Section 4.2.4.2 Surface Mounted — continued

SECTION 4.2.4.2.2 500 mW LEADLESS (DO-34 BODY SIZE)

DATA SHEETS

MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	T1, T2(1)	2K
Tape and Reel	T3, T4(1)	5K

NOTE 1 The numbers on the suffixes indicate the following
1 7″ Reel Cathode lead toward sprocket hole
2 7″ Reel Cathode lead away from sprocket hole
3 13″ Reel Cathode lead toward sprocket hole
4 13″ Reel Cathode lead away from sprocket hole

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

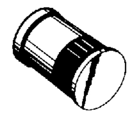
500 mW Leadless DO-34 Glass Zener Voltage Regulator Diodes

GENERAL DATA APPLICABLE TO ALL SERIES IN THIS GROUP

500 mW Hermetically Sealed Glass Silicon Zener Diodes

GENERAL DATA
500 mW LEADLESS DO-34

LEADLESS GLASS ZENER DIODES 500 MILLIWATTS 1.8–56 VOLTS



CASE 362-03 GLASS

Specification Features:

- Complete Voltage Range — 1 8 to 56 Volts
- Leadless Package for Surface Mount Technology
- 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, for 10 seconds

FINISH: All external surfaces are corrosion resistant and readily solderable

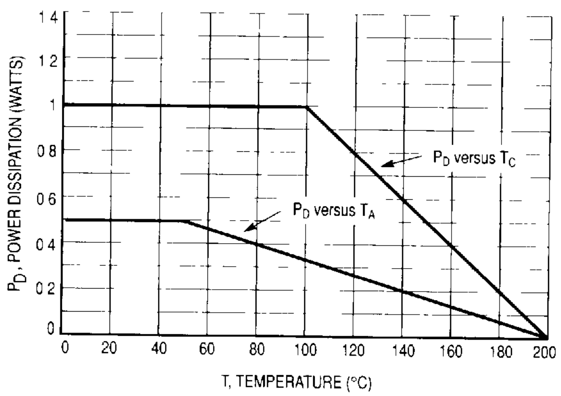
POLARITY: Cathode indicated by color band. When operated in zener mode, cathode will be positive with respect to anode

MOUNTING POSITION: Any

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Power Dissipation @ $T_A \leq 50°C$ Derate above $T_A = 50°C$	P_D	500 3.3	mW mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	– 65 to +200	°C

STEADY STATE POWER DERATING



GENERAL DATA — 500 mW LEADLESS DO-34

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:

Case Temperature, T_C, should be determined from:

$$T_C = \theta_{CA} P_D + T_A$$

θ_{CA} is the case-to-ambient thermal resistance (°C/W) and P_D is the power dissipation. The value for θ_{CA} will vary and depends on the device mounting method. θ_{CA} is generally 200°C/W for the various clips and tie points in common use and for printed circuit board wiring.

The temperature of the case can also be measured using a thermocouple placed at the case end 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_C, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

ΔT_{JC} is the increase in junction temperature above the case temperature and may be found by using:

$$\Delta T_{JC} = \theta_{JC} P_D$$

For worst-case design, using expected limits of I_Z, limits of P_D and the extremes of T_J (ΔT_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 Figures 3 and 4.

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 6. 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 6 be exceeded.

4

4.2

TYPICAL CHARACTERISTICS

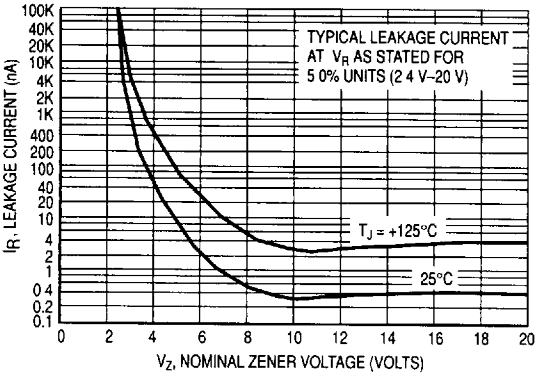


Figure 1. Typical Leakage Current

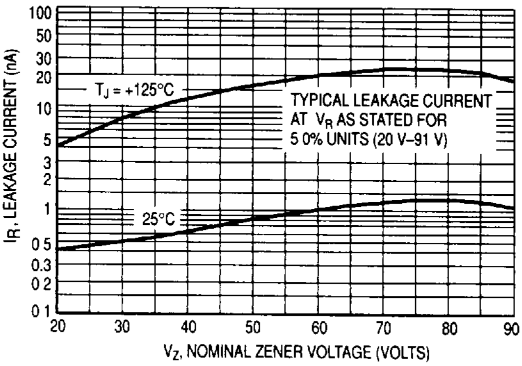


Figure 2. Typical Leakage Current

GENERAL DATA — 500 mW LEADLESS DO-34

a. Range for Units to 12 Volts

b. Range for Units to 12 to 100 Volts

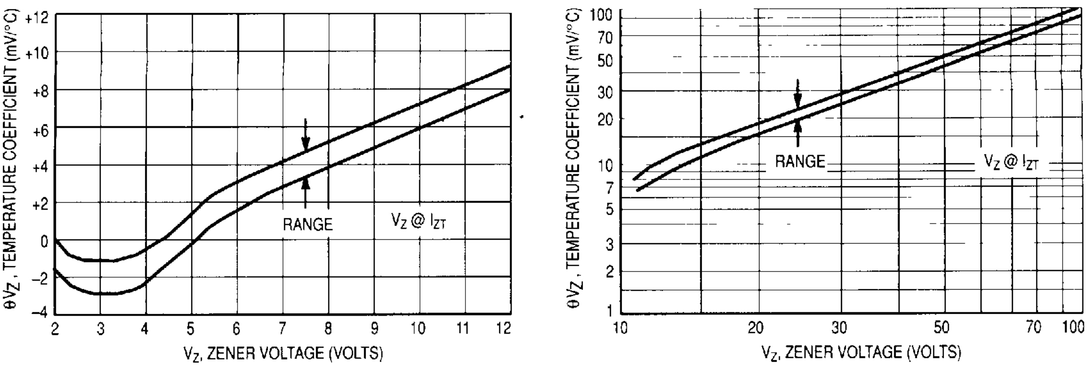


Figure 3. Temperature Coefficients

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

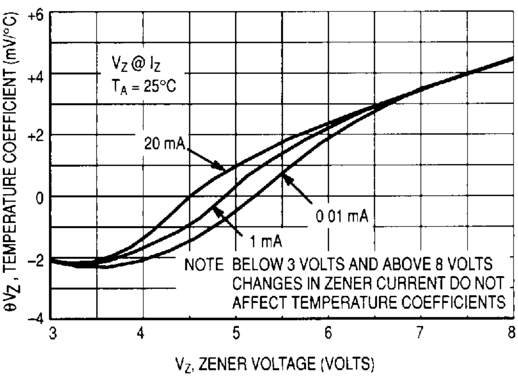


Figure 4. Effect of Zener Current

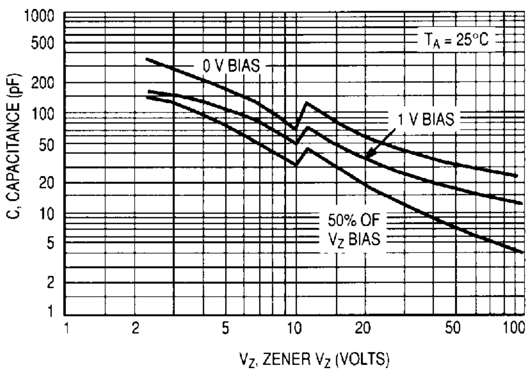
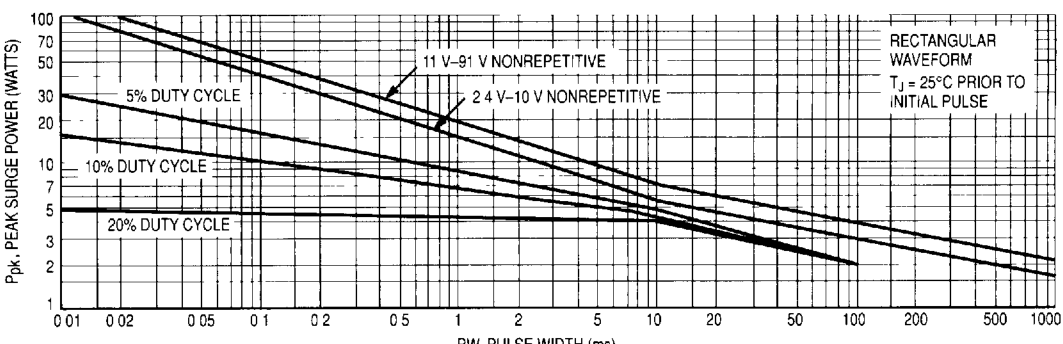


Figure 5. Typical Capacitance



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

Figure 6. Maximum Surge Power

GENERAL DATA — 500 mW LEADLESS DO-34

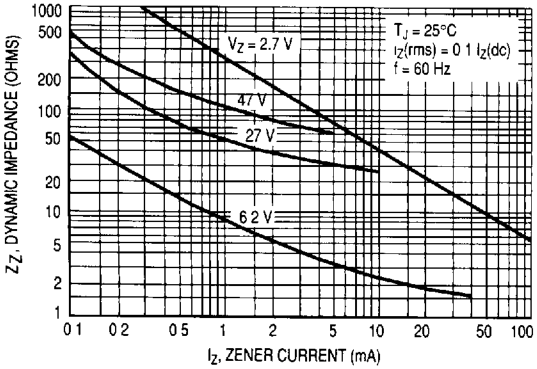


Figure 7. Effect of Zener Current on Zener Impedance

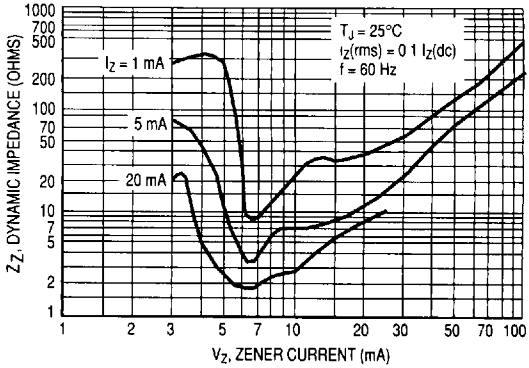


Figure 8. Effect of Zener Voltage on Zener Impedance

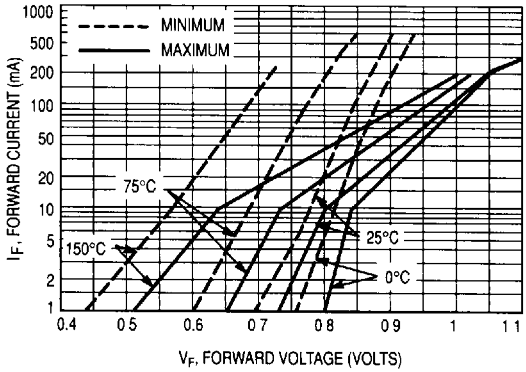


Figure 9. Typical Forward Characteristics

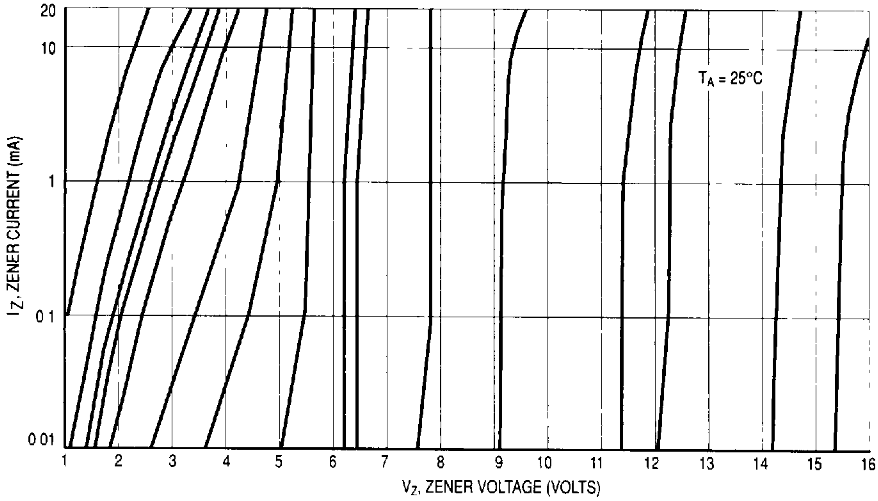


Figure 10. Zener Voltage versus Zener Current — V_Z = 1 thru 16 Volts

GENERAL DATA — 500 mW LEADLESS DO-34

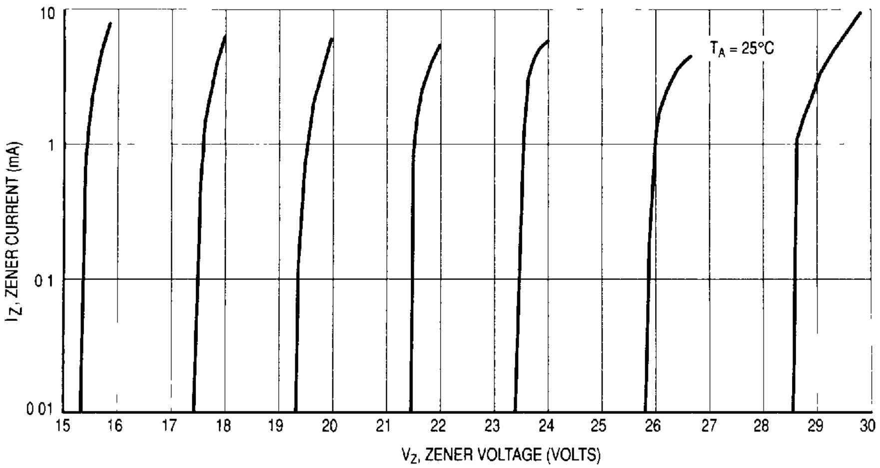


Figure 11. Zener Voltage versus Zener Current — V_Z = 15 thru 30 Volts

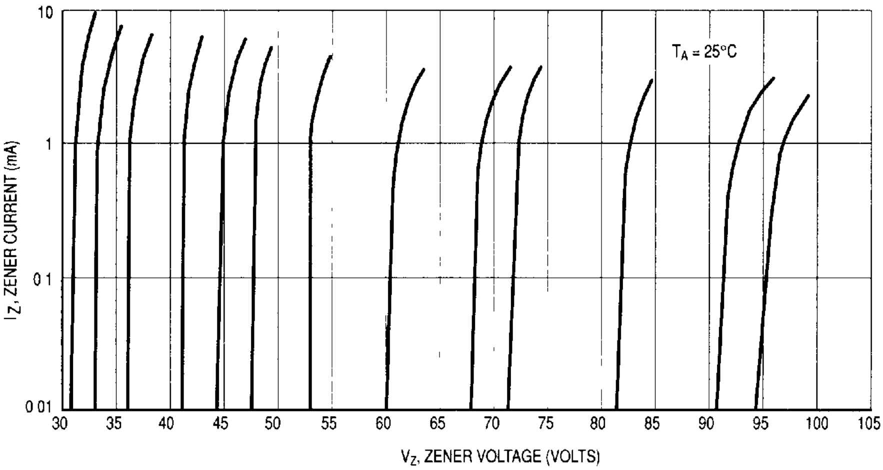


Figure 12. Zener Voltage versus Zener Current — V_Z = 30 thru 105 Volts

BZV55C2V4 thru BZV55C56

ELECTRICAL CHARACTERISTICS (V_F = 0.9 V Max @ I_F = 10 mA for all types)

Type Number	Zener Voltage V_{Z1} (Volts) @ I_{ZT1} = 5 mA (Note 1) Nom	Min	Max	Max Zener Impedance Z_{ZT1} (Ohms) @ I_{ZT1} = 5 mA	Max Reverse Leakage Current I_R µA	@ V_R Volts	Zener Voltage V_{Z2} (Volts) @ I_{ZT2} = 1 mA (Note 1) Min	Max	Max Zener Impedance Z_{ZT2} (Ohms) @ I_{ZT2} = 1 mA	Zener Voltage V_{Z3} (Volts) @ I_{ZT3} = 20 mA (Note 1) Min	Max	Max Zener Impedance Z_{ZT3} (Ohms) @ I_{ZT3} = 20 mA
BZV55C2V4	2.4	2.2	2.6	100	50	1	1.7	2.1	600	2.6	3.2	50
BZV55C2V7	2.7	2.5	2.9	100	20	1	1.9	2.4	600	3	3.6	50
BZV55C3V0	3	2.8	3.2	95	10	1	2.1	2.7	600	3.3	3.9	50
BZV55C3V3	3.3	3.1	3.5	95	5	1	2.3	2.9	600	3.6	4.2	40
BZV55C3V6	3.6	3.4	3.8	90	5	1	2.7	3.3	600	3.9	4.5	40
BZV55C3V9	3.9	3.7	4.1	90	3	1	2.9	3.5	600	4.1	4.7	30
BZV55C4V3	4.3	4	4.6	90	3	1	3.3	4	600	4.4	5.1	30
BZV55C4V7	4.7	4.4	5	80	3	2	3.7	4.7	500	4.5	5.4	15
BZV55C5V1	5.1	4.8	5.4	60	2	2	4.2	5.3	480	5	5.9	15
BZV55C5V6	5.6	5.2	6	40	1	2	4.8	6	400	5.2	6.3	10
BZV55C6V2	6.2	5.8	6.6	10	3	4	5.6	6.6	150	5.8	6.8	6
BZV55C6V8	6.8	6.4	7.2	15	2	4	6.3	7.2	80	6.4	7.4	6
BZV55C7V5	7.5	7	7.9	15	1	5	6.9	7.9	80	7	8	6
BZV55C8V2	8.2	7.7	8.7	15	0.7	5	7.6	8.7	80	7.7	8.8	6
BZV55C9V1	9.1	8.5	9.6	15	0.5	6	8.4	9.6	100	8.5	9.7	8
BZV55C10	10	9.4	10.6	20	0.2	7	9.3	10.6	150	9.4	10.7	10
BZV55C11	11	10.4	11.6	20	0.1	8	10.2	11.6	150	10.4	11.8	10
BZV55C12	12	11.4	12.7	25	0.1	8	11.2	12.7	150	11.4	12.9	10
BZV55C13	13	12.4	14.1	30	0.1	8	12.3	14	170	12.5	14.2	15
BZV55C15	15	13.8	15.6	30	0.05	10.5	13.7	15.5	200	13.9	15.7	20
BZV55C16	16	15.3	17.1	40	0.05	11.2	15.2	17	200	15.4	17.2	20
BZV55C18	18	16.8	19.1	45	0.05	12.6	16.7	19	225	16.9	19.2	20
BZV55C20	20	18.8	21.2	55	0.05	14	18.7	21.1	225	18.9	21.4	20
BZV55C22	22	20.8	23.3	55	0.05	15.4	20.7	23.2	250	20.9	23.4	25
BZV55C24	24	22.8	25.6	70	0.05	16.8	22.7	25.5	250	22.9	25.7	25
	V_{Z1} Below @ I_{ZT1} = 2 mA			Z_{ZT1} Below @ I_{ZT1} = 2 mA			V_{Z2} Below @ I_{ZT2} = 0.1 mA		Z_{ZT2} Below @ I_{ZT4} = 0.5 mA (Note 2)	V_{Z3} Below @ I_{ZT3} = 10 mA		Z_{ZT3} Below @ I_{ZT3} = 10 mA
BZV55C27	27	25.1	28.9	80	0.05	18.9	25	28.9	300	25.2	29.3	45
BZV55C30	30	28	32	80	0.05	21	27.8	32	300	28.1	32.4	50
BZV55C33	33	31	35	80	0.05	23.1	30.8	35	325	31.1	35.4	55
BZV55C36	36	34	38	90	0.05	25.2	33.8	38	350	34.1	38.4	60
BZV55C39	39	37	41	130	0.05	27.3	36.7	41	350	37.1	41.5	70
BZV55C43	43	40	46	150	0.05	30.1	39.7	46	375	40.1	46.5	80
BZV55C47	47	44	50	170	0.05	32.9	43.7	50	375	44.1	50.5	90
BZV55C51	51	48	54	180	0.05	35.7	47.6	54	400	48.1	54.6	100
BZV55C56	56	52	60	200	0.05	39.2	51.5	60	425	52.1	60.8	110

NOTES: 1. Zener voltage is measured with a pulse test current (I_Z) applied at an ambient temperature of 25°C

2. The zener impedance, Z_{ZT2}, for the 27 through 56 volt types is tested at 0.5 mA rather than the test current of 0.1 mA used for V_{Z2}

MLL4678 thru MLL4717

Low level oxide passivated zener diodes for applications requiring extremely low operating currents, low leakage, and sharp breakdown voltage.

- Complete Voltage Range — 1.8 to 43 Volts
- Zener Voltage Specified @ I_{ZT} = 50 µA
- Leadless Package for Surface Mount Technology
- Maximum Delta V_Z Given from 10 to 100 µA

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_F = 0 9 V Max at I_F = 10 mA for all types)

Type Number (Note 1)	Zener Voltage V_Z @ I_{ZT} = 50 µA Volts			Maximum Reverse Current I_R µA (Note 3)	Test Voltage V_R Volts (Note 3)	Maximum Zener Current I_{ZM} mA (Note 2)	Maximum Voltage Change ΔV_Z Volts (Note 4)
	Nom (Note 5)	Min	Max				
MLL4678	1 8	1 71	1.89	7 5	1	120	0.7
MLL4679	2	1.9	2 1	5	1	110	0 7
MLL4680	2 2	2 09	2 31	4	1	100	0 75
MLL4681	2 4	2 28	2 52	2	1	95	0 8
MLL4682	2 7	2 565	2 835	1	1	90	0 85
MLL4683	3	2.85	3 15	0.8	1	85	0.9
MLL4684	3.3	3.135	3 465	7 5	1 5	80	0 95
MLL4685	3 6	3 42	3.78	7 5	2	75	0 95
MLL4686	3 9	3 705	4.095	5	2	70	0.97
MLL4687	4 3	4 085	4 515	4	2	65	0 99
MLL4688	4.7	4 465	4.935	10	3	60	0 99
MLL4689	5.1	4.845	5.355	10	3	55	0 97
MLL4690	5 6	5.32	5.88	10	4	50	0 96
MLL4691	6.2	5 89	6 51	10	5	45	0 95
MLL4692	6 8	6 46	7.14	10	5 1	35	0 9
MLL4693	7 5	7 125	7 875	10	5.7	31 8	0 75
MLL4694	8 2	7 79	8 61	1	6.2	29	0 5
MLL4695	8.7	8.265	9 135	1	6.6	27 4	0.1
MLL4696	9.1	8.645	9 555	1	6 9	26 2	0 08
MLL4697	10	9 5	10.5	1	7 6	24 8	0 1
MLL4698	11	10 45	11 55	0 05	8.4	21.6	0 11
MLL4699	12	11 4	12 6	0 05	9 1	20.4	0 12
MLL4700	13	12.35	13 65	0 05	9.8	19	0.13
MLL4701	14	13.3	14.7	0.05	10 6	17 5	0.14
MLL4702	15	14 25	15.75	0.05	11 4	16 3	0.15
MLL4703	16	15.2	16 8	0 05	12.1	15.4	0.16
MLL4704	17	16 15	17 85	0 05	12.9	14.5	0.17
MLL4705	18	17 1	18 9	0 05	13.6	13 2	0 18
MLL4706	19	18.05	19 95	0 05	14 4	12 5	0 19
MLL4707	20	19	21	0.01	15 2	11 9	0 2
MLL4708	22	20.9	23 1	0 01	16 7	10 8	0.22
MLL4709	24	22 8	25 2	0 01	18.2	9.9	0 24
MLL4710	25	23 75	26 25	0 01	19	9 5	0.25
MLL4711	27	25.65	28.35	0 01	20 4	8 8	0 27
MLL4712	28	26.6	29 4	0 01	21 2	8 5	0 28
MLL4713	30	28.5	31 5	0 01	22 8	7.9	0.3
MLL4714	33	31 35	34 65	0 01	25	7 2	0 33
MLL4715	36	34 2	37 8	0 01	27.3	6 6	0 36
MLL4716	39	37.05	40 95	0 01	29 6	6 1	0 39
MLL4717	43	40 85	45 15	0 01	32.6	5 5	0 43

NOTE 1 TOLERANCE AND VOLTAGE DESIGNATION (V_Z)

The type numbers shown have a standard tolerance of ±5% on the nominal zener voltage

NOTE 2 MAXIMUM ZENER CURRENT RATINGS (I_{ZM})

Maximum zener current ratings are based on maximum zener voltage of the individual units

NOTE 3 REVERSE LEAKAGE CURRENT (I_R)

Reverse leakage currents are guaranteed and are measured at V_R as shown on the table

NOTE 4. MAXIMUM VOLTAGE CHANGE (ΔV_Z)

Voltage change is equal to the difference between V_Z at 100 µA and V_Z at 10 µA

NOTE 5 ZENER VOLTAGE (V_Z) MEASUREMENT

Nominal zener voltage is measured with the device junction in thermal equilibrium at the case temperature of 30°C ±1°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted. Based on dc measurements at thermal equilibrium; case temperature maintained at 30 ± 2°C V_F = 0 9 Max @ I_F = 10 mA for all types)

Type No. (Note 1)	Nominal Zener Voltage V_Z @ I_{ZT} Volts (Note 2)	Test Current I_{ZT} mA	Max Zener Impedance		Max Reverse Leakage Current		Max Zener Voltage Temperature Coeff. θ_{VZ} (%/°C) (Note 3)
			Z_{ZT} @ I_{ZT} Ohms	Z_{ZK} @ I_{ZK} = 0.25 mA Ohms	I_R µA	@ V_R Volts	
MLL5221B	2.4	20	30	1200	100	1	−0.085
MLL5222B	2.5	20	30	1250	100	1	−0.085
MLL5223B	2.7	20	30	1300	75	1	−0 08
MLL5224B	2 8	20	30	1400	75	1	−0 08
MLL5225B	3	20	29	1600	50	1	−0 075
MLL5226B	3 3	20	28	1600	25	1	−0 07
MLL5227B	3.6	20	24	1700	15	1	−0 065
MLL5228B	3.9	20	23	1900	10	1	−0 06
MLL5229B	4 3	20	22	2000	5	1	±0 055
MLL5230B	4.7	20	19	1900	5	2	± 0 03
⇒ **MLL5231B**	**5.1**	**20**	**17**	**1600**	**5**	**2**	**±0.03**
MLL5232B	5 6	20	11	1600	5	3	+0.038
⇒ **MLL5233B**	**6**	**20**	**7**	**1600**	**5**	**3.5**	**+0.038**
MLL5234B	6 2	20	7	1000	5	4	+0.045
MLL5235B	6 8	20	5	750	3	5	+0 05
MLL5236B	7 5	20	6	500	3	6	+0.058
MLL5237B	8 2	20	8	500	3	6.5	+0 062
MLL5238B	8 7	20	8	600	3	6.5	+0 065
MLL5239B	9 1	20	10	600	3	7	+0.068
MLL5240B	10	20	17	600	3	8	+0 075
MLL5241B	11	20	22	600	2	8.4	+0.076
MLL5242B	12	20	30	600	1	9.1	+0.077
MLL5243B	13	9.5	13	600	0 5	9 9	+0.079
⇒ **MLL5244B**	**14**	**9**	**15**	**600**	**0.1**	**10**	**+0.082**
MLL5245B	15	8.5	16	600	0 1	11	+0.082
MLL5246B	16	7.8	17	600	0.1	12	+0.083
MLL5247B	17	7.4	19	600	0 1	13	+0.084
MLL5248B	18	7	21	600	0 1	14	+0.085
MLL5249B	19	6.6	23	600	0.1	14	+0.086
MLL5250B	20	6.2	25	600	0 1	15	+0.086
MLL5251B	22	5.6	29	600	0 1	17	+0.087
⇒ **MLL5252B**	**24**	**5.2**	**33**	**600**	**0.1**	**18**	**+0.088**
MLL5253B	25	5	35	600	0 1	19	+0.089
MLL5254B	27	4.6	41	600	0.1	21	+0 09
MLL5255B	28	4.5	44	600	0.1	21	+0.091
MLL5256B	30	4.2	49	600	0.1	23	+0.091
MLL5257B	33	3.8	58	700	0.1	25	+0.092
MLL5258B	36	3.4	70	700	0.1	27	+0 093
MLL5259B	39	3 2	80	800	0 1	30	+0.094
MLL5260B	43	3	93	900	0 1	33	+0.095
MLL5261B	47	2 7	105	1000	0 1	36	+0.095
MLL5262B	51	2 5	125	1100	0 1	39	+0.096
MLL5263B	56	2 2	150	1300	0 1	43	+0.096

(continued)

⇒ **Preferred part**

(See Notes on the following page)

4

4.2

MLL5221B thru MLL5263B

NOTE 1. TOLERANCE

Units shown indicate a tolerance of ±5%

NOTE 2. SPECIAL SELECTIONS AVAILABLE:

For information on special selections contact your nearest Motorola representative

NOTE 3. TEMPERATURE COEFFICIENT (θ_{VZ})

Test conditions for temperature coefficient are as follows

a I_{ZT} = 7 5 mA, T_1 = 25°C,

T_2 = 125°C (MLL5221B through MLL5242B)

b I_{ZT} = Rated I_{ZT}, T_1 = 25°C

T_2 = 125°C (MLL5243B through MLL5263B)

Device to be temperature stabilized with current applied prior to reading breakdown voltage at the specified ambient temperature.

NOTE 4. ZENER VOLTAGE (V_Z) MEASUREMENT

Nominal zener voltage is measured with the device junction in thermal equilibrium at the case temperature of 30°C ±1°C

NOTE 5. 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 x $I_Z(dc)$ with the ac frequency = 1 kHz

4

4.2