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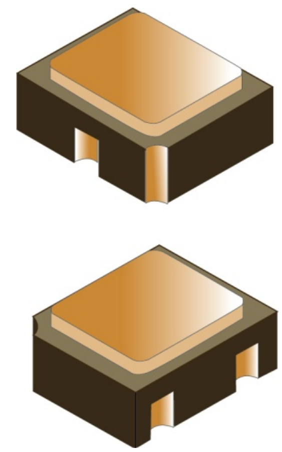
RoHS Available

# Low Voltage Ultra-Sharp Knee Zener Diode

## DESCRIPTION

This new multi-layer pn junction Zener design for ultra-sharp knee characteristics is used for low-voltage regulation and very low leakage currents. The new design offers significantly improved voltage regulation and lower dynamic impedance and capacitance compared to conventional Zeners. They also provide ESD protection for those threats defined per IEC 61000-4-2 or electrical fast transients per IEC 61000-4-4 as well as other transient threats. Because of their relatively small physical size and weight, this product is ideal for use in High reliable portable and hand-held electronic devices.

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



**UB Package**

## FEATURES

- Ultra-sharp knee, low-voltage Zener
- Excellent Voltage Regulation (4X better than standard Zener diode)
- Lower Zener impedance (1/4 that of standard Zener diode)
- Lower leakage current (about 40X lower than standard Zener diode)
- Lower capacitance
- Small, hermetically sealed, surface mount UB package
- High surge capability
- RoHS compliant versions are available
- ESD Nonsensitive Rating

## APPLICATIONS / BENEFITS

- Superior low voltage regulation
- Portables requiring low battery drain
- ESD & EFT protection per IEC 61000-4-2 and IEC 61000-4-4
- Stabistor replacement
- Low voltage transient protection

## MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | Value | Unit |
|---|---|---|---|
| Junction and Storage Temperature | $T_J$ and $T_{STG}$ | -55 to +150 | ºC |
| Thermal Resistance, Junction-to-Solder Pad (Infinite Sink) | $R_{\Theta JSP(IS)}$ | 120 | ºC/W |
| Thermal Resistance, Junction-to-Ambient on PC Board (1) | $R_{\Theta JA(PCB)}$ | 325 | ºC/W |
| Power Dissipation (see derating graph) | $P_D$ | 500 | mW |
| Zener Surge Current (8/20 µs) | $I_{ZSM}$ | 25 | A |
| Forward Voltage @ 100 mA | $V_F$ | 1.00 | V |
| Solder Temperature @ 10 s | | 260 | °C |

1. With 0.025 inch$^2$ pads (see Figure 2).

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## MECHANICAL and PACKAGING

- CASE: Hermetically sealed ceramic package with metal lid
- TERMINALS: Gold over nickel plating
- MARKING: Device marking code and polarity band
- POLARITY: Pin 1 = cathode; (Pin 2 = not connected); Pin 3 = anode
- TAPE & REEL option: Standard per EIA-481-D. 7 inch diameter reel, 2000 devices max. per reel
- WEIGHT: Approximately 0.042 grams
- See Package Dimensions on last page.

## PART NOMENCLATURE

**MQ SZL 1.0 A**

**Reliability Level**
MQ (reference JAN)
MX (reference JANTX)
MV (reference JANTXV)
Blank = Commercial

**Type number**
(Sharp Zener Low $I_{ZT}$)

**Tolerance**
A = 10%
Contact Factory for tighter Tolerance

**Voltage Nominal**
(see Electrical Characteristic table)

## SYMBOLS & DEFINITIONS

| Symbol | Definition |
|---|---|
| $\alpha_{VZ}$ | Temperature Coefficient of Regulator Voltage: The change in regulator voltage divided by the change in temperature that caused it expressed in %/C or mV/°C. |
| $C_T$ | Total Capacitance: The total small signal capacitance between the diode terminals of a complete device. |
| $I_R$ | Reverse Current: The dc current flowing from the external circuit into the cathode terminal at the specified voltage $V_R$. |
| $I_{ZT}$ | Regulator Current: The dc regulator current ($I_Z$), at a specified test point ($I_{ZT}$). |
| $V_Z$ | Zener Voltage: The Zener voltage the device will exhibit at a specified current ($I_Z$) in its breakdown region. |
| $Z_{ZT}$ | The measured Zener impedance at the specified test current ($I_{ZT}$). |

## ELECTRICAL CHARACTERISTICS @ 25 ºC unless otherwise noted

| PART NUMBER | NOMINAL VOLTAGE $V_Z$ @ $I_{ZT}$ | TEST CURRENT $I_{ZT}$ (Note 5) | MAXIMUM ZENER IMPEDANCE @ $I_{ZT}$ | MAXIMUM REVERSE CURRENT | | MAXIMUM TOTAL CAPACITANCE $C_T$ f = 1 MHz @ 0 volts | MAXIMUM MAGNITUDE TEMPERATURE COEFFICIENT OF ZENER VOLTAGE $\alpha_{vz}$ | MAXIMUM REGULATION FACTOR $\Delta V_Z$ (Note 4) |
|---|---|---|---|---|---|---|---|---|
| | | | | $I_R$ | $V_R$ | | | |
| | Volts | mA | Ohms | µA | Volts | pF | % / °C | Volts |
| SZL1.0A | 1.0 | 0.25 | 325 | 0.05 | 0.3 | 150 | -0.17 | 0.35 |
| SZL1.1A | 1.1 | 0.25 | 325 | 0.05 | 0.4 | 150 | -0.17 | 0.35 |
| SZL1.2A | 1.2 | 0.25 | 325 | 0.05 | 0.4 | 150 | -0.16 | 0.35 |
| SZL1.3A | 1.3 | 0.25 | 325 | 0.05 | 0.5 | 150 | -0.16 | 0.35 |
| SZL1.4A | 1.4 | 0.25 | 325 | 0.05 | 0.5 | 150 | -0.15 | 0.35 |
| SZL1.5A | 1.5 | 0.25 | 325 | 0.05 | 0.6 | 150 | -0.15 | 0.35 |
| SZL1.6A | 1.6 | 0.25 | 325 | 0.05 | 0.6 | 150 | -0.14 | 0.35 |
| SZL1.7A | 1.7 | 0.25 | 325 | 0.05 | 0.7 | 150 | -0.13 | 0.35 |
| SZL1.8A | 1.8 | 0.25 | 325 | 0.05 | 0.8 | 150 | -0.12 | 0.35 |
| SZL1.9A | 1.9 | 0.25 | 325 | 0.05 | 0.9 | 150 | -0.12 | 0.35 |
| SZL2.0A | 2.0 | 0.25 | 325 | 0.05 | 1.1 | 150 | -.011 | 0.35 |
| SZL2.2A | 2.2 | 0.25 | 325 | 0.05 | 1.1 | 150 | -.010 | 0.35 |
| SZL2.4A | 2.4 | 0.25 | 325 | 0.05 | 1.2 | 150 | -.010 | 0.35 |

**NOTE:**

1. ZENER ($V_Z$) VOLTAGE MEASUREMENT: Nominal Zener voltage is measured with the device junction in thermal equilibrium with ambient temperature of 25 °C at the test current ($I_{ZT}$) shown.
2. ZENER IMPEDANCE ($Z_{ZT}$): The Zener impedance is derived from the 60 Hz voltage, which results when an ac current having a rms value equal to 10% of the dc Zener current ($I_{ZT}$) is superimposed on $I_{ZT}$.
3. REVERSE CURRENT ($I_R$): Reverse (leakage) current is guaranteed and measured at $V_R$ as shown on the table.
4. MAXIMUM REGULATION FACTOR ($\Delta V_Z$): $\Delta V_Z$ is the maximum difference between $V_Z$ at $I_Z$ = 0.025 mA and $V_Z$ at $I_Z$ = 2.5 mA
5. MAXIMUM ZENER CURRENT ($I_{ZM}$) should be based on 500 mW maximum power dissipation rating in conjunction with derating based on mounted thermal resistance divided by $V_Z$ based on nominal $V_Z$ modified for $V_Z$ $I_Z$ trend shown in Figure 4a-c.

## GRAPHS

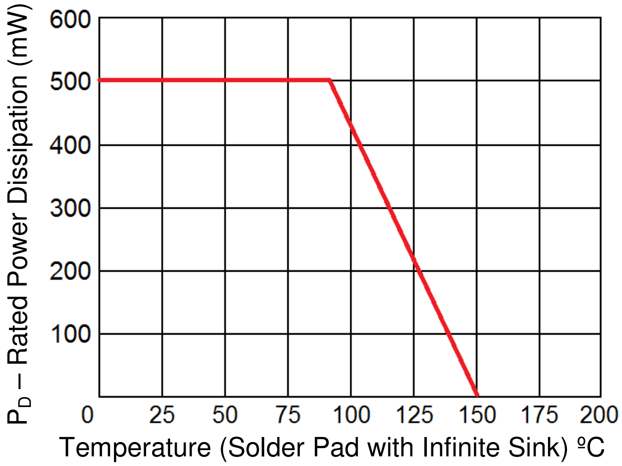



**FIGURE 1**

Power Derating Curve $R_{\Theta JSP(IS)}$ (see Figure 2 for alternate PCB mounting)

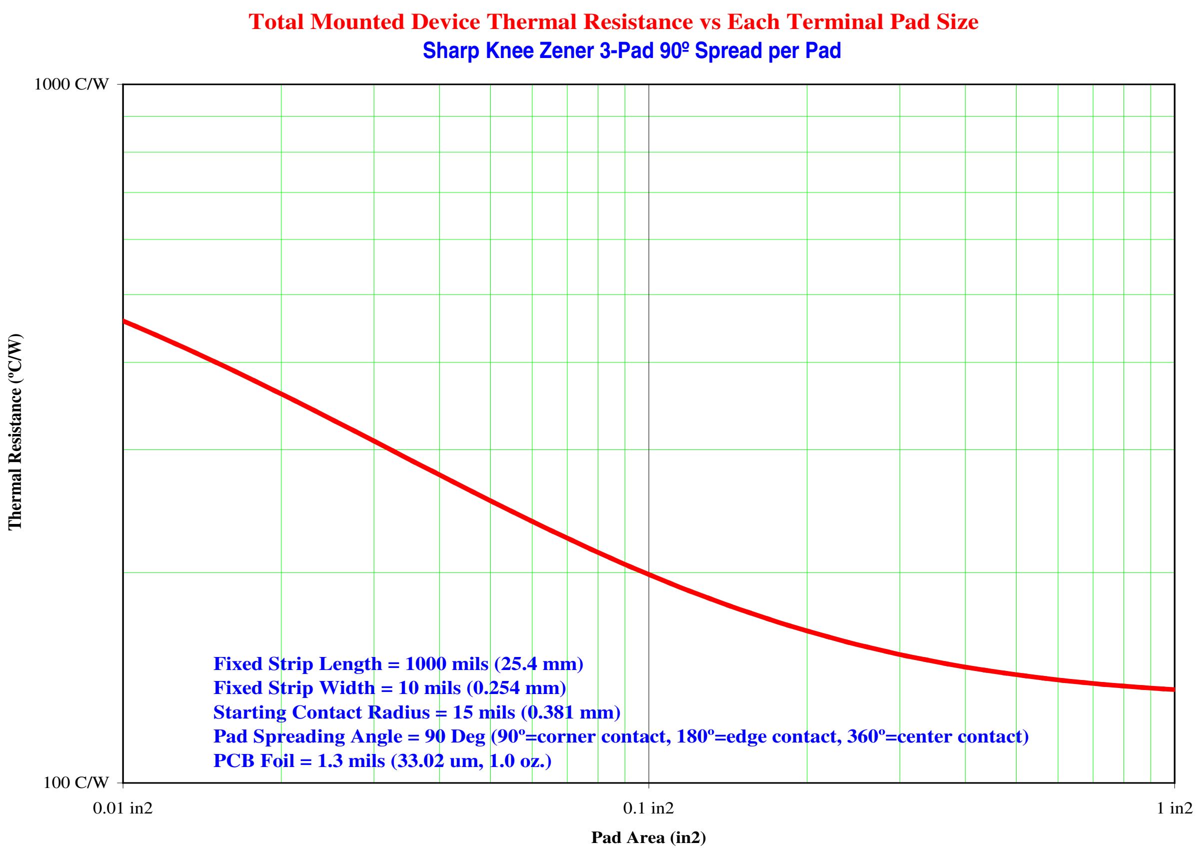



**FIGURE 2**

Thermal Resistance Junction to Ambient vs. Bond Pad Size (3 pads)

**GRAPHS** (continued)

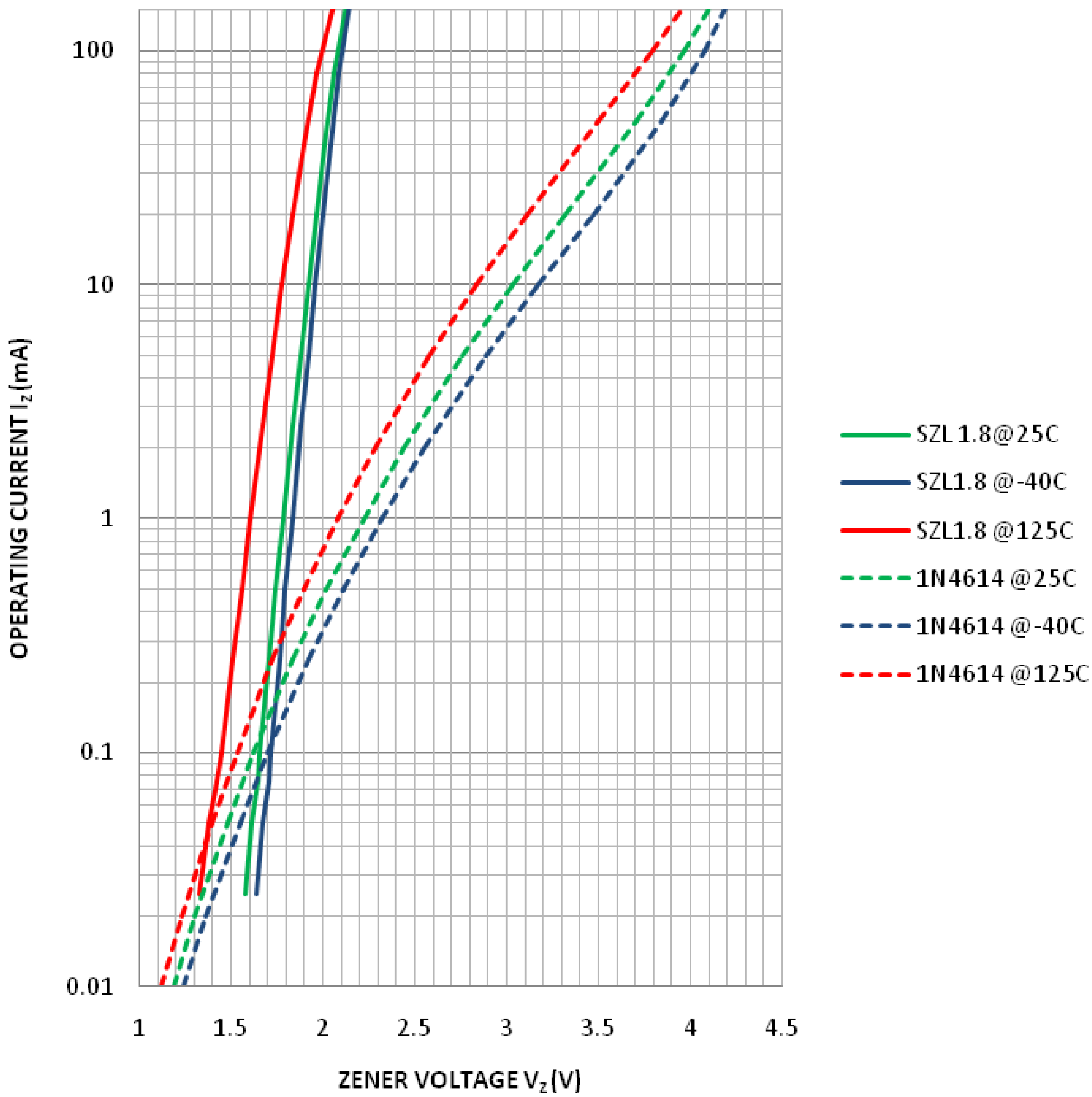



**FIGURE 3**

$V_Z$ versus $I_Z$ Performance of SZL1.8 and 1N4614 (typical)*

* **Note:** Comparison of typical industry standard Zener Diode (1N4614) and Microsemi's SZL series. Both parts have a nominal $V_Z$ = 1.8 V rating at 0.25 mA

**GRAPHS** (continued)

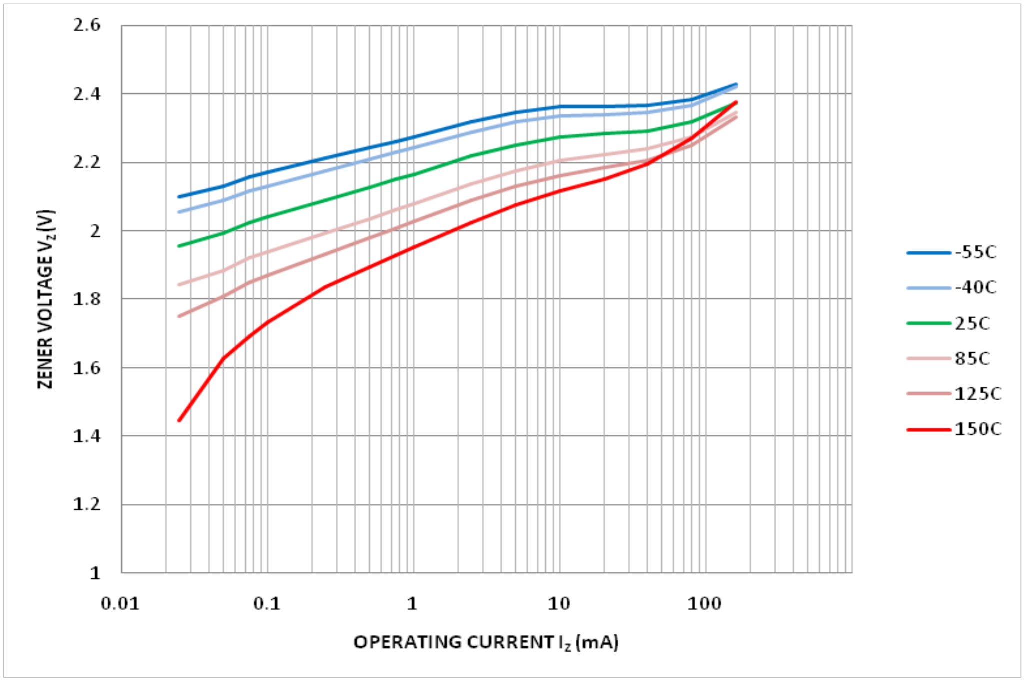



**FIGURE 4a**

ZENER VOLTAGE vs. OPERATING CURRENT vs. TEMPERATURE - SZL2.2A (typical)

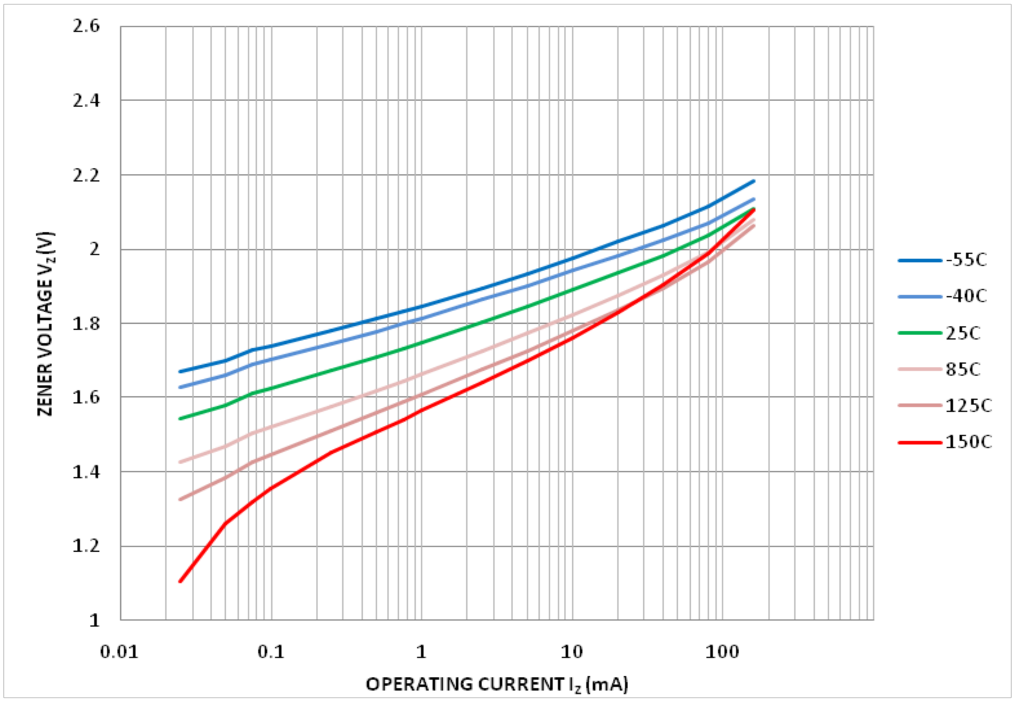



**FIGURE 4b**

ZENER VOLTAGE vs. OPERATING CURRENT vs. TEMPERATURE - SZL1.8A (typical)

## GRAPHS (continued)

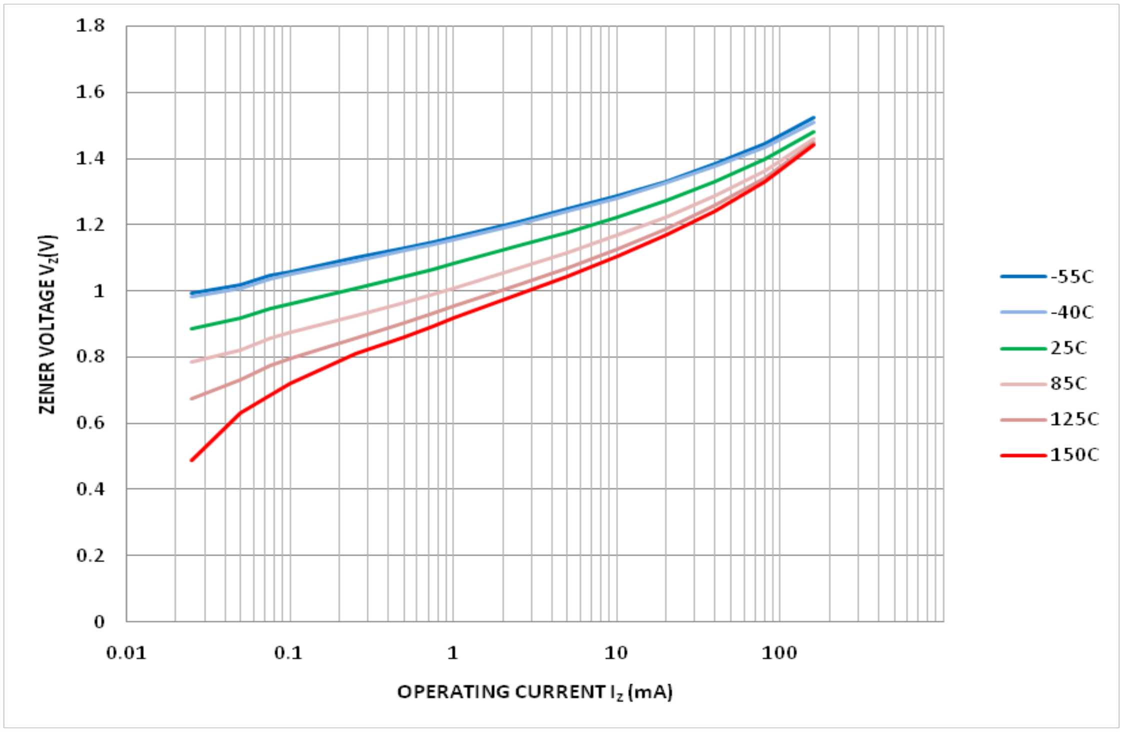



**FIGURE 4c**
ZENER VOLTAGE vs. OPERATING CURRENT vs. TEMPERATURE - SZL1.0A (typical)

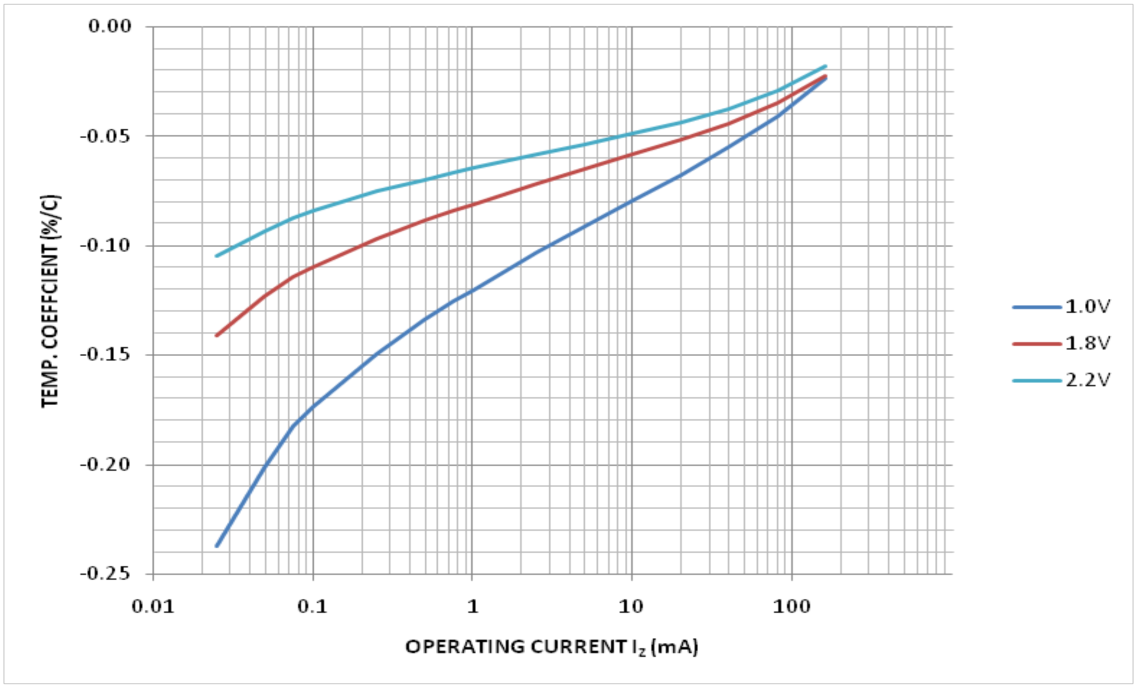



**FIGURE 5**
ZENER VOLTAGE TEMPERATURE COEFFICIENT vs. OPERATING CURRENT (typical)
ΔT FROM 25 °C TO 125 °C

## GRAPHS (continued)

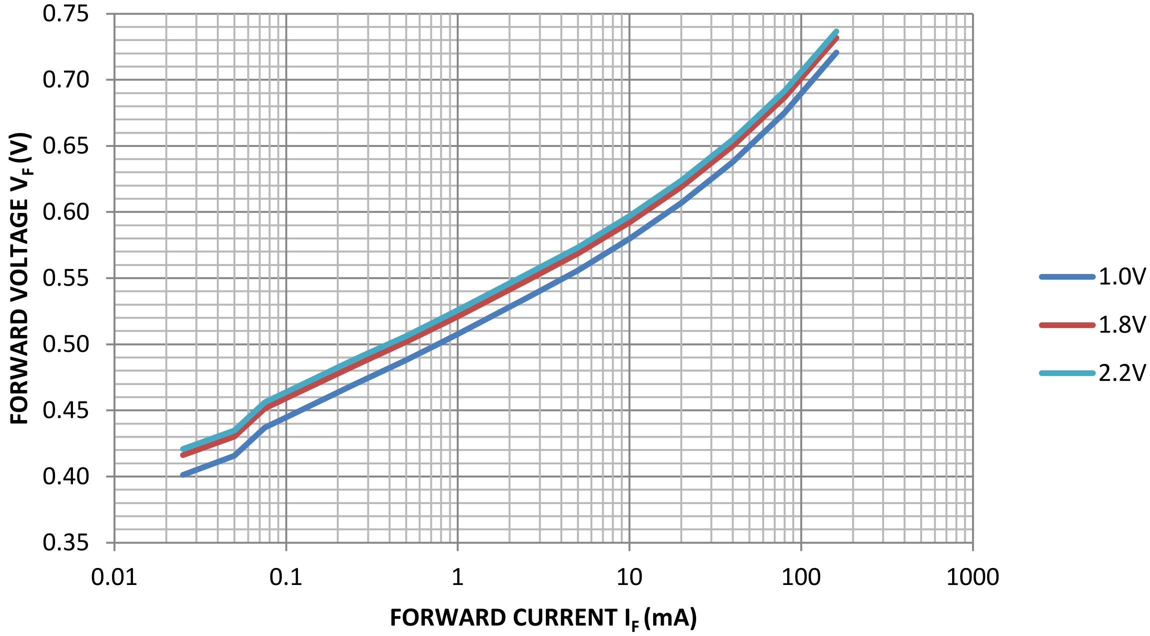



**FIGURE 6**
FORWARD VOLTAGE vs. FORWARD CURRENT at 25 °C (typical)

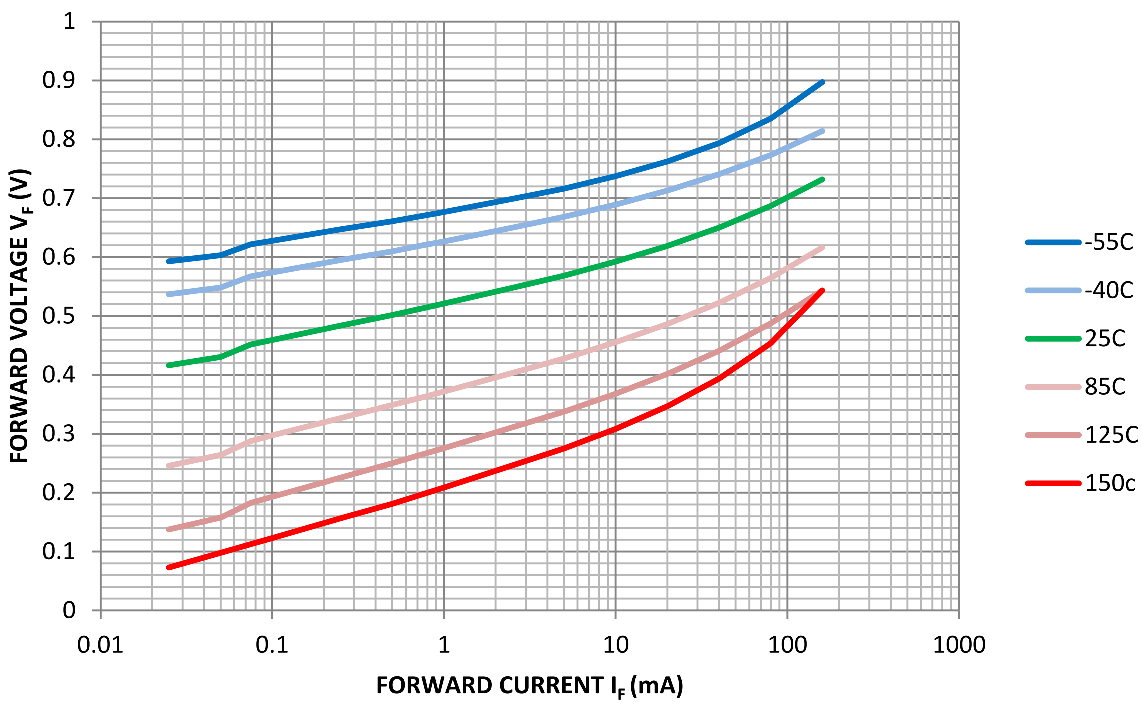
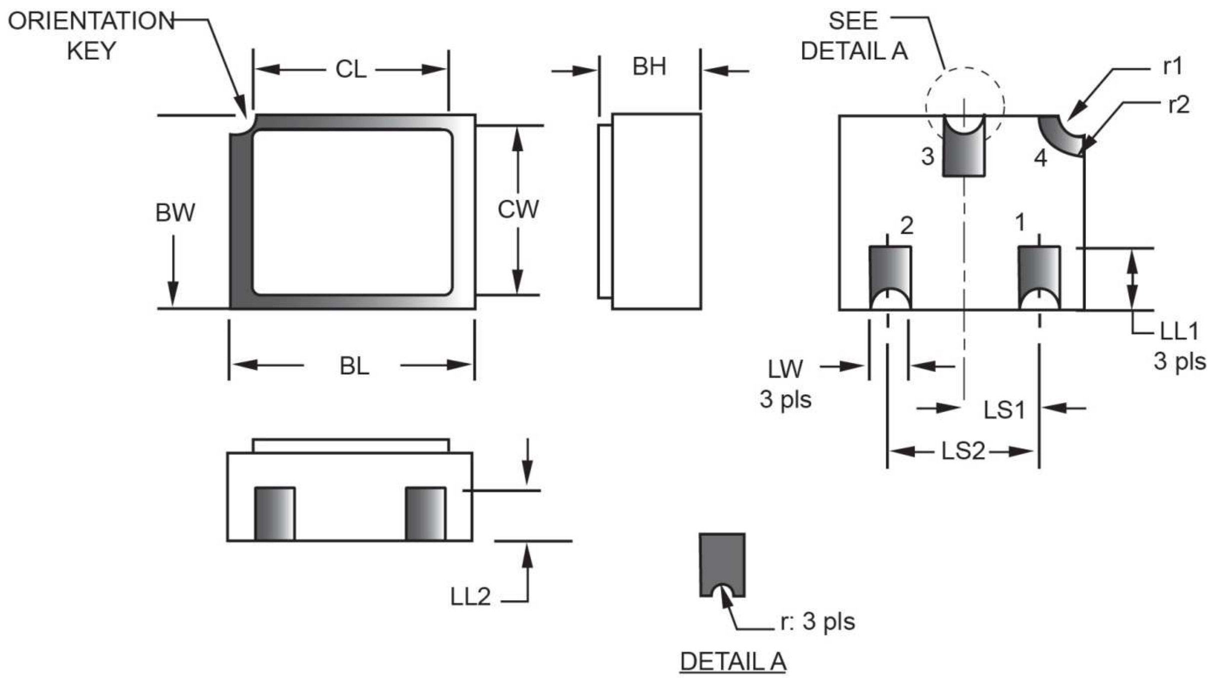



**FIGURE 7**
FORWARD VOLTAGE vs. FORWARD CURRENT SZL1.8 (typical)

## PACKAGE DIMENSIONS

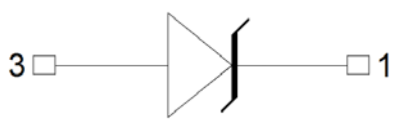



| Symbol | Dimensions inch Min | inch Max | millimeters Min | millimeters Max | Note | Symbol | Dimensions inch Min | inch Max | millimeters Min | millimeters Max | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BH** | 0.046 | 0.056 | 1.17 | 1.42 | | **LS1** | 0.035 | 0.040 | 0.89 | 1.02 | |
| **BL** | 0.115 | 0.128 | 2.92 | 3.25 | | **LS2** | 0.071 | 0.079 | 1.80 | 2.01 | |
| **BW** | 0.095 | 0.108 | 2.41 | 2.74 | | **LW** | 0.016 | 0.024 | 0.41 | 0.61 | |
| **CL** | - | 0.128 | - | 3.25 | | **r** | - | 0.008 | - | 0.20 | |
| **CW** | - | 0.108 | - | 2.74 | | **r1** | - | 0.012 | - | 0.30 | 6 |
| **LL1** | 0.022 | 0.038 | 0.56 | 0.97 | | **r2** | - | 0.022 | - | 0.056 | |
| **LL2** | 0.014 | 0.035 | 0.356 | 0.89 | | | | | | | |

**NOTES:**

1. Dimensions are in inches. Millimeters are given for information only.
2. Ceramic package only.
3. Hatched areas on package denote metalized areas.
4. Pad 1 = Cathode, Pad 2 = not used, Pad 3 = Anode, Pad 4 = Shielding connected to the lid.
5. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
6. For reference only.

## SCHEMATIC




**PAD ASSIGNMENTS: 1 = Cathode, 2 = Not Used, 3 = Anode, 4 = Shielding Connected to Lid**