.                | NOM. | MAX.  |              |           | MAX.                    |      | MAX.               | MAX.                  |
| TLZ2V4A     | 2A4          | 2.33                | 2.4  | 2.52  | 20           | 1         | 70                      | 1    | 100                | 2000                  |
| TLZ2V4B     | 2B4          | 2.43                | 2.4  | 2.63  | 20           | 1         | 70                      | 1    | 100                | 2000                  |
| TLZ2V7A     | 2A7          | 2.54                | 2.7  | 2.75  | 20           | 1         | 50                      | 1    | 100                | 1000                  |
| TLZ2V7B     | 2B7          | 2.69                | 2.7  | 2.91  | 20           | 1         | 50                      | 1    | 100                | 1000                  |
| TLZ3V0A     | 3A0          | 2.85                | 3.0  | 3.07  | 20           | 1         | 50                      | 1    | 80                 | 1000                  |
| TLZ3V0B     | 3B0          | 3.01                | 3.0  | 3.22  | 20           | 1         | 10                      | 1    | 80                 | 1000                  |
| TLZ3V3A     | 3A3          | 3.16                | 3.3  | 3.38  | 20           | 1         | 10                      | 1    | 70                 | 1000                  |
| TLZ3V3B     | 3B3          | 3.32                | 3.3  | 3.53  | 20           | 1         | 10                      | 1    | 70                 | 1000                  |
| TLZ3V6A     | 3A6          | 3.455               | 3.6  | 3.695 | 20           | 1         | 5                       | 1    | 60                 | 1000                  |
| TLZ3V6B     | 3B6          | 3.6                 | 3.6  | 3.845 | 20           | 1         | 5                       | 1    | 60                 | 1000                  |
| TLZ3V9A     | 3A9          | 3.74                | 3.9  | 4.01  | 20           | 1         | 3                       | 1    | 50                 | 1000                  |
| TLZ3V9B     | 3B9          | 3.89                | 3.9  | 4.16  | 20           | 1         | 3                       | 1    | 50                 | 1000                  |
| TLZ4V3A     | 4A3          | 4.04                | 4.3  | 4.29  | 20           | 1         | 3                       | 1    | 40                 | 1000                  |
| TLZ4V3B     | 4B3          | 4.17                | 4.3  | 4.43  | 20           | 1         | 3                       | 1    | 40                 | 1000                  |
| TLZ4V3C     | 4C3          | 4.3                 | 4.3  | 4.57  | 20           | 1         | 3                       | 1    | 40                 | 1000                  |
| TLZ4V7A     | 4A7          | 4.44                | 4.7  | 4.68  | 20           | 1         | 5                       | 1    | 25                 | 900                   |
| TLZ4V7B     | 4B7          | 4.55                | 4.7  | 4.8   | 20           | 1         | 5                       | 1    | 25                 | 900                   |
| TLZ4V7C     | 4C7          | 4.68                | 4.7  | 4.93  | 20           | 1         | 5                       | 1    | 25                 | 900                   |
| TLZ5V1A     | 5A1          | 4.81                | 5.1  | 5.07  | 20           | 1         | 2                       | 2    | 20                 | 800                   |
| TLZ5V1B     | 5B1          | 4.94                | 5.1  | 5.2   | 20           | 1         | 2                       | 2    | 20                 | 800                   |
| TLZ5V1C     | 5C1          | 5.09                | 5.1  | 5.37  | 20           | 1         | 2                       | 2    | 20                 | 800                   |
| TLZ5V6A     | 5A6          | 5.28                | 5.6  | 5.55  | 20           | 1         | 1                       | 2    | 13                 | 500                   |
| TLZ5V6B     | 5B6          | 5.45                | 5.6  | 5.73  | 20           | 1         | 1                       | 2    | 13                 | 500                   |
| TLZ5V6C     | 5C6          | 5.61                | 5.6  | 5.91  | 20           | 1         | 1                       | 2    | 13                 | 500                   |
| TLZ6V2A     | 6A2          | 5.78                | 6.2  | 6.09  | 20           | 1         | 3                       | 4    | 10                 | 300                   |
| TLZ6V2B     | 6B2          | 5.96                | 6.2  | 6.27  | 20           | 1         | 3                       | 4    | 10                 | 300                   |
| TLZ6V2C     | 6C2          | 6.12                | 6.2  | 6.44  | 20           | 1         | 3                       | 4    | 10                 | 300                   |
| TLZ6V8A     | 6A8          | 6.29                | 6.8  | 6.63  | 20           | 0.5       | 2                       | 4    | 8                  | 150                   |
| TLZ6V8B     | 6B8          | 6.49                | 6.8  | 6.83  | 20           | 0.5       | 2                       | 4    | 8                  | 150                   |
| TLZ6V8C     | 6C8          | 6.66                | 6.8  | 7.01  | 20           | 0.5       | 2                       | 4    | 8                  | 150                   |
| TLZ7V5A     | 7A5          | 6.85                | 7.5  | 7.22  | 20           | 0.5       | 3                       | 6.5  | 8                  | 120                   |
| TLZ7V5B     | 7B5          | 7.07                | 7.5  | 7.45  | 20           | 0.5       | 3                       | 6.73 | 8                  | 120                   |
| TLZ7V5C     | 7C5          | 7.29                | 7.5  | 7.67  | 20           | 0.5       | 3                       | 6.93 | 8                  | 120                   |
| TLZ8V2A     | 8A2          | 7.53                | 8.2  | 7.92  | 20           | 0.5       | 7.5                     | 7.15 | 8                  | 120                   |
| TLZ8V2B     | 8B2          | 7.78                | 8.2  | 8.19  | 20           | 0.5       | 7.5                     | 7.39 | 8                  | 120                   |
| TLZ8V2C     | 8C2          | 8.03                | 8.2  | 8.45  | 20           | 0.5       | 7.5                     | 7.63 | 8                  | 120                   |
| TLZ9V1A     | 9A1          | 8.29                | 9.1  | 8.73  | 20           | 0.5       | 0.04                    | 7.88 | 8                  | 120                   |
| TLZ9V1B     | 9B1          | 8.57                | 9.1  | 9.01  | 20           | 0.5       | 0.04                    | 8.14 | 8                  | 120                   |
| TLZ9V1C     | 9C1          | 8.83                | 9.1  | 9.3   | 20           | 0.5       | 0.04                    | 8.39 | 8                  | 120                   |
| TLZ10A      | 10A          | 9.12                | 10   | 9.59  | 20           | 0.5       | 0.04                    | 8.66 | 8                  | 120                   |
| TLZ10B      | 10B          | 9.41                | 10   | 9.9   | 20           | 0.5       | 0.04                    | 8.94 | 8                  | 120                   |
| TLZ10C      | 10C          | 9.7                 | 10   | 10.2  | 20           | 0.5       | 0.04                    | 9.22 | 8                  | 120                   |
| TLZ10D      | 10D          | 9.94                | 10   | 10.44 | 20           | 0.5       | 0.04                    | 9.44 | 8                  | 120                   |

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PART NUMBER | MARKING CODE | ZENER VOLTAGE RANGE |      |       | TEST CURRENT |           | REVERSE LEAKAGE CURRENT |       | DYNAMIC RESISTANCE |                       |
|-------------|--------------|---------------------|------|-------|--------------|-----------|-------------------------|-------|--------------------|-----------------------|
|             |              | $V_Z$ at $I_{ZT1}$  |      |       | $I_{ZT1}$    | $I_{ZT2}$ | $I_R$ at $V_R$          |       | $Z_Z$ at $I_{ZT1}$ | $Z_{ZK}$ at $I_{ZT2}$ |
|             |              | V                   |      |       | mA           |           | $\mu\text{A}$           | V     | $\Omega$           |                       |
|             |              | MIN.                | NOM. | MAX.  |              |           | MAX.                    |       | MAX.               | MAX.                  |
| TLZ11A      | 11A          | 10.18               | 11   | 10.71 | 10           | 0.5       | 0.04                    | 9.67  | 10                 | 120                   |
| TLZ11B      | 11B          | 10.5                | 11   | 11.05 | 10           | 0.5       | 0.04                    | 9.98  | 10                 | 120                   |
| TLZ11C      | 11C          | 10.82               | 11   | 11.38 | 10           | 0.5       | 0.04                    | 10.28 | 10                 | 120                   |
| TLZ12A      | 12A          | 11.13               | 12   | 11.71 | 10           | 0.5       | 0.04                    | 10.6  | 12                 | 110                   |
| TLZ12B      | 12B          | 11.44               | 12   | 12.03 | 10           | 0.5       | 0.04                    | 10.9  | 12                 | 110                   |
| TLZ12C      | 12C          | 11.74               | 12   | 12.35 | 10           | 0.5       | 0.04                    | 11.2  | 12                 | 110                   |
| TLZ13A      | 13A          | 12.11               | 13   | 12.75 | 10           | 0.5       | 0.04                    | 11.5  | 14                 | 110                   |
| TLZ13B      | 13B          | 12.55               | 13   | 13.21 | 10           | 0.5       | 0.04                    | 11.9  | 14                 | 110                   |
| TLZ13C      | 13C          | 12.99               | 13   | 13.66 | 10           | 0.5       | 0.04                    | 12.3  | 14                 | 110                   |
| TLZ15A      | 15A          | 13.44               | 15   | 14.13 | 10           | 0.5       | 0.04                    | 12.8  | 16                 | 110                   |
| TLZ15B      | 15B          | 13.89               | 15   | 14.62 | 10           | 0.5       | 0.04                    | 13.2  | 16                 | 110                   |
| TLZ15C      | 15C          | 14.35               | 15   | 15.09 | 10           | 0.5       | 0.04                    | 13.6  | 16                 | 110                   |
| TLZ16A      | 16A          | 14.8                | 16   | 15.57 | 10           | 0.5       | 0.04                    | 14.1  | 18                 | 150                   |
| TLZ16B      | 16B          | 15.25               | 16   | 16.04 | 10           | 0.5       | 0.04                    | 14.5  | 18                 | 150                   |
| TLZ16C      | 16C          | 15.69               | 16   | 16.51 | 10           | 0.5       | 0.04                    | 14.9  | 18                 | 150                   |
| TLZ18A      | 18A          | 16.22               | 18   | 17.06 | 10           | 0.5       | 0.04                    | 15.4  | 23                 | 150                   |
| TLZ18B      | 18B          | 16.82               | 18   | 17.7  | 10           | 0.5       | 0.04                    | 16    | 23                 | 150                   |
| TLZ18C      | 18C          | 17.42               | 18   | 18.33 | 10           | 0.5       | 0.04                    | 16.5  | 23                 | 150                   |
| TLZ20A      | 20A          | 18.02               | 20   | 18.96 | 10           | 0.5       | 0.04                    | 17.1  | 28                 | 200                   |
| TLZ20B      | 20B          | 18.63               | 20   | 19.59 | 10           | 0.5       | 0.04                    | 17.7  | 28                 | 200                   |
| TLZ20C      | 20C          | 19.23               | 20   | 20.22 | 10           | 0.5       | 0.04                    | 18.3  | 28                 | 200                   |
| TLZ20D      | 20D          | 19.72               | 20   | 20.72 | 10           | 0.5       | 0.04                    | 18.7  | 28                 | 200                   |
| TLZ22A      | 22A          | 20.15               | 22   | 21.2  | 5            | 0.5       | 0.04                    | 19.1  | 30                 | 200                   |
| TLZ22B      | 22B          | 20.64               | 22   | 21.71 | 5            | 0.5       | 0.04                    | 19.6  | 30                 | 200                   |
| TLZ22C      | 22C          | 21.08               | 22   | 22.17 | 5            | 0.5       | 0.04                    | 20    | 30                 | 200                   |
| TLZ22D      | 22D          | 21.52               | 22   | 22.63 | 5            | 0.5       | 0.04                    | 20.4  | 30                 | 200                   |
| TLZ24A      | 24A          | 22.05               | 24   | 23.18 | 5            | 0.5       | 0.04                    | 20.9  | 35                 | 200                   |
| TLZ24B      | 24B          | 22.61               | 24   | 23.77 | 5            | 0.5       | 0.04                    | 21.5  | 35                 | 200                   |
| TLZ24C      | 24C          | 23.12               | 24   | 24.31 | 5            | 0.5       | 0.04                    | 22    | 35                 | 200                   |
| TLZ24D      | 24D          | 23.63               | 24   | 24.85 | 5            | 0.5       | 0.04                    | 22.4  | 35                 | 200                   |
| TLZ27A      | 27A          | 24.26               | 27   | 25.52 | 5            | 0.5       | 0.04                    | 23    | 45                 | 250                   |
| TLZ27B      | 27B          | 24.97               | 27   | 26.26 | 5            | 0.5       | 0.04                    | 23.7  | 45                 | 250                   |
| TLZ27C      | 27C          | 25.63               | 27   | 26.95 | 5            | 0.5       | 0.04                    | 24.3  | 45                 | 250                   |
| TLZ27D      | 27D          | 26.29               | 27   | 27.64 | 5            | 0.5       | 0.04                    | 25    | 45                 | 250                   |
| TLZ30A      | 30A          | 26.99               | 30   | 28.39 | 5            | 0.5       | 0.04                    | 25.6  | 55                 | 250                   |
| TLZ30B      | 30B          | 27.7                | 30   | 29.13 | 5            | 0.5       | 0.04                    | 26.3  | 55                 | 250                   |
| TLZ30C      | 30C          | 28.36               | 30   | 29.82 | 5            | 0.5       | 0.04                    | 26.9  | 55                 | 250                   |
| TLZ30D      | 30D          | 29.02               | 30   | 30.51 | 5            | 0.5       | 0.04                    | 27.6  | 55                 | 250                   |
| TLZ33A      | 33A          | 29.68               | 33   | 31.22 | 5            | 0.5       | 0.04                    | 28.2  | 65                 | 250                   |
| TLZ33B      | 33B          | 30.32               | 33   | 31.88 | 5            | 0.5       | 0.04                    | 28.8  | 65                 | 250                   |
| TLZ33C      | 33C          | 30.9                | 33   | 32.5  | 5            | 0.5       | 0.04                    | 29.4  | 65                 | 250                   |
| TLZ33D      | 33D          | 31.49               | 33   | 33.11 | 5            | 0.5       | 0.04                    | 29.9  | 65                 | 250                   |
| TLZ36A      | 36A          | 32.14               | 36   | 33.79 | 5            | 0.5       | 0.04                    | 30.5  | 75                 | 250                   |
| TLZ36B      | 36B          | 32.79               | 36   | 34.49 | 5            | 0.5       | 0.04                    | 31.2  | 75                 | 250                   |
| TLZ36C      | 36C          | 33.4                | 36   | 35.13 | 5            | 0.5       | 0.04                    | 31.7  | 75                 | 250                   |
| TLZ36D      | 36D          | 34.01               | 36   | 35.77 | 5            | 0.5       | 0.04                    | 32.3  | 75                 | 250                   |

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |              |                     |      |       |              |           |                         |      |                    |                       |
|----------------------------------------------------------------------------------------------------------|--------------|---------------------|------|-------|--------------|-----------|-------------------------|------|--------------------|-----------------------|
| PART NUMBER                                                                                              | MARKING CODE | ZENER VOLTAGE RANGE |      |       | TEST CURRENT |           | REVERSE LEAKAGE CURRENT |      | DYNAMIC RESISTANCE |                       |
|                                                                                                          |              | $V_Z$ at $I_{ZT1}$  |      |       | $I_{ZT1}$    | $I_{ZT2}$ | $I_R$ at $V_R$          |      | $Z_Z$ at $I_{ZT1}$ | $Z_{ZK}$ at $I_{ZT2}$ |
|                                                                                                          |              | V                   |      |       | mA           |           | $\mu\text{A}$           | V    | $\Omega$           |                       |
|                                                                                                          |              | MIN.                | NOM. | MAX.  |              |           | MAX.                    |      | MAX.               | MAX.                  |
| TLZ39A                                                                                                   | 39A          | 34.68               | 39   | 36.47 | 5            | 0.5       | 0.04                    | 32.9 | 85                 | 250                   |
| TLZ39B                                                                                                   | 39B          | 35.36               | 39   | 37.19 | 5            | 0.5       | 0.04                    | 33.6 | 85                 | 250                   |
| TLZ39C                                                                                                   | 39C          | 36                  | 39   | 37.85 | 5            | 0.5       | 0.04                    | 34.2 | 85                 | 250                   |
| TLZ39D                                                                                                   | 39D          | 36.63               | 39   | 38.52 | 5            | 0.5       | 0.04                    | 34.8 | 85                 | 250                   |
| TLZ39E                                                                                                   | 39E          | 37.36               | 39   | 39.29 | 5            | 0.5       | 0.04                    | 35.5 | 85                 | 250                   |
| TLZ39F                                                                                                   | 39F          | 38.14               | 39   | 40.11 | 5            | 0.5       | 0.04                    | 36.2 | 85                 | 250                   |
| TLZ39G                                                                                                   | 39G          | 38.94               | 39   | 40.8  | 5            | 0.5       | 0.04                    | 37   | 85                 | 250                   |
| TLZ43                                                                                                    | 43           | 40                  | 43   | 45    | 5            | -         | 0.04                    | 38   | 90                 | -                     |
| TLZ47                                                                                                    | 47           | 44                  | 47   | 49    | 5            | -         | 0.04                    | 41.8 | 90                 | -                     |
| TLZ51                                                                                                    | 51           | 48                  | 51   | 54    | 5            | -         | 0.04                    | 45.6 | 100                | -                     |
| TLZ56                                                                                                    | 56           | 53                  | 56   | 60    | 5            | -         | 0.04                    | 50.4 | 100                | -                     |

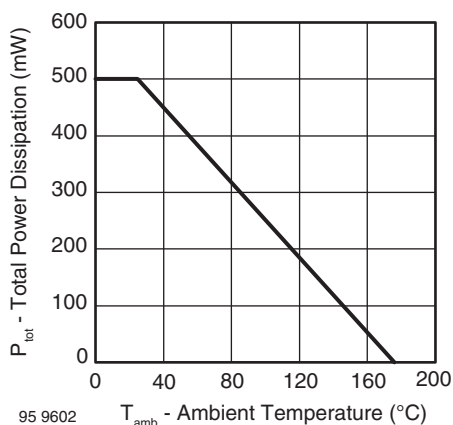
**BASIC CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

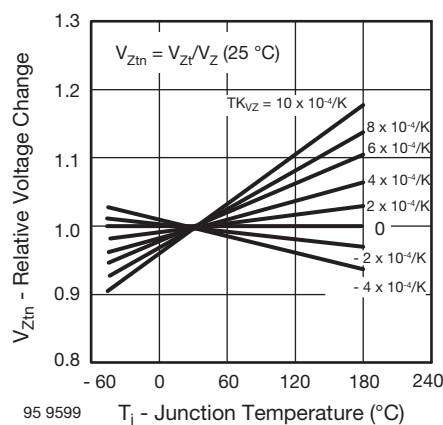
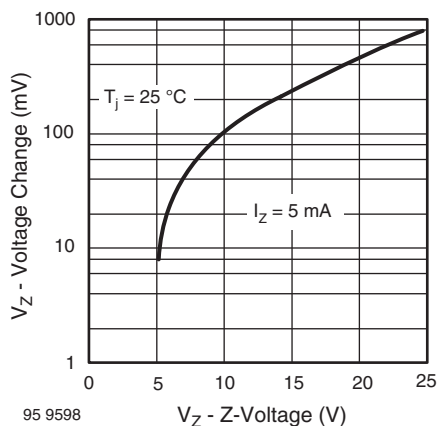
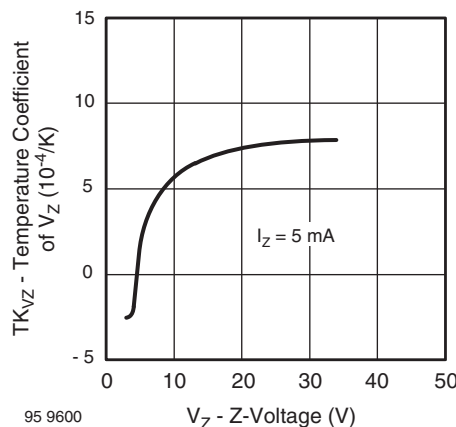


Fig. 3 - Typical Change of Working Voltage vs. Junction Temperature


Fig. 2 - Typical Change of Working Voltage under Operating Conditions at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ 

Fig. 4 - Temperature Coefficient of  $V_Z$  vs. Z-Voltage

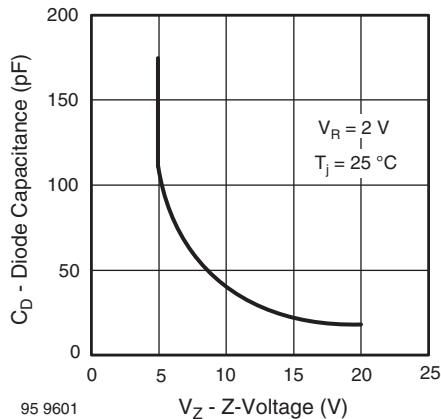


Fig. 5 - Diode Capacitance vs. Z-Voltage

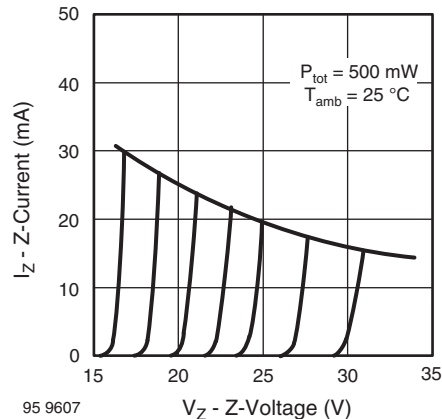


Fig. 8 - Z-Current vs. Z-Voltage

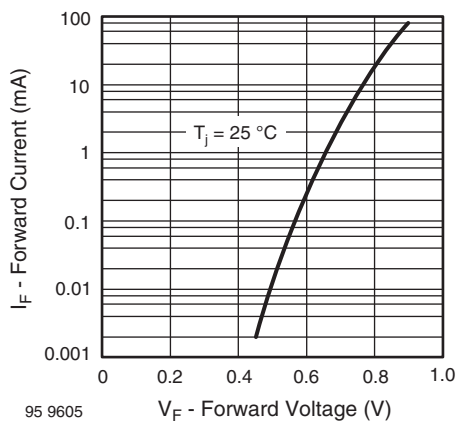


Fig. 6 - Forward Current vs. Forward Voltage

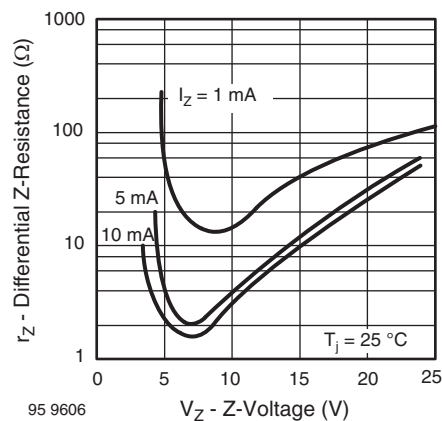


Fig. 9 - Differential Z-Resistance vs. Z-Voltage

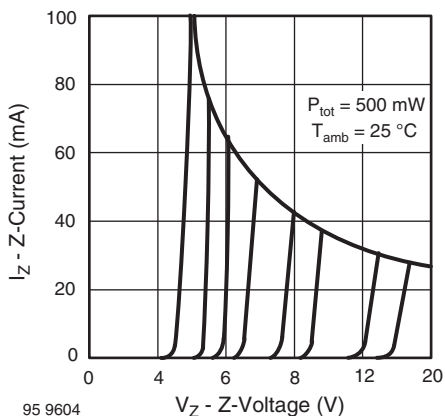


Fig. 7 - Z-Current vs. Z-Voltage

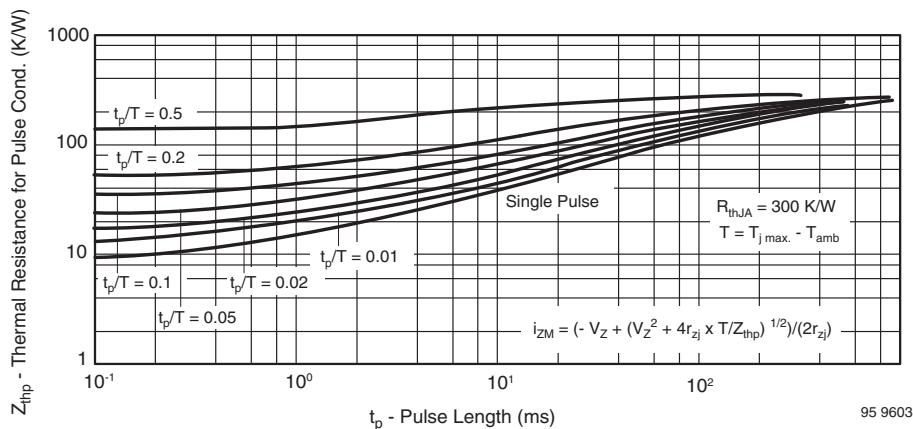
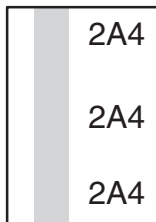


Fig. 10 - Thermal Response

## MARKING VOLTAGE GROUP

### TLZ2V4A



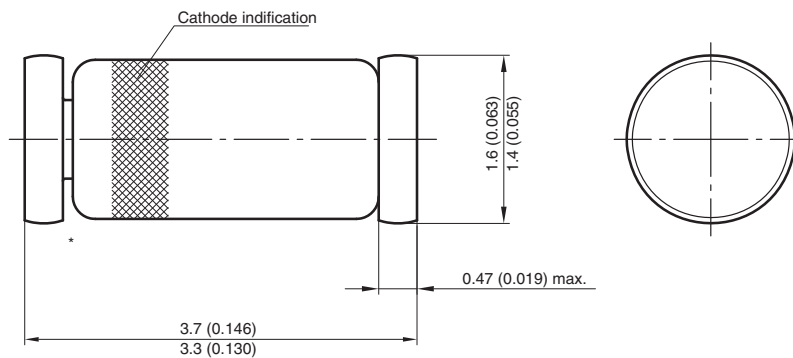
18660\_2

## Remark

The Zener voltage group TLZ2V4A is printed with max 3 digits 3 times on the surface. The marking should be readable at minimum 2 times. The third print is allowed to be incomplete due to tolerances in diameter of the glass body.

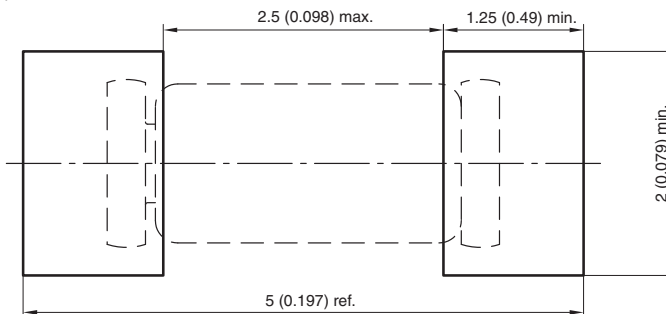


**PACKAGE DIMENSIONS** in millimeters (inches): **MiniMELF SOD-80**



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

Foot print recommendation:



Document no.:6.560-5005.01-4  
Rev. 8 - Date: 07.June.2006  
96 12070



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