

MPLAD36KP14A—MPLAD36KP400CA
Datasheet
Surface Mount 36,000 W Transient Voltage Suppressor

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1

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.

1.1

Revision 1.0

Revision 1.0 was published in May 2017. It is the first publication of this document.

2 Product Overview

These high-power, 36 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 14 Volts to 400 Volts in either unidirectional or bidirectional construction.

2.1 Features

The following are key features of the MPLAD36KP14A—MPLAD36KP400CA 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 36,000 W at 10/1000 μ s (see Figure 1)
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020D.1
- RoHS-compliant versions are available
- 3σ lot norm screening performed on standby current (I_D)

2.2 Applications and Benefits

The following are benefits of the MPLAD36KP14A—MPLAD36KP400CA devices:

- Protection from switching transients and induced RFI
- 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 Ω source impedance:
 - Class 1,2,3,4,5: MPLAD36KP14A to 400CA
 - Class 5: MPLAD36KP14A to 400CA (short distance)
 - Class 5: MPLAD36KP14A to 260CA (long distance)
- Secondary lightning protection per IEC 61000-4-5 with 12 Ω source impedance:
 - Class 1,2,3: MPLAD36KP14A to 400CA
 - Class 4: MPLAD36KP14A to 280CA
- Secondary lightning protection per IEC 61000-4-5 with 2 ohms source impedance:
 - Class 2: MPLAD36KP10A to 400CA
 - Class 3: MPLAD36KP14A to 260CA
 - Class 4: MPLAD36KP14A to 130CA
- Pin injection protection per RTCA/DO-160F for Waveform 4 (6.4/69 μ s @ 25°C)*:

Level 4: MPLAD36KP14A to 400CA

Level 5: MPLAD36KP14A to 300CA

- Pin injection protection per RTCA/DO-160F for Waveform 5A (40/120 μ s @ 25 °C)*:

Level 4: MPLAD36KP14A to 78CA

Level 5: MPLAD36KP14A to 38CA

* See MicroNote 132 for further temperature derating selection.

2.3 Part Nomenclature

The following table lists the part nomenclature for the MPLAD36KP14A — MPLAD36KP400CA devices.

Table 1 • MPLAD36KP14A Part Nomenclature

M	Reliability level*	M MA MX MXL *(see Hirel Non-Hermetic Product Portfolio)
PLAD	Package designation	
36K	P _{PP} rating (W)	
P	Plastic	
14	Reverse standoff voltage	
CA	polarity	A = Unidirectional
		CA = Bidirectional
e3	RoHS compliance	e3 = RoHS compliant
		blank = non-RoHS compliant

2.4 Symbols and Definitions

The following table lists the symbols and definitions used for the MPLAD36KP14A—MPLAD36KP400CA 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 at the rated standoff voltage V_{WM} .
I_{PP}	Peak Impulse current	The peak current during the impulse.
$V_{(BR)}$	Breakdown voltage	The minimum voltage the device will exhibit at a specified current.
V_C	Clamping voltage	Clamping voltage at I_{PP} (peak pulse current) at the specified pulse conditions (typically shown as maximum value).
V_{WM}	Rated Working Standoff voltage	The maximum peak voltage that can be applied over the operating temperature range.
$\alpha_{V(BR)}$	Temperature Coefficient of Breakdown voltage	The change in breakdown voltage divided by change in temperature.

3 Electrical Specifications

This section details the electrical specifications for the MPLAD36KP714A — MPLAD36KP400CA devices.

3.1 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	$R_{\theta JC}$	1.0	°C/W
Peak Pulse Power at 10/1000 μ s ²	P_{PP}	36,000	W
$t_{clamping}$ (0 V to $V_{(BR)}$ min)	Unidirectional	<100	ps
	Bidirectional	<5	ns
Forward Clamping Voltage at 500 A ³	V_{FS}	4.0	V
Forward Surge Current ³	I_{FSM}	1500	A
Solder Temperature at 10 s	T_{SP}	260	°C
Steady-State Power dissipation ⁵	$T_A = 25^\circ\text{C}$	$P_D = 2.5$ ¹	W
	$T_C = 100^\circ\text{C}$	50 ⁴	W

1. When mounted on FR4 PC board (1oz Cu) with recommended mounting pad (see pad layout).
2. Also see Figures 1 and 2. With impulse repetition rate (duty factor) of 0.05% 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.

3.2 Typical Electrical Performance

The following table shows the Electrical characteristics of the MPLAD36KLP14A–MPLAD36KP400CA devices at 25 °C unless otherwise specified.

Table 4 • Typical Electrical Performance

Part Number		Reverse Standoff Voltage ¹	Breakdown Voltage at I_{BR}		Max Clamping Voltage at I_{PP}	Max Standby Current at V_{WM}	Max Peak Pulse Current I_{PP}^3	Max Temp Coefficient $\alpha_{V(BR)}$
Unidirectional	Bidirectional	V	V_{BR}	mA	V_C	I_D	A	mV/°C
MPLAD36KP14A	MPLAD36KP14CA	14	15.6–17.2	150	24.0	3000	1500 ²	10
MPLAD36KP15A	MPLAD36KP15CA	15	16.7–18.5	5	25.8	750	1396 ²	12
MPLAD36KP16A	MPLAD36KP16CA	16	17.8–19.7	5	27.2	450	1324 ²	12
MPLAD36KP17A	MPLAD36KP17CA	17	18.9–20.9	5	28.8	150	1250 ²	14
MPLAD36KP18A	MPLAD36KP18CA	18	20.0–22.1	5	30.8	60	1169 ²	16
MPLAD36KP20A	MPLAD36KP20CA	20	22.2–24.5	5	34.0	45	1059 ²	18
MPLAD36KP22A	MPLAD36KP22CA	22	24.4–26.9	5	36.4	10	990	20
MPLAD36KP24A	MPLAD36KP24CA	24	26.7–29.5	5	39.8	10	905	22
MPLAD36KP26A	MPLAD36KP36CA	26	28.9–31.9	5	43.0	10	838	24
MPLAD36KP28A	MPLAD36KP38CA	28	31.1–34.4	5	46.4	10	776	26
MPLAD36KP30A	MPLAD36KP30CA	30	33.3–36.8	5	48.8	10	738	30
MPLAD36KP33A	MPLAD36KP33CA	33	36.7–40.6	5	53.3	10	676	35
MPLAD36KP36A	MPLAD36KP36CA	36	40.0–44.2	5	58.1	10	620	38
MPLAD36KP40A	MPLAD36KP40CA	40	44.4–49.1	5	64.5	10	559	44
MPLAD36KP43A	MPLAD36KP43CA	43	47.8–52.8	5	69.4	10	519	50
MPLAD36KP45A	MPLAD36KP45CA	45	50.0–55.3	5	72.7	10	496	51
MPLAD36KP48A	MPLAD36KP48CA	48	58.3–58.9	5	77.4	10	466	54
MPLAD36KP51A	MPLAD36KP51CA	51	56.7–62.7	5	82.4	10	437	58
MPLAD36KP54A	MPLAD36KP54CA	54	60.0–66.3	5	87.1	10	414	64
MPLAD36KP58A	MPLAD36KP58CA	58	64.4–71.2	5	93.6	10	385	70
MPLAD36KP60A	MPLAD36KP60CA	60	66.7–73.7	5	96.8	10	372	72
MPLAD36KP64A	MPLAD36KP64CA	64	71.1–48.6	5	103.0	10	350	75
MPLAD36KP70A	MPLAD36KP70CA	70	77.8–86.0	5	113	10	319	84
MPLAD36KP75A	MPLAD36KP75CA	75	83.3–92.1	5	121	10	298	98
MPLAD36KP78A	MPLAD36KP78CA	78	86.7–95.8	5	126	10	286	95
MPLAD36KP85A	MPLAD36KP85CA	85	94.4–104.0	5	137	10	263	104
MPLAD36KP90A	MPLAD36KP90CA	90	100–111	5	146	10	247	109
MPLAD36KP100A	MPLAD36KP100CA	100	111–123	5	162	10	223	122

Part Number		Reverse Standoff Voltage ¹	Breakdown Voltage at I_{BR}		Max Clamping Voltage at I_{PP}	Max Standby Current at V_{WM}	Max Peak Pulse Current I_{PP}^3	Max Temp Coefficient $\alpha_{V(BR)}$
MPLAD36KP110A	MPLAD36KP110CA	110	122 – 135	5	177	10	204	132
MPLAD36KP120A	MPLAD36KP120CA	120	133 – 147	5	193	10	187	145
MPLAD36KP130A	MPLAD36KP130CA	130	144 – 159	5	209	10	173	157
MPLAD36KP150A	MPLAD36KP150CA	150	167 – 185	5	243	10	149	183
MPLAD36KP160A	MPLAD36KP160CA	160	178 – 197	5	259	10	139	195
MPLAD36KP170A	MPLAD36KP170CA	170	189 – 209	5	275	10	131	207
MPLAD36KP180A	MPLAD36KP180CA	180	200 – 221	5	291	10	124	219
MPLAD36KP200A	MPLAD36KP200CA	200	222–245	5	322	10	112	243
MPLAD36KP220A	MPLAD36KP220CA	220	245 – 271	5	356	10	102	269
MPLAD36KP260A	MPLAD36KP260CA	260	289 – 320	5	419	10	86	318
MPLAD36KP280A	MPLAD36KP280CA	280	311 – 345	5	451	10	80	344
MPLAD36KP300A	MPLAD36KP300CA	300	333 – 369	5	483	10	75	368
MPLAD36KP350A	MPLAD36KP350CA	350	389 – 431	5	564	10	64	430
MPLAD36KP400A	MPLAD36KP400CA	400	444 – 492	5	644	10	56	493

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.

3.3 Typical Performance Curves

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

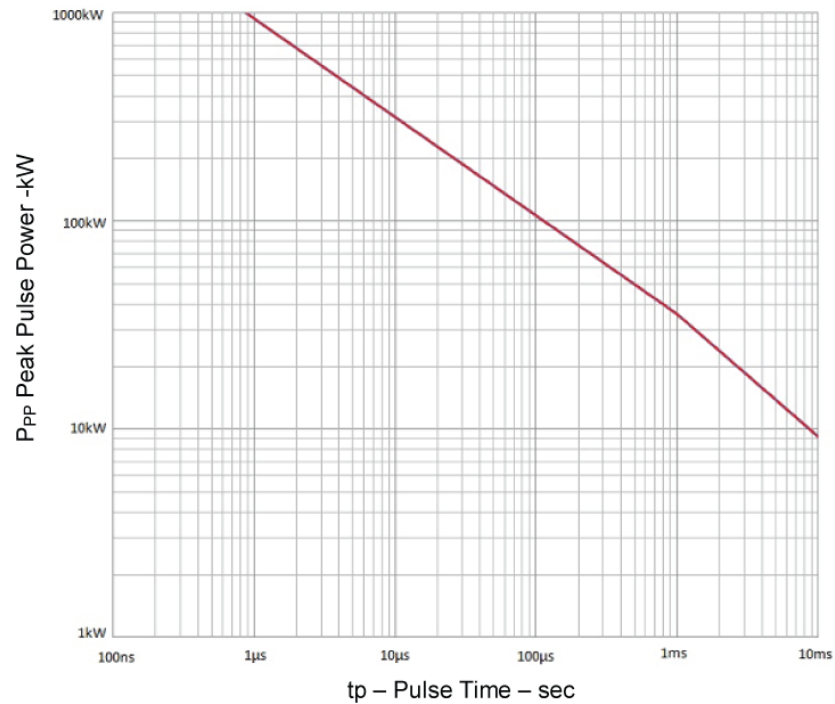
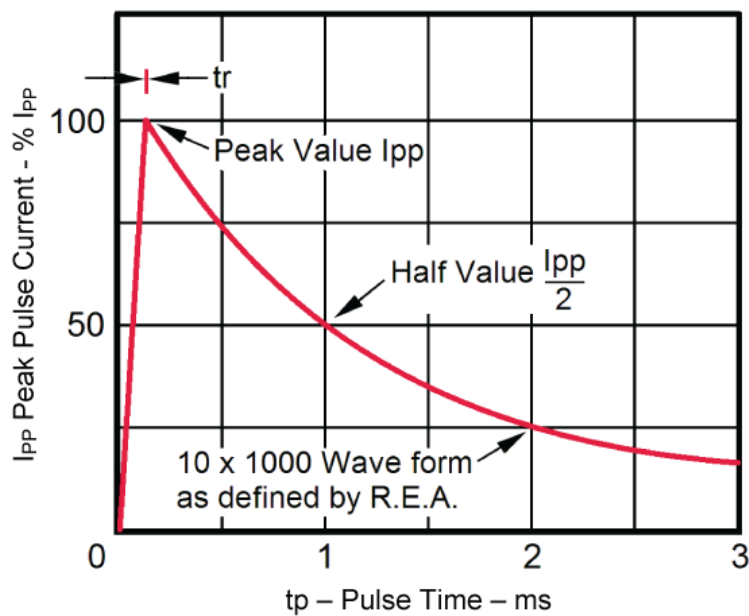


Figure 2 • Pulse Waveform



Test waveform parameters: $t_r = 10 \mu s$, $t_p = 1000 \mu s$

Figure 3 • Derating Curve

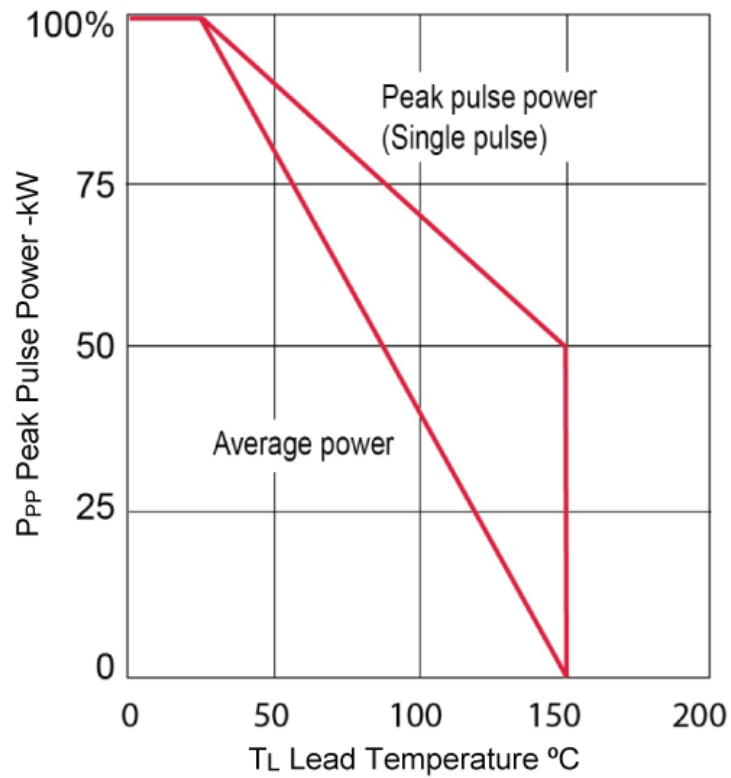
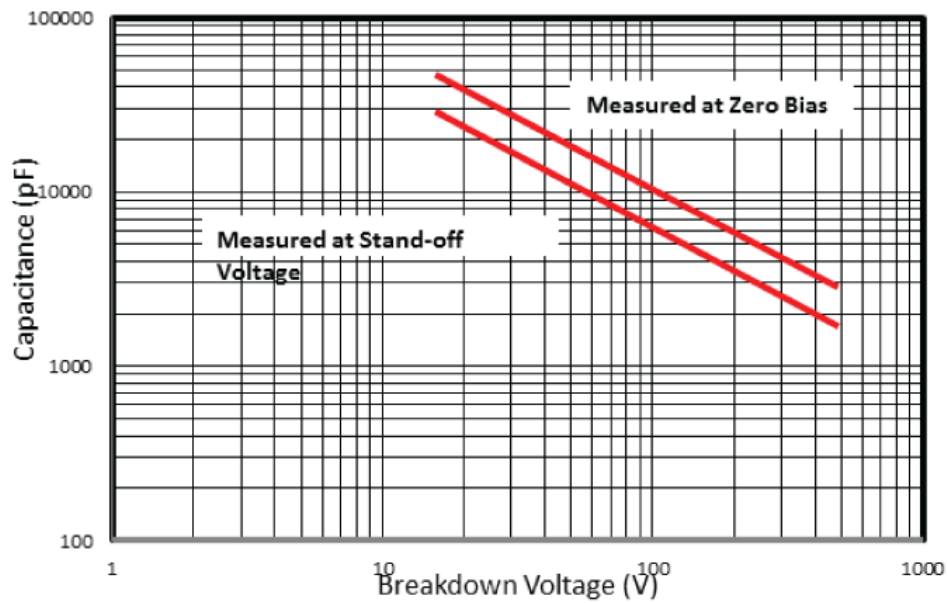


Figure 4 • Typical Capacitance vs. Breakdown Voltage (Unidirectional Configuration)



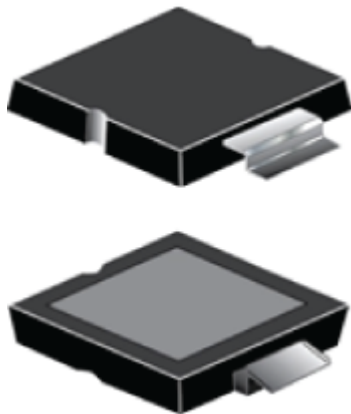
Note: Bidirectional capacitance is half that shown at 0 V.

4 Package Specification

The following illustration is the MPLAD36KP714A - MPLAD18KP400CA package. This package is tested in accordance with the requirements of AEC-Q101.

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 MPLAD36KP714A - MPLAD36KP400CA devices.

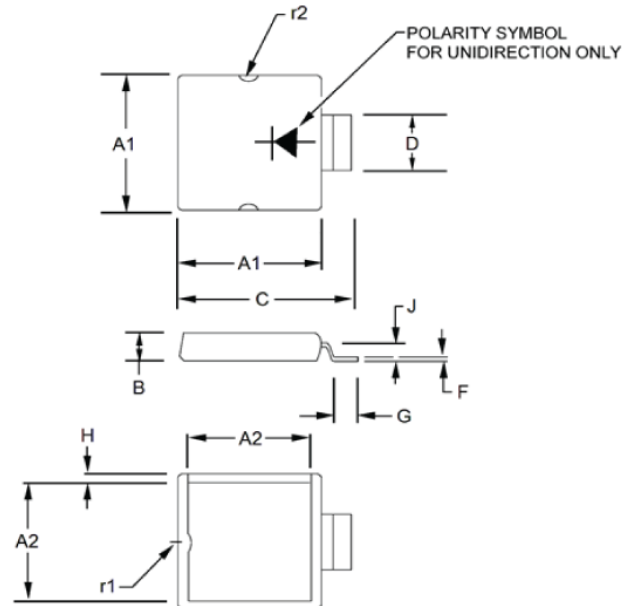
Table 5 • Mechanical and Packaging

Mechanical and Packaging
• 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)
• 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 1.7–2.0 g
• See Package Dimensions on last page.

4.1 Package Dimensions

The following illustration shows the package dimensions for the MPLAD36KP14A – MPLAD36KP400CA devices.

Figure 6 • Chip Outline Drawing

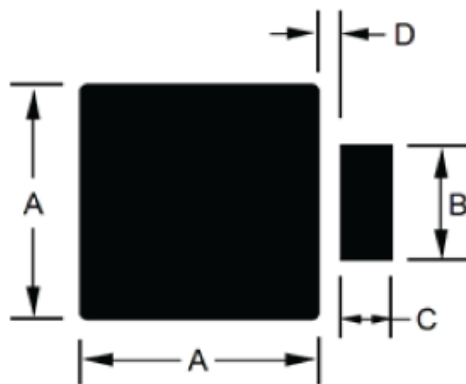


Ref.	Dimensions			
	Inch		Millimeters	
	Min	Max	Min	Max
A1	0.485	0.495	12.32	12.57
A2	0.415	0.425	10.54	10.80
B	0.145	0.155	3.68	3.94
C	0.585	0.595	14.86	15.11
D	0.200	0.210	5.08	5.33
F	0.008	0.013	0.20	0.33
G	0.055	0.065	1.40	1.65
H	0.015	0.025	0.38	0.64
J	0.062 TYP		1.57 TYP	
r1	0.030 TYP		0.76 TYP	
r2	0.045 TYP		1.14 TYP	

4.2 Pad Layout

The following illustration shows the pad layout for the MPLAD36KP14A – MPLAD36KP400CA 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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