P6KE6.8A Series

600 Watt Peak Power Surmetic™-40 Transient Voltage Suppressors

Unidirectional*

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 and fast response time. These devices are ON Semiconductor'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.

Features:

- Working Peak Reverse Voltage Range − 5.8 to 171 V
- Peak Power − 600 W @ 1 ms
- ESD Rating of Class 3 (>16 KV) per Human Body Model
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5 μA above 10 V
- Maximum Temperature Coefficient Specified
- UL 497B for Isolated Loop Circuit Protection
- Response Time is Typically < 1 ns
- Pb−Free Packages are Available*

Mechanical Characteristics:

CASE: Void-free, Transfer-molded, Thermosetting plastic

FINISH: All external surfaces are corrosion resistant and leads are readily solderable

MAXIMUM LEAD TEMPERATURE FOR SOLDERING: 260°C, 1/16″ from the case for 10 seconds

POLARITY: Cathode indicated by polarity band

MOUNTING POSITION: Any

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation (Note 1) @ $T_L \le 25°C$	P_{PK}	600	W
Steady State Power Dissipation @ $T_L \le 25°C$, Lead Length = 3/8 in Derated above $T_L = 50°C$	P_D	5.0 50	W mW/°C
Thermal Resistance, Junction−to−Lead	$R_{\theta JL}$	20	°C/W
Forward Surge Current (Note 2) @ $T_A = 25°C$	I_{FSM}	100	A
Operating and Storage Temperature Range	T_J, T_{stg}	− 55 to +150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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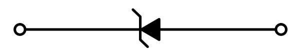
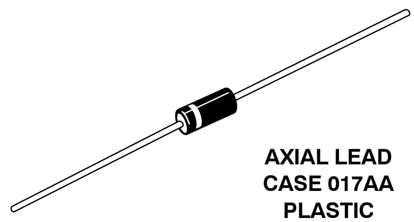
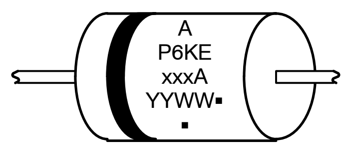
http://onsemi.com





AXIAL LEAD
CASE 017AA
PLASTIC

MARKING DIAGRAM



A	=	Assembly Location
P6KExxxA	=	Device Number
YY	=	Year
WW	=	Work Week
▪	=	Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
P6KExxxA	Axial Lead	1000 Units / Box
P6KExxxAG	Axial Lead (Pb−Free)	1000 Units / Box
P6KExxxARL	Axial Lead	4000/Tape & Reel
P6KExxxARLG	Axial Lead (Pb−Free)	4000/Tape & Reel

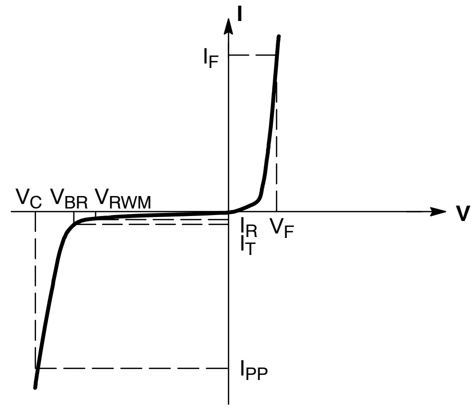
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

October, 2009 − Rev. 10

Publication Order Number:
P6KE6.8A/D

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 3.5 V Max. @ I_F (Note 6) = 50 A)

Symbol	Parameter
I_{PP}	Maximum Reverse Peak Pulse Current
V_C	Clamping Voltage @ I_{PP}
V_{RWM}	Working Peak Reverse Voltage
I_R	Maximum Reverse Leakage Current @ V_{RWM}
V_{BR}	Breakdown Voltage @ I_T
I_T	Test Current
ΘV_{BR}	Maximum Temperature Coefficient of V_{BR}
I_F	Forward Current
V_F	Forward Voltage @ I_F



Uni-Directional TVS

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 3.5 V Max. @ I_F (Note 6) = 50 A)

Device*	Device Marking	V_{RWM} (Note 3)	I_R @ V_{RWM}	Breakdown Voltage V_{BR} (Note 4) (V)			@ I_T	V_C @ I_{PP} (Note 5)		ΘV_{BR}
		V	μA	Min	Nom	Max	mA	V_C V	I_{PP} A	%/°C
P6KE6.8A, G	P6KE6.8A	5.8	1000	6.45	6.80	7.14	10	10.5	57	0.057
P6KE7.5ARLG	P6KE7.5A	6.4	500	7.13	7.51	7.88	10	11.3	53	0.061
P6KE10AG	P6KE10A	8.55	10	9.5	10	10.5	1	14.5	41	0.073
P6KE12A, G	P6KE12A	10.2	5	11.4	12	12.6	1	16.7	36	0.078
P6KE13AG	P6KE13A	11.1	5	12.4	13.05	13.7	1	18.2	33	0.081
P6KE15AG	P6KE15A	12.8	5	14.3	15.05	15.8	1	21.2	28	0.084
P6KE16A, G	P6KE16A	13.6	5	15.2	16	16.8	1	22.5	27	0.086
P6KE18AG	P6KE18A	15.3	5	17.1	18	18.9	1	25.2	24	0.088
P6KE20ARLG	P6KE20A	17.1	5	19	20	21	1	27.7	22	0.09
P6KE22ARLG	P6KE22A	18.8	5	20.9	22	23.1	1	30.6	20	0.092
P6KE24ARLG	P6KE24A	20.5	5	22.8	24	25.2	1	33.2	18	0.094
P6KE27ARLG	P6KE27A	23.1	5	25.7	27.05	28.4	1	37.5	16	0.096
P6KE30ARLG	P6KE30A	25.6	5	28.5	30	31.5	1	41.4	14.4	0.097
P6KE33AG	P6KE33A	28.2	5	31.4	33.05	34.7	1	45.7	13.2	0.098
P6KE36AG	P6KE36A	30.8	5	34.2	36	37.8	1	49.9	12	0.099
P6KE39AG	P6KE39A	33.3	5	37.1	39.05	41	1	53.9	11.2	0.1
P6KE43AG	P6KE43A	36.8	5	40.9	43.05	45.2	1	59.3	10.1	0.101
P6KE47AG	P6KE47A	40.2	5	44.7	47.05	49.4	1	64.8	9.3	0.101
P6KE51AG	P6KE51A	43.6	5	48.5	51.05	53.6	1	70.1	8.6	0.102
P6KE56AG	P6KE56A	47.8	5	53.2	56	58.8	1	77	7.8	0.103
P6KE62ARLG	P6KE62A	53	5	58.9	62	65.1	1	85	7.1	0.104
P6KE68AG	P6KE68A	58.1	5	64.6	68	71.4	1	92	6.5	0.104
P6KE75ARLG	P6KE75A	64.1	5	71.3	75.05	78.8	1	103	5.8	0.105
P6KE82ARLG	P6KE82A	70.1	5	77.9	82	86.1	1	113	5.3	0.105
P6KE91ARLG	P6KE91A	77.8	5	86.5	91	95.5	1	125	4.8	0.106
P6KE100ARLG	P6KE100A	85.5	5	95	100	105	1	137	4.4	0.106
P6KE120ARLG	P6KE120A	102	5	114	120	126	1	165	3.6	0.107
P6KE130AG	P6KE130A	111	5	124	130.5	137	1	179	3.3	0.107
P6KE150AG	P6KE150A	128	5	143	150.5	158	1	207	2.9	0.108
P6KE160ARLG	P6KE160A	136	5	152	160	168	1	219	2.7	0.108
P6KE180ARLG	P6KE180A	154	5	171	180	189	1	246	2.4	0.108
P6KE200A, G	P6KE200A	171	5	190	200	210	1	274	2.2	0.108

3. A transient suppressor is normally selected according to the maximum working peak reverse voltage (V_{RWM}), which should be equal to or greater than the dc or continuous peak operating voltage level.
4. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C
5. Surge current waveform per Figure 4 and derate per Figures 1 and 2.
6. 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.

*The “G” suffix indicates Pb−Free package or Pb−Free Packages are available.

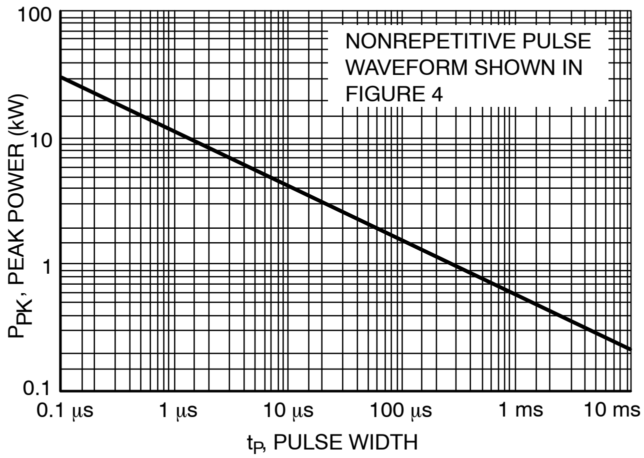


Figure 1. Pulse Rating Curve

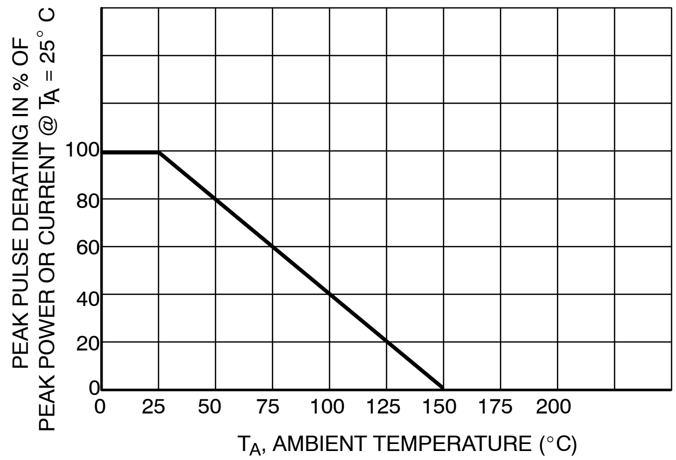


Figure 2. Pulse Derating Curve

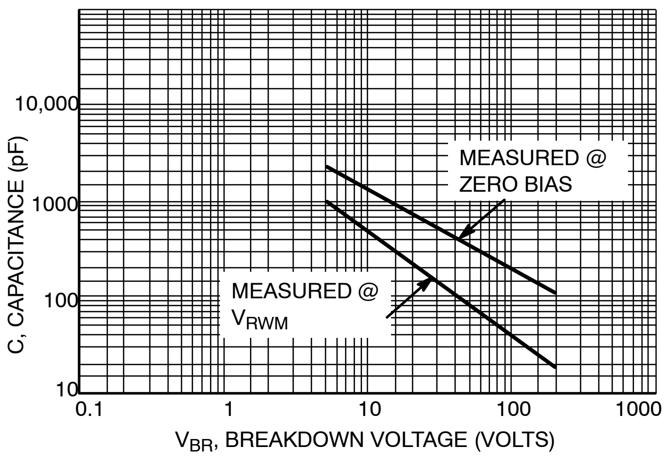


Figure 3. Capacitance versus Breakdown Voltage

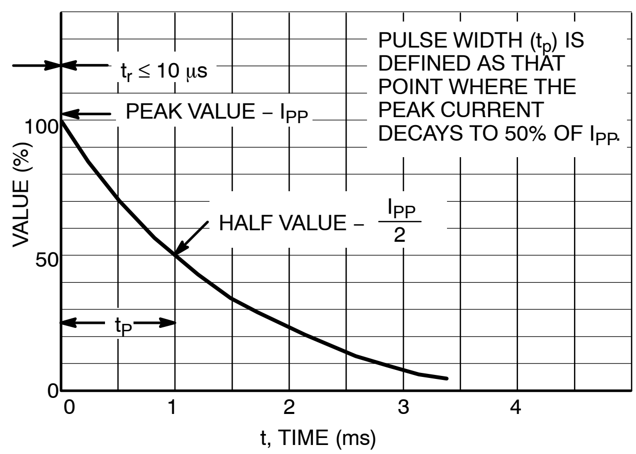


Figure 4. Pulse Waveform

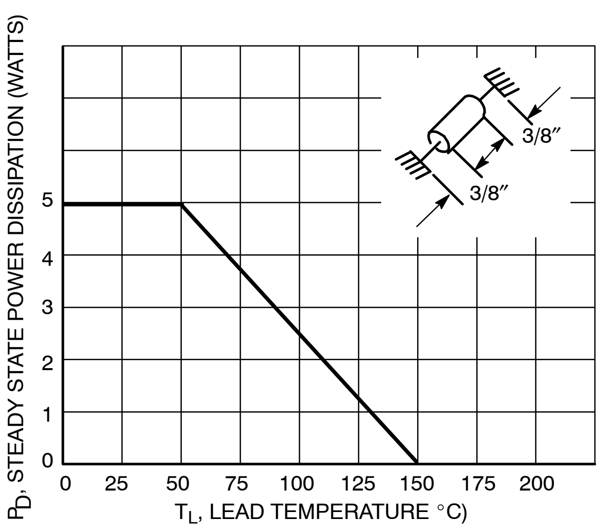


Figure 5. Steady State Power Derating

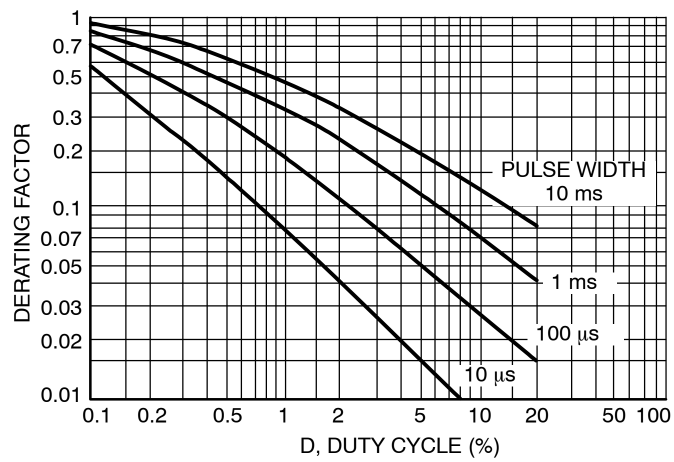


Figure 6. Typical Derating Factor for Duty Cycle

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 7.

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 8. 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.

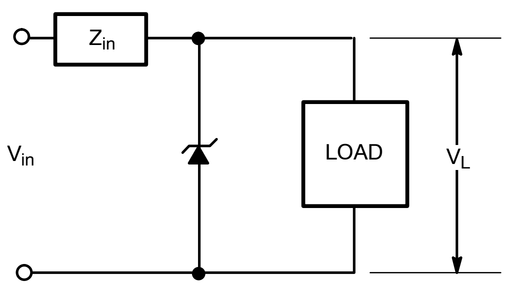
Some input impedance represented by Z_{in} is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

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



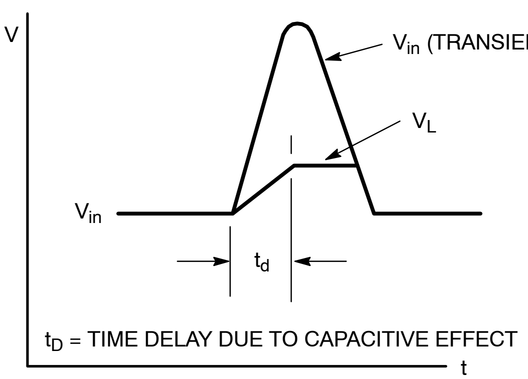


Figure 7.

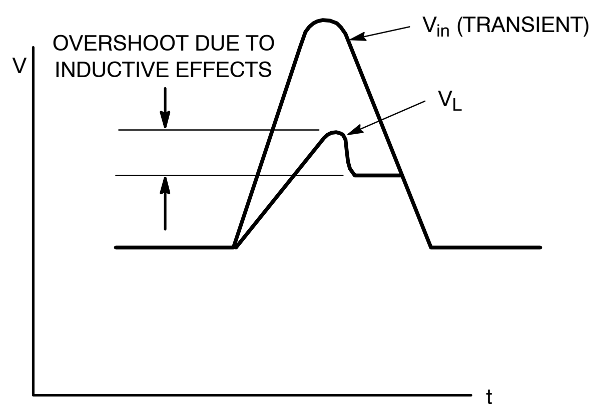


Figure 8.

UL RECOGNITION*

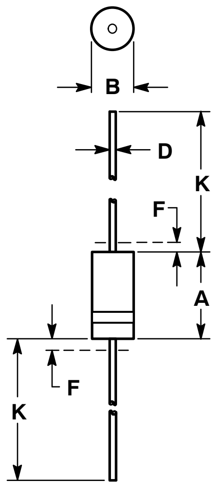
The entire series including the bidirectional CA suffix has *Underwriters Laboratory Recognition* for the classification of protectors (QVGQ2) under the UL standard for safety 497B and File #E210057. Many competitors only have one or two devices recognized or have recognition in a non-protective category. 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.

*Applies to P6KE6.8A – P6KE200A.

PACKAGE DIMENSIONS

SURMETIC 40, AXIAL LEAD
CASE 017AA−01
ISSUE O



NOTES:
1. CONTROLLING DIMENSION: INCH
2. LEAD DIAMETER AND FINISH NOT CONTROLLED WITHIN DIMENSION F.
3. CATHODE BAND INDICATES POLARITY

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
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Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative