



1N5518A,B thru 1N5546A,B

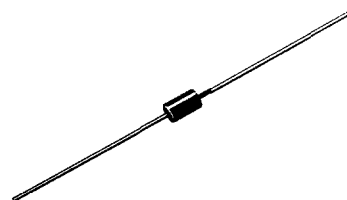
LOW VOLTAGE AVALANCHE SILICON OXIDE PASSIVATED ZENER REGULATOR DIODES

Highly reliable silicon regulators utilizing an oxide-passivated junction for long-term voltage stability. Double slug construction provides a rugged, glass-enclosed, hermetically sealed structure.

- Low Zener Noise Specified
- Low Maximum Regulation Factor
- Low Zener Impedance
- Low Leakage Current
- Controlled Forward Characteristics
- Temperature Range: -65 to +200°C

LOW VOLTAGE AVALANCHE ZENER DIODES

400 MILLIWATTS
3.3 THRU 33 VOLTS

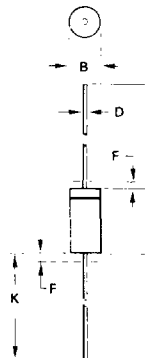


MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|----------------------------|
| DC Power Dissipation @ $T_A = 50^\circ\text{C}$ Derate above 50°C | P_D | 400 3.2 | mW mW/ $^\circ\text{C}$ |
| DC Power Dissipation @ $T_L = 50^\circ\text{C}$ Lead Length = 1/8" Derate above 50°C (Figure 1) | P_D | 500 3.3 | mW mW/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +200 | $^\circ\text{C}$ |

MECHANICAL CHARACTERISTICS

CASE: Hermetically sealed, all-glass
 DIMENSIONS: See outline drawing.
 FINISH: All external surfaces are corrosion resistant and leads are readily solderable and weldable.
 POLARITY: Cathode indicated by polarity band.
 WEIGHT: 0.2 Gram (approx)
 MOUNTING POSITION: Any



NOTES

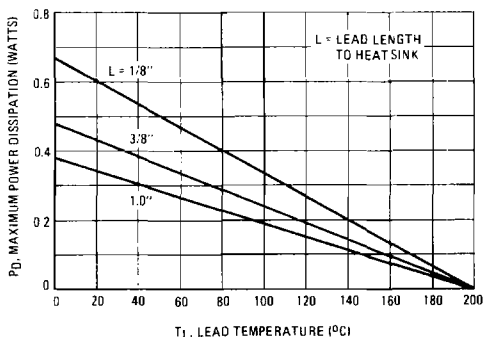
1. PACKAGE CONTOUR OPTIONAL WITHIN A AND B HEAT SLUGS IF ANY, SHALL BE INCLUDED WITHIN THIS CYLINDER, BUT NOT SUBJECT TO THE MINIMUM LIMIT OF B.
2. LEAD DIAMETER NOT CONTROLLED IN ZONE F TO ALLOW FOR FLASH LEAD FINISH BUILDUP AND MINOR IRREGULARITIES OTHER THAN HEAT SLUGS.
3. POLARITY DENOTED BY CATHODE BAND.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 3.05 | 5.08 | 0.120 | 0.200 |
| B | 1.52 | 2.29 | 0.060 | 0.090 |
| D | 0.46 | 0.56 | 0.018 | 0.022 |
| F | - | 1.27 | - | 0.050 |
| K | 25.40 | 39.10 | 1.000 | 1.500 |

All JEDEC dimensions and notes apply

CASE 299-Q2
DO-204 AH

FIGURE 1 - POWER-TEMPERATURE DERATING CURVE



1N5518A, B thru 1N5546A, B

ELECTRICAL CHARACTERISTICS ($T_A = 25^{\circ}\text{C}$ unless otherwise noted. Based on dc measurements at thermal equilibrium, $V_F = 1.1$ Max @ $I_F = 200$ mA for all types)

| JEDEC Type No. (Note 1) | Nominal Zener Voltage V_Z @ I_{ZT} Volts (Note 2) | Test Current I_{ZT} mA dc | Max Zener Impedance B-C-D Suffix Z_{ZT} @ I_{ZT} Ohms (Note 3) | Max Reverse Leakage Current | | | B-C-D Suffix Maximum DC Zener Current I_{ZM} mA dc (Note 5) | B-C-D Suffix Max Noise Density at $I_Z = 250 \mu\text{A}$ N_D (Figure 1) (micro-volts per square root cycle) | Regulation Factor ΔV_Z Volts (Note 6) | Low V_Z Current I_{ZL} mA dc |
|-------------------------|---|-----------------------------|--|---------------------------------|----------------------|--------------|---|--|---|----------------------------------|
| | | | | I_R μA dc (Note 4) | $V_R - \text{Volts}$ | | | | | |
| | | | | | Non & A. Suffix | B-C-D Suffix | | | | |
| 1N5518A | 3.3 | 20 | 26 | 5.0 | 0.90 | 1.0 | 115 | 0.5 | 0.90 | 2.0 |
| 1N5519A | 3.6 | 20 | 24 | 3.0 | 0.90 | 1.0 | 105 | 0.5 | 0.90 | 2.0 |
| 1N5520A | 3.9 | 20 | 22 | 1.0 | 0.90 | 1.0 | 98 | 0.5 | 0.85 | 2.0 |
| 1N5521A | 4.3 | 20 | 18 | 3.0 | 1.0 | 1.5 | 88 | 0.5 | 0.75 | 2.0 |
| 1N5522A | 4.7 | 10 | 22 | 2.0 | 1.5 | 2.0 | 81 | 0.5 | 0.60 | 1.0 |
| 1N5523A | 5.1 | 5.0 | 26 | 2.0 | 2.0 | 2.5 | 75 | 0.5 | 0.65 | 0.25 |
| 1N5524A | 5.6 | 3.0 | 30 | 2.0 | 3.0 | 3.5 | 68 | 1.0 | 0.30 | 0.25 |
| 1N5525A | 6.2 | 1.0 | 30 | 1.0 | 4.5 | 5.0 | 61 | 1.0 | 0.20 | 0.01 |
| 1N5526A | 6.8 | 1.0 | 30 | 1.0 | 5.5 | 6.2 | 56 | 1.0 | 0.10 | 0.01 |
| 1N5527A | 7.5 | 1.0 | 35 | 0.5 | 6.0 | 6.8 | 51 | 2.0 | 0.05 | 0.01 |
| 1N5528A | 8.2 | 1.0 | 40 | 0.5 | 6.5 | 7.5 | 46 | 4.0 | 0.05 | 0.01 |
| 1N5529A | 9.1 | 1.0 | 45 | 0.1 | 7.0 | 8.2 | 42 | 4.0 | 0.05 | 0.01 |
| 1N5530A | 10.0 | 1.0 | 60 | 0.05 | 8.0 | 9.1 | 38 | 4.0 | 0.10 | 0.01 |
| 1N5531A | 11.0 | 1.0 | 80 | 0.05 | 9.0 | 9.9 | 35 | 5.0 | 0.20 | 0.01 |
| 1N5532A | 12.0 | 1.0 | 90 | 0.05 | 9.5 | 10.8 | 32 | 10 | 0.20 | 0.01 |
| 1N5533A | 13.0 | 1.0 | 90 | 0.01 | 10.5 | 11.7 | 29 | 15 | 0.20 | 0.01 |
| 1N5534A | 14.0 | 1.0 | 100 | 0.01 | 11.5 | 12.6 | 27 | 20 | 0.20 | 0.01 |
| 1N5535A | 15.0 | 1.0 | 100 | 0.01 | 12.5 | 13.5 | 25 | 20 | 0.20 | 0.01 |
| 1N5536A | 16.0 | 1.0 | 100 | 0.01 | 13.0 | 14.4 | 24 | 20 | 0.20 | 0.01 |
| 1N5537A | 17.0 | 1.0 | 100 | 0.01 | 14.0 | 15.3 | 22 | 20 | 0.20 | 0.01 |
| 1N5538A | 18.0 | 1.0 | 100 | 0.01 | 15.0 | 16.2 | 21 | 20 | 0.20 | 0.01 |
| 1N5539A | 19.0 | 1.0 | 100 | 0.01 | 16.0 | 17.1 | 20 | 20 | 0.20 | 0.01 |
| 1N5540A | 20.0 | 1.0 | 100 | 0.01 | 17.0 | 18.0 | 19 | 20 | 0.20 | 0.01 |
| 1N5541A | 22.0 | 1.0 | 100 | 0.01 | 18.0 | 19.8 | 17 | 20 | 0.25 | 0.01 |
| 1N5542A | 24.0 | 1.0 | 100 | 0.01 | 20.0 | 21.6 | 16 | 20 | 0.30 | 0.01 |
| 1N5543A | 25.0 | 1.0 | 100 | 0.01 | 21.0 | 22.4 | 15 | 20 | 0.35 | 0.01 |
| 1N5544A | 28.0 | 1.0 | 100 | 0.01 | 23.0 | 25.2 | 14 | 20 | 0.40 | 0.01 |
| 1N5545A | 30.0 | 1.0 | 100 | 0.01 | 24.0 | 27.0 | 13 | 20 | 0.45 | 0.01 |
| 1N5546A | 33.0 | 1.0 | 100 | 0.01 | 28.0 | 29.7 | 12 | 20 | 0.50 | 0.01 |

NOTE 1 – TOLERANCE AND VOLTAGE DESIGNATION

The JEDEC type numbers shown are $\pm 10\%$ with guaranteed limits for V_Z , I_R , and V_F . Units with guaranteed limits for all six parameters are indicated by a "B" suffix for $\pm 5.0\%$ units, "C" suffix for $\pm 2.0\%$ and "D" suffix for $\pm 1.0\%$.

NOTE 2 – ZENER VOLTAGE (V_Z) MEASUREMENT

Nominal zener voltage is measured with the device junction in thermal equilibrium with ambient temperature of 25°C .

NOTE 3 – ZENER IMPEDANCE (Z_Z) DERIVATION

The zener impedance is derived from the 60 Hz ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (I_{ZT}) is superimposed on I_{ZT} .

NOTE 4 – REVERSE LEAKAGE CURRENT (I_R)

Reverse leakage currents are guaranteed and are measured at V_R as shown on the table.

NOTE 5 – MAXIMUM REGULATOR CURRENT (I_{ZM})

The maximum current shown is based on the maximum voltage of a 5.0% type unit, therefore, it applies only to the "B" suffix device. The actual I_{ZM} for any device may not exceed the value of 400 milliwatts divided by the actual V_Z of the device.

NOTE 6 – MAXIMUM REGULATION FACTOR (ΔV_Z)

ΔV_Z is the maximum difference between V_Z at I_{ZT} and V_Z at I_{ZL} measured with the device junction in thermal equilibrium.

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ZENER NOISE DENSITY

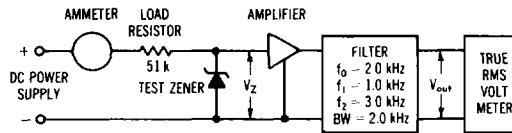
A zener diode generates noise when it is biased in the zener direction. A small part of this noise is due to the internal resistance associated with the device. A larger part of zener noise is a result of the zener breakdown phenomenon and is called microplasma noise. To eliminate the higher frequency components of noise a small shunting capacitor can be used. The lower frequency noise generally must be tolerated since a capacitor required to eliminate the lower frequencies would degrade the regulation properties of the zener in many applications.

Motorola is rating this series with a maximum noise density at 250 microamperes, a bandwidth of 2.0 kHz and a center frequency of 2.0 kHz.

Noise density decreases as zener current increases. The junction temperature will also change the zener noise levels, thus the noise rating must indicate frequency, bandwidth, current level and temperature.

The block diagram shown in Figure 2 represents the method used to measure noise density. The input voltage and load resistance is high so that the zener is driven from a constant current source. The amplifier must be low noise so that the amplifier noise is negligible compared to the test zener. The filter frequency and bandpass is known so that the noise density in volts RMS per square root cycle can be calculated.

FIGURE 2 - NOISE DENSITY MEASUREMENT METHOD



$$\text{NOISE DENSITY (VOLTS PER SQUARE ROOT BANDWIDTH)} = \frac{V_{out}}{\text{OVERALL GAIN} \sqrt{BW}}$$

WHERE: BW = FILTER BANDWIDTH (Hz)
 V_{out} = OUTPUT NOISE (VOLTS RMS)

FIGURE 3 - TYPICAL CAPACITANCE

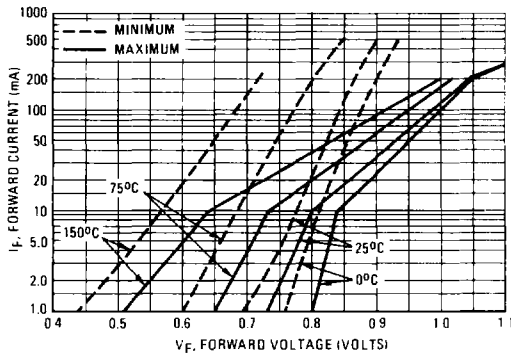
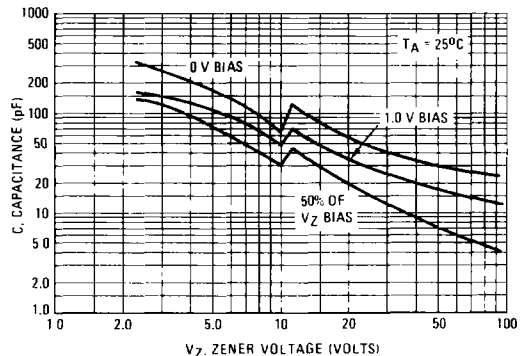


FIGURE 4 - TYPICAL FORWARD CHARACTERISTICS



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FIGURE 5 – ZENER DIODE CHARACTERISTICS AND SYMBOL IDENTIFICATION

