Section 4.2.4.1 Axial Leaded — continued

SECTION 4.2.4.1.2 1–1.3 WATT DO-41 GLASS

DATA SHEETS

Devices	Page No.
General Data — 1–1.3 Watt DO-41 Glass	4-2-40
1N4728A thru 1N4764A	4-2-44
BZX85C3V3 thru BZX85C100	4-2-45
M-ZPY3.9 thru M-ZPY100	4-2-46

MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	RL, RL2[1]	6K
Tape and Ammo	TA, TA2[1]	4K

NOTE 1 The "2" suffix refers to 26 mm tape spacing

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

1–1.3 Watt DO-41 Glass Zener Voltage Regulator Diodes

GENERAL DATA APPLICABLE TO ALL SERIES IN THIS GROUP

One Watt Hermetically Sealed Glass Silicon Zener Diodes

GENERAL DATA
1–1.3 WATT
DO-41 GLASS

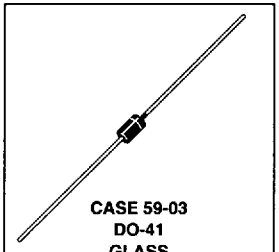
1 WATT
ZENER REGULATOR
DIODES
3.3–100 VOLTS

Specification Features:

- Complete Voltage Range — 3.3 to 100 Volts
- DO-41 Package
- Double Slug Type Construction
- Metallurgically Bonded Construction
- Oxide Passivated Die

Mechanical Characteristics:

CASE: Double slug type, hermetically sealed glass
MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 230°C, 1/16″ from case for 10 seconds
FINISH: All external surfaces are corrosion resistant with readily solderable leads
POLARITY: Cathode indicated by color band. When operated in zener mode, cathode will be positive with respect to anode
MOUNTING POSITION: Any



CASE 59-03
DO-41
GLASS

4

MAXIMUM RATINGS			
Rating	**Symbol**	**Value**	**Unit**
DC Power Dissipation @ $T_A = 50°C$ Derate above 50°C	P_D	1 6.67	Watt mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	– 65 to +200	°C

4.2

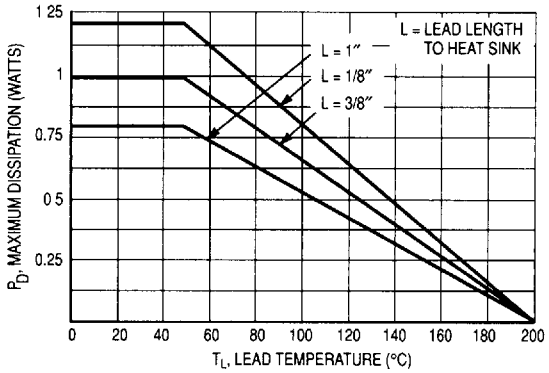
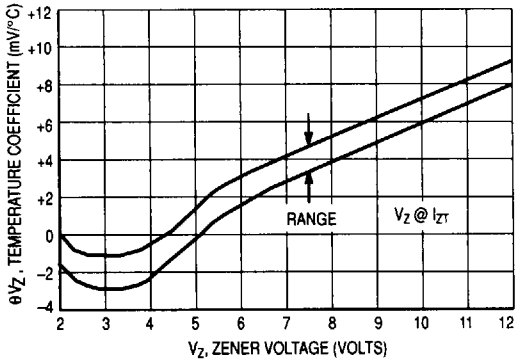


Figure 1. Power Temperature Derating Curve

GENERAL DATA — 1–1.3 WATT DO-41 GLASS

a. Range for Units to 12 Volts



b. Range for Units to 12 to 100 Volts

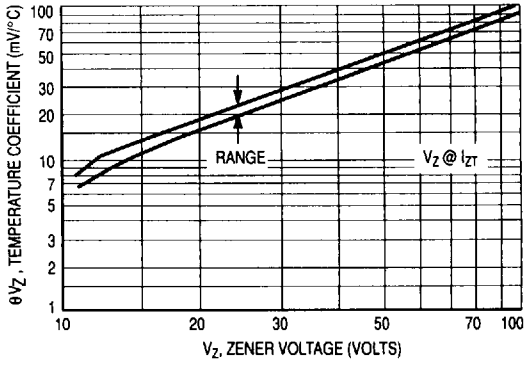


Figure 2. Temperature Coefficients

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

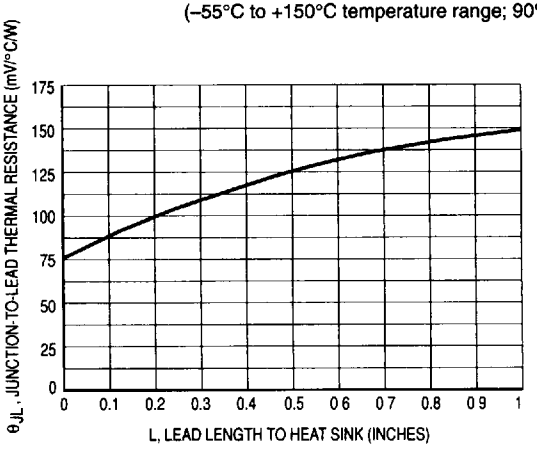


Figure 3. Typical Thermal Resistance versus Lead Length

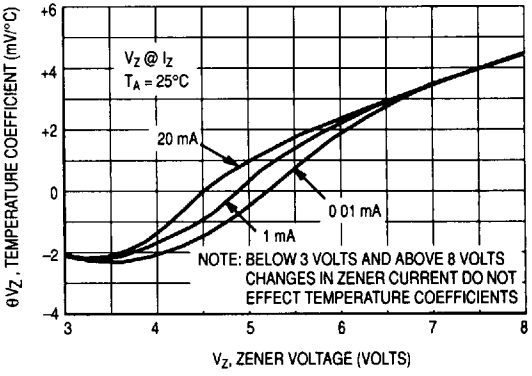
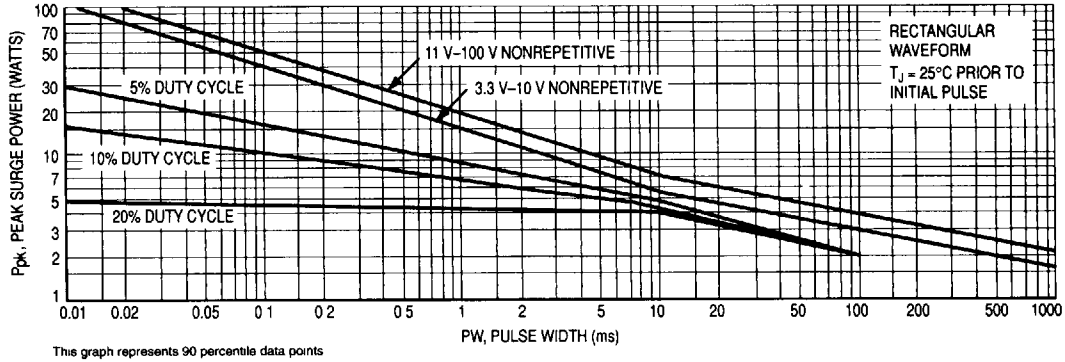


Figure 4. Effect of Zener Current



This graph represents 90 percentile data points
For worst case design charactenstics, multiply surge power by 2/3

Figure 5. Maximum Surge Power

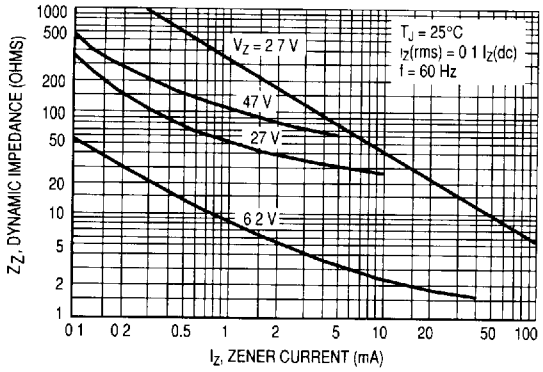


Figure 6. Effect of Zener Current on Zener Impedance

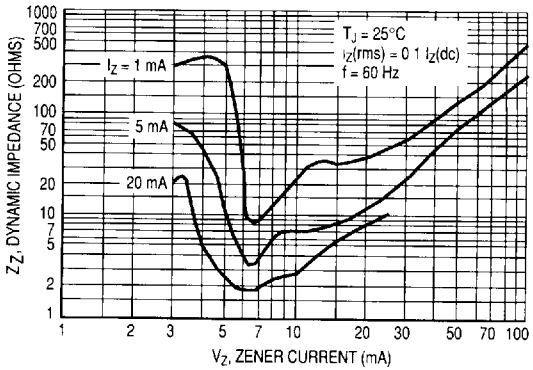


Figure 7. Effect of Zener Voltage on Zener Impedance

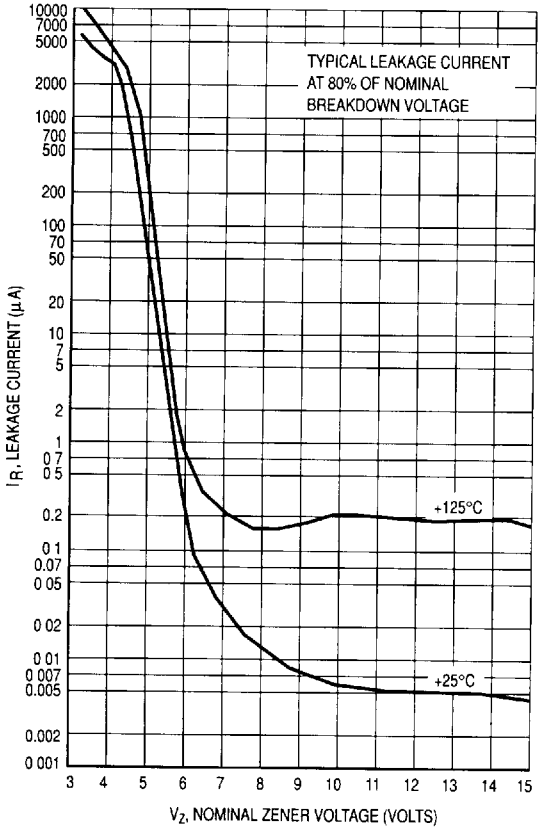


Figure 8. Typical Leakage Current

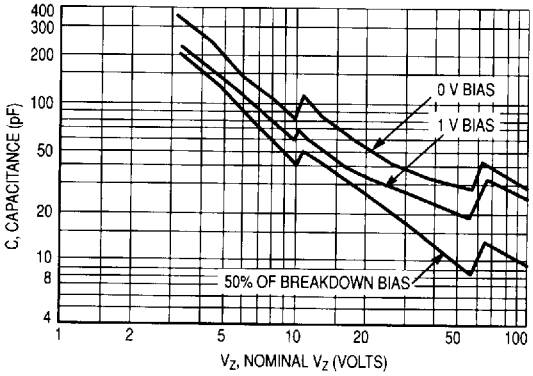


Figure 9. Typical Capacitance versus V_Z

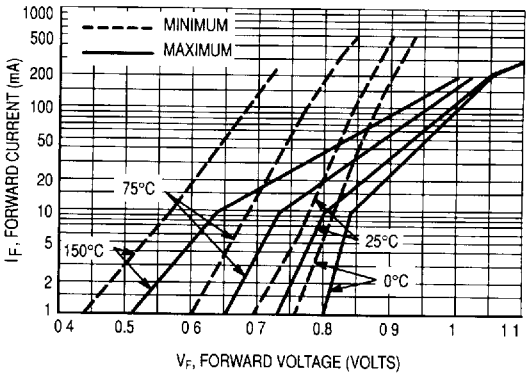


Figure 10. Typical Forward Characteristics

APPLICATION NOTE

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 as follows:

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

θ_{JL} may be determined from Figure 3 for dc power conditions. 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:

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

θ_{VZ}, the zener voltage temperature coefficient, is found from Figure 2.

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 5. 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 5 be exceeded.

1N4728A thru 1N4764A

***ELECTRICAL CHARACTERISTICS** (T_A = 25°C unless otherwise noted) V_F = 1 2 V Max, I_F = 200 mA for all types

JEDEC Type No. (Note 1)	Nominal Zener Voltage V_Z @ I_{ZT} Volts (Notes 2 and 3)	Test Current I_{ZT} mA	Maximum Zener Impedance (Note 4)			Leakage Current		Surge Current @ T_A = 25°C i_r – mA (Note 5)
			Z_{ZT} @ I_{ZT} Ohms	Z_{ZK} @ I_{ZK} Ohms	I_{ZK} mA	I_R µA Max	V_R Volts	
⇒ **1N4728A**	**3.3**	**76**	**10**	**400**	**1**	**100**	**1**	**1380**
1N4729A	3 6	69	10	400	1	100	1	1260
1N4730A	3 9	64	9	400	1	50	1	1190
⇒ **1N4731A**	**4.3**	**58**	**9**	**400**	**1**	**10**	**1**	**1070**
⇒ **1N4732A**	**4.7**	**53**	**8**	**500**	**1**	**10**	**1**	**970**
⇒ **1N4733A**	**5.1**	**49**	**7**	**550**	**1**	**10**	**1**	**890**
⇒ **1N4734A**	**5.6**	**45**	**5**	**600**	**1**	**10**	**2**	**810**
⇒ **1N4735A**	**6.2**	**41**	**2**	**700**	**1**	**10**	**3**	**730**
⇒ **1N4736A**	**6.8**	**37**	**3.5**	**700**	**1**	**10**	**4**	**660**
1N4737A	7 5	34	4	700	0 5	10	5	605
⇒ **1N4738A**	**8.2**	**31**	**4.5**	**700**	**0.5**	**10**	**6**	**550**
⇒ **1N4739A**	**9.1**	**28**	**5**	**700**	**0.5**	**10**	**7**	**500**
⇒ **1N4740A**	**10**	**25**	**7**	**700**	**0.25**	**10**	**7.6**	**454**
⇒ **1N4741A**	**11**	**23**	**8**	**700**	**0.25**	**5**	**8.4**	**414**
⇒ **1N4742A**	**12**	**21**	**9**	**700**	**0.25**	**5**	**9.1**	**380**
⇒ **1N4743A**	**13**	**19**	**10**	**700**	**0.25**	**5**	**9.9**	**344**
⇒ **1N4744A**	**15**	**17**	**14**	**700**	**0.25**	**5**	**11.4**	**304**
⇒ **1N4745A**	**16**	**15.5**	**16**	**700**	**0.25**	**5**	**12.2**	**285**
⇒ **1N4746A**	**18**	**14**	**20**	**750**	**0.25**	**5**	**13.7**	**250**
⇒ **1N4747A**	**20**	**12.5**	**22**	**750**	**0.25**	**5**	**15.2**	**225**
1N4748A	22	11 5	23	750	0 25	5	16.7	205
⇒ **1N4749A**	**24**	**10.5**	**25**	**750**	**0.25**	**5**	**18.2**	**190**
⇒ **1N4750A**	**27**	**9.5**	**35**	**750**	**0.25**	**5**	**20.6**	**170**
⇒ **1N4751A**	**30**	**8.5**	**40**	**1000**	**0.25**	**5**	**22.8**	**150**
1N4752A	33	7.5	45	1000	0 25	5	25 1	135
1N4753A	36	7	50	1000	0 25	5	27 4	125
1N4754A	39	6 5	60	1000	0 25	5	29 7	115
1N4755A	43	6	70	1500	0 25	5	32 7	110
1N4756A	47	5 5	80	1500	0 25	5	35 8	95
1N4757A	51	5	95	1500	0 25	5	38 8	90
1N4758A	56	4.5	110	2000	0 25	5	42 6	80
1N4759A	62	4	125	2000	0 25	5	47 1	70
1N4760A	68	3 7	150	2000	0.25	5	51 7	65
1N4761A	75	3 3	175	2000	0.25	5	56	60
1N4762A	82	3	200	3000	0.25	5	62 2	55
1N4763A	91	2 8	250	3000	0 25	5	69 2	50
1N4764A	100	2 5	350	3000	0 25	5	76	45

⇒ Preferred part

*Indicates JEDEC Registered Data

NOTE 1. TOLERANCE AND TYPE NUMBER DESIGNATION

The JEDEC type numbers listed have a standard tolerance on the nominal zener voltage of ±5% C for ±2% D for ±1%

NOTE 2 SPECIALS AVAILABLE INCLUDE

Nominal zener voltages between the voltages shown and tighter voltage tolerances

For detailed information on price availability and delivery, contact your nearest Motorola representative

NOTE 3. ZENER VOLTAGE (V_Z) MEASUREMENT

Motorola guarantees the zener voltage when measured at 90 seconds while maintaining the lead temperature (T_L) at 30°C ± 1°C 3/8″ from the diode body

NOTE 4 ZENER IMPEDANCE (Z_Z) DERIVATION

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

NOTE 5. SURGE CURRENT (i_r) NON-REPETITIVE

The rating listed in the electrical characteristics table is maximum peak non repetitive reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current I_{ZT} per JEDEC registration however actual device capability is as described in Figure 5 of the General Data — DO-41 Glass

BZX85C3V3 thru BZX85C100

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.) (V_F = 1.2 V Max, I_F = 200 mA for all types.)

Type (Note 1)	Zener Voltage V_{ZT} (V) (Notes 2 and 3)		Test Current I_{ZT} (mA)	Zener Impedance Z_Z (ohms) (Note 4)			Leakage Current (μA)		Surge Current T_A = 25°C I_r (mA) (Note 5)
	V_Z Min	V_Z Max		Max at I_{ZT}	Max at I_Z	(mA)	V_R (V)	I_R Max	
BZX85C3V3	3.1	3.5	80	20	400	1	1	60	1380
BZX85C3V6	3.4	3.8	60	15	500	1	1	30	1260
BZX85C3V9	3.7	4.1	60	15	500	1	1	5	1190
BZX85C4V3	4	4.6	50	13	500	1	1	3	1070
BZX85C4V7	4.4	5	45	13	600	1	1.5	3	970
BZX85C5V1	4.8	5.4	45	10	500	1	2	1	890
BZX85C5V6	5.2	6	45	7	400	1	2	1	810
BZX85C6V2	5 8	6.6	35	4	300	1	3	1	730
BZX85C6V8	6 4	7.2	35	3.5	300	1	4	1	660
BZX85C7V5	7	7.9	35	3	200	0.5	4.5	1	605
BZX85C8V2	7.7	8.7	25	5	200	0.5	5	1	550
BZX85C9V1	8.5	9.6	25	5	200	0.5	6.5	1	500
BZX85C10	9.4	10.6	25	7	200	0.5	7	0 5	454
BZX85C11	10 4	11.6	20	8	300	0.5	7.7	0.5	414
BZX85C12	11.4	12.7	20	9	350	0.5	8.4	0.5	380
BZX85C13	12.4	14.1	20	10	400	0.5	9.1	0.5	344
BZX85C15	13.8	15.6	15	15	500	0.5	10.5	0.5	304
BZX85C16	15.3	17.1	15	15	500	0.5	11	0.5	285
BZX85C18	16.8	19.1	15	20	500	0.5	12.5	0.5	250
BZX85C20	18 8	21.2	10	24	600	0.5	14	0.5	225
BZX85C22	20.8	23.3	10	25	600	0.5	15.5	0.5	205
BZX85C24	22 8	25.6	10	25	600	0.5	17	0.5	190
BZX85C27	25.1	28.9	8	30	750	0.25	19	0 5	170
BZX85C30	28	32	8	30	1000	0.25	21	0.5	150
BZX85C33	31	35	8	35	1000	0.25	23	0.5	135
BZX85C36	34	38	8	40	1000	0.25	25	0.5	125
BZX85C39	37	41	6	45	1000	0.25	27	0.5	115
BZX85C43	40	46	6	50	1000	0.25	30	0.5	110
BZX85C47	44	50	4	90	1500	0.25	33	0.5	95
BZX85C51	48	54	4	115	1500	0.25	36	0.5	90
BZX85C56	52	60	4	120	2000	0.25	39	0.5	80
BZX85C62	58	66	4	125	2000	0.25	43	0.5	70
BZX85C68	64	72	4	130	2000	0.25	47	0.5	65
BZX85C75	70	80	4	150	2000	0.25	51	0.5	60
BZX85C82	77	87	2.7	200	3000	0.25	56	0.5	55
BZX85C91	85	96	2.7	250	3000	0.25	62	0 5	50
BZX85C100	96	106	2.7	350	3000	0.25	68	0.5	45

NOTE 1. TOLERANCE AND TYPE NUMBER DESIGNATION

The type numbers listed have zener voltage min/max limits as shown. Device tolerance of ±2% are indicated by a "B" instead of "C."

NOTE 2. SPECIALS AVAILABLE INCLUDE:

Nominal zener voltages between the voltages shown and tighter voltage tolerances

For detailed information on price, availability, and delivery, contact your nearest Motorola representative

NOTE 3. ZENER VOLTAGE (V_Z) MEASUREMENT

V_Z is measured after the test current has been applied to 40 ± 10 msec, while maintaining the lead temperature (T_L) at 30°C ± 1°C, 3/8" from the diode body

NOTE 4. ZENER IMPEDANCE (Z_Z) DERIVATION

The zener impedance is derived from the 1 kHz cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (I_{ZT}) or (I_{ZK}) is superimposed on I_{ZT} or I_{ZK}.

NOTE 5. SURGE CURRENT (I_r) NON-REPETITIVE

The rating listed in the electrical characteristics table is maximum peak, non-repetitive, reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current I_{ZT}. However, actual device capability is as described in Figure 5 of General Data DO-41 glass

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 1 2 V Max, I_F = 200 mA for all types

Type No. (Note 1)	Zener Voltage (V) (Notes 2 and 3)		Test Current I_{ZT} (mA)	Zener Impedance (Note 4) f = 1 kHz (ohms)		Blocking Volt Min (V)	Surge Current T_A = 25°C i_r (mA) (Note 5)
	V_Z Min	V_Z Max		Typ	Max	I_R = 1 μA	
MZPY3.9	3 7	4 1	100	4	7	—	1190
MZPY4.3	4	4 6	100	4	7	—	1070
MZPY4 7	4.4	5	100	4	7	—	970
MZPY5 1	4 8	5.4	100	2	5	0 7	890
MZPY5.6	5 2	6	100	1	2	1.5	810
MZPY6 2	5 8	6 6	100	1	2	2	730
MZPY6 8	6 4	7 2	100	1	2	3	660
MZPY7 5	7	7.9	100	1	2	5	605
MZPY8.2	7 7	8 7	100	1	2	6	550
MZPY9.1	8 5	9 6	50	2	4	7	500
MZPY10	9 4	10 6	50	2	4	7 5	454
MZPY11	10 4	11 6	50	3	7	8.5	414
MZPY12	11.4	12 7	50	3	7	9	380
MZPY13	12 4	14 1	50	4	9	10	344
MZPY15	14 2	15.8	50	4	9	11	304
MZPY16	15.3	17.1	25	5	10	12	285
MZPY18	16 8	19 1	25	5	11	14	250
MZPY20	18 8	21 2	25	6	12	15	225
MZPY22	20 8	23 3	25	7	13	17	205
MZPY24	22 8	25.6	25	8	14	18	190
MZPY27	25 1	28 9	25	9	15	20	170
MZPY30	28	32	25	10	20	22 5	150
MZPY33	31	35	25	11	20	25	135
MZPY36	34	38	10	25	60	27	125
MZPY39	37	41	10	30	60	29	115
MZPY43	40	46	10	35	80	32	110
MZPY47	44	50	10	40	80	35	95
MZPY51	48	54	10	45	100	38	90
MZPY56	52	60	10	50	100	42	80
MZPY62	58	66	10	60	130	47	70
MZPY68	64	72	10	65	130	51	65
MZPY75	70	79	10	70	160	56	60
MZPY82	77	88	10	80	160	61	55
MZPY91	85	96	5	120	250	68	50
MZPY100	94	106	5	130	250	75	45

NOTE 1. TOLERANCE AND TYPE NUMBER DESIGNATION

The type numbers listed have zener voltage min/max limits as shown Device tolerance of ±2% are indicated by a "C" and ±1% by a "D" suffix

NOTE 2. SPECIALS AVAILABLE INCLUDE:

Nominal zener voltages between the voltages shown and tighter voltage tolerances

For detailed information on price, availability and delivery, contact your nearest Motorola representative

NOTE 3 ZENER VOLTAGE (V_Z) MEASUREMENT

V_Z is measured after the test current has been applied to 40 ± 10 msec while maintaining the lead temperature (T_L) at 30°C ± 1°C, 3/8" from the diode body

NOTE 4 ZENER IMPEDANCE (Z_Z) DERIVATION

The zener impedance is derived from the 1 kHz cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current (I_{ZT}) of (I_{ZK}) is superimposed on I_{ZT} or I_{ZK}

NOTE 5 SURGE CURRENT (i_r) NON-REPETITIVE

The rating listed in the electrical characteristics table is maximum peak non repetitive reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current I_{ZT}, however, actual device capability is as described in Figure 5 of General Data DO 41 glass