RT100KP40A 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 40 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

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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)	Maximum Reverse Leakage @ V_{WM}	Maximum Peak Pulse Current (3) @6.4/69 µs	Maximum $V_{(BR)}$ temperature Coefficient
		$V_{(BR)}$	$I_{(BR)}$				
	VOLTS	VOLTS	mA	VOLTS	µAmps	Amps	mV/ºC
RT100KP40A	40	44.4-49.1	20	78.6	1500	1273 *	46
RT100KP43A	43	47.8-52.8	10	84.5	500	1184 *	50
RT100KP45A	45	50.0-55.3	5	88.5	150	1130 *	52
RT100KP48A	48	53.3-58.9	5	94.3	150	1061 *	56
RT100KP51A	51	56.7-62.7	5	101	50	990 *	60
RT100KP54A	54	60.0-66.3	5	106	25	943 *	63
RT100KP58A	58	64.4-71.2	5	114	15	878	68
RT100KP60A	60	66.7-73.7	5	118	15	848	71
RT100KP64A	64	71.1-78.6	5	126	10	795	76
RT100KP70A	70	77.8-86.0	5	138	10	725	83
RT100KP75A	75	83.3-92.1	5	147	10	680	89
RT100KP78A	78	86.7-95.8	5	153	10	655	93
RT100KP85A	85	94.4-104	5	166	10	602	102
RT100KP90A	90	100-111	5	178	10	563	109
RT100KP100A	100	111-123	5	197	10	508	121
RT100KP110A	110	122-135	5	216	10	463	133
RT100KP120A	120	133-147	5	235	10	426	145
RT100KP130A	130	144-159	5	254	10	394	157
RT100KP150A	150	167-185	5	296	10	338	183
RT100KP160A	160	178-197	5	315	10	318	195
RT100KP170A	170	189-209	5	334	10	300	207
RT100KP180A	180	200-221	5	354	10	283	219
RT100KP200A	200	222-245	5	392	10	256	243
RT100KP220A	220	245-271	5	434	10	231	269
RT100KP250A	250	278-308	5	493	10	203	306
RT100KP260A	260	289-320	5	512	10	196	318
RT100KP280A	280	311-345	5	552	10	181	344
RT100KP300A	300	333-369	5	590	10	170	368
RT100KP350A	350	389-431	5	690	10	145	430
RT100KP400A	400	444-492	5	787	10	127	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.

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GRAPHS

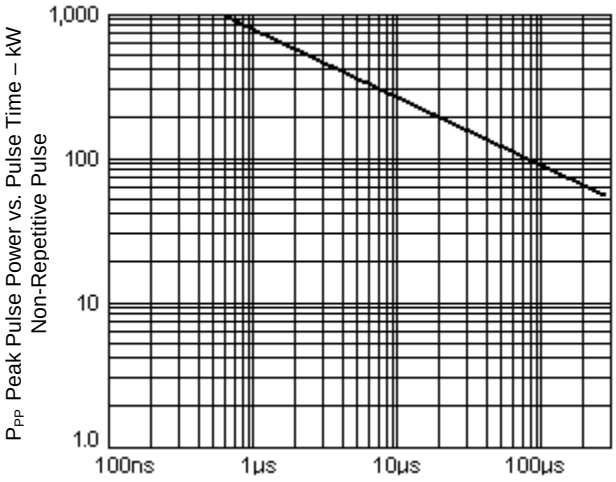

FIGURE 1
Peak Pulse Power vs. Pulse Time
To 50% of Exponentially Decaying Pulse

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.

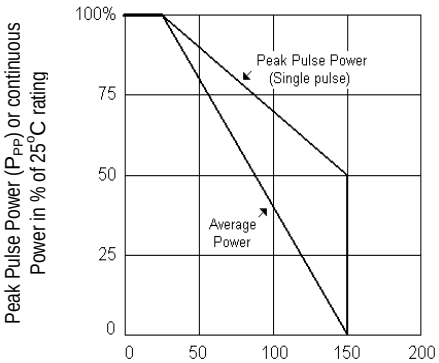

FIGURE 2
POWER DERATING

INSTALLATION

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".

Correct

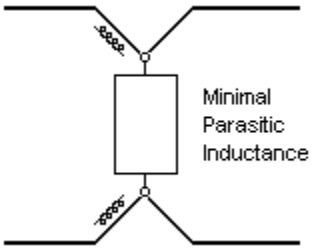

FIGURE 3

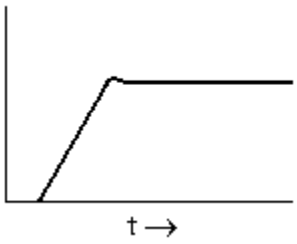

FIGURE 4

Wrong

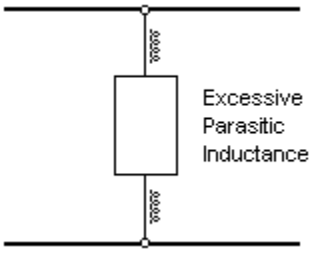

FIGURE 5

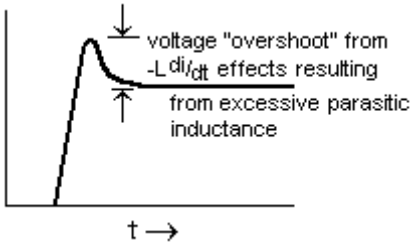

FIGURE 6

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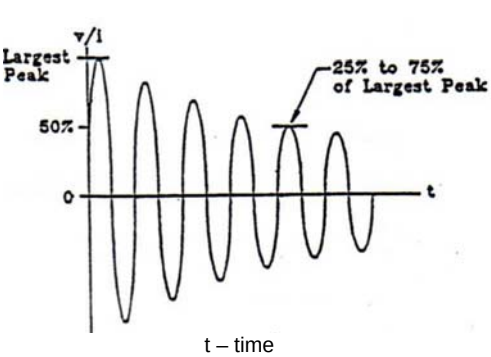
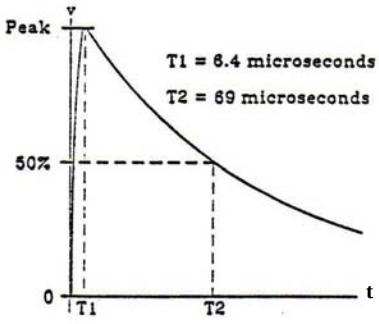


t – time

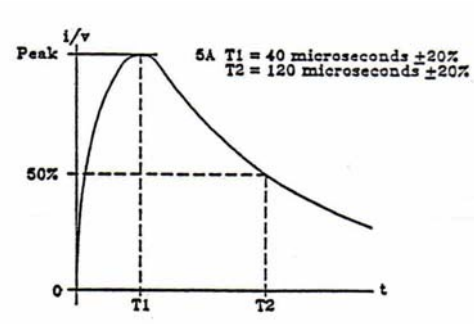
Note: frequency is 1MHz

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.

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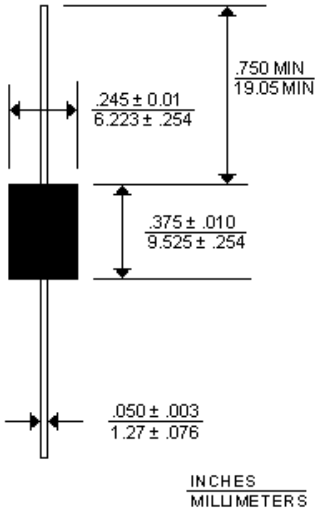
DIMENSIONS



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