Surface Mount 15,000 Watt Transient Voltage Suppressor

MPLAD15KP7.0A – MXLPLAD15KP200CA(e3)

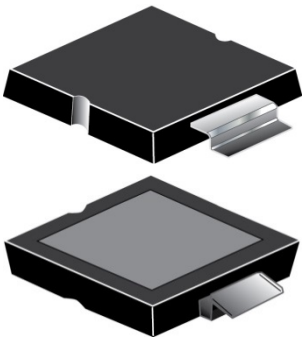
Product Overview

These 15 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 PLAD15KP is offered with standoff voltages (V_{WM}) from 7.0 to 200 volts in either unidirectional or bidirectional versions. For more information on PLAD packaged products and our broad range of TVS solutions, please see the Microchip 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 15,000W at 10/1000 µs (see Figure 4-1)
- Enhanced reliability screening in reference to MIL-PRF-19500 is 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 7.0 to 200 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: MPLAD15KP7.0A to MXLPLAD15KP200CA
  Class 5: MPLAD15KP7.0A to MXLPLAD15KP200CA (short distance)
  Class 5: MPLAD15KP7.0A to MXLPLAD15KP110CA (long distance)
- Secondary lightning protection per IEC 61000-4-5 with 12 ohms source impedance:
  Class 1, 2, 3: MPLAD15KP7.0A to MXLPLAD15KP200CA
  Class 4: MPLAD15KP7.0A to MXLPLAD15KP120CA
- Secondary lightning protection per IEC 61000-4-5 with 2 ohms source impedance:
  Class 2: MPLAD15KP7.0A to MXLPLAD15KP200CA
  Class 3: MPLAD15KP7.0A to MXLPLAD15KP110CA
  Class 4: MPLAD15KP7.0A to MXLPLAD15KP54CA
- Pin injection protection per RTCA/DO-160F for Waveform 4 (6.4/69 µs at 25 °C)[1]:
  Level 4: MPLAD15KP7.0A to MXLPLAD15KP200CA
  Level 5: MPLAD15KP7.0A to MXLPLAD15KP100CA
- Pin injection protection per RTCA/DO-160F for Waveform 5A (40/120 µs at 25 °C)[1]:
  Level 4: MPLAD15KP7.0A to MXLPLAD15KP28CA

Note:

1. See MicroNote 132 for further temperature derating selection.

Table of Contents

1. Maximum Ratings

Table 1-1. 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
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[2]		P_{PP}	15,000	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] 71 [4]	W W

Notes:

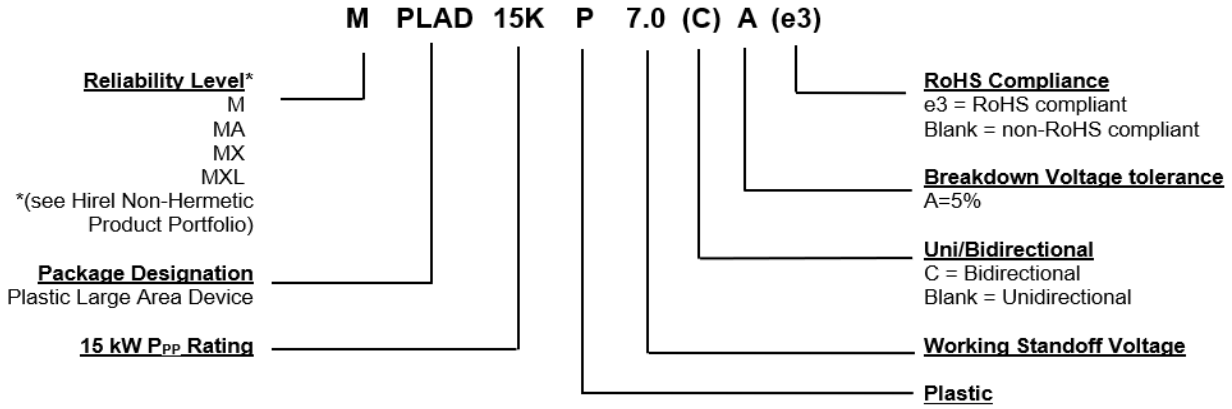
1. When mounted on FR4 PC board (1 oz Cu) with recommended mounting pad (see Pad Layout).
2. Also see Figure 4-1 and Figure 4-2. At 10/1000 µs with impulse repetition rate (duty factor) of 0.05% or less.
3. At 8.3 ms half-sine wave (unidirectional devices only).
4. Case temperature controlled on heat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

1.1 Mechanical 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: 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 gram
- 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 Characteristics at 25 °C Unless Otherwise Stated

Part Number	Working Standoff Voltage[1] V_{WM}	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
MPLAD15KP7.0(C)A	7.0	7.78 – 8.60	150	12.0	3000	1251 [5]	5.0
MPLAD15KP7.5(C)A	7.5	8.33 – 9.21	5	12.9	750	1164 [5]	6.0
MPLAD15KP8.0(C)A	8.0	8.89 – 9.83	5	13.6	450	1101 [5]	6.0
MPLAD15KP8.5(C)A	8.5	9.44 – 10.4	5	14.4	150	1041 [5]	7.0
MPLAD15KP9.0(C)A	9.0	10.0 – 11.1	5	15.4	60	975	8.0
MPLAD15KP10(C)A	10	11.1 – 12.3	5	17.0	45	882	9.0
MPLAD15KP11(C)A	11	12.2 – 13.5	5	18.2	20	822	10
MPLAD15KP12(C)A	12	13.3 – 14.7	5	19.9	10	753	11
MPLAD15KP13(C)A	13	14.4 – 15.9	5	21.5	10	696	12
MPLAD15KP14(C)A	14	15.6 – 17.2	5	23.2	10	645	13
MPLAD15KP15(C)A	15	16.7 – 18.5	5	24.4	10	618	15
MPLAD15KP16(C)A	16	17.8 – 19.7	5	26.0	10	576	16
MPLAD15KP17(C)A	17	18.9 – 20.9	5	27.6	10	543	18
MPLAD15KP18(C)A	18	20.0 – 22.1	5	29.2	10	516	19
MPLAD15KP20(C)A	20	22.2 – 24.5	5	32.4	10	462	22
MPLAD15KP22(C)A	22	24.4 – 26.9	5	35.5	10	423	24
MPLAD15KP24(C)A	24	26.7 – 29.5	5	38.9	10	384	27
MPLAD15KP26(C)A	26	28.9 – 31.9	5	42.1	10	357	29
MPLAD15KP28(C)A	28	31.1 – 34.4	5	45.5	10	330	30
MPLAD15KP30(C)A	30	33.3 – 36.8	5	48.4	10	309	35
MPLAD15KP33(C)A	33	36.7 – 40.6	5	53.3	10	282	38
MPLAD15KP36(C)A	36	40.0 – 44.2	5	58.1	10	258	40
MPLAD15KP40(C)A	40	44.4 – 49.1	5	64.5	10	234	45
MPLAD15KP43(C)A	43	47.8 – 52.8	5	69.4	10	216	49
MPLAD15KP45(C)A	45	50.0 – 55.3	5	72.7	10	207	51
MPLAD15KP48(C)A	48	53.3 – 58.9	5	77.4	10	195	55
MPLAD15KP51(C)A	51	56.7 – 62.7	5	82.4	10	183	60
MPLAD15KP54(C)A	54	60.0 – 66.3	5	87.1	10	171	64
MPLAD15KP58(C)A	58	64.4 – 71.2	5	93.6	10	159	69
MPLAD15KP60(C)A	60	66.7 – 73.7	5	96.8	10	156	70
MPLAD15KP64(C)A	64	71.1 – 78.6	5	103	10	147	75
MPLAD15KP70(C)A	70	77.8 – 86.0	5	113	10	132	84
MPLAD15KP75(C)A	75	83.3 – 92.1	5	121	10	123	90
MPLAD15KP78(C)A	78	86.7 – 95.8	5	126	10	120	94
MPLAD15KP85(C)A	85	94.4 – 104.0	5	137	10	108	102

.....continued

Part Number	Working Standoff Voltage[1] V_{WM}	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
MPLAD15KP90(C)A	90	100 – 111	5	146	10	102	109
MPLAD15KP100(C)A	100	111 – 123	5	162	10	93	122
MPLAD15KP110(C)A	110	122 – 135	5	177	10	84	132
MPLAD15KP120(C)A	120	133 – 147	5	193	10	78	145
MPLAD15KP130(C)A	130	144 – 159	5	209	10	71	157
MPLAD15KP150(C)A	150	167 – 185	5	243	10	62	183
MPLAD15KP160(C)A	160	178 – 197	5	259	10	58	195
MPLAD15KP170(C)A	170	189 – 209	5	275	10	55	207
MPLAD15KP180(C)A	180	200 – 221	5	291	10	52	219
MPLAD15KP200(C)A	200	222 – 245	5	322	10	47	243

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 2.0 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 (to 50% of Exponentially Decaying Pulse)

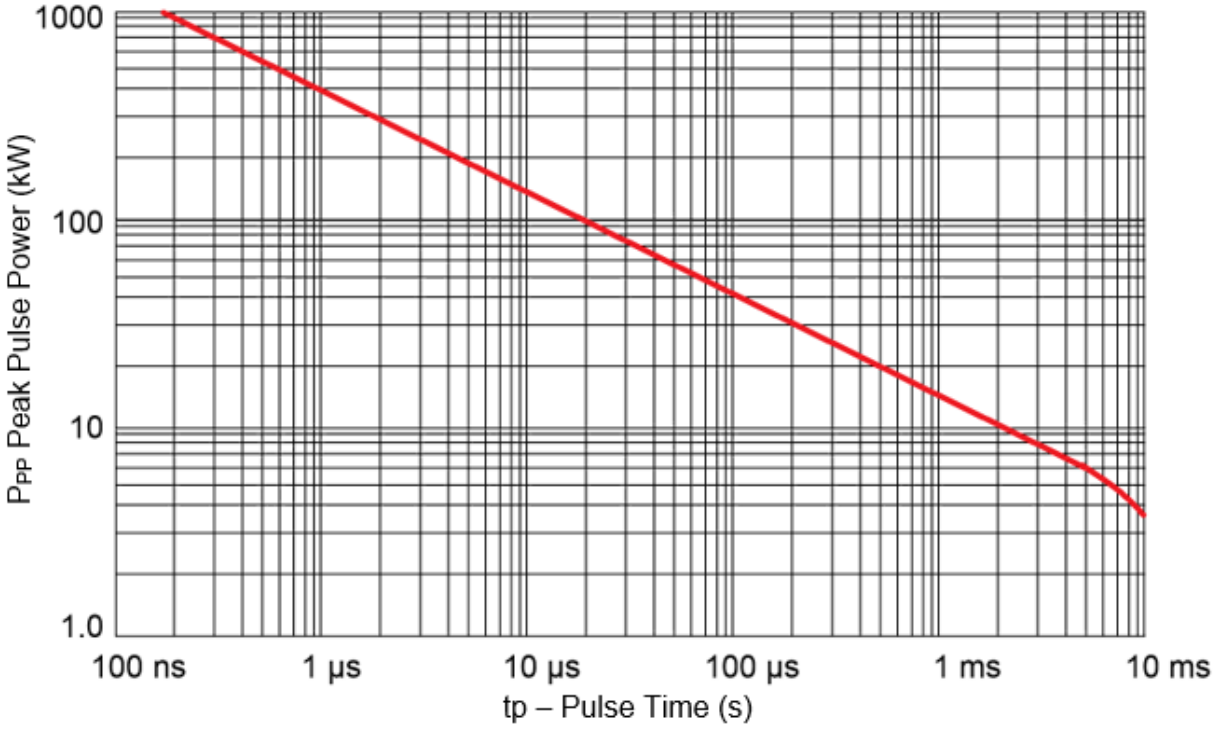


Figure 4-2. Pulse Waveform

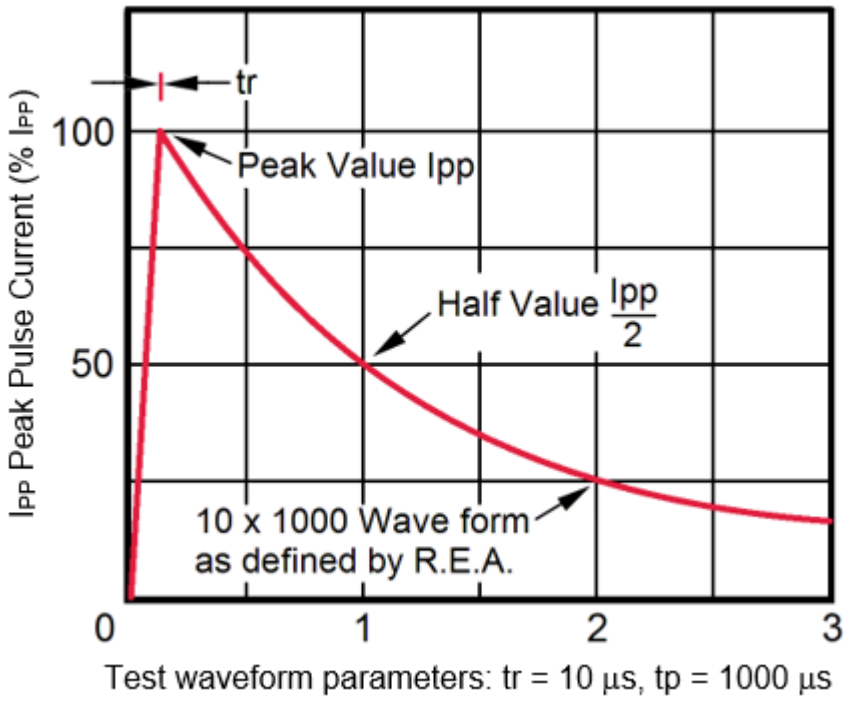


Figure 4-3. Derating Curve

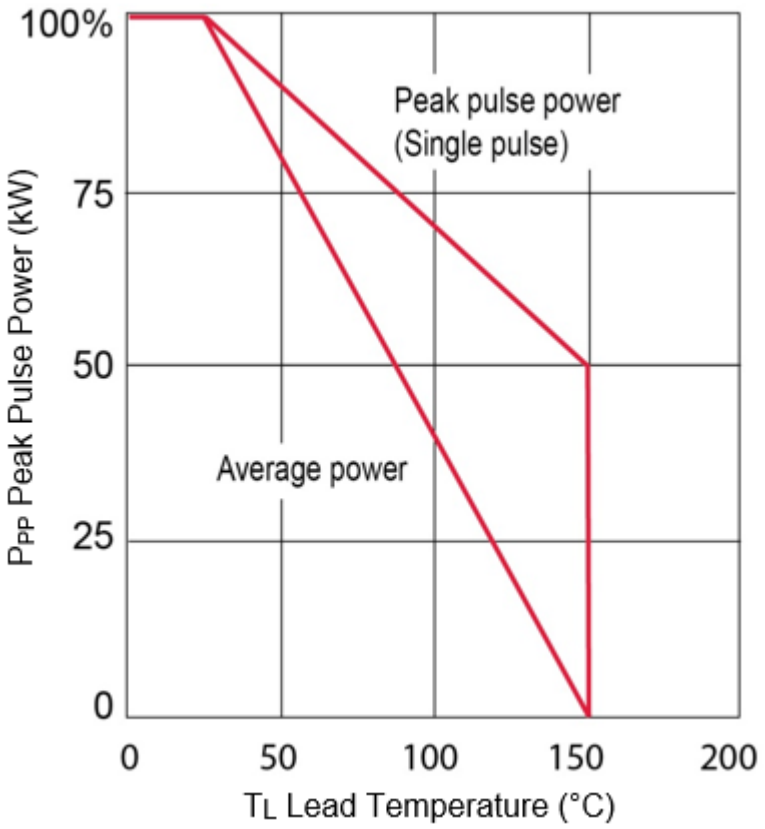
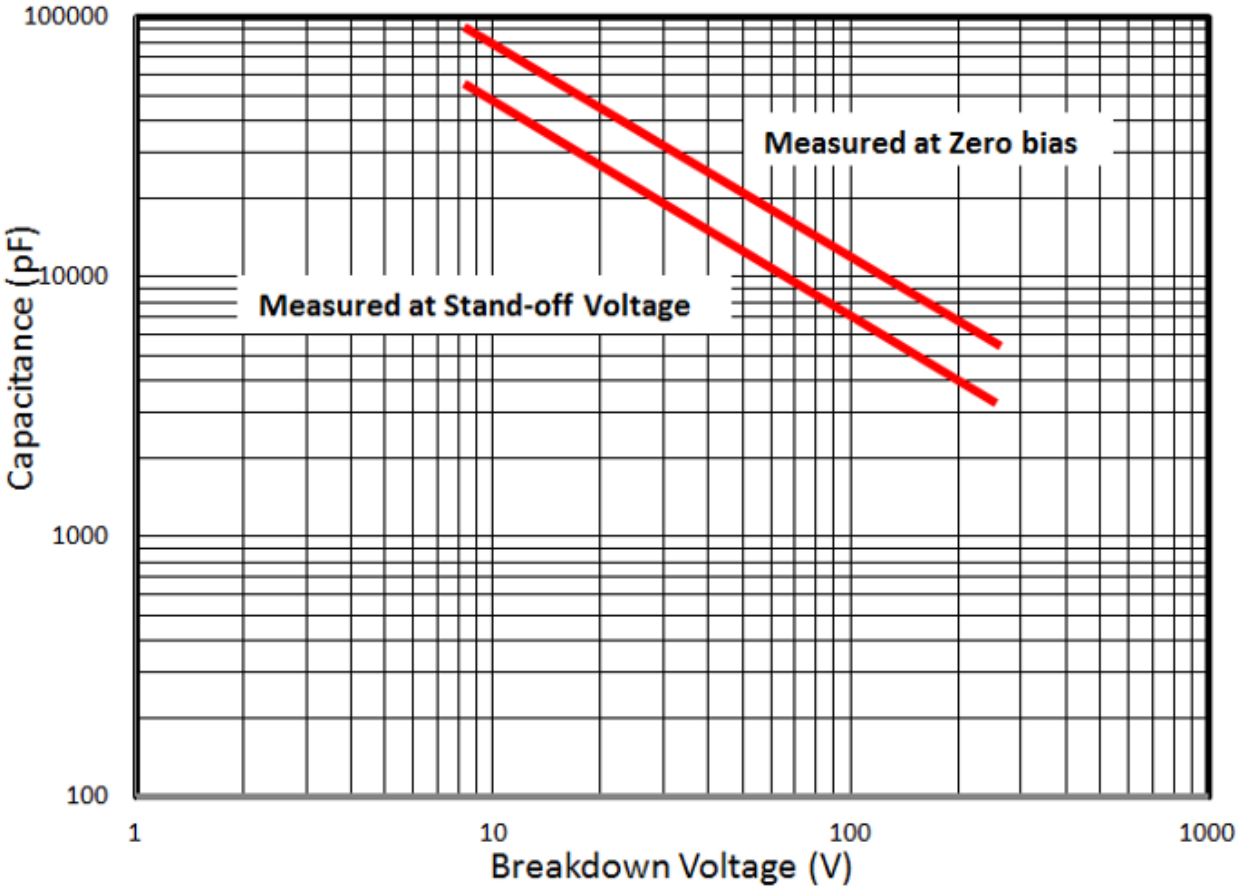


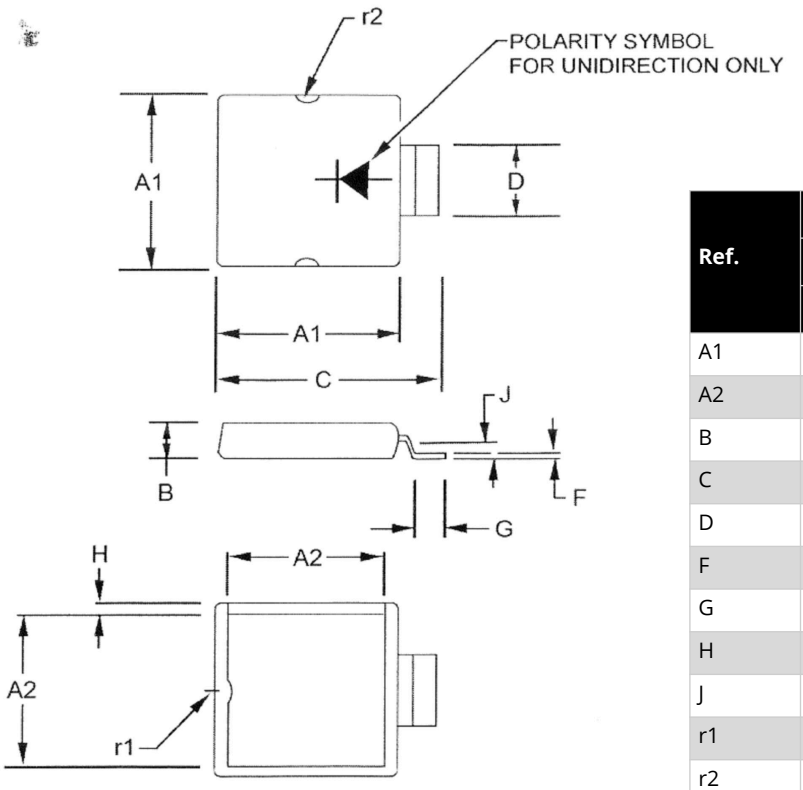
Figure 4-4. Typical Capacitance Vs. Breakdown Voltage (Unidirectional Configuration)



Bidirectional capacitance is half that shown at zero volts.

5. Package Dimensions

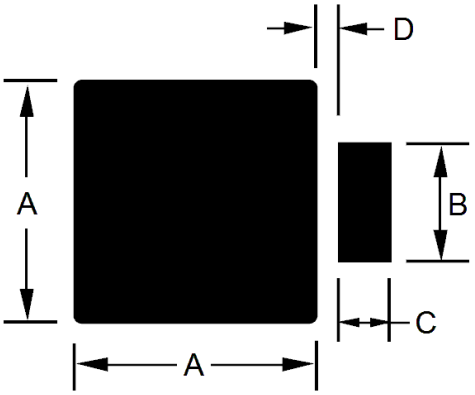
Figure 5-1. Package Dimensions



Ref.	Dimensions			
	Inch		Millimeters	
	Min.	Max.	Min.	Max.
A1	0.485	0.495	12.32	12.57
A2	0.445	0.455	11.30	11.56
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	
	Min.	Max.	Min.	Max.
A	0.465	0.475	11.81	12.07
B	0.225	0.235	5.72	5.97
C	0.095	0.105	2.41	2.67
D	0.04	0.05	1.02	1.27

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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