RoHS Available

Unidirectional and Bidirectional Transient Voltage Suppressor (TVS) Device

Screening in reference to MIL-PRF-19500 available

DESCRIPTION

These MRT100KP40A – MRT100KP400CA high reliability devices protect against dangerous high-voltage, short term transients such as those caused the the secondary effects of lightning per IEC61000-4-5 (see protection classes below) and RTCA/DO-160. They also protect against voltage spikes caused by inductive load switching, induced RFI, and ESD or EFT per IEC61000-4-2 and IEC61000-4-4. Clamping time is nearly instantaneous at < 5ns.

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

DO-204AR Package

FEATURES

- Available in both unidirectional and bidirectional configurations
- Suppresses transients up to 100 kW @ 6.4/69 μs
- Fast response with less than 5 ns turn-on time
- Preferred 100 kW TVS for aircraft power bus protection
- 3σ lot norm screening performed on standby current I_D
- 100% surge tested devices
- Multiple screening levels in reference to MIL-PRF-19500 are available. Refer to Hirel Non-Hermetic Product Portfolio for more details on the screening options.
  (See part nomenclature for all options.)
- High reliability controlled devices have wafer fabrication and assembly lot traceability
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant versions are available

APPLICATIONS / BENEFITS

- Economical TVS series for thru-hole mounting
- 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-160 up to Level 4 for Waveform 4 (6.4/69 μs) on all devices
- Pin injection protection per RTCA/DO-160 up to Level 5 for Waveform 4 (6.4/69 μs) on device types MRT100KP33A or CA up to MRT100KP260A or CA
- Pin injection protection per RTCA/DO-160 up to Level 3 for Waveform 5A (40/120 μs) on all devices
- Pin injection protection per RTCA/DO-160 up to Level 4 for Waveform 5A (40/120 μs) on device types MRT100KP33A or CA up to MRT100KP64A or CA
- Consult Factory for other voltages with similar Peak Pulse Power (P_{PP}) capabilities

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MAXIMUM RATINGS @ 25 ºC unless otherwise noted

Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	T_J and T_{STG}	-65 to +150	ºC
Thermal Resistance, Junction to Lead @ 3/8 inch (10 mm) lead length from body	$R_{ΘJL}$	17.5	ºC/W
Thermal Resistance, Junction to Ambient [(1)]	$R_{ΘJA}$	77.5	ºC/W
Peak Pulse Power Dissipation [(2)] 6.4/69 µs	P_{PP}	100	kW
Steady-State Power Dissipation @ T_A = 25 ºC	P_D	7 1.61 [(1)]	W
$T_{clamping}$ (0 volts to $V_{(BR)}$ min, theoretical) Unidirectional Bidirectional		< 100 < 5	ps ns
Surge Peak Forward Current [(2)]	I_{FSM}	250	A
Solder Temperature @ 10 s		260	ºC

Notes: 1. When mounted on FR4 PC board with 4 mm^2 copper pads (1 oz) and track width 1 mm, length 25 mm.
2. At 8.3 ms half-sine wave (unidirectional only).

MECHANICAL and PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0.
- TERMINALS: Tin-lead or RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750, method 2026.
- MARKING: Part number
- POLARITY: Cathode indicated by band. No cathode band on bidirectional devices.
- TAPE & REEL option: Standard per EIA-296 (add “TR” suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 1.7 grams
- See Package Dimensions on last page.

PART NOMENCLATURE

M RT 100 K P 40 C A (e3)

Reliability Level
M
MA
MX
MXL
(*See Hirel Non-Hermetic Product Portfolio)

RTCA/DO-160 Rated

Peak Pulse Power

Kilowatt Rating

Encapsulated Plastic Package

RoHS Compliance
e3 = RoHS compliant
Blank = non-RoHS compliant

Voltage Tolerance
A = 5% tolerance level
Blank = 10% tolerance

Polarity
C = Bi-directional
Blank = Unidirectional

Stand-off Voltage Rating
(see Electrical Characteristics table)

SYMBOLS & 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.
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.
P_{PP}	Peak Pulse Power. The rated random recurring peak impulse power or rated nonrepetitive peak impulse power. The impulse power is the maximum-rated value of 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.
I_D	Standby Current: The current through the device at rated stand-off voltage.
I_{PP}	Peak Impulse Current: The maximum rated random recurring peak impulse current or nonrepetitive peak impulse current that may be applied to a device. A random recurring or nonrepetitive transient current is usually due to an external cause, and it is assumed that its effect will have completely disappeared before the next transient arrives.
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.
$I_{(BR)}$	Breakdown Current: The current used for measuring Breakdown Voltage $V_{(BR)}$

ELECTRICAL CHARACTERISTICS @ 25 ºC

Part Number	Rated Stand-off Voltage V_{WM}	Breakdown Voltage $V_{(BR)}$ Volts @ $I_{(BR)}$ $V_{(BR)}$	$I_{(BR)}$	Maximum Clamping @ I_{PP} (1) V_C	Maximum Reverse Leakage @ V_{WM} I_D	Maximum Peak Pulse Current (2) @ 6.4/69 µs I_{PP}	Maximum $V_{(BR)}$ Temperature Coefficient $\alpha_{V(BR)}$
	Volts	Volts	mA	Volts	µAmps	Amps	mV/°C
MRT100KP40A	40	44.4-49.1	20	78.6	1500	1273 *	46
MRT100KP43A	43	47.8-52.8	10	84.5	500	1184 *	50
MRT100KP45A	45	50.0-55.3	5	88.5	150	1130 *	52
MRT100KP48A	48	53.3-58.9	5	94.3	150	1061 *	56
MRT100KP51A	51	56.7-62.7	5	101	50	990 *	60
MRT100KP54A	54	60.0-66.3	5	106	25	943 *	63
MRT100KP58A	58	64.4-71.2	5	114	15	878	68
MRT100KP60A	60	66.7-73.7	5	118	15	848	71
MRT100KP64A	64	71.1-78.6	5	126	10	795	76
MRT100KP70A	70	77.8-86.0	5	138	10	725	83
MRT100KP75A	75	83.3-92.1	5	147	10	680	89
MRT100KP78A	78	86.7-95.8	5	153	10	655	93
MRT100KP85A	85	94.4-104	5	166	10	602	102
MRT100KP90A	90	100-111	5	178	10	563	109
MRT100KP100A	100	111-123	5	197	10	508	121
MRT100KP110A	110	122-135	5	216	10	463	133
MRT100KP120A	120	133-147	5	235	10	426	145
MRT100KP130A	130	144-159	5	254	10	394	157
MRT100KP150A	150	167-185	5	296	10	338	183
MRT100KP160A	160	178-197	5	315	10	318	195
MRT100KP170A	170	189-209	5	334	10	300	207
MRT100KP180A	180	200-221	5	354	10	283	219
MRT100KP200A	200	222-245	5	392	10	256	243
MRT100KP220A	220	245-271	5	434	10	231	269
MRT100KP250A	250	278-308	5	493	10	203	306
MRT100KP260A	260	289-320	5	512	10	196	318
MRT100KP280A	280	311-345	5	552	10	181	344
MRT100KP300A	300	333-369	5	590	10	170	368
MRT100KP350A	350	389-431	5	690	10	145	430
MRT100KP400A	400	444-492	5	787	10	127	490

NOTES:

1. Clamping voltage does not include any variable parasitic lead inductance effects observed during the 6.4 µs rise time due to lead length.
2. 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).

GRAPHS

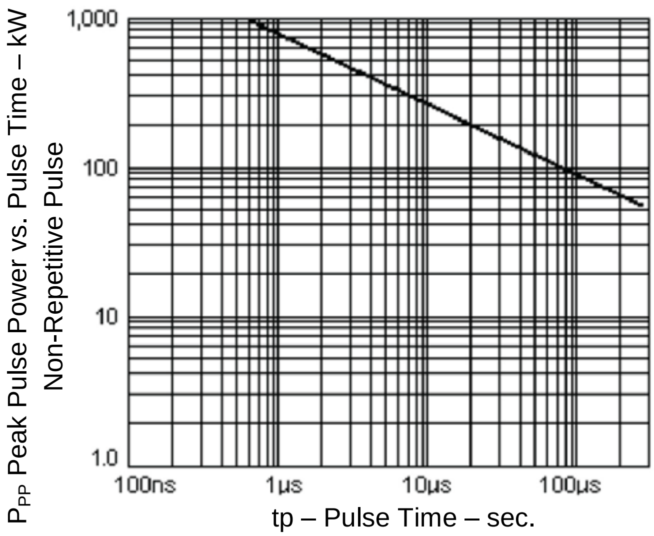


FIGURE 1
Peak Pulse Power vs. Pulse Time
To 50% of Exponentially Decaying Pulse

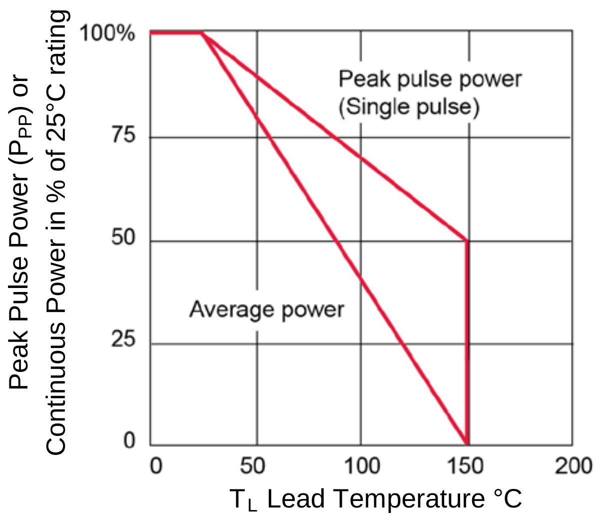


FIGURE 2
Power Derating

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

CORRECT

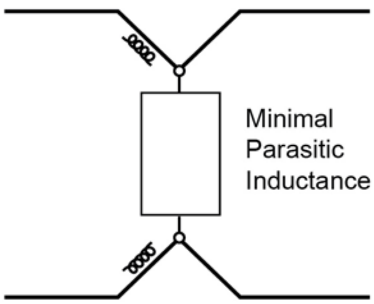


FIGURE 3

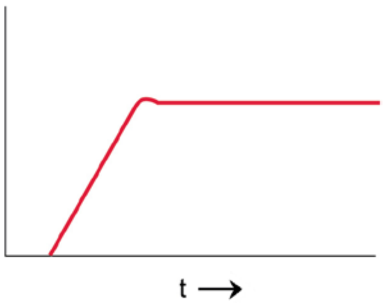


FIGURE 4

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 to 6. Figure 3 illustrates minimal parasitic inductance with attachment at end of device. Inductive voltage drop is across the 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”.

INCORRECT

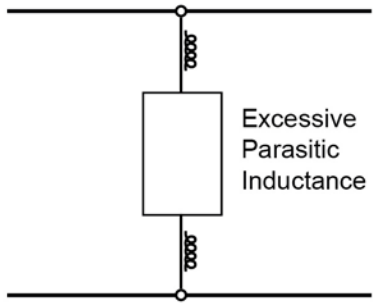


FIGURE 5

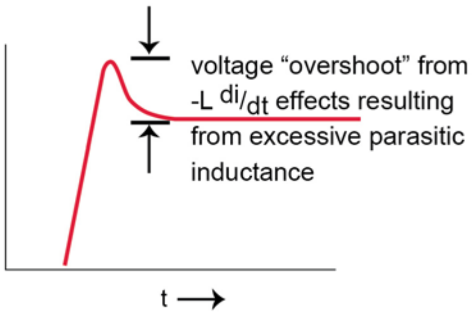


FIGURE 6

GRAPHS (continued)

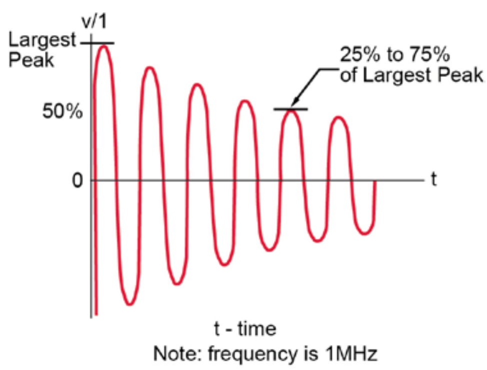
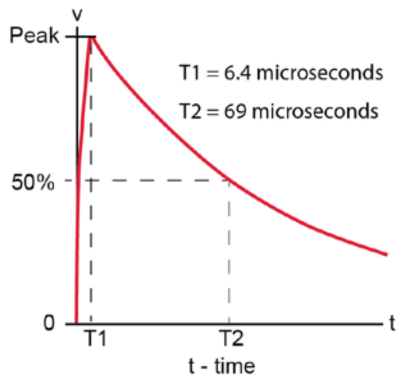


FIGURE 7 – Waveform 3



FIGURES 8 – Waveform 4

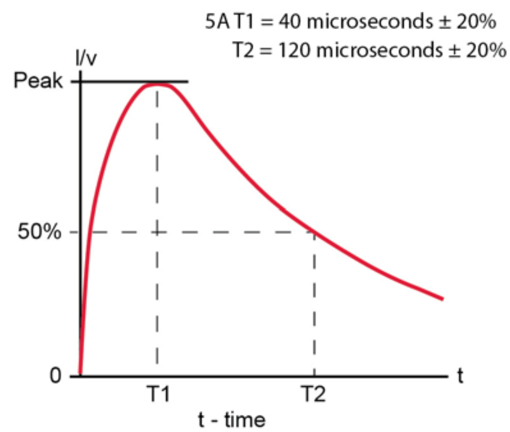


FIGURE 9 – Waveform 5A

NOTE: The 1 MHz 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-160 for waveforms 3, 4 and 5A (above) have been determined referencing Figure 1 herein as well as MicroNotes 104 and 120 (found on www.microsemi.com) and are listed below.

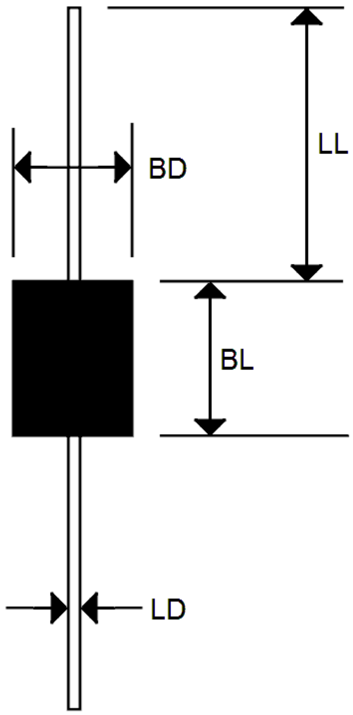
WAVEFORM NUMBER	PULSE WIDTH μs	PEAK PULSE POWER kW	Peak Pulse Current Conversion Factor * from Rated I_{PP} at 6.4/69 μs
3	4	340	3.40x
4	6.4/69	100	1.00x
5A	40/120	70	0.70x

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

NOTE 1: 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 table as also described in Figures 5 and 6 herein.

NOTE 2: Also see MicroNotes 127, 130, and 132 on www.microsemi.com for further information on transient voltage suppressors with reference to aircraft industry specification RTCA/DO-160.

PACKAGE DIMENSIONS



Dim	Dimensions			
	Inch		Millimeters	
	Min	Max	Min	Max
LL	1.100	1.500	27.95	38.1
BL	0.365	0.375	9.27	9.52
BD	0.240	0.250	6.1	6.35
LD	0.048	0.052	1.22	1.32