Surface Mount 18,000 W Transient Voltage Suppressor Datasheet

1 Product Overview

These high-power, 18 kW-rated transient voltage suppressors in a surface-mount package are provided with design features to minimize thermal resistance and cumulative heating. 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. This efficient low-profile package design is offered in standoff voltage selections (V_{WM}) of 7 V to 200 V in either unidirectional or bidirectional construction.

1.1 Features

The following are key features of the MPLAD18KP7.0A—MPLAD18KP200CA devices:

- Available in both unidirectional and bidirectional construction (bidirectional with CA suffix)
- High reliability with wafer fabrication and assembly lot traceability
- All parts surge tested
- Low-profile surface mount package
- Optional upscreening is available with various screening and conformance inspection options based on MIL-PRF-19500. Refer to Hirel Non-Hermetic Product Portfolio brochure on our website for more details on the screening options.
- Suppresses transients up to 18,000 W at 10/1000 µs (see Peak Pulse Power vs. Pulse Time (see page 6))
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS-compliant versions are available
- 3σ lot norm screening performed on standby current (I_D)
- AEC-Q101 qualified

1.2 Applications and Benefits

The following are benefits of the MPLAD18KP7.0A—MPLAD18KP200CA devices:

- Protection from switching transients and induced RFI
- Protection from electrostatic discharge (ESD) and electrical fast transient (EFT) per IEC 61000-4-2 and IEC 61000-4-4
- Secondary lightning protection per IEC 61000-4-5 with 42 Ω source impedance:
  Class 1,2,3,4,5: MPLAD18KP7.0A to 200CA
- Secondary lightning protection per IEC 61000-4-5 with 12 Ω source impedance:
  Class 1,2,3,4: MPLAD18KP7.0A to 200CA
- Secondary lightning protection per IEC 61000-4-5 with 2 Ω source impedance:
  Class 4: MPLAD18KP5.0 to 64CA
- Pin injection protection per RTCA/DO-160G for Waveform 4 (6.4/69 µs at 25 °C)[1]:
  Level 4: MPLAD18KP7.0A to 200CA
  Level 5: MPLAD18KP7.0A to 130CA
- Pin injection protection per RTCA/DO-160G for Waveform 5A (40/120 µs at 25 °C)[1]:
  Level 4: MPLAD18KP7.0A to 36CA

Notes:

1. See MicroNote 132 for further temperature derating selection.

1.3 Part Nomenclature

The following table shows the part nomenclature for the MPLAD18KP7.0A—MPLAD18KP200CA devices.

Table 1 • MPLAD18KP7.0A Part Nomenclature

M	Reliability level*	M MA MX MXL *(see Hirel Non-Hermetic Product Portfolio)
PLAD	Package designation	
18K	P_{PP} rating (18 kW)	
P	Plastic	
7.0	Reverse standoff voltage	
CA	polarity	A = Unidirectional
		CA = Bidirectional
e3	RoHS compliance	e3 = RoHS compliant
		blank = non-RoHS compliant

1.4 Symbols and Definitions

The following table shows the symbols and definitions used for the MPLAD18KP7.0A—MPLAD18KP200CA devices.

Table 2 • Symbols and Definitions

Symbol	Value	Definition
$I_{(BR)}$	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.
$V_{(BR)}$	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.
$\alpha_{V(BR)}$	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.

2 Electrical Specifications

This section details the electrical specifications for the MPLAD18KP7.0A—MPLAD18KP200CA devices.

2.1 Maximum Ratings

Table 3 • Absolute Maximum Ratings

Parameter/Test Conditions		Symbol	Value	Unit
Junction and storage temperature		T_J and T_{STG}	–55 to 150	°C
Thermal resistance junction-to-ambient[1]		$R_{\theta JA}$	50	°C/W
Thermal resistance junction-to-case		$R_{\theta JC}$	0.7	°C/W
Peak pulse power at 10/1000 µs[2]		P_{PP}	18000	W
$t_{clamping}$ (0 V to $V_{(BR)}$min)	Unidirectional		<100	ps
	Bidirectional		<5	ns
Forward clamping voltage at 500 A[3]		V_{FS}	2.0	V
Forward surge current[3]		I_{FSM}	1500	A
Solder temperature at 10 seconds		T_{SP}	260	°C
Steady-state power dissipation[5]	T_A = 25 ° C	P_D	2.5[1]	W
	T_C = 100 °C		50[4]	W

Notes:

1. When mounted on FR4 PC board (1 oz Cu) with recommended mounting pad (see pad layout).
2. Also see Figure 1 (see page 6) and Figure 2 (see page 6). 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.

2.2 Electrical Characteristics

The following table shows the electrical characteristics of the MPLAD18KLP7.0A—MPLAD18KP200CA devices at 25 °C unless otherwise specified. Bidirectional part numbers have a "CA" suffix instead of an "A" suffix.

Table 4 • Typical Electrical Performance

Part Number	V_{WM} Working Standoff Voltage[1]	V_{BR} Breakdown Voltage at $I_{(BR)}$	I_{BR} Test Current	V_C Max Clamping Voltage at I_{PP}	I_D Max Stand-by Current at V_{WM}	I_{PP} Max Peak Pulse Current[3]	$\alpha_{V(BR)}$ Max Temp Coefficient
Unidirectional	**(V)**	**Min – Max (V)**	**(mA)**	**(V)**	**(µA)**	**(A)**	**(mV/°C)**
MPLAD18KP7.0A	7.0	7.78 – 8.60	150	12.0	3000	1500[2]	5.0
MPLAD18KP7.5A	7.5	8.33 – 9.21	5	12.9	750	1396[2]	6.0
MPLAD18KP8.0A	8.0	8.89 – 9.83	5	13.6	450	1324[2]	6.0
MPLAD18KP8.5A	8.5	9.44 – 10.4	5	14.4	150	1250[2]	7.0
MPLAD18KP9.0A	9.0	10.0 – 11.1	5	15.4	60	1169[2]	8.0
MPLAD18KP10A	10	11.1 – 12.3	5	17.0	45	1059[2]	9.0
MPLAD18KP11A	11	12.2 – 13.5	5	18.2	10	989	10
MPLAD18KP12A	12	13.3 – 14.7	5	19.9	10	909	11
MPLAD18KP13A	13	14.4 – 15.9	5	21.5	10	838	12
MPLAD18KP14A	14	15.6 – 17.2	5	23.2	10	776	13
MPLAD18KP15A	15	16.7 – 18.5	5	24.4	10	738	15
MPLAD18KP16A	16	17.8 – 19.7	5	26.0	10	693	16
MPLAD18KP17A	17	18.9 – 20.9	5	27.6	10	556	18
MPLAD18KP18A	18	20.0 – 22.1	5	29.2	10	617	19
MPLAD18KP20A	20	22.2 – 24.5	5	32.4	10	556	22
MPLAD18KP22A	22	24.4 – 26.9	5	35.5	10	508	24
MPLAD18KP24A	24	26.7 – 29.5	5	38.9	10	463	27
MPLAD18KP26A	26	28.9 – 31.9	5	42.1	10	428	29
MPLAD18KP28A	28	31.1 – 34.4	5	45.5	10	396	30
MPLAD18KP30A	30	33.3 – 36.8	5	48.4	10	372	35
MPLAD18KP33A	33	36.7 – 40.6	5	53.3	10	388	38
MPLAD18KP36A	36	40.0 – 44.2	5	58.1	10	310	40
MPLAD18KP40A	40	44.4 – 49.1	5	64.5	10	280	45
MPLAD18KP43A	43	47.8 – 52.8	5	69.4	10	260	49
MPLAD18KP45A	45	50.0 – 55.3	5	72.7	10	248	51
MPLAD18KP48A	48	53.3 – 58.9	5	77.4	10	233	55
MPLAD18KP51A	51	56.7 – 62.7	5	82.4	10	219	60
MPLAD18KP54A	54	60.0 – 66.3	5	87.1	10	207	64
MPLAD18KP58A	58	64.4 – 71.2	5	93.6	10	193	69

Part Number	V_{WM} Working Standoff Voltage[1]	V_{BR} Breakdown Voltage at $I_{(BR)}$	I_{BR} Test Current	V_C Max Clamping Voltage at I_{PP}	I_D Max Stand-by Current at V_{WM}	I_{PP} Max Peak Pulse Current[3]	$\alpha_{V(BR)}$ Max Temp Coefficient
Unidirectional	**(V)**	**Min – Max (V)**	**(mA)**	**(V)**	**(µA)**	**(A)**	**(mV/°C)**
MPLAD18KP60A	60	66.7 – 73.7	5	96.8	10	186	70
MPLAD18KP64A	64	71.1 – 78.6	5	103	10	175	75
MPLAD18KP70A	70	77.8 – 86.0	5	113	10	160	84
MPLAD18KP75A	75	83.3 – 92.1	5	121	10	149	90
MPLAD18KP78A	78	86.7 – 95.8	5	126	10	143	94
MPLAD18KP85A	85	94.4 –104.0	5	137	10	132	102
MPLAD18KP90A	90	100 – 111	5	146	10	124	109
MPLAD18KP100A	100	111 – 123	5	162	10	112	122
MPLAD18KP110A	110	122 – 135	5	177	10	102	132
MPLAD18KP120A	120	133 – 147	5	193	10	94	145
MPLAD18KP130A	130	144 – 159	5	209	10	87	157
MPLAD18KP150A	150	167 – 185	5	193	10	75	183
MPLAD18KP160A	160	178 – 197	5	259	10	70	195
MPLAD18KP170A	170	189 – 209	5	275	10	66	207
MPLAD18KP180A	180	200 – 221	5	291	10	62	219
MPLAD18KP200A	200	222 – 245	5	322	10	56	243

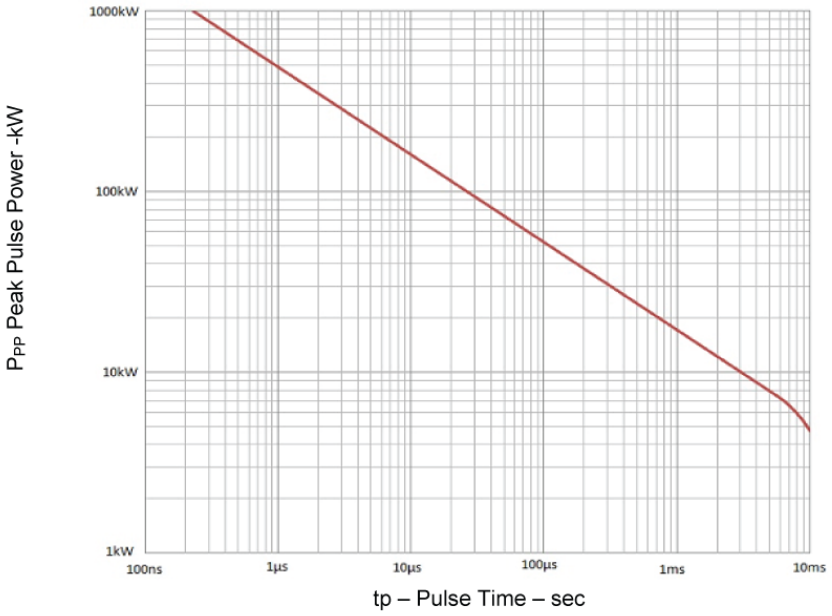
Notes:

1. Transient voltage suppressors are normally selected with reverse standoff voltage V_{WM}, which should be equal to or greater than the peak operating voltage.
2. Surge testing is performed to 1000 A due to equipment limitations.
3. See Figure 3 (see page 7).

2.3 Typical Performance Curves

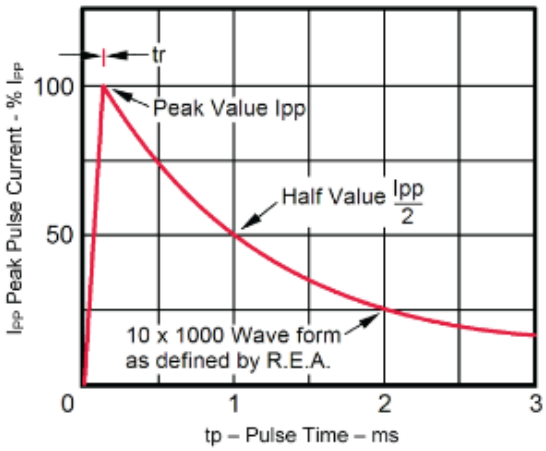
This section details the typical performance curves of the MPLAD18KLP7.0A–MPLAD18KP200CA devices. The following graph shows peak pulse power versus pulse time (to 50% of exponentially decaying pulse).

Figure 1 • Peak Pulse Power vs. Pulse Time (to 50% of exponentially decaying pulse)



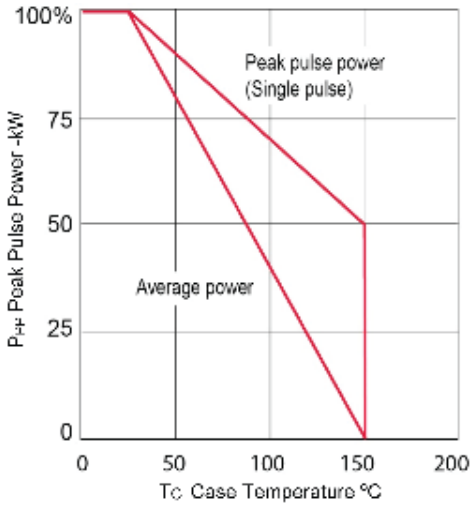
The following graph shows the pulse waveform with these parameters: tr = 10 µs and tp = 1000 µs.

Figure 2 • Pulse Waveform



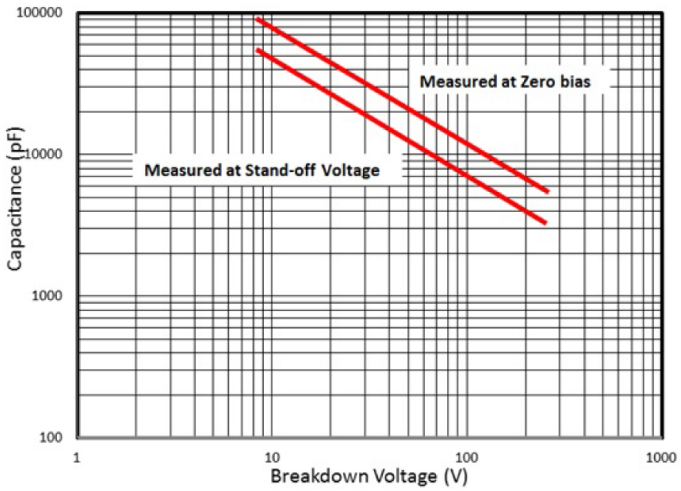
The following graph shows the derating curve.

Figure 3 • Derating Curve



The following graph shows the typical capacitance versus the breakdown voltage. Note that the bidirectional capacitance is half that shown at 0 V.

Figure 4 • Typical Capacitance vs. Breakdown Voltage (Unidirectional Configuration)

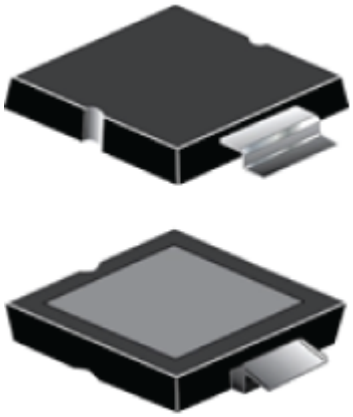


3 Package Specification

The following illustration is the MPLAD18KP7.0A—MPLAD18KP200CA package.

The cathode is the metal base under the body of this device.

Figure 5 • PLAD Package



The following table lists mechanical and packaging information for the MPLAD18KP7.0A—MPLAD18KP200CA devices.

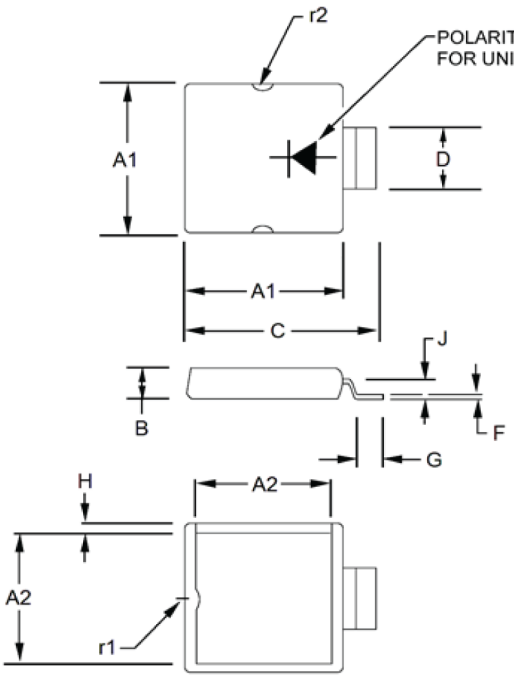
Table 5 • Mechanical and Packaging

Component	Description
Case	Void-free transfer molded thermosetting epoxy body meeting UL94V-0
Terminals	Tin-lead or RoHS-compliant annealed matte-tin plating readily solderable per MIL-STD-750, method 2026.
Marking	Body marked with part number
Polarity	For unidirectional devices, the cathode is on the metal backside (package bottom)
Packaging	Available in bulk or custom tape-and-reel packaging
Tape-and-Reel	Standard per EIA-481-B (add “TR” suffix to part number). Consult factory for quantities.
Weight	Approximately 1 g
See Package Dimensions on last page.	

3.1 Package Dimensions

The following illustration shows the package dimensions for the MPLAD18KP7.0A—MPLAD18KP200CA devices.

Figure 6 • Package Outline Drawing

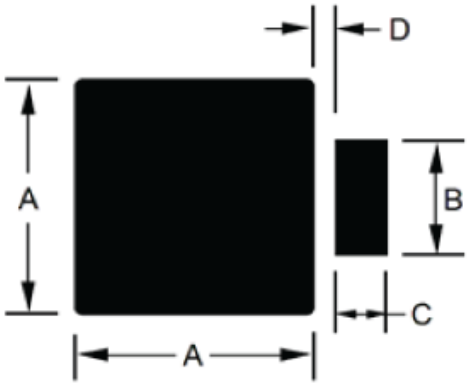


Ref.	Dimensions			
	Inch		Millimeters	
	Min	Max	Min	Max
A1	0.485	0.495	12.32	12.57
A2	0.415	0.425	10.54	10.80
B	0.145	0.155	3.68	3.94
C	0.585	0.595	14.86	15.11
D	0.200	0.210	5.08	5.33
F	0.008	0.013	0.20	0.33
G	0.045	0.055	1.14	1.40
H	0.015	0.025	0.38	0.64
J	0.062 TYP		1.57 TYP	
r1	0.030 TYP		0.76 TYP	
r2	0.045 TYP		1.14 TYP	

3.2 Pad Layout

The following illustration shows the pad layout for the MPLAD18KP7.0A – MPLAD18KP200CA devices

Figure 7 • Pad Layout



Ref.	Dimensions	
	Inch	Millimeters
	Typical	Typical
A	0.470	11.94
B	0.230	5.85
C	0.100	2.44
D	0.045	1.15

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