

TVS/Zeners

Transient Voltage Suppressors

Zener Regulator and Reference Diodes

In Brief . . .

Motorola's standard TVS (Transient Voltage Suppressors) and Zener diodes comprise the largest inventoried line in the industry. Continuous development of improved manufacturing techniques have resulted in computerized diffusion and test, as well as critical process controls learned from surface-sensitive MOS fabrication. Resultant high yields lower factory costs. Check the following features for application to your specific requirements:

- Wide selection of package materials and styles:
 - Plastic (Surmetic) for low cost, mechanical ruggedness
 - Glass for high reliability, low cost
 - Surface Mount packages for state of the art designs
- Power Ratings from 0.25 to 5.0 Watts
- Breakdown voltages from 1.8 to 400 Volts in approximately 10% steps
- TVS from 24 to 1500 Watts and from 6.2 to 250 Volts
- ESD protection devices
- Special selection of electrical characteristics available at low cost due to high-volume lines (check your Motorola sales representative for special quotations)
- UL Recognition on many TVS device types
- Tape and Reel options available on all axial leaded and surface mount types

	Page
TVS (Transient Voltage Suppressors)	5.2-2
General-Purpose	5.2-2
Axial Leaded for Through-hole Designs	5.2-2
Surface Mount Packages	5.2-9
Overvoltage Transient Suppressors	5.2-18
Zener Diodes	5.2-19
Voltage Regulator Diodes	5.2-19
Notes — Axial Leaded Chart	5.2-23
Notes — Surface Mount Chart	5.2-26
Voltage Reference Diodes	5.2-33
Current Regulator Diodes	5.2-33

Note: Any TVS/Zener device not listed in this Master Selection Guide may be available with a special order. Please contact your Motorola representative for details.

TVS (Transient Voltage Suppressors)

General-Purpose

Transient Voltage Suppressors are designed for applications requiring protection of voltage sensitive electronic devices in danger of destruction by high energy voltage transients. Many of the zener voltage regulator diodes listed in the previous charts are in fact used in circuits as transient voltage suppressors. The purpose of this section is to present the families of Motorola Zeners that are specified with the key transient voltage suppressor parameters and limits, e.g., maximum clamping voltage at maximum surge current rating and working peak reverse (stand-off) voltage.

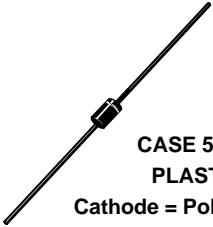
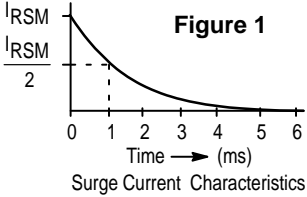
Selection sequence:

1. Package type (axial or surface mount)
2. Peak surge power expected for the application
3. Working peak reverse stand-off voltage (or the breakdown voltage)
4. Maximum reverse clamping voltage

Consult the factory for special electrical selections if there is no standard device type available to fit the application.

Axial Leaded for Through-hole Designs

**Table 1. Peak Power Dissipation⁽¹⁾ (500 Watts @ 1 ms Surge – Figure 1)
Case 59-04 — Mini Mosorb**

 <p>CASE 59-04 (Mini Mosorb™) PLASTIC Cathode = Polarity Band</p>		 <p>Figure 1 Surge Current Characteristics</p>					
				<p>ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F = 35\text{ A Pulse}$ (except bidirectional devices).</p>			
Working Peak Reverse Voltage V_{RWM} (Volts)	Device ⁽²⁾	Breakdown Voltage			Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current I_{RSM} Figure 1 (Amps)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
		V_{BR} (Volts)		@ I_T Pulse (mA)			
		Min	Max				
5	SA5.0A	6.4	7	10	600	54.3	9.2
6	SA6.0A	6.67	7.37	10	600	48.5	10.3
7	SA7.0A	7.78	8.6	10	150	41.7	12
8	SA8.0A	8.89	9.83	1	25	36.7	13.6
11	SA11A	12.2	13.5	1	1	27.4	18.2
12	SA12A	13.3	14.7	1	1	25.1	19.9
13	SA13A	14.4	15.9	1	1	23.2	21.5
14	SA14A	15.6	17.2	1	1	21.5	23.2
15	SA15A	16.7	18.5	1	1	20.6	24.4
16	SA16A	17.8	19.7	1	1	19.2	26
17	SA17A	18.9	20.9	1	1	18.1	27.6

(1) Steady state power dissipation = 3 watt max rating

(2) For bidirectional types use CA suffix, **SA6.5CA**, **SA12CA**, **SA13CA** and **SA15CA** are Motorola preferred devices. Have cathode polarity band on each end. (Consult factory for availability).

Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leaded for Through-hole Designs (continued)

Table 1. Peak Power Dissipation⁽¹⁾ (500 Watts @ 1 ms Surge – Figure 1) (continued)
Case 59-04 — Mini Mosorb

ELECTRICAL CHARACTERISTICS (T _A = 25°C unless otherwise noted) V _F = 3.5 V Max, I _F = 35 A Pulse (except bidirectional devices).							
Working Peak Reverse Voltage V _{RWM} (Volts)	Device ⁽²⁾	Breakdown Voltage			Maximum Reverse Leakage @ V _{RWM} I _R (μA)	Maximum Reverse Surge Current I _{RSM} Figure 1 (Amps)	Maximum Reverse Voltage @ I _{RSM} (Clamping Voltage) V _{RSM} (Volts)
		V _{BR} (Volts)		@ I _T Pulse (mA)			
		Min	Max				
20	SA20A	22.2	24.5	1	1	15.4	32.4
24	SA24A	26.7	29.5	1	1	12.8	38.9
26	SA26A	28.9	31.9	1	1	11.9	42.1
28	SA28A	31.1	34.4	1	1	11	45.4
30	SA30A	33.3	36.8	1	1	10.3	48.4
36	SA36A	40	44.2	1	1	8.6	58.1
51	SA51A	56.7	62.7	1	1	6.1	82.4
58	SA58A	64.4	71.2	1	1	5.3	93.6
60	SA60A	66.7	73.7	1	1	5.2	96.8
75	SA75A	83.3	92.1	1	1	4.1	121
78	SA78A	86.7	95.8	1	1	4	126
90	SA90A	100	111	1	1	3.4	146
110	SA110A	122	135	1	1	2.8	177
130	SA130A	144	159	1	1	2.4	209
160	SA160A	178	197	1	1	1.9	259
170	SA170A	189	209	1	1	1.8	275

(1) Steady state power dissipation = 3 watt max rating

(2) For bidirectional types, use CA suffix.

Have cathode polarity band on each end. (Consult factory for availability).

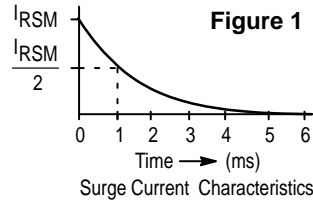
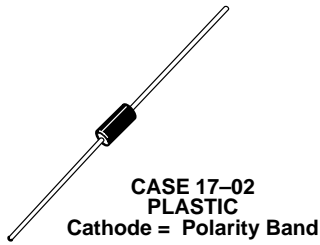
Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leded for Through-hole Designs (continued)

Table 2. Peak Power Dissipation⁽²⁾ (600 Watts @ 1 ms Surge – Figure 1)
Case 17-02 — Surmetic 40

Breakdown Voltage ⁽³⁾		Device ^(1, 4)	Working Peak Reverse Voltage V_{RWM} (Volts)	Maximum Reverse Leakage @ V_{RWM} I_R (μ A)	Maximum Reverse Surge Current I_{RSM} Figure 1 (Amps)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
V_{BR} (Volts)	@ t_T Pulse (mA)					
Nom						
6.8	10	P6KE6.8A	5.8	1000	57	10.5
7.5	10	P6KE7.5A	6.4	500	53	11.3
8.2	10	P6KE8.2A	7.02	200	50	12.1
9.1	1	P6KE9.1A	7.78	50	45	13.4
10	1	P6KE10A	8.55	10	41	14.5
11	1	P6KE11A	9.4	5	38	15.6
12	1	P6KE12A	10.2	5	36	16.7
13	1	P6KE13A	11.1	5	33	18.2
15	1	P6KE15A	12.8	5	28	21.2
16	1	P6KE16A	13.6	5	27	22.5
18	1	P6KE18A	15.3	5	24	25.2
20	1	P6KE20A	17.1	5	22	27.7
22	1	P6KE22A	18.8	5	20	30.6
24	1	P6KE24A	20.5	5	18	33.2
27	1	P6KE27A	23.1	5	16	37.5
30	1	P6KE30A	25.6	5	14.4	41.4
33	1	P6KE33A	28.2	5	13.2	45.7
36	1	P6KE36A	30.8	5	12	49.9
39	1	P6KE39A	33.3	5	11.2	53.9
43	1	P6KE43A	36.8	5	10.1	59.3
47	1	P6KE47A	40.2	5	9.3	64.8
51	1	P6KE51A	43.6	5	8.6	70.1
56	1	P6KE56A	47.8	5	7.8	77
62	1	P6KE62A	53	5	7.1	85
68	1	P6KE68A	58.1	5	6.5	92
75	1	P6KE75A	64.1	5	5.8	103
82	1	P6KE82A	70.1	5	5.3	113
91	1	P6KE91A	77.8	5	4.8	125
120	1	P6KE120A	102	5	3.6	165



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F = 50\text{ A Pulse}$ (except bidirectional devices).

- (1) For bidirectional types use CA suffix, **P6KE7.5CA** and **P6KE11CA** are Motorola preferred devices. Have cathode polarity band on each end. (Consult factory for availability).
- (2) Steady state power dissipation = 5 watt max rating.
- (3) Breakdown voltage tolerance is $\pm 5\%$ for A suffix.
- (4) UL recognition for classification of protectors (QVG2) under the UL standard for safety 497B and file #E116110 for entire series including CA suffixes.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leaded for Through-hole Designs (continued)

Table 2. Peak Power Dissipation⁽²⁾ (600 Watts @ 1 ms Surge – Figure 1) (continued)
Case 17-02 — Surmetic 40

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F = 50\text{ A Pulse}$ (except bidirectional devices).						
Breakdown Voltage⁽³⁾		Device^(1, 4)	Working Peak Reverse Voltage V_{RWM} (Volts)	Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current I_{RSM} Figure 1 (Amps)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
V_{BR} (Volts)	@ I_T Pulse (mA)					
Nom						
130	1	P6KE130A	111	5	3.3	179
150	1	P6KE150A	128	5	2.9	207
160	1	P6KE160A	136	5	2.7	219
180	1	P6KE180A	154	5	2.4	246
200	1	P6KE200A	171	5	2.2	274

(1) For bidirectional types use CA suffix. Have cathode polarity band on each end. (Consult factory for availability).

(2) Steady state power dissipation = 5 watt max rating.

(3) Breakdown voltage tolerance is $\pm 5\%$ for A suffix.


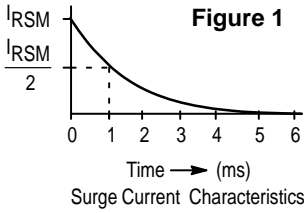
(4) UL recognition for classification of protectors (QVGV2) under the UL standard for safety 497B and file #E116110 for entire series including CA suffixes.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leded for Through-hole Designs (continued)

**Table 3. Peak Power Dissipation⁽¹⁾ (1500 WATTS @ 1 ms Surge – Figure 1)
Case 41A-02 — Mosorb**

 <p>CASE 41A-02 PLASTIC Cathode = Polarity Band</p>		 <p>Figure 1 Surge Current Characteristics</p>							
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F = 100\text{ A Pulse}$ (C suffix denotes standard back to back bidirectional versions. Test both polarities)									
Maximum Reverse Stand-Off Voltage V_{RWM} (Volts)	JEDEC ⁽²⁾ Device	Device ⁽²⁾	Breakdown Voltage		Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current Figure 1 I_{RSM} (Volts)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)	Clamping Voltage ⁽³⁾	
			V_{BR} Volts Min	@ I_T Pulse (mA)				Peak Pulse Current @ $I_{pp1} = 1\text{ A}$ Figure 1 V_{C1} (Volts max)	Peak Pulse Current @ $I_{pp2} = 10\text{ A}$ Figure 1 V_{C2} (Volts max)
5	1N5908		6	1	300	120	8.5	7.6 @ 30 A	8 @ 60 A

(1) Steady state power dissipation = 5 watts max rating.

(2) 1N6382 thru 1N6389 and C suffix ICTE/MPTE device types are bidirectional. Have cathode polarity band on each end. All other device types are unidirectional only. (Consult factory for availability)

(3) Clamping voltage peak pulse currents for 1N5908 are 30 Amps and 60 Amps.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leaded for Through-hole Designs (continued)

**Table 4. Peak Power Dissipation⁽¹⁾ (1500 Watts @ 1 ms Surge – Figure 1)
Case 41A-02 – Mosorb**

Breakdown Voltage ⁽²⁾		JEDEC Device	Device ^(3, 4)	Working Peak Reverse Voltage V_{RWM} (Volts)	Maximum Reverse Leakage @ V_{RWM} I_R (μ A)	Maximum Reverse Surge Current Figure 1 I_{RSM} (Amps)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
V_{BR} Volts	@ I_T Pulse (mA)						
Nom							
6.8	10	1N6267A	1.5KE6.8A	5.8	1000	143	10.5
7.5	10	1N6268A	1.5KE7.5A	6.4	500	132	11.3
8.2	10	1N6269A	1.5KE8.2A	7.02	200	124	12.1
10	1	1N6271A	1.5KE10A	8.55	10	103	14.5
11	1	1N6272A	1.5KE11A	9.4	5	96	15.6
12	1	1N6273A	1.5KE12A	10.2	5	90	16.7
13	1	1N6274A	1.5KE13A	11.1	5	82	18.2
15	1	1N6275A	1.5KE15A	12.8	5	71	21.2
16	1	1N6276A	1.5KE16A	13.6	5	67	22.5
18	1	1N6277A	1.5KE18A	15.3	5	59.5	25.2
20	1	1N6278A	1.5KE20A	17.1	5	54	27.7
22	1	1N6279A	1.5KE22A	18.8	5	49	30.6
24	1	1N6280A	1.5KE24A	20.5	5	45	33.2
27	1	1N6281A	1.5KE27A	23.1	5	40	37.5
30	1	1N6282A	1.5KE30A	25.6	5	36	41.4
33	1	1N6283A	1.5KE33A	28.2	5	33	45.7
36	1	1N6284A	1.5KE36A	30.8	5	30	49.9
39	1	1N6285A	1.5KE39A	33.3	5	28	53.9
43	1	1N6286A	1.5KE43A	36.8	5	25.3	59.3
47	1	1N6287A	1.5KE47A	40.2	5	23.2	64.8
51	1	1N6288A	1.5KE51A	43.6	5	21.4	70.1
56	1	1N6289A	1.5KE56A	47.8	5	19.5	77
62	1	1N6290A	1.5KE62A	53	5	17.7	85
68	1	1N6291A	1.5KE68A	58.1	5	16.3	92
75	1	1N6292A	1.5KE75A	64.1	5	14.6	103
82	1	1N6293A	1.5KE82A	70.1	5	13.3	113
91	1	1N6294A	1.5KE91A	77.8	5	12	125
100	1	1N6295A	1.5KE100A	85.5	5	11	137
110	1	1N6296A	1.5KE110A	94	5	9.9	152
120	1	1N6297A	1.5KE120A	102	5	9.1	165
130	1	1N6298A	1.5KE130A	111	5	8.4	179

(1) Steady state power dissipation = 5 watts max rating.

(2) Breakdown voltage tolerance is $\pm 5\%$ for A suffix.

(3) For bidirectional types use CA suffix on 1.5KE series only. Have cathode polarity band on each end. (Consult factory for availability)

1N6267-6303A series do not have CA option since the CA is not included in EIA Registration.

(4) UL recognition for classification of protectors (QVGV2) under the UL standard for safety 497B and file #E116110 for 1.5KE6.8A, CA thru 1.5KE250A, CA.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Axial Leaded for Through-hole Designs (continued)

Table 4. Peak Power Dissipation⁽¹⁾ (1500 Watts @ 1 ms Surge – Figure 1) (continued)
Case 41A-02 – Mosorb

ELECTRICAL CHARACTERISTICS (T _A = 25°C unless otherwise noted) V _F = 3.5 V Max, I _F = 100 A Pulse							
Breakdown Voltage ⁽²⁾		JEDEC Device	Device ^(3, 4)	Working Peak Reverse Voltage V _{RWM} (Volts)	Maximum Reverse Leakage @ V _{RWM} I _R (μA)	Maximum Reverse Surge Current Figure 1 I _{RSM} (Amps)	Maximum Reverse Voltage @ I _{RSM} (Clamping Voltage) V _{RSM} (Volts)
V _{BR} Volts	@ I _T Pulse (mA)						
Nom							
150	1	1N6299A	1.5KE150A	128	5	7.2	207
160	1	1N6300A	1.5KE160A	136	5	6.8	219
170	1	1N6301A	1.5KE170A	145	5	6.4	234
180	1	1N6302A	1.5KE180A	154	5	6.1	246
200	1	1N6303A	1.5KE200A	171	5	5.5	274
220	1		1.5KE220A	185	5	4.6	328
250	1		1.5KE250A	214	5	5	344

(1) Steady state power dissipation = 5 watts max rating.

(2) Breakdown voltage tolerance is ±5% for A suffix.

(3) For bidirectional types use CA suffix. Have cathode polarity band on each end. (Consult factory for availability).

1N6267–6303A series do not have CA option since the CA is not included in EIA Registration.

(4) UL recognition for classification of protectors (QVGV2) under the UL standard for safety 497B and file #E116110 for 1.5KE6.8A,CA thru 1.5KE250A,CA.

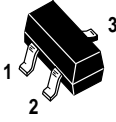
Devices listed in bold, italic are Motorola preferred devices.

Surface Mount Packages

Table 5. Peak Power Dissipation (40 Watts @ 1 ms Surge – Figure 1)(1)

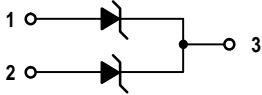
Case 318–08 — Common Cathode

MMBZ15VDLT1, MMBZ27VCLT1(2) — SOT–23 Dual Monolithic Common Cathode Bipolar Zener (for ESD protection)



CASE 318-08, STYLE 9
TO-236AB
LOW PROFILE SOT-23
PLASTIC

Pinout: TERMINAL 1 — ANODE
TERMINAL 2 — ANODE
TERMINAL 3 — COMMON CATHODE



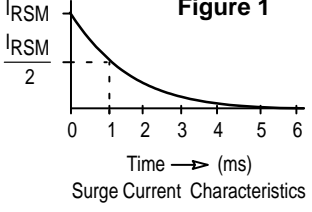


Figure 1
Surge Current Characteristics

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

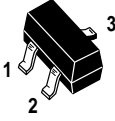
BIDIRECTIONAL (Circuit tied to pins 1 and 2)

Breakdown Voltage			Working Peak Reverse Voltage V_{RWM} (Volts)	Maximum Reverse Leakage Current I_{RWM} I_R (nA)	Maximum Reverse Surge Current I_{RSM} (Amps)	Maximum Reverse Voltage @ I_{RMS} (Clamping Voltage) V_{RSM} (Volts)	Maximum Temperature Coefficient of V_{BR} (mV/°C)
$V_{BR}^{(3)}$ (Volts)							
Min	Nom	Max					
14.3	15	15.8	1.0	12.8	1.9	21.2	12
25.65	27	28.35	1.0	22	1.0	38	26

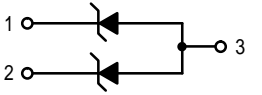
Table 6. Peak Power Dissipation (24 Watts @ 1 ms Surge – Figure 1)(1)

Case 318–08 — Common Anode

MMBZ5V6ALT1, MMBZ6V2ALT1, MMBZ15ALT1, MMBZ20ALT1(2) — SOT–23 Dual Monolithic Common Anode Zener (for ESD Protection)



CASE 318-08, STYLE 12
TO-236AB
LOW PROFILE SOT-23
PLASTIC



PIN 1. CATHODE
2. CATHODE
3. COMMON ANODE

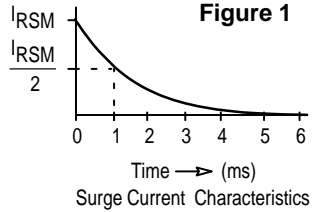


Figure 1
Surge Current Characteristics

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

UNIDIRECTIONAL (Circuit tied to pins 1 and 3 or Pins 2 and 3) ($V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$)

Breakdown Voltage			Max Reverse Leakage Current	Max Zener Impedance(4)			Max Reverse Surge Current I_{RSM} (A)	Max Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (V)	Maximum Temperature Coefficient of V_{BR} (mV/°C)		
$V_{BR}^{(3)}$ (Volts)				I_R @ V_R (μA)	Z_{ZT} @ I_T (Ω)	Z_{ZK} @ I_{ZK} (Ω)					
Min	Nom	Max	@ I_T (mA)								
5.32	5.6	5.88	20	5.0	3.0	11	1600	0.25	3.0	8.0	1.26
5.89	6.2	6.51	1.0	0.5	3.0	220			2.76	8.7	2.80
14.25	15	15.75	1.0	0.05	12	100			1.9	21	12.3
19	20	21	1.0	0.05	17	100			1.4	28	17

(1) Other voltages may be available upon request. Contact your Motorola representative.

(2) T1 suffix designates tape and reel of 3000 units.

(3) V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C .

(4) Z_{ZT} and Z_{ZK} are measured by dividing the AC voltage drop across the device by the AC current supplied. The specified limits are $I_{Z(AC)} = 0.1 I_{Z(DC)}$, with AC frequency = 1 kHz.

Devices listed in bold, italic are Motorola preferred devices.

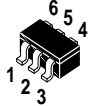
TVS

Surface Mount Packages (continued)

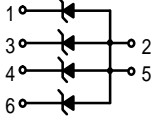
Table 7. Peak Power Dissipation (24 Watts @ 1 ms Surge – Figure 1)

Case 318F-02—Monolithic 4-Function Device

MMQA5V6T1, MMQA20VT1(1) — SC-59 Quad Transient Voltage Suppressor (for ESD Protection)



CASE 318F-02
SC-59
PLASTIC



PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. ANODE
6. CATHODE

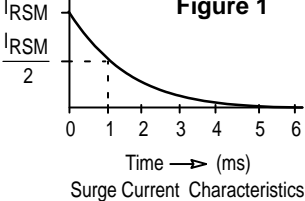


Figure 1
Surge Current Characteristics

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

UNIDIRECTIONAL (Circuit tied to pins 1, 2, and 5; Pins 2, 3, and 5; Pins 2, 4, and 5; or Pins 2, 5, and 6) ($V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$)

Device	Breakdown Voltage			@ I_{ZT} (mA)	Max Reverse Leakage Current		Max Zener Impedance(2) Z_{ZT} @ I_{ZT} (Ω)	Max Reverse Surge Current $I_{RSM}^{(4)}$ (Amps)	Max Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)	Maximum Temperature Coefficient of V_Z (mV/°C)
	$V_{ZT}^{(1)}$ (Volts)				I_R (μA)	V_R (Volts)				
	Min	Nom	Max							
MMQA5V6T1,T3	5.32	5.6	5.88	1.0	2000	3.0	400	3.0	8.0	1.26
MMQA6V2T1,T3	5.89	6.2	6.51	1.0	700	4.0	300	2.66	9.0	10.6
MMQA6V8T1,T3	6.46	6.8	7.14	1.0	500	4.3	300	2.45	9.8	10.9
MMQA12VT1,T3	11.4	12	12.6	1.0	75	9.1	80	1.39	17.3	14
MMQA13VT1,T3	12.4	13	13.7	1.0	75	9.8	80	1.29	18.6	15
MMQA15VT1,T3	14.3	15	15.8	1.0	75	11	80	1.1	21.7	16
MMQA18VT1,T3	17.1	18	18.9	1.0	75	14	80	0.923	26.0	19
MMQA20VT1,T3	19	20	21	1.0	75	15	80	0.84	28.6	20.1
MMQA21VT1,T3	20	21	22.1	1.0	75	16	80	0.792	30.3	21
MMQA22VT1,T3	20.9	22	23.1	1.0	75	17	80	0.758	31.7	22
MMQA24VT1,T3	22.8	24	25.2	1.0	75	18	100	0.694	34.6	25
MMQA27VT1,T3	25.7	27	28.4	1.0	75	21	125	0.615	39	28
MMQA30VT1,T3	28.5	30	31.5	1.0	75	23	150	0.554	43.3	32
MMQA33VT1,T3	31.4	33	34.7	1.0	75	25	200	0.504	47.6	37

(1) V_Z measured at pulse test current I_T at an ambient temperature of 25°C .


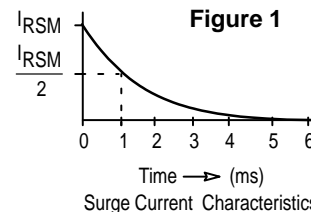
(2) Z_{ZT} is measured by dividing the AC voltage drop across the device by the AC current supplied. The specified limits are $I_{Z(AC)} = 0.1 I_{Z(DC)}$, with AC frequency = 1 kHz.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Surface Mount Packages (continued)

Table 8. Peak Power Dissipation — Case 403B-01


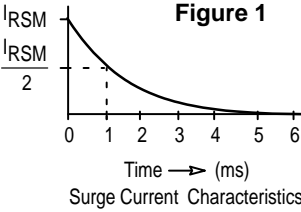
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>CASE 403B-01 SMA PLASTIC</p> </div> <div style="text-align: right;">  <p>Figure 1 Surge Current Characteristics</p> </div> </div>							
ELECTRICAL CHARACTERISTICS ($V_F = 3.5$ Volts @ $I_F = 40$ A for all types)							
Device	Reverse Stand-off Voltage V_{RWM} (Volts)	Breakdown Voltage		Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)	Maximum Reverse Surge Current I_{RSM} (Amps)	Maximum Reverse Leakage @ V_{RWM} I_R (μ A)	Device Marking
		V_{BR} Volts (Min)	I_T mA				
1SMA5.0AT3	5.0	6.4	10	9.2	43.5	400	QE
1SMA6.0AT3	6.0	6.67	10	10.3	38.8	400	QG
1SMA6.5AT3	6.5	7.22	10	11.2	35.7	250	QK
1SMA7.0AT3	7.0	7.78	10	12.0	33.3	250	QM
1SMA7.5AT3	7.5	8.33	1	12.9	31.0	50	QP
1SMA8.0AT3	8.0	8.89	1	13.6	29.4	25	QR
1SMA8.5AT3	8.5	9.44	1	14.4	27.8	5.0	QT
1SMA9.0AT3	9.0	10	1	15.4	26.0	2.5	QV
1SMA10AT3	10	11.1	1	17.0	23.5	2.5	QX
1SMA11AT3	11	12.2	1	18.2	22.0	2.5	QZ
1SMA12AT3	12	13.3	1	19.9	20.1	2.5	RE
1SMA13AT3	13	14.4	1	21.5	18.6	2.5	RG
1SMA14AT3	14	15.6	1	23.2	17.2	2.5	RK
1SMA15AT3	15	16.7	1	24.4	16.4	2.5	RM
1SMA16AT3	16	17.8	1	26.0	15.4	2.5	RP
1SMA17AT3	17	18.9	1	27.6	14.5	2.5	RR
1SMA18AT3	18	20	1	29.2	13.7	2.5	RT
1SMA20AT3	20	22.2	1	32.4	12.3	2.5	RV
1SMA22AT3	22	24.4	1	35.5	11.3	2.5	RX
1SMA24AT3	24	26.7	1	38.9	10.3	2.5	RZ
1SMA26AT3	26	28.9	1	42.1	9.5	2.5	SE
1SMA28AT3	28	31.1	1	45.4	8.8	2.5	SG
1SMA30AT3	30	33.3	1	48.4	8.3	2.5	SK
1SMA33AT3	33	36.7	1	53.3	7.5	2.5	SM
1SMA36AT3	36	40	1	58.1	6.9	2.5	SP
1SMA40AT3	40	44.4	1	64.5	6.2	2.5	SR
1SMA43AT3	43	47.8	1	69.4	5.8	2.5	ST
1SMA45AT3	45	50	1	72.2	5.5	2.5	SV
1SMA48AT3	48	53.3	1	77.4	5.2	2.5	SX
1SMA51AT3	51	56.7	1	82.4	4.9	2.5	SZ
1SMA54AT3	54	60	1	87.1	4.6	2.5	TE
1SMA58AT3	58	64.4	1	93.6	4.8	2.5	TG
1SMA60AT3	60	66.7	1	96.8	4.1	2.5	TK
1SMA64AT3	64	71.1	1	103.0	3.9	2.5	TM
1SMA70AT3	70	77.8	1	113.0	3.5	2.5	TP
1SMA75AT3	75	83.3	1	121.0	3.3	2.5	TR

Devices listed in bold, italic are Motorola preferred devices.

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Surface Mount Packages (continued)

Table 8. Peak Power Dissipation — Case 403B-01 (continued)


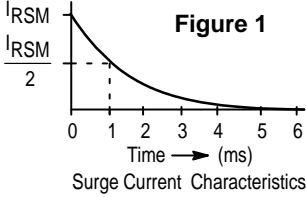
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>CASE 403B-01 SMA PLASTIC</p> </div> <div style="text-align: right;">  <p>Figure 1 Surge Current Characteristics</p> </div> </div>							
ELECTRICAL CHARACTERISTICS ($V_F = 3.5$ Volts @ $I_F = 40$ A for all types)							
Device	Reverse Stand-off Voltage V_{RWM} (Volts)	Breakdown Voltage		Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)	Maximum Reverse Surge Current I_{RSM} (Amps)	Maximum Reverse Leakage @ V_{RWM} I_R (μ A)	Device Marking
		V_{BR} Volts (Min)	I_T mA				
1SMA10CAT3	10	11.1	1	17.0	23.5	2.5	QXC
1SMA11CAT3	11	12.2	1	18.2	22.0	2.5	QZC
1SMA12CAT3	12	13.3	1	19.9	20.1	2.5	REC
1SMA13CAT3	13	14.4	1	21.5	18.6	2.5	RGC
1SMA14CAT3	14	15.6	1	23.2	17.2	2.5	RKC
1SMA15CAT3	15	16.7	1	24.4	16.4	2.5	RMC
1SMA16CAT3	16	17.8	1	26.0	15.4	2.5	RPC
1SMA17CAT3	17	18.9	1	27.6	14.5	2.5	RRC
1SMA18CAT3	18	20	1	29.2	13.7	2.5	RTC
1SMA20CAT3	20	22.2	1	32.4	12.3	2.5	RVC
1SMA22CAT3	22	24.4	1	35.5	11.3	2.5	RXC
1SMA24CAT3	24	26.7	1	38.9	10.3	2.5	RZC
1SMA26CAT3	26	28.9	1	42.1	9.5	2.5	SEC
1SMA28CAT3	28	31.1	1	45.4	8.8	2.5	SGC
1SMA30CAT3	30	33.3	1	48.4	8.3	2.5	SKC
1SMA33CAT3	33	36.7	1	53.3	7.5	2.5	SMC
1SMA36CAT3	36	40	1	58.1	6.9	2.5	SPC
1SMA40CAT3	40	44.4	1	64.5	6.2	2.5	SRC
1SMA43CAT3	43	47.8	1	69.4	5.8	2.5	STC
1SMA45CAT3	45	50	1	72.2	5.5	2.5	SVC
1SMA48CAT3	48	53.3	1	77.4	5.2	2.5	SXC
1SMA51CAT3	51	56.7	1	82.4	4.9	2.5	SZC
1SMA54CAT3	54	60	1	87.1	4.6	2.5	TEC
1SMA58CAT3	58	64.4	1	93.6	4.3	2.5	TGC
1SMA60CAT3	60	66.7	1	96.8	4.1	2.5	TKC
1SMA64CAT3	64	71.1	1	103.0	3.9	2.5	TMC
1SMA70CAT3	70	77.8	1	113.0	3.5	2.5	TPC
1SMA75CAT3	75	83.3	1	121.0	3.3	2.5	TRC
1SMA78CAT3	78	86.7	1	126.0	3.2	2.5	TTC

Devices listed in bold, italic are Motorola preferred devices.

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Surface Mount Packages (continued)

Table 9. Peak Power Dissipation (600 Watts @ 1 ms Surge – Figure 1) Case 403A-03

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>SMB CASE 403A-03 PLASTIC Cathode = Notch</p> </div> <div style="text-align: center;">  <p>Figure 1 Surge Current Characteristics</p> </div> </div>							
ELECTRICAL CHARACTERISTICS (T _A = 25°C unless otherwise noted)							
Reverse Stand-Off V _R (Volts)(1)	Device(2, 3)	Breakdown Voltage		Maximum Clamping Voltage V _C @ I _{pp} Volts	Peak Pulse Current (See Figure 1) I _{pp} Amps	Maximum Reverse Leakage @ V _R I _R μA	Device Marking
		V _{BR} @ I _T					
		Volts Min	Pulse mA				
5	1SMB5.0AT3	6.4	10	9.2	65.2	800	KE
6	1SMB6.0AT3	6.67	10	10.3	58.3	800	KG
6.5	1SMB6.5AT3	7.22	10	11.2	53.6	500	KK
7	1SMB7.0AT3	7.78	10	12	50	200	KM
7.5	1SMB7.5AT3	8.33	1	12.9	46.5	100	KP
8	1SMB8.0AT3	8.89	1	13.6	44.1	50	KR
8.5	1SMB8.5AT3	9.44	1	14.4	41.7	10	KT
9	1SMB9.0AT3	10	1	15.4	39	5	KV
10	1SMB10AT3	11.1	1	17	35.3	5	KX
11	1SMB11AT3	12.2	1	18.2	33	5	KZ
12	1SMB12AT3	13.3	1	19.9	30.2	5	LE
13	1SMB13AT3	14.4	1	21.5	27.9	5	LG
14	1SMB14AT3	15.6	1	23.2	25.8	5	LK
15	1SMB15AT3	16.7	1	24.4	24	5	LM
16	1SMB16AT3	17.8	1	26	23.1	5	LP
18	1SMB18AT3	20	1	29.2	20.5	5	LT
20	1SMB20AT3	22.2	1	32.4	18.5	5	LV
22	1SMB22AT3	24.4	1	35.5	16.9	5	LX
24	1SMB24AT3	26.7	1	38.9	15.4	5	LZ
26	1SMB26AT3	28.9	1	42.1	14.2	5	ME
28	1SMB28AT3	31.1	1	45.4	13.2	5	MG
30	1SMB30AT3	33.3	1	48.4	12.4	5	MK
36	1SMB36AT3	40	1	58.1	10.3	5	MP
40	1SMB40AT3	44.4	1	64.5	9.3	5	MR
43	1SMB43AT3	47.8	1	69.4	8.6	5	MT
45	1SMB45AT3	50	1	72.7	8.3	5	MV
48	1SMB48AT3	53.3	1	77.4	7.7	5	MX
51	1SMB51AT3	56.7	1	82.4	7.3	5	MZ
54	1SMB54AT3	60	1	87.1	6.9	5	NE
58	1SMB58AT3	64.4	1	93.6	6.4	5	NG
60	1SMB60AT3	66.7	1	96.8	6.2	5	NK

(1) A transient suppressor is normally selected according to the reverse "Stand Off Voltage" (V_R) which should be equal to or greater than the DC or continuous peak operating voltage level.

(2) T3 suffix designates tape and reel of 2500 units.


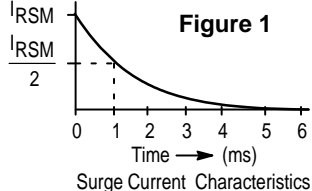
(3) Bidirectional version available for 1SMB10AT3 thru 1SMB78AT3, electrical characteristics apply in both directions except for V_{p1}. Use CAT3 suffix.

Devices listed in bold, italic are Motorola preferred devices.

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Surface Mount Packages (continued)

Table 9. Peak Power Dissipation (600 Watts @ 1 ms Surge – Figure 1) Case 403A-03 (continued)

 <p>SMB CASE 403A-03 PLASTIC Cathode = Notch</p>		 <p>Figure 1 Surge Current Characteristics</p>					
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)							
Reverse Stand-Off V_R (Volts)(1)	Device(2, 3)	Breakdown Voltage		Maximum Clamping Voltage $V_C @ I_{pp}$ Volts	Peak Pulse Current (See Figure 1) I_{pp} Amps	Maximum Reverse Leakage @ V_R I_R μA	Device Marking
		$V_{BR} @ I_T$					
		Volts Min	Pulse mA				
64	1SMB64AT3	71.1	1	103	5.8	5	NM
70	1SMB70AT3	77.8	1	113	5.3	5	NP
75	1SMB75AT3	83.3	1	121	4.9	5	NR
78	1SMB78AT3	86.7	1	126	4.7	5	NT
85	1SMB85AT3	94.4	1	137	4.4	5	NV
90	1SMB90AT3	100	1	146	4.1	5	NX
100	1SMB100AT3	111	1	162	3.7	5	NZ
110	1SMB110AT3	122	1	177	3.4	5	PE
120	1SMB120AT3	133	1	193	3.1	5	PG
130	1SMB130AT3	144	1	209	2.9	5	PK
150	1SMB150AT3	167	1	243	2.5	5	PM
160	1SMB160AT3	178	1	259	2.3	5	PP
170	1SMB170AT3	189	1	275	2.2	5	PR

- (1) A transient suppressor is normally selected according to the reverse "Stand Off Voltage" (V_R) which should be equal to or greater than the DC or continuous peak operating voltage level.
- (2) T3 suffix designates tape and reel of 2500 units.
- (3) Bidirectional version available for 1SMB10AT3 thru 1SMB78AT3, electrical characteristics apply in both directions except for V_{PI} . Use CAT3 suffix.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Surface Mount Packages (continued)

Table 10. Peak Power Dissipation (600 Watts @ 1 ms Surge – Figure 1) Case 403A–03

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F^{(5)} = 100\text{ A}$ for all types.										
Device(3, 4)	V_{BR} @ I_T Volts				Working Peak Reverse Voltage V_{RWM} Volts	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{RSM} Amps	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} Volts	Maximum Temperature Coefficient of V_{BR} %/°C	Device Marking
	Min	Nom	Max	mA						
<i>P6SMB6.8AT3</i>	<i>6.45</i>	<i>6.8</i>	<i>7.14</i>	<i>10</i>	<i>5.8</i>	<i>1000</i>	<i>57</i>	<i>10.5</i>	<i>0.057</i>	<i>6V8A</i>
<i>P6SMB7.5AT3</i>	<i>7.13</i>	<i>7.5</i>	<i>7.88</i>	<i>10</i>	<i>6.4</i>	<i>500</i>	<i>53</i>	<i>11.3</i>	<i>0.061</i>	<i>7V5A</i>
P6SMB9.1AT3	8.65	9.1	9.55	1	7.78	50	45	13.4	0.068	9V1A
<i>P6SMB10AT3</i>	<i>9.5</i>	<i>10</i>	<i>10.5</i>	<i>1</i>	<i>8.55</i>	<i>10</i>	<i>41</i>	<i>14.5</i>	<i>0.073</i>	<i>10A</i>
P6SMB12AT3	11.4	12	12.6	1	10.2	5	36	16.7	0.078	12A
<i>P6SMB13AT3</i>	<i>12.4</i>	<i>13</i>	<i>13.7</i>	<i>1</i>	<i>11.1</i>	<i>5</i>	<i>33</i>	<i>18.2</i>	<i>0.081</i>	<i>13A</i>
<i>P6SMB15AT3</i>	<i>14.3</i>	<i>15</i>	<i>15.8</i>	<i>1</i>	<i>12.8</i>	<i>5</i>	<i>28</i>	<i>21.2</i>	<i>0.084</i>	<i>15A</i>
<i>P6SMB16AT3</i>	<i>15.2</i>	<i>16</i>	<i>16.8</i>	<i>1</i>	<i>13.6</i>	<i>5</i>	<i>27</i>	<i>22.5</i>	<i>0.086</i>	<i>16A</i>
<i>P6SMB18AT3</i>	<i>17.1</i>	<i>18</i>	<i>18.9</i>	<i>1</i>	<i>15.3</i>	<i>5</i>	<i>24</i>	<i>25.2</i>	<i>0.088</i>	<i>18A</i>
<i>P6SMB20AT3</i>	<i>19</i>	<i>20</i>	<i>21</i>	<i>1</i>	<i>17.1</i>	<i>5</i>	<i>22</i>	<i>27.7</i>	<i>0.09</i>	<i>20A</i>
<i>P6SMB22AT3</i>	<i>20.9</i>	<i>22</i>	<i>23.1</i>	<i>1</i>	<i>18.8</i>	<i>5</i>	<i>20</i>	<i>30.6</i>	<i>0.092</i>	<i>22A</i>
P6SMB24AT3	22.8	24	25.2	1	20.5	5	18	33.2	0.094	24A
<i>P6SMB27AT3</i>	<i>25.7</i>	<i>27</i>	<i>28.4</i>	<i>1</i>	<i>23.1</i>	<i>5</i>	<i>16</i>	<i>37.5</i>	<i>0.096</i>	<i>27A</i>
<i>P6SMB30AT3</i>	<i>28.5</i>	<i>30</i>	<i>31.5</i>	<i>1</i>	<i>25.6</i>	<i>5</i>	<i>14.4</i>	<i>41.4</i>	<i>0.097</i>	<i>30A</i>
P6SMB33AT3	31.4	33	34.7	1	28.2	5	13.2	45.7	0.098	33A
<i>P6SMB36AT3</i>	<i>34.2</i>	<i>36</i>	<i>37.8</i>	<i>1</i>	<i>30.8</i>	<i>5</i>	<i>12</i>	<i>49.9</i>	<i>0.099</i>	<i>36A</i>
<i>P6SMB39AT3</i>	<i>37.1</i>	<i>39</i>	<i>41</i>	<i>1</i>	<i>33.3</i>	<i>5</i>	<i>11.2</i>	<i>53.9</i>	<i>0.1</i>	<i>39A</i>
P6SMB47AT3	44.7	47	49.4	1	40.2	5	9.3	64.8	0.101	47A
<i>P6SMB51AT3</i>	<i>48.5</i>	<i>51</i>	<i>53.6</i>	<i>1</i>	<i>43.6</i>	<i>5</i>	<i>8.6</i>	<i>70.1</i>	<i>0.102</i>	<i>51A</i>
P6SMB56AT3	<i>37.1</i>	<i>39</i>	<i>41</i>	<i>1</i>	<i>33.3</i>	<i>5</i>	<i>11.2</i>	<i>53.9</i>	<i>0.1</i>	<i>39A</i>
P6SMB62AT3	58.9	62	65.1	1	53	5	7.1	85	0.104	62A
P6SMB68AT3	64.6	68	71.4	1	58.1	5	6.5	92	0.104	68A
P6SMB82AT3	77.9	82	86.1	1	70.1	5	5.3	113	0.105	82A
P6SMB91AT3	86.5	91	95.5	1	77.8	5	4.8	125	0.106	91A
P6SMB100AT3	95	100	105	1	85.5	5	4.4	137	0.106	100A
P6SMB110AT3	105	110	116	1	94	5	4	152	0.107	110A
P6SMB120AT3	114	120	126	1	102	5	3	165	0.107	120A
P6SMB150AT3	143	150	158	1	128	5	2.9	207	0.108	150A
<i>P6SMB160AT3</i>	<i>152</i>	<i>160</i>	<i>168</i>	<i>1</i>	<i>136</i>	<i>5</i>	<i>2.7</i>	<i>219</i>	<i>0.108</i>	<i>160A</i>
P6SMB170AT3	162	170	179	1	145	5	2.6	234	0.108	170A
P6SMB180AT3	171	180	189	1	154	5	2.4	246	0.108	180A
P6SMB200AT3	190	200	210	1	171	5	2.2	274	0.108	200A

(1) Breakdown voltage tolerance is $\pm 5\%$ for A suffix.

(2) V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C .

(3) T3 suffix designates tape and reel of 2500 units.

(4) Bidirectional version available for P6SMB12AT3 thru P6SMB91AT3. Electrical characteristics apply in both directions except for V_F . Use CAT3 suffix.

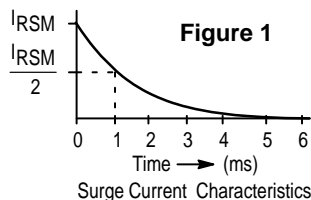
(5) 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Surface Mount Packages (continued)

Table 11. Peak Power Dissipation (1500 Watts @ 1 ms Surge – Figure 1) Case 403–03



ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Device(1)	Reverse Stand-Off Voltage V _R Volts(2)	Breakdown Voltage(3)		Maximum Clamping Voltage V _C @ I _{pp} Volts	Peak Pulse Current (See Figure 1) I _{pp} Amps	Maximum Reverse Leakage @ V _R I _R μA	Device Marking
		V _{BR} @ I _T Volts Min	mA				
1SMC5.0AT3	5.0	6.40	10	9.2	163.0	1000	GDE
1SMC6.0AT3	6.0	6.67	10	10.3	145.6	1000	GDG
1SMC6.5AT3	6.5	7.22	10	11.2	133.9	500	GDK
1SMC7.0AT3	7.0	7.78	10	12.0	125.0	200	GDM
1SMC7.5AT3	7.5	8.33	1.0	12.9	116.3	100	GDP
1SMC8.0AT3	8.0	8.89	1.0	13.6	110.3	50	GDR
1SMC8.5AT3	8.5	9.44	1.0	14.4	104.2	20	GDT
1SMC9.0AT3	9.0	10.0	1.0	15.4	97.4	10	GDV
1SMC10AT3	10	11.1	1.0	17.0	88.2	5.0	GDX
1SMC11AT3	11	12.2	1.0	18.2	82.4	5.0	GDZ
1SMC12AT3	12	13.3	1.0	19.9	75.3	5.0	GEE
1SMC13AT3	13	14.4	1.0	21.5	69.7	5.0	GEG
1SMC14AT3	14	15.6	1.0	23.2	64.7	5.0	GEK
1SMC15AT3	15	16.7	1.0	24.4	61.5	5.0	GEM
1SMC16AT3	16	17.8	1.0	26.0	57.7	5.0	GEP
1SMC17AT3	17	18.9	1.0	27.6	53.3	5.0	GER
1SMC18AT3	18	20.0	1.0	29.2	51.4	5.0	GET
1SMC20AT3	20	22.2	1.0	32.4	46.3	5.0	GEV
1SMC22AT3	22	24.4	1.0	35.5	42.2	5.0	GEX
1SMC24AT3	24	26.7	1.0	38.9	38.6	5.0	GEZ
1SMC26AT3	26	28.9	1.0	42.1	35.6	5.0	GFE
1SMC28AT3	28	31.1	1.0	45.4	33.0	5.0	GFG
1SMC30AT3	30	33.3	1.0	48.4	31.0	5.0	GFK
1SMC33AT3	33	36.7	1.0	53.3	28.1	5.0	GFM
1SMC36AT3	36	40.0	1.0	58.1	25.8	5.0	GFP
1SMC40AT3	40	44.4	1.0	64.5	23.2	5.0	GFR
1SMC43AT3	43	47.8	1.0	69.4	21.6	5.0	GFT
1SMC45AT3	45	50.0	1.0	72.7	20.6	5.0	GFV
1SMC48AT3	48	53.3	1.0	77.4	19.4	5.0	GFX
1SMC51AT3	51	56.7	1.0	82.4	18.2	5.0	GFZ
1SMC54AT3	54	60.0	1.0	87.1	17.2	5.0	GGE
1SMC58AT3	58	64.4	1.0	93.6	16.0	5.0	GGG
1SMC60AT3	60	66.7	1.0	96.8	15.5	5.0	GGK
1SMC64AT3	64	71.1	1.0	103	14.6	5.0	GGM
1SMC70AT3	70	77.8	1.0	113	13.3	5.0	GGP
1SMC75AT3	75	83.3	1.0	121	12.4	5.0	GGR
1SMC78AT3	78	86.7	1.0	126	11.4	5.0	GGT

(1) T3 suffix designates tape and reel of 2500 units.

(2) A transient suppressor is normally selected according to the reverse "Stand Off Voltage" (V_R) which should be equal to or greater than the DC or continuous peak operating voltage level.

(3) V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Surface Mount Packages (continued)

Table 12. Peak Power Dissipation (1500 Watts @ 1 ms Surge – Figure 1) Case 403-03

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) $V_F = 3.5\text{ V Max}$, $I_F^{(3)} = 100\text{ A}$ for all types.										
Device(1)	Breakdown Voltage(2)				Working Peak Reverse Voltage V_{RWM} Volts	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{RSM} Amps	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} Volts	Maximum Temperature Coefficient of V_{BR} $\%/^\circ\text{C}$	Device Marking
	V_{BR} @ I_T Volts									
	Min	Nom	Max	mA						
1.5SMC6.8AT3	6.45	6.8	7.14	10	5.8	1000	143	10.5	0.057	6V8A
1.5SMC8.2AT3	7.79	8.2	8.61	10	7.02	200	124	12.1	0.065	8V2A
1.5SMC9.1AT3	8.65	9.1	9.55	1	7.78	50	112	13.4	0.068	9V1A
1.5SMC10AT3	9.5	10	10.5	1	8.55	10	103	14.5	0.073	10A
1.5SMC11AT3	10.5	11	11.6	1	9.4	5	96	15.6	0.075	11A
1.5SMC12AT3	11.4	12	12.6	1	10.2	5	90	16.7	0.078	12A
1.5SMC13AT3	12.4	13	13.7	1	11.1	5	82	18.2	0.081	13A
1.5SMC15AT3	14.3	15	15.8	1	12.8	5	71	21.2	0.084	15A
1.5SMC18AT3	17.1	18	18.9	1	15.3	5	59.5	25.2	0.088	18A
1.5SMC22AT3	20.9	22	23.1	1	18.8	5	49	30.6	0.092	22A
1.5SMC24AT3	22.8	24	25.2	1	20.5	5	45	33.2	0.094	24A
1.5SMC27AT3	25.7	27	28.4	1	23.1	5	40	37.5	0.096	27A
1.5SMC30AT3	28.5	30	31.5	1	25.6	5	36	41.4	0.097	30A
1.5SMC33AT3	31.4	33	34.7	1	28.2	5	33	45.7	0.098	33A
1.5SMC36AT3	34.2	36	37.8	1	30.8	5	30	49.9	0.099	36A
1.5SMC39AT3	37.1	39	41	1	33.3	5	28	53.9	0.1	39A
1.5SMC43AT3	40.9	43	45.2	1	36.8	5	25.3	59.3	0.101	43A
1.5SMC47AT3	44.7	47	49.4	1	40.2	5	23.2	64.8	0.101	47A
1.5SMC51AT3	48.5	51	53.6	1	43.6	5	21.4	70.1	0.102	51A
1.5SMC56AT3	53.2	56	58.8	1	47.8	5	19.5	77	0.103	56A
1.5SMC62AT3	58.9	62	65.1	1	53	5	17.7	85	0.104	62A
1.5SMC68AT3	64.6	68	71.4	1	58.1	5	16.3	92	0.104	68A
1.5SMC75AT3	71.3	75	78.8	1	64.1	5	14.6	103	0.105	75A
1.5SMC82AT3	77.9	82	86.1	1	70.1	5	13.3	113	0.105	82A
1.5SMC91AT3	86.5	91	95.5	1	77.8	5	12	125	0.106	91A

(1) T3 suffix designates tape and reel of 2500 units.

(2) V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C .

(3) 1/2 sine wave (or equivalent square wave), $PW = 8.3\text{ ms}$, duty cycle = 4 pulses per minute maximum.

Devices listed in bold, italic are Motorola preferred devices.

TVS

Overvoltage Transient Suppressors

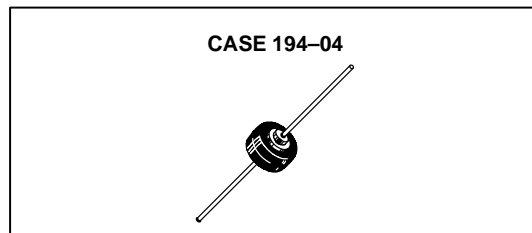
Table 13. Overvoltage Transient Suppressors

Overvoltage transient suppressors are designed for protection against over-voltage conditions in the auto electrical system including the “LOAD DUMP” phenomenon that occurs when the battery open circuits while the car is running.

OVERVOLTAGE TRANSIENT SUPPRESSOR	
	CASE 194-04 MR2535L
V_{RRM} (Volts)	20
I_O (Amp)	35
V(BR) (Volts)	24-32
I_{RSM}⁽³⁰⁾ (Amp)	110
T_C @ Rated I_O (°C)	150
T (°C)	175

⁽³⁰⁾ Time constant = 10 ms, duty cycle ≤ 1%, T_C = 25°C.

Note: MR2535L is considered part of the rectifier product portfolio.

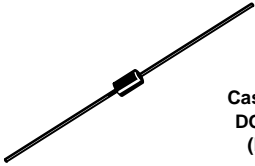


Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Voltage Regulator Diodes

Table 14. Axial Leaded for Through-hole Designs – 500 mW

Nominal Zener Breakdown Voltage	500 mW Low Level Cathode = Polarity Band	500 mW Cathode = Polarity Band			500 mW Low Level Cathode = Polarity Band	500 mW Cathode = Polarity Band
		(*Note 3)	(*Note 4)	(*Note 5)		
(*Note 1)	(*Note 2)	(*Note 3)	(*Note 4)	(*Note 5)	(*Note 6)	(*Note 7)
Volts	 <p>Glass Case 299-02 DO-204AH (DO-35)</p>					
1.8	1N4678				MZ4614	
2.0	1N4679				MZ4615	
2.2					MZ4616	
2.4	1N4681	1N5221B	1N5985B	BZX79C2V4RL	MZ4617	
2.5		1N5222B				
2.7	1N4682	1N5223B		BZX79C2V7RL	MZ4618	
2.8		1N5224B				
3.0	1N4683	1N5225B	1N5987B	BZX79C3V0RL	MZ4619	
3.3	1N4684	1N5226B	1N5988B	BZX79C3V3RL	MZ4620	
3.6	1N4685	1N5227B	1N5989B	BZX79C3V6RL		
3.9	1N4686	1N5228B	1N5990B		MZ4622	MZ5520B
4.3	1N4687	1N5229B	1N5991B	BZX79C4V3RL	MZ4623	MZ5521B
4.7	1N4688	1N5230B	1N5992B	BZX79C4V7RL	MZ4624	
5.1	1N4689	1N5231B	1N5993B	BZX79C5V1RL	MZ4625	MZ5523B
5.6	1N4690	1N5232B	1N5994B	BZX79C5V6RL	MZ4626	MZ5524B
6.0		1N5233B				
6.2	1N4691	1N5234B	1N5995B	BZX79C6V2RL	MZ4627	MZ5525B
6.8	1N4692	1N5235B	1N5996B	BZX79C6V8RL	MZ4099	
7.5	1N4693	1N5236B	1N5997B			MZ5527B
8.2	1N4694	1N5237B	1N5998B	BZX79C8V2RL	MZ4101	
8.7	1N4695	1N5238B				
9.1	1N4696	1N5239B	1N5999B	BZX79C9V1RL		MZ5529B
10	1N4697	1N5240B	1N6000B		MZ4104	
11	1N4698	1N5241B				
12	1N4699	1N5242B	1N6002B	BZX79C12RL		
13	1N4700	1N5243B	1N6003B			
14		1N5244B				
15	1N4702	1N5245B	1N6004B	BZX79C15RL		
16	1N4703	1N5246B		BZX79C16RL		
17	1N4704	1N5247B				
18	1N4705	1N5248B				

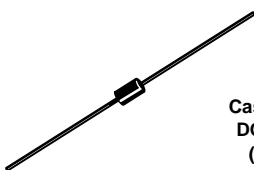
*See Notes on page 5.2–23.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Voltage Regulator Diodes (continued)

Table 14. Axial Leaded for Through-hole Designs – 500 mW (continued)

Nominal Zener Breakdown Voltage	500 mW Low Level Cathode = Polarity Band	500 mW Cathode = Polarity Band			500 mW Low Level Cathode = Polarity Band	500 mW Cathode = Polarity Band
		(*Note 3)	(*Note 4)	(*Note 5)		
Volts	 <p>Glass Case 299-02 DO-204AH (DO-35)</p>					
19	1N4707 1N4708	1N5249B	1N6007B			
20		1N5250B				
22		1N5251B				
24		1N5252B				
25		1N5253B				
27	1N5254B					
28		1N5255B		BZX79C33RL		
30		1N5256B				
33		1N5257B				
36		1N5258B				
39		1N5259B				
43		1N5260B				
47		1N5261B				
51		1N5262B				
56		1N5263B				
60		1N5264B				
62		1N5265B				
68		1N5266B				
75						
82	1N5268B					
87	1N5269B					
91	1N5270B					
100		1N5271B				
110		1N5272B				
120		1N5273B				
130		1N5274B				
140		1N5275B				
150		1N5276B				
160		1N5278B				
170		1N5279B				
180		1N5280B				
190		1N5281B				
200						
220						
240						
270						
300						
330						
360						
400						

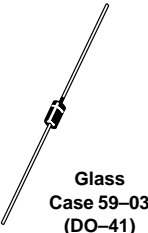
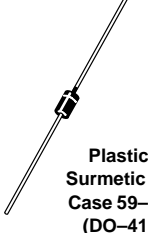
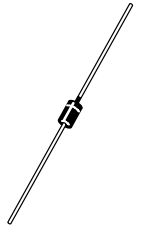
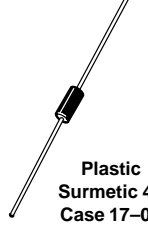
*See Notes on page 5.2–23.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Voltage Regulator Diodes (continued)

Table 15. Axial Leaded for Through-hole Designs – 1, 1.3, 1.5, 3 and 5 Watt

Nominal Zener Breakdown Voltage	1 Watt Cathode = Polarity Band		1.5 Watt Cathode = Polarity Band	3 Watt Cathode = Polarity Band	5 Watt Cathode = Polarity Band
(*Note 1)	(*Note 8)	(*Note 9)	(*Note 10)	(*Note 11)	(*Note 12)
Volts	 Glass Case 59-03 (DO-41)	 Plastic Surmetic 30 Case 59-03 (DO-41)	 Plastic Surmetic 30 Case 59-03 (DO-41)		 Plastic Surmetic 40 Case 17-02
3.3	1N4728A	MZP4728A	1N5913B		1N5333B
3.6	1N4729A	MZP4729A	1N5914B	3EZ4.3D5	1N5334B
3.9	1N4730A				1N5335B
4.3	1N4731A		1N5916B		1N5336B
4.7	1N4732A		1N5917B		1N5337B
5.1	1N4733A		1N5918B		1N5338B
5.6	1N4734A	MZP4734A	1N5919B		1N5339B
6.0					1N5340B
6.2	1N4735A	MZP4735A	1N5920B		1N5341B
6.8	1N4736A		1N5921B		1N5342B
7.5	1N4737A	MZP4737A	1N5922B	3EZ7.5D5	1N5343B
8.2	1N4738A	MZP4738A	1N5923B	3EZ8.2D5	1N5344B
8.7					1N5345B
9.1	1N4739A		1N5924B	3EZ9.1D5	1N5346B
10	1N4740A	MZP4740A	1N5925B	3EZ10D5	1N5347B
11	1N4741A	MZP4741A	1N5926B	3EZ11D5	1N5348B
12	1N4742A		1N5927B		1N5349B
13	1N4743A			3EZ13D5 3EZ14D5	1N5350B
14					1N5351B
15	1N4744A	MZP4744A	1N5929B		1N5352B
16	1N4745A	MZP4745A	1N5930B		1N5353B
17					1N5354B
18	1N4746A	MZP4746A	1N5931B		1N5355B
19				3EZ19D5	1N5356B
20	1N4747A		1N5932B		1N5357B
22	1N4748A		1N5933B	3EZ22D5	1N5358B
24	1N4749A	MZP4749A	1N5934B		1N5359B
25					1N5360B
27	1N4750A	MZP4750A	1N5935B	3EZ27D5	1N5361B
28				3EZ28D5	1N5362B
30	1N4751A	MZP4751A	1N5936B		1N5363B
33	1N4752A	MZP4752A	1N5937B	3EZ33D5	1N5364B
36	1N4753A	MZP4753A	1N5938B	3EZ36D5	1N5365B
39	1N4754A		1N5939B		1N5366B
43	1N4755A			3EZ43D5	1N5367B
47	1N4756A		1N5941B	3EZ47D5	1N5368B
51	1N4757A				1N5369B
56	1N4758A		1N5943B	3EZ56D5	1N5370B
60					1N5371B
62	1N4759A				1N5372B

*See Notes on page 5.2-23.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Voltage Regulator Diodes (continued)

Table 15. Axial Leaded for Through-hole Designs – 1, 1.3, 1.5, 3 and 5 Watt (continued)

Nominal Zener Breakdown Voltage	1 Watt Cathode = Polarity Band		1.5 Watt Cathode = Polarity Band	3 Watt Cathode = Polarity Band	5 Watt Cathode = Polarity Band
(*Note 1)	(*Note 8)	(*Note 9)	(*Note 10)	(*Note 11)	(*Note 12)
Volts	 Glass Case 59-03 (DO-41)	 Plastic Surmetic 30 Case 59-03 (DO-41)	 Plastic Surmetic 30 Case 59-03 (DO-41)		 Plastic Surmetic 40 Case 17-02
75	1N4761A		1N5946B	3EZ75D5	1N5374B
82	1N4762A				1N5375B
87					1N5376B
91	1N4763A			3EZ91D5	1N5377B
100	1N4764A				1N5378B
110				3EZ110D5	1N5379B
120			1N5951B	3EZ120D5	1N5380B
130				3EZ130D5	1N5381B
140				3EZ140D5	1N5382B
150			1N5953B		1N5383B
160			1N5954B	3EZ160D5	1N5384B
170					1N5385B
180			1N5955B		1N5386B
190				3EZ190D5	1N5387B
200			1N5956B	3EZ200D5	1N5388B
220				3EZ220D5	
240				3EZ240D5	
270					
300					
330				3EZ330D5	
360					
400				3EZ400D5	

*See Notes on page 5.2-23.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Notes — Axial Leaded Chart

1. Zener Voltage is the key parameter for each device type. It is specified at a particular test current applied at either thermal equilibrium (T.E.) or pulse test condition. The voltage tolerance for the device types listed is, in general, $\pm 5\%$; however, for some series, the voltage tolerance varies from device type to device type over a range of $\pm(5$ to $8.5)\%$. Consult the complete data sheet to determine the exact test conditions and minimum/maximum limits for the zener voltage. Consult Application Note AN924 regarding measurement of Zener Voltage (pulse versus thermal equilibrium).

Power Ratings represent the capability of the case size listed as supplied by Motorola. These ratings may be higher than the JEDEC registration and/or the same device types supplied by other manufacturers. (On tight tolerance devices, please consult factory on availability.)





V_Z Test Conditions and Tolerances

2. 1N4678 Series $I_{ZT} = 50 \mu\text{A}$ (T.E.).
No suffix = $\pm 5\%$.
Also has delta V_Z parameter and limit.
3. 1N5221B–42B $I_{ZT} = 20 \text{ mA}$ (T.E.).
1N5243B–81B I_{ZT} @ approximately 125 mW point (T.E.).
B suffix = $\pm 5\%$.
4. 1N5985B–1N6007B $I_{ZT} = 5 \text{ mA}$ (T.E.).
B suffix = $\pm 5\%$.
5. BZX79C2V4–C16RL $I_{ZT} = 5 \text{ mA}$ (pulse).
BZX79C33 $I_{ZT} = 2 \text{ mA}$ (pulse).
C indicates $\pm(5$ to $8.5)\%$ depending on type number.
6. MZ4614–27 $I_{ZT} = 250 \mu\text{A}$ (T.E.).
MZ4099–4104 $I_{ZT} = 250 \mu\text{A}$ (T.E.).
Tolerance is $\pm 5\%$.
7. MZ5520B–21B $I_{ZT} = 20 \text{ mA}$ (T.E.).
MZ5523B $I_{ZT} = 5 \text{ mA}$ (T.E.).
MZ5524B $I_{ZT} = 3 \text{ mA}$ (T.E.).
MZ5525B–29B $I_{ZT} = 1 \text{ mA}$ (T.E.).
Tolerance is $\pm 5\%$.
Also has delta V_Z parameter and limit.
8. 1N4728A–64A
 I_{ZT} @ approximately 250 mW point (T.E.).
A suffix = $\pm 5\%$.
9. MZP4728A–53A
 I_{ZT} @ approximately 250 mW point (T.E.).
MZP Series A suffix = $\pm 5\%$.
10. 1N5913B–56B
 I_{ZT} @ approximately 375 mW point (T.E.).
B suffix = $\pm 5\%$.
11. 3EZ4.3D5–400D5
 I_{ZT} @ approximately 750 mW point (pulse).
Suffix 5 = $\pm 5\%$.
12. 1N5333B–88B
 I_{ZT} varies from 0.9 to 1.5 W point depending on type number (pulse)
B suffix = $\pm 5\%$.
Also has delta V_Z parameter and limit.

Zener Diodes

Voltage Regulator Diodes (continued)

Table 16. Surface Mount Packages

Nominal Zener Breakdown Voltage	225 mW Surface Mount		500 mW Surface Mount	500 mW Low Level Surface Mount	500 mW Surface Mount	1.5 Watt Surface Mount	3 Watt Surface Mount
	SOT-23		SOD-123	SOD-123	SOD-123	SMA	SMB
(*Note 1)	(*Note 2)	(*Note 3)	(*Note 4)	(*Note 5)	(*Note 6)	(*Note 7)	(*Note 8)
Volts	 Anode Cathode No Connection Plastic Case 318-08 TO-236AB		 Plastic Case 425-04, Style 1			 Plastic Case 403B-01	 Plastic Case 403A-03 Cathode = Notch
1.8				MMSZ4678T1			
2.0				MMSZ4679T1			
2.2				MMSZ4680T1			
2.4	BZX84C2V4LT1	MMBZ5221BLT1	MMSZ2V4T1	MMSZ4681T1	MMSZ5221BT1		
2.5		MMBZ5222BLT1			MMSZ5222BT1		
2.7	BZX84C2V7LT1	MMBZ5223BLT1	MMSZ2V7T1	MMSZ4682T1	MMSZ5223BT1		
2.8		MMBZ5224BLT1			MMSZ5224BT1		
3.0	BZX84C3V0LT1	MMBZ5225BLT1	MMSZ3V0T1	MMSZ4683T1	MMSZ5225BT1		
3.3	BZX84C3V3LT1	MMBZ5226BLT1	MMSZ3V3T1	MMSZ4684T1	MMSZ5226BT1	1SMA5913BT3	1SMB5913BT3
3.6	BZX84C3V6LT1	MMBZ5227BLT1	MMSZ3V6T1	MMSZ4685T1	MMSZ5227BT1	1SMA5914BT3	
3.9	BZX84C3V9LT1	MMBZ5228BLT1	MMSZ3V9T1	MMSZ4686T1	MMSZ5228BT1	1SMA5915BT3	1SMB5915BT3
4.3	BZX84C4V3LT1	MMBZ5229BLT1	MMSZ4V3T1	MMSZ4687T1	MMSZ5229BT1	1SMA5916BT3	1SMB5916BT3
4.7	BZX84C4V7LT1	MMBZ5230BLT1	MMSZ4V7T1	MMSZ4688T1	MMSZ5230BT1	1SMA5917BT3	1SMB5917BT3
5.1	BZX84C5V1LT1	MMBZ5231BLT1	MMSZ5V1T1	MMSZ4689T1	MMSZ5231BT1	1SMA5918BT3	1SMB5918BT3
5.6	BZX84C5V6LT1	MMBZ5232BLT1	MMSZ5V6T1	MMSZ4690T1	MMSZ5232BT1	1SMA5919BT3	1SMB5919BT3
6.0		MMBZ5233BLT1			MMSZ5233BT1		
6.2	BZX84C6V2LT1	MMBZ5234BLT1	MMSZ6V2T1	MMSZ4691T1	MMSZ5234BT1	1SMA5920BT3	1SMB5920BT3
6.8	BZX84C6V8LT1	MMBZ5235BLT1	MMSZ6V8T1	MMSZ4692T1	MMSZ5235BT1	1SMA5921BT3	1SMB5921BT3
7.5	BZX84C7V5LT1	MMBZ5236BLT1	MMSZ7V5T1	MMSZ4693T1	MMSZ5236BT1	1SMA5922BT3	1SMB5922BT3
8.2	BZX84C8V2LT1	MMBZ5237BLT1	MMSZ8V2T1	MMSZ4694T1	MMSZ5237BT1	1SMA5923BT3	1SMB5923BT3
8.7		MMBZ5238BLT1		MMSZ4695T1	MMSZ5238BT1		
9.1	BZX84C9V1LT1	MMBZ5239BLT1	MMSZ9V1T1	MMSZ4696T1	MMSZ5239BT1	1SMA5924BT3	1SMB5924BT3
10	BZX84C10LT1	MMBZ5240BLT1	MMSZ10T1	MMSZ4697T1	MMSZ5240BT1	1SMA5925BT3	1SMB5925BT3
11	BZX84C11LT1	MMBZ5241BLT1	MMSZ11T1	MMSZ4698T1	MMSZ5241BT1	1SMA5926BT3	1SMB5926BT3
12	BZX84C12LT1	MMBZ5242BLT1	MMSZ12T1	MMSZ4699T1	MMSZ5242BT1	1SMA5927BT3	1SMB5927BT3
13	BZX84C13LT1	MMBZ5243BLT1	MMSZ13T1	MMSZ4700T1	MMSZ5243BT1	1SMA5928BT3	1SMB5928BT3
14		MMBZ5244BLT1		MMSZ4701T1	MMSZ5244BT1		
15	BZX84C15LT1	MMBZ5245BLT1	MMSZ15T1	MMSZ4702T1	MMSZ5245BT1	1SMA5929BT3	1SMB5929BT3
16	BZX84C16LT1	MMBZ5246BLT1	MMSZ16T1	MMSZ4703T1	MMSZ5246BT1	1SMA5930BT3	1SMB5930BT3
17		MMBZ5247BLT1		MMSZ4704T1	MMSZ5247BT1		
18	BZX84C18LT1	MMBZ5248BLT1	MMSZ18T1	MMSZ4705T1	MMSZ5248BT1	1SMA5931BT3	1SMB5931BT3
19		MMBZ5249BLT1		MMSZ4706T1	MMSZ5249BT1		
20	BZX84C20LT1	MMBZ5250BLT1	MMSZ20T1	MMSZ4707T1	MMSZ5250BT1	1SMA5932BT3	1SMB5932BT3
22	BZX84C22LT1	MMBZ5251BLT1	MMSZ22T1	MMSZ4708T1	MMSZ5251BT1	1SMA5933BT3	1SMB5933BT3
24	BZX84C24LT1	MMBZ5252BLT1	MMSZ24T1	MMSZ4709T1	MMSZ5252BT1	1SMA5934BT3	1SMB5934BT3
25				MMSZ4710T1	MMSZ5253BT1		
27	BZX84C27LT1	MMBZ5254BLT1	MMSZ27T1	MMSZ4711T1	MMSZ5254BT1	1SMA5935BT3	1SMB5935BT3





*See Notes page 5.2-26.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Voltage Regulator Diodes (continued)

Table 16. Surface Mount Packages (continued)

Nominal Zener Breakdown Voltage	225 mW Surface Mount		500 mW Surface Mount	500 mW Low Level Surface Mount	500 mW Surface Mount	1.5 Watt Surface Mount	3 Watt Surface Mount
(*Note 1)	(*Note 2)	(*Note 3)	(*Note 4)	(*Note 5)	(*Note 6)	(*Note 7)	(*Note 8)
Volts	 Anode Cathode No Connection Plastic Case 318-08 TO-236AB		 Plastic Case 425-04, Style 1		 Plastic Case 403B-01	 Plastic Case 403A-03 Cathode = Notch	
28		MMBZ5255BLT1		MMSZ4712T1	MMSZ5255BT1		
30	BZX84C30LT1	MMBZ5256BLT1	MMSZ30T1	MMSZ4713T1	MMSZ5256BT1	1SMA5936BT3	1SMB5936BT3
33	BZX84C33LT1	MMBZ5257BLT1	MMSZ33T1	MMSZ4714T1	MMSZ5257BT1	1SMA5937BT3	1SMB5937BT3
36	BZX84C36LT1	MMBZ5258BLT1	MMSZ36T1	MMSZ4715T1	MMSZ5258BT1	1SMA5938BT3	1SMB5938BT3
39	BZX84C39LT1	MMBZ5259BLT1	MMSZ39T1	MMSZ4716T1	MMSZ5259BT1	1SMA5939BT3	1SMB5939BT3
43	BZX84C43LT1	MMBZ5260BLT1	MMSZ43T1	MMSZ4717T1	MMSZ5260BT1	1SMA5940BT3	1SMB5940BT3
47	BZX84C47LT1	MMBZ5261BLT1	MMSZ47T1		MMSZ5261BT1	1SMA5941BT3	1SMB5941BT3
51	BZX84C51LT1	MMBZ5262BLT1	MMSZ51T1		MMSZ5262BT1	1SMA5942BT3	1SMB5942BT3
56	BZX84C56LT1	MMBZ5263BLT1	MMSZ56T1		MMSZ5263BT1	1SMA5943BT3	1SMB5943BT3
60		MMBZ5264BLT1			MMSZ5264BT1		
62	BZX84C62LT1	MMBZ5265BLT1	MMSZ62T1		MMSZ5265BT1	1SMA5944BT3	1SMB5944BT3
68	BZX84C68LT1	MMBZ5266BLT1	MMSZ68T1		MMSZ5266BT1	1SMA5945BT3	1SMB5945BT3
75	BZX84C75LT1	MMBZ5267BLT1	MMSZ75T1		MMSZ5267BT1		1SMB5946BT3
82		MMBZ5268BLT1			MMSZ5268BT1		1SMB5947BT3
87		MMBZ5269BLT1			MMSZ5269BT1		
91		MMBZ5270BLT1			MMSZ5270BT1		
100					MMSZ5271BT1		1SMB5949BT3
110							1SMB5950BT3
120							1SMB5951BT3
130							1SMB5952BT3
150							1SMB5953BT3
160							1SMB5954BT3
170							
180							
200							

*See Notes page 5.2-26.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Notes — Surface Mount Chart

1. *Zener Voltage* is the key parameter for each device type. It is specified at a particular test current applied at either thermal equilibrium (T.E.) or pulse test condition. The voltage tolerance for the device types listed is, in general $\pm 5\%$; however, for some series, the voltage tolerance varies from device type to device type over a range of $\pm(5$ to $8.5)\%$. Consult the complete data sheet to determine the exact test conditions and minimum/maximum limits for the zener voltage.

Power Ratings represent the capability of the case size listed as supplied by Motorola. These ratings may be higher than the same device types supplied by other manufacturers.

***V_Z* Test Conditions and Tolerances**

2. ***BZX84C2V4L–C24LT1*** $I_{ZT} = 5$ mA (pulse).
BZX84C27L–C75LT1
 $I_{ZT} = 2$ mA (pulse).

Tolerance is $\pm(5$ to $8.5)\%$ depending on type number. Each device type also has other V_Z min/max limits at two other I_{ZT} pulse current values.

3. ***MMBZ5221BL–42BLT1*** $I_{ZT} = 20$ mA (pulse).
MMBZ5243BL–70BLT1
 I_{ZT} @ approximately 125 mW point (pulse).
BL suffix = $\pm 5\%$.

4. ***MMSZ2V4–24T1*** $I_{ZT} = 5$ mA (pulse).
MMSZ27–56T1 $I_{ZT} = 2$ mA (pulse).

Tolerance is $\pm(5$ to $8.5)\%$ depending on type number. Each device type also has other V_Z min/max limits at two other I_{ZT} pulse current values.

5. ***MMSZ4678T1 Series*** $I_{ZT} = 50$ μ A (T.E.).
No suffix = $\pm 5\%$.

6. ***MMSZ5221B–42BT1*** $I_{ZT} = 20$ mA (T.E.).
MMSZ5243B–63BT1
 I_{ZT} @ approximately 125 mW point (T.E.).
A suffix = $\pm 10\%$.
B suffix = $\pm 5\%$.

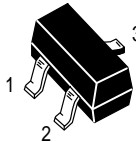
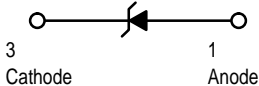
7. ***1SMA5913BT3 Series***
 I_{ZT} @ approximately 375 mW point (T.E.).
BT3 suffix = $\pm 5\%$.
T3 suffix designates tape and reel of 2500 units.

8. ***1SMB5913BT3 Series***
 I_{ZT} @ approximately 750 mW point (T.E.).
BT3 suffix = $\pm 5\%$.
T3 suffix designates tape and reel of 2500 units.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 17. 225 mW Rating on FR-5 Board – Case 318-08 – SOT-23

CASE 318-08, STYLE 8
SOT-23 (TO-236AB)
PLASTIC

ELECTRICAL CHARACTERISTICS (Pinout: 1-Anode, 2-NC, 3-Cathode) ($V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ for all types)																
Type Number	Marking	Zener Voltage V_{Z1} (Volts) @ $I_{ZT1} = 5\text{ mA}$ (1)			Max Zener Impedance Z_{ZT1} (Ohms) @ $I_{ZT1} = 5\text{ mA}$	Max Reverse Leakage Current		Zener Voltage V_{Z2} (Volts) @ $I_{ZT2} = 1\text{ mA}$ (1)		Max Zener Impedance Z_{ZT2} (Ohms) @ $I_{ZT2} = 1\text{ mA}$	Zener Voltage V_{Z3} (Volts) @ $I_{ZT3} = 20\text{ mA}$ (1)		Max Zener Impedance Z_{ZT3} (Ohms) @ $I_{ZT3} = 20\text{ mA}$	dV_Z/dI (mV/k) @ $I_{ZT1} = 5\text{ mA}$		C_{pF} Max @ $V_R = 0$ f = 1 MHz
		Nom	Min	Max		I_R	V_R	Min	Max		Min	Max		Min	Max	
BZX84C2V4LT1	Z11	2.4	2.2	2.6	100	50	1	1.7	2.1	600	2.6	3.2	50	-3.5	0	450
BZX84C2V7LT1	Z12	2.7	2.5	2.9	100	20	1	1.9	2.4	600	3	3.6	50	-3.5	0	450
BZX84C3V0LT1	Z13	3	2.8	3.2	95	10	1	2.1	2.7	600	3.3	3.9	50	-3.5	0	450
BZX84C3V3LT1	Z14	3.3	3.1	3.5	95	5	1	2.3	2.9	600	3.6	4.2	40	-3.5	0	450
BZX84C3V6LT1	Z15	3.6	3.4	3.8	90	5	1	2.7	3.3	600	3.9	4.5	40	-3.5	0	450
BZX84C3V9LT1	Z16	3.9	3.7	4.1	90	3	1	2.9	3.5	600	4.1	4.7	30	-3.5	-2.5	450
BZX84C4V3LT1	W9	4.3	4	4.6	90	3	1	3.3	4	600	4.4	5.1	30	-3.5	0	450
BZX84C4V7LT1	Z1	4.7	4.4	5	80	3	2	3.7	4.7	500	4.5	5.4	15	-3.5	0.2	260
BZX84C5V1LT1	Z2	5.1	4.8	5.4	60	2	2	4.2	5.3	480	5	5.9	15	-2.7	1.2	225
BZX84C5V6LT1	Z3	5.6	5.2	6	40	1	2	4.8	6	400	5.2	6.3	10	-2.0	2.5	200
BZX84C6V2LT1	Z4	6.2	5.8	6.6	10	3	4	5.6	6.6	150	5.8	6.8	6	0.4	3.7	185
BZX84C6V8LT1	Z5	6.8	6.4	7.2	15	2	4	6.3	7.2	80	6.4	7.4	6	1.2	4.5	155
BZX84C7V5LT1	Z6	7.5	7	7.9	15	1	5	6.9	7.9	80	7	8	6	2.5	5.3	140
BZX84C8V2LT1	Z7	8.2	7.7	8.7	15	0.7	5	7.6	8.7	80	7.7	8.8	6	3.2	6.2	135
BZX84C9V1LT1	Z8	9.1	8.5	9.6	15	0.5	6	8.4	9.6	100	8.5	9.7	8	3.8	7.0	130
BZX84C10LT1	Z9	10	9.4	10.6	20	0.2	7	9.3	10.6	150	9.4	10.7	10	4.5	8.0	130
BZX84C11LT1	Y1	11	10.4	11.6	20	0.1	8	10.2	11.6	150	10.4	11.8	10	5.4	9.0	130
BZX84C12LT1	Y2	12	11.4	12.7	25	0.1	8	11.2	12.7	150	11.4	12.9	10	6.0	10.0	130
BZX84C13LT1	Y3	13	12.4	14.1	30	0.1	8	12.3	14	170	12.5	14.2	15	7.0	11.0	120
BZX84C15LT1	Y4	15	13.8	15.6	30	0.05	10.5	13.7	15.5	200	13.9	15.7	20	9.2	13.0	110
BZX84C16LT1	Y5	16	15.3	17.1	40	0.05	11.2	15.2	17	200	15.4	17.2	20	10.4	14.0	105
BZX84C18LT1	Y6	18	16.8	19.1	45	0.05	12.6	16.7	19	225	16.9	19.2	20	12.4	16.0	100
BZX84C20LT1	Y7	20	18.8	21.2	55	0.05	14	18.7	21.1	225	18.9	21.4	20	14.4	18.0	85
BZX84C22LT1	Y8	22	20.8	23.3	55	0.05	15.4	20.7	23.2	250	20.9	23.4	25	16.4	20.0	85
BZX84C24LT1	Y9	24	22.8	25.6	70	0.05	16.8	22.7	25.5	250	22.9	25.7	25	18.4	22.0	80
		V_{Z1} Below @ $I_{ZT1} = 2\text{ mA}$			Z_{ZT1} Below @ $I_{ZT1} = 2\text{ mA}$			V_{Z2} Below @ $I_{ZT2} = 0.1\text{ mA}$		Z_{ZT2} Below @ $I_{ZT2} = 0.5\text{ mA}$ (2)	V_{Z3} Below @ $I_{ZT3} = 10\text{ mA}$		Z_{ZT3} Below @ $I_{ZT3} = 10\text{ mA}$	dV_Z/dI (mV/k) Below @ $I_{ZT1} = 2\text{ mA}$		
BZX84C27LT1	Y10	27	25.1	28.9	80	0.05	18.9	25	28.9	300	25.2	29.3	45	21.4	25.3	70
BZX84C30LT1	Y11	30	28	32	80	0.05	21	27.8	32	300	28.1	32.4	50	24.4	29.4	70
BZX84C33LT1	Y12	33	31	35	80	0.05	23.1	30.8	35	325	31.1	35.4	55	27.4	33.4	70
BZX84C36LT1	Y13	36	34	38	90	0.05	25.2	33.8	38	350	34.1	38.4	60	30.4	37.4	70
BZX84C39LT1	Y14	39	37	41	130	0.05	27.3	36.7	41	350	37.1	41.5	70	33.4	41.2	45
BZX84C43LT1	Y15	43	40	46	150	0.05	30.1	39.7	46	375	40.1	46.5	80	37.6	46.6	40
BZX84C47LT1	Y16	47	44	50	170	0.05	32.9	43.7	50	375	44.1	50.5	90	42.0	51.8	40
BZX84C51LT1	Y17	51	48	54	180	0.05	35.7	47.6	54	400	48.1	54.6	100	46.6	57.2	40
BZX84C56LT1	Y18	56	52	60	200	0.05	39.2	51.5	60	425	52.1	60.8	110	52.2	63.8	40
BZX84C62LT1	Y19	62	58	66	215	0.05	43.4	57.4	66	450	58.2	67	120	58.8	71.6	35
BZX84C68LT1	Y20	68	64	72	240	0.05	47.6	63.4	72	475	64.2	73.2	130	65.6	79.8	35
BZX84C75LT1	Y21	75	70	79	255	0.05	52.5	69.4	79	500	70.3	80.2	140	73.4	88.6	35

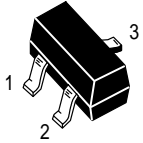

(1) V_Z is measured with a pulse test current (I_{ZT}) applied at an ambient temperature of 25°C.

(2) The zener impedance, Z_{ZT2} , for the 27 through 75 volt types is tested at 0.5 mA rather than the test current of 0.1 mA used for V_{Z2} .

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 18. 225 mW Rating on FR-5 Board – Case 318-08 – SOT-23

**CASE 318-08, STYLE 8
SOT-23 (TO-236AB)
PLASTIC**

ELECTRICAL CHARACTERISTICS (Pinout: 1–Anode, 2–NC, 3–Cathode) ($V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ for all types.)

Device	Marking	Test Current I_{ZT} mA	Zener Voltage $V_Z (\pm 5\%)$ Nominal ⁽¹⁾	Z_{ZK} $I_Z = 0.25\text{ mA}$ Ω Max	Z_{ZT} $I_Z = I_{ZT}$ @ 10% Mode Ω Max	Max I_R @ μA	V_R V
MMBZ5221BLT1	18A	20	2.4	1200	30	100	1
MMBZ5222BLT1	18B	20	2.5	1250	30	100	1
MMBZ5225BLT1	18E	20	3	1600	29	50	1
MMBZ5226BLT1	8A	20	3.3	1600	28	25	1
MMBZ5228BLT1	8C	20	3.9	1900	23	10	1
MMBZ5229BLT1	8D	20	4.3	2000	22	5	1
MMBZ5230BLT1	8E	20	4.7	1900	19	5	2
MMBZ5231BLT1	8F	20	5.1	1600	17	5	2
MMBZ5232BLT1	8G	20	5.6	1600	11	5	3
MMBZ5233BLT1	8H	20	6	1600	7	5	3.5
MMBZ5234BLT1	8J	20	6.2	1000	7	5	4
MMBZ5235BLT1	8K	20	6.8	750	5	3	5
MMBZ5236BLT1	8L	20	7.5	500	6	3	6
MMBZ5237BLT1	8M	20	8.2	500	8	3	6.5
MMBZ5239BLT1	8P	20	9.1	600	10	3	7
MMBZ5240BLT1	8Q	20	10	600	17	3	8
MMBZ5241BLT1	8R	20	11	600	22	2	8.4
MMBZ5242BLT1	8S	20	12	600	30	1	9.1
MMBZ5243BLT1	8T	9.5	13	600	13	0.5	9.9
MMBZ5244BLT1	8U	9	14	600	15	0.1	10
MMBZ5245BLT1	8V	8.5	15	600	16	0.1	11
MMBZ5246BLT1	8W	7.8	16	600	17	0.1	12
MMBZ5247BLT1	8X	7.4	17	600	19	0.1	13
MMBZ5248BLT1	8Y	7	18	600	21	0.1	14
MMBZ5249BLT1	8Z	6.6	19	600	23	0.1	14
MMBZ5250BLT1	81A	6.2	20	600	25	0.1	15
MMBZ5251BLT1	81B	5.6	22	600	29	0.1	17
MMBZ5252BLT1	81C	5.2	24	600	33	0.1	18
MMBZ5254BLT1	81E	4.6	27	600	41	0.1	21
MMBZ5255BLT1	81F	4.5	28	600	44	0.1	21
MMBZ5256BLT1	81G	4.2	30	600	49	0.1	23
MMBZ5257BLT1	81H	3.8	33	700	58	0.1	25
MMBZ5258BLT1	81J	3.4	36	700	70	0.1	27
MMBZ5259BLT1	81K	3.2	39	800	80	0.1	30

(1) V_Z is measured at pulse test current (I_{ZT}) at an ambient temperature of 25°C.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 18. 225 mW Rating on FR-5 Board – Case 318-08 – SOT-23 (continued)

ELECTRICAL CHARACTERISTICS (Pinout: 1–Anode, 2–NC, 3–Cathode) ($V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ for all types.)							
Device	Marking	Test Current I_{ZT} mA	Zener Voltage $V_Z (\pm 5\%)$ Nominal (1)	Z_{ZK} $I_Z = 0.25\text{ mA}$ Ω Max	Z_{ZT} $I_Z = I_{ZT}$ @ 10% Mode Ω Max	Max I_R @ μA	V_R V
MMBZ5261BLT1	81M	2.7	47	1000	105	0.1	36
MMBZ5262BLT1	81N	2.5	51	1100	125	0.1	39
MMBZ5263BLT1	81P	2.2	56	1300	150	0.1	43
MMBZ5265BLT1	81R	2	62	1400	185	0.1	47
MMBZ5266BLT1	81S	1.8	68	1600	230	0.1	52
MMBZ5268BLT1	81U	1.5	82	2000	330	0.1	62
MMBZ5269BLT1	81V	1.4	87	2200	370	0.1	68
MMBZ5270BLT1	81W	1.4	91	2300	400	0.1	69

(1) V_Z is measured at pulse test current (I_{ZT}) at an ambient temperature of 25°C.

Table 19. 500 mW Rating on FR-4 or FR-5 Board – Case 425-04 – SOD-123

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted ⁽¹⁾ , ($V_F = 0.9\text{ V Max. @ } I_F = 10\text{ mA}$ for all types)									
Type Number	Marking	Zener Voltage V_Z @ I_{ZT} Volts(1,2, 3)			Test Voltage V_R Volts	Max Zener Impedance(4)		Max Reverse Leakage Current I_R @ V_R μA	Test Voltage V_R Volts
		Nom	Min	Max		Z_{ZT} @ $I_Z = I_{ZT}$ Ω	Z_{ZK} @ $I_{ZK} = 0.25\text{ mA}$ Ω		
<i>MMSZ5221BT1</i>	C1	2.4	2.28	2.52	20	30	1200	100	1
<i>MMSZ5222BT1</i>	C2	2.5	2.38	2.63	20	30	1250	100	1
<i>MMSZ5223BT1</i>	C3	2.7	2.57	2.84	20	30	1300	75	1
<i>MMSZ5224BT1</i>	C4	2.8	2.66	2.94	20	30	1400	75	1
<i>MMSZ5225BT1</i>	C5	3.0	2.85	3.15	20	30	1600	50	1
<i>MMSZ5226BT1</i>	D1	3.3	3.14	3.47	20	28	1600	25	1
<i>MMSZ5227BT1</i>	D2	3.6	3.42	3.78	20	24	1700	15	1
<i>MMSZ5228BT1</i>	D3	3.9	3.71	4.10	20	23	1900	10	1
<i>MMSZ5229BT1</i>	D4	4.3	4.09	4.52	20	22	2000	5	1
<i>MMSZ5230BT1</i>	D5	4.7	4.47	4.94	20	19	1900	5	2

(1) Nominal zener voltage is measured with the device junction in thermal equilibrium at $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$.

(2) All part numbers shown indicate a V_Z tolerance of $\pm 5\%$.

(3) V_Z is measured at pulse test current (I_{ZT}) at an ambient temperature of 25°C.

(4) 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 the AC frequency = 1 kHz.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 19. 500 mW Rating on FR-4 or FR-5 Board – Case 425-04 – SOD-123 (continued)

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted ⁽¹⁾ , ($V_F = 0.9\text{ V Max. @ } I_F = 10\text{ mA}$ for all types)									
Type Number	Marking	Zener Voltage $V_Z @ I_{ZT}$ Volts ^(1,2,3)			Test Voltage V_R Volts	Max Zener Impedance ⁽⁴⁾		Max Reverse Leakage Current $I_R @ V_R$ μA	Test Voltage V_R Volts
		Nom	Min	Max		Z_{ZT} @ $I_Z = I_{ZT}$ Ω	Z_{ZK} @ $I_{ZK} = 0.25\text{ mA}$ Ω		
MMSZ5231BT1	E1	5.1	4.85	5.36	20	17	1600	5	2
MMSZ5232BT1	E2	5.6	5.32	5.88	20	11	1600	5	3
MMSZ5233BT1	E3	6.0	5.70	6.30	20	7	1600	5	3.5
MMSZ5234BT1	E4	6.2	5.89	6.51	20	7	1000	5	4
MMSZ5235BT1	E5	6.8	6.46	7.14	20	5	750	3	5
MMSZ5236BT1	F1	7.5	7.13	7.88	20	6	500	3	6
MMSZ5237BT1	F2	8.2	7.79	8.61	20	8	500	3	6.5
MMSZ5238BT1	F3	8.7	8.27	9.14	20	8	600	3	6.5
MMSZ5239BT1	F4	9.1	8.65	9.56	20	10	600	3	7
MMSZ5240BT1	F5	10	9.50	10.50	20	17	600	3	8
MMSZ5241BT1	H1	11	10.45	11.55	20	22	600	2	8.4
MMSZ5242BT1	H2	12	11.40	12.60	20	30	600	1	9.1
MMSZ5243BT1	H3	13	12.35	13.65	9.5	13	600	0.5	9.9
MMSZ5244BT1	H4	14	13.30	14.70	9.0	15	600	0.1	10
MMSZ5245BT1	H5	15	14.25	15.75	8.5	16	600	0.1	11
MMSZ5246BT1	J1	16	15.20	16.80	7.8	17	600	0.1	12
MMSZ5247BT1	J2	17	16.15	17.85	7.4	19	600	0.1	13
MMSZ5248BT1	J3	18	17.10	18.90	7.0	21	600	0.1	14
MMSZ5249BT1	J4	19	18.05	19.95	6.6	23	600	0.1	14
MMSZ5250BT1	J5	20	19.00	21.00	6.2	25	600	0.1	15
MMSZ5251BT1	K1	22	20.90	23.10	5.6	29	600	0.1	17
MMSZ5252BT1	K2	24	22.80	25.20	5.2	33	600	0.1	18
MMSZ5253BT1	K3	25	23.75	26.25	5.0	35	600	0.1	19
MMSZ5254BT1	K4	27	25.65	28.35	4.6	41	600	0.1	21
MMSZ5255BT1	K5	28	26.60	29.40	4.5	44	600	0.1	21
MMSZ5256BT1	M1	30	28.50	31.50	4.2	49	600	0.1	23
MMSZ5257BT1	M2	33	31.35	34.65	3.8	58	700	0.1	25
MMSZ5258BT1	M3	36	34.20	37.80	3.4	70	700	0.1	27
MMSZ5259BT1	M4	39	37.05	40.95	3.2	80	800	0.1	30
MMSZ5260BT1	M5	43	40.85	45.15	3.0	93	900	0.1	33
MMSZ5261BT1	N1	47	44.65	49.35	2.7	105	1000	0.1	36
MMSZ5262BT1	N2	51	48.45	53.55	2.5	125	1100	0.1	39
MMSZ5263BT1	N3	56	53.20	58.80	2.2	150	1300	0.1	43
MMSZ5264BT1	N4	60	57.00	63.00	2.1	170	1400	0.1	46
MMSZ5265BT1	N5	62	58.90	65.10	2.0	185	1400	0.1	47
MMSZ5266BT1	P1	68	64.60	71.40	1.8	230	1600	0.1	52
MMSZ5267BT1	P2	75	71.25	78.75	1.7	270	1700	0.1	56
MMSZ5268BT1	P3	82	77.90	86.10	1.5	330	2000	0.1	62
MMSZ5269BT1	P4	87	82.65	91.35	1.4	370	2200	0.1	68
MMSZ5270BT1	P5	91	86.45	95.55	1.4	400	2300	0.1	69

(1) Nominal zener voltage is measured with the device junction in thermal equilibrium at $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$.

(2) All part numbers shown indicate a V_Z tolerance of $\pm 5\%$.

(3) V_Z is measured at pulse test current (I_{ZT}) at an ambient temperature of 25°C .

(4) 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 $I_Z(\text{AC}) = 0.1 I_Z(\text{DC})$, with the AC frequency = 1 kHz.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 20. 500 mW Rating on FR-4 or FR-5 Board – Case 425-04 – SOD-123

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted ⁽¹⁾ , ($V_F = 0.9\text{ V Max. @ } I_F = 10\text{ mA}$ for all types)						
Type Number	Marking	Zener Voltage $V_Z @ I_{ZT} = 50\ \mu\text{A}$ Volts ^(1, 2)			Max Reverse Leakage Current $I_R @ V_R$ μA	Test Voltage V_R Volts
		Nom	Min	Max		
MMSZ4678T1	CC	1.8	1.71	1.89	7.5	1
MMSZ4679T1	CD	2.0	1.90	2.10	5	1
<i>MMSZ4680T1</i>	CE	2.2	2.09	2.31	4	1
MMSZ4681T1	CF	2.4	2.28	2.52	2	1
MMSZ4682T1	CH	2.7	2.57	2.84	1	1
MMSZ4683T1	CJ	3.0	2.85	3.15	0.8	1
MMSZ4684T1	CK	3.3	3.14	3.47	7.5	1.5
<i>MMSZ4685T1</i>	CM	3.6	3.42	3.78	7.5	2
MMSZ4686T1	CN	3.9	3.71	4.10	5	2
MMSZ4687T1	CP	4.3	4.09	4.52	4	2
<i>MMSZ4688T1</i>	CT	4.7	4.47	4.94	10	3
<i>MMSZ4689T1</i>	CU	5.1	4.85	5.36	10	3
<i>MMSZ4690T1</i>	CV	5.6	5.32	5.88	10	4
MMSZ4691T1	CA	6.2	5.89	6.51	10	5
MMSZ4692T1	CX	6.8	6.46	7.14	10	5.1
MMSZ4693T1	CY	7.5	7.13	7.88	10	5.7
MMSZ4694T1	CZ	8.2	7.79	8.61	1	6.2
MMSZ4695T1	DC	8.7	8.27	9.14	1	6.6
MMSZ4696T1	DD	9.1	8.65	9.56	1	6.9
MMSZ4697T1	DE	10	9.50	10.50	1	7.6
MMSZ4698T1	DF	11	10.45	11.55	0.05	8.4
MMSZ4699T1	DH	12	11.40	12.60	0.05	9.1
MMSZ4700T1	DJ	13	12.35	13.65	0.05	9.8
MMSZ4701T1	DK	14	13.30	14.70	0.05	10.6
MMSZ4702T1	DM	15	14.25	15.75	0.05	11.4
MMSZ4703T1	DN	16	15.20	16.80	0.05	12.1
MMSZ4704T1	DP	17	16.15	17.85	0.05	12.9
MMSZ4705T1	DT	18	17.10	18.90	0.05	13.6
MMSZ4706T1	DU	19	18.05	19.95	0.05	14.4
MMSZ4707T1	DV	20	19.00	21.00	0.01	15.2
MMSZ4708T1	DA	22	20.90	23.10	0.01	16.7
MMSZ4709T1	DZ	24	22.80	25.20	0.01	18.2
MMSZ4710T1	DY	25	23.75	26.25	0.01	19.00
MMSZ4711T1	EA	27	25.65	28.35	0.01	20.4
MMSZ4712T1	EC	28	26.60	29.40	0.01	21.2
MMSZ4713T1	ED	30	28.50	31.50	0.01	22.8
MMSZ4714T1	EE	33	31.35	34.65	0.01	25.0
MMSZ4715T1	EF	36	34.20	37.80	0.01	27.3
MMSZ4716T1	EH	39	37.05	40.95	0.01	29.6
MMSZ4717T1	EJ	43	40.85	45.15	0.01	32.6

(1) Nominal zener voltage is measured with the device junction in thermal equilibrium at $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$.

(2) All part numbers shown indicate a V_Z tolerance of $\pm 5\%$.

Devices listed in bold, italic are Motorola preferred devices.

Zener Diodes

Table 21. 500 mW Rating on FR-4 or FR-5 Board — Case 425-04 — SOD-123

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted ⁽¹⁾ , ($V_F = 0.9\text{ V Max. @ } I_F = 10\text{ mA}$ for all types)										
Type Number	Marking	Zener Voltage V_{Z1} (Volts) @ $I_{ZT1} = 5\text{ mA}$ (2, 3)			Max Zener Impedance Z_{ZT1} @ $I_{ZT1} = 5\text{ mA}$ (4) Ω	Max Reverse Leakage Current		Zener Voltage V_{Z2} (Volts) @ $I_{ZT2} = 1\text{ mA}$ (3)		Max Zener Impedance Z_{ZT2} @ $I_{ZT1} = 1\text{ mA}$ (4,5) Ω
		Nom	Min	Max		I_R μA	@ V_R Volts	Min	Max	
MMSZ2V4T1	T1	2.4	2.28	2.52	100	50	1	1.7	2.1	600
MMSZ2V7T1	T2	2.7	2.57	2.84	100	20	1	1.9	2.4	600
MMSZ3V0T1	T3	3.0	2.85	3.15	95	10	1	2.1	2.7	600
MMSZ3V3T1	T4	3.3	3.14	3.47	95	5	1	2.3	2.9	600
MMSZ3V6T1	T5	3.6	3.42	3.78	90	5	1	2.7	3.3	600
MMSZ3V9T1	U1	3.9	3.71	4.10	90	3	1	2.9	3.5	600
MMSZ4V3T1	U2	4.3	4.09	4.52	90	3	1	3.3	4.0	600
MMSZ4V7T1	U3	4.7	4.47	4.94	80	3	2	3.7	4.7	500
MMSZ5V1T1	U4	5.1	4.85	5.36	60	2	2	4.2	5.3	480
MMSZ5V6T1	U5	5.6	5.32	5.88	40	1	2	4.8	6.0	400
MMSZ6V2T1	V1	6.2	5.89	6.51	10	3	4	5.6	6.6	150
MMSZ6V8T1	V2	6.8	6.46	7.14	15	2	4	6.3	7.2	80
MMSZ7V5T1	V3	7.5	7.13	7.88	15	1	5	6.9	7.9	80
MMSZ8V2T1	V4	8.2	7.79	8.61	15	0.7	5	7.6	8.7	80
MMSZ9V1T1	V5	9.1	8.65	9.56	15	0.5	6	8.4	9.6	100
MMSZ10T1	A1	10	9.50	10.50	20	0.2	7	9.3	10.6	150
MMSZ11T1	A2	11	10.45	11.55	20	0.1	8	10.2	11.6	150
MMSZ12T1	A3	12	11.40	12.60	25	0.1	8	11.2	12.7	150
MMSZ13T1	A4	13	12.35	13.65	30	0.1	8	12.3	14.0	170
MMSZ15T1	A5	15	14.25	15.75	30	0.05	10.5	13.7	15.5	200
MMSZ16T1	X1	16	15.20	16.80	40	0.05	11.2	15.2	17.0	200
MMSZ18T1	X2	18	17.10	18.90	45	0.05	12.6	16.7	19.0	225
MMSZ20T1	X3	20	19.00	21.00	55	0.05	14	18.7	21.1	225
MMSZ22T1	X4	22	20.80	23.10	55	0.05	15.4	20.7	23.2	250
MMSZ24T1	X5	24	22.80	25.20	70	0.05	16.8	22.7	25.5	250
MMSZ27T1	Y1	27	25.65	28.35	80	0.05	18.9	25	28.9	300
MMSZ30T1	Y2	30	28.50	31.50	80	0.05	21	27.8	32	300
MMSZ33T1	Y3	33	31.35	34.65	80	0.05	23.1	30.8	35	325
MMSZ36T1	Y4	36	34.20	37.80	90	0.05	25.2	33.8	38	350
MMSZ39T1	Y5	39	37.05	40.95	130	0.05	27.3	36.7	41	350
MMSZ43T1	Z1	43	40.85	45.15	150	0.05	30.1	39.7	46	375
MMSZ47T1	Z2	47	44.65	49.35	170	0.05	32.9	43.7	50	375
MMSZ51T1	Z3	51	48.45	53.55	180	0.05	35.7	47.6	54	400
MMSZ56T1	Z4	56	53.20	58.80	200	0.05	39.2	51.5	60	425
MMSZ62T1	Z5	62	58.90	65.10	215	0.05	43.4	57.4	66	450
MMSZ68T1	Z6	68	64.60	71.40	240	0.05	47.6	63.4	72	475
MMSZ75T1	Z7	75	71.25	78.75	255	0.05	52.5	69.4	79	500

(1) Nominal zener voltage is measured with the device junction in thermal equilibrium at $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$.

(2) All part numbers shown indicate a V_Z tolerance of $\pm 5\%$.

(3) Zener voltage is measured with the zener current applied for $PW = 1.0\text{ ms}$.

(4) 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 $I_Z(\text{AC}) = 0.1\text{ I}_Z(\text{DC})$, with the AC frequency = 1 kHz.

(5) The zener impedance, Z_{ZT2} , for the 27 through 75 volt types is tested at 0.5 mA rather than the test current of 0.1 mA used for V_{Z2} .

Devices listed in bold, italic are Motorola preferred devices.

Voltage Reference Diodes

Temperature Compensated Reference Devices

For applications where output voltage must remain within narrow limits during changes in input voltage, load resistance and temperature. Motorola guarantees all reference devices to fall within the specified maximum voltage variations, ΔV_Z , at the specifically indicated test temperatures and test current (JEDEC Standard #5). Temperature coefficient is also specified but should be considered as a reference only — not a maximum rating.

Devices in this table are hermetically sealed structures.

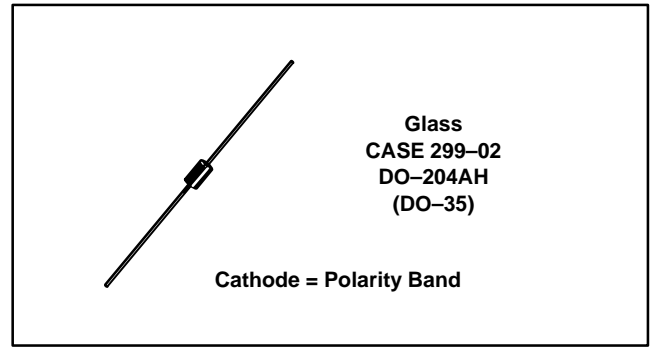


Table 22. Temperature Compensated Reference Devices

V _Z Volts	Test Current mAdc	Test ⁽²⁾ Temp Points	AVERAGE TEMPERATURE COEFFICIENT OVER THE OPERATING RANGE									
			0.01 %/°C		0.005 %/°C		0.002 %/°C		0.001 %/°C		0.0005 %/°C	
			Device Type	ΔV_Z Max Volts	Device Type	ΔV_Z Max Volts	Device Type	ΔV_Z Max Volts	Device Type	ΔV_Z Max Volts	Device Type	ΔV_Z Max Volts
6.2 ⁽¹⁾	7.5	A	1N821	0.096	1N823	0.048	1N825	0.019	1N827	0.009	1N829	0.005
6.2 ⁽¹⁾	7.5	A	1N821A	0.096	1N823A	0.048	1N825A	0.019	1N827A	0.009	1N829A	0.005

(1) Non-suffix — Z_{ZT} = 15 ohms, "A" Suffix — Z_{ZT} = 10 ohms

(2) Test Temperature Points °C: A = -55, 0, +25, +75, +100

Current Regulator Diodes

High impedance diodes whose "constant current source" characteristic complements the "constant voltage" of the zener line. Currents are available from 0.22 to 4.7 mA, with usable voltage range from a minimum limit of 1.0 to 2.5 Volts, up to a voltage compliance of 100 Volts, for the 1N5283 series.

Table 23. Current Regulator Diodes

ELECTRICAL CHARACTERISTICS (T _A = 25°C unless otherwise noted)						
Type No.	Regulator Current I _P (mA) @ V _T = 25 V			Minimum Dynamic Impedance @ V _T = 25 V Z _T (MΩ)	Minimum Knee Impedance @ V _K = 6.0 V Z _K (MΩ)	Maximum Limiting Voltage @ I _L = 0.8 I _P (min) V _L (Volts)
	Nom	Min	Max			
1N5283	0.22	0.198	0.242	25.0	2.75	1.00
1N5287	0.33	0.297	0.363	6.6	1.35	1.00
1N5297	1.00	0.900	1.100	0.800	0.205	1.35
1N5298	1.00	0.900	1.210	0.700	0.180	1.40
1N5305	2.00	1.80	2.20	0.395	0.061	1.85
1N5309	3.00	2.70	3.30	0.300	0.029	2.25
1N5310	3.30	2.97	3.63	0.280	0.024	2.35
1N5311	3.60	3.24	3.96	0.265	0.020	2.50
1N5312	3.90	3.51	4.29	0.255	0.017	2.60
1N5313	4.30	3.87	4.73	0.245	0.014	2.75
1N5314	4.70	4.23	5.17	0.235	0.012	2.90

Devices listed in bold, italic are Motorola preferred devices.