7.5 kW, Unidirectional and Bidirectional TVS Protection Device

MPLAD7.5KP10A(e3) – MPLAD7.5KP48CA(e3)

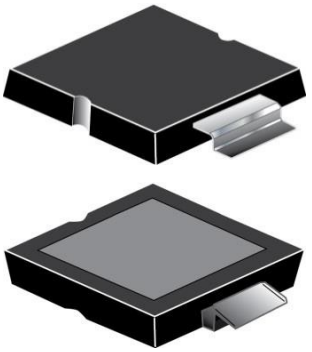
Description

These 7.5 kW rated transient voltage suppressors (TVS) in a surface mount PLAD package are provided with design features to minimize thermal resistance and cumulative heating. These devices have the ability to clamp dangerous high voltage, short term transients such as those produced by electrostatic discharge, radiated RFI, inductive load dumps, and the secondary effects of lightning strikes before they reach sensitive component regions of a circuit. Typical applications include lightning and automotive load dump protection. They are particularly effective at meeting the multi-stroke lightning standard RTCA DO-160, section 22 for aircraft design. The all-metal bottom of this space-efficient, low profile package provides a very low thermal impedance path for heat to escape to the mounting substrate, keeping the junction temperature low. The PLAD7.5KP is offered with stand-off voltages (V_{WM}) from 10 to 48 volts in either unidirectional or bidirectional versions. High-reliability screening is available in reference to MIL-PRF-19500, and the product is tested in accordance with the requirements of AEC-Q101. For more information on PLAD packaged products and our broad range of TVS solutions, please see our website.

Features

- Available in both unidirectional and bidirectional construction (bidirectional with CA suffix)
- High-reliable, with wafer fabrication and assembly lot traceability
- All parts 100% surge tested
- Low profile surface-mount package
- Optional up-screening is available with various screening and conformance inspection options based on MIL-PRF-19500. Refer to the Hi-Rel Non-Hermetic Products brochure on our web site for more details on the screening options.
- Suppresses transients up to 7,500W at 10/1000 µs (see Figure 4-1)
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020
- 3σ lot norm screening performed on standby current (I_D)
- RoHS compliant (2002/95/EC) devices available
- Halogen free (IEC 61249-2-21)

Figure 1. mini-Plad



The cathode is the heat sink under the body of this device.

Applications/Benefits

- Protection from switching transients and induced RF
- Protection from ESD and EFT per IEC 61000-4-2 and IEC 61000-4-4
- Secondary lightning protection per IEC 61000-4-5 with 42 ohms source impedance:
  Class 1, 2, 3, 4, 5: MPLAD7.5KP10A to 48CA
- Secondary lightning protection per IEC 61000-4-5 with 12 ohms source impedance:
  Class 1, 2, 3, 4: MPLAD7.5KP10A to 48CA
- Secondary lightning protection per IEC 61000-4-5 with 2 ohms source impedance:
  Class 2, 3: MPLAD7.5KP10A to 48CA

  Class 4: MPLAD7.5KP10A to 26CA
- Pin injection protection per RTCA/DO-160G for Waveform 4 (6.4/69 µs at 25 °C)[1]:
  Level 1, 2, 3, 4, 5: MPLAD7.5KP10A to 48CA
- Pin injection protection per RTCA/DO-160G for Waveform 5A (40/120 µs at 25 °C)[1]:
  Level 1, 2, 3: MPLAD7.5KP10A to 48CA

  Level 4: MPLAD7.5KP10A to 14CA
- Longer transient pulse width capability if well heat sunk for automotive load dump
- I_{PP} rating of 97 amps to 441 amps
- V_{WM} rating of 10 volts to 48 volts
- $V_{(BR)(Min)}$ range of 11.1 volts to 53.3 volts
- $V_{C(Max)}$ rating of 17 volts to 77.4 volts

Note:

1. See MicroNote 132 for further temperature derating selection.

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1. Absolute Maximum Ratings

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

Parameters/Test Conditions		Symbol	Value	Unit
Junction and storage temperature		T_J and T_{STG}	–55 to +150	°C/W
Thermal resistance junction-to-ambient[1]		$R_{\Theta JA}$	50	°C/W
Thermal resistance junction-to-case		$R_{\Theta JC}$	1.5	°C/W
Peak pulse power at 10/1000 µs[2]		P_{PP}	7,500	W
$t_{clamping}$ (0 volts to $V_{(BR)}$ min)	Unidirectional Bidirectional	—	< 100 < 5	ps ns
Forward clamping voltage at 400 amps[3]		V_{FS}	2.5	V
Forward surge current[3]		I_{FSM}	500	A
Solder temperature at 10 s		—	260	°C
Rated average power dissipation[5]	T_A = 25 °C T_C = 100 °C	$P_{M(AV)}$	2.5[1] 33.3[4]	W W

Notes:

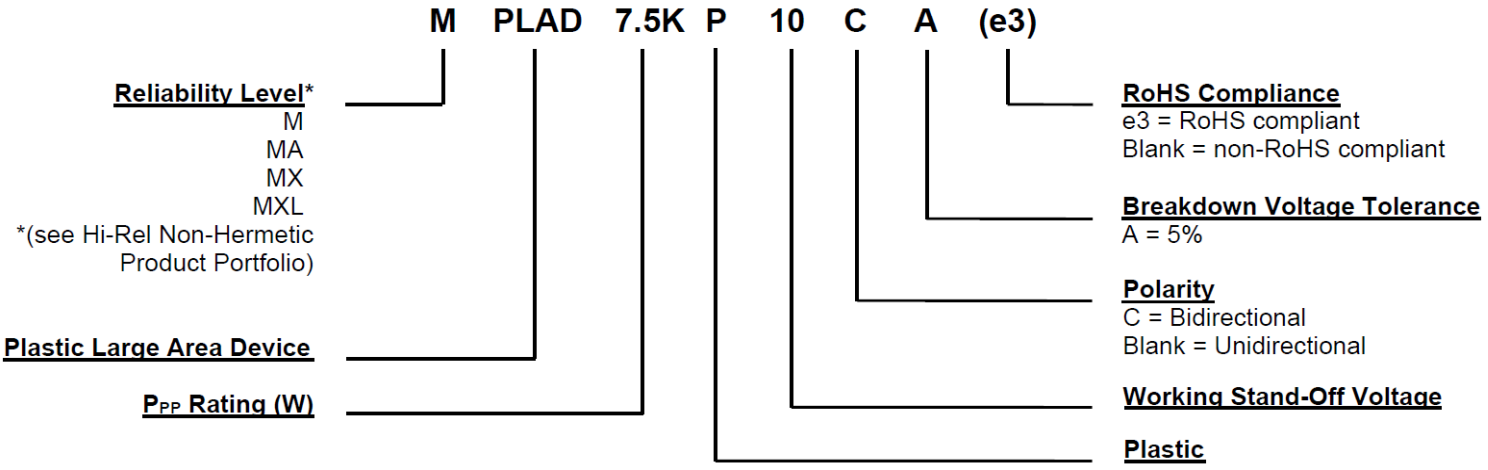
1. When mounted on FR4 PC board with recommended mounting pad (see Pad Layout)
2. Also see Figure 4-1 and Figure 4-2. With impulse repetition rate (duty factor) of 0.05% or less
3. At 8.3 ms half-sine wave (unidirectional devices only)
4. Case temperature controlled on heat sink as specified
5. See MicroNote 134 for derating P_{PP} when also applying steady-state power

1.1 Mechanical and Packaging

- Case: Epoxy, meets UL94V-0
- Terminals: Tin/lead or matte-tin (fully RoHS compliant) plating
- Marking: Reliability level, part number, polarity symbol (unidirectional only), and date code
- Delivery option: Tape and reel (13 inch)
- 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.
$I_{(BR)}$	Breakdown current: The current used for measuring breakdown voltage $V_{(BR)}$.
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 peak power that can be applied for a specific pulse width and waveform. The product of V_C and I_{PP}.
$V_{(BR)}$	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 stand-off 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 Unless Otherwise Stated

Device[1]	Working Stand-Off Voltage V_{WM}	Breakdown Voltage $V_{(BR)}$ $V_{(BR)}$ at $I_{(BR)}$		Maximum Clamping Voltage V_C at I_{PP}	Maximum Standby Current I_D at V_{WM}	Maximum Peak Pulse Current (Figure 4-2) I_{PP}	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
	Volts	Volts	mA	Volts	µA	Amps	mV/°C
MPLAD7.5KP10(C)A(e3)	10	11.1-12.3	5	17.0	15	441	9
MPLAD7.5KP11(C)A(e3)	11	12.2-13.5	5	18.2	10	412	10
MPLAD7.5KP12(C)A(e3)	12	13.3-14.7	5	19.9	10	377	11
MPLAD7.5KP13(C)A(e3)	13	14.4-15.9	5	21.5	10	349	12
MPLAD7.5KP14(C)A(e3)	14	15.6-17.2	5	23.2	10	323	13
MPLAD7.5KP15(C)A(e3)	15	16.7-18.5	5	24.4	10	307	15
MPLAD7.5KP16(C)A(e3)	16	17.8-19.7	5	26.0	10	288	16
MPLAD7.5KP17(C)A(e3)	17	18.9-20.9	5	27.6	10	272	18
MPLAD7.5KP18(C)A(e3)	18	20.0-22.1	5	29.2	10	257	19
MPLAD7.5KP20(C)A(e3)	20	22.2-24.5	5	32.4	10	231	22
MPLAD7.5KP22(C)A(e3)	22	24.4-26.9	5	35.5	10	211	24
MPLAD7.5KP24(C)A(e3)	24	26.7-29.5	5	38.9	10	193	27
MPLAD7.5KP26(C)A(e3)	26	28.9-31.9	5	42.1	10	178	29
MPLAD7.5KP28(C)A(e3)	28	31.1-34.4	5	45.5	10	165	30
MPLAD7.5KP30(C)A(e3)	30	33.3-36.8	5	48.4	10	155	35
MPLAD7.5KP33(C)A(e3)	33	36.7-40.6	5	53.3	10	141	38
MPLAD7.5KP36(C)A(e3)	36	40.0-44.2	5	58.1	10	129	40
MPLAD7.5KP40(C)A(e3)	40	44.4-49.1	5	64.5	10	116	45
MPLAD7.5KP43(C)A(e3)	43	47.8-52.8	5	69.4	10	108	49
MPLAD7.5KP45(C)A(e3)	45	50.0-55.3	5	72.7	10	103	51
MPLAD7.5KP48(C)A(e3)	48	53.3-58.9	5	77.4	10	97	54

Note:

1. See Part Nomenclature for additional screening prefixes and C suffix bidirectional option.

4. Graphs

Figure 4-1. Peak Pulse Power Vs. Pulse Time (to 50% of exponentially decaying pulse)

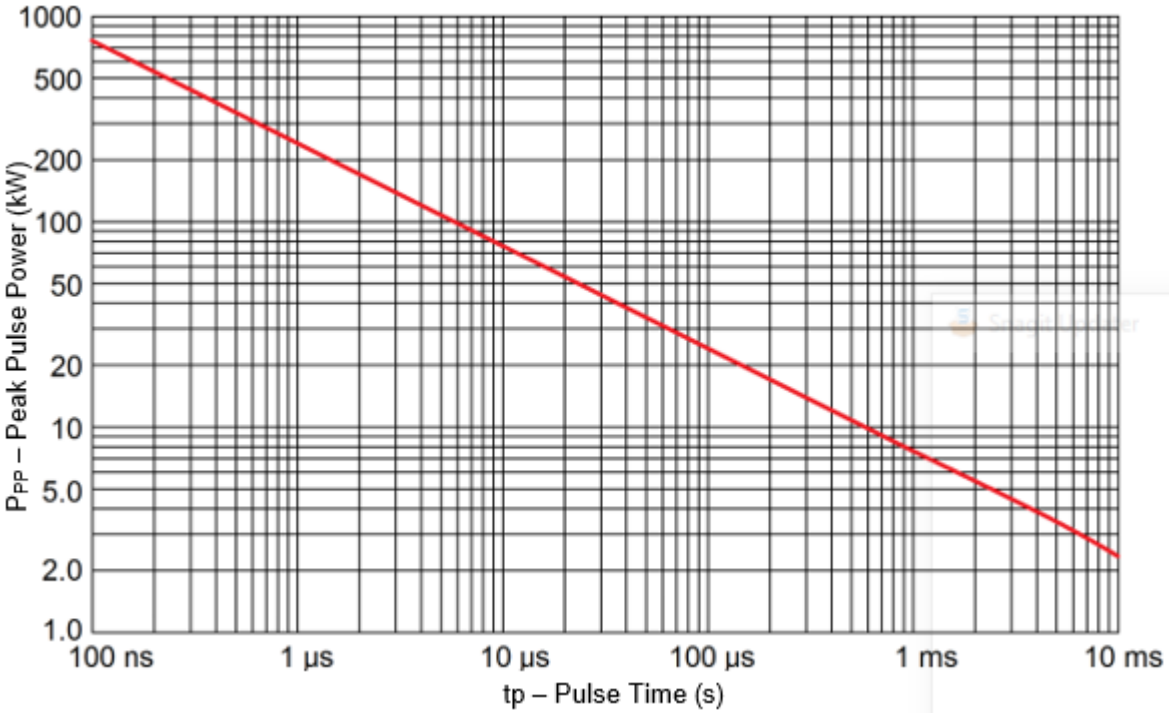


Figure 4-2. Pulse Waveform

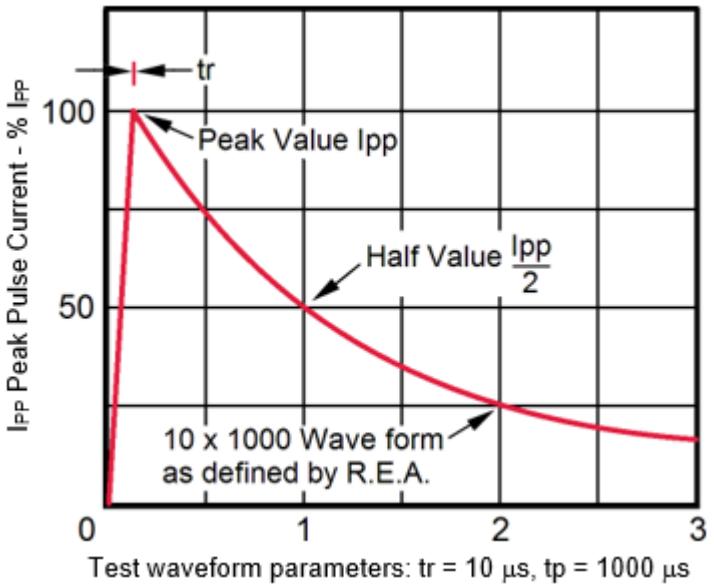
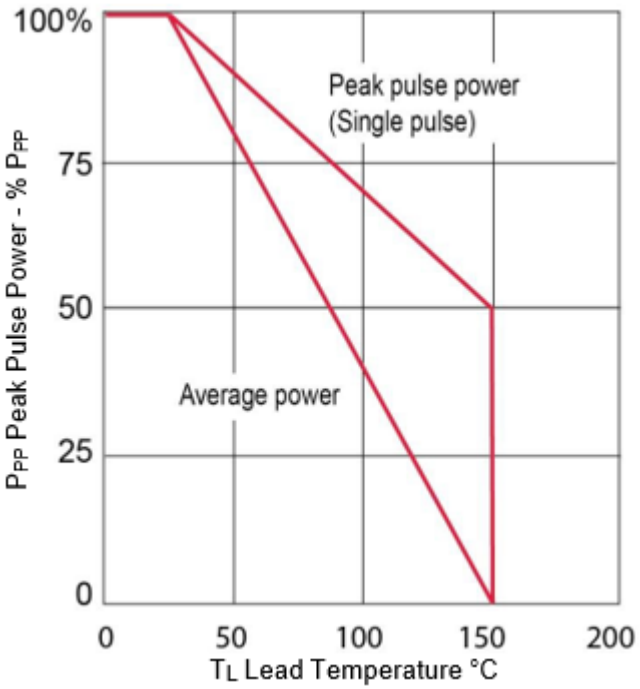
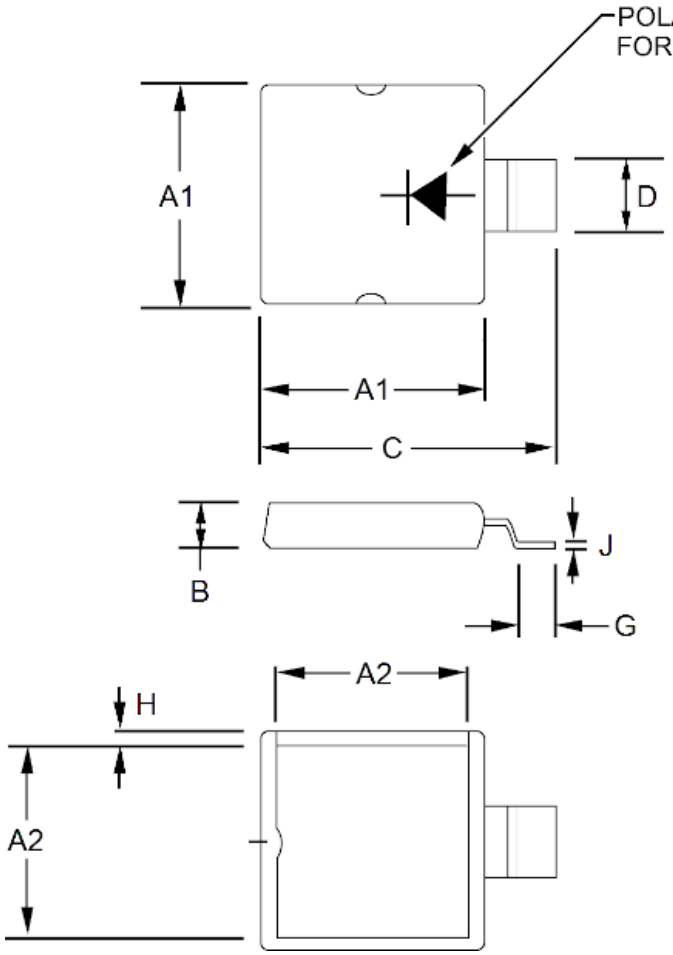


Figure 4-3. Derating Curve



5. Package Dimensions

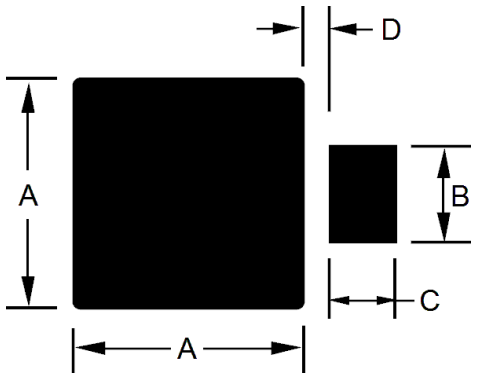
Figure 5-1. Package Dimensions



Ref.	Dimensions			
	Inch		Millimeters	
	Min.	Max.	Min.	Max.
A1	0.337	0.353	8.56	8.97
A2	0.277	0.293	7.04	7.44
B	0.117	0.133	2.97	3.38
C	0.436	0.452	11.07	11.48
D	0.092	0.108	2.34	2.74
G	0.062	0.078	1.57	1.98
H	0.022	0.038	0.56	0.96
J	0.008	0.012	0.20	0.30

5.1 Pad Layout

Figure 5-2. Pad Layout



Ref.	Dimensions	
	Inch	Millimeters
	Typical	Typical
A	0.353	8.97
B	0.117	2.97
C	0.078	1.98
D	0.033	0.84

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	10/2023	Initial revision.

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