Microsemi
SCOTTSDALE DIVISION

# RT100KP33A thru RT100KP400CA, e3

## Preferred 100 kW Transient Voltage Suppressor for AIRCRAFT POWER BUS **PROTECTION**

## DESCRIPTION

Microsemi's 100 kW Transient Voltage Suppressors (TVSs) are designed for aircraft applications requiring high power transient protection with a comparatively small axial-leaded package size. This includes various threats such as "Waveform 4" at 6.4/69 µs per **RTCA/DO-160E** Section 22. It is also available with screening in accordance with MIL-PRF-19500 or avionics screening as described in the Features section herein. It may also be optionally acquired with RoHS Compliant (annealed matte-Tin finish) with an e3 suffix added to the part number. Microsemi also offers a broad spectrum of other TVSs to meet your needs.

## APPEARANCE



**IMPORTANT:** For the most current data, consult *MICROSEMI's* website: **http://www.microsemi.com**

## FEATURES

- Available in both Unidirectional and Bidirectional construction (Bidirectional with CA suffix)
- TVS selection for 33 to 400 V Standoff Voltages ($V_{WM}$)
- Suppresses transients up to **100 kW @ 6.4/69 µs**
- Fast response with less than 5 ns turn-on time.
- Optional 100% **screening for avionics grade** is available by adding **MA** prefix to part number for added 100% temperature cycle -55°C to +125°C (10X), surge (3X) in each direction, 24 hours HTRB in each direction, and post test ($V_{BR}$ and $I_D$)
- Options for **screening** in accordance with MIL-PRF-19500 **for JAN, JANTX,** and **JANTXV** are also available by adding MQ, MX, or MV prefixes respectively to part numbers.
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B.
- RoHS Compliant devices available by adding "e3" suffix

## APPLICATIONS / BENEFITS

- Protection from high power switching transients, induced RF, and lightning threats with comparatively small package size (0.25 inch diameter)
- Protection from ESD and EFT per IEC61000-4-2 and IEC61000-4-4
- Pin injection protection per RTCA/DO-160E up to Level 4 for Waveform 4 (6.4/69 µs) on all devices
- Pin injection protection per RTCA/DO-160E up to Level 5 for Waveform 4 (6.4/69 µs) on device types RT100KP33A or CA up to RT100KP260A or CA
- Pin injection protection per RTCA/DO-160E up to Level 3 for Waveform 5A (40/120 µs) on all devices
- Pin injection protection per RTCA/DO-160E up to Level 4 for Waveform 5A (40/120 µs) on device types RT100KP33A or CA up to RT100KP64A or CA
- Consult Factory for other voltages with similar Peak Pulse Power capabilities.

## MAXIMUM RATINGS

- Peak Pulse Power dissipation at 25ºC: 100 kW at 6.4/69 µs waveform in Figure 8 (also see figures 1 and 2)
- Impulse repetition rate: 0.005%
- $t_{clamping}$ (0 volts to $V_{BR}$ min): <100 ps theoretical for unidirectional and <5 ns for bidirectional
- Operating & storage temperatures: -65°C to +150°C
- Thermal resistance: 17.5C/W junction to lead, or 77.5C/W junction to ambient when mounted on FR4 PC board with 4 $mm^2$ copper pads (1 oz ) and track width 1 mm, length 25 mm
- Steady-state power dissipation: 7 Watts @ $T_L$ = 27.5°C or 1.61 Watts at TA =25 °C when mounted on FR4 PC Board described for thermal resistance above
- Forward surge: 250 Amps 8.3 ms half-sine wave for unidirectional devices only
- Solder Temperatures: 260°C for 10 s maximum

## MECHANICAL & PACKAGING

- CASE: Void free transfer molded thermosetting epoxy meeting UL94V-O requirements
- FINISH: Tin-Lead or RoHS Compliant matte-Tin plating solderable per MIL-STD-750, method 2026
- Polarity: Cathode marked with band for unidirectional (no band required for bi-directional)
- MARKING: Manufacturers logo and part number. Add prefix MA, MQ, MX, etc., for screened parts.
- WEIGHT: 1.7 grams (approximate)
- TAPE & REEL option: Standard per EIA-296 for axial package (add "TR" suffix to part number)
- Package dimensions: See last page



Copyright © 2007


**Microsemi**
Scottsdale Division
8700 E. Thomas Rd. PO Box 1390, Scottsdale, AZ 85252 USA, (480) 941-6300, Fax: (480) 947-1503

# Preferred 100 kW Transient Voltage Suppressor for AIRCRAFT POWER BUS PROTECTION

## ELECTRICAL CHARACTERISTICS at 25ºC

| Part Number (1) (4) | Rated Stand-off Voltage $V_{WM}$ | Breakdown Voltage $V_{(BR)}$ Volts @ $I_{(BR)}$ | | Maximum Clamping @ $I_{PP}$ (2) $V_C$ | Maximum Reverse Leakage @ $V_{WM}$ $I_D$ | Maximum Peak Pulse Current (3) @6.4/69 µs $I_{PP}$ | Maximum $V_{(BR)}$ temperature Coefficient $\alpha_{V(BR)}$ |
|---|---|---|---|---|---|---|---|
| | | $V_{(BR)}$ | $I_{(BR)}$ | | | | |
| | VOLTS | VOLTS | mA | VOLTS | µAmps | Amps | mV/°C |
| ***RT100KP33A*** | 33 | 36.7-40.6 | 50 | 58.6 | 5000 | 1825 * | 38 |
| ***RT100KP36A*** | 36 | 40.0-44.2 | 50 | 61.8 | 5000 | 1672 * | 41 |
| RT100KP40A | 40 | 44.4-49.1 | 20 | 68.6 | 1500 | 1518 * | 46 |
| ***RT100KP43A*** | 43 | 47.8-52.8 | 10 | 71.0 | 500 | 1432 * | 50 |
| ***RT100KP45A*** | 45 | 50.0-55.3 | 5 | 73.0 | 150 | 1365 * | 52 |
| ***RT100KP48A*** | 48 | 53.3-58.9 | 5 | 77.7 | 150 | 1285 * | 56 |
| RT100KP51A | 51 | 56.7-62.7 | 5 | 82.8 | 50 | 1205 * | 60 |
| RT100KP54A | 54 | 60.0-66.3 | 5 | 87.5 | 25 | 1139 * | 63 |
| RT100KP58A | 58 | 64.4-71.2 | 5 | 94.0 | 15 | 1066 * | 68 |
| RT100KP60A | 60 | 66.7-73.7 | 5 | 97.3 | 15 | 1012 * | 71 |
| RT100KP64A | 64 | 71.1-78.6 | 5 | 104 | 10 | 959 * | 76 |
| ***RT100KP70A*** | 70 | 77.8-86.0 | 5 | 114 | 10 | 879 | 83 |
| ***RT100KP75A*** | 75 | 83.3-92.1 | 5 | 122 | 10 | 819 | 89 |
| ***RT100KP78A*** | 78 | 86.7-95.8 | 5 | 126 | 10 | 793 | 93 |
| RT100KP85A | 85 | 94.4-104 | 5 | 137 | 10 | 726 | 102 |
| RT100KP90A | 90 | 100-111 | 5 | 146 | 10 | 686 | 109 |
| RT100KP100A | 100 | 111-123 | 5 | 162 | 10 | 619 | 121 |
| RT100KP110A | 110 | 122-135 | 5 | 178 | 10 | 559 | 133 |
| RT100KP120A | 120 | 133-147 | 5 | 193 | 10 | 519 | 145 |
| RT100KP130A | 130 | 144-159 | 5 | 209 | 10 | 473 | 157 |
| RT100KP150A | 150 | 167-185 | 5 | 243 | 10 | 413 | 183 |
| RT100KP160A | 160 | 178-197 | 5 | 259 | 10 | 386 | 195 |
| ***RT100KP170A*** | 170 | 189-209 | 5 | 275 | 10 | 366 | 207 |
| ***RT100KP180A*** | 180 | 200-221 | 5 | 291 | 10 | 346 | 219 |
| ***RT100KP200A*** | 200 | 222-245 | 5 | 322 | 10 | 313 | 243 |
| ***RT100KP220A*** | 220 | 245-271 | 5 | 356 | 10 | 280 | 269 |
| RT100KP250A | 250 | 278-308 | 5 | 403 | 10 | 246 | 306 |
| RT100KP260A | 260 | 289-320 | 5 | 419 | 10 | 236 | 318 |
| ***RT100KP280A*** | 280 | 311-345 | 5 | 451 | 10 | 220 | 344 |
| ***RT100KP300A*** | 300 | 333-369 | 5 | 483 | 10 | 206 | 368 |
| ***RT100KP350A*** | 350 | 389-431 | 5 | 564 | 10 | 176 | 430 |
| ***RT100KP400A*** | 400 | 444-492 | 5 | 644 | 10 | 153 | 490 |

1. For bidirectional construction, indicate a CA suffix (instead of A) after the part number
2. Clamping voltage does not include any variable parasitic lead inductance effects observed during the 6.4 µs rise time due to lead length.
3. The Maximum Peak Pulse Current ($I_{PP}$) shown represents the performance capabilities by design.
   * Surge test screening is only performed up to 900 Amps (test equipment limitations).
4. Part numbers in bold italics are preferred devices.



Copyright © 2007


**Microsemi**
Scottsdale Division
8700 E. Thomas Rd. PO Box 1390, Scottsdale, AZ 85252 USA, (480) 941-6300, Fax: (480) 947-1503

Microsemi
SCOTTSDALE DIVISION

# Preferred 100 kW Transient Voltage Suppressor for AIRCRAFT POWER BUS PROTECTION

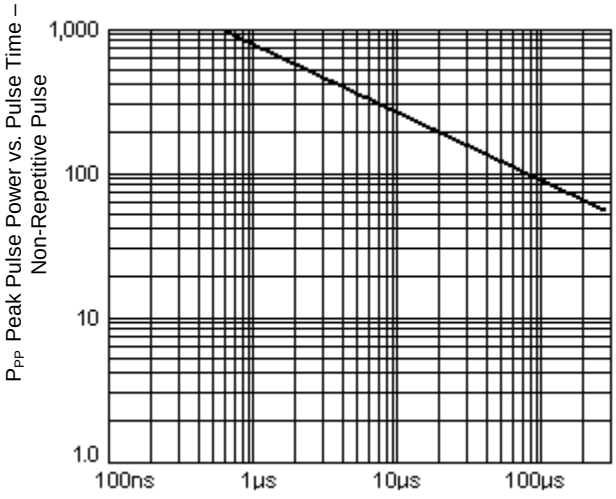



**FIGURE 1**
Peak Pulse Power vs. Pulse Time
To 50% of Exponentially Decaying Pulse

NOTE: This $P_{PP}$ versus time graph allows the designer to use these parts over a broad power spectrum using the guidelines illustrated in App Note 104 on Microsemi's website. Aircraft transients are described with exponential decaying waveforms. For suppression of square-wave impulses, derate power and current to 66% of that for exponential decay shown in Figure 1.

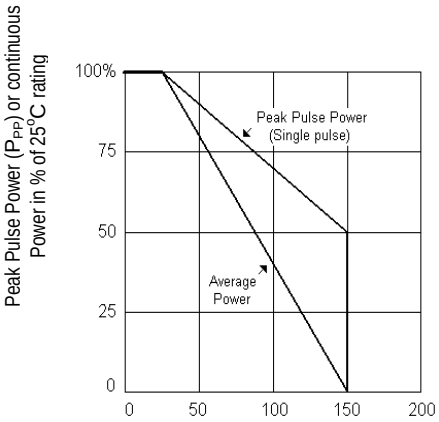



**FIGURE 2**
POWER DERATING

## INSTALLATION

**Correct**

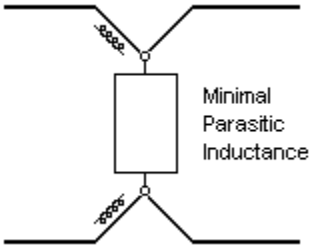



**FIGURE 3**

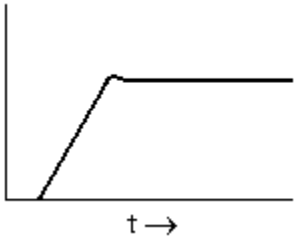



**FIGURE 4**

TVS devices used across power lines are subject to relatively high magnitude surge currents and are more prone to adverse parasitic inductance effects in the mounting leads. Minimizing the shunt path of the lead inductance and their V= -Ldi/dt effects will optimize the TVS effectiveness. Examples of optimum installation and poor installation are illustrated in figures 3 through figure 6. Figure 3 illustrates minimal parasitic inductance with attachment at end of device. Inductive voltage drop is across input leads. Virtually no "overshoot" voltage results as illustrated with figure 4. The loss of effectiveness in protection caused by excessive parasitic inductance is illustrated in figures 5 and 6. Also see MicroNote 111 for further information on "Parasitic Lead Inductance in TVS".

**Wrong**

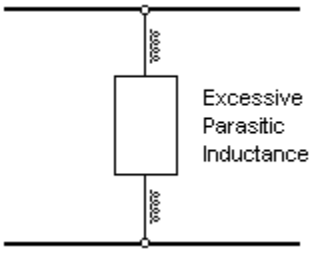



**FIGURE 5**

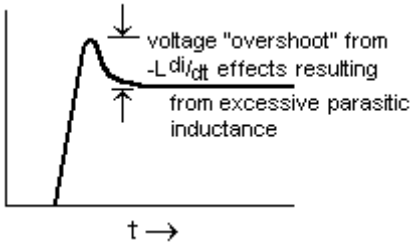


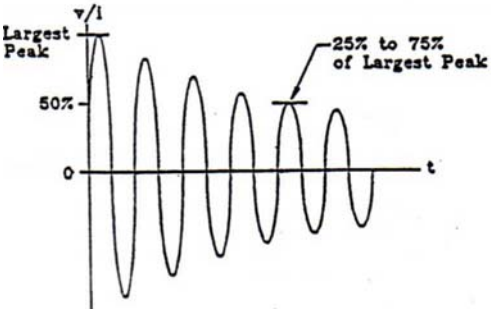

**FIGURE 6**



Copyright © 2007

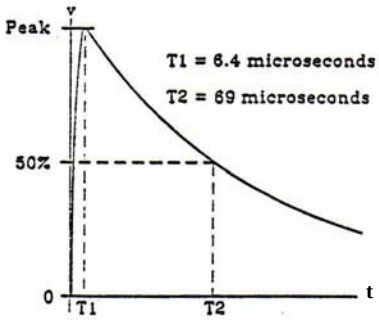

**Microsemi**
Scottsdale Division
8700 E. Thomas Rd. PO Box 1390, Scottsdale, AZ 85252 USA, (480) 941-6300, Fax: (480) 947-1503

# Preferred 100 kW Transient Voltage Suppressor for AIRCRAFT POWER BUS PROTECTION



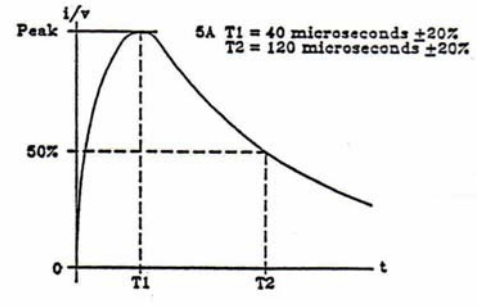

t – time
Note: frequency is 1MHz

**FIGURE 7 –** Waveform 3




t – time

**FIGURE 8 –** Waveform 4




t - Time

**FIGURE 9 –** Waveform 5A

NOTE: The 1MHz damped oscillatory waveform (3) has an effective pulse width of 4 µs. Equivalent peak pulse power at each of the pulse widths represented in RTCA/DO-160E for waveforms 3, 4 and 5A (above) have been determined referencing Figure 1 herein as well as Application Notes 104 and 120 (found on Microsemi's website) and are listed below.

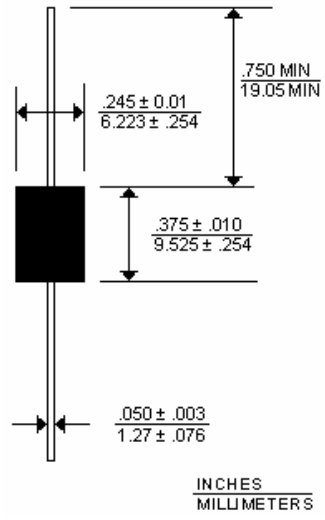
| WAVEFORM NUMBER | PULSE WIDTH µs | PEAK PULSE POWER kW | Peak Pulse Current Conversion Factor * from Rated $I_{PP}$ at 6.4/69 µs |
|---|---|---|---|
| **3** | 4 | 340 | 3.40x |
| **4** | 6.4/69 | 100 | 1.00x |
| **5A** | 40/120 | 70 | 0.70x |

* Multiply by the conversion factor shown with reference to the maximum rated $I_{PP}$ in the Electrical Characteristics Table on page 2.

Note: High current fast rise-time transients of 250 ns or less can more than triple the $V_C$ from parasitic inductance effects (V= -Ldi/dt) compared to the clamping voltage shown in the initial Electrical Characteristics on page 1 as also described in Figures 5 and 6 herein.

Also see MicroNotes 127, 130, and 132 on the Microsemi website (Support section) for further information on Transient Voltage Suppressors with reference to aircraft industry specification RTCA/DO-160E.

## DIMENSIONS




Copyright © 2007