Surface Mount 36,000 Watt Transient Voltage Suppressor

MPLAD36KP14A – MXLPLAD36KP400CA(e3)

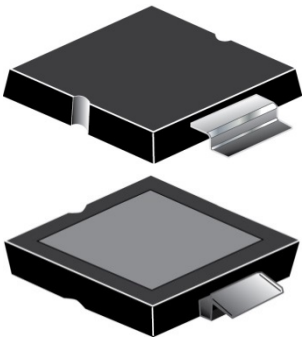
Product Overview

These 36 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 PLAD36KP is offered with standoff voltages (V_{WM}) from 14 to 400 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)
- 3σ lot norm screening performed on standby current (I_D) for all M prefix devices
- High reliability with wafer fabrication and assembly lot traceability for all M prefix devices
- 100% surge tested devices
- Suppresses transients up to 36,000W at 10/1000 µs (see Figure 4-1)
- Enhanced reliability screening in reference to MIL-PRF-19500 are available. Refer to Hi-Rel Non-Hermetic Product Portfolio for more details on the screening options.
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020F
- RoHS compliant versions are available

Figure 1. PLAD



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

Applications/Benefits

- Available in working standoff voltage (V_{WM}) range 14 to 400 volts
- 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 ohms source impedance:
  Class 1, 2, 3, 4, 5: MPLAD36KP14A to MXLPLAD400CAe3
  Class 5: MPLAD36KP14A to MXLPLAD36KP400CAe3 (short distance)
  Class 5: MPLAD36KP14A to MXLPLAD36KP260CAe3 (long distance)
- Secondary lightning protection per IEC 61000-4-5 with 12 ohms source impedance:
  Class 1, 2, 3: MPLAD36KP14A to MXLPLAD36KP400CAe3
  Class 4: MPLAD36KP14A to MXLPLAD36KP280CAe3
- Secondary lightning protection per IEC 61000-4-5 with 2 ohms source impedance:
  Class 2: MPLAD36KP10A to MXLPLAD36KP400CAe3
  Class 3: MPLAD36KP14A to MXLPLAD36KP260CAe3
  Class 4: MPLAD36KP14A to MXLPLAD36KP130CAe3
- Pin injection protection per RTCA/DO-160F for Waveform 4 (6.4/69 µs @ 25°C)*:
  Level 4: MPLAD36KP14A to MXLPLAD36KP400CAe3
  Level 5: MPLAD36KP14A to MXLPLAD36KP300CAe3
- Pin injection protection per RTCA/DO-160F for Waveform 5A (40/120 µs @25°C)*:
  Level 4: MPLAD36KP14A to MXLPLAD36KP78CAe3
  Level 5: MPLAD36KP14A to MXLPLAD36KP38CAe3

See MicroNote 132 for further temperature derating selection.

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}	–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 [2]		P_{PP}	36,000	W
$t_{clamping}$ (0 volts to $V_{(BR)}$ min)	Unidirectional Bidirectional		<100 <5	ps ns
Forward surge current [3]		I_{FSM}	1,500	A
Solder temperature at 10 seconds		T_{SP}	260	°C
Average power dissipation [5]	T_A = 25 °C T_C = 100 °C	P_D	2.5 [1] 50 [4]	W W

Notes:

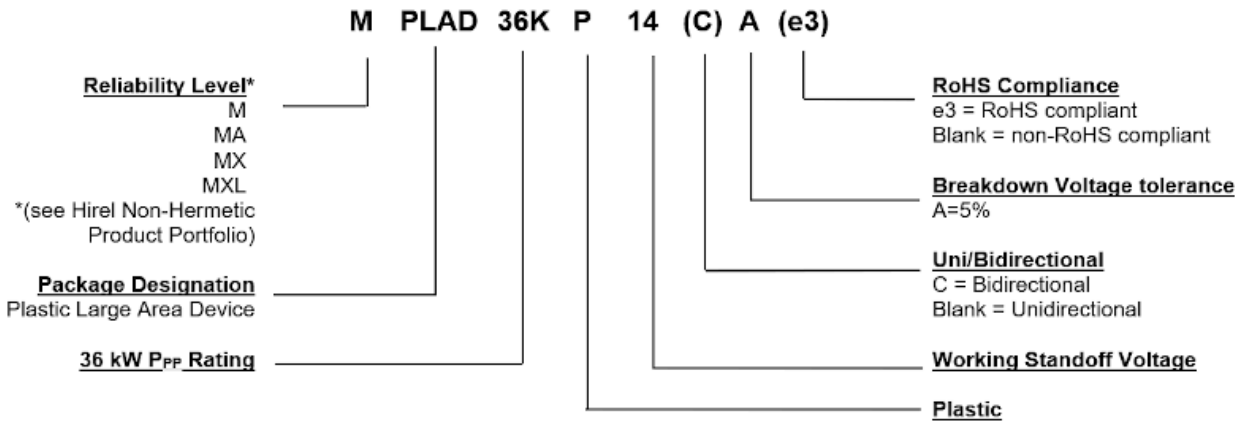
1. When mounted on FR4 PC board (1oz Cu) with recommended mounting pad (see pad layout).
2. Also see Figure 4-1 and Figure 4-2. At 10/1000 µs with impulse repetition rate (duty factor) of 0.05% or less.
3. At 8.3 ms half-sine wave (unidirectional devices only).
4. Case temperature controlled on heat sink as specified.
5. See MicroNote 134 for derating P_{PP} when also applying steady-state power.

1.1 Mechanical 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: Reliability level, part number, date code
- Polarity: Unidirectional devices include polarity symbol, 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 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 peak 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 Characteristic at 25 °C Unless Otherwise Stated[1-4]

Part Number	Working Standoff Voltage V_{WM}[1]	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 I_{PP} (Figure 4-3)	Maximum Temperature Coefficient $\alpha_{V(BR)}$
	Volts	Volts	mA	Volts	µA	A	mV/ °C
MPLAD36KP14(C)A	14	15.6 – 17.2	150	24.0	3000	1500[5]	10
MPLAD36KP15(C)A	15	16.7 – 18.5	5	25.8	750	1396[5]	12
MPLAD36KP16(C)A	16	17.8 – 19.7	5	27.2	450	1324[5]	12
MPLAD36KP17(C)A	17	18.9 – 20.9	5	28.8	150	1250[5]	14
MPLAD36KP18(C)A	18	20.0 – 22.1	5	30.8	60	1169[5]	16
MPLAD36KP20(C)A	20	22.2 – 24.5	5	34.0	45	1059[5]	18
MPLAD36KP22(C)A	22	24.4 – 26.9	5	36.4	10	990	20
MPLAD36KP24(C)A	24	26.7 – 29.5	5	39.8	10	905	22
MPLAD36KP26(C)A	26	28.9 – 31.9	5	43.0	10	838	24
MPLAD36KP28(C)A	28	31.1 – 34.4	5	46.4	10	776	26
MPLAD36KP30(C)A	30	33.3 – 36.8	5	48.8	10	738	30
MPLAD36KP33(C)A	33	36.7 – 40.6	5	53.3	10	676	35
MPLAD36KP36(C)A	36	40.0 – 44.2	5	58.1	10	620	38
MPLAD36KP40(C)A	40	44.4 – 49.1	5	64.5	10	559	44
MPLAD36KP43(C)A	43	47.8 – 52.8	5	69.4	10	519	50
MPLAD36KP45(C)A	45	50.0 – 55.3	5	72.7	10	496	51
MPLAD36KP48(C)A	48	53.3 – 58.9	5	77.4	10	466	54
MPLAD36KP51(C)A	51	56.7 – 62.7	5	82.4	10	437	58
MPLAD36KP54(C)A	54	60.0 – 66.3	5	87.1	10	414	64
MPLAD36KP58(C)A	58	64.4 – 71.2	5	93.6	10	385	70
MPLAD36KP60(C)A	60	66.7 – 73.7	5	96.8	10	372	72
MPLAD36KP64(C)A	64	71.1 – 78.6	5	103.0	10	350	75
MPLAD36KP70(C)A	70	77.8 – 86.0	5	113	10	319	84
MPLAD36KP75(C)A	75	83.3 – 92.1	5	121	10	298	90
MPLAD36KP78(C)A	78	86.7 – 95.8	5	126	10	286	95
MPLAD36KP85(C)A	85	94.4 - 104.0	5	137	10	263	104
MPLAD36KP90(C)A	90	100 – 111	5	146	10	247	109
MPLAD36KP100(C)A	100	111 – 123	5	162	10	223	122
MPLAD36KP110(C)A	110	122 – 135	5	177	10	204	132
MPLAD36KP120(C)A	120	133 – 147	5	193	10	187	145
MPLAD36KP130(C)A	130	144 – 159	5	209	10	173	157
MPLAD36KP150(C)A	150	167 – 185	5	243	10	149	183
MPLAD36KP160(C)A	160	178 – 197	5	259	10	139	195
MPLAD36KP170(C)A	170	189 – 209	5	275	10	131	207

.....continued

Part Number	Working Standoff Voltage V_{WM}[1]	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 I_{PP} (Figure 4-3)	Maximum Temperature Coefficient $\alpha_{V(BR)}$
	Volts	Volts	mA	Volts	µA	A	mV/ °C
MPLAD36KP180(C)A	180	200 – 221	5	291	10	124	219
MPLAD36KP200(C)A	200	222 – 245	5	322	10	112	243
MPLAD36KP220(C)A	220	245 – 271	5	356	10	102	269
MPLAD36KP260(C)A	260	289 – 320	5	419	10	86	318
MPLAD36KP280(C)A	280	311 – 345	5	451	10	80	344
MPLAD36KP300(C)A	300	333 – 369	5	483	10	75	368
MPLAD36KP350(C)A	350	389 – 431	5	564	10	64	430
MPLAD36KP400(C)A	400	444 – 492	5	644	10	56	490

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.
3. For bidirectional parts, the capacitance will be half that shown in Figure 4-2 for zero bias.
4. For unidirectional parts, the forward voltage (V_F) is 4.0 volts maximum at 500 amps peak for 8.3 ms half-sine wave.
5. Surge testing is performed to 1000 amps due to equipment limitations.

4. Graphs

Figure 4-1. Peak Pulse Power Vs. Pulse Time

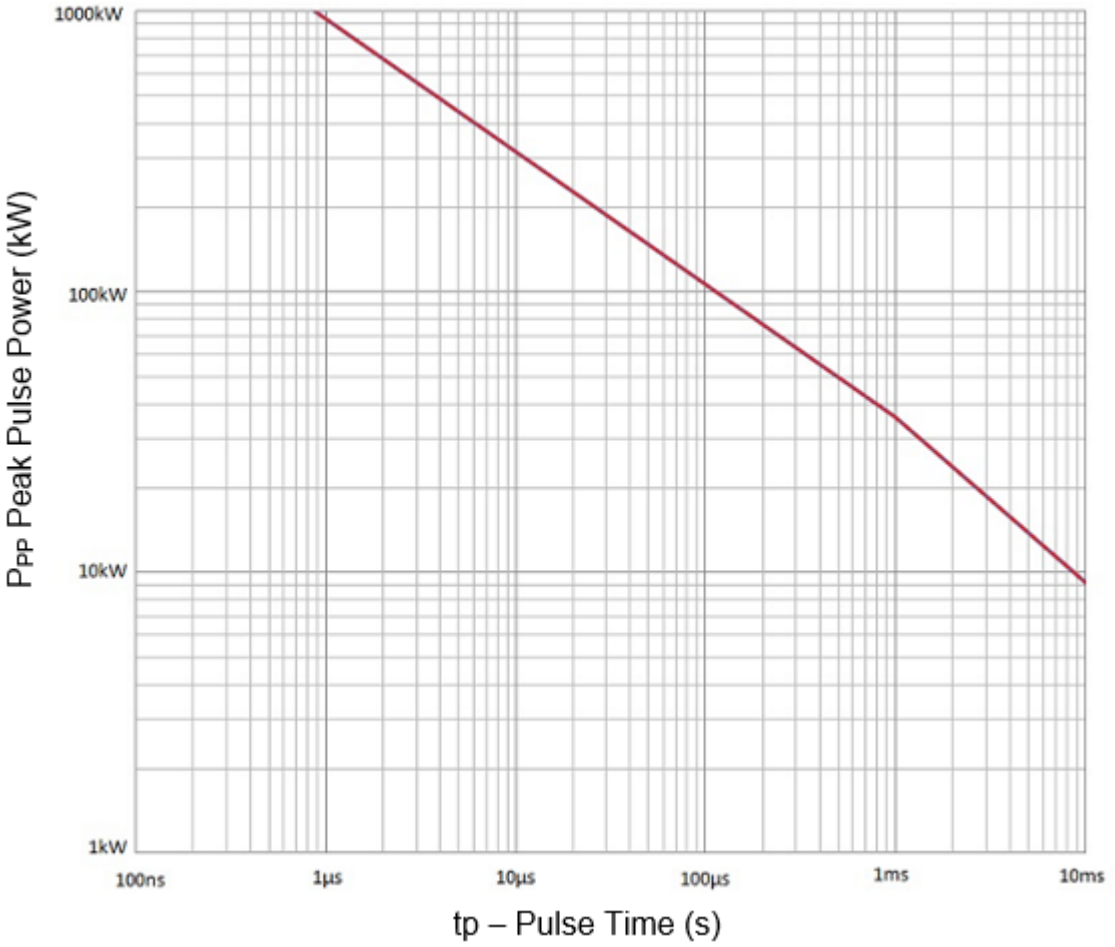


Figure 4-2. Pulse Waveform

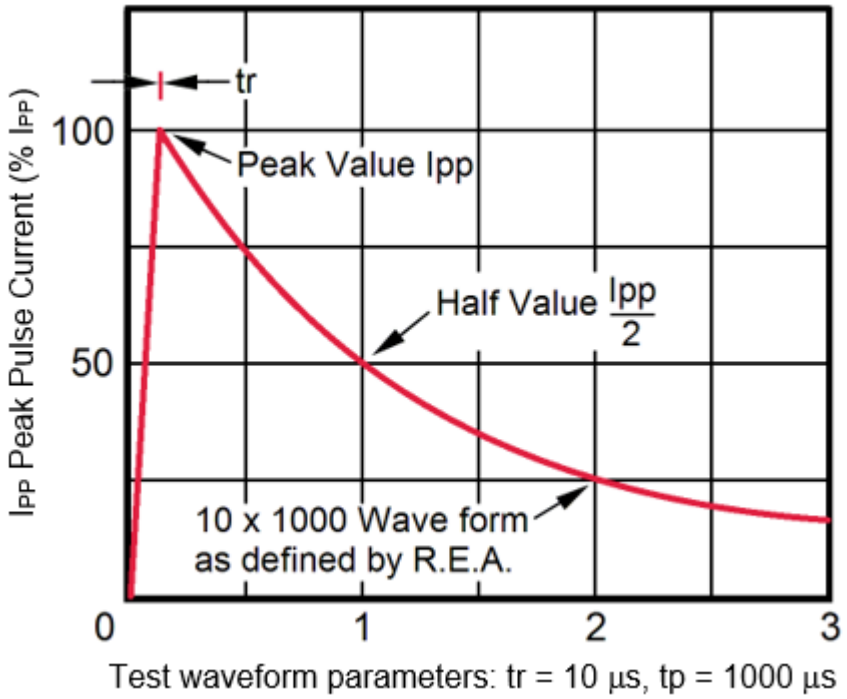


Figure 4-3. Derating Curve

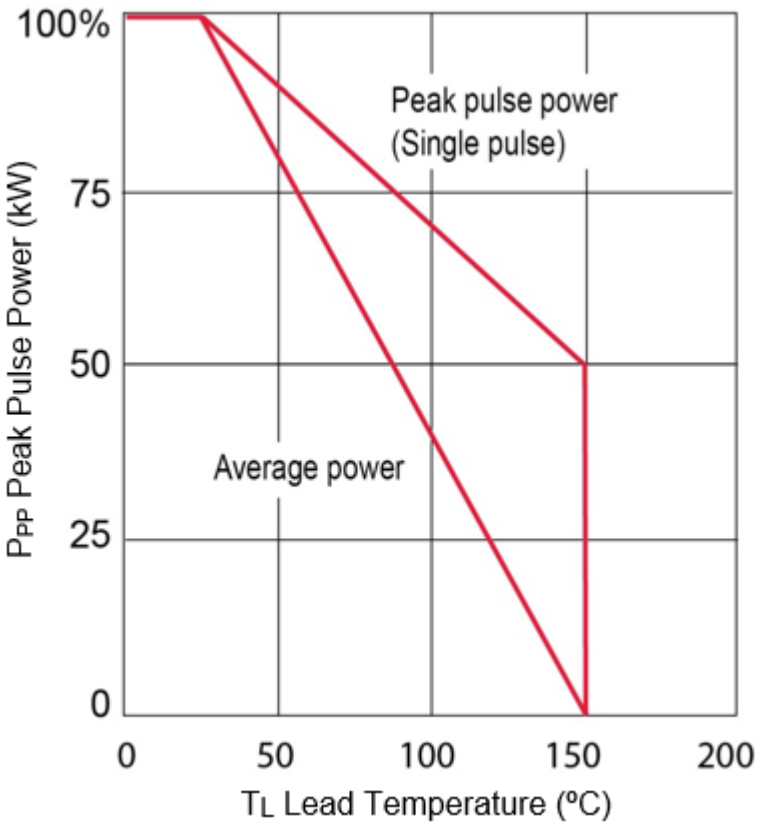
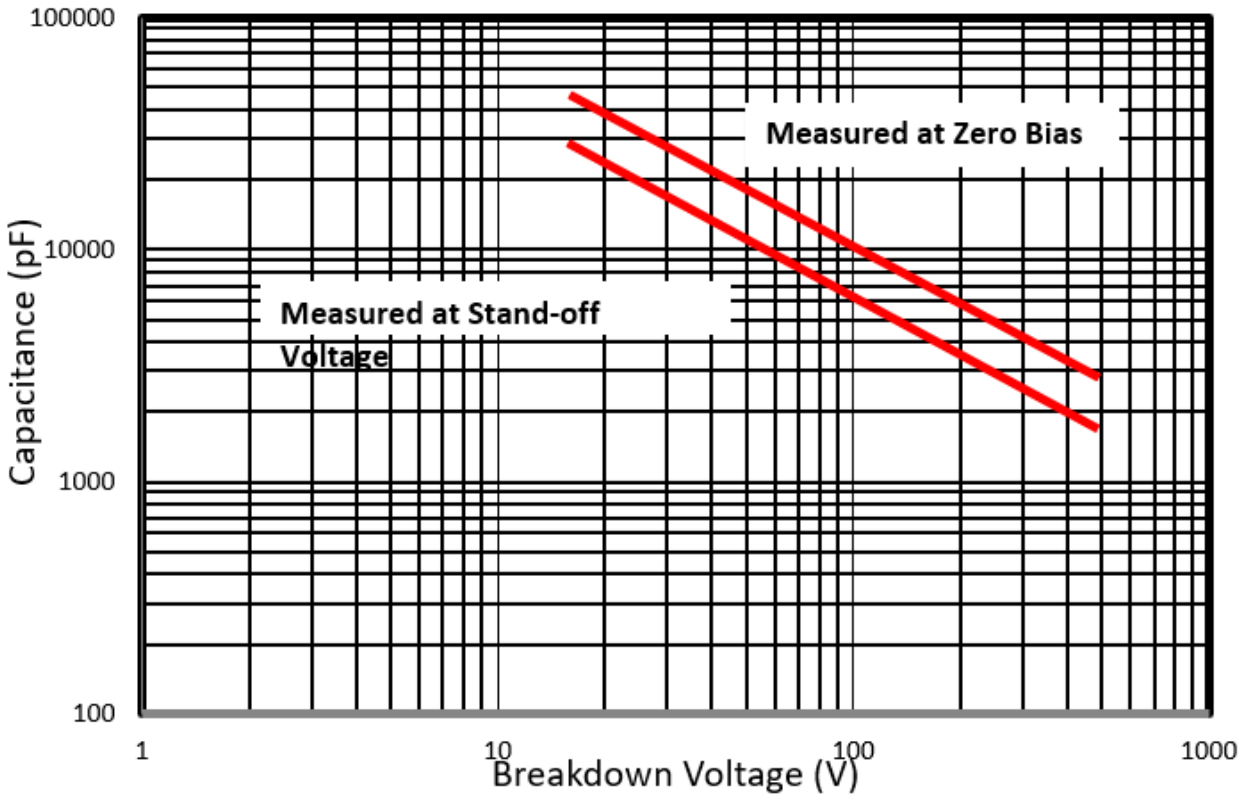


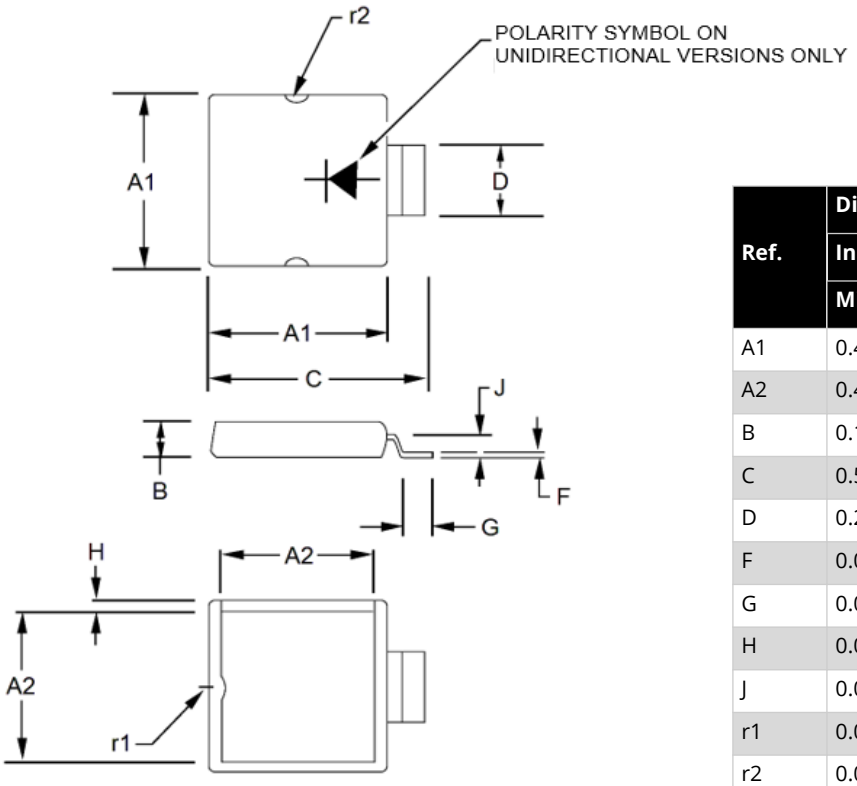
Figure 4-4. Typical Capacitance Vs. Breakdown Voltage (Unidirectional Configuration)



For bidirectional construction, capacitance will be half that shown.

5. Package Dimensions

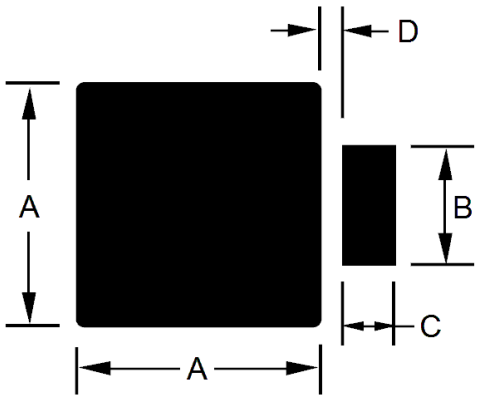
Figure 5-1. Package Dimensions



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	

5.1 Pad Layout

Figure 5-2. 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

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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ISBN: 978-1-6683-3760-8

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