# Surface Mount Zener Diode

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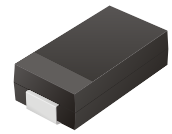
# CZRB2011 Thru CZRB2100

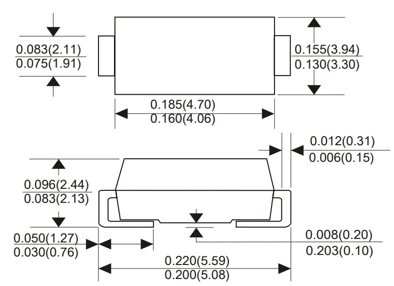
**Voltage: 11 - 100 Volts**
**Power: 2.0 Watt**



## Features

- For surf ace mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- Typical $I_D$ less than 1uA above 11V
- High temperature soldering 260°C /10 seconds at terminals
- Plastic package has underwriters laboratory flammability classification 94V-O

SMB/DO-214AA




Dimensions in inches and (maillimeter)

## Mechanical data

- Case: JEDEC DO-214AA, Molded plastic over passivated junction
- Terminals: Solder plated, solderable per MIL-STD-750, method 2026
- Polarity: Color band denotes positive end (cathode) except Bidirectional
- Standard Packaging: 12mm tape (EIA-481)
- Weight: 0.002 ounce, 0.064 gram

## Maximum Ratings and Electrical Characterics

Ratings at 25°C ambient temperature unless otherwise specified.

| Rating | Symbol | Value | Units |
|---|---|---|---|
| Peak Pulse Power Dissipation (Note A)<br>Derate above 75°C | $P_D$ | 2<br>24 | Watts<br>mW/°C |
| Peak forward Surge Current 8.3ms single half sine-wave superimposed on rated load (JEDEC Method) (Note B) | $I_{FSM}$ | 15 | Amps |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 to +150 | °C |

Rating and Characteristic Curevs (CZRB2011 Thru CZRB2100)

## ELECTRICAL CHARACTERISTICS

($T_A$=25°C unless otherwise noted) ($V_F$=1.2Volts Max, $I_F$=500mA for all types.)

| **Device** (Note 1.) | **Nominal Zener Voltage $V_Z$ @ $I_{ZT}$** (Note 2.) | **Test current $I_{ZT}$** | **Maximum Zener Impedance** (Note 3.) | | | **Leakage Current** | | **Maximum Zener Current $I_{ZM}$** | **Surge Current @$T_A$=25°C** (Note 4.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | **$Z_{ZT}$ @ $I_{ZT}$** | **$Z_{ZK}$ @ $I_{ZK}$** | **$I_{ZK}$** | **$I_R$** | **$V_R$** | | |
| | **(Volts)** | **(mA)** | **(Ohms)** | **(Ohms)** | **(mA)** | **(uA)** | **(Volts)** | **(mA)** | **Ir - mA** |
| CZRB2011 | 11 | 45.5 | 4 | 700 | 0.25 | 1.0 | 8.4 | 166 | 1.82 |
| CZRB2012 | 12 | 41.5 | 4.5 | 700 | 0.25 | 1.0 | 9.1 | 152 | 1.66 |
| CZRB2013 | 13 | 38.5 | 5 | 700 | 0.25 | 0.5 | 9.9 | 138 | 1.54 |
| CZRB2014 | 14 | 35.7 | 5.5 | 700 | 0.25 | 0.5 | 10.6 | 130 | 1.43 |
| CZRB2015 | 15 | 33.4 | 7 | 700 | 0.25 | 0.5 | 11.4 | 122 | 1.33 |
| CZRB2016 | 16 | 31.2 | 8 | 700 | 0.25 | 0.5 | 12.2 | 114 | 1.25 |
| CZRB2017 | 17 | 29.4 | 9 | 750 | 0.25 | 0.5 | 13 | 107 | 1.18 |
| CZRB2018 | 18 | 27.8 | 10 | 750 | 0.25 | 0.5 | 13.7 | 100 | 1.11 |
| CZRB2019 | 19 | 26.3 | 11 | 750 | 0.25 | 0.5 | 14.4 | 95 | 1.05 |
| CZRB2020 | 20 | 25 | 11 | 750 | 0.25 | 0.5 | 15.2 | 90 | 1.00 |
| CZRB2022 | 22 | 22.8 | 12 | 750 | 0.25 | 0.5 | 16.7 | 82 | 0.91 |
| CZRB2024 | 24 | 20.8 | 13 | 750 | 0.25 | 0.5 | 18.2 | 76 | 0.83 |
| CZRB2027 | 27 | 18.5 | 18 | 750 | 0.25 | 0.5 | 20.6 | 68 | 0.74 |
| CZRB2030 | 30 | 16.6 | 20 | 1000 | 0.25 | 0.5 | 22.5 | 60 | 0.67 |
| CZRB2033 | 33 | 15.1 | 23 | 1000 | 0.25 | 0.5 | 25.1 | 55 | 0.61 |
| CZRB2036 | 36 | 13.9 | 25 | 1000 | 0.25 | 0.5 | 27.4 | 50 | 0.56 |
| CZRB2039 | 39 | 12.8 | 30 | 1000 | 0.25 | 0.5 | 29.7 | 47 | 0.51 |
| CZRB2043 | 43 | 11.6 | 35 | 1500 | 0.25 | 0.5 | 32.7 | 43 | 0.45 |
| CZRB2047 | 47 | 10.6 | 40 | 1500 | 0.25 | 0.5 | 35.6 | 39 | 0.42 |
| CZRB2051 | 51 | 9.8 | 48 | 1500 | 0.25 | 0.5 | 38.8 | 36 | 0.39 |
| CZRB2056 | 56 | 9 | 55 | 2000 | 0.25 | 0.5 | 42.6 | 32 | 0.36 |
| CZRB2062 | 62 | 8.1 | 60 | 2000 | 0.25 | 0.5 | 47.1 | 29 | 0.32 |
| CZRB2068 | 68 | 7.4 | 75 | 2000 | 0.25 | 0.5 | 51.7 | 27 | 0.29 |
| CZRB2075 | 75 | 6.7 | 90 | 2000 | 0.25 | 0.5 | 56 | 24 | 0.27 |
| CZRB2082 | 82 | 6.1 | 100 | 3000 | 0.25 | 0.5 | 62.2 | 22 | 0.24 |
| CZRB2091 | 91 | 5.5 | 125 | 3000 | 0.25 | 0.5 | 69.2 | 20 | 0.22 |
| CZRB2100 | 100 | 5 | 175 | 3000 | 0.25 | 0.5 | 76 | 18 | 0.20 |

NOTE:

1. TOLERANCES - Suffix indicates 5% tolerance any other tolerance will be considered as a special device.
2. ZENER VOLTAGE (Vz) MEASUREMENT - guarantees the zener voltage when measured at 40 ms ± 10ms from the diode body, and an ambient temperature of 25 °C (+ 8 °C , -2 °C ).
3. ZENER IMPEDANCE (Zz) DERIVATION - The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms falue equal to 10% of the dc zener current ($I_{ZT}$ or $I_{ZK}$) is superimposed on $I_{ZT}$ or $I_{ZK}$.
4. SURGE CURRENT (Ir) NON-REPETITIVE - The rating listed in the electrical characteristics table is maximum peak, non-repetitive, reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current, $I_{ZT}$, per JEDEC standards, however, actual device capability is as described in Figure 3.

## Rating and Characteristic Curves (CZRB2011 Thru CZRB2100)

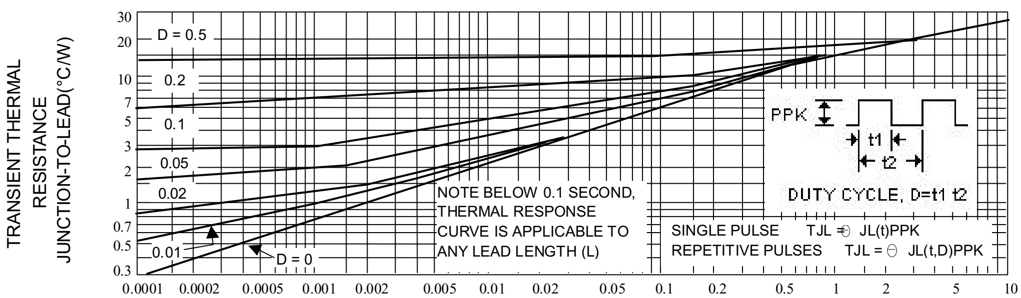



Fig. 2-TYPICAL THERMAL RESPONSE L,

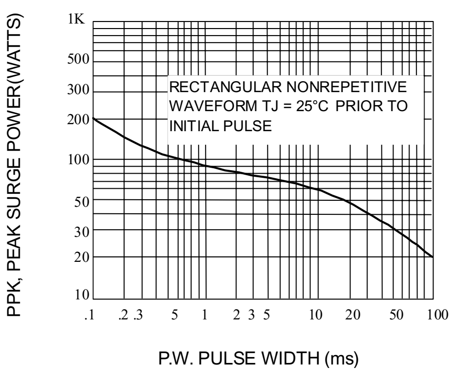



Fig. 3-MAXIMUM SURGE POWER

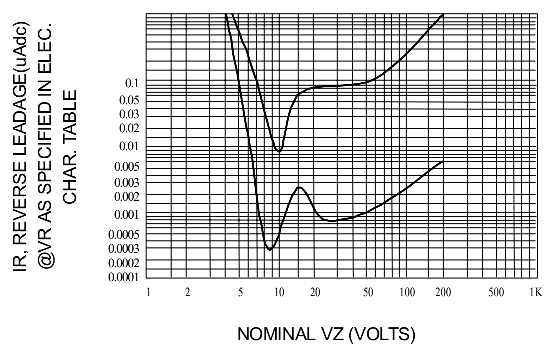



Fig. 4-TYPICAL REVERSE LEAKAGE

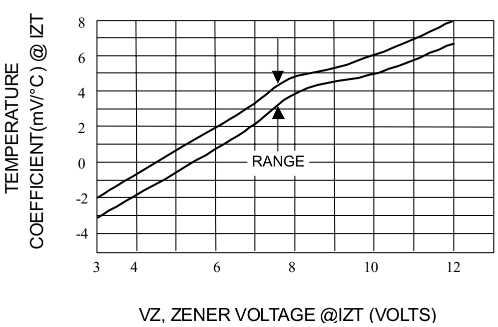



Fig. 5 - UNITS TO 12 VOLTS

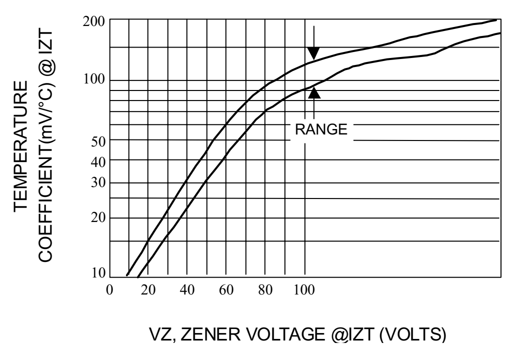
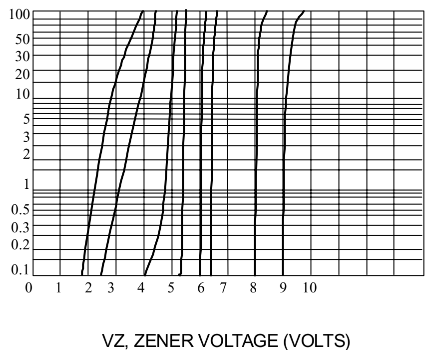
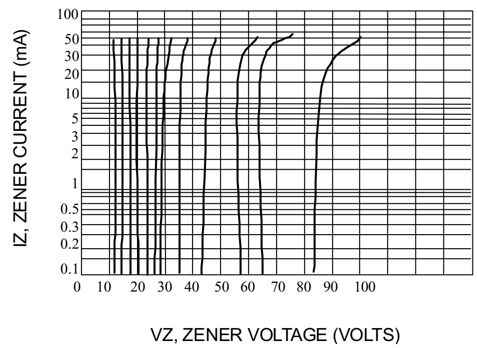



Fig. 6 - UNITS 10 TO 100 VOLTS

Rating and Characteristic Curves (CZRB2011 Thru CZRB2100)



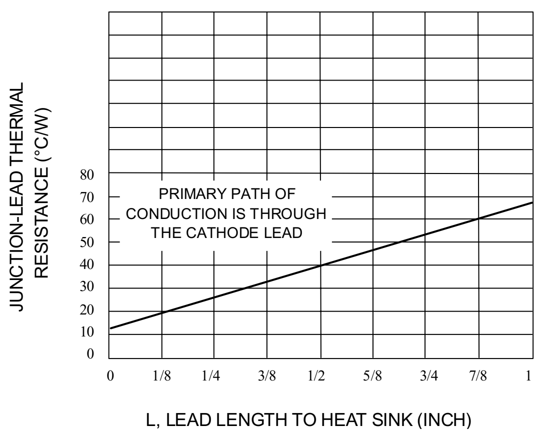




Fig. 9 -TYPICAL THERMAL RESISTANCE

**APPLICATION NOTE:**

Since the actual voltage available from a given zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature, $T_L$, should be determined from:

$$T_L = \theta_{LA} P_D + T_A$$

$\theta_{LA}$ is the lead-to-ambient thermal resistance (°C/W) and PD is the power dissipation. The value for $\theta_{LA}$ will vary and depends on the device mounting method. $\theta_{LA}$ is generally 30-40 °C/W for the various chips and tie points in common use and for printed circuit board wiring.

The temperature of the lead can also be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of $T_L$, the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}$$

$\Delta T_{JL}$ is the increase in junction temperature above the lead temperature and may be found from Figure 2 for a train of power pulses or from Figure 10 for dc power.

$$\Delta T_{JL} = \theta_{LA} P_D$$

For worst-case design, using expected limits of Iz, limits of PD and the extremes of TJ ($\Delta T_{JL}$ ) may be estimated. Changes in voltage, Vz, can then be found from:

$$\Delta V = \theta_{VZ}\, \Delta T_J$$

$\theta_{VZ}$ , the zener voltage temperature coefficient, is found from Figures 5 and 6.

Under high power-pulse operation, the zener voltage will vary with time and may also be affected significantly be the zener resistance. For best regulation, keep current excursions as low as possible.

Data of Figure 2 should not be used to compute surge capability. Surge limitations are given in Figure 3. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots resulting in device degradation should the limits of Figure 3 be exceeded.