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TECHNICAL DATA

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T-11-23

Zener Overvoltage Transient Suppressors

P6SMB6.8,A thru P6SMB200,A

PLASTIC SURFACE MOUNT ZENER OVERVOLTAGE TRANSIENT SUPPRESSORS 6.8–200 VOLTS 600 WATT PEAK POWER 3.0 WATTS STEADY STATE

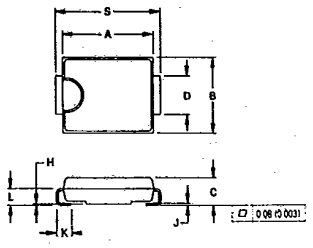
The P6SMB6.8 series is designed to protect voltage sensitive components from high voltage, high energy transients. They have excellent clamping capability, high surge capability, low zener impedance and fast response time. The P6SMB6.8 series is supplied in Motorola's exclusive, cost-effective, highly reliable surmetic axial leaded package and is ideally suited for use in communication systems, numerical controls, process controls, medical equipment, business machines, power supplies and many other industrial/consumer applications.

- Standard Zener Voltage Range — 6.8 to 200 V
- Peak Power — 600 Watts @ 1.0 ms
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5.0 μA Above 10 V
- Maximum Temperature Coefficient Specified
- Available in Tape and Reel

CASE 403A-01

Mechanical Characteristics:
CASE: Void-free transfer-molded, thermosetting plastic
FINISH: All external surfaces are corrosion resistant and leads are readily solderable and weldable
POLARITY: Cathode indicated by molded polarity notch. When operated in zener mode, will be positive with respect to anode.
MOUNTING POSITION: Any
LEADS: Modified L-Bend providing more contact area to bond pad
MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES: 230°C for 10 seconds

OUTLINE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.20	4.44	0.165	0.175
B	3.43	3.68	0.135	0.145
C	2.01	2.26	0.079	0.089
D	1.91	2.15	0.075	0.085
H	0.013	0.101	0.0005	0.0040
J	0.11	0.25	0.004	0.010
K	1.02	1.27	0.040	0.050
L	1.22	1.47	0.048	0.058
S	5.29	5.53	0.208	0.218

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation (1) @ $T_L \leq 25°C$	P_{PK}	600	Watts
Steady State Power Dissipation @ $T_L \leq 75°C$	P_D	3.0	Watts
Derated above $T_L = 75°C$		50	mW/°C
Forward Surge Current (2) @ $T_A = 25°C$	I_{FSM}	100	Amps
Operating and Storage Temperature Range	T_J, T_{stg}	−65 to +175	°C

NOTES: 1. Non-Repetitive Current Pulse per Figure 2.
2. 1/2 Square Wave (or equivalent), PW = 8.3 ms, Duty Cycle = 4 Pulses per minute maximum.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V max, I_F** = 100 A for all types.

Device	Breakdown Voltage* 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						
P6SMB6.8	6.12	6.8	7.48	10	5.50	1000	56	10.8	0.057	V68
P6SMB6.8A	6.45	6.8	7.14	10	5.80	1000	57	10.5	0.057	A68
P6SMB7.5	6.75	7.5	8.25	10	6.05	500	51	11.7	0.061	V75
P6SMB7.5A	7.13	7.5	7.88	10	6.40	500	53	11.3	0.061	A75
P6SMB8.2	7.38	8.2	9.02	10	6.63	200	48	12.5	0.065	V82
P6SMB8.2A	7.79	8.2	8.61	10	7.02	200	50	12.1	0.065	A82
P6SMB9.1	8.19	9.1	10.0	1.0	7.37	50	44	13.8	0.068	V91
P6SMB9.1A	8.65	9.1	9.55	1.0	7.78	50	45	13.4	0.068	A91
P6SMB10	9.00	10	11.0	1.0	8.10	10	40	15.0	0.073	1V0
P6SMB10A	9.50	10	10.5	1.0	8.55	10	41	14.5	0.073	1A0
P6SMB11	9.90	11	12.1	1.0	8.92	5.0	37	16.2	0.075	1V1
P6SMB11A	10.5	11	11.6	1.0	9.40	5.0	38	15.6	0.075	1A1
P6SMB12	10.8	12	13.2	1.0	9.72	5.0	35	17.3	0.078	1V2
P6SMB12A	11.4	12	12.6	1.0	10.2	5.0	36	16.7	0.078	1A2
P6SMB13	11.7	13	14.3	1.0	10.5	5.0	32	19.0	0.081	1V3
P6SMB13A	12.4	13	13.7	1.0	11.1	5.0	33	18.2	0.081	1A3
P6SMB15	13.5	15	16.5	1.0	12.1	5.0	27	22.0	0.084	1V5
P6SMB15A	14.3	15	15.8	1.0	12.8	5.0	28	21.2	0.084	1A5
P6SMB16	14.4	16	17.6	1.0	12.9	5.0	26	23.5	0.086	1V6
P6SMB16A	15.2	16	16.8	1.0	13.6	5.0	27	22.5	0.086	1A6
P6SMB18	16.2	18	19.8	1.0	14.5	5.0	23	26.5	0.088	1V8
P6SMB18A	17.1	18	18.9	1.0	15.3	5.0	24	25.2	0.088	1A8
P6SMB20	18.0	20	22.0	1.0	16.2	5.0	21	29.1	0.090	2V0
P6SMB20A	19.0	20	21.0	1.0	17.1	5.0	22	27.7	0.090	2A0
P6SMB22	19.8	22	24.2	1.0	17.8	5.0	19	31.9	0.092	2V2
P6SMB22A	20.9	22	23.1	1.0	18.8	5.0	20	30.6	0.092	2A2
P6SMB24	21.6	24	26.4	1.0	19.4	5.0	17	34.7	0.094	2V4
P6SMB24A	22.8	24	25.2	1.0	20.5	5.0	18	33.2	0.094	2A4
P6SMB27	24.3	27	29.7	1.0	21.8	5.0	15	39.1	0.096	2V7
P6SMB27A	25.7	27	28.4	1.0	23.1	5.0	16	37.5	0.096	2A7
P6SMB30	27.0	30	33.0	1.0	24.3	5.0	14	43.5	0.097	3V0
P6SMB30A	28.5	30	31.5	1.0	25.6	5.0	14.4	41.4	0.097	3A0
P6SMB33	29.7	33	36.3	1.0	26.8	5.0	12.6	47.7	0.098	3V3
P6SMB33A	31.4	33	34.7	1.0	28.2	5.0	13.2	45.7	0.098	3A3
P6SMB36	32.4	36	39.6	1.0	29.1	5.0	11.6	52.0	0.099	3V6
P6SMB36A	34.2	36	37.8	1.0	30.8	5.0	12	49.9	0.099	3A6
P6SMB39	35.1	39	42.9	1.0	31.6	5.0	10.6	56.4	0.100	3V9
P6SMB39A	37.1	39	41.0	1.0	33.3	5.0	11.2	53.9	0.100	3A9
P6SMB43	38.7	43	47.3	1.0	34.8	5.0	9.6	61.9	0.101	4V3
P6SMB43A	40.9	43	45.2	1.0	36.8	5.0	10.1	59.3	0.101	4A3
P6SMB47	42.3	47	51.7	1.0	38.1	5.0	8.9	67.8	0.101	4V7
P6SMB47A	44.7	47	49.4	1.0	40.2	5.0	9.3	64.8	0.101	4A7
P6SMB51	45.9	51	56.1	1.0	41.3	5.0	8.2	73.5	0.102	5V1
P6SMB51A	48.5	51	53.6	1.0	43.6	5.0	8.6	70.1	0.102	5A1
P6SMB56	50.4	56	61.6	1.0	45.4	5.0	7.4	80.5	0.103	5V6
P6SMB56A	53.2	56	68.8	1.0	47.8	5.0	7.8	77.0	0.103	5A6
P6SMB62	55.8	62	68.2	1.0	50.2	5.0	6.8	89.0	0.104	6V2
P6SMB62A	58.9	62	65.1	1.0	53.0	5.0	7.1	85.0	0.104	6A2
P6SMB68	61.2	68	74.8	1.0	55.1	5.0	6.1	98.0	0.104	6V8
P6SMB68A	64.6	68	71.4	1.0	58.1	5.0	6.5	92.0	0.104	6A8
P6SMB75	67.5	75	82.5	1.0	60.7	5.0	5.5	108.0	0.105	7V5
P6SMB75A	71.3	75	78.8	1.0	64.1	5.0	5.8	103.0	0.105	7A5
P6SMB82	73.8	82	90.2	1.0	66.4	5.0	5.1	118.0	0.105	8V2
P6SMB82A	77.9	82	86.1	1.0	70.1	5.0	5.3	113.0	0.105	8A2
P6SMB91	81.9	91	100.0	1.0	73.7	5.0	4.8	131.0	0.106	9V1
P6SMB91A	86.5	91	95.5	1.0	77.8	5.0	4.8	125.0	0.106	9A1

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ELECTRICAL CHARACTERISTICS — continued (T_A = 25°C unless otherwise noted) V_F = 3.5 V max, I_F** = 100 A for all types.

Device	Breakdown Voltage V_{BR} @ I_T Volts Min	Nom	Max	mA	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
P6SMB100	90.0	100	110.0	1.0	81.0	5.0	4.2	144.0	-0.106	10V
P6SMB100A	95.0	100	105.0	1.0	85.5	5.0	4.4	137.0	0.106	10A
P6SMB110	99.0	110	121.0	1.0	89.2	5.0	3.8	158.0	0.107	11V
P6SMB110A	105.0	110	116.0	1.0	94.0	5.0	4.0	152.0	0.107	11A
P6SMB120	108.0	120	132.0	1.0	97.2	5.0	3.5	173.0	0.107	12V
P6SMB120A	114.0	120	126.0	1.0	102.0	5.0	3.6	165.0	0.107	12A
P6SMB130	117.0	130	143.0	1.0	105.0	5.0	3.2	187.0	0.107	13V
P6SMB130A	124.0	130	137.0	1.0	111.0	5.0	3.3	179.0	0.107	13A
P6SMB150	135.0	150	165.0	1.0	121.0	5.0	2.8	215.0	0.108	15V
P6SMB150A	143.0	150	158.0	1.0	128.0	5.0	2.9	207.0	0.108	15A
P6SMB160	144.0	160	176.0	1.0	130.0	5.0	2.6	230.0	0.108	16V
P6SMB160A	152.0	160	168.0	1.0	136.0	5.0	2.7	219.0	0.108	16A
P6SMB170	153.0	170	187.0	1.0	138.0	5.0	2.5	244.0	0.108	17V
P6SMB170A	162.0	170	179.0	1.0	145.0	5.0	2.6	234.0	0.108	17A
P6SMB180	162.0	180	198.0	1.0	146.0	5.0	2.3	258.0	0.108	18V
P6SMB180A	171.0	180	189.0	1.0	154.0	5.0	2.4	246.0	0.108	18A
P6SMB200	180.0	200	220.0	1.0	162.0	5.0	2.1	287.0	0.108	20V
P6SMB200A	190.0	200	210.0	1.0	171.0	5.0	2.2	274.0	0.108	20A

†Surge Current Waveform per Figure 2.
*V_{BR} measured after I_T applied for 300 μs, I_T = Square Wave Pulse or equivalent.
**1/2 Square or Equivalent Sine Wave, PW = 8.3 ms, Duty Cycle = 4 Pulses per minute maximum.

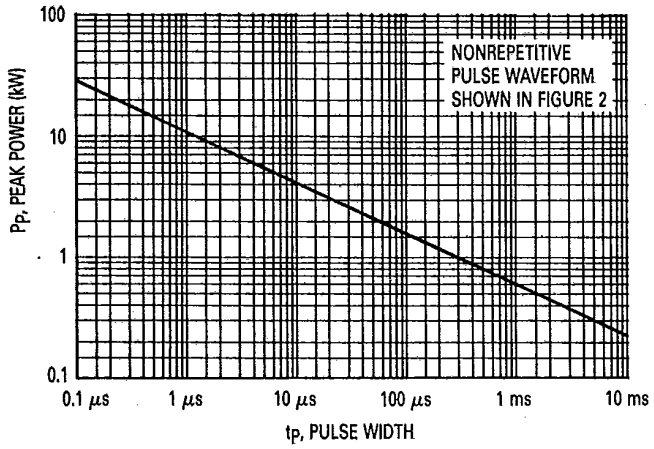

Figure 1. Pulse Rating Curve

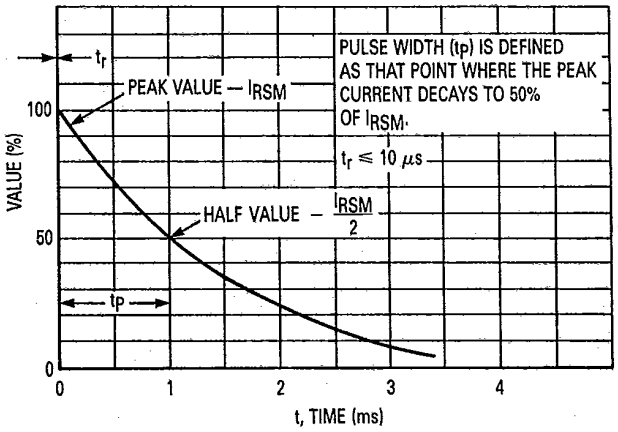

Figure 2. Pulse Waveform

RESPONSE TIME

In most applications, the transient suppressor device is placed in parallel with the equipment or component to be protected. In this situation, there is a time delay associated with the capacitance of the device and an overshoot condition associated with the inductance of the device and the inductance of the connection method. The capacitive effect is of minor importance in the parallel protection scheme because it only produces a time delay in the transition from the operating voltage to the clamp voltage as shown in Figure 3.

The inductive effects in the device are due to actual turn-on time (time required for the device to go from zero current to full current) and lead inductance. This inductive effect produces an overshoot in the voltage across the equipment or component being protected as shown in Figure 4. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. The P6SMB6.8 series has very good response time, typically < 1.0 ns and negligible inductance. However, external inductive effects could produce unacceptable overshoot. Proper circuit layout, minimum lead lengths and placing the suppressor device as close as possible to the equipment or components to be protected will minimize this overshoot.

Some input impedance represented by Z_{in} is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

TYPICAL PROTECTION CIRCUIT

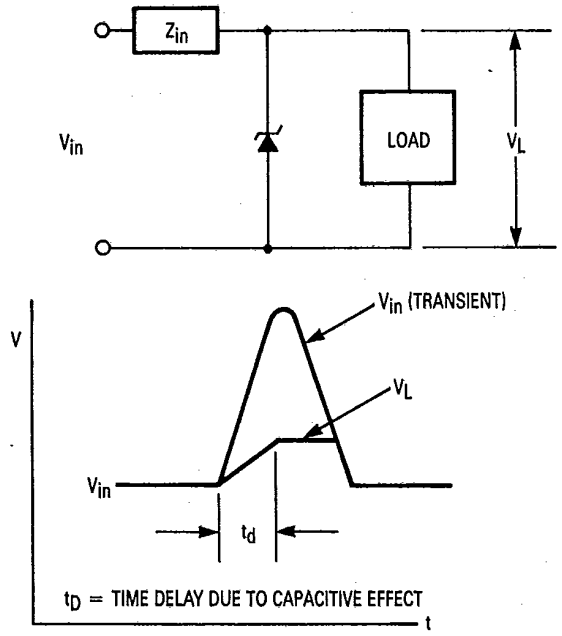

Figure 3.

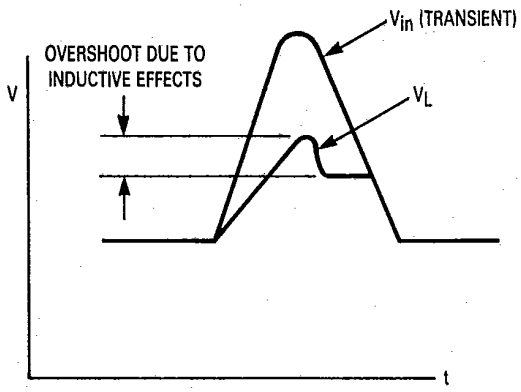

Figure 4.

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