

**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**

**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

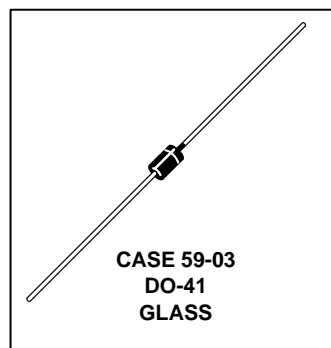
**WAFER FAB LOCATION:** Phoenix, Arizona

**ASSEMBLY/TEST LOCATION:** Seoul, Korea

**GENERAL**  
**DATA**

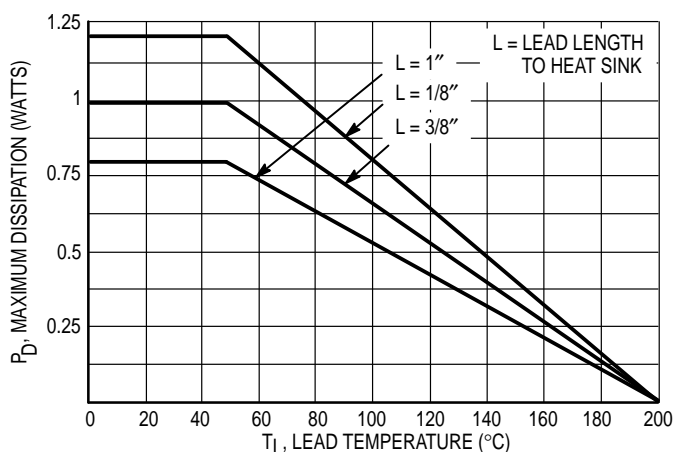
**1–1.3 WATT**  
**DO-41 GLASS**

**1 WATT**  
**ZENER REGULATOR**  
**DIODES**  
**3.3–100 VOLTS**



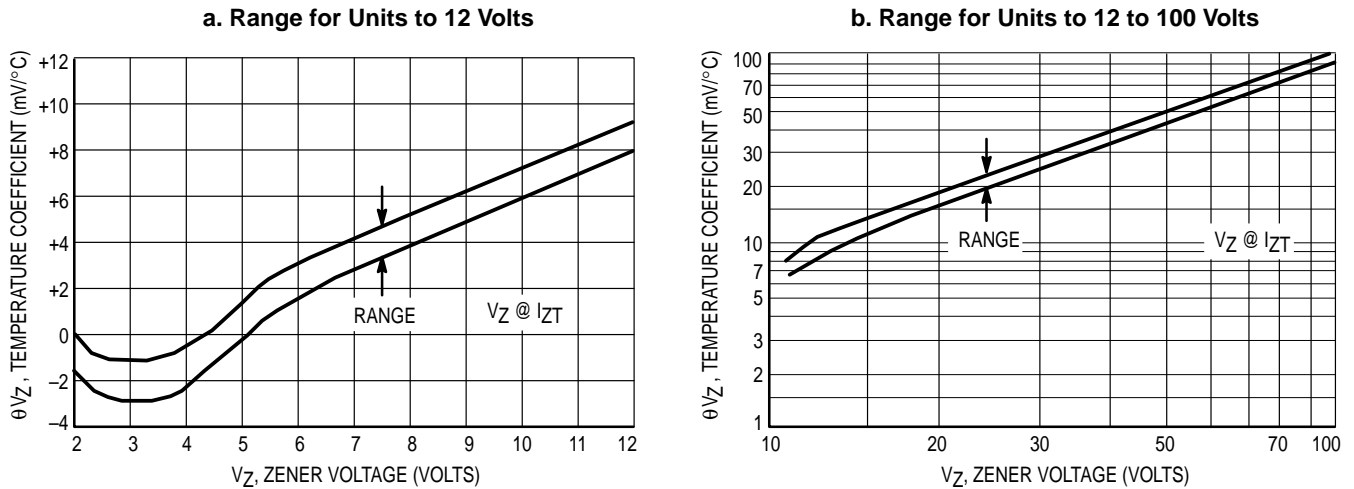
**MAXIMUM RATINGS**

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

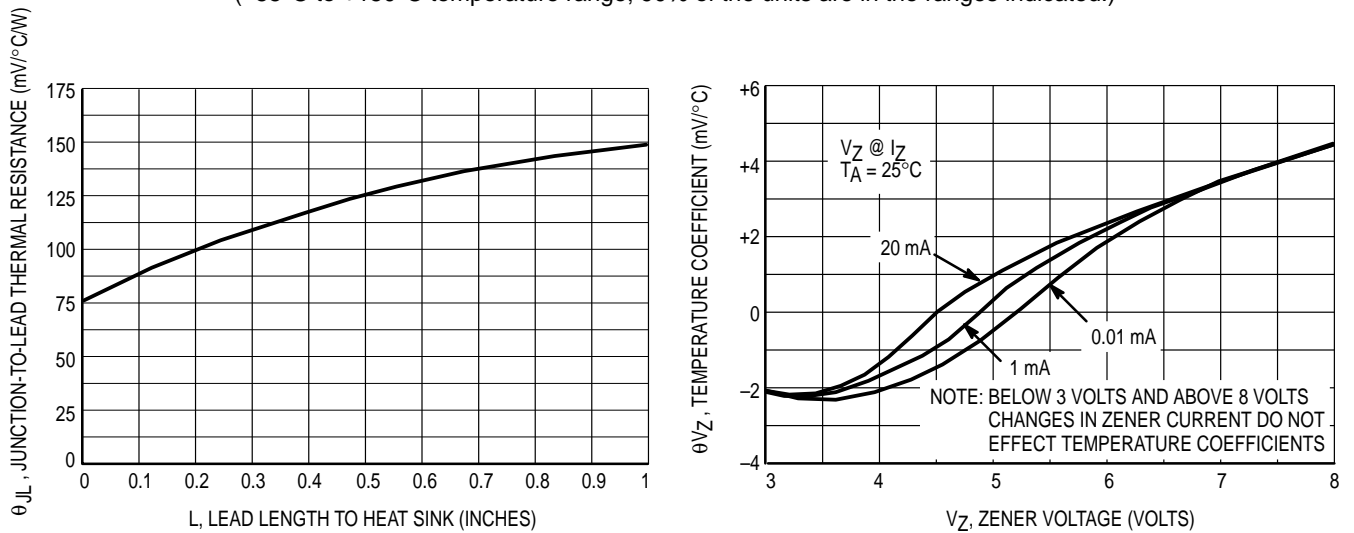


**Figure 1. Power Temperature Derating Curve**

# GENERAL DATA — 1–1.3 WATT DO-41 GLASS

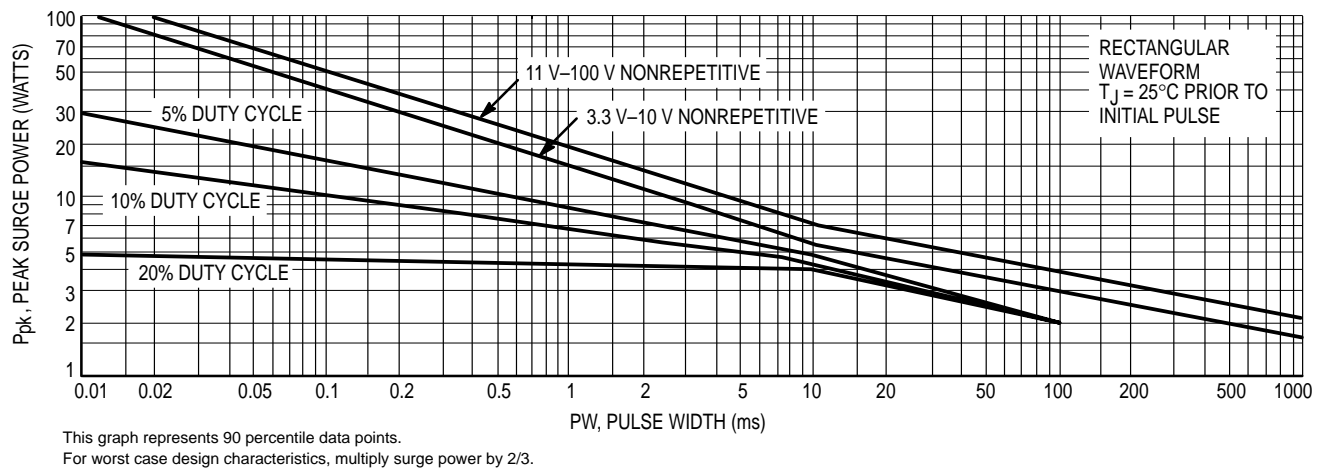


**Figure 2. Temperature Coefficients**  
(–55°C to +150°C temperature range; 90% of the units are in the ranges indicated.)



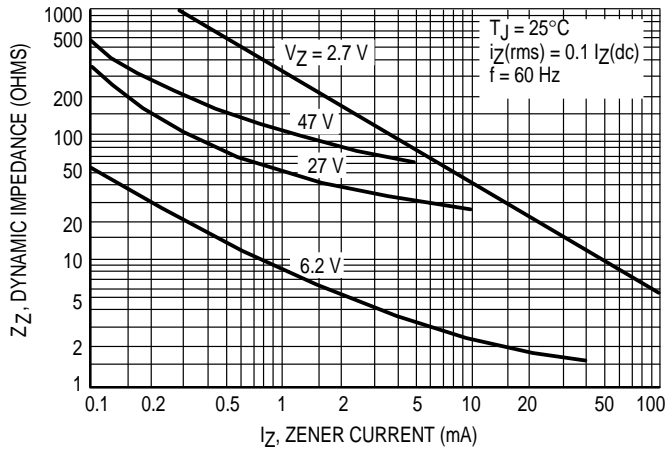
**Figure 3. Typical Thermal Resistance versus Lead Length**

**Figure 4. Effect of Zener Current**

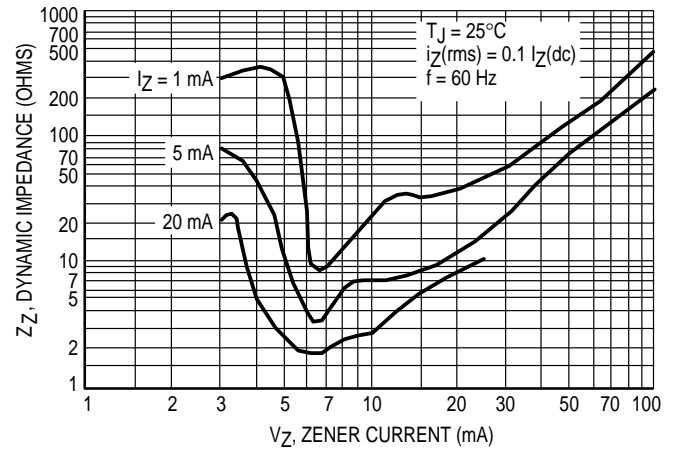


**Figure 5. Maximum Surge Power**

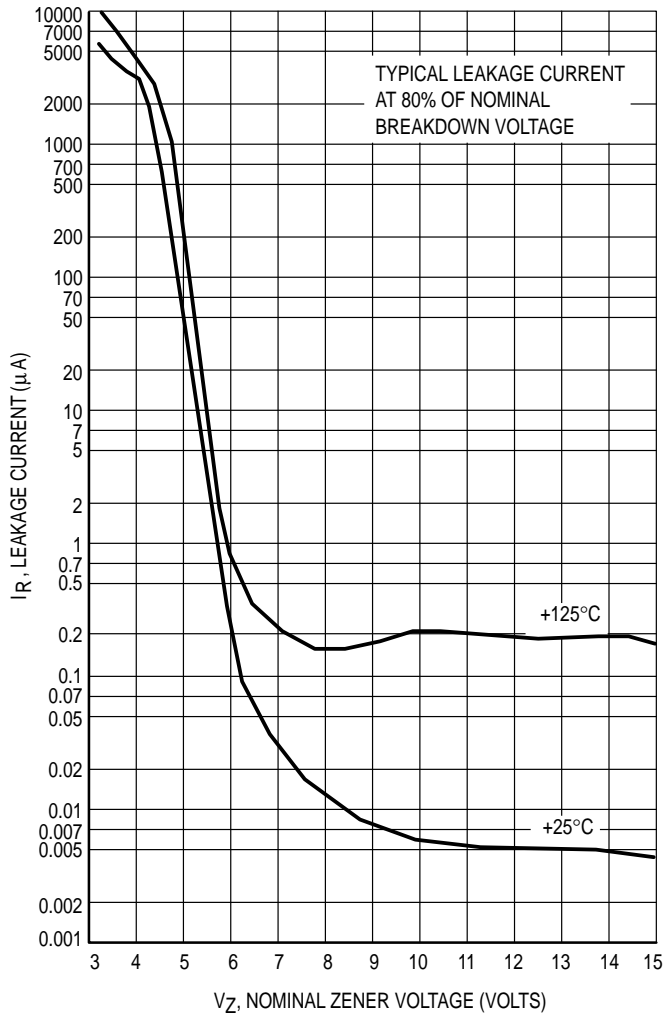
# GENERAL DATA — 1–1.3 WATT DO-41 GLASS



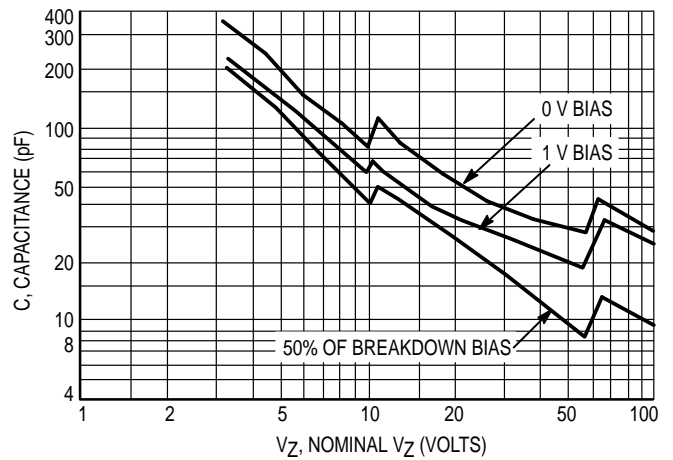
**Figure 6. Effect of Zener Current on Zener Impedance**



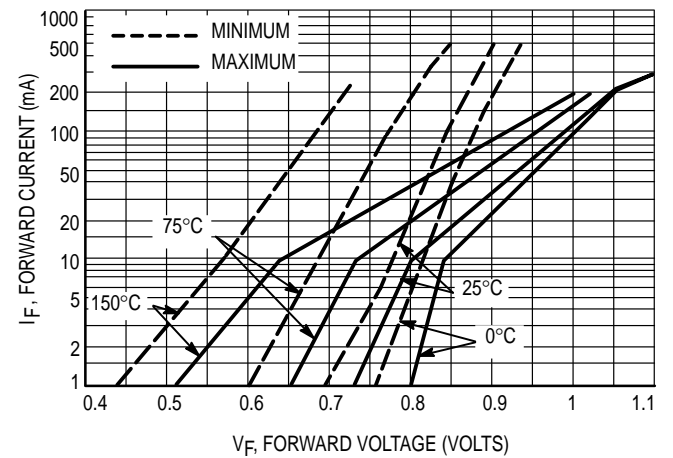
**Figure 7. Effect of Zener Voltage on Zener Impedance**



**Figure 8. Typical Leakage Current**



**Figure 9. Typical Capacitance versus  $V_Z$**



**Figure 10. Typical Forward Characteristics**

# GENERAL DATA — 1–1.3 WATT DO-41 GLASS

## 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:

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

$\theta_{LA}$  is the lead-to-ambient thermal resistance ( $^{\circ}\text{C}/\text{W}$ ) and  $P_D$  is the power dissipation. The value for  $\theta_{LA}$  will vary and depends on the device mounting method.  $\theta_{LA}$  is generally 30 to 40  $^{\circ}\text{C}/\text{W}$  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:

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

$\Delta T_{JL}$  is the increase in junction temperature above the lead

temperature and may be found as follows:

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

$\theta_{JL}$  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:

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

$\theta_{VZ}$ , 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.

# GENERAL DATA — 1–1.3 WATT DO-41 GLASS

\*ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)  $V_F = 1.2\text{ V Max}$ ,  $I_F = 200\text{ mA}$  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 @ $T_A = 25^\circ\text{C}$ $i_r$ – mA (Note 5)
			$Z_{ZT}$ @ $I_ZT$ Ohms	$Z_{ZK}$ @ $I_{ZK}$ Ohms	$I_{ZK}$ mA	$I_R$ $\mu\text{A Max}$	$V_R$ 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
<b>1N4733A</b>	<b>5.1</b>	<b>49</b>	<b>7</b>	<b>550</b>	<b>1</b>	<b>10</b>	<b>1</b>	<b>890</b>
<b>1N4734A</b>	<b>5.6</b>	<b>45</b>	<b>5</b>	<b>600</b>	<b>1</b>	<b>10</b>	<b>2</b>	<b>810</b>
<b>1N4735A</b>	<b>6.2</b>	<b>41</b>	<b>2</b>	<b>700</b>	<b>1</b>	<b>10</b>	<b>3</b>	<b>730</b>
<b>1N4736A</b>	<b>6.8</b>	<b>37</b>	<b>3.5</b>	<b>700</b>	<b>1</b>	<b>10</b>	<b>4</b>	<b>660</b>
1N4737A	7.5	34	4	700	0.5	10	5	605
<b>1N4738A</b>	<b>8.2</b>	<b>31</b>	<b>4.5</b>	<b>700</b>	<b>0.5</b>	<b>10</b>	<b>6</b>	<b>550</b>
1N4739A	9.1	28	5	700	0.5	10	7	500
<b>1N4740A</b>	<b>10</b>	<b>25</b>	<b>7</b>	<b>700</b>	<b>0.25</b>	<b>10</b>	<b>7.6</b>	<b>454</b>
<b>1N4741A</b>	<b>11</b>	<b>23</b>	<b>8</b>	<b>700</b>	<b>0.25</b>	<b>5</b>	<b>8.4</b>	<b>414</b>
<b>1N4742A</b>	<b>12</b>	<b>21</b>	<b>9</b>	<b>700</b>	<b>0.25</b>	<b>5</b>	<b>9.1</b>	<b>380</b>
1N4743A	13	19	10	700	0.25	5	9.9	344
<b>1N4744A</b>	<b>15</b>	<b>17</b>	<b>14</b>	<b>700</b>	<b>0.25</b>	<b>5</b>	<b>11.4</b>	<b>304</b>
<b>1N4745A</b>	<b>16</b>	<b>15.5</b>	<b>16</b>	<b>700</b>	<b>0.25</b>	<b>5</b>	<b>12.2</b>	<b>285</b>
<b>1N4746A</b>	<b>18</b>	<b>14</b>	<b>20</b>	<b>750</b>	<b>0.25</b>	<b>5</b>	<b>13.7</b>	<b>250</b>
<b>1N4747A</b>	<b>20</b>	<b>12.5</b>	<b>22</b>	<b>750</b>	<b>0.25</b>	<b>5</b>	<b>15.2</b>	<b>225</b>
<b>1N4748A</b>	<b>22</b>	<b>11.5</b>	<b>23</b>	<b>750</b>	<b>0.25</b>	<b>5</b>	<b>16.7</b>	<b>205</b>
<b>1N4749A</b>	<b>24</b>	<b>10.5</b>	<b>25</b>	<b>750</b>	<b>0.25</b>	<b>5</b>	<b>18.2</b>	<b>190</b>
<b>1N4750A</b>	<b>27</b>	<b>9.5</b>	<b>35</b>	<b>750</b>	<b>0.25</b>	<b>5</b>	<b>20.6</b>	<b>170</b>
<b>1N4751A</b>	<b>30</b>	<b>8.5</b>	<b>40</b>	<b>1000</b>	<b>0.25</b>	<b>5</b>	<b>22.8</b>	<b>150</b>
<b>1N4752A</b>	<b>33</b>	<b>7.5</b>	<b>45</b>	<b>1000</b>	<b>0.25</b>	<b>5</b>	<b>25.1</b>	<b>135</b>
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

\*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  $\pm 5\%$ . C for  $\pm 2\%$ , D for  $\pm 1\%$ .

## 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  $30^\circ\text{C} \pm 1^\circ\text{C}$ ,  $3/8"$  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.

# GENERAL DATA — 1–1.3 WATT DO-41 GLASS

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted.) ( $V_F = 1.2\text{ V Max}$ ,  $I_F = 200\text{ mA}$  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 ( $\mu\text{A}$ )		Surge Current $T_A = 25^\circ\text{C}$ $i_r$ (mA) (Note 5)
	$V_Z$ Min	$V_Z$ Max		Max at $I_{ZT}$	Max at $I_Z$ (mA)		$V_R$ (V)	$I_R$ Max	
BZX85C3V3RL	3.1	3.5	80	20	400	1	1	60	1380
BZX85C3V6RL	3.4	3.8	60	15	500	1	1	30	1260
BZX85C3V9RL	3.7	4.1	60	15	500	1	1	5	1190
BZX85C4V3RL	4	4.6	50	13	500	1	1	3	1070
BZX85C4V7RL	4.4	5	45	13	600	1	1.5	3	970
BZX85C5V1RL	4.8	5.4	45	10	500	1	2	1	890
BZX85C5V6RL	5.2	6	45	7	400	1	2	1	810
BZX85C6V2RL	5.8	6.6	35	4	300	1	3	1	730
BZX85C6V8RL	6.4	7.2	35	3.5	300	1	4	1	660
BZX85C7V5RL	7	7.9	35	3	200	0.5	4.5	1	605
BZX85C8V2RL	7.7	8.7	25	5	200	0.5	5	1	550
BZX85C9V1RL	8.5	9.6	25	5	200	0.5	6.5	1	500
BZX85C10RL	9.4	10.6	25	7	200	0.5	7	0.5	454
BZX85C11RL	10.4	11.6	20	8	300	0.5	7.7	0.5	414
BZX85C12RL	11.4	12.7	20	9	350	0.5	8.4	0.5	380
BZX85C13RL	12.4	14.1	20	10	400	0.5	9.1	0.5	344
BZX85C15RL	13.8	15.6	15	15	500	0.5	10.5	0.5	304
BZX85C16RL	15.3	17.1	15	15	500	0.5	11	0.5	285
BZX85C18RL	16.8	19.1	15	20	500	0.5	12.5	0.5	250
BZX85C20RL	18.8	21.2	10	24	600	0.5	14	0.5	225
BZX85C22RL	20.8	23.3	10	25	600	0.5	15.5	0.5	205
BZX85C24RL	22.8	25.6	10	25	600	0.5	17	0.5	190
BZX85C27RL	25.1	28.9	8	30	750	0.25	19	0.5	170
BZX85C30RL	28	32	8	30	1000	0.25	21	0.5	150
BZX85C33RL	31	35	8	35	1000	0.25	23	0.5	135
BZX85C36RL	34	38	8	40	1000	0.25	25	0.5	125
BZX85C39RL	37	41	6	45	1000	0.25	27	0.5	115
BZX85C43RL	40	46	6	50	1000	0.25	30	0.5	110
BZX85C47RL	44	50	4	90	1500	0.25	33	0.5	95
BZX85C51RL	48	54	4	115	1500	0.25	36	0.5	90
BZX85C56RL	52	60	4	120	2000	0.25	39	0.5	80
BZX85C62RL	58	66	4	125	2000	0.25	43	0.5	70
BZX85C68RL	64	72	4	130	2000	0.25	47	0.5	65
BZX85C75RL	70	80	4	150	2000	0.25	51	0.5	60
BZX85C82RL	77	87	2.7	200	3000	0.25	56	0.5	55
BZX85C91RL	85	96	2.7	250	3000	0.25	62	0.5	50
BZX85C100RL	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  $\pm 2\%$  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  $40 \pm 10\text{ msec.}$ , while maintaining the lead temperature ( $T_L$ ) at  $30^\circ\text{C} \pm 1^\circ\text{C}$ ,  $3/8"$  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.

# GENERAL DATA — 1–1.3 WATT DO-41 GLASS

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)  $V_F = 1.2\text{ V Max}$ ,  $I_F = 200\text{ mA}$  for all types.

Type No. (Note 1)	Zener Voltage (V) (Notes 2 and 3)		Test Current $I_{ZT}$ (mA)	Zener Impedance (Note 4) $f = 1\text{ kHz (ohms)}$		Blocking Volt Min (V) $I_R = 1\text{ }\mu\text{A}$	Surge Current $T_A = 25^\circ\text{C}$ $i_r$ (ma) (Note 5)
	$V_Z$ Min	$V_Z$ Max		Typ	Max		
MZPY3.9RL	3.7	4.1	100	4	7	—	1190
MZPY4.3RL	4	4.6	100	4	7	—	1070
MZPY4.7RL	4.4	5	100	4	7	—	970
MZPY5.1RL	4.8	5.4	100	2	5	0.7	890
MZPY5.6RL	5.2	6	100	1	2	1.5	810
MZPY6.2RL	5.8	6.6	100	1	2	2	730
MZPY6.8RL	6.4	7.2	100	1	2	3	660
MZPY7.5RL	7	7.9	100	1	2	5	605
MZPY8.2RL	7.7	8.7	100	1	2	6	550
MZPY9.1RL	8.5	9.6	50	2	4	7	500
MZPY10RL	9.4	10.6	50	2	4	7.5	454
MZPY11RL	10.4	11.6	50	3	7	8.5	414
MZPY12RL	11.4	12.7	50	3	7	9	380
MZPY13RL	12.4	14.1	50	4	9	10	344
MZPY15RL	14.2	15.8	50	4	9	11	304
MZPY16RL	15.3	17.1	25	5	10	12	285
MZPY18RL	16.8	19.1	25	5	11	14	250
MZPY20RL	18.8	21.2	25	6	12	15	225
MZPY22RL	20.8	23.3	25	7	13	17	205
MZPY24RL	22.8	25.6	25	8	14	18	190
MZPY27RL	25.1	28.9	25	9	15	20	170
MZPY30RL	28	32	25	10	20	22.5	150
MZPY33RL	31	35	25	11	20	25	135
MZPY36RL	34	38	10	25	60	27	125
MZPY39RL	37	41	10	30	60	29	115
MZPY43RL	40	46	10	35	80	32	110
MZPY47RL	44	50	10	40	80	35	95
MZPY51RL	48	54	10	45	100	38	90
MZPY56RL	52	60	10	50	100	42	80
MZPY62RL	58	66	10	60	130	47	70
MZPY68RL	64	72	10	65	130	51	65
MZPY75RL	70	79	10	70	160	56	60
MZPY82RL	77	88	10	80	160	61	55
MZPY91RL	85	96	5	120	250	68	50
MZPY100RL	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  $\pm 2\%$  are indicated by a "C" and  $\pm 1\%$  by a "D" suffix.

**NOTE 2. SPECIALS AVAILABLE INCLUDE:**

Nominal zener voltages between the voltages shown and tighter voltage tolerances.

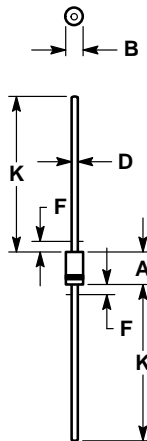
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**NOTE 3. ZENER VOLTAGE ( $V_Z$ ) MEASUREMENT**

$V_Z$  is measured after the test current has been applied to  $40 \pm 10\text{ msec.}$ , while maintaining the lead temperature ( $T_L$ ) at  $30^\circ\text{C} \pm 1^\circ\text{C}$ , 3/8" from the diode body.

## Zener Voltage Regulator Diodes — Axial Leaded

### 1–1.3 Watt DO-41 Glass



#### NOTES:

1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO-41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.07	5.20	0.160	0.205
B	2.04	2.71	0.080	0.107
D	0.71	0.86	0.028	0.034
F	—	1.27	—	0.050
K	27.94	—	1.100	—

**CASE 59-03  
DO-41  
GLASS**

(Refer to Section 10 for Surface Mount, Thermal Data and Footprint Information.)

#### MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

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

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

(Refer to Section 10 for more information on Packaging Specifications.)

NOTE 4. ZENER IMPEDANCE ( $Z_Z$ ) DERIVATION



## GENERAL DATA — 1–1.3 WATT DO-41 GLASS

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 ( $I_P$ ) 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.