1N4370A Series

500 mW DO-35 Hermetically Sealed Glass Zener Voltage Regulators

This is a complete series of 500 mW Zener diodes with limits and excellent operating characteristics that reflect the superior capabilities of silicon–oxide passivated junctions. All this in an axial–lead hermetically sealed glass package that offers protection in all common environmental conditions.

Specification Features:

- Zener Voltage Range – 2.4 V to 12 V
- ESD Rating of Class 3 (>16 KV) per Human Body Model
- DO–204AH (DO–35) Package – Smaller than Conventional DO–204AA Package
- Double Slug Type Construction
- Metallurgical Bonded Construction

Mechanical Characteristics:

CASE: Double slug type, hermetically sealed glass
FINISH: All external surfaces are corrosion resistant and leads are readily solderable
MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 230°C, 1/16″ from the case for 10 seconds
POLARITY: Cathode indicated by polarity band
MOUNTING POSITION: Any

MAXIMUM RATINGS (Note 1.)

Rating	Symbol	Value	Unit
Max. Steady State Power Dissipation @ $T_L \le 75°C$, Lead Length = 3/8″ Derate above 75°C	P_D	500 4.0	mW mW/°C
Operating and Storage Temperature Range	T_J, T_{stg}	–65 to +200	°C

1. Some part number series have lower JEDEC registered ratings.

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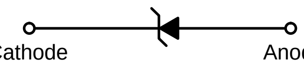
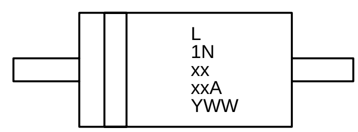


Cathode Anode

AXIAL LEAD
CASE 299
GLASS

MARKING DIAGRAM



L = Assembly Location
1NxxxxA = Device Code (See Table Next Page)
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
1NxxxxA	Axial Lead	3000 Units/Box
1NxxxxARL	Axial Lead	5000/Tape & Reel
1NxxxxARL2 *	Axial Lead	5000/Tape & Reel
1NxxxxARA1	Axial Lead	3000/Ammo Pack
1NxxxxATA	Axial Lead	5000/Ammo Pack
1NxxxxATA2 *	Axial Lead	5000/Tape & Reel
1NxxxxARR1 †	Axial Lead	3000/Tape & Reel
1NxxxxARR2 ‡	Axial Lead	3000/Tape & Reel

* The “2” suffix refers to 26 mm tape spacing.
† Polarity band **up** with cathode lead off first
‡ Polarity band **down** with cathode lead off first

Devices listed in ***bold, italic*** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

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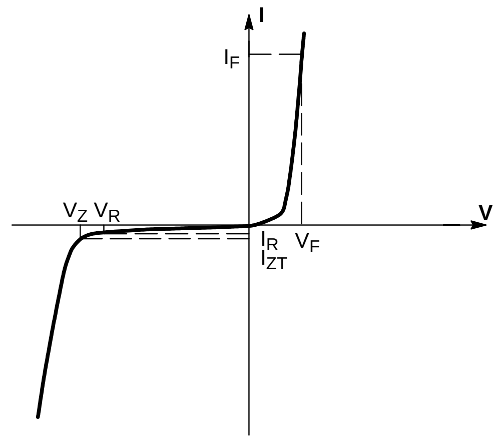
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.5 V Max @ I_F = 200 mA for all types)

Symbol	Parameter
V_Z	Reverse Zener Voltage @ I_{ZT}
I_{ZT}	Reverse Current
Z_{ZT}	Maximum Zener Impedance @ I_{ZT}
I_{ZM}	Maximum DC Zener Current
I_R	Reverse Leakage Current @ V_R
V_R	Reverse Voltage
I_F	Forward Current
V_F	Forward Voltage @ I_F



Zener Voltage Regulator

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.5 V Max @ I_F = 200 mA for all types)

Device (Note 2.)	Device Marking	Zener Voltage (Note 3.) V_Z (Volts) Min	Nom	Max	@ I_{ZT} (mA)	Z_{ZT} (Note 4.) @ I_{ZT} (Ω)	I_{ZM} (Note 5.) (mA)	I_R @ V_R = 1 V T_A = 25°C (μA)	T_A = 150°C (μA)
1N4370A	1N4370A	2.28	2.4	2.52	20	30	150	100	200
1N4371A	1N4371A	2.57	2.7	2.84	20	30	135	75	150
1N4372A	1N4372A	2.85	3.0	3.15	20	29	120	50	100
1N746A	***1N746A***	***3.14***	***3.3***	***3.47***	***20***	***28***	***110***	***10***	***30***
1N747A	1N747A	3.42	3.6	3.78	20	24	100	10	30
1N748A	1N748A	3.71	3.9	4.10	20	23	95	10	30
1N749A	1N749A	4.09	4.3	4.52	20	22	85	2	30
1N750A	1N750A	4.47	4.7	4.94	20	19	75	2	30
1N751A	***1N751A***	***4.85***	***5.1***	***5.36***	***20***	***17***	***70***	***1***	***20***
1N752A	***1N752A***	***5.32***	***5.6***	***5.88***	***20***	***11***	***65***	***1***	***20***
1N753A	***1N753A***	***5.89***	***6.2***	***6.51***	***20***	***7***	***60***	***0.1***	***20***
1N754A	1N754A	6.46	6.8	7.14	20	5	55	0.1	20
1N755A	1N755A	7.13	7.5	7.88	20	6	50	0.1	20
1N756A	1N756A	7.79	8.2	8.61	20	8	45	0.1	20
1N757A	1N757A	8.65	9.1	9.56	20	10	40	0.1	20
1N758A	1N758A	9.50	10	10.5	20	17	35	0.1	20
1N759A	1N759A	11.40	12	12.6	20	30	30	0.1	20

2. **TOLERANCE AND TYPE NUMBER DESIGNATION (V_Z)**
   The type numbers listed have a standard tolerance on the nominal zener voltage of ±5%.
3. **ZENER VOLTAGE (V_Z) MEASUREMENT**
   Nominal zener voltage is measured with the device junction in the thermal equilibrium at the lead temperature (T_L) at 30°C ± 1°C and 3/8″ lead length.
4. **ZENER IMPEDANCE (Z_Z) DERIVATION**
   Z_{ZT} and Z_{ZK} are measured by dividing the ac voltage drop across the device by the ac current applied. The specified limits are for $I_{Z(ac)}$ = 0.1 $I_{Z(dc)}$ with the ac frequency = 60 Hz.
5. **MAXIMUM ZENER CURRENT RATINGS (I_{ZM})**
   Values shown are based on the JEDEC rating of 400 mW where the actual zener voltage (V_Z) is known at the operating point, the maximum zener current may be increased and is limited by the derating curve.

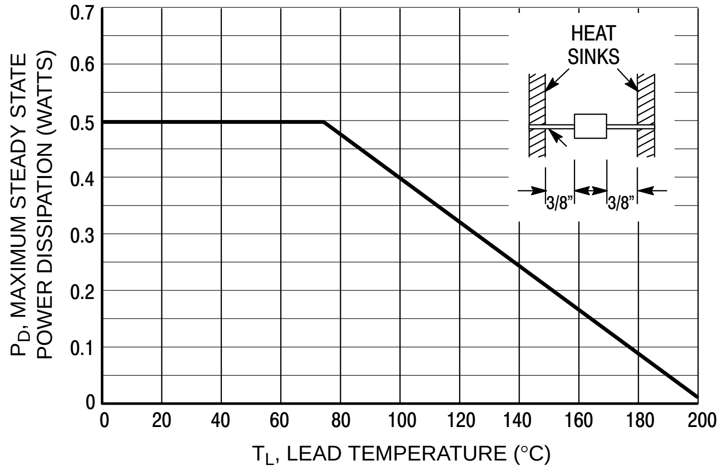


Figure 1. Steady State Power Derating

APPLICATION NOTE — ZENER VOLTAGE

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:

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

θ_{LA} is the lead-to-ambient thermal resistance (°C/W) and P_D is the power dissipation. The value for θ_{LA} will vary and depends on the device mounting method. θ_{LA} is generally 30 to 40°C/W for the various clips 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:

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

ΔT_{JL} is the increase in junction temperature above the lead temperature and may be found from Figure 2 for dc power:

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

For worst-case design, using expected limits of I_Z, limits of P_D and the extremes of $T_J(\Delta T_J)$ may be estimated. Changes in voltage, V_Z, can then be found from:

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

θ_{VZ}, the zener voltage temperature coefficient, is found from Figures 4 and 5.

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

Surge limitations are given in Figure 7. 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 7 be exceeded.

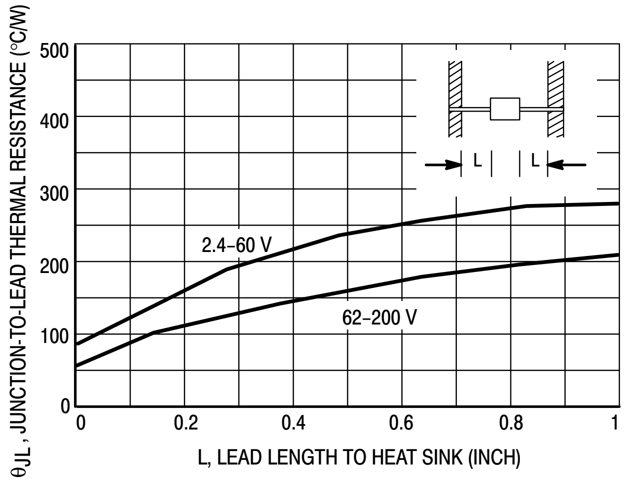


Figure 2. Typical Thermal Resistance

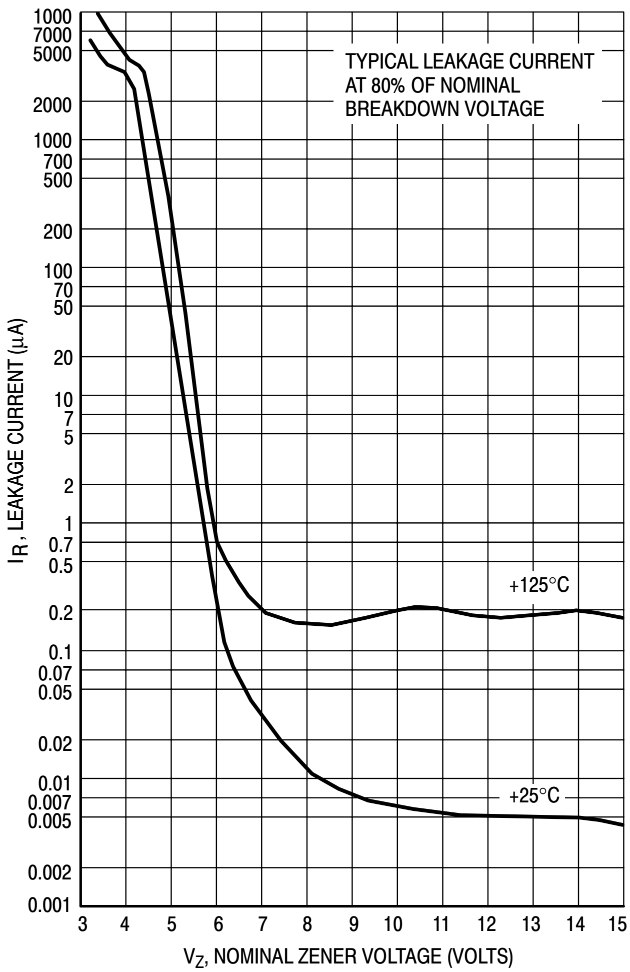


Figure 3. Typical Leakage Current

TEMPERATURE COEFFICIENTS

(–55°C to +150°C temperature range; 90% of the units are in the ranges indicated.)

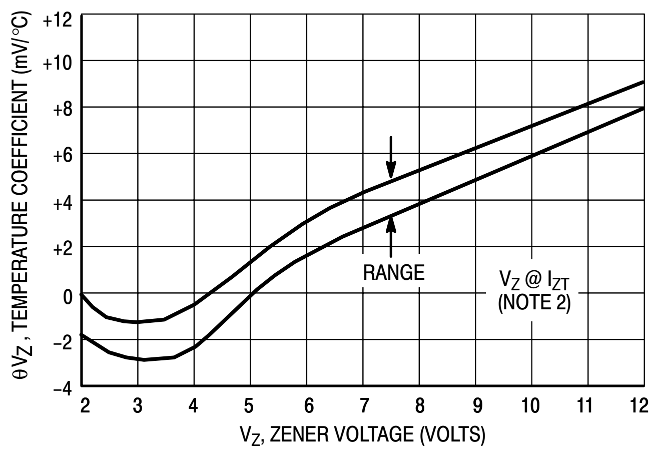


Figure 4a. Range for Units to 12 Volts

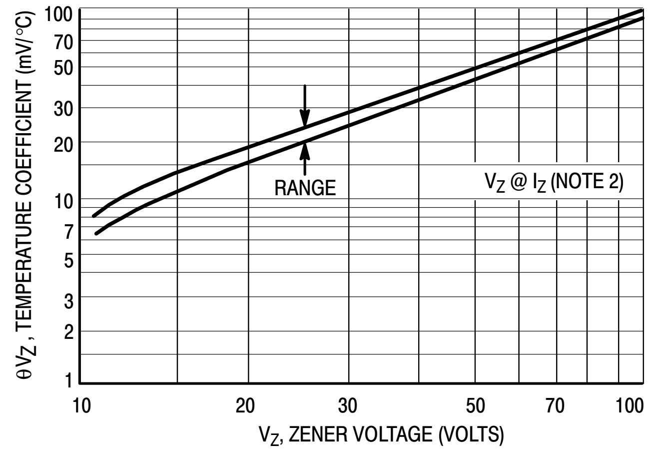


Figure 4b. Range for Units 12 to 100 Volts

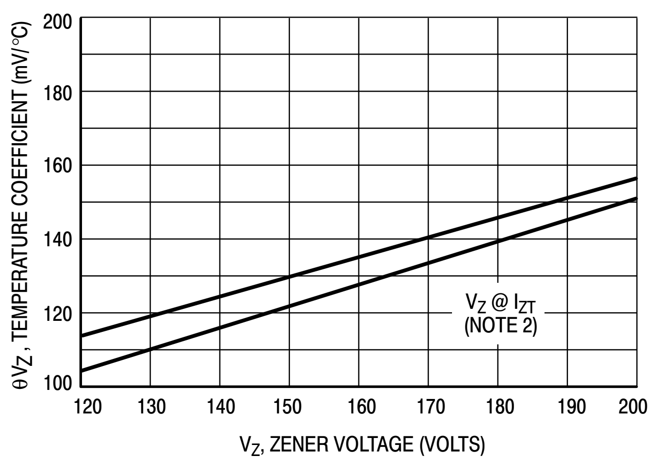


Figure 4c. Range for Units 120 to 200 Volts

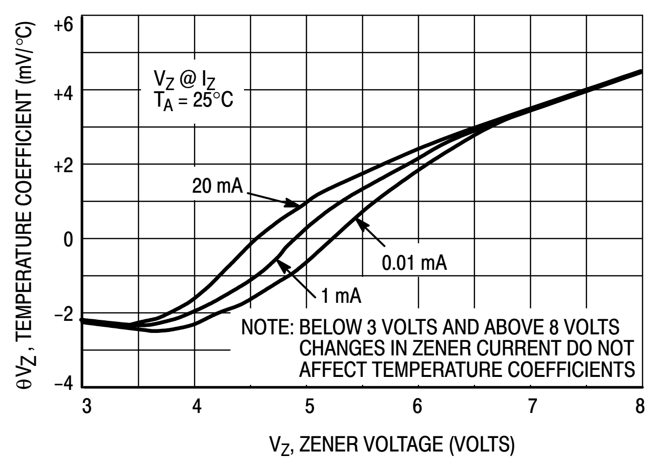


Figure 5. Effect of Zener Current

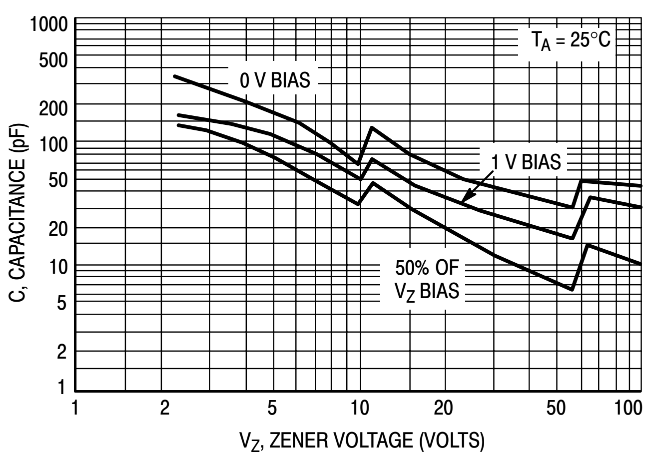


Figure 6a. Typical Capacitance 2.4–100 Volts

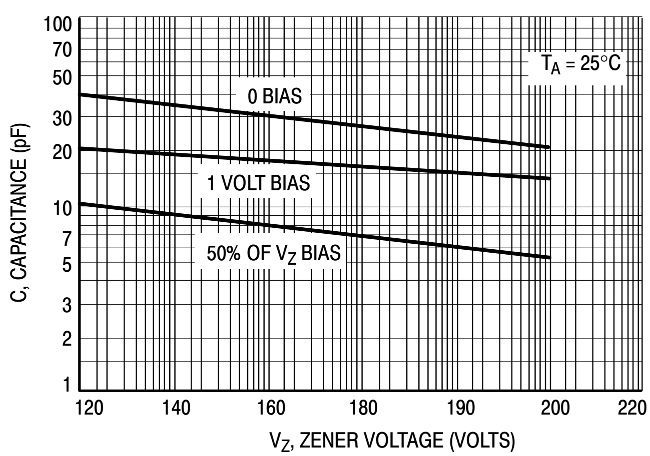


Figure 6b. Typical Capacitance 120–200 Volts

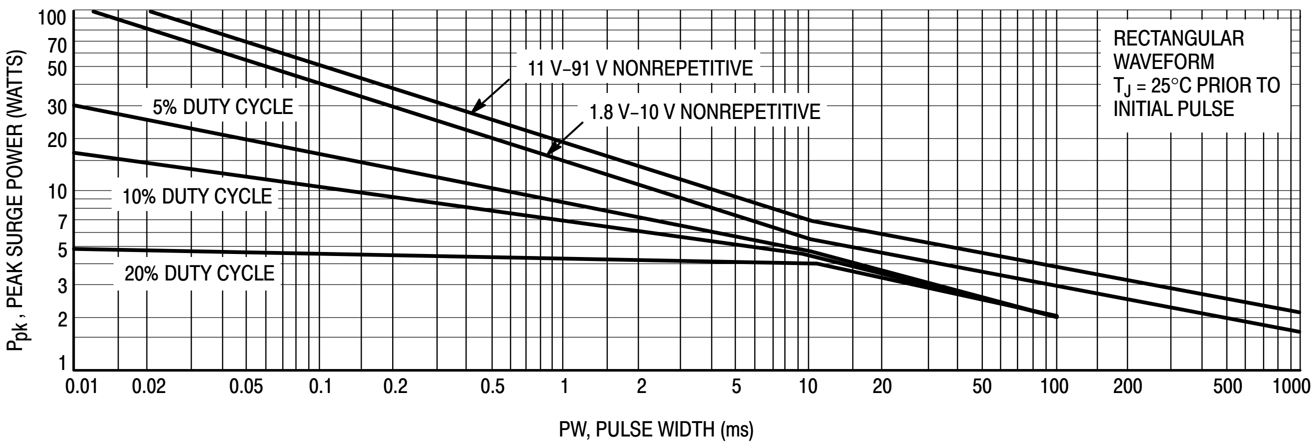


Figure 7a. Maximum Surge Power 1.8–91 Volts

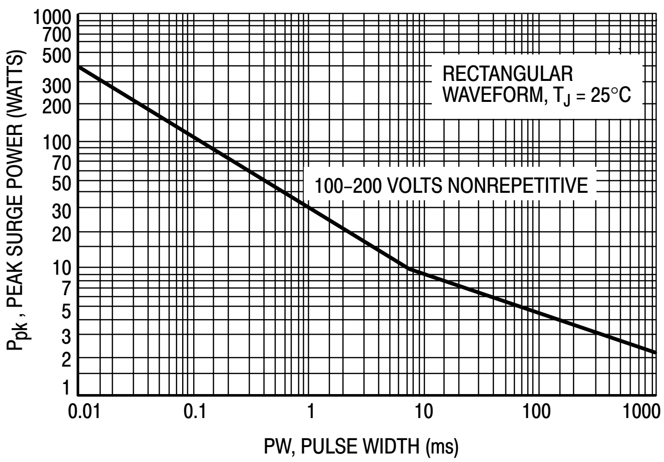


Figure 7b. Maximum Surge Power DO-204AH 100–200 Volts

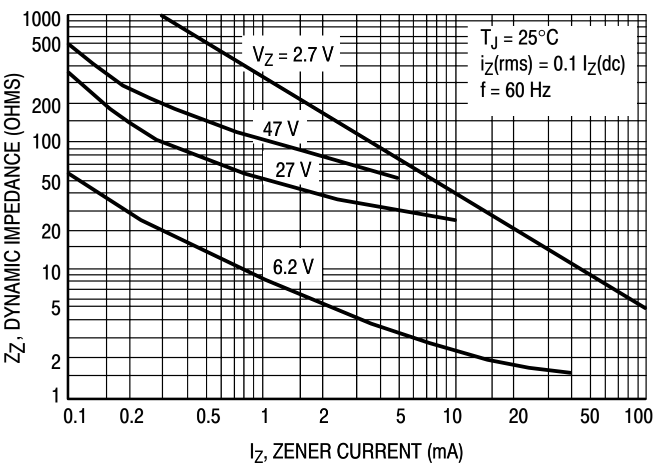


Figure 8. Effect of Zener Current on Zener Impedance

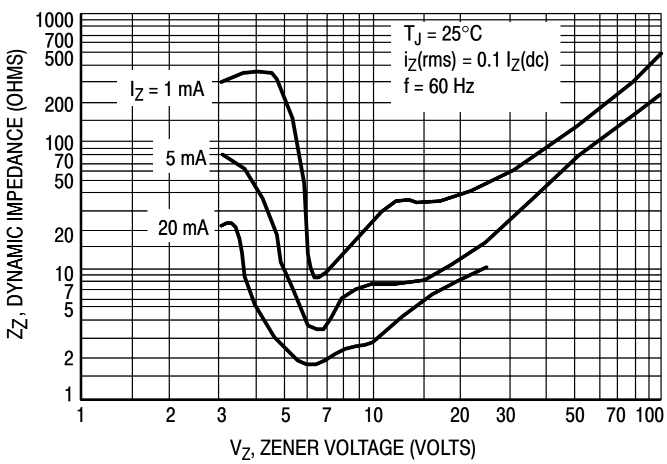


Figure 9. Effect of Zener Voltage on Zener Impedance

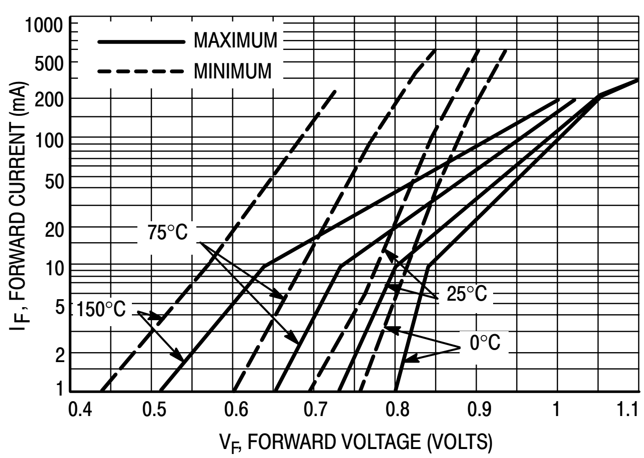


Figure 10. Typical Forward Characteristics

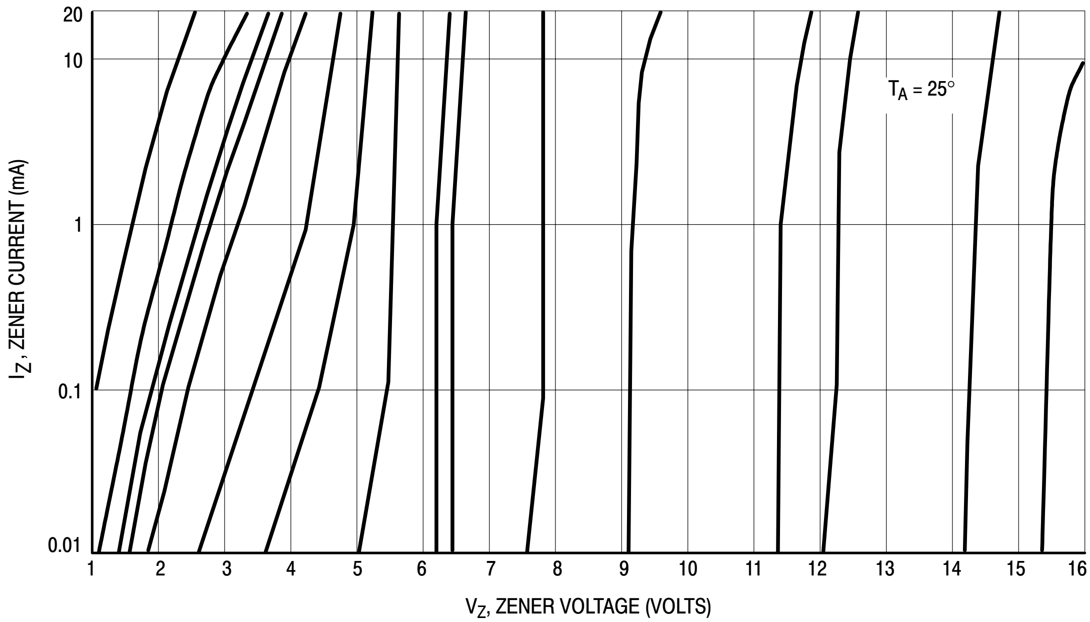


Figure 11. Zener Voltage versus Zener Current — V_Z = 1 thru 16 Volts

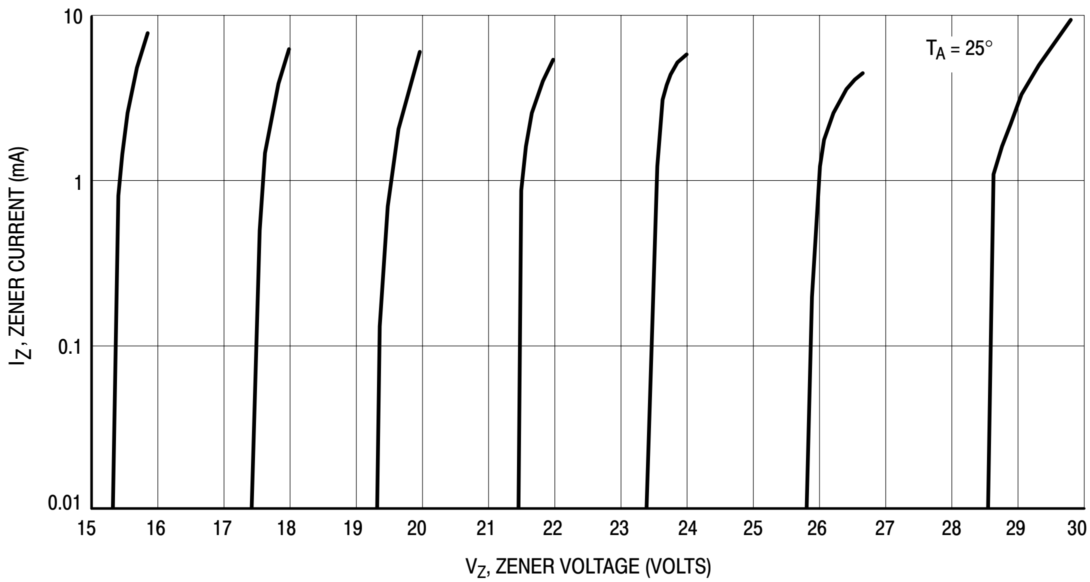


Figure 12. Zener Voltage versus Zener Current — V_Z = 15 thru 30 Volts

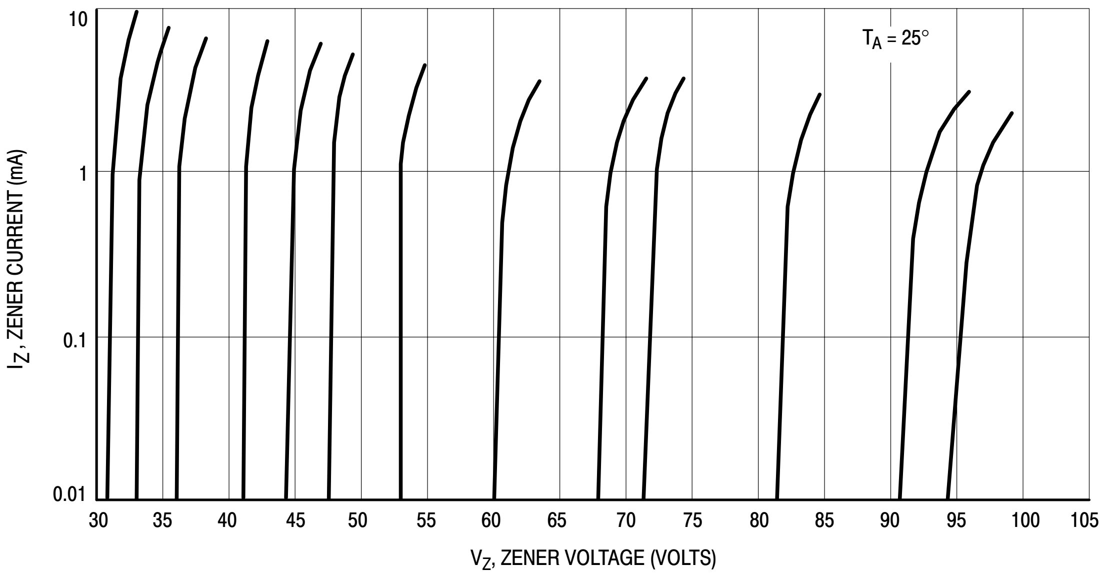


Figure 13. Zener Voltage versus Zener Current — V_Z = 30 thru 105 Volts

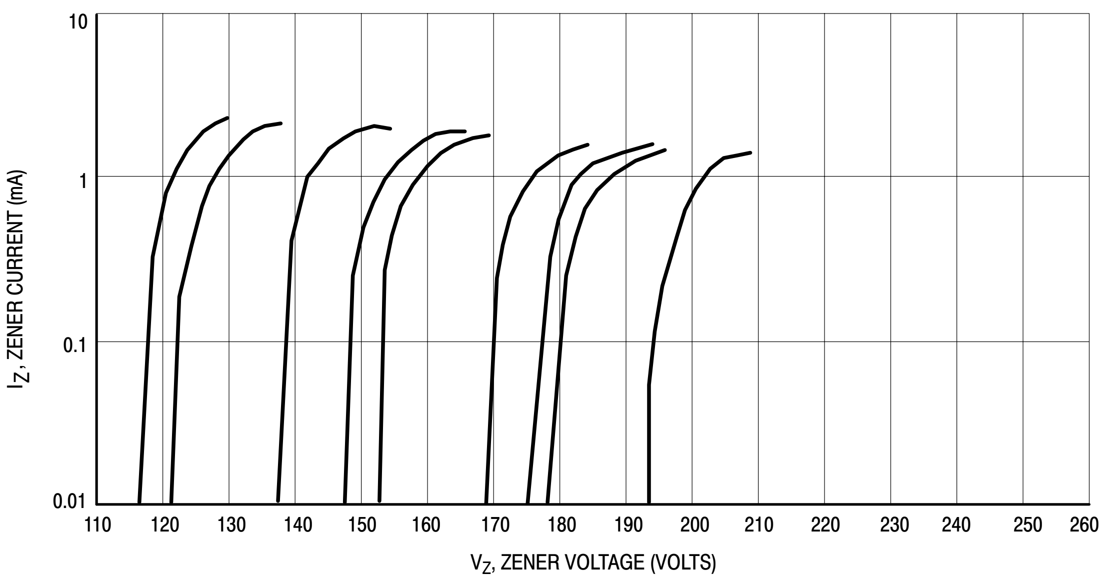


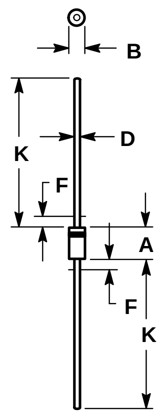
Figure 14. Zener Voltage versus Zener Current — V_Z = 110 thru 220 Volts

OUTLINE DIMENSIONS

Zener Voltage Regulators – Axial Leaded

500 mW DO–35 Glass

GLASS DO–35/D0–204AH
CASE 299–02
ISSUE A



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 Y14.5M, 1982.

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	38.10	1.000	1.500

All JEDEC dimensions and notes apply.

Notes

Notes

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