BZX55C2V4RL 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 33 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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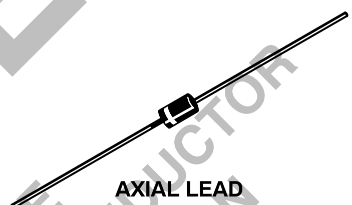
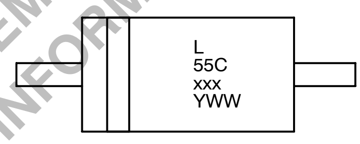


AXIAL LEAD
CASE 299
GLASS

MARKING DIAGRAM



L = Assembly Location
55Cxxx = Device Code (See Table Next Page)
Y = Year
WW = Work Week

ORDERING INFORMATION

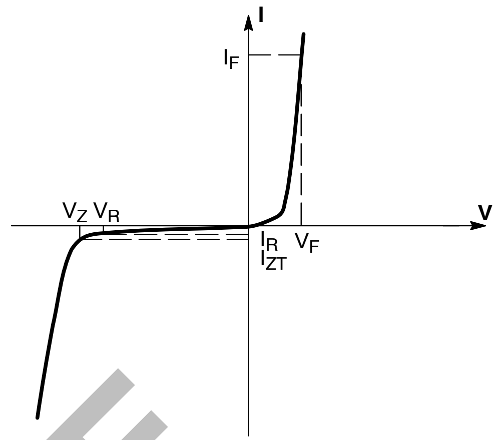
Device	Package	Shipping
BZX55CxxxRL	Axial Lead	5000/Tape & Reel
BZX55CxxxRL2*	Axial Lead	5000/Tape & Reel

* The “2” suffix refers to 26 mm tape spacing.

August, 2006 − Rev. 1
Publication Order Number: BZX55C2V4RL/D

ELECTRICAL CHARACTERISTICS (T_L = 30°C unless otherwise noted, V_F = 1.5 V Max @ I_F = 100 mA for all types)

Symbol	Parameter
V_Z	Reverse Zener Voltage @ I_{ZT}
I_{ZT}	Reverse Current
Z_{ZT}	Maximum Zener Impedance @ I_{ZT}
ΘV_{BR}	Temperature Coefficient of V_{BR} (Typical)
I_R	Reverse Leakage Current (T_A = 25°C) @ V_R
V_R	Breakdown Voltage
I_F	Forward Current
V_F	Forward Voltage @ I_F
C	Capacitance (Typical)



Zener Voltage Regulator

ELECTRICAL CHARACTERISTICS (T_L = 30°C unless otherwise noted, V_F = 1.3 V Max, I_F = 100 mAdc for all types)

Device	Device Marking	V_{ZT} at I_{ZT} (V) Min (Note 2)	V_{ZT} at I_{ZT} (V) Max (Note 2)	Max Zener Impedance (Note 4) Z_{ZT} @ I_{ZT} (Ohms) Max	I_{ZT} (mA)	Max Reverse Leakage Current I_R at V_R (μA) T_{amb} 25°C Max	Max Reverse Leakage Current I_R at V_R (μA) T_{amb} 125°C Max	V_R (V)	I_{ZM} (mA) (Note 3)
BZX55C2V4RL	55C2V4	2.28	2.56	85	5	50	100	1	155
BZX55C2V7RL	55C2V7	2.5	2.9	85	5	10	50	1	135
BZX55C3V0RL	55C3V0	2.8	3.2	85	5	4	40	1	125
BZX55C3V3RL	55C3V3	3.1	3.5	85	5	2	40	1	115
BZX55C3V6RL	55C3V6	3.4	3.8	85	5	2	40	1	105
BZX55C3V9RL	55C3V9	3.7	4.1	85	5	2	40	1	95
BZX55C4V3RL	55C4V3	4	4.6	75	5	1	20	1	90
BZX55C4V7RL	55C4V7	4.4	5	60	5	0.5	10	1	85
BZX55C5V1RL	55C5V1	4.8	5.4	35	5	0.1	2	1	80
BZX55C5V6RL	55C5V6	5.2	6	25	5	0.1	2	1	70
BZX55C6V2RL	55C6V2	5.8	6.6	10	5	0.1	2	2	64
BZX55C6V8RL	55C6V8	6.4	7.2	8	5	0.1	2	3	58
BZX55C7V5RL	55C7V5	7	7.9	7	5	0.1	2	5	53
BZX55C8V2RL	55C8V2	7.7	8.7	7	5	0.1	2	6	47
BZX55C9V1RL	55C9V1	8.5	9.6	10	5	0.1	2	7	43
BZX55C10RL	55C10	9.4	10.6	15	5	0.1	2	7.5	40
BZX55C11RL	55C11	10.4	11.6	20	5	0.1	2	8.5	36
BZX55C12RL	55C12	11.4	12.7	20	5	0.1	2	9	32
BZX55C13RL	55C13	12.4	14.1	26	5	0.1	2	10	29
BZX55C15RL	55C15	13.8	15.6	30	5	0.1	2	11	27
BZX55C16RL	55C16	15.3	17.1	40	5	0.1	2	12	24
BZX55C18RL	55C18	16.8	19.1	50	5	0.1	2	14	21
BZX55C20RL	55C20	18.8	21.1	55	5	0.1	2	15	20
BZX55C22RL	55C22	20.8	23.3	55	5	0.1	2	17	18
BZX55C24RL	55C24	22.8	25.6	80	5	0.1	2	18	16
BZX55C27RL	55C27	25.1	28.9	80	5	0.1	2	20	14
BZX55C30RL	55C30	28	32	80	5	0.1	2	22	13
BZX55C33RL	55C33	31	35	80	5	0.1	2	24	12
BZX55C36RL	55C36	34	38	80	5	0.1	2	27	11
BZX55C39RL	55C39	37	41	90	2.5	0.1	5	28	10
BZX55C43RL	55C43	40	46	90	2.5	0.1	5	32	9.2
BZX55C47RL	55C47	44	50	110	2.5	0.1	5	35	8.5
BZX55C51RL	55C51	48	54	125	2.5	0.1	10	38	7.8
BZX55C56RL	55C56	52	60	135	2.5	0.1	10	42	7
BZX55C62RL	55C62	58	66	150	2.5	0.1	10	47	6.4
BZX55C68RL	55C68	64	72	160	2.5	0.1	10	51	5.9
BZX55C75RL	55C75	70	80	170	2.5	0.1	10	56	5.3
BZX55C82RL	55C82	77	87	200	2.5	0.1	10	62	4.8
BZX55C91RL	55C91	85	96	250	1	0.1	10	69	4.3

2. **TOLERANCE AND VOLTAGE DESIGNATION**
   Tolerance designation − the type numbers listed have zener voltage min/max limits as shown. Device tolerance of ±2% are indicated by a "B" instead of a "C". Zener voltage is measured with the device junction in thermal equilibrium at the lead temperature of 30°C ±1°C and 3/8″ lead length.
3. This data was calculated using nominal voltages. The maximum current handling capability on a worst case basis is limited by the actual zener voltage at the operating point and the powered derating curve.
4. 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 = 1.0 kHz.

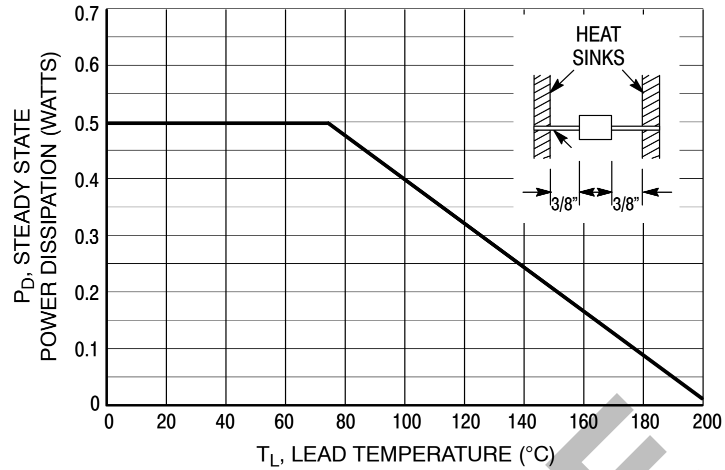


Figure 1. Steady State Power Derating

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.

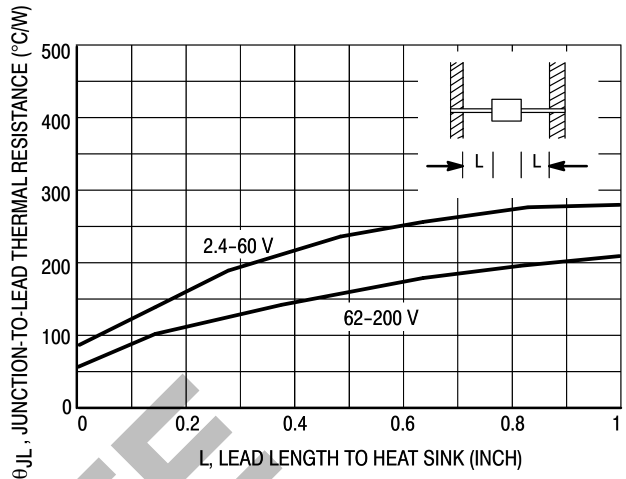


Figure 2. Typical Thermal Resistance

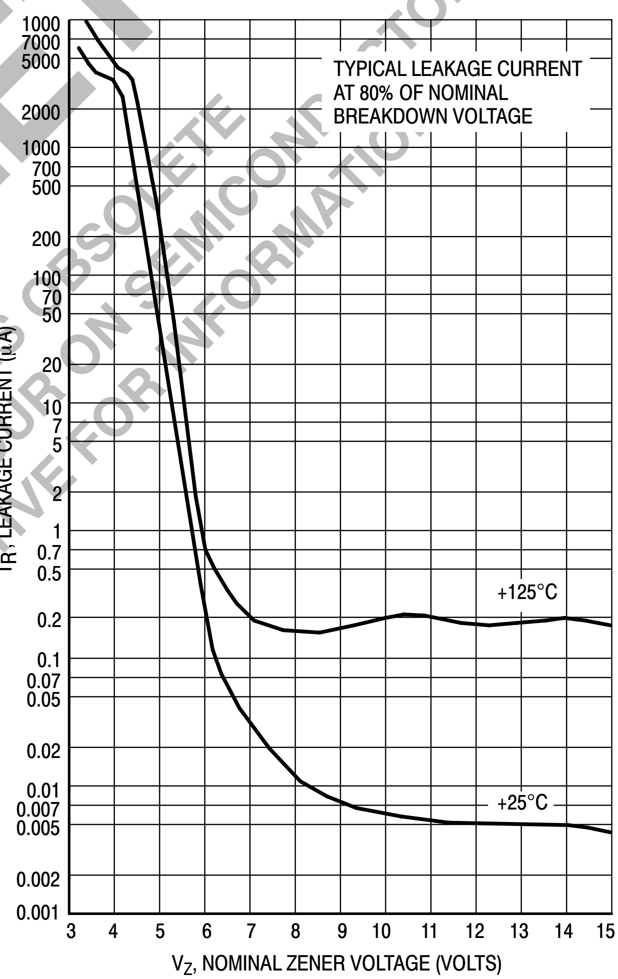


Figure 3. Typical Leakage Current

TEMPERATURE COEFFICIENTS

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

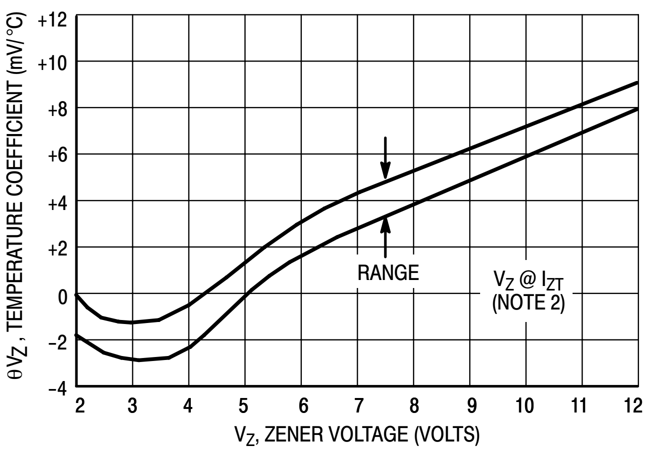


Figure 4a. Range for Units to 12 Volts

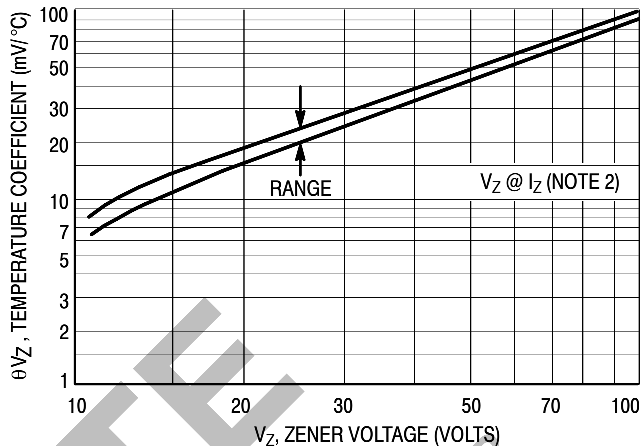


Figure 4b. Range for Units 12 to 100 Volts

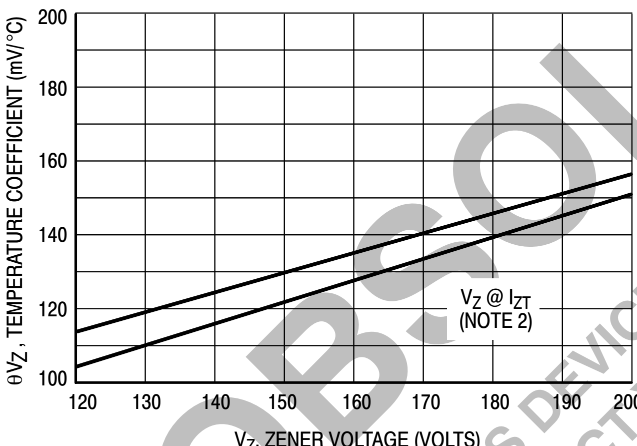


Figure 4c. Range for Units 120 to 200 Volts

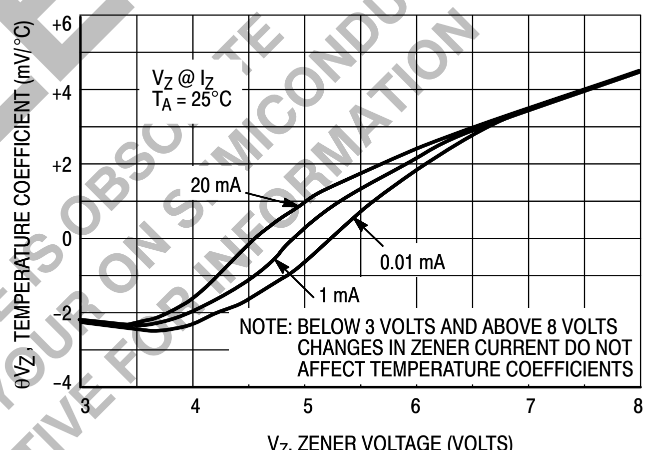


Figure 5. Effect of Zener Current

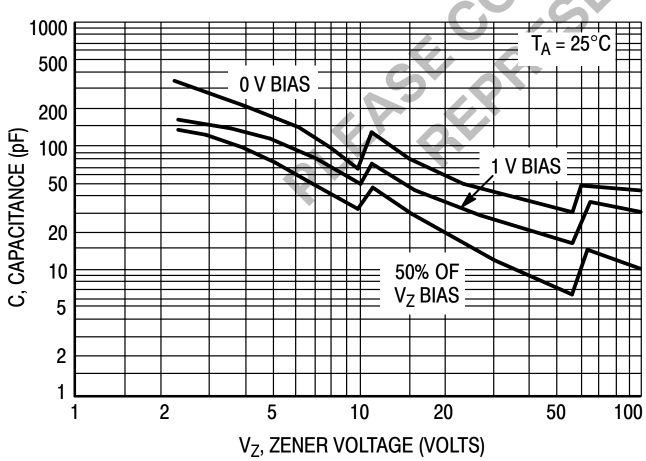


Figure 6a. Typical Capacitance 2.4−100 Volts

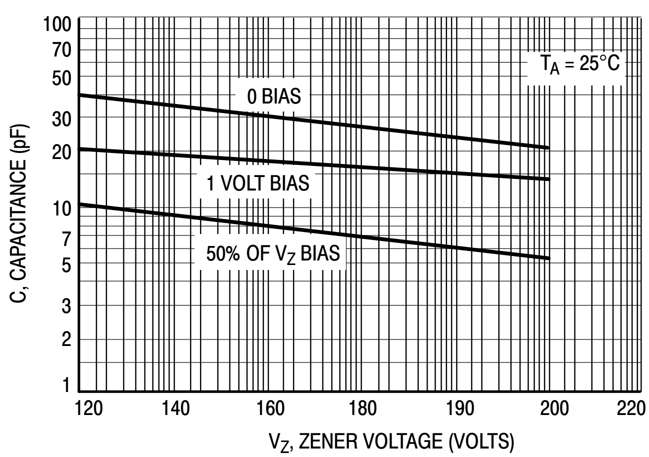


Figure 6b. Typical Capacitance 120−200 Volts

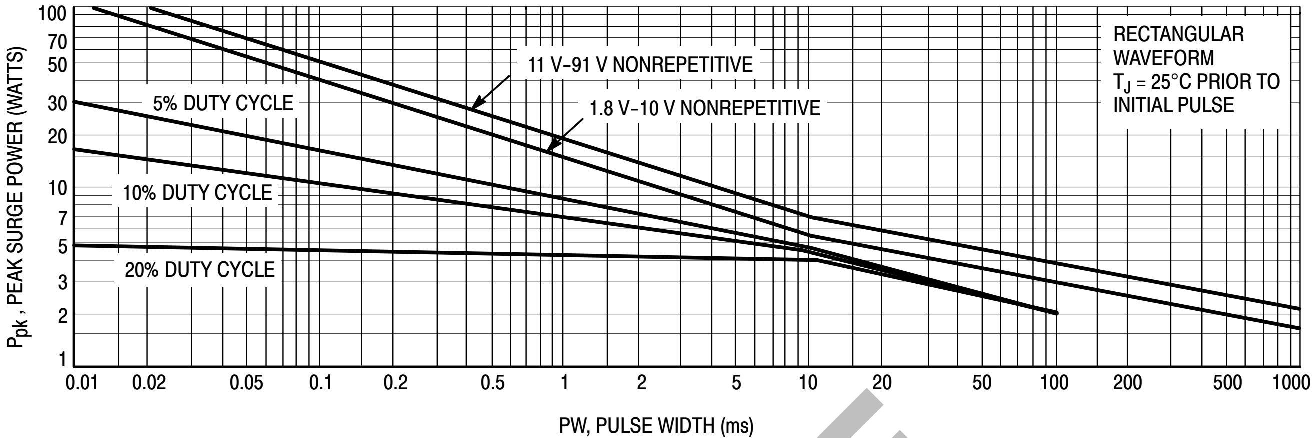


Figure 7a. Maximum Surge Power 1.8−91 Volts

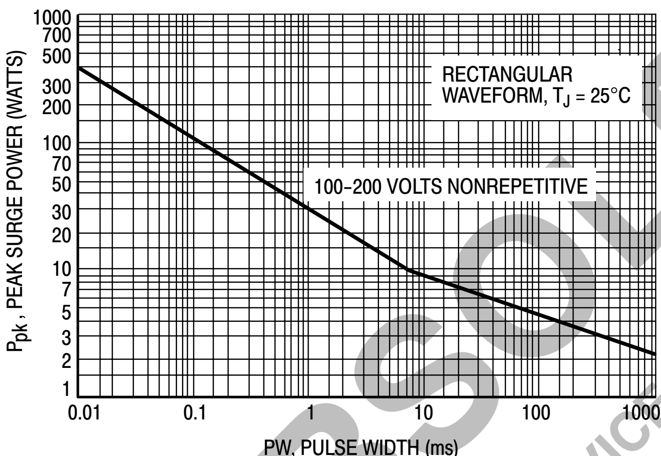


Figure 7b. Maximum Surge Power DO-204AH 100−200 Volts

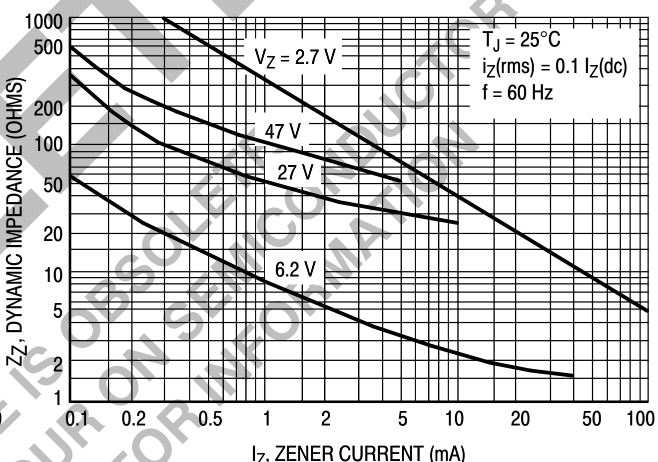


Figure 8. Effect of Zener Current on Zener Impedance

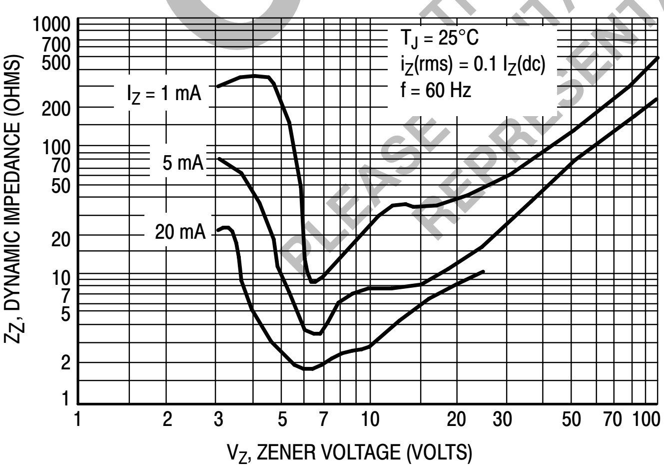


Figure 9. Effect of Zener Voltage on Zener Impedance

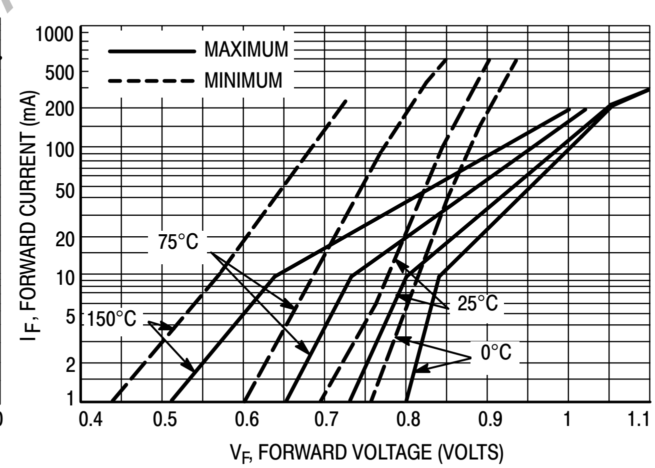


Figure 10. Typical Forward Characteristics

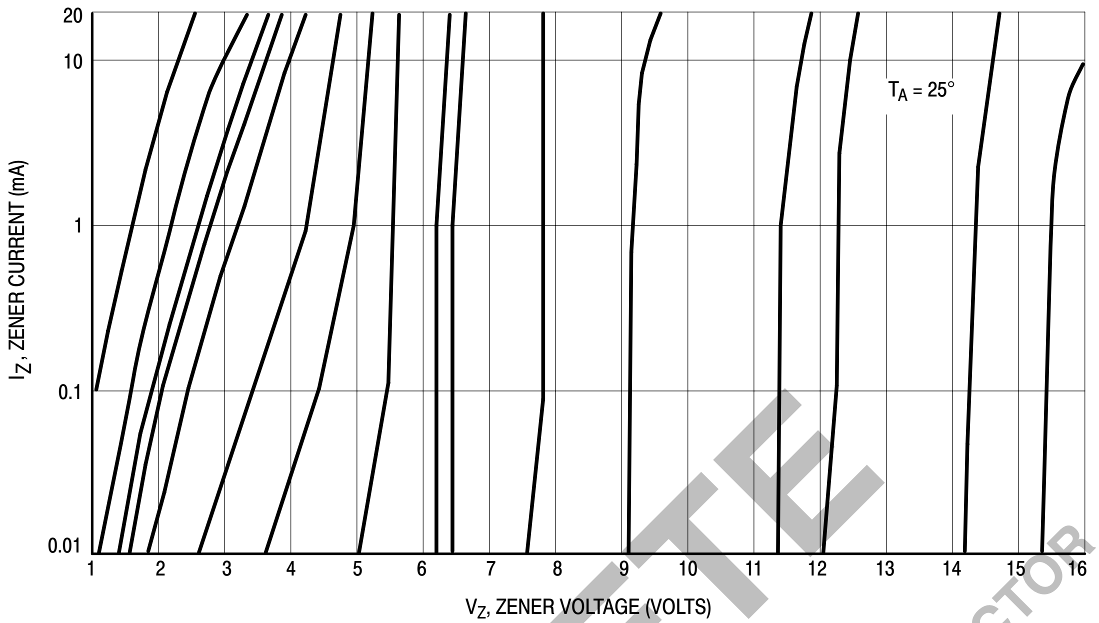


Figure 11. Zener Voltage versus Zener Current — V_Z = 1 thru 16 Volts

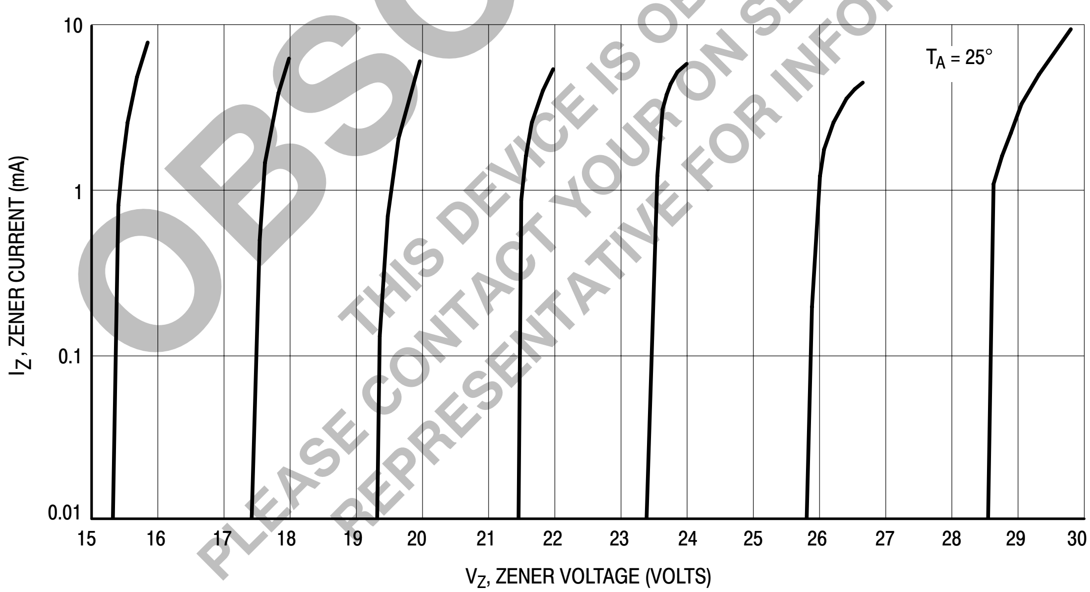


Figure 12. Zener Voltage versus Zener Current — V_Z = 15 thru 30 Volts

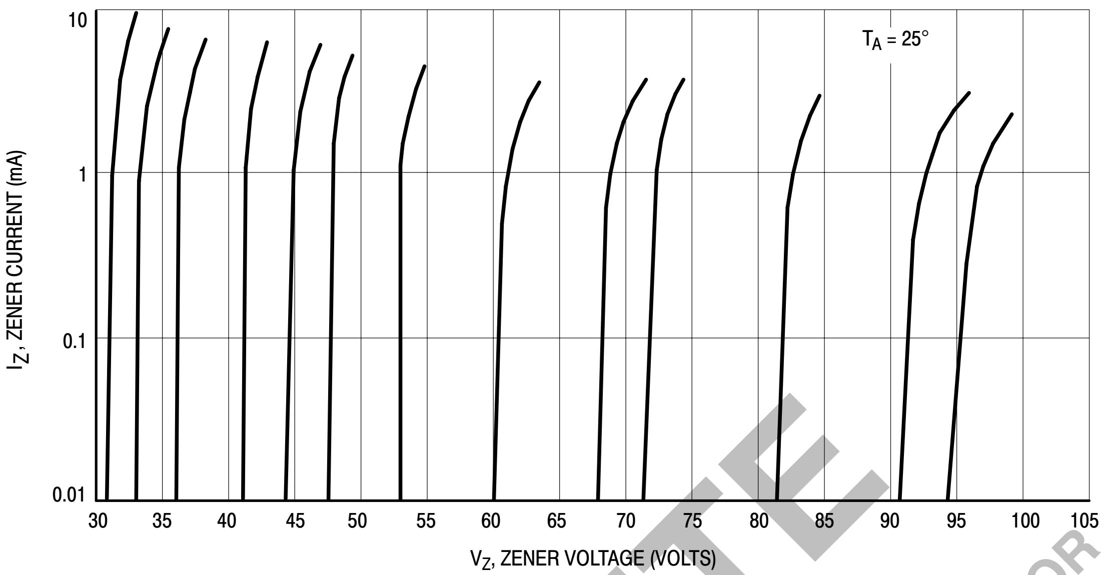


Figure 13. Zener Voltage versus Zener Current — V_Z = 30 thru 105 Volts

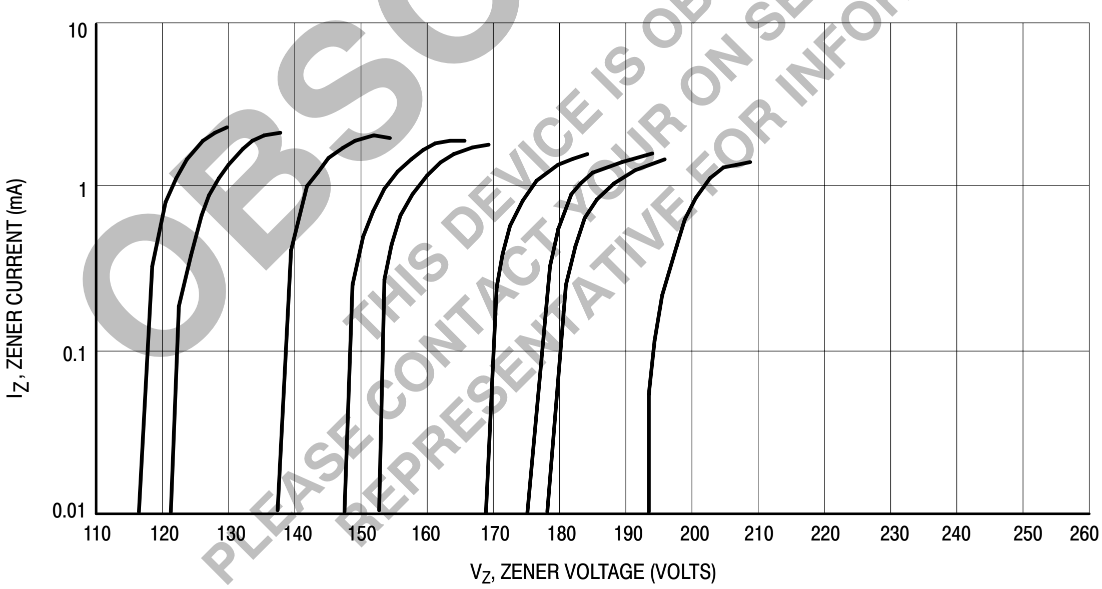


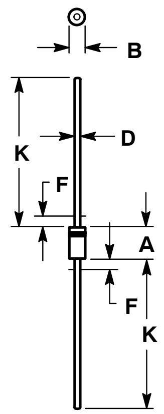
Figure 14. Zener Voltage versus Zener Current — V_Z = 110 thru 220 Volts

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.

	MILLIMETERS		INCHES	
DIM	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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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