



5,000 Watt Transient Voltage Suppressor (TVS) Protection Device



DESCRIPTION

This RoHS compliant transient voltage suppressor series 5KP5.0e3 - 5KP250CAe3 provides a range of standoff voltage options from 5.0 to 250V in both unidirectional and bidirectional options. Clamping action is almost instantaneous. As a result, they provide effective protection from ESD and EFT per IEC61000-4-2 and IEC61000-4-4, as well as transients caused by inductive switching and RFI. They also protect from secondary lightning effects per 61000-4-5 at the class levels specified below.

Important: For the latest information, visit our website <http://www.microsemi.com>.

FEATURES

- Available in both unidirectional and bidirectional configurations
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant

APPLICATIONS / BENEFITS

- Selections for 5.0 to 250 volts stand-off voltage (V_{WM})
- Economical TVS series for thru-hole mounting
- Pico- to nano-second response time
- Protection from transients caused by inductive switching and RFI
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:
 - Class 1, 2, 3, 4: 5KP5.0 to 5KP110CA
 - Class 5: 5KP5.0 to 5KP110CA (short distance)
 - Class 5: 5KP5.0 to 5KP36CA (long distance)
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
 - Class 1 & 2: 5KP5.0 to 5KP110CA
 - Class 3: 5KP5.0 to 5KP78CA
 - Class 4: 5KP5.0 to 5KP40CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
 - Class 2: 5KP5.0 to 5KP70CA
 - Class 3: 5KP5.0 to 5KP36CA
 - Class 4: 5KP5.0 to 5KP18CA



P600 Package

Also available in:

**Case 5A (DO-204AR)
package**

(hirel plastic axial-leaded)

 [M5KP5.0A – M5KP110CA](#)

DO-13 package

(metal axial-leaded)

 [LC6.5A – LC170A](#)

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MAXIMUM RATINGS @ 25 °C unless otherwise noted

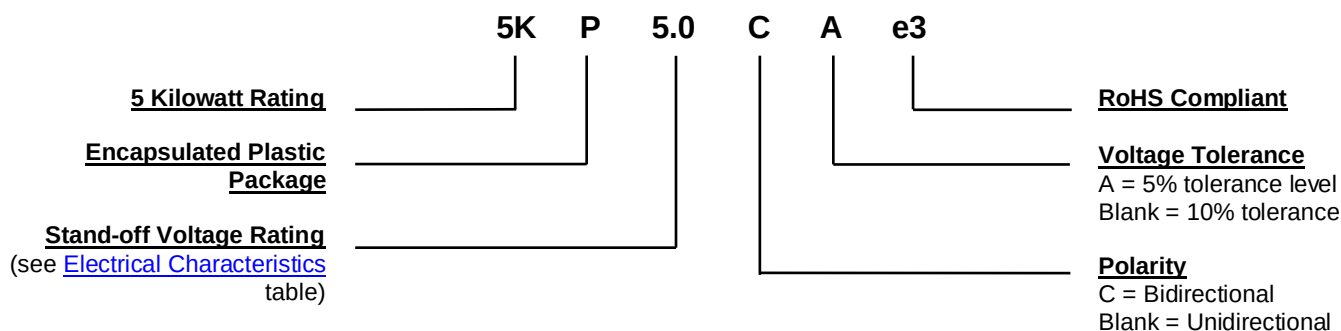
Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	T_J and T_{STG}	-55 to +175	°C
Thermal Resistance, Junction to Lead @ 0.375 inch (9.5 mm) lead length from body	$R_{\theta JL}$	8.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W
Peak Pulse Power Dissipation 10/1000 μ s	P_{PP}	5000	W
Rated Average Power Dissipation @ $T_L = 75$ °C 0.375 inch (9.5 mm) from body ⁽¹⁾	$P_{M(AV)}$	8.0	W
Surge Peak Forward Current ⁽²⁾	I_{FSM}	500	A
Solder Temperature @ 10 s		260	°C

Notes: 1. When mounted as shown in [Figure 5](#)

2. Measured on 8.3ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

MECHANICAL and PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- TERMINALS: RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750, method 2026.
- MARKING: Manufacturer, date code, part number, polarity and tolerance suffixes
- POLARITY: For unidirectional types the color band denotes the cathode, which is positive with respect to the anode under normal TVS operation.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 2.1 grams
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE


SYMBOLS & DEFINITIONS	
Symbol	Definition
$\alpha_{V(BR)}$	Temperature Coefficient of Breakdown Voltage: The change in breakdown voltage divided by the change in temperature that caused it expressed in $\%/^{\circ}\text{C}$ or $\text{mV}/^{\circ}\text{C}$.
I_D	Standby Current: The current through the device at rated stand-off voltage.
I_{PP}	Peak Impulse Current: The maximum rated random recurring peak impulse current or nonrepetitive peak impulse current that may be applied to a device. A random recurring or nonrepetitive transient current is usually due to an external cause, and it is assumed that its effect will have completely disappeared before the next transient arrives.
P_{PP}	Peak Pulse Power. The rated random recurring peak impulse power or rated nonrepetitive peak impulse power. The impulse power is the maximum-rated value of the product of I_{PP} and V_C .
$V_{(BR)}$	Breakdown Voltage: The voltage across the device at a specified current $I_{(BR)}$ in the breakdown region.
V_C	Clamping Voltage: The voltage across the device in a region of low differential resistance during the application of an impulse current (I_{PP}) for a specified waveform.
V_{WM}	Working Standoff Voltage: The maximum-rated value of dc or repetitive peak positive cathode-to-anode voltage that may be continuously applied over the standard operating temperature.

ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise stated

DEVICE NUMBER	BREAKDOWN VOLTAGE ⁽¹⁾ V _(BR) @ I _T		TEST CURRENT I _T	WORKING STAND-OFF VOLTAGE V _{WM}	MAXIMUM STANDBY CURRENT ⁽³⁾ I _D @ V _{WM}	MAXIMUM PEAK PULSE CURRENT ⁽²⁾ I _{PP}	MAXIMUM CLAMPING VOLTAGE V _C @ I _{PP}	MAXIMUM TEMPERATURE COEFFICIENT OF V _(BR) α _{V(BR)}
	Min	Max						
	Volts	mA						
5KP5.0e3 / 5KP5.0Ce3	6.40	7.30	50	5.0	5000	521	9.6	0.057
5KP5.0Ae3 / 5KP5.0CAe3	6.40	7.00	50	5.0	5000	543	9.2	0.057
5KP6.0e3 / 5KP6.0Ce3	6.67	8.15	50	6.0	5000	439	11.4	0.061
5KP6.0Ae3 / 5KP6.0CAe3	6.67	7.37	50	6.0	5000	485	10.3	0.061
5KP6.5e3 / 5KP6.5Ce3	7.22	8.82	50	6.5	2000	407	12.3	0.065
5KP6.5Ae3 / 5KP6.5CAe3	7.22	7.98	50	6.5	2000	446	11.2	0.065
5KP7.0e3 / 5KP7.0Ce3	7.78	9.51	50	7.0	1000	376	13.3	0.068
5KP7.0Ae3 / 5KP7.0CAe3	7.78	8.60	50	7.0	1000	417	12.0	0.068
5KP7.5e3 / 5KP7.5Ce3	8.33	10.2	5	7.5	250	350	14.3	0.073
5KP7.5Ae3 / 5KP7.5CAe3	8.33	9.21	5	7.5	250	388	12.9	0.073
5KP8.0e3 / 5KP8.0Ce3	8.89	10.9	5	8.0	150	333	15.0	0.075
5KP8.0Ae3 / 5KP8.0CAe3	8.89	9.83	5	8.0	150	368	13.6	0.075
5KP8.5e3 / 5KP8.5Ce3	9.44	11.5	5	8.5	50	314	15.9	0.078
5KP8.5Ae3 / 5KP8.5CAe3	9.44	10.4	5	8.5	50	347	14.4	0.078
5KP9.0e3 / 5KP9.0Ce3	10.0	12.2	5	9.0	20	296	16.9	0.081
5KP9.0Ae3 / 5KP9.0CAe3	10.0	11.1	5	9.0	20	325	15.4	0.081
5KP10e3 / 5KP10Ce3	11.1	13.6	5	10	15	266	18.8	0.084
5KP10Ae3 / 5KP10CAe3	11.1	12.3	5	10	15	294	17.0	0.084
5KP11e3 / 5KP11Ce3	12.2	14.9	5	11	10	249	20.1	0.086
5KP11Ae3 / 5KP11CAe3	12.2	13.5	5	11	10	275	18.2	0.086
5KP12e3 / 5KP12Ce3	13.3	16.3	5	12	5	227	22.0	0.088
5KP12Ae3 / 5KP12CAe3	13.3	14.7	5	12	5	251	19.9	0.088
5KP13e3 / 5KP13Ce3	14.4	17.6	5	13	2	210	23.8	0.090
5KP13Ae3 / 5KP13CAe3	14.4	15.9	5	13	2	233	21.5	0.090
5KP14e3 / 5KP14Ce3	15.6	19.1	5	14	2	194	25.8	0.092
5KP14Ae3 / 5KP14CAe3	15.6	17.2	5	14	2	216	23.2	0.092
5KP15e3 / 5KP15Ce3	16.7	20.4	5	15	2	186	26.9	0.094
5KP15Ae3 / 5KP15CAe3	16.7	18.5	5	15	2	205	24.4	0.094
5KP16e3 / 5KP16Ce3	17.8	21.8	5	16	2	174	28.8	0.096
5KP16Ae3 / 5KP16CAe3	17.8	19.7	5	16	2	192	26.0	0.096
5KP17e3 / 5KP17Ce3	18.9	23.1	5	17	2	164	30.5	0.097
5KP17Ae3 / 5KP17CAe3	18.9	20.9	5	17	2	181	27.6	0.097
5KP18e3 / 5KP18Ce3	20.0	24.4	5	18	2	155	32.2	0.098
5KP18Ae3 / 5KP18CAe3	20.0	22.1	5	18	2	171	29.2	0.098
5KP20e3 / 5KP20Ce3	22.2	27.1	5	20	2	140	35.8	0.099
5KP20Ae3 / 5KP20CAe3	22.2	24.5	5	20	2	154	32.4	0.099
5KP22e3 / 5KP22Ce3	24.4	29.8	5	22	2	127	39.4	0.100
5KP22Ae3 / 5KP22CAe3	24.4	26.9	5	22	2	141	35.5	0.100
5KP24e3 / 5KP24Ce3	26.7	32.6	5	24	2	116	43.0	0.101
5KP24Ae3 / 5KP24CAe3	26.7	29.5	5	24	2	129	38.9	0.101

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ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise stated (continued)

DEVICE NUMBER	BREAKDOWN VOLTAGE ⁽¹⁾ V _(BR) @ I _T		TEST CURRENT I _T	STAND-OFF VOLTAGE V _{WM}	MAXIMUM STANDBY CURRENT ⁽³⁾ I _b @ V _{WM}	MAXIMUM PEAK PULSE CURRENT ⁽²⁾ I _{PP}	MAXIMUM CLAMPING VOLTAGE V _C @ I _{PP}	MAXIMUM TEMPERATURE COEFFICIENT OF V _(BR) α _{V(BR)}
	Min	Max						
	Volts	mA			μA	Amps	Volts	%/°C
5KP26e3 / 5KP26Ce3	28.9	35.3	5	26	2	107	46.6	0.101
5KP26Ae3 / 5KP26CAe3	28.9	31.9	5	26	2	119	42.1	0.101
5KP28e3 / 5KP28Ce3	31.1	38.0	5	28	2	100	50.0	0.102
5KP28Ae3 / 5KP28CAe3	31.1	34.4	5	28	2	110	45.4	0.102
5KP30e3 / 5KP30Ce3	33.3	40.7	5	30	2	93.5	53.5	0.103
5KP30Ae3 / 5KP30CAe3	33.3	36.8	5	30	2	103	48.4	0.103
5KP33e3 / 5KP33Ce3	36.7	44.9	5	33	2	84.7	59.0	0.104
5KP33Ae3 / 5KP33CAe3	36.7	40.6	5	33	2	93.8	53.3	0.104
5KP36e3 / 5KP36Ce3	40.0	48.9	5	36	2	77.8	64.3	0.104
5KP36Ae3 / 5KP36CAe3	40.0	44.2	5	36	2	86.1	58.1	0.104
5KP40e3 / 5KP40Ce3	44.4	54.3	5	40	2	70.0	71.4	0.105
5KP40Ae3 / 5KP40CAe3	44.4	49.1	5	40	2	77.5	64.5	0.105
5KP43e3 / 5KP43Ce3	47.8	58.4	5	43	2	65.2	76.7	0.105
5KP43Ae3 / 5KP43CAe3	47.8	52.8	5	43	2	72.0	69.4	0.105
5KP45e3 / 5KP45Ce3	50.0	61.1	5	45	2	62.3	80.3	0.106
5KP45Ae3 / 5KP45CAe3	50.0	55.3	5	45	2	68.8	72.7	0.106
5KP48e3 / 5KP48Ce3	53.3	65.2	5	48	2	58.5	85.5	0.106
5KP48Ae3 / 5KP48CAe3	53.3	58.9	5	48	2	64.6	77.4	0.106
5KP51e3 / 5KP51Ce3	56.7	69.3	5	51	2	54.9	91.1	0.107
5KP51Ae3 / 5KP51CAe3	56.7	62.7	5	51	2	60.7	82.4	0.107
5KP54e3 / 5KP54Ce3	60.0	73.3	5	54	2	51.9	96.3	0.107
5KP54Ae3 / 5KP54CAe3	60.0	66.3	5	54	2	57.4	87.1	0.107
5KP58e3 / 5KP58Ce3	64.4	78.7	5	58	2	48.5	103	0.107
5KP58Ae3 / 5KP58CAe3	64.4	71.2	5	58	2	53.4	94	0.107
5KP60e3 / 5KP60Ce3	66.7	81.5	5	60	2	46.7	107	0.108
5KP60Ae3 / 5KP60CAe3	66.7	73.7	5	60	2	51.7	97	0.108
5KP64e3 / 5KP64Ce3	71.1	86.9	5	64	2	43.9	114	0.108
5KP64Ae3 / 5KP64CAe3	71.1	78.6	5	64	2	48.5	103	0.108
5KP70e3 / 5KP70Ce3	77.8	95.1	5	70	2	40.0	125	0.108
5KP70Ae3 / 5KP70CAe3	77.8	86.0	5	70	2	44.2	113	0.108
5KP75e3 / 5KP75Ce3	83.3	102	5	75	2	37.3	134	0.108
5KP75Ae3 / 5KP75CAe3	83.3	92.1	5	75	2	41.3	121	0.108
5KP78e3 / 5KP78Ce3	86.7	106	5	78	2	36.0	139	0.108
5KP78Ae3 / 5KP78CAe3	86.7	95.8	5	78	2	39.7	126	0.108
5KP85e3 / 5KP85Ce3	94.4	115	5	85	2	33.1	151	0.108
5KP85Ae3 / 5KP85CAe3	94.4	104	5	85	2	36.5	137	0.108
5KP90e3 / 5KP90Ce3	100	122	5	90	2	31.3	160	0.110
5KP90Ae3 / 5KP90CAe3	100	111	5	90	2	34.2	146	0.110
5KP100e3 / 5KP100Ce3	111	136	5	100	2	27.9	179	0.110
5KP100Ae3 / 5KP100CAe3	111	123	5	100	2	30.9	162	0.110

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ELECTRICAL CHARACTERISTICS @ 25 °C unless otherwise stated (continued)

DEVICE NUMBER	BREAKDOWN VOLTAGE ⁽¹⁾ $V_{(BR)}$ @ I_T		TEST CURRENT I_T	STAND-OFF VOLTAGE V_{WM}	MAXIMUM STANDBY CURRENT ⁽³⁾ I_D @ V_{WM}	MAXIMUM PEAK PULSE CURRENT ⁽²⁾ I_{PP}	MAXIMUM CLAMPING VOLTAGE V_C @ I_{PP}	MAXIMUM TEMPERATURE COEFFICIENT OF $V_{(BR)}$ $\alpha_{V(BR)}$
	Min	Max						
	Volts	mA			μA	Amps	Volts	%/°C
5KP110e3 / 5KP110Ce3	122	149	5	110	2	25.5	196	0.110
5KP110Ae3 / 5KP110CAe3	122	135	5	110	2	28.2	177	0.110
5KP120e3 / 5KP120Ce3	133	162	5	120	2	23.5	213	0.110
5KP120Ae3 / 5KP120CAe3	133	147	5	120	2	26.4	193	0.110
5KP130e3 / 5KP130Ce3	144	175	5	130	2	21.6	231	0.110
5KP130Ae3 / 5KP130CAe3	144	159	5	130	2	24.4	209	0.110
5KP150e3 / 5KP150Ce3	167	204	5	150	2	18.7	268	0.110
5KP150Ae3 / 5KP150CAe3	167	185	5	150	2	21.0	243	0.110
5KP160e3 / 5KP160Ce3	178	217	5	160	2	17.4	287	0.110
5KP160Ae3 / 5KP160CAe3	178	197	5	160	2	19.7	259	0.110
5KP170e3 / 5KP170Ce3	189	231	5	170	2	16.4	304	0.110
5KP170Ae3 / 5KP170CAe3	189	209	5	170	2	18.5	275	0.110
5KP180e3 / 5KP180Ce3	200	244	5	180	2	15.5	323	0.110
5KP180Ae3 / 5KP180CAe3	200	221	5	180	2	17.5	292	0.110
5KP190e3 / 5KP190Ce3	211	258	5	190	2	14.6	343	0.110
5KP190Ae3 / 5KP190CAe3	211	233	5	190	2	16.5	310	0.110
5KP200e3 / 5KP200Ce3	222	271	5	200	2	13.7	364	0.110
5KP200Ae3 / 5KP200CAe3	222	246	5	200	2	15.5	329	0.110
5KP210e3 / 5KP210Ce3	233	284	5	210	2	12.9	386	0.110
5KP210Ae3 / 5KP210CAe3	233	258	5	210	2	14.6	349	0.110
5KP220e3 / 5KP220Ce3	244	298	5	220	2	12.2	410	0.110
5KP220Ae3 / 5KP220CAe3	244	270	5	220	2	13.7	371	0.110
5KP250e3 / 5KP250Ce3	277	338	5	250	2	10.6	470	0.110
5KP250Ae3 / 5KP250CAe3	277	306	5	250	2	12.0	425	0.110

NOTES:

- (1) $V_{(BR)}$ measured after I_T applied for 300 μs , I_T = square wave pulse or equivalent
- (2) Surge current waveform per [Figure 3](#) and derated per [Figure 2](#)
- (3) For bidirectional types with V_{WM} of 30 volts and less, the I_D limit is doubled

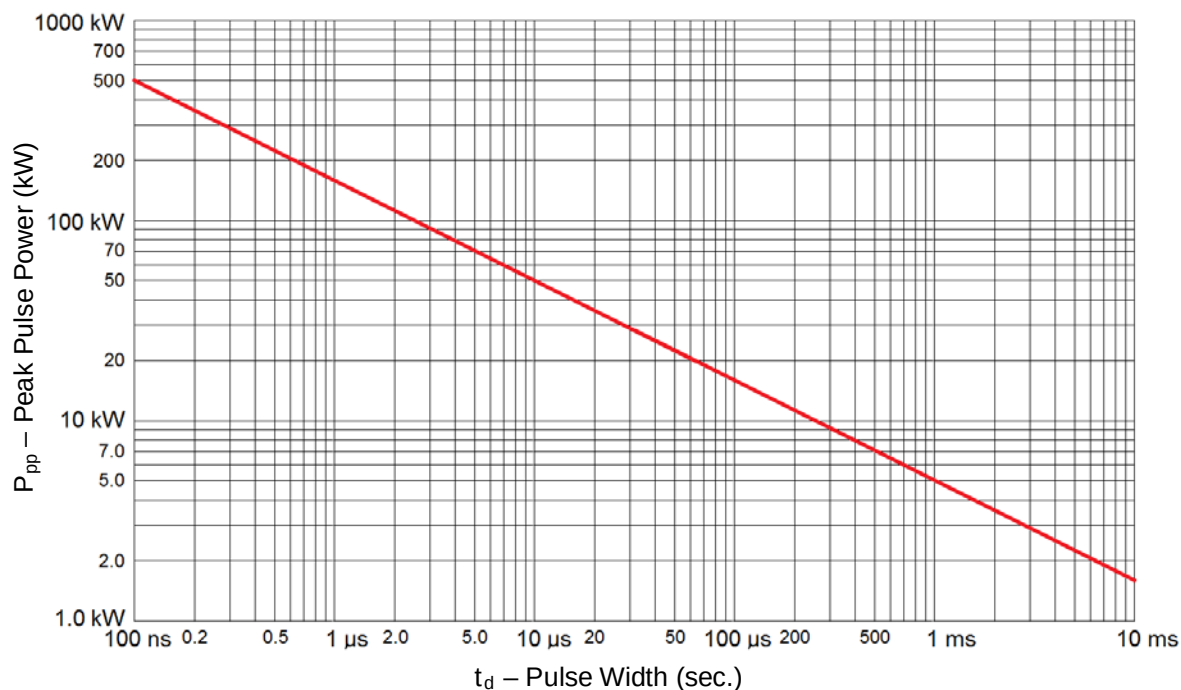
GRAPHS


FIGURE 1
Peak Pulse Power Rating Curve

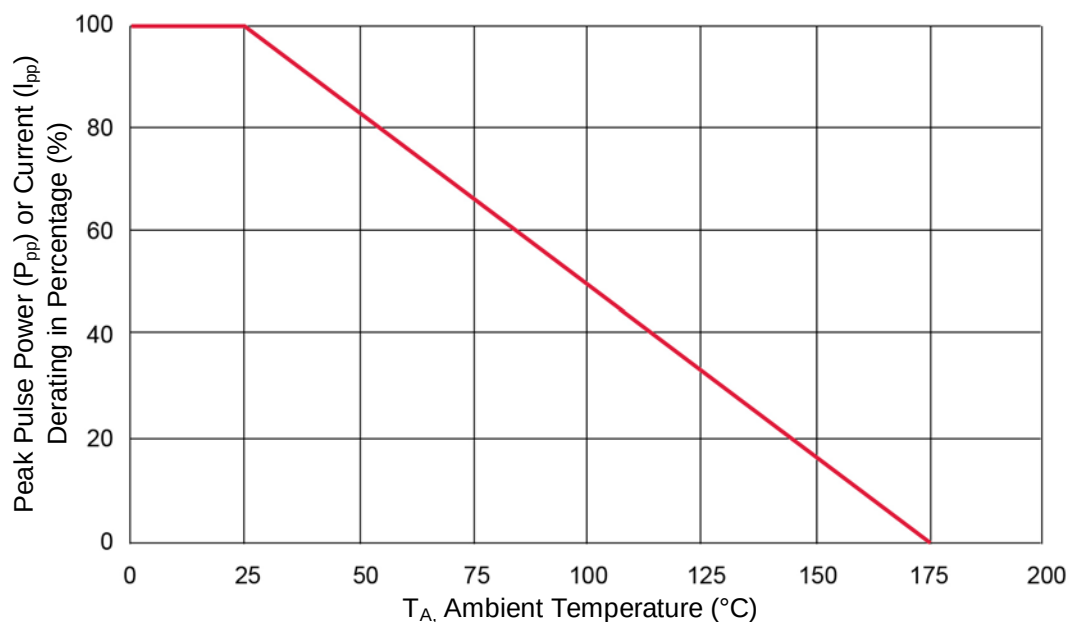
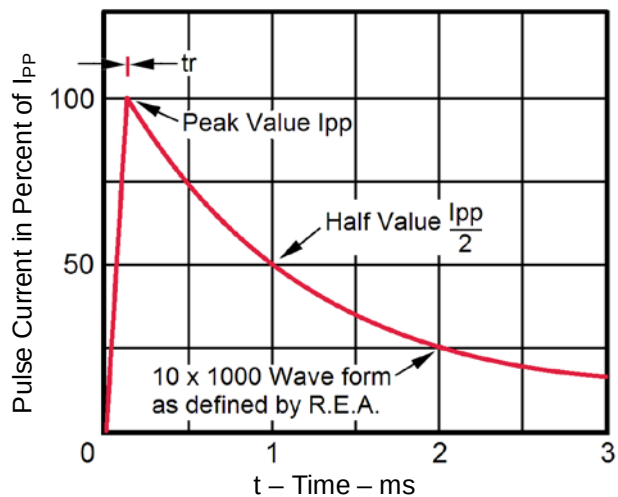


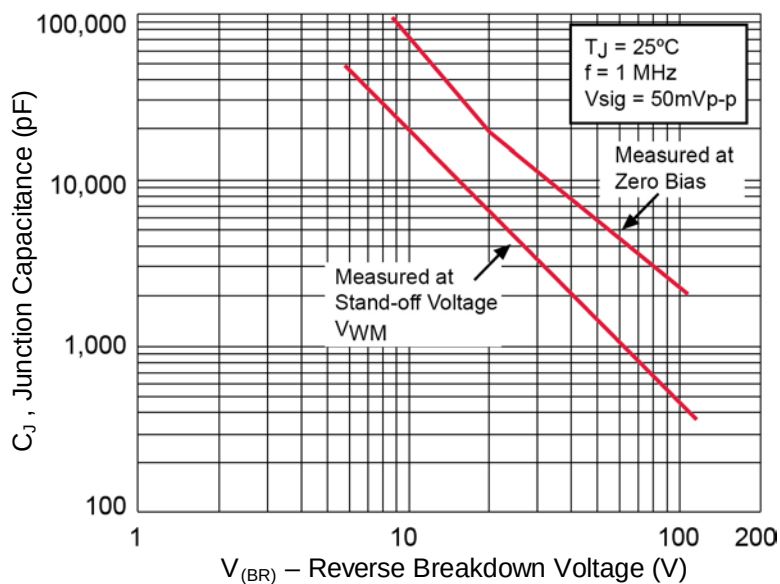
FIGURE 2
Pulse Derating Curve

GRAPHS (continued)


Test waveform parameters: $t_r=10\ \mu s$, $t_p=1000\ \mu s$

FIGURE 3

Pulse Waveform for 10/1000 μs Exponential Surge


FIGURE 4

Typical Junction Capacitance

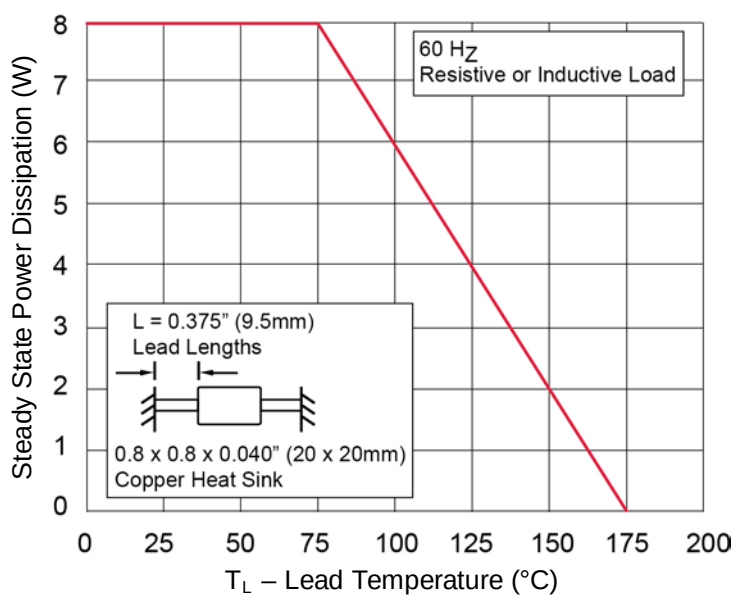
GRAPHS (continued)


FIGURE 5
Steady State Power Derating Curve

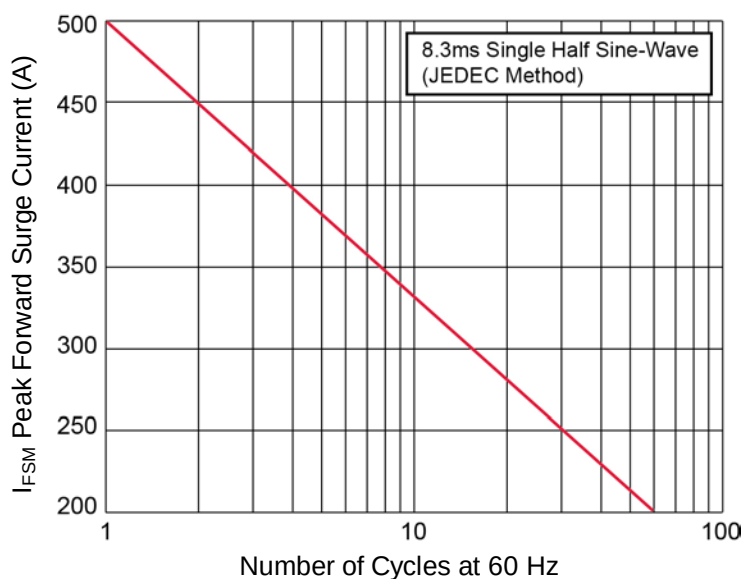


FIGURE 6
Maximum Non-repetitive Forward Surge Current

A diagram showing a square block on a vertical rod. The rod is represented by two vertical lines. The block is a solid black square. Four dimensions are indicated with arrows and labels: BD is the diameter of the rod (horizontal arrow between the rod lines); LL is the total length of the rod (vertical arrow on the right); BL is the height of the block (vertical arrow on the right, from the bottom of the block to the top of the block); and LD is the diameter of the rod at the bottom (horizontal arrow between the rod lines).

Dim	Dimensions			
	Inch		Millimeters	
	Min	Max	Min	Max
LL	0.750	-	19.05	-
BL	0.340	0.360	8.645	9.135
BD	0.340	0.360	8.645	9.135
LD	0.047	0.053	1.194	1.346