# THE DATASHEET OF

# UPT12E3/TR7

RoHS Available

# 5V – 48V Small Footprint, Surface Mount Transient Voltage Suppressors

## DESCRIPTION

Microsemi's unique and new Powermite UPT 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 (cathode) side that eliminates the possibility of solder flux entrapment at assembly and a unique locking tab serves as an integral heat sink. Its innovative design makes this device fully compatible for use with automatic insertion equipment.

**Important:** For the latest information, visit our website http://www.microsemi.com.

**DO-216AA Package**

## FEATURES

- Powermite package with standoff voltages 5 to 48 V.
- Both unidirectional and bidirectional polarities:
  -Anode to case bottom (UPT5e3 thru UPT48e3)
  -Cathode to case bottom (UPT8Re3 thru UPT48Re3)
  -Bidirectional (UPTB5e3 thru UPTB48e3)
- 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-020B.
- RoHS compliant versions available.

## APPLICATIONS / BENEFITS

- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, $T^2L$, etc.
- Protection from switching and induced RF transients.
- New improved lower leakage current for the UPT8Re3:
  -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: UPT5//UPT5R/UPTB8 to17
  Class 2: UPT5//UPT5R/UPTB5 to12

Class 3: Class 4

## MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | 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 1 and Figure 2) | | @ 8/20 µs | @10/1000µs | |
| UPT8Re3: | $P_{PP}$ | 600 | 100 | W |
| UPT5e3 thru UPT48e3: | | 1000 | 150 | |
| UPT8Re3 thru UPT48Re3: | | 1000 | 150 | |
| UPTB5e3 thru UPTB48e3: | | 1000 | 150 | |
| Rated Average Power Dissipation (base tab ≤ 112 °C) | $P_{M(AV)}$ | 2.5 | | W |
| Impulse Repetition Rate (duty factor) | | 0.01 | | % |
| Solder Temperature @ 10 s | $T_{SP}$ | 260 | | °C |

**Notes:** 1. When mounted on FR4 PC board with 1 oz copper.

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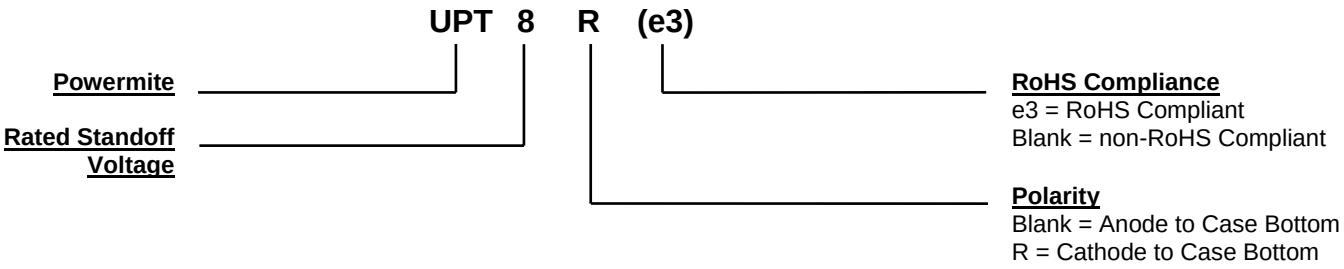
## MECHANICAL and PACKAGING

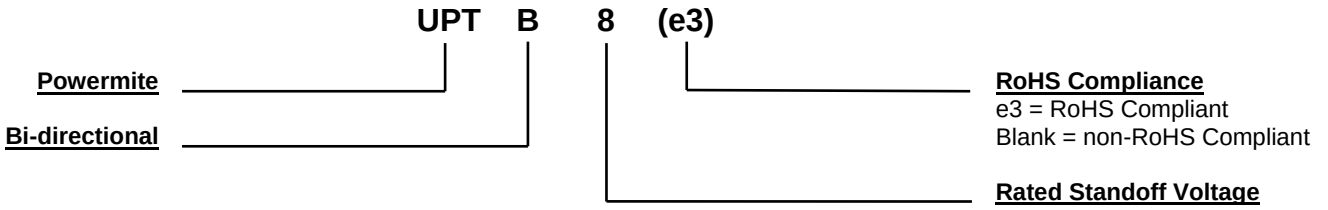
- CASE: Void-free transfer molded thermosetting epoxy compound meeting UL94V-0.
- TERMINALS: Annealed matte-tin plating over copper and readily solderable per MIL-STD-750, method 2026.
- MARKING:
  **Anode to TAB 1**: T plus the last two digits of part number underlined, e.g. UPT5e3 is T05▪, UPT12e3 is T12▪
  **Cathode to TAB1**: U plus last two digits of part number underlined, e.g. UPT8Re3 is U08▪, UPT12Re3 is U12▪
  **Bipolar**: B plus the last two digits of part number underlined, e.g. UPTB8e3 is B08▪, UPTB12e3 is B12▪, etc.
  *Please note dot suffix (for e3 suffix)*
- POLARITY: Cathode or anode to TAB 1 (bottom) as described in marking above and on last page.
- TAPE & REEL option: Standard per EIA-481-B using 12 mm tape. Consult factory for quantities.
- WEIGHT: Approximately 0.016 gram.
- See package dimensions on last page.

## PART NOMENCLATURE

*Applicable to unidirectional UPT5e3 – UPT48e3, UPT8Re3 – UPT48Re3 only:*




*Applicable to bidirectional UPTB5e3 – UPTB48e3 only:*




## SYMBOLS & DEFINITIONS

| Symbol | Definition |
|---|---|
| $V_{(BR)}$ | Breakdown Voltage: The minimum voltage the device will exhibit at a specified current. |
| $V_{WM}$ | Working Peak Standoff Voltage: The maximum peak voltage that can be applied over the operating temperature range. |
| $P_{PP}$ | Peak Pulse Power: The peak power that can be applied for a specified pulse width and waveform. |
| $I_D$ | Standby Current: The maximum current that will flow at the specified voltage and temperature. |
| $I_{PP}$ | Peak Pulse Current: The peak current that can be applied for a specified pulse width and waveform. |
| C | Capacitance: The capacitance in picofarads of the TVS as defined @ 0 volts at a frequency of 1 MHz. |

## ELECTRICAL CHARACTERISTICS

| DEVICE TYPE | | RATED STANDOFF VOLTAGE | MINIMUM BREAKDOWN VOLTAGE | MAXIMUM STANDBY CURRENT | MAXIMUM PEAK PULSE CURRENT* | MAXIMUM CLAMPING VOLTAGE | MAXIMUM TEMPERATURE COEFFICIENT of $V_{(BR)}$ |
|---|---|---|---|---|---|---|---|
| | | $V_{WM}$ | $V_{(BR)}$ @ 1 mA | $I_D$ @ $V_{WM}$ | $I_{PP}$ @ 10/1000 µs | $V_C$ @ $I_{PP}$ | $\alpha_{V(BR)}$ |
| **Unidirectional** | **Bi-directional** | **V** | **V** | **µA** | **A** | **V** | **%/°C** |
| UPT5 | UPTB5 | 5 | 6.0 | 50 | 15.7 | 9.5 | 0.030 |
| UPT8 & UPT8R | UPTB8 | 8 | 9.0 | 2 | 10.9 | 13.7 | 0.040 |
| UPT10 & UPT10R | UPTB10 | 10 | 11.0 | 2 | 8.33 | 18.0 | 0.045 |
| UPT12 & UPT12R | UPTB12 | 12 | 13.8 | 1 | 6.94 | 21.6 | 0.050 |
| UPT15 & UPT15R | UPTB15 | 15 | 16.7 | 1 | 5.77 | 26.0 | 0.055 |
| UPT17 & UPT17R | UPTB17 | 17 | 19.0 | 1 | 5.14 | 29.2 | 0.060 |
| UPT24 & UPT24R | UPTB24 | 24 | 28.4 | 1 | 3.47 | 43.2 | 0.070 |
| UPT28 & UPT28R | UPTB28 | 28 | 31.0 | 1 | 3.13 | 47.8 | 0.075 |
| UPT33 & UPT33R | UPTB33 | 33 | 36.8 | 1 | 2.65 | 56.7 | 0.080 |
| UPT48 & UPT48R | UPTB48 | 48 | 54.0 | 1 | 1.78 | 84.3 | 0.090 |

* See figure 1 for $I_{PP}$ waveform of 10/1000 µs test pulse.

## GRAPHS

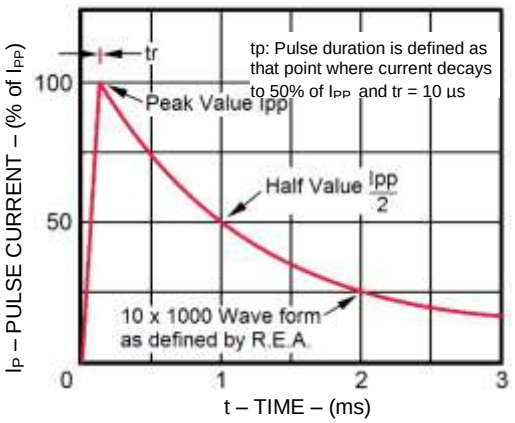



**FIGURE 1**
Pulse Waveform for 10/1000 µs

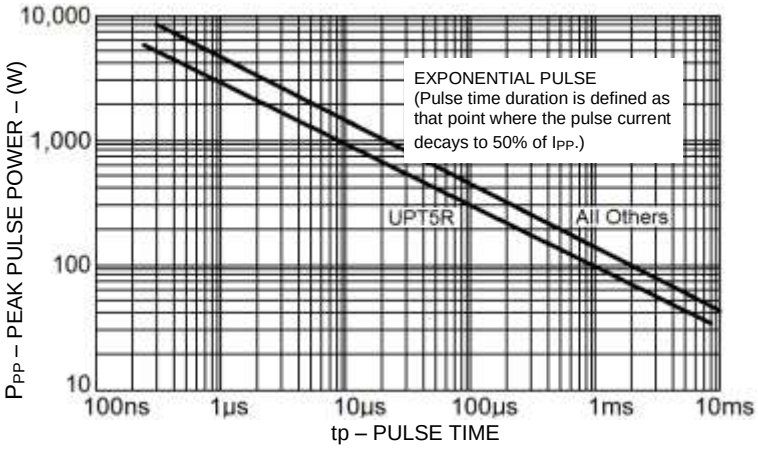



**FIGURE 2**
Peak Pulse Power vs. Pulse Duration

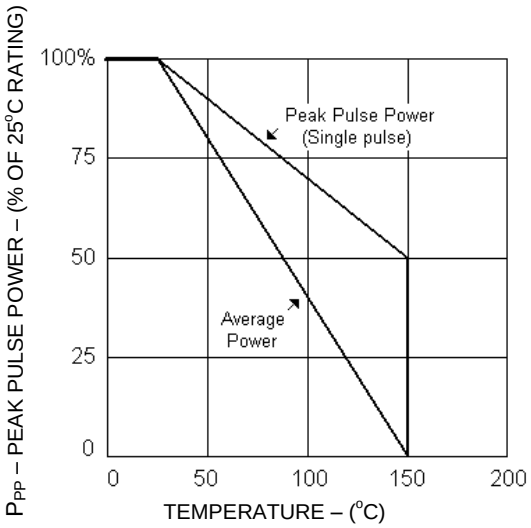



**FIGURE 3**
Derating Curve

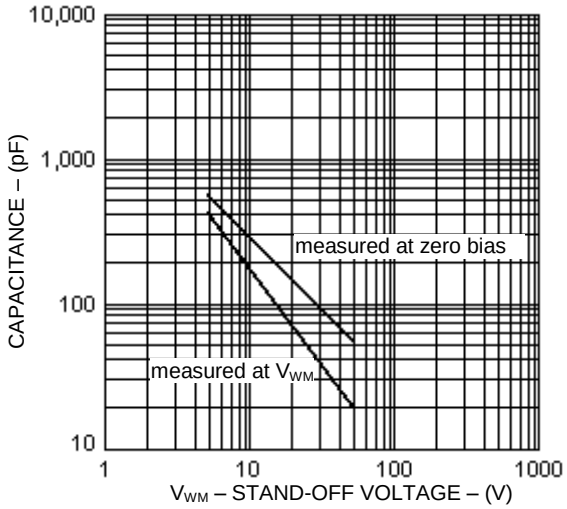
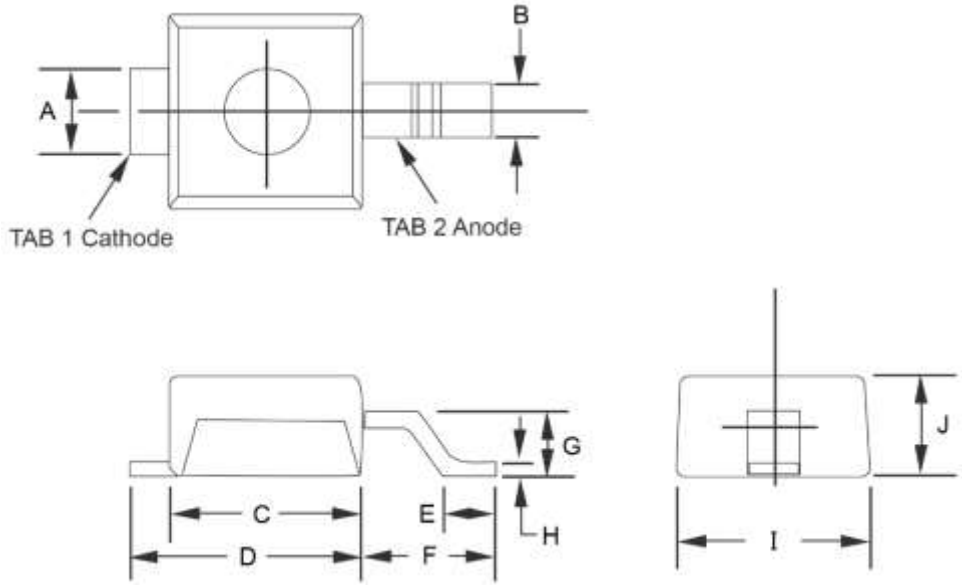


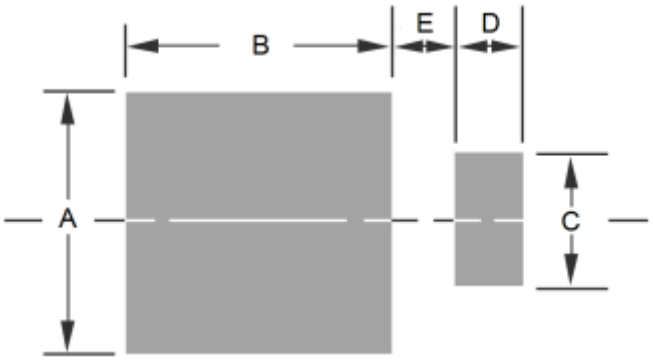

**FIGURE 4**
Typical Capacitance vs. Stand-Off Voltage

## 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 |

## 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 |

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