TAK CHEONG ®

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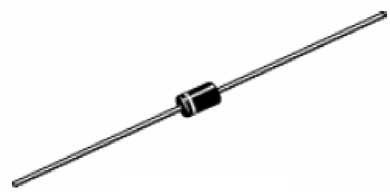
500 mW DO-35 Hermetically Sealed Glass Zener Voltage Regulators

Maximum Ratings (Note 1)

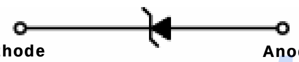
Rating	Symbol	Value	Units
Maximum Steady State Power Dissipation @TL≤75℃, Lead Length = 3/8”	P_D	500	mW
Derate Above 75℃		4.0	mW/℃
Operating and Storage Temperature Range	T_J, T_{stg}	-65 to +200	°C

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



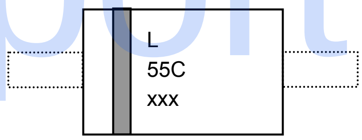
Specification Features:

- Zener Voltage Range = 2.4V to 91V
- ESD Rating of Clas 3 (>6 KV) per Human Body Model
- DO-35 Package (DO-204AH)
- Double Slug Type Construction
- Metallurgical Bonded Construction



Specification Features:

Case : Double slug type, hermetically sealed glass
Finish : All external surfaces are corrosion resistant and leads are readily solderable
Polarity : Cathode indicated by polarity band
Mounting: Any



L = Logo
79Cxxx = BZX79Cxxx Device Code

Maximum Lead Temperature for Soldering Purposes
230℃, 1/16” from the case for 10 seconds

Ordering Information

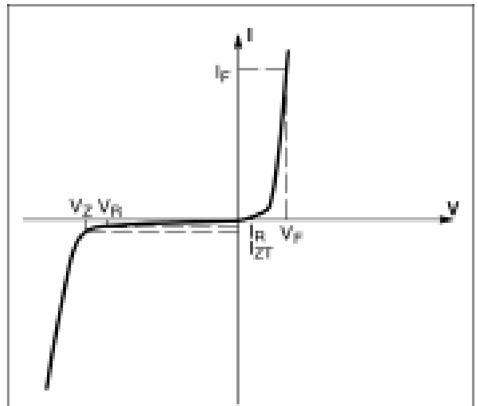
Device	Package	Quantity
BZX55Cxxx	Axial Lead	3000 Units / Box
BZX55CxxxRL	Axial Lead	5000 Units / Tape & Reel
BZX55CxxxRL2*	Axial Lead	5000 Units / Tape & Reel
BZX55CxxxRR1 !	Lead Form	3000 Units / Radial Tape & Reel
BZX55CxxxRR2 i	Lead Form	3000 Units / Radial Tape & Reel
BZX55CxxxTA	Axial Lead	5000 Units / Tape & Ammo
BZX55CxxxTA2*	Axial Lead	5000 Units / Tape & Ammo
BZX55CxxxRA1 !	Axial Lead	3000 Units / Radial Tape & Ammo
BZX55CxxxRA2 i	Axial Lead	3000 Units / Radial Tape & Ammo

* The “2” suffix refer to 26mm tape spacing.
! “1”: Polarity band **up** with cathode lead off first.
i “2”: Polarity band **down** with cathode lead off first.

Devices listed in **bold italic** are Tak Cheong **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

ELECTRICAL CHARACTERISTICS (T_A = 25ºC unless otherwise noted. V_F = 1.3 V Max @ I_F = 100mA for all types)

Symbol	Parameter
V_Z	Reverse Zener Voltage @ I_{ZT}
I_{ZT}	Reverse Zener 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 = 25ºC unless otherwise noted, V_F = 1.3 V Max @ I_F = 100mA for all types)

Device	Device Marking	V_{ZT} @ I_{ZT} (Volts) (Note 2.) Min	Max	Max Zener Impedance (Note 4) Z_{ZT} @ I_{ZT} (Ω)	I_{ZT} (mA)	Max Reverse Leakage Current I_R at V_R T_{amb} 25ºC (μA)	T_{amb} 125ºC (μA)	V_R (Volts)	I_{ZM} (Note 3.) (mA)
BZX55C2V4	55C2V4	2.28	2.56	85	5	50	100	1	155
BZX55C2V7	55C2V7	2.5	2.9	85	5	10	50	1	135
BZX55C3V0	55C3V0	2.8	3.2	85	5	4	40	1	125
BZX55C3V3	55C3V3	3.1	3.5	85	5	2	40	1	115
BZX55C3V6	55C3V6	3.4	3.8	85	5	2	40	1	105
BZX55C3V9	55C3V9	3.7	4.1	85	5	2	40	1	95
BZX55C4V3	55C4V3	4	4.6	75	5	1	20	1	90
BZX55C4V7	55C4V7	4.4	5	60	5	0.5	10	1	85
BZX55C5V1	55C5V1	4.8	5.4	35	5	0.1	c	1	80
BZX55C5V6	55C5V6	5.2	6	25	5	0.1	2	1	70
BZX55C6V2	55C6V2	5.8	6.6	10	5	0.1	2	2	64
BZX55C6V8	55C6V8	6.4	7.2	8	5	0.1	2	3	58
BZX55C7V5	55C7V5	7	7.9	7	5	0.1	2	5	53
BZX55C8V2	55C8V2	7.7	8.7	7	5	0.1	2	6	47
BZX55C9V1	55C9V1	8.5	9.6	10	5	0.1	2	7	43
BZX55C10	55C10	9.4	10.6	15	5	0.1	2	7.5	40
BZX55C11	55C11	10.4	11.6	20	5	0.1	2	8.5	36
BZX55C12	55C12	11.4	12.7	20	5	0.1	2	9	32
BZX55C13	55C13	12.4	14.1	26	5	0.1	2	10	29
BZX55C15	55C15	13.8	15.6	30	5	0.1	2	11	27

2. TOLERANCE AND VOLTAGE DESIGNATION (V_{Zt})
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 thermal equilibrium at the temperature of 30°C ±1°C and 3/8" lead length.

3. MAXIMUM ZENER CURRENT RATINGS (I_{ZM})
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 operation point and the power derating curve.

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 AC frequency = 60Hz.

ELECTRICAL CHARACTERISTICS (T_A = 25ºC unless otherwise noted, V_F = 1.3 V Max @ I_F = 100mA for all types)

Device	Device Marking	V_{ZT} @ I_{ZT} (Volts) (Note 5.)		Max Zener Impedance (Note 7) Z_{ZT} @ I_{ZT}	I_{ZT}	Max Reverse Leakage Current I_R at V_R		V_R	I_{ZM} (Note 6.)
		Min	Max	(Ω)	(mA)	T_{amb} 25°C (μA)	T_{amb} 125°C (μA)	(Volts)	(mA)
BZX55C16	55C16	15.3	17.1	40	5	0.1	2	12	24
BZX55C18	55C18	16.8	19.1	50	5	0.1	2	14	21
BZX55C20	55C20	18.8	21.1	55	5	0.1	2	15	20
BZX55C22	55C22	20.8	23.3	55	5	0.1	2	17	18
BZX55C24	55C24	22.8	25.6	80	5	0.1	2	18	16
BZX55C27	55C27	25.1	28.9	80	5	0.1	2	20	14
BZX55C30	55C30	28	32	80	5	0.1	2	22	13
BZX55C33	55C33	31	35	80	5	0.1	2	24	12
BZX55C36	55C36	34	38	80	5	0.1	2	27	11
BZX55C39	55C39	37	41	90	2.5	0.1	5	28	10
BZX55C43	55C43	40	46	90	2.5	0.1	5	32	9.2
BZX55C47	55C47	44	50	110	2.5	0.1	5	35	8.5
BZX55C51	55C51	48	54	125	2.5	0.1	10	38	7.8
BZX55C56	55C56	52	60	135	2.5	0.1	10	42	7
BZX55C62	55C62	58	66	150	2.5	0.1	10	47	6.4
BZX55C68	55C68	64	72	160	2.5	0.1	10	51	5.9
BZX55C75	55C75	70	80	170	2.5	0.1	10	56	5.3
BZX55C82	55C82	77	87	200	2.5	0.1	10	62	4.8
BZX55C91	55C91	85	96	250	1	0.1	10	69	4.3

5. TOLERANCE AND VOLTAGE DESIGNATION (V_{Zt})
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 thermal equilibrium at the temperature of 30°C ±1°C and 3/8" lead length.

6. MAXIMUM ZENER CURRENT RATINGS (I_{ZM})
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 operation point and the power derating curve.

7. 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 AC frequency = 60Hz.

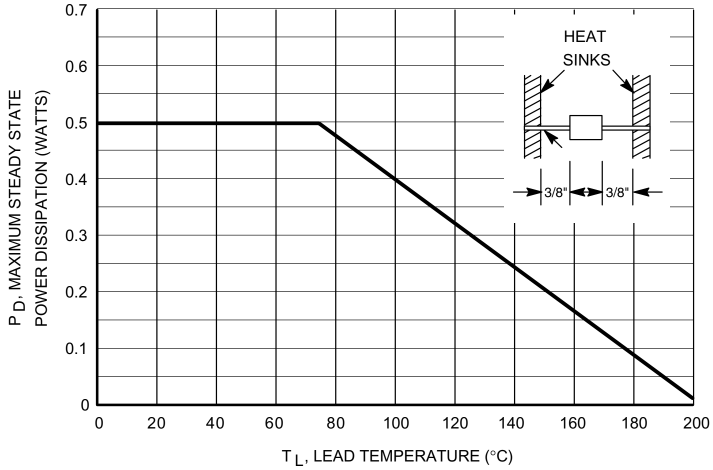


Figure 1. Steady State Power Derating

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.

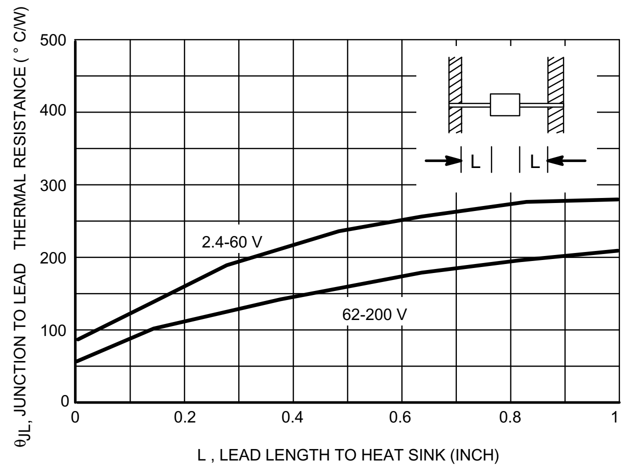


Figure 2. Typical Thermal Resistance

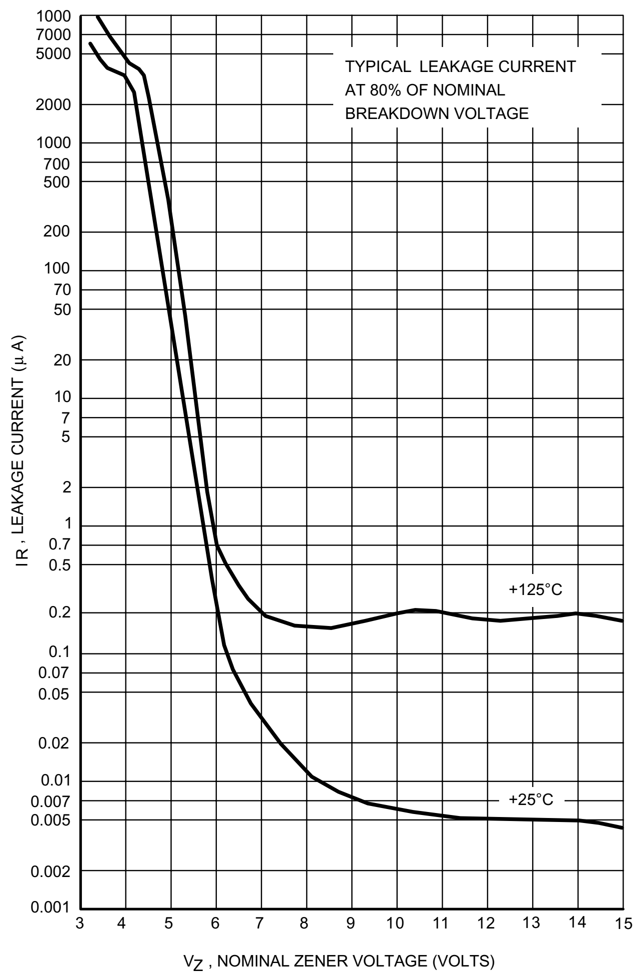


Figure 3. Typical Leakage Current

TEMPERATURE COEFFICIENTS

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

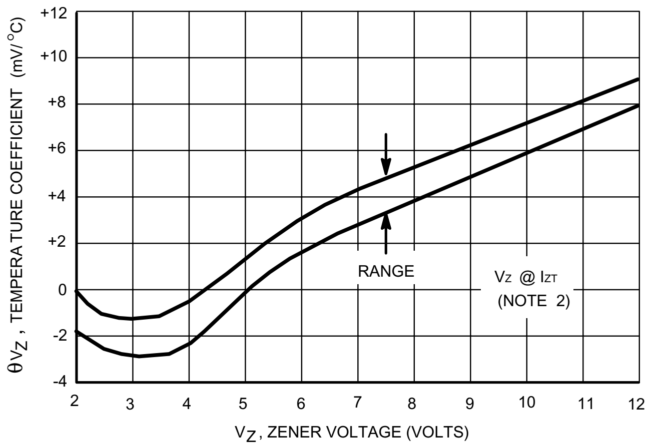


Figure 4a. Range for Units to 12 Volts

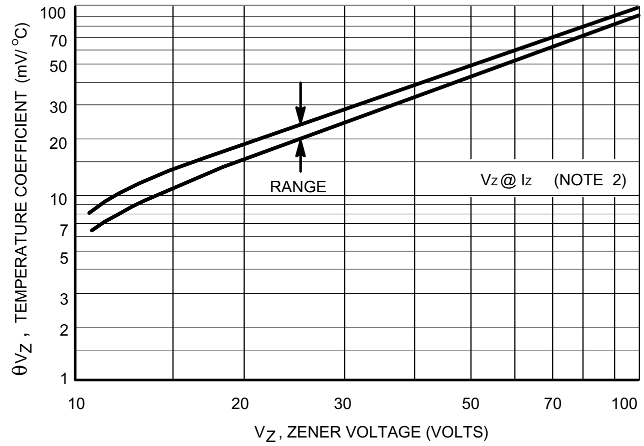


Figure 4b. Range for Units 12 to 100 Volts

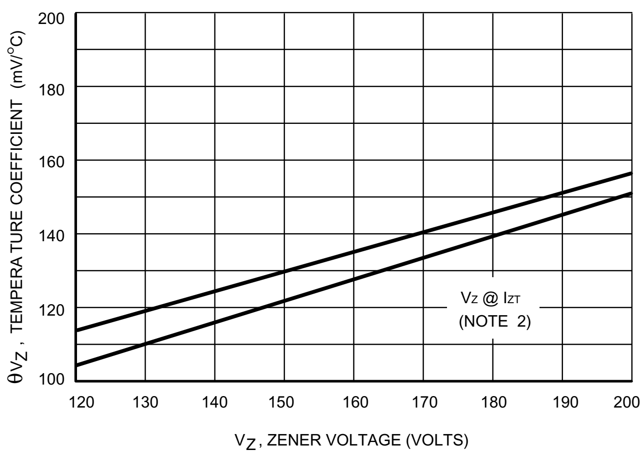


Figure 4c. Range for Units 120 to 200 Volts

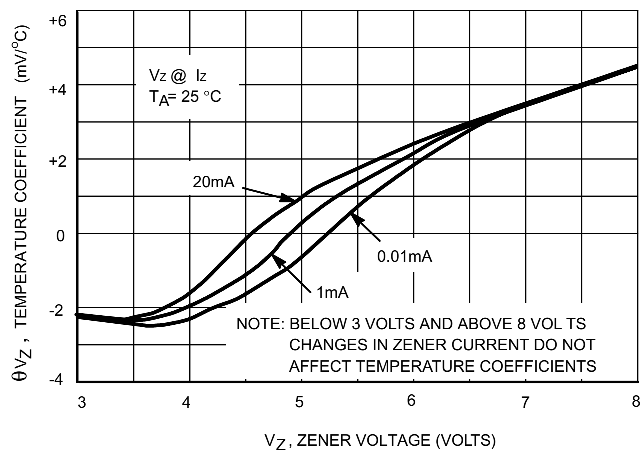


Figure 5. Effect of Zener Current

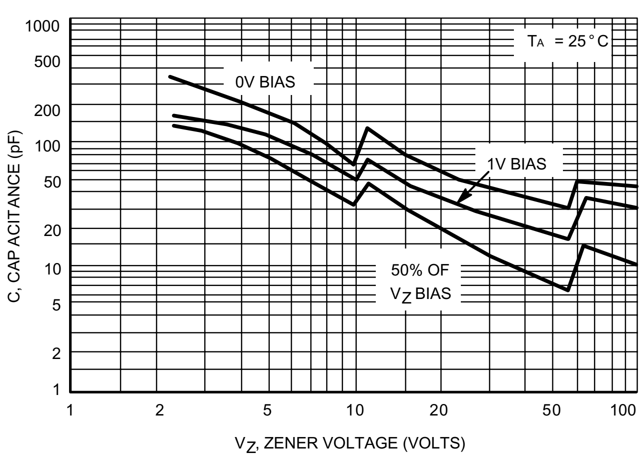


Figure 6a. Typical Capacitance 2.4-100 Volts

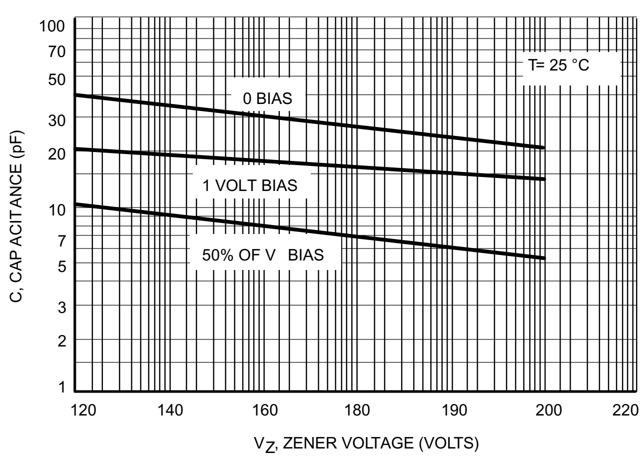


Figure 6b. Typical Capacitance 120-200 Volts

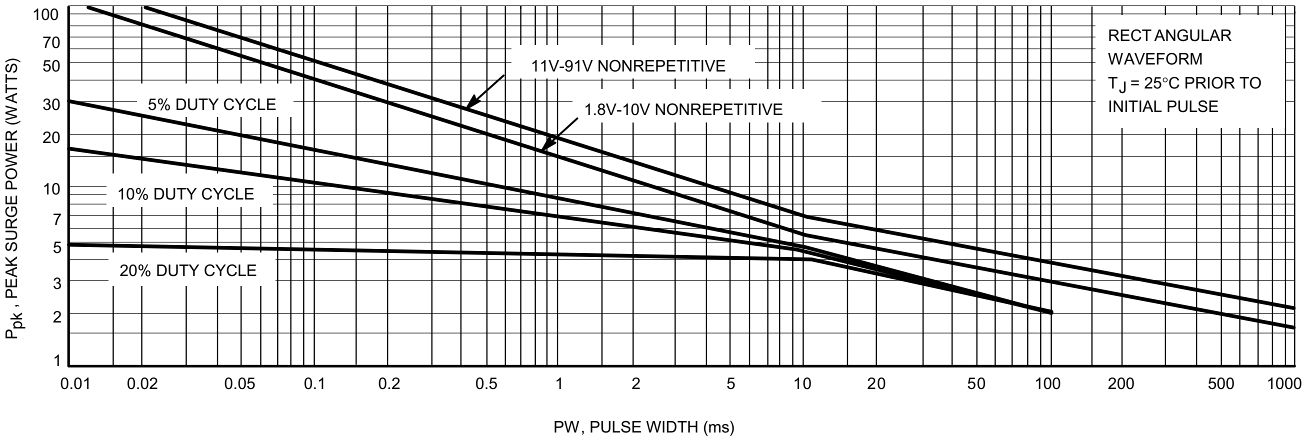


Figure 7a. Maximum Surge Power 1.8-91 Volts

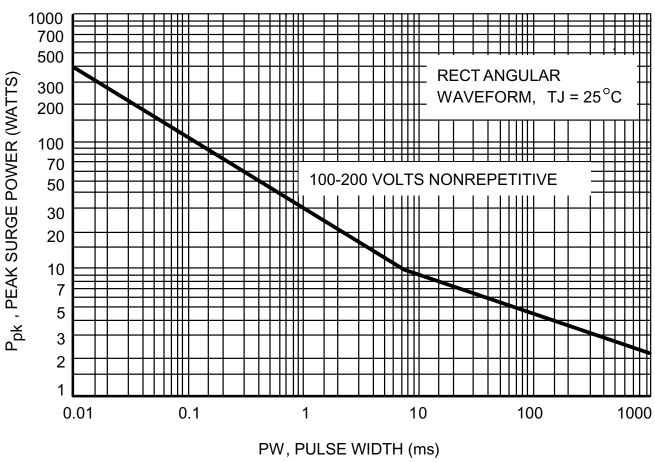


Figure 7b. Maximum Surge Power DO-35 100-200Volts

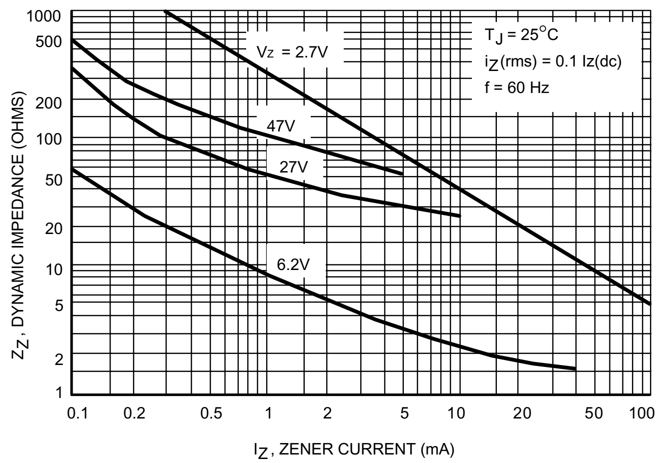


Figure 8. Effect of Zener Current on Zener Impedance

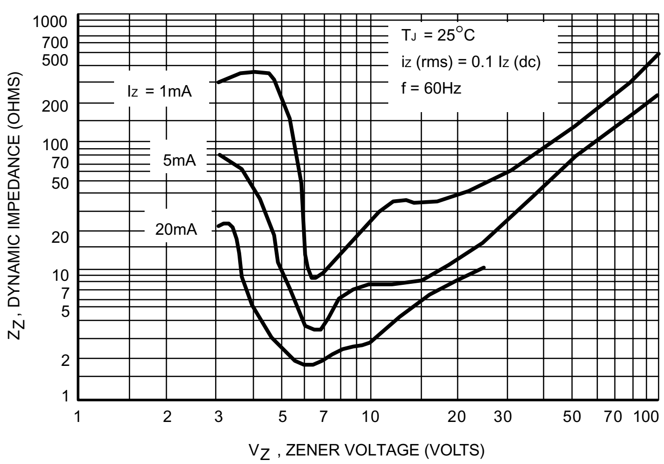


Figure 9. Effect of Zener Voltage on Zener Impedance

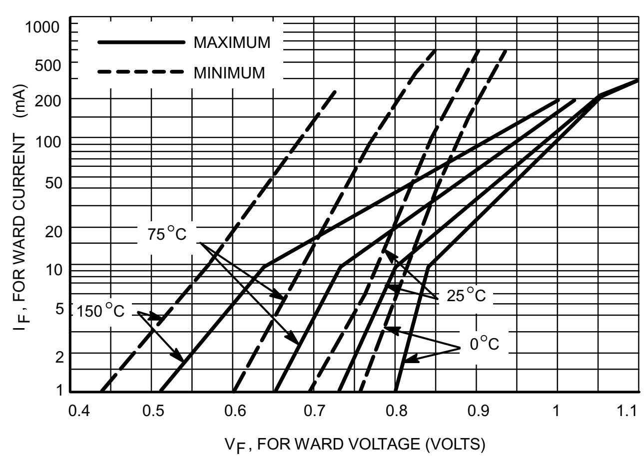


Figure 10. Typical Forward Characteristics

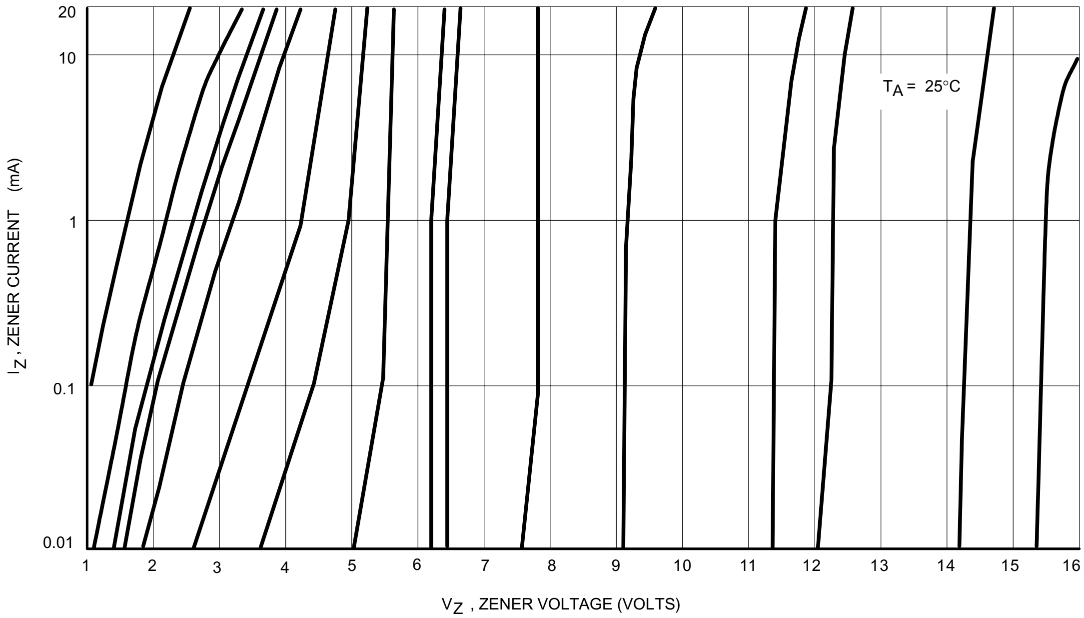


Figure 1 1. Zener Voltage versus Zener Current - V_Z = 1 thru 16 Volts

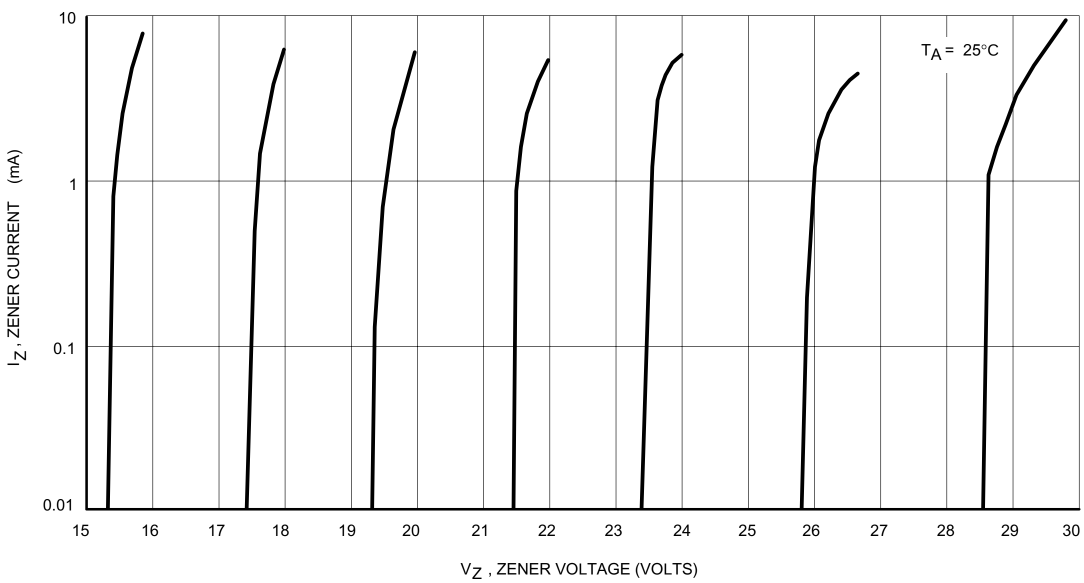


Figure 12. Zener Voltage versus Zener Current - V_Z = 15 thru 30 Volts

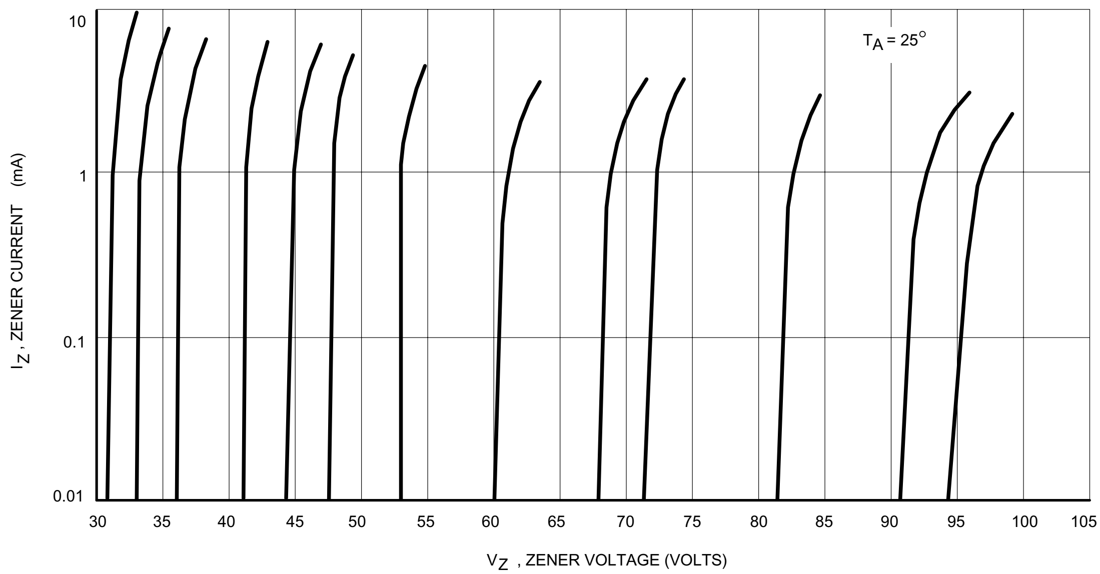


Figure 13. Zener Voltage versus Zener Current - V_Z = 30 thru 105 Volts

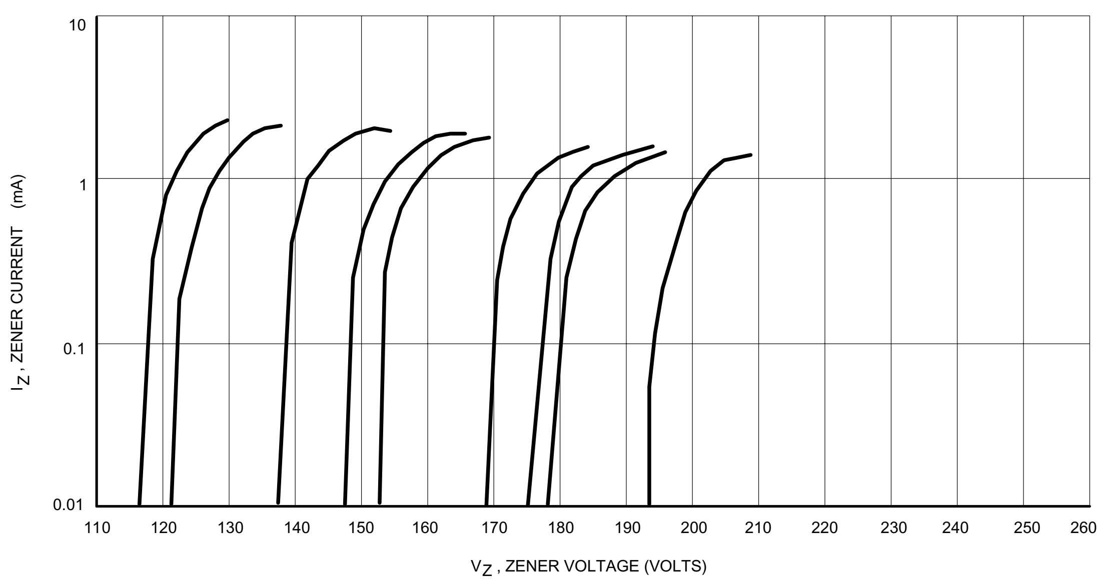


Figure 14. Zener Voltage versus Zener Current - V_Z = 110 thru 220 Volts