5,000 Watt Transient Voltage Suppressor

M5KP5.0A – MXL5KP110CA(e3)

Product Overview

The M5KP5.0A – MXL5KP110CA series of axial lead 5,000 watt transient voltage suppressors provide a selection of standoff voltages (V_{WM}) from 5.0 to 110V. 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 in reference to MIL-PRF-19500. They can protect against the secondary effects of lightning per IEC61000-4-5 and against voltage pulses from inductive switching environments and induced by RFI. 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 5,000 watts at 10/1000 µs (see Figure 4-1)
- Enhanced reliability screening in reference to MIL-PRF-19500 is 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

Applications/Benefits

- Available in working standoff voltage (V_{WM}) range 5.0 to 110V
- Economical axial-lead plastic encapsulated TVS series for thru-hole mounting
- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, T2L, and so on
- 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 IEC61000-4-5 with 42 ohms source impedance:
  Class 1, 2, 3, 4: M5KP5.0A to MXL5KP110CA
  Class 5: M5KP5.0A to MXL5KP110CA (short distance)
  Class 5: M5KP5.0A to MXL5KP36CA (long distance)
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  Class 1 and 2: M5KP5.0A to MXL5KP110CA
  Class 3: M5KP5.0A to MXL5KP78CA
  Class 4: M5KP5.0A to MXL5KP40CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  Class 2: M5KP5.0A to MXL5KP70CA
  Class 3: M5KP5.0A to MXL5KP36CA
  Class 4: M5KP5.0A to MXL5KP18CA

Figure 1. DO-204AR Package

Also available in:

P600 package

(commercial plastic axial-leaded)

5KP5.0e3 – 5KP250CAe3

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]		$R_{\Theta JL}$	20	°C/W
Thermal resistance, junction to ambient[2]		$R_{\Theta JA}$	80	°C/W
Peak pulse power	At T_L = +25 °C[3]	P_{PP}	5,000	W
Average power dissipation	At T_L= +25 °C[1] At T_A = +25 °C[2]	$P_{M(AV)}$	6 1.56	W
$T_{clamping}$ (0 volts to $V_{(BR)}$ min)	Unidirectional Bidirectional	—	<100 <5	ps ns
Solder temperature at 10 seconds		T_{SP}	260	°C

Notes:

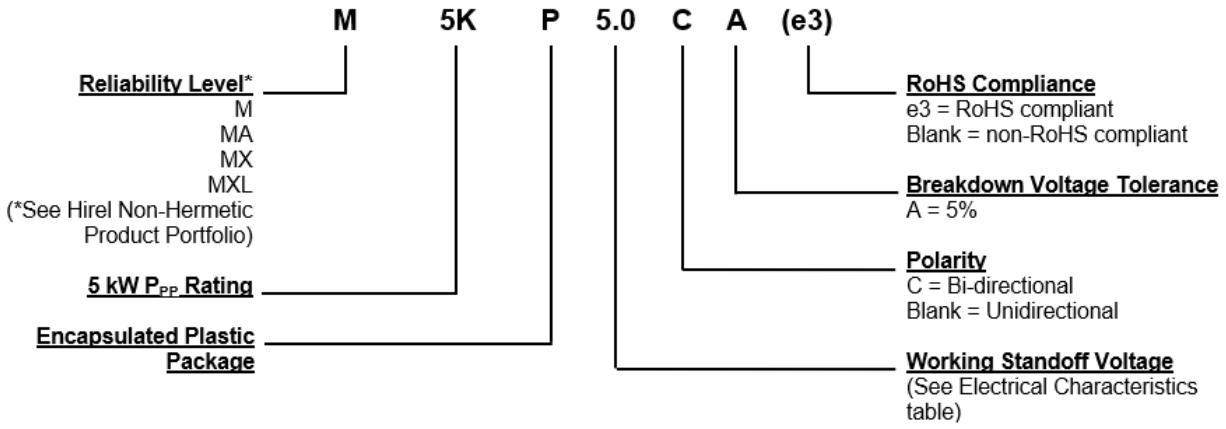
1. At 0.375 inch (10 mm) from body
2. Mounted on FR4 PC board with 4 mm^2 copper pads (1 oz) and track width 1 mm, length 25 mm
3. At 10/1000 µs with repetition rate of 0.01% or less (see Figure 4-1)

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. No cathode band on bidirectional devices.
- Tape and reel option: Standard per EIA-296 (add “TR” suffix to part number). Consult factory for quantities.
- Weight: Approximately 1.4 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[1–3]

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}	Maximum Peak Pulse Current At 10/1000 µs I_{PP} Figure 4-2	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
	V	V	mA	V	µA	A	mV/ °C
M5KP5.0(C)A	5.0	6.40 – 7.00	50	9.2	2000*	543	4.0
M5KP6.0(C)A	6.0	6.67 – 7.37	50	10.3	5000	485	4.0
M5KP6.5(C)A	6.5	7.22 – 7.98	50	11.2	2000	447	4.0
M5KP7.0(C)A	7.0	7.78 – 8.60	50	12.0	1000	417	5.0
M5KP7.5(C)A	7.5	8.33 – 9.21	5	12.9	250	388	6.0
M5KP8.0(C)A	8.0	8.89 – 9.83	5	13.6	150	367	6.0
M5KP8.5(C)A	8.5	9.44 – 10.4	5	14.4	50	347	7.0
M5KP9.0(C)A	9.0	10.0 – 11.1	5	15.4	20	325	8.0
M5KP10(C)A	10	11.1 – 12.3	5	17.0	15	294	9.0
M5KP11(C)A	11	12.2 – 13.5	5	18.2	10	274	10
M5KP12(C)A	12	13.3 – 14.7	5	19.9	10	251	11
M5KP13(C)A	13	14.4 – 15.9	5	21.5	10	232	12
M5KP14(C)A	14	15.6 – 17.2	5	23.2	10	215	13
M5KP15(C)A	15	16.7 – 18.5	5	24.4	10	206	15
M5KP16(C)A	16	17.8 – 19.7	5	26.0	10	192	16
M5KP17(C)A	17	18.9 – 20.9	5	27.6	10	181	18
M5KP18(C)A	18	20.0 – 22.1	5	29.2	10	172	19
M5KP20(C)A	20	22.2 – 24.5	5	32.4	10	154	22
M5KP22(C)A	22	24.4 – 26.9	5	35.5	10	141	24
M5KP24(C)A	24	26.7 – 29.5	5	38.9	10	128	27
M5KP26(C)A	26	28.9 – 31.9	5	42.1	10	119	29
M5KP28(C)A	28	31.1 – 34.4	5	45.5	10	110	30
M5KP30(C)A	30	33.3 – 36.8	5	48.4	10	103	35
M5KP33(C)A	33	36.7 – 40.6	5	53.3	10	94	38
M5KP36(C)A	36	40.0 – 44.2	5	58.1	10	86	40
M5KP40(C)A	40	44.4 – 49.1	5	64.5	10	78	45
M5KP43(C)A	43	47.8 – 52.8	5	69.4	10	72	49
M5KP45(C)A	45	50.0 – 55.3	5	72.7	10	69	51
M5KP48(C)A	48	53.3 – 58.9	5	77.4	10	65	55
M5KP51(C)A	51	56.7 – 62.7	5	82.4	10	61	60
M5KP54(C)A	54	60.0 – 66.3	5	87.1	10	57	64
M5KP58(C)A	58	64.4 – 71.2	5	93.6	10	53	69
M5KP60(C)A	60	66.7 – 73.7	5	96.8	10	52	70
M5KP64(C)A	64	71.1 – 78.6	5	103.0	10	49	75

.....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}	Maximum Peak Pulse Current At 10/1000 µs I_{PP} Figure 4-2	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
	V	V	mA	V	µA	A	mV/ °C
M5KP70(C)A	70	77.8 – 86.0	5	113	10	44	84
M5KP75(C)A	75	83.3 – 92.1	5	121	10	41	90
M5KP78(C)A	78	86.7 – 95.8	5	126	10	40	94
M5KP85(C)A	85	94.4 – 104.0	5	137	10	36	102
M5KP90(C)A	90	100 – 111	5	146	10	34	109
M5KP100(C)A	100	111 – 123	5	162	10	31	122
M5KP110(C)A	110	122 - 135	5	177	10	28	132

Notes:

* For bidirectional M5KP5.0CA, the I_D standby current is doubled to 4,000 uA.

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. For unidirectional, 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 Rating Curve

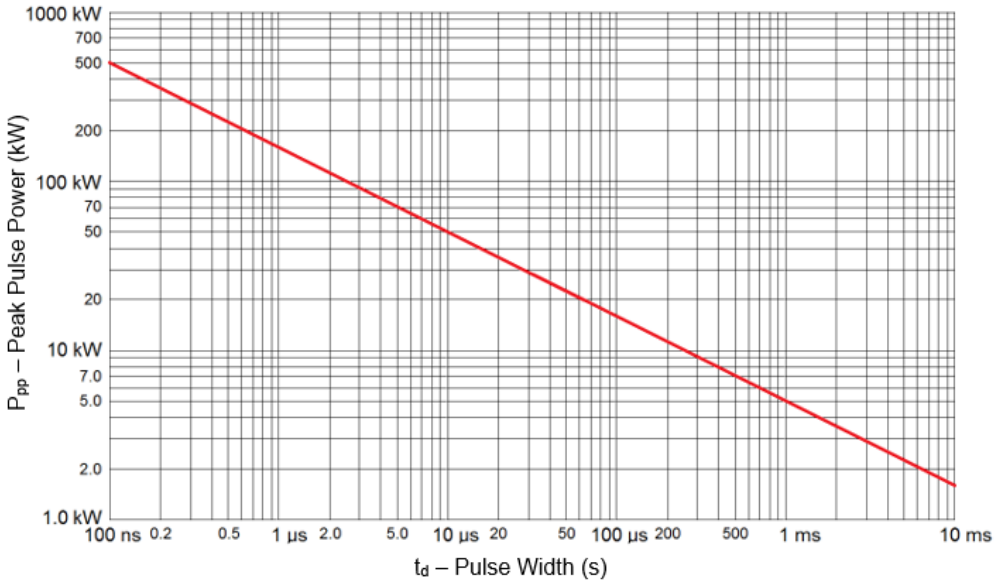


Figure 4-2. Pulse Waveform for 10/1000 µs Exponential Surge

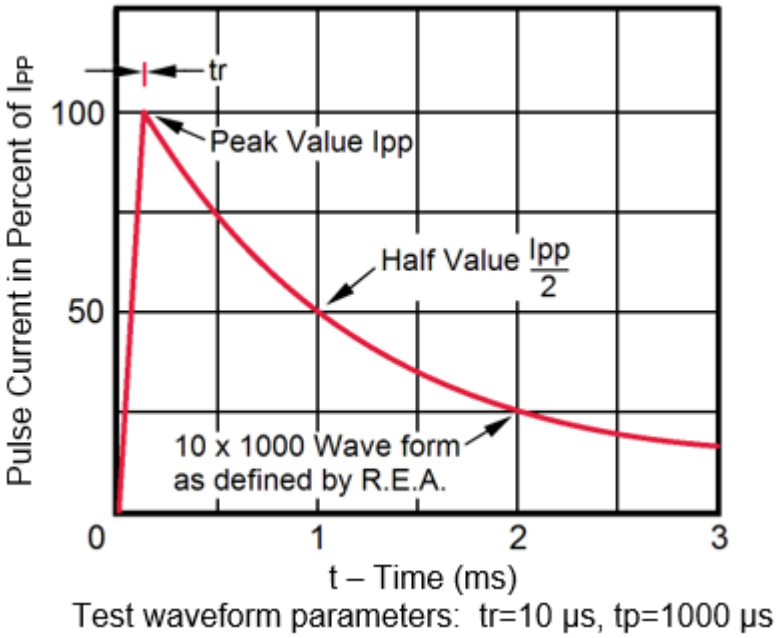
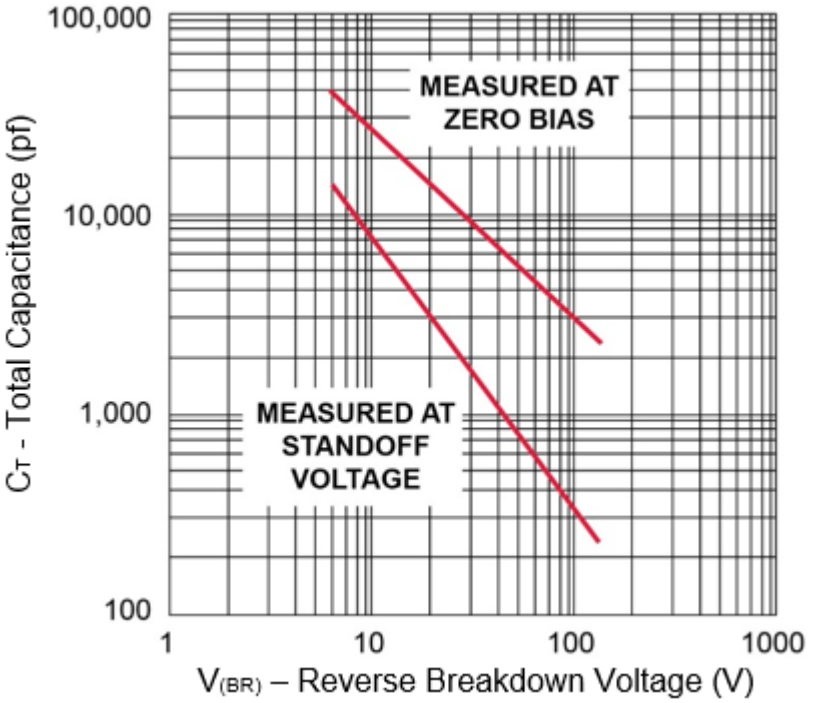


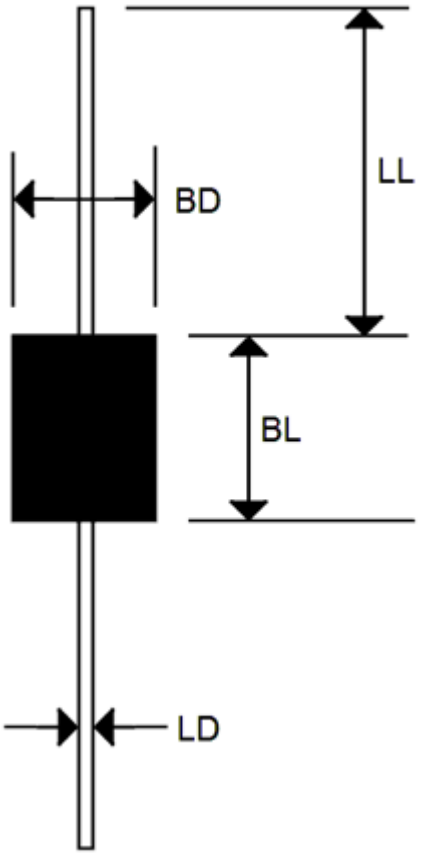
Figure 4-3. Typical Junction Capacitance



Bidirectional capacitance is half that shown.

5. Package Dimensions

Figure 5-1. Package Dimensions



Dim.	Dimensions			
	Inch		Millimeters	
	Min	Max	Min	Max
LL	0.750	—	19.05	—
BL	0.365	0.385	9.27	9.78
BD	0.235	0.255	5.97	6.48
LD	0.047	0.053	1.194	1.346

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
B	02/2024	• Changed RF radiation to RFI in Product Overview. • Changed the average power dissipation at T_L to +25 °C in Table 1-1.
A	01/2024	Initial revision.

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