400 Watt Transient Voltage Suppressors

MP4KE6.8A – MXLP4KE400CA(e3)

Product Overview

The MP4KE6.8A – MXLP4KE400CA series of axial lead 400 watt transient voltage suppressors provide a selection of standoff voltages (V_{WM}) from 5.8 to 342V, with nominal breakdown voltages of 6.8 to 400V. These high-reliability devices are available in either unidirectional or bidirectional versions. RoHS compliant versions are available. These are available with a variety of upscreening options for enhanced reliability. They can protect against the secondary effects of lightning per IEC61000-4-5 and against voltage pulses from inductive switching environments and induced by RF radiation. Since their response time is virtually instantaneous, they can also be used in protection from ESD and EFT per IEC61000-4-2 and IEC61000-4-4.

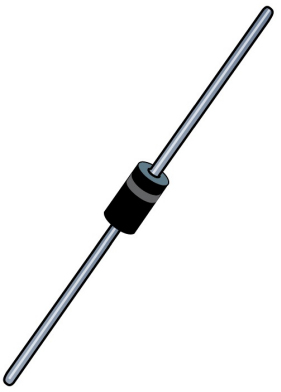
Features

- Available in both unidirectional and bidirectional configurations
- 3σ lot norm screening performed on standby current I_D for all M prefix devices
- 100% surge tested devices
- Suppress transients up to 400 watts at 10\1000 µs (see Figure 4-1)
- Enhanced reliability screening in reference to MIL-PRF-19500 are available. Refer to High Reliability Non-Hermetic Product Portfolio for more details on the screening options.
  (See Part Nomenclature for all options.)
- High reliability controlled devices have wafer fabrication and assembly lot traceability for all M prefix devices
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020F for all M prefix devices
- RoHS compliant versions are available
- Surface mount equivalent packages for PCB mounting are available as MSMBJ5.0A - MXLSMBG170Ae3 (contact Microchip for other options).

Applications/Benefits

- Available in working standoff voltage (V_{WM}) range 5.8 to 342 volts, with nominal breakdown voltage $V_{(BR)}$ 6.8 to 400 volts.
- Economical axial-lead plastic encapsulated TVS series for thru-hole mounting
- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, T2L, etc
- Protection from switching transients and induced RFI
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively.
- Secondary lightning protection per IEC 61000-4-5 with 42 ohms source impedance:
  Class 1: MP4KE6.8A to MXLP4KE91CA
  Class 2: MP4KE6.8A to MXLP4KE47CA
  Class 3: MP4KE6.8A to MXLP4KE24CA
  Class 4: MP4KE6.8A to MXLP4KE12CA
- Secondary lightning protection per IEC 61000-4-5 with 12 ohms source impedance:
  Class 1: MP4KE6.8A to MXLP4KE30CA
  Class 2: MP4KE6.8A to MXLP4KE15CA

Figure 1. DO-41 (DO-204AL) Package



Also available in:

SMASF Package

(surface mount)

MSMASF5.8A – MXLSMASF214CA

Table of Contents

1. Maximum Ratings

Table 1-1. Maximum Ratings at 25 °C Unless Otherwise Noted

Parameters/Test Conditions		Symbol	Value	Unit
Junction and storage temperature		T_J and T_{STG}	–65 to +150	°C
Thermal resistance, junction to lead[1]		$R_{\Theta JL}$	50	°C/W
Thermal resistance, junction to ambient[2]		$R_{\Theta JA}$	110	°C/W
Peak pulse power dissipation at 10/1000µs[3]		P_{PP}	400	W
Average power dissipation	at T_L = 25 °C[1] at T_A = 25 °C[2]	P_D	2.5 1.13	W
$T_{clamping}$ (0 volts to $V_{(BR)}$ min, theoretical)	Unidirectional Bidirectional	—	< 100 < 5	ps ns
Solder temperature at 10 seconds		—	260	°C

Notes:

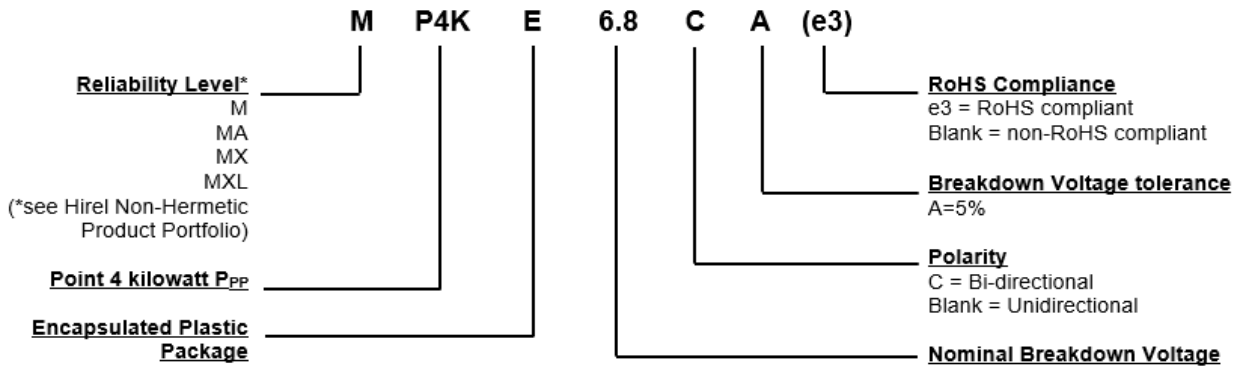
1. At 3/8 (10 mm) lead length from body.
2. Mounted on FR4 PC board with 4 mm^2 copper pads (1 oz) and track width 1 mm, length 25 mm.
3. With impulse repetition rate (duty factor) of 0.01% or less (see Figure 4-1, Figure 4-2, and Figure 4-3 for t_W waveform and derating effects)

1.1 Mechanical Packaging

- Case: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- Terminals: Tin-lead or RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750, method 2026.
- Marking: Reliability level, part number, date code
- Polarity: Cathode indicated by band. Bidirectional not marked.
- Tape and Reel option: Standard per EIA-296 (add “TR” suffix to part number). Consult factory for quantities.
- Weight: Approximately 0.3 grams
- See Package Dimensions

2. Part Nomenclature

Figure 2-1. Part Nomenclature



2.1 Symbols and Definitions

Table 2-1. Symbols and 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 %/°C or mV/°C.
C_T	Total capacitance: The total small signal capacitance between the diode terminals of a complete device.
$I_{(BR)}$	Breakdown current: The current used for measuring breakdown voltage $V_{(BR)}$.
I_D	Standby current: The current through the device at working standoff voltage.
I_{PP}	Peak impulse current: The peak current during an impulse.
P_{PP}	Peak pulse power: The peak power that can be applied for a specific pulse width and waveform. 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.

3. Electrical Characteristics

Table 3-1. Electrical Characteristics at 25 °C

Part Number	Working Standoff Voltage V_{WM}	Breakdown Voltage $V_{(BR)}$ at $I_{(BR)}$			Maximum Clamping Voltage V_C at I_{PP}	Maximum Standby Current I_D at V_{WM}	Peak Pulse Current at 10/1000 µs (see Figure 4-2) I_{PP}	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
	Volts	Min.	Max.	mA	Volts	µA	Amps	%/°C
MP4KE6.8(C)A	5.80	6.45	7.14	10	10.5	500	38	0.057
MP4KE7.5(C)A	6.40	7.13	7.88	10	11.3	200	35	0.061
MP4KE8.2(C)A	7.02	7.79	8.61	10	12.1	100	33	0.065
MP4KE9.1(C)A	7.78	8.65	9.55	1	13.4	20	30	0.068
MP4KE10(C)A	8.55	9.50	10.5	1	14.5	5	28	0.073
MP4KE11(C)A	9.40	10.5	11.6	1	15.6	2	26	0.075
MP4KE12(C)A	10.2	11.4	12.6	1	16.7	1	24	0.078
MP4KE13(C)A	11.1	12.4	13.7	1	18.2	1	22	0.081
MP4KE15(C)A	12.8	14.3	15.8	1	21.2	1	19	0.084
MP4KE16(C)A	13.6	15.2	16.8	1	22.5	1	18	0.086
MP4KE18(C)A	15.3	17.1	18.0	1	25.2	1	16	0.088
MP4KE20(C)A	17.1	19.0	21.0	1	27.7	1	14.5	0.090
MP4KE22(C)A	18.8	20.9	23.1	1	30.6	1	13	0.092
MP4KE24(C)A	20.5	22.8	25.2	1	33.2	1	12	0.094
MP4KE27(C)A	23.1	25.7	28.4	1	37.5	1	11	0.096
MP4KE30(C)A	25.6	28.5	31.5	1	41.4	1	9.5	0.097
MP4KE33(C)A	28.2	31.4	34.7	1	45.7	1	9.0	0.098
MP4KE36(C)A	30.8	34.2	37.8	1	49.9	1	8.0	0.099
MP4KE39(C)A	33.3	37.1	41.0	1	53.9	1	7.5	0.100
MP4KE43(C)A	36.8	40.9	45.2	1	59.3	1	7.0	0.101
MP4KE47(C)A	40.2	44.7	49.4	1	64.8	1	6.2	0.101
MP4KE51(C)A	43.6	48.5	53.6	1	70.1	1	5.7	0.102
MP4KE56(C)A	47.8	53.2	58.8	1	77.0	1	5.2	0.103
MP4KE62(C)A	53.0	58.9	65.1	1	85.0	1	4.7	0.104
MP4KE68(C)A	58.1	64.6	71.4	1	92.0	1	4.4	0.104
MP4KE75(C)A	64.1	71.3	78.8	1	103.0	1	3.9	0.105
MP4KE82(C)A	70.1	77.9	86.1	1	113.0	1	3.5	0.105
MP4KE91(C)A	77.8	86.5	95.5	1	125.0	1	3.2	0.106
MP4KE100(C)A	85.5	95.0	105.0	1	137.0	1	2.9	0.106
MP4KE110(C)A	94.0	105.0	116.0	1	152.0	1	2.6	0.107
MP4KE120(C)A	102.0	114.0	126.0	1	165.0	1	2.4	0.107
MP4KE130(C)A	111.0	124.0	137.0	1	179.0	1	2.2	0.107
MP4KE150(C)A	128.0	143.0	158.0	1	207.0	1	1.95	0.108
MP4KE160(C)A	136.0	152.0	168.0	1	219.0	1	1.8	0.108

.....continued

Part Number	Working Standoff Voltage V_{WM}	Breakdown Voltage $V_{(BR)}$ at $I_{(BR)}$			Maximum Clamping Voltage V_C at I_{PP}	Maximum Standby Current I_D at V_{WM}	Peak Pulse Current at 10/1000 µs (see Figure 4-2) I_{PP}	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
	Volts	Min.	Max.	mA	Volts	µA	Amps	%/°C
MP4KE170(C)A	145.0	162.0	179.0	1	234.0	1	1.7	0.108
MP4KE180(C)A	154.0	171.0	189.0	1	246.0	1	1.6	0.108
MP4KE200(C)A	171.0	190.0	210.0	1	274.0	1	1.5	0.108
MP4KE220(C)A	185.0	209.0	231.0	1	328.0	1	1.0	0.110
MP4KE250(C)A	214.0	237.0	263.0	1	344.0	1	1.0	0.110
MP4KE300(C)A	256.0	285.0	315.0	1	414.0	1	1.0	0.110
MP4KE350(C)A	300.0	333.0	368.0	1	482.0	1	1.0	0.110
MP4KE400(C)A	342.0	380.0	420.0	1	548.0	1	1.0	0.110

Notes:

1. Normal selection criteria for TVS devices is by working standoff voltage (V_{WM}) and should be equal or greater than DC or continuous peak operating voltage.
2. TVS devices are tested to maximum peak pulse current (I_{PP}) with clamping voltage monitored. This surge capability is one of the most significant electrical characteristics of the device and should be considered as part of customer quality inspections.
3. Bidirectional devices are indicated with a CA suffix after part number. Bidirectional capacitance is half that shown in Figure 4-4 at zero volts. For bidirectional types having V_{WM} of 8 volts and under, the I_D leakage current is doubled.
4. For unidirectional devices, the forward voltage (V_F) is 3.5 volts maximum at 100 Amps peak for 8.3 ms half-sine wave.

4. Graphs

Figure 4-1. Peak Pulse Power Vs. Pulse Time

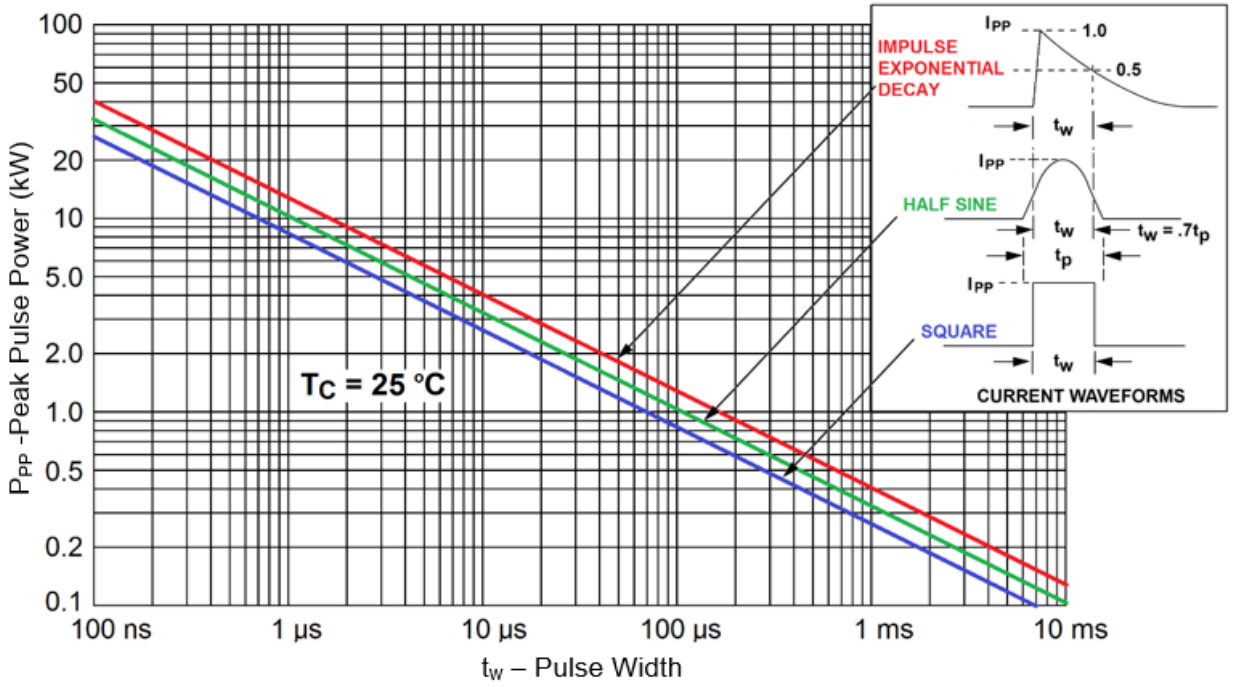


Figure 4-2. Pulse Waveform for Exponential Surge

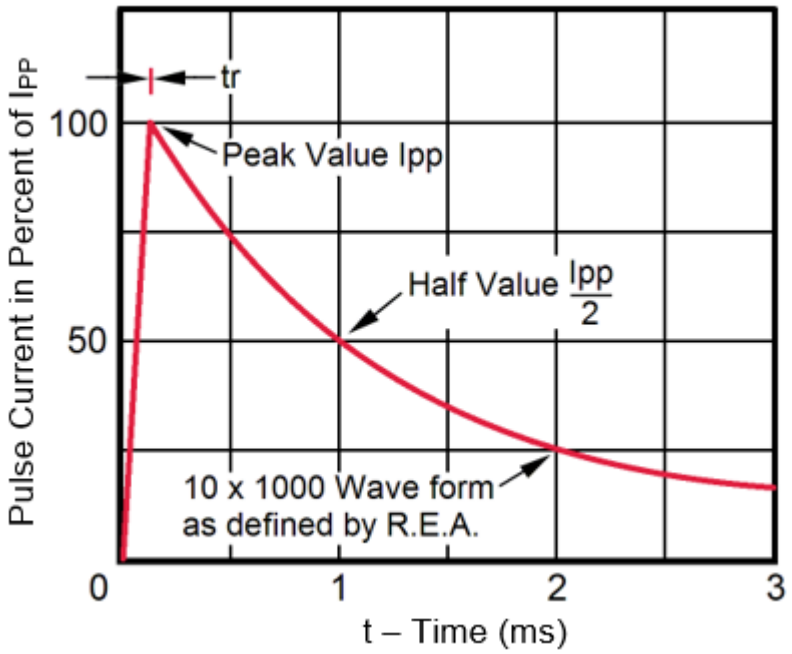


Figure 4-3. Derating Curve

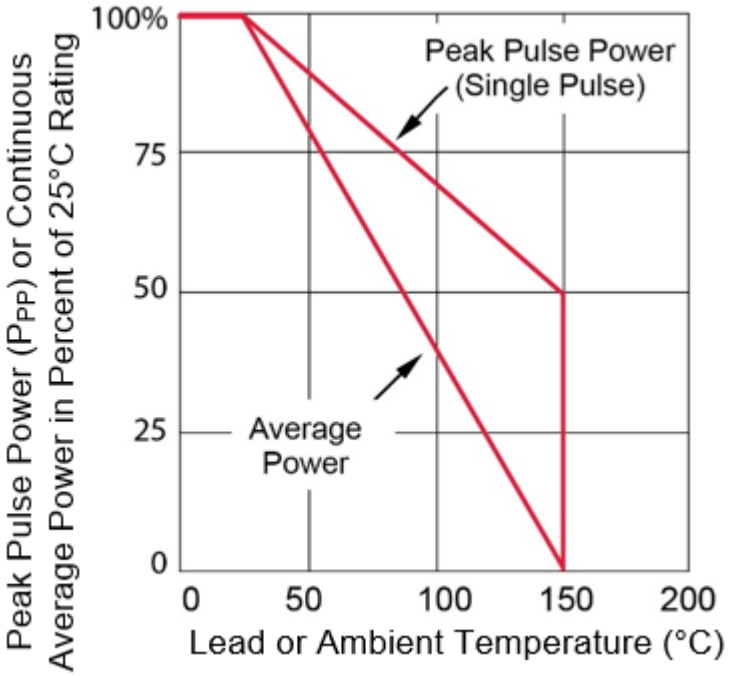
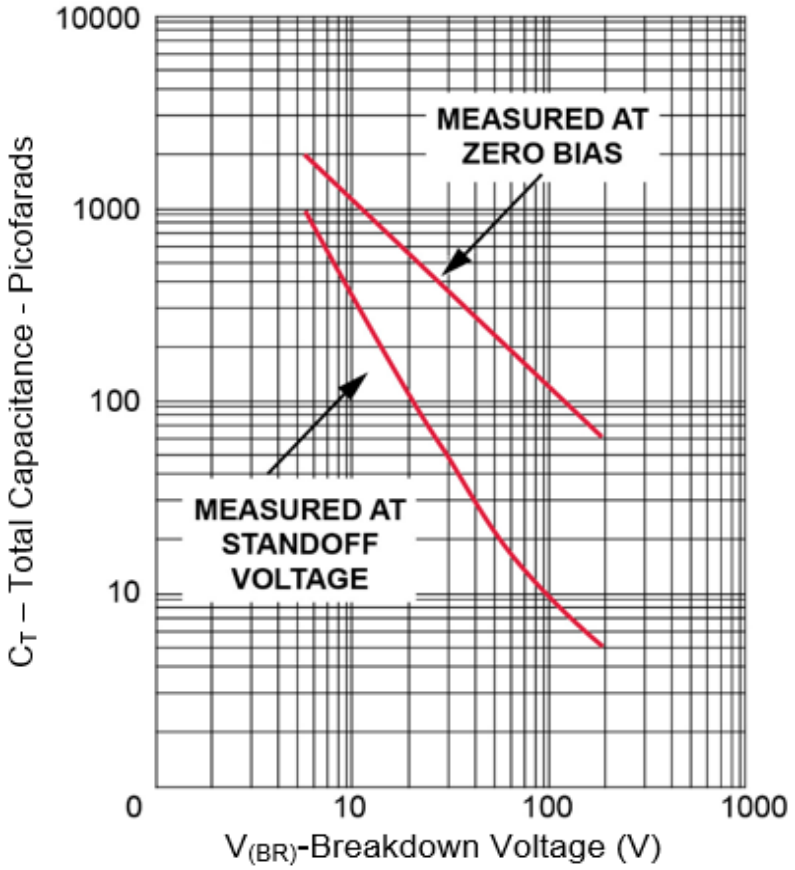


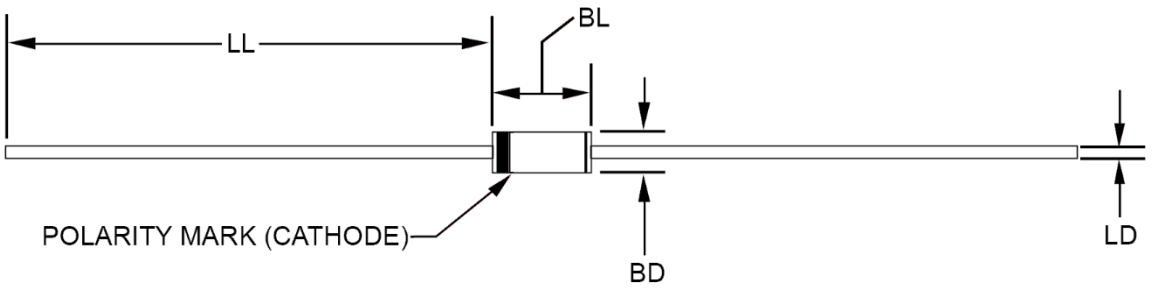
Figure 4-4. MP4KE Typical Capacitance Vs. Breakdown Voltage (Unipolar)



Bidirectional capacitance is half that shown.

5. Package Dimensions

Figure 5-1. Package Dimensions[1]



Note:

1. Cathode indicated by band.

Dim.	Dimensions			
	Inches		Millimeters	
	Min.	Max.	Min.	Max.
LL	1.00	—	25.4	—
BL	—	0.205	—	5.207
BD	—	0.107	—	2.72
LD	0.030	0.034	0.76	0.86

6. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	01/2024	Initial revision.

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