TAK CHEONG®

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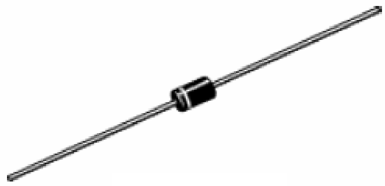
500 mW DO-35 Hermetically Sealed Glass Zener Voltage Regulators

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.



AXIAL LEAD
DO35

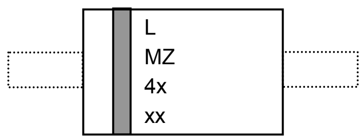
Specification Features:

- Zener Voltage Range = 1.8V to 10V
- 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

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



L = Logo
MZ4xxx = Device Code

Ordering Information

Device	Package	Quantity
MZ4xxx	Axial Lead	3000 Units / Box
MZ4xxxRL	Axial Lead	5000 Units / Tape & Reel
MZ4xxxRL2*	Axial Lead	5000 Units / Tape & Reel
MZ4xxxRR1 !	Lead Form	3000 Units / Radial Tape & Reel
MZ4xxxRR2 i	Lead Form	3000 Units / Radial Tape & Reel
MZ4xxxTA	Axial Lead	5000 Units / Tape & Ammo
MZ4xxxTA2*	Axial Lead	5000 Units / Tape & Ammo
MZ4xxxRA1 !	Axial Lead	3000 Units / Radial Tape & Ammo
MZ4xxxRA2 i	Axial Lead	3000 Units / Radial Tape & Ammo

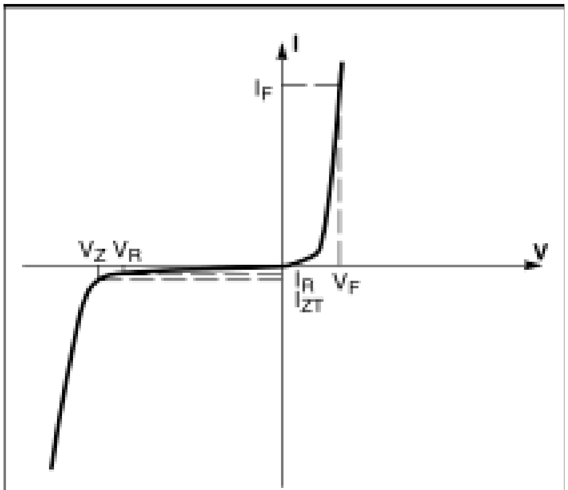
* The “2” suffix refer to 26mm tape spacing.
! “1”: Polarity band **up** with cathode lead off first.
i “2”: Polarity band **down** with cathode lead off first.

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

Designed for 250mW applications requiring low leakage and low leakage and low impedance. Zener impedance and zener voltage specified for low-level operation at I_{ZT} = 250μA.

ELECTRICAL CHARACTERISTICS (T_A = 25ºC unless otherwise noted. V_F = 1.1 V Max @ I_F = 200mA 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 = 1.1 V Max @ I_F = 200mA for all types)

Device (Note 2.)	Device Marking	Zener Voltage (Note 3 & 4.) V_Z (Volts) Min	Nom	Max	I_{ZM} (mA)	Leakage Current (Note 5.) I_R @ V_R (µA Max)	(Volts)	Zener Impedance (Note 6.) Z_{ZT} @ I_{ZT} (Ω Max)
MZ4614	MZ4614	1.71	1.8	1.89	120	7.5	1	1200
MZ4615	MZ4615	1.9	2	2.1	110	5	1	1250
MZ4616	MZ4616	2.09	2.2	2.31	100	4	1	1300
MZ4617	MZ4617	2.28	2.4	2.52	95	2	1	1400
MZ4618	MZ4618	2.565	2.7	2.835	90	1	1	1500
MZ4619	MZ4619	2.85	3	3.15	85	0.8	1	1600
MZ4620	MZ4620	3.135	3.3	3.465	80	7.5	1.5	1650
MZ4621	MZ4621	3.42	3.6	3.78	75	7.5	2	1700
MZ4622	MZ4622	3.705	3.9	4.095	70	5	2	1650
MZ4623	MZ4623	4.085	4.3	4.515	65	4	2	1600
MZ4624	MZ4624	4.465	4.7	4.935	60	10	3	1550
MZ4625	MZ4625	4.845	5.1	5.355	55	10	3	1500
MZ4626	MZ4626	5.32	5.6	5.88	50	10	4	1400
MZ4627	MZ4627	5.89	6.2	6.51	45	10	5	1200
MZ4099	MZ4099	6.46	6.8	7.14	35	10	5.2	200

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. 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.

5. REVERSE LEAKAGE CURRENT (I_R)
Reverse leakage current are guaranteed and measured at V_R shown on the table.

6. ZENER IMPEDANCE (Z_{ZT}) DERIVATION
The zener impedance is derived from the 60 cycle ac voltage, which results when an AC current having an rms value to 10% of the DC zener current (I_{ZT}) is superimposed on I_{ZT}.

ELECTRICAL CHARACTERISTICS (T_A = 25ºC unless otherwise noted, V_F = 1.1 V Max @ I_F = 200mA for all types)

Device (Note 7.)	Device Marking	Zener Voltage (Note 8 & 9.)				Leakage Current (Note 10.)		Zener Impedance (Note 11.)
		V_Z (Volts)			@ I_{ZM}	I_R @ V_R		Z_{ZT} @ I_{ZT}
		Min	Nom	Max	(mA)	(µA Max)	(Volts)	(Ω Max)
MZ4100	MZ4100	7.125	7.5	7.875	31.8	10	5.7	200
MZ4101	MZ4101	7.79	8.2	8.61	29	1	6.3	200
MZ4102	MZ4102	8.265	8.7	9.135	27.4	1	6.7	200
MZ4103	MZ4103	8.645	9.1	9.555	26.2	1	7	200
MZ4104	MZ4104	9.5	10	10.5	24.8	1	7.6	200

7. **TOLERANCE AND TYPE NUMBER DESIGNATION (V_Z)**
   The type numbers listed have a standard tolerance on the nominal zener voltage of ±5%.
8. **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.
9. **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.
10. **REVERSE LEAKAGE CURRENT (I_R)**
    Reverse leakage current are guaranteed and measured at V_R shown on the table.
11. **ZENER IMPEDANCE (Z_{ZT}) DERIVATION**
    The zener impedance is derived from the 60 cycle ac voltage, which results when an AC current having an rms value to 10% of the DC zener current (I_{ZT}) is superimposed on I_{ZT}.

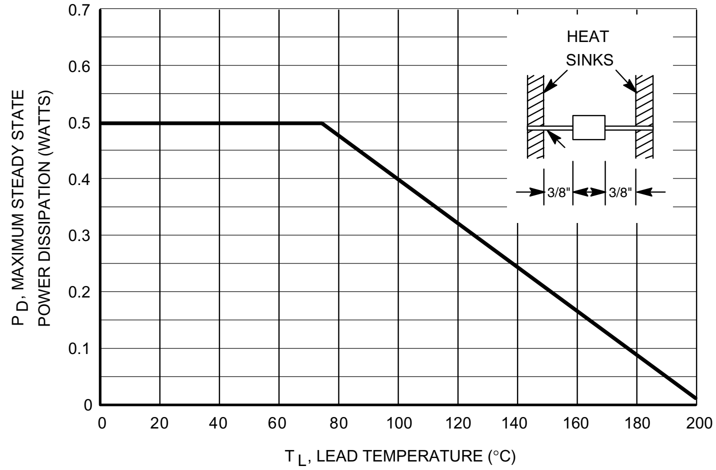


Figure 1. Steady State Power Derating

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.

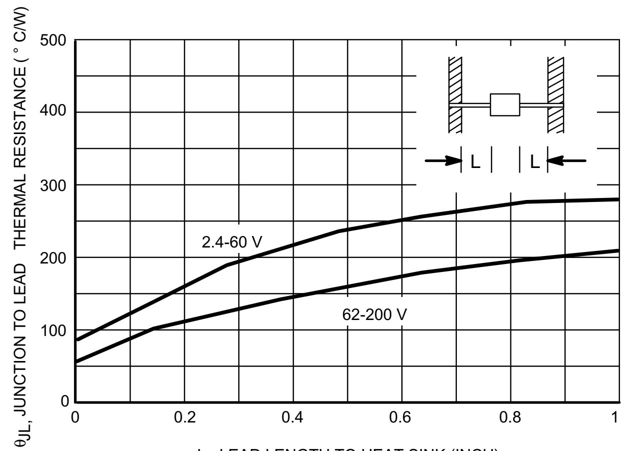


Figure 2. Typical Thermal Resistance

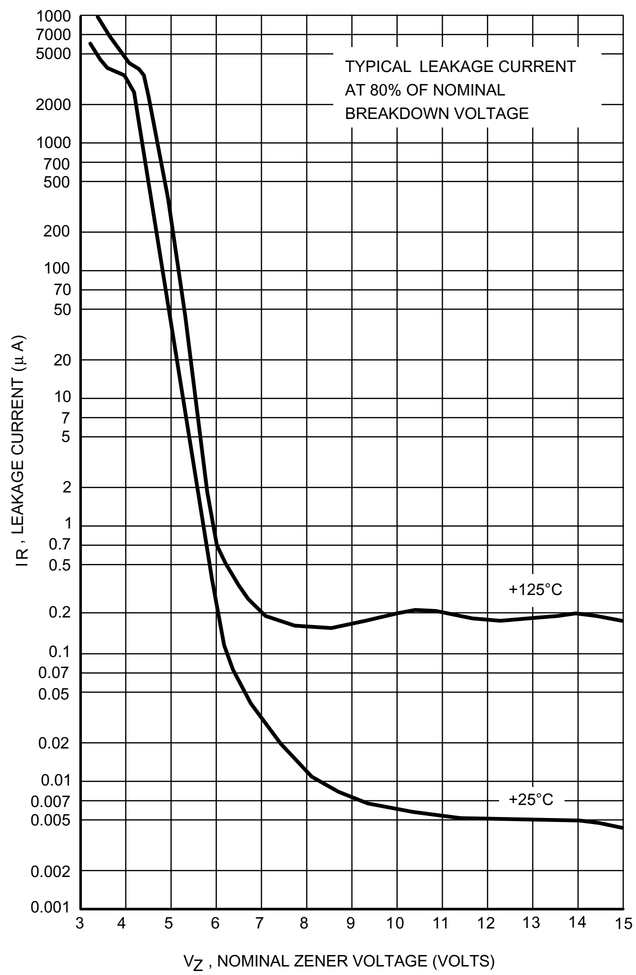


Figure 3. Typical Leakage Current

TEMPERATURE COEFFICIENTS

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

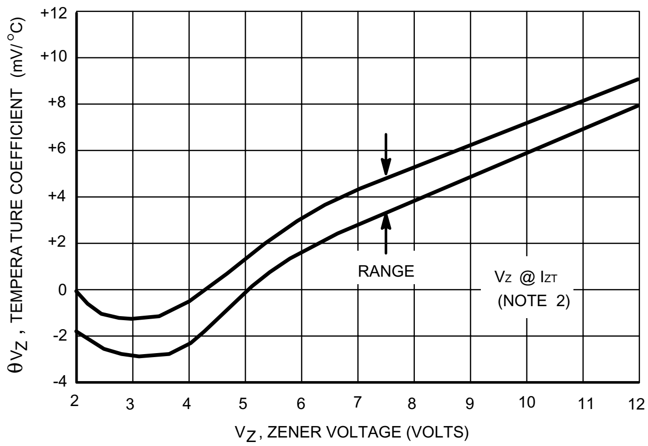


Figure 4a. Range for Units to 12 Volts

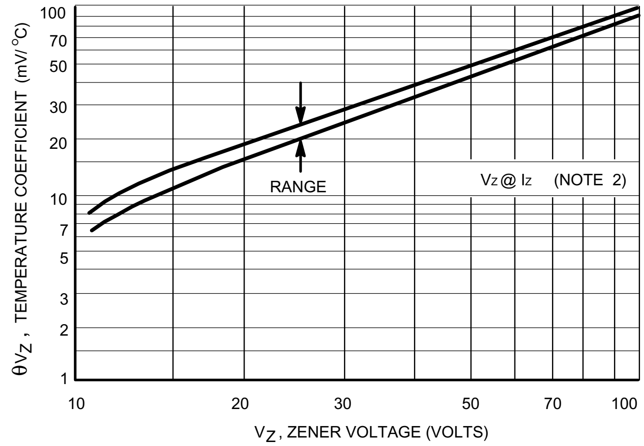


Figure 4b. Range for Units 12 to 100 Volts

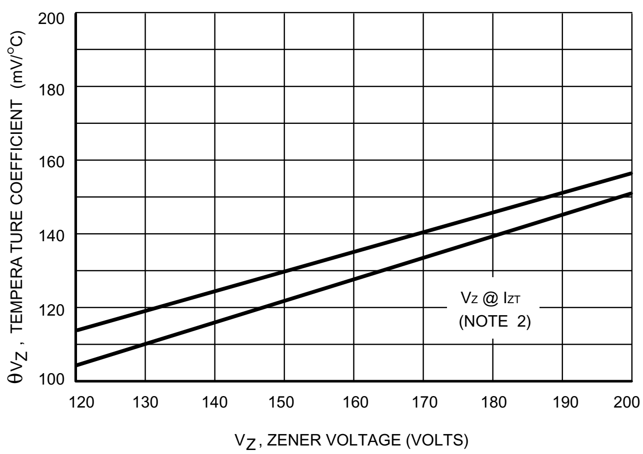


Figure 4c. Range for Units 120 to 200 Volts

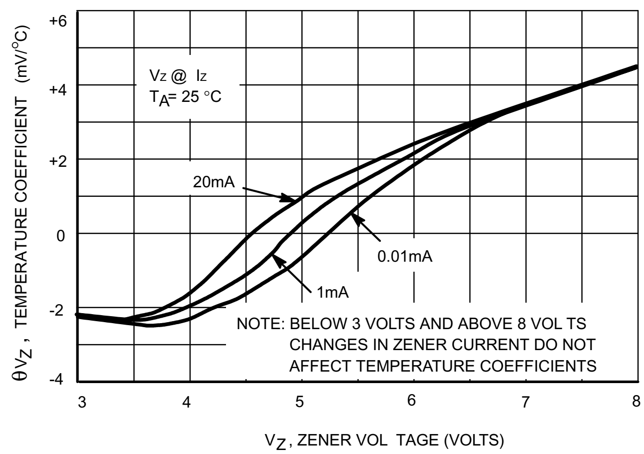


Figure 5. Effect of Zener Current

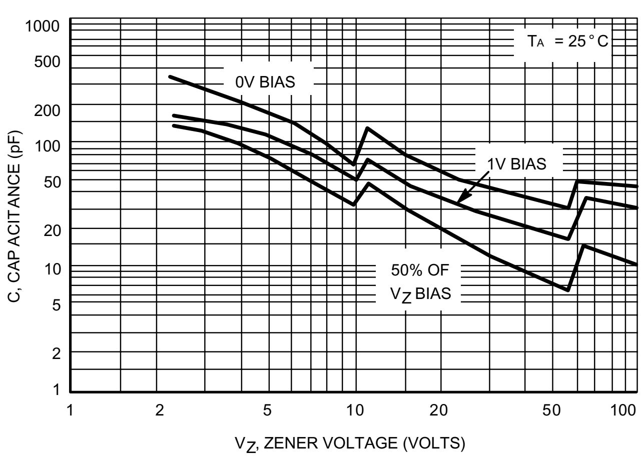


Figure 6a. Typical Capacitance 2.4-100 Volts

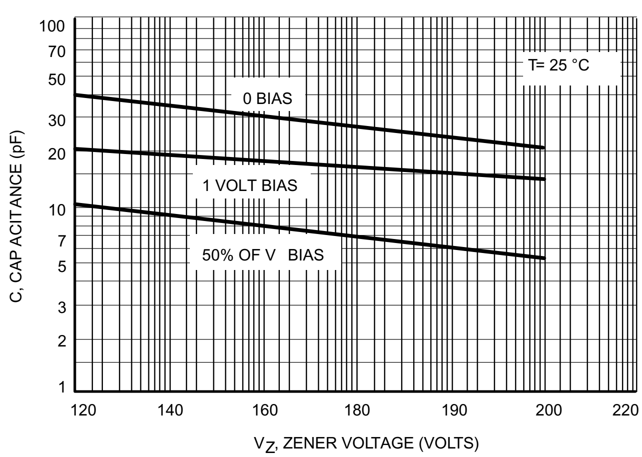


Figure 6b. Typical Capacitance 120-200 Volts

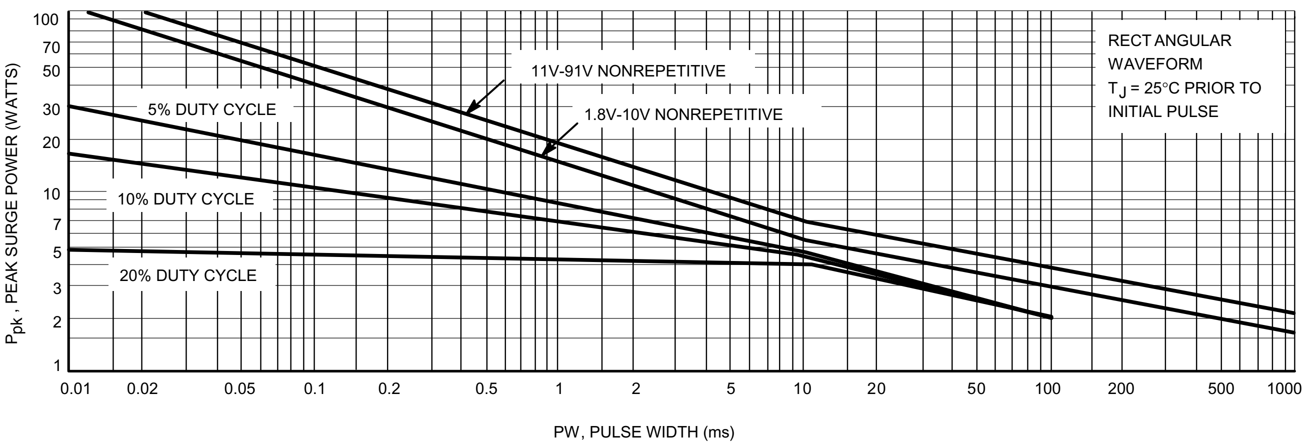


Figure 7a. Maximum Surge Power 1.8-91 Volts

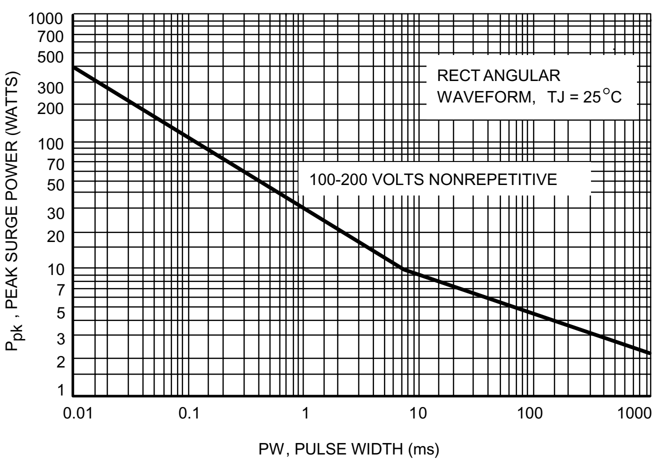


Figure 7b. Maximum Surge Power DO-35 100-200Volts

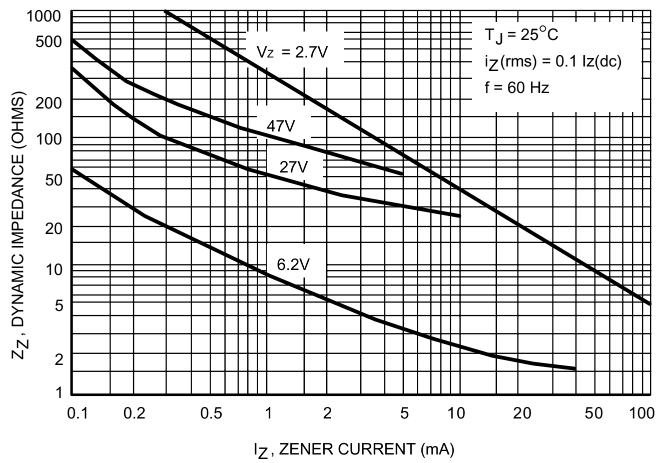


Figure 8. Effect of Zener Current on Zener Impedance

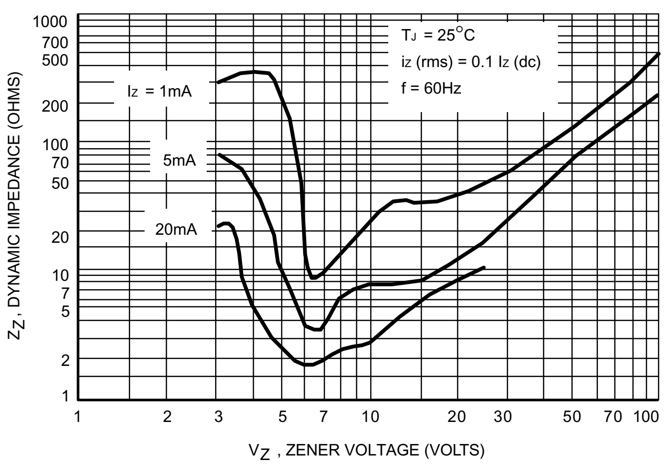


Figure 9. Effect of Zener Voltage on Zener Impedance

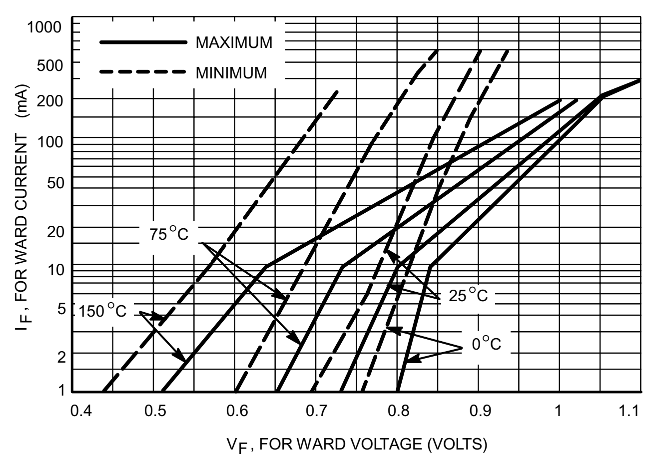


Figure 10. Typical Forward Characteristics

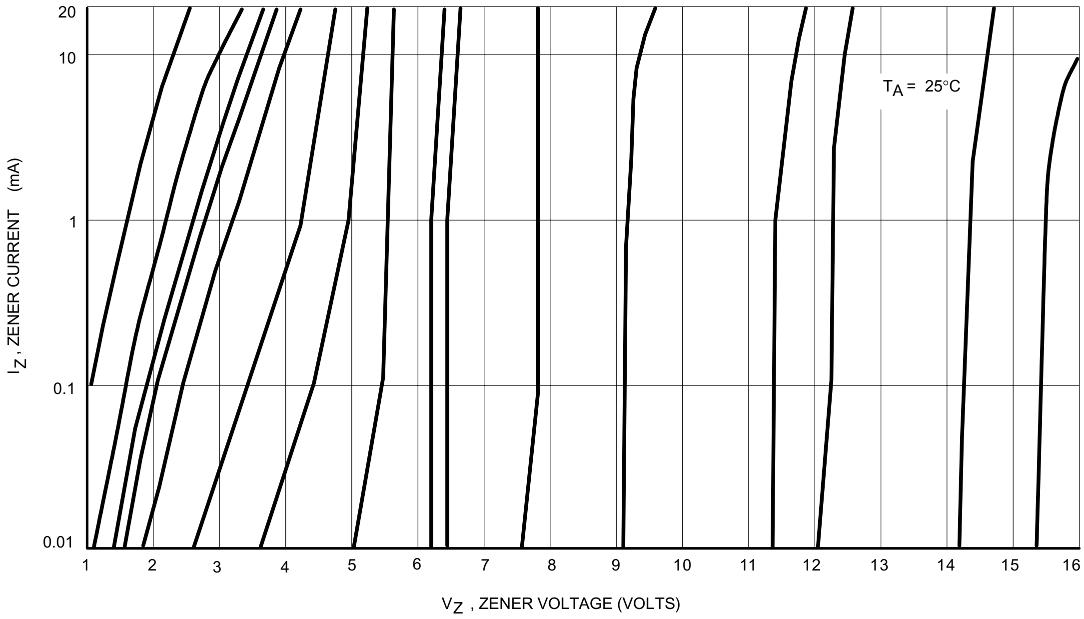


Figure 1 1. Zener Voltage versus Zener Current - V_Z = 1 thru 16 Volts

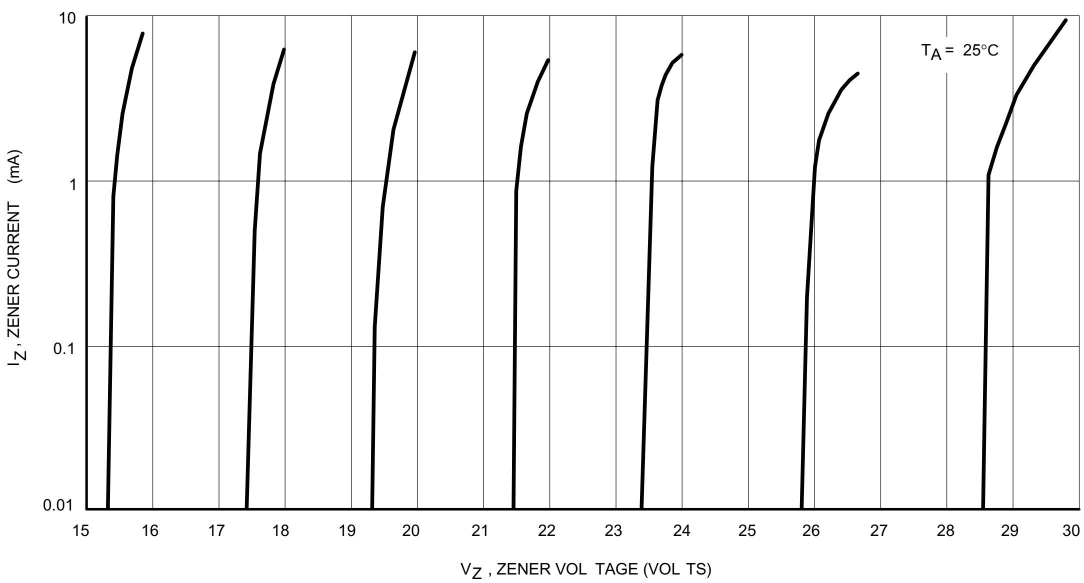


Figure 12. Zener Voltage versus Zener Current - V_Z = 15 thru 30 Volts

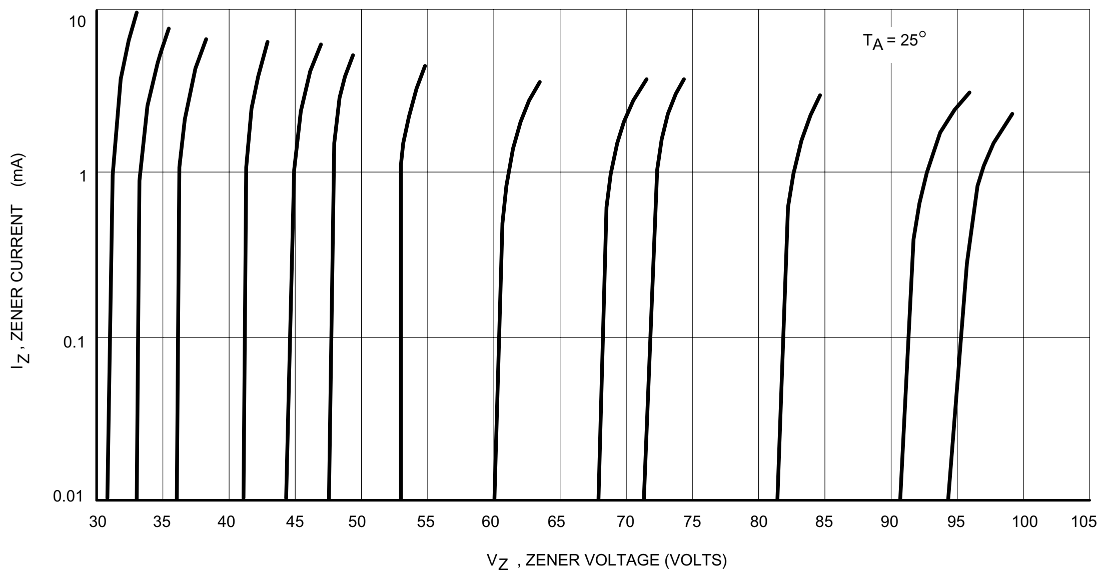


Figure 13. Zener Voltage versus Zener Current - V_Z = 30 thru 105 Volts

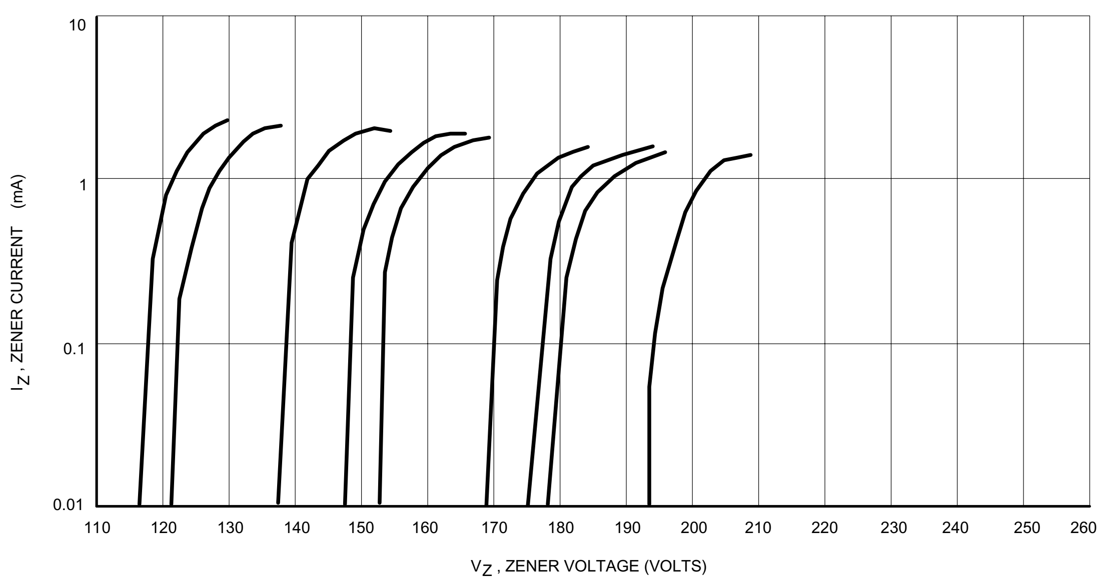


Figure 14. Zener Voltage versus Zener Current - V_Z = 110 thru 220 Volts