15,000 Watt Transient Voltage Suppressor

M15KP22A – MXL15KP280CA(e3)

Product Overview

The M15KP22A – MXL15KP280CA series of axial lead 15,000 watt transient voltage suppressors provide a selection of standoff voltages (V_{WM}) from 22 to 280 V. 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 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 15,000 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

Figure 1. DO-204AR Package

Applications/Benefits

- Available in working standoff voltage (V_{WM}) range 22 to 280 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 & 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: M15KP22A to MXL15KP280CA
  Class 5: M15KP22A to MXL15KP280CA (short distance)
  Class 5: M15KP22A to MXL15KP110CA (long distance)
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  Class 1 and 2: M15KP22A to MXL15KP280CA
  Class 3: M15KP22A to MXL15KP240CA
  Class 4: M15KP22A to MXL15KP120CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  Class 2: M15KP22A to MXL15KP220CA
  Class 3: M15KP22A to MXL15KP110CA
  Class 4: M15KP22A to MXL15KP54CA

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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}	15,000	W
Average power dissipation	At T_L = +40 °C [1] At T_A = +25 °C [2]	P_D	6 1.56	W
$t_{clamping}$ (0 volts to $V_{(BR)}$ min, theoretical)	Unidirectional Bidirectional	—	<100 <5	ps ns
Surge peak forward current [4]		I_{FSM}	200	A
Solder temperature at 10 seconds		—	260	°C

Notes:

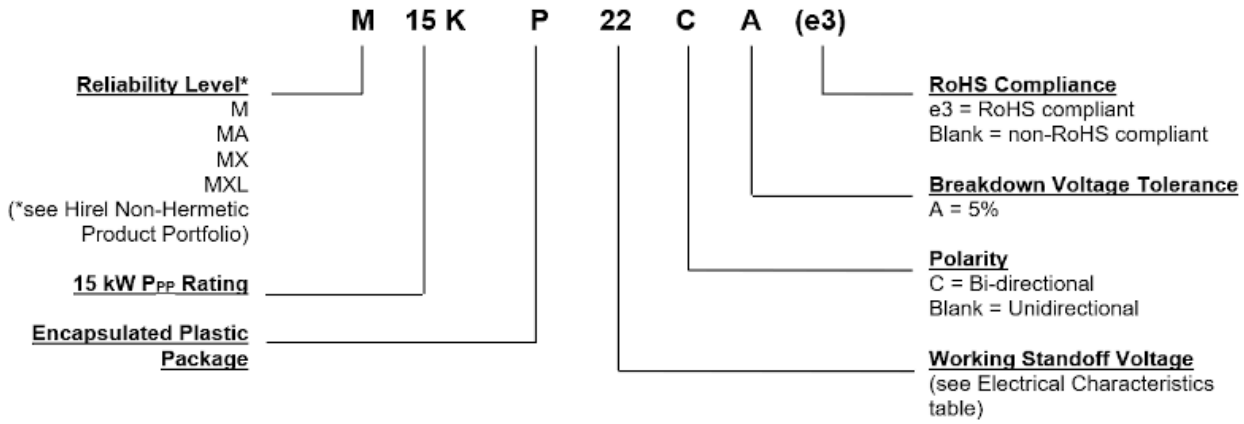
1. At 0.375 inch (10 mm) from body
2. When mounted on FR4 PC board with 4 mm^2 copper pads (1 oz) and track width 1 mm, length 25 mm.
3. At 10/1000 µs with repetition rate of 0.01% or less (see Figure 4-1).
4. At 8.3 ms half-sine wave for unidirectional devices only.

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_{FSM}	Surge seak forward current: The forward current including all nonrepetitive transient currents but excluding all repetitive transients (ref JESD282-B).
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}	Minimum 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
M15KP22(C)A	22	24.4	10	37.1	500	404	24
M15KP24(C)A	24	26.7	5	40.7	150	369	27
M15KP26(C)A	26	28.9	5	44.0	50	341	29
M15KP28(C)A	28	31.1	5	47.5	25	316	31
M15KP30(C)A	30	33.3	5	50.7	15	296	34
M15KP33(C)A	33	36.7	5	54.8	10	274	38
M15KP36(C)A	36	40.0	5	59.7	10	251	41
M15KP40(C)A	40	44.4	5	65.8	10	228	46
M15KP43(C)A	43	47.8	5	69.7	10	215	50
M15KP45(C)A	45	50.0	5	73.0	10	205	52
M15KP48(C)A	48	53.3	5	77.7	10	193	56
M15KP51(C)A	51	56.7	5	82.8	10	181	60
M15KP54(C)A	54	60.0	5	87.5	10	171	63
M15KP58(C)A	58	64.4	5	94.0	10	160	68
M15KP60(C)A	60	66.7	5	97.3	10	154	71
M15KP64(C)A	64	71.1	5	104	10	144	76
M15KP70(C)A	70	77.8	5	114	10	132	83
M15KP75(C)A	75	83.3	5	122	10	123	89
M15KP78(C)A	78	86.7	5	126	10	119	93
M15KP85(C)A	85	94.4	5	137	10	109	102
M15KP90(C)A	90	100	5	146	10	103	109
M15KP100(C)A	100	111	5	162	10	93	121
M15KP110(C)A	110	122	5	178	10	84	133
M15KP120(C)A	120	133	5	193	10	78	145
M15KP130(C)A	130	144	5	209	10	72	157
M15KP150(C)A	150	167	5	243	10	62	183
M15KP160(C)A	160	178	5	259	10	58	195
M15KP170(C)A	170	189	5	275	10	55	207
M15KP180(C)A	180	200	5	291	10	52	219
M15KP200(C)A	200	222	5	322	10	47	243
M15KP220(C)A	220	245	5	356	10	42	269
M15KP240(C)A	240	267	5	388	10	39	293
M15KP260(C)A	260	289	5	419	10	36	317
M15KP280(C)A	280	311	5	452	10	33	342

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.

4. Graphs

Figure 4-1. Peak Pulse Power Rating Curve

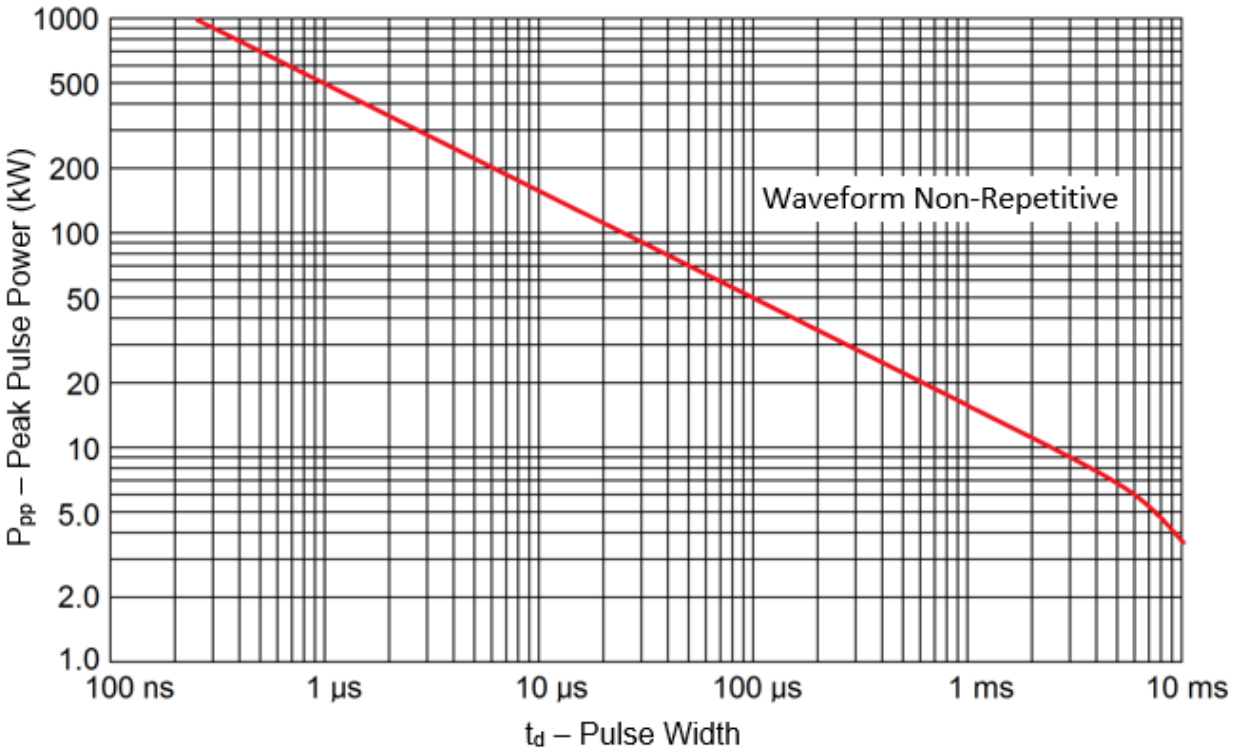
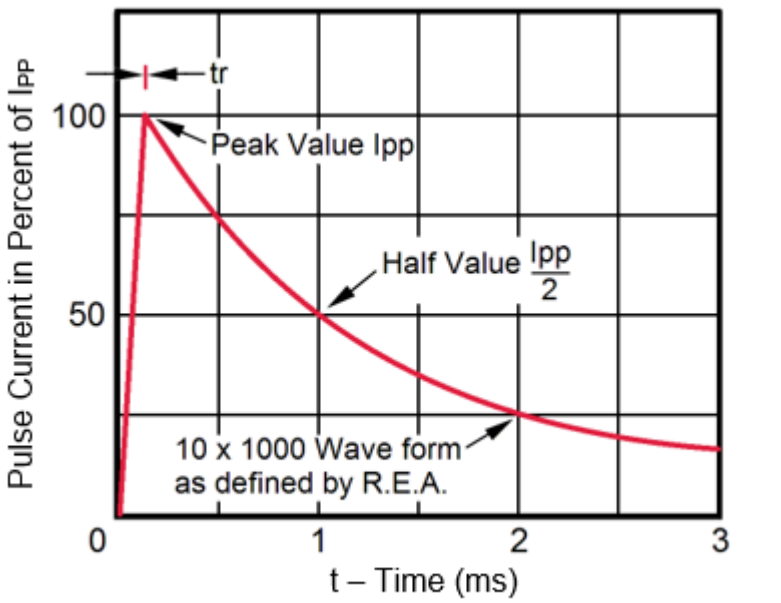
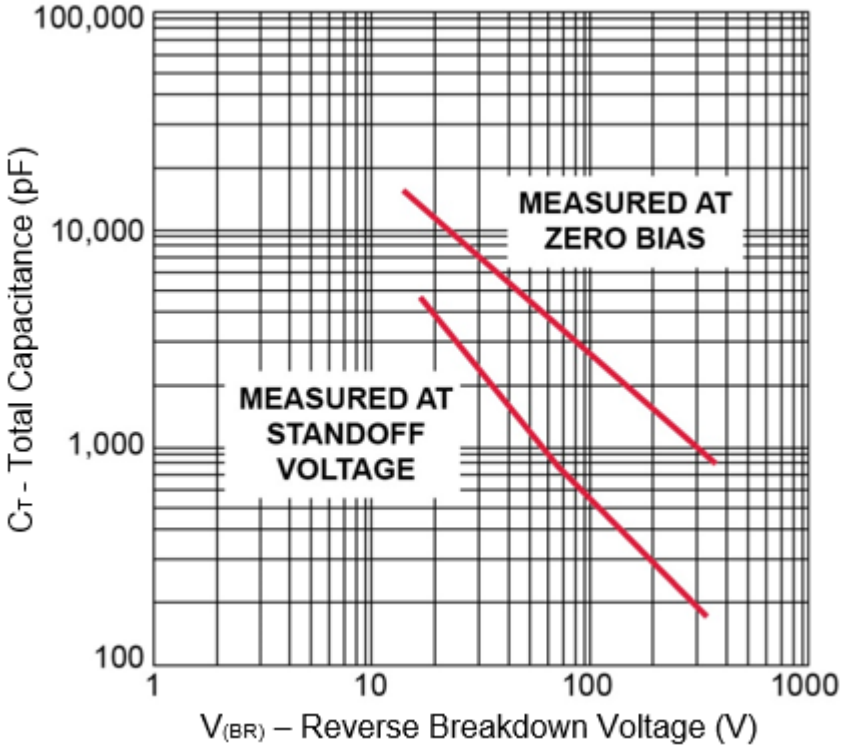


Figure 4-2. Pulse Waveform for 10/1000 µs Exponential Surge



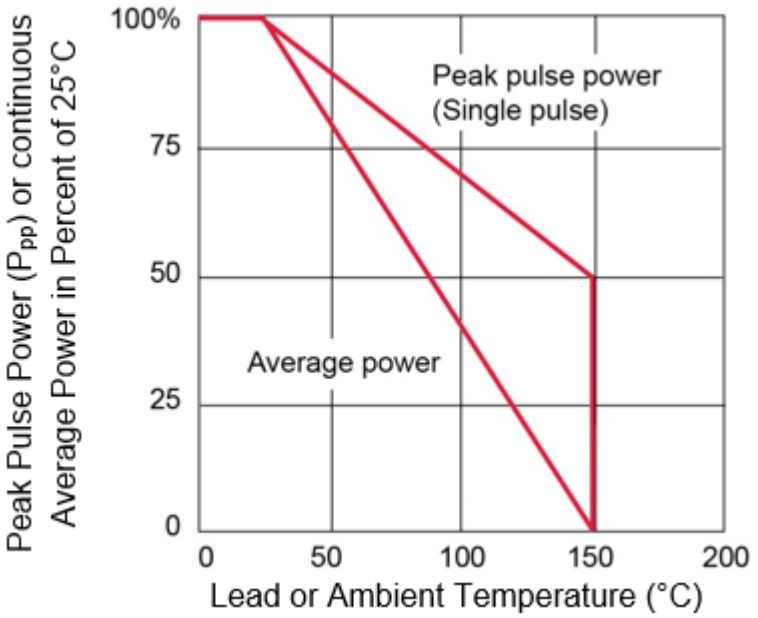
Test waveform parameters: tr=10 µs, tp=1000 µs

Figure 4-3. Typical Junction Capacitance



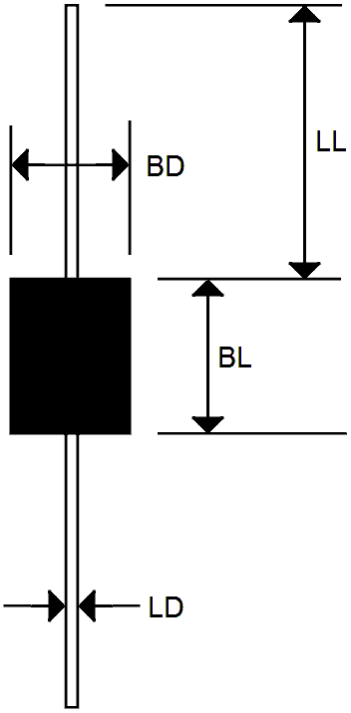
For bidirectional construction, capacitance will be half that shown.

Figure 4-4. Derating Curve



5. Package Dimensions

Figure 5-1. Package Dimensions



Dim.	Dimensions			
	Inch		Millimeters	
	Min.	Max.	Min.	Max.
LL	1.100	1.500	27.95	38.1
BL	0.365	0.375	9.27	9.52
BD	0.240	0.250	6.1	6.35
LD	0.048	0.052	1.22	1.32

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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