150 W Powermite, Small Surface Mount Transient Voltage Suppressor

MUPT5e3 – MXLUPTR48e3, MUPTB5e3 – MXLUPTB48e3

Product Overview

Microchip's unique Powermite MUPT series of transient voltage suppressors feature oxide-passivated chips with high-temperature solder bonds for high surge capability and negligible electrical degradation under repeated surge conditions. Both unidirectional and bidirectional configurations are available. In addition to its size advantages, the Powermite package includes a fully metallic bottom side that eliminates the possibility of solder flux entrapment at assembly and a unique locking tab design that serves as an integral heat sink. Its innovative design makes this device fully compatible for use with automatic insertion equipment.

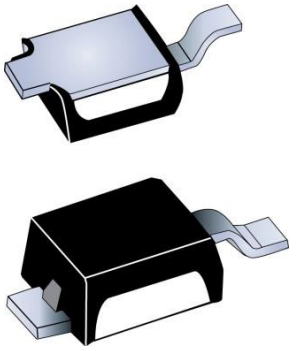
Features

- Powermite package with working stand-off voltages 5 to 48V
- 3(σ) lot norm screening performed on standby current (I_D) for all M prefix devices
- Both unidirectional and bidirectional polarities:
  - Anode to case bottom (MUPT5e3 thru MUPT48e3)
  - Cathode to case bottom (MUPT8Re3 thru MUPT48Re3)
  - Bidirectional (MUPTB5e3 thru MUPTB48e3)
- Suppress transients up to 150 watts at 10/1000 µs (see Figure 4-1)
- Enhanced reliability screening options are available in reference to MIL-PRF-19500. Refer to High Reliability Up-Screened Plastic Products Portfolio for more details on the screening options.
  (See Part Nomenclature for all available options.)
- High reliability devices with fabrication and assembly lot traceability for all M prefix devices
- Clamping time less than 100 pico-seconds for unidirectional and 5 nano-seconds for bidirectional
- 100% surge current testing of all parts
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020F.
- RoHS compliant versions available

Applications/Benefits

- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, T2L, and so on
- Protection from switching and induced RF transients
- Integral heat sink/locking tabs
- Fully metallic bottom side eliminates flux entrapment
- Compliant to IEC61000-4-2 and IEC61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:
  Class 1: MUPT5 or MUPTB8 to MXLUPT17 or MXLMUPTB17
  Class 2: MUPT5 or MUPTB8 to MXLUPT12 or MXLMUPTB12

Figure 1. DO-216AA Package



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1. Maximum Ratings

Table 1-1. Maximum Ratings

Parameters/Test Conditions	Symbols	Value		Unit
Junction and storage temperature	T_J/T_{STG}	–65 to +150		°C
Thermal resistance junction-to-ambient[1]	$R_{\theta JA}$	240		°C/W
Thermal resistance junction-to-case (base tab)	$R_{\theta JC}$	15		°C/W
Peak pulse power (see Figure 4-1 and Figure 4-2) MUPT5e3 thru MXLUPT48e3: MUPTB5e3 thru MXLUPTB48e3:	P_{PP}	At 8/20 µs 1000 1000	At 10/1000 µs 150 150	W
Forward surge current (at 8.3 ms half-sine wave)	I_{FSM}	25		A
Average power dissipation (base tab ≤ 112 °C)	$P_{M(AV)}$	2.5		W
Impulse repetition rate (duty factor)	—	0.01		%
Solder temperature at 10 s	T_{SP}	260		°C

Note:

1. When mounted on FR4 PC board with 1 oz copper

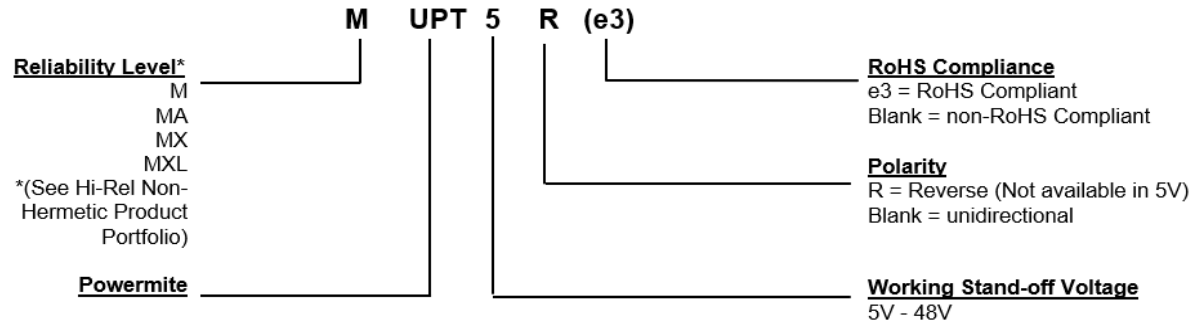
1.1 Mechanical Packaging

- Case: Void-free transfer molded thermosetting epoxy compound meeting UL94V-0
- Terminals: Annealed matte-tin plating over copper and readily solderable per MIL-STD-750, method 2026
- Marking:
  First letter is screening level where “M” depicts M, “A” depicts MA, “X” depicts MX, “L” depicts MXL.
  Anode to TAB 1: “T” plus the V_{WM} of part number in two digit form underlined, for example MUPT5e3 is MT05▪, MAUPT12e3 is AT12▪
  Anode to TAB 2: The V_{WM} of part number in two digit form plus an “R” underlined, for example MXUPT5Re3 is X05R▪, MXLUPT12Re3 is L12R▪
  Bipolar: “B” plus the V_{WM} of part number in two digit form underlined, for example MUPTB8e3 is MB08▪, MUPTB12e3 is MB12▪, etc.
  Please note dot suffix (for e3 suffix)
- Tape and reel option: Standard per EIA-481-B using 12 mm tape. Consult factory for quantities.
- Weight: Approximately 0.016 gram
- See Package Dimensions

2. Part Nomenclature

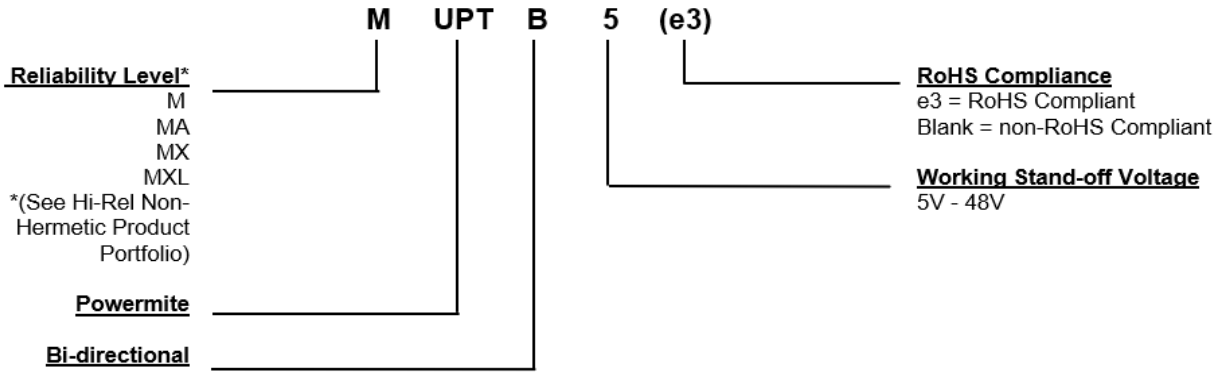
Applicable to unidirectional MUPT5e3 – MUPT48e3 only:

Figure 2-1. Unidirectional MUPT5e3 – MUPT48e3 Part Nomenclature



Applicable to bidirectional MUPTB5e3 – MUPTB48e3 only:

Figure 2-2. Bidirectional MUPTB5e3 – MUPTB48e3 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 rated stand-off 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 pulse current: The peak current during an impulse
P_{PP}	Peak pulse power: The peak power that can be applied for a specified 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 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

Device Type			Working Stand-off Voltage V_{WM}	Minimum Breakdown Voltage $V_{(BR)}$ at 1 mA	Maximum Standby Current I_D at V_{WM}	Maximum Peak Pulse Current[1] I_{PP} at 10/1000 µs	Maximum Clamping Voltage V_C at I_{PP}	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$
Uni-Directional	Bi-Directional	Reverse	V	V	µA	A	V	%/° C
MUPT5	MUPTB5	—	5	6.0	50	15.7	9.5	0.030
MUPT8	MUPTB8	MUPT8R	8	9.0	2	10.9	13.7	0.040
MUPT10	MUPTB10	MUPT10R	10	11.0	2	8.33	18.0	0.045
MUPT12	MUPTB12	MUPT12R	12	13.8	1	6.94	21.6	0.050
MUPT15	MUPTB15	MUPT15R	15	16.7	1	5.77	26.0	0.055
MUPT17	MUPTB17	MUPT17R	17	19.0	1	5.14	29.2	0.060
MUPT24	MUPTB24	MUPT24R	24	28.4	1	3.47	43.2	0.070
MUPT28	MUPTB28	MUPT28R	28	31.0	1	3.13	47.8	0.075
MUPT33	MUPTB33	MUPT33R	33	36.8	1	2.65	56.7	0.080
MUPT48	MUPTB48	MUPT48R	48	54.0	1	1.78	84.3	0.090

Note:

1. See Figure 4-2 for I_{PP} waveform of 10/1000 µs test pulse

4. Graphs

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

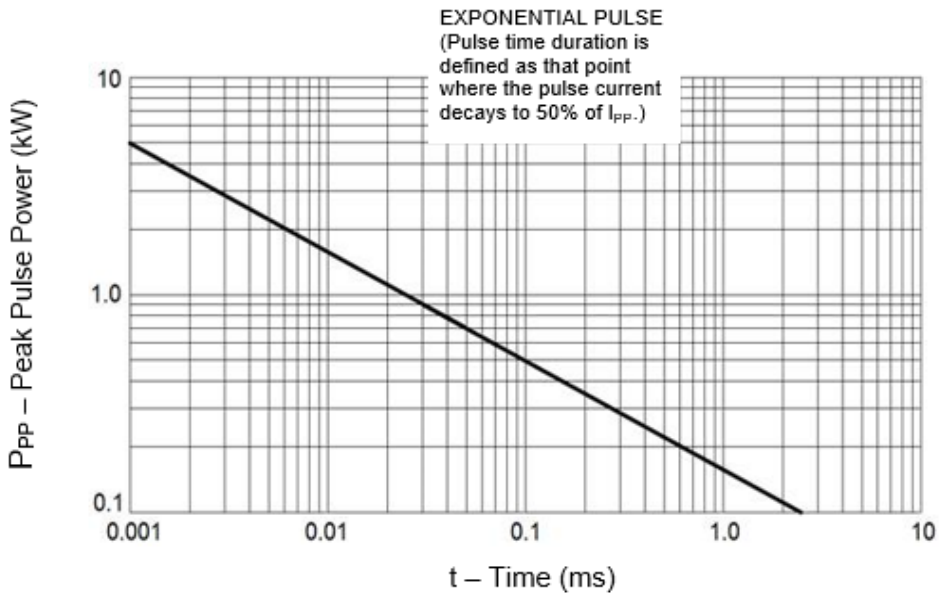


Figure 4-2. Pulse Waveform for 10/1000 µs for Exponential Surge

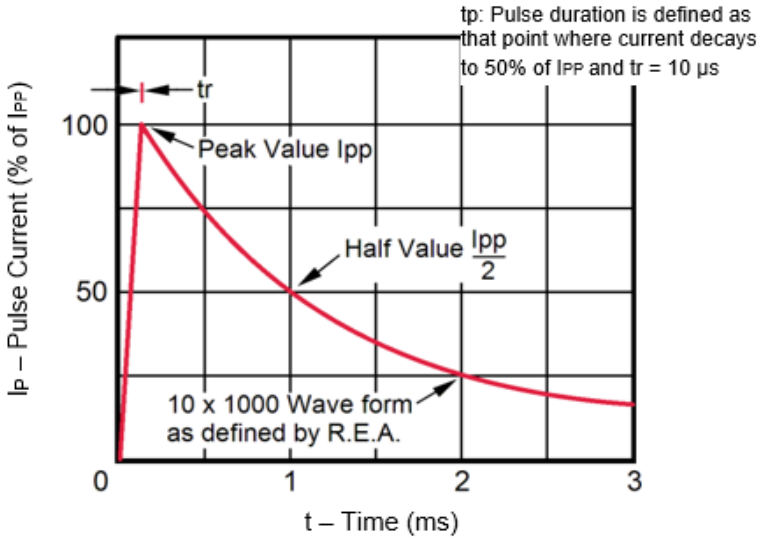


Figure 4-3. Derating Curve

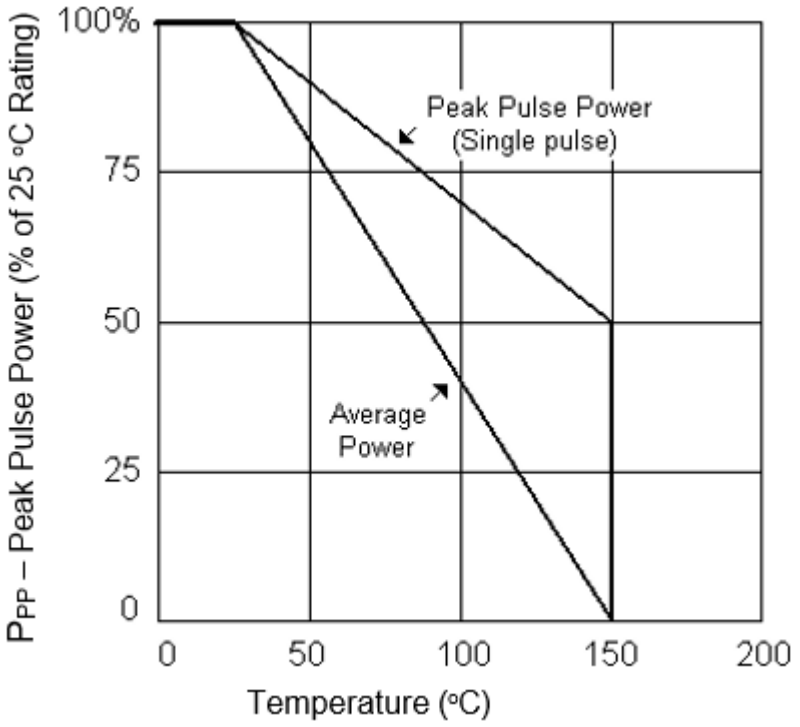
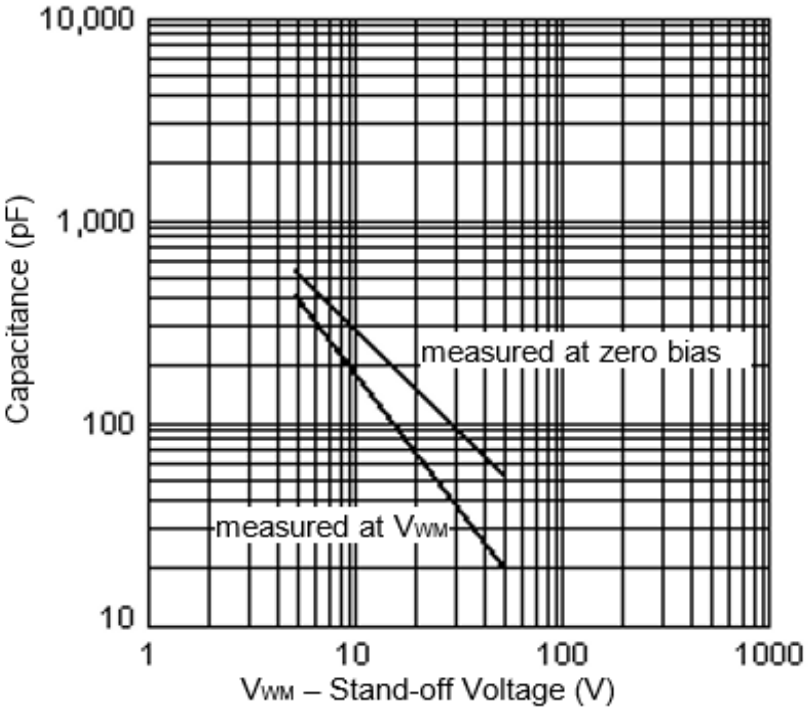


Figure 4-4. Typical Capacitance Vs. Stand-Off Voltage[1]

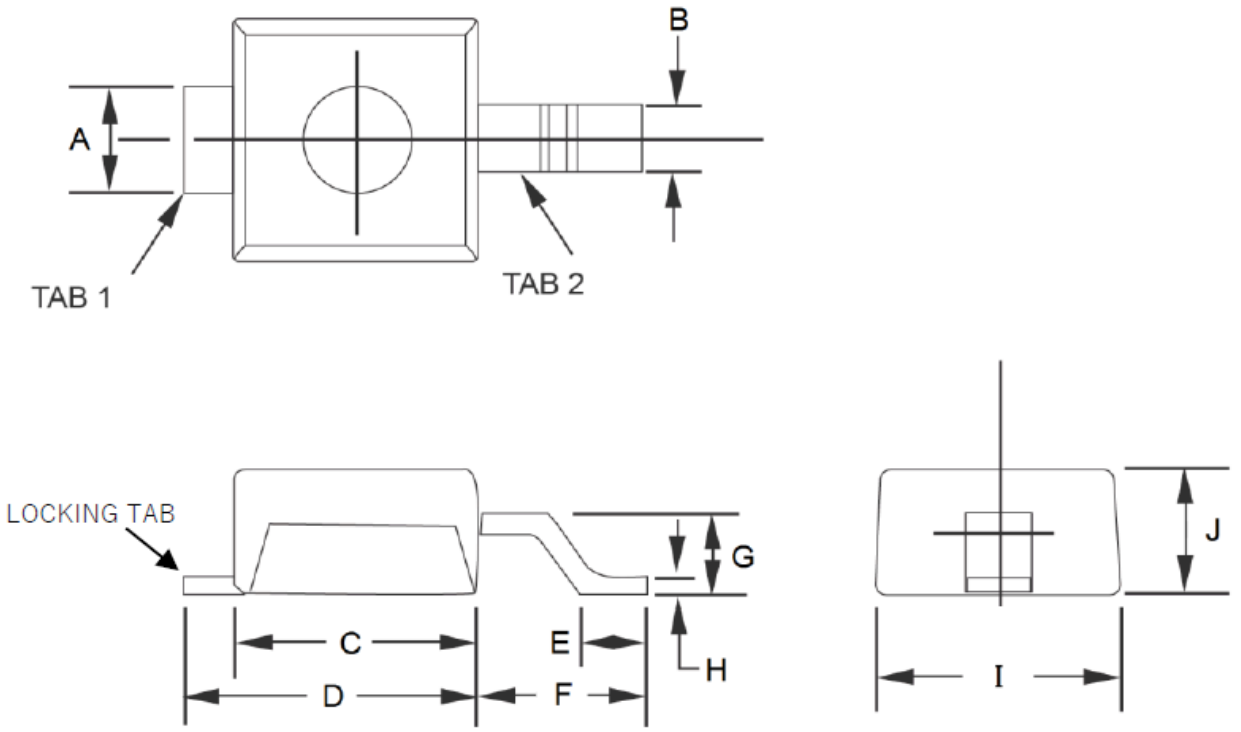


Note:

1. Bidirectional capacitance is half that shown

5. Package Dimensions

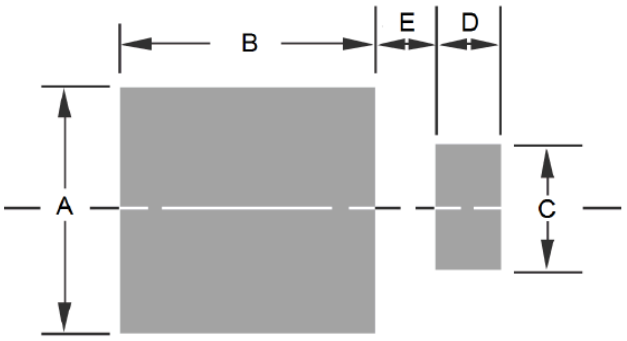
Figure 5-1. Package Dimensions



Ltr	Dimensions			
	Inch		Millimeters	
	Min.	Max.	Min.	Max.
A	0.029	0.039	0.73	0.99
B	0.016	0.026	0.40	0.66
C	0.070	0.080	1.77	2.03
D	0.087	0.097	2.21	2.46
E	0.020	0.030	0.50	0.76
F	0.051	0.061	1.29	1.54
G	0.021	0.031	0.53	0.78
H	0.004	0.008	0.10	0.20
I	0.070	0.080	1.77	2.03
J	0.035	0.045	0.89	1.14

6. Pad Layout

Figure 6-1. Pad Layout



Ltr	Dimensions	
	Inch	Millimeters
A	0.100	2.54
B	0.105	2.67
C	0.050	1.27
D	0.030	0.76
E	0.025	0.64

7. 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	11/2023	Initial revision.

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