P6KE6.8A through P6KE200A

Zener Transient Voltage Suppressors Undirectional and Bidirectional

The P6KE6.8A 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 P6KE6.8A 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.

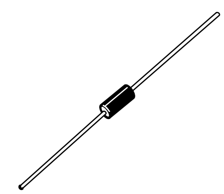
Specification Features:

- Standard Zener Voltage Range — 6.8 to 200 Volts
- Peak Power — 600 Watts @ 1 ms
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5 µA Above 10 Volts
- Maximum Temperature Coefficient Specified
- UL Recognition
- Response Time is Typically < 1 ns

Mechanical Characteristics:

CASE: Void-free, transfer-molded, thermosetting plastic
FINISH: All external surfaces are corrosion resistant and leads are readily solderable
POLARITY: Cathode indicated by polarity band. When operated in zener mode, will be positive with respect to anode
MOUNTING POSITION: Any
WAFER FAB LOCATION: Phoenix, Arizona
ASSEMBLY/TEST LOCATION: Seoul, Korea

**ZENER OVERVOLTAGE TRANSIENT SUPPRESSORS
6.8–200 VOLT
600 WATT PEAK POWER
5 WATTS STEADY STATE**



**CASE 17, Style 1
PLASTIC**

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation (1) @ $T_L \le 25°C$	P_{PK}	600	Watts
Steady State Power Dissipation @ $T_L \le 75°C$, Lead Length = 3/8″ Derated above $T_L = 75°C$	P_D	5 50	Watts 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

Lead Temperature not less than 1/16″ from the case for 10 seconds: 230°C

NOTES: 1. Nonrepetitive current pulse per Figure 4 and derated above $T_A = 25°C$ per Figure 2.
2. 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.

P6KE6.8A through P6KE200A

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V Max, I_F** = 50 A (except bidirectional devices).

Device	Breakdown Voltage*				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)
	V_{BR} (Volts)			@ I_T (mA)					
	Min	Nom	Max						
P6KE6.8A	6.45	6.8	7.14	10	5.8	1000	57	10.5	0.057
P6KE7.5A	7.13	7.5	7.88	10	6.4	500	53	11.3	0.061
P6KE8.2A	7.79	8.2	8.61	10	7.02	200	50	12.1	0.065
P6KE9.1A	8.65	9.1	9.55	1	7.78	50	45	13.4	0.068
P6KE10A	9.5	10	10.5	1	8.55	10	41	14.5	0.073
P6KE11A	10.5	11	11.6	1	9.4	5	38	15.6	0.075
P6KE12A	11.4	12	12.6	1	10.2	5	36	16.7	0.078
P6KE13A	12.4	13	13.7	1	11.1	5	33	18.2	0.081
P6KE15A	***14.3***	***15***	***15.8***	***1***	***12.8***	***5***	***28***	***21.2***	***0.084***
P6KE16A	15.2	16	16.8	1	13.6	5	27	22.5	0.086
P6KE18A	17.1	18	18.9	1	15.3	5	24	25.2	0.088
P6KE20A	19	20	21	1	17.1	5	22	27.7	0.09
P6KE22A	20.9	22	23.1	1	18.8	5	20	30.6	0.092
P6KE24A	22.8	24	25.2	1	20.5	5	18	33.2	0.094
P6KE27A	25.7	27	28.4	1	23.1	5	16	37.5	0.096
P6KE30A	28.5	30	31.5	1	25.6	5	14.4	41.4	0.097
P6KE33A	31.4	33	34.7	1	28.2	5	13.2	45.7	0.098
P6KE36A	34.2	36	37.8	1	30.8	5	12	49.9	0.099
P6KE39A	37.1	39	41	1	33.3	5	11.2	53.9	0.1
P6KE43A	40.9	43	45.2	1	36.8	5	10.1	59.3	0.101
P6KE47A	44.7	47	49.4	1	40.2	5	9.3	64.8	0.101
P6KE51A	48.5	51	53.6	1	43.6	5	8.6	70.1	0.102
P6KE56A	53.2	56	58.8	1	47.8	5	7.8	77	0.103
P6KE62A	58.9	62	65.1	1	53	5	7.1	85	0.104
P6KE68A	64.6	68	71.4	1	58.1	5	6.5	92	0.104
P6KE75A	71.3	75	78.8	1	64.1	5	5.8	103	0.105
P6KE82A	77.9	82	86.1	1	70.1	5	5.3	113	0.105
P6KE91A	86.5	91	95.5	1	77.8	5	4.8	125	0.106
P6KE100A	95	100	105	1	85.5	5	4.4	137	0.106
P6KE110A	105	110	116	1	94	5	4	152	0.107
P6KE120A	114	120	126	1	102	5	3.6	165	0.107
P6KE130A	124	130	137	1	111	5	3.3	179	0.107
P6KE150A	143	150	158	1	128	5	2.9	207	0.108
P6KE160A	152	160	168	1	136	5	2.7	219	0.108
P6KE170A	162	170	179	1	145	5	2.6	234	0.108
P6KE180A	171	180	189	1	154	5	2.4	246	0.108
P6KE200A	190	200	210	1	171	5	2.2	274	0.108

* V_{BR} measured after I_T applied for 300 μs, I_T = square wave pulse or equivalent.
** 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.
† Surge current waveform per Figure 4 and derate per Figure 2.

FOR BIDIRECTIONAL APPLICATIONS —
USE CA SUFFIX for P6KE6.8CA through P6KE200CA.
Electrical characteristics apply in both directions.

Preferred Bidirectional Devices —

P6KE7.5CA	**P6KE11CA**	**P6KE20CA**
P6KE22CA	**P6KE27CA**	**P6KE30CA**

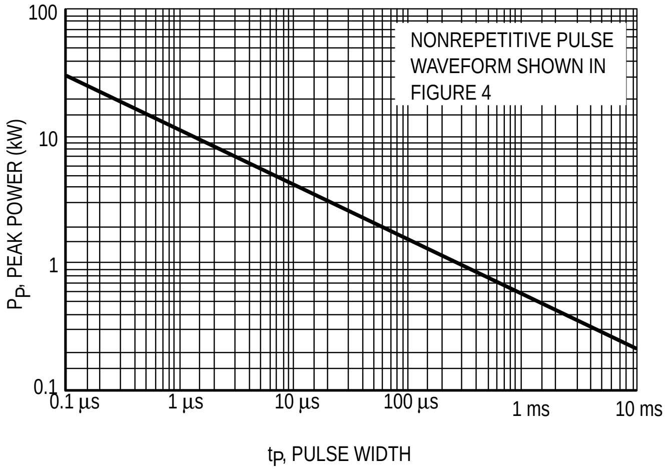


Figure 1. Pulse Rating Curve

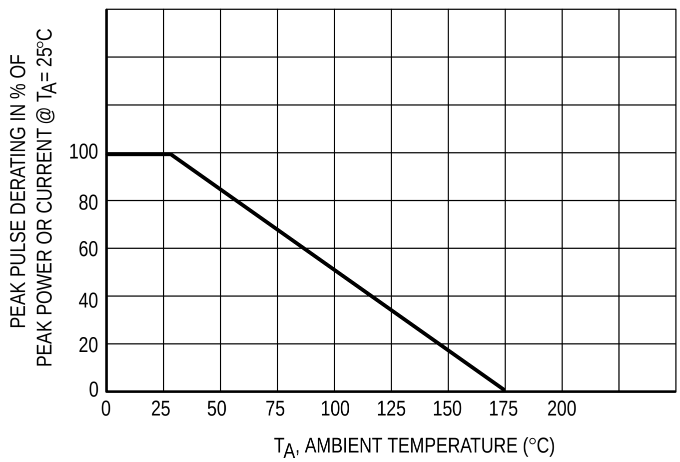


Figure 2. Pulse Derating Curve

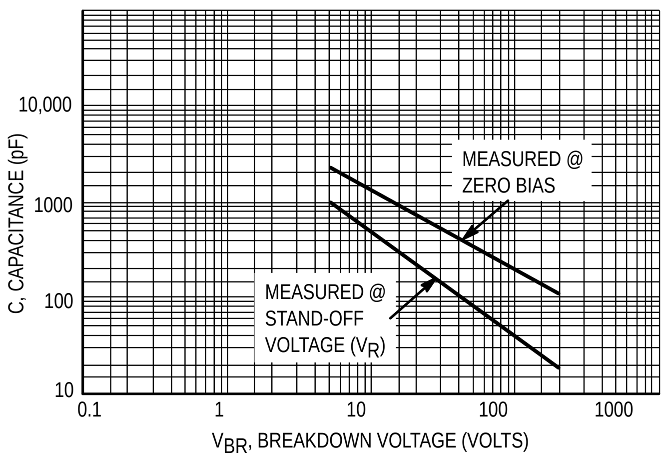


Figure 3. Capacitance versus Breakdown Voltage

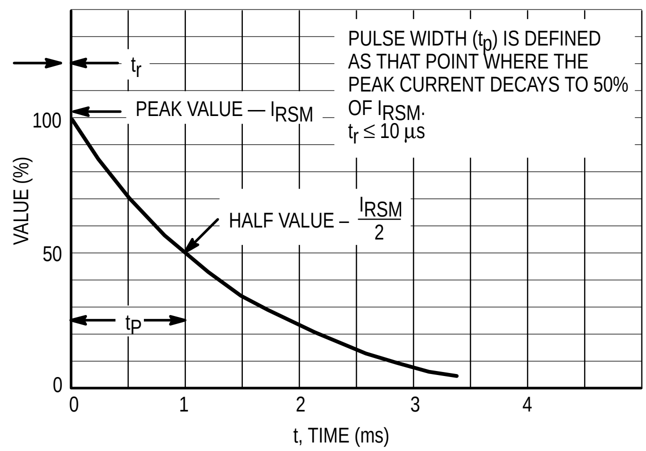


Figure 4. Pulse Waveform

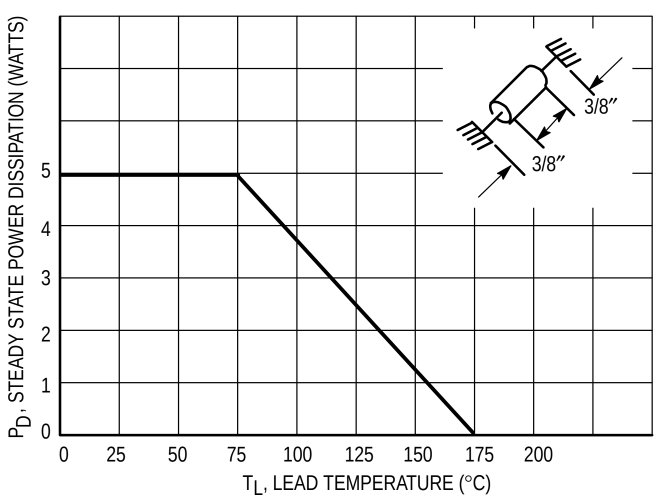


Figure 5. Steady State Power Derating

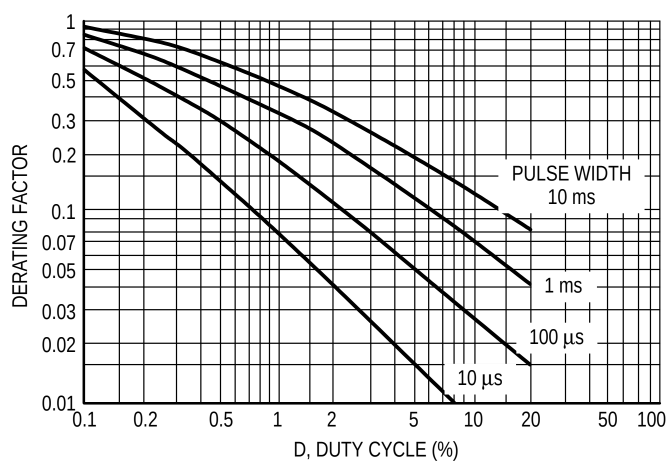


Figure 6. Typical Derating Factor for Duty Cycle

Devices listed in bold, italic are Motorola preferred devices.

APPLICATION NOTES

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 capacitance 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 A.

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 B. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. The P6KE6.8A series has very good response time, typically < 1 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.

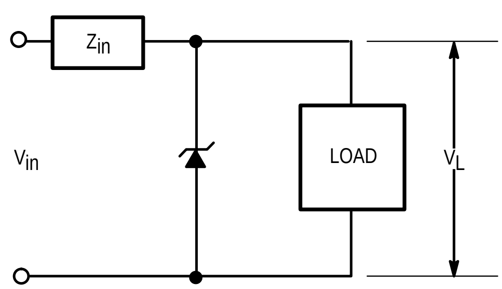
Some input impedance represented by Z_{in} is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

DUTY CYCLE DERATING

The data of Figure 1 applies for non-repetitive conditions and at a lead temperature of 25°C. If the duty cycle increases, the peak power must be reduced as indicated by the curves of Figure 6. Average power must be derated as the lead or ambient temperature rises above 25°C. The average power derating curve normally given on data sheets may be normalized and used for this purpose.

At first glance the derating curves of Figure 6 appear to be in error as the 10 ms pulse has a higher derating factor than the 10 µs pulse. However, when the derating factor for a given pulse of Figure 6 is multiplied by the peak power value of Figure 1 for the same pulse, the results follow the expected trend.

TYPICAL PROTECTION CIRCUIT



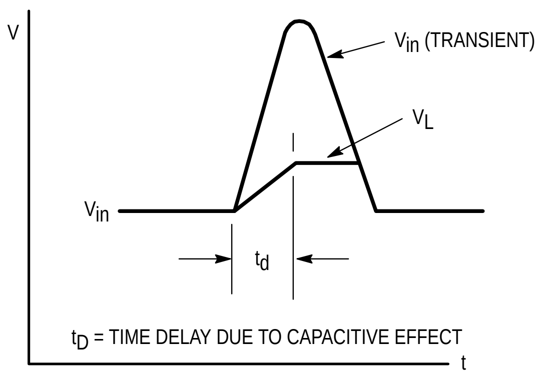


Figure 7.

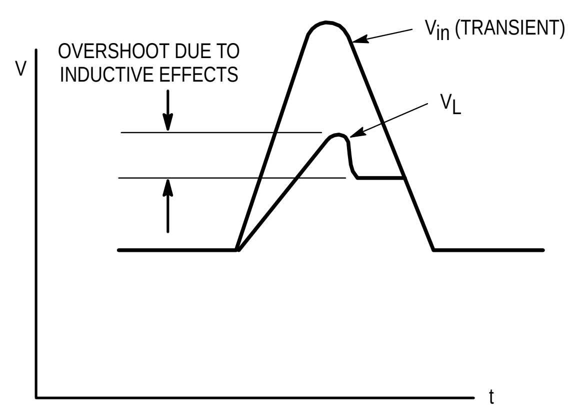


Figure 8.

UL RECOGNITION

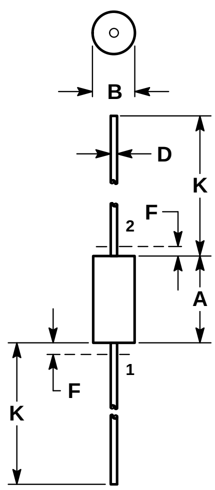
The entire series including the bidirectional CA suffix has *Underwriters Laboratory Recognition* for the classification of protectors (QVGV2) under the UL standard for safety 497B and File #E 116110. Many competitors only have one or two devices recognized or have recognition in a non-protective category. Some competitors have no recognition at all. With the UL497B recognition, our parts successfully passed several tests including Strike Voltage Breakdown test, Endurance Conditioning, Temperature test, Dielectric Voltage-Withstand test, Discharge test and several more.

Whereas, some competitors have only passed a flammability test for the package material, we have been recognized for much more to be included in their protector category.

Devices listed in bold, italic are Motorola preferred devices.

Transient Voltage Suppressors — Axial Leaded

600 Watt Peak Power



NOTE:
1. LEAD DIAMETER & FINISH NOT CONTROLLED WITHIN DIM F.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.330	0.350	8.38	8.89
B	0.130	0.145	3.30	3.68
D	0.037	0.043	0.94	1.09
F	—	0.050	—	1.27
K	1.000	1.250	25.40	31.75

STYLE 1:
PIN 1. ANODE
2. CATHODE

CASE 17-02
PLASTIC

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

MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	RL	4K
Tape and Ammo	TA	2K

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

Literature Distribution Centers:
USA: Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036.
EUROPE: Motorola Ltd.; European Literature Centre; 88 Tanners Drive, Blakelands, Milton Keynes, MK14 5BP, England.
JAPAN: Nippon Motorola Ltd.; 4-32-1, Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan.
ASIA PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Center, No. 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.