RoHS Available

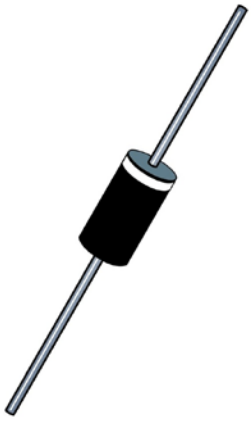
1500 Watt Unidirectional and Bidirectional Transient Voltage Suppressor

Screening in reference to MIL-PRF-19500 available

DESCRIPTION

The popular Transient Voltage Suppressor series of M1.5KE6.8 – M1.5KE400CA with its various upscreening options offer an extended voltage range and provides a wide variety of commercial, high reliability, RoHS and bidirectional options. All have the same high peak pulse power rating of 1500 W and extremely fast response time. They can protect from secondary effects of lightning per IEC61000-4-5 and the class levels as shown below as well as voltage transients from inductive switching and RFI. Since their response time is virtually instantaneous, they also protect from ESD and EFT per IEC61000-4-2 and IEC61000-4-4.

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



Case 1 Package

FEATURES

- High reliability devices with fabrication and assembly lot traceability
- Economical plastic encapsulated TVS series for thru-hole mounting
- 3σ lot norm screening performed on standby current (I_D)
- 100% surge tested devices suppress transients up to 1500 watts @ 10/1000 µs (see figure 1)
- Enhanced reliability screening available in reference to MIL-PRF-19500. Refer to Hirel Non-Hermetic Product Portfolio for more details on the screening options.
  (See part nomenclature for all options.)
- Enhanced reliability source 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 available

APPLICATIONS / BENEFITS

- High-reliability devices
- Protection from switching and RFI induced transients
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:
  - Class 1: M1.5KE6.8A to M1.5KE200CA
  - Class 2: M1.5KE6.8A to M.5KE180CA
  - Class 3: M1.5KE6.8A to M1.5KE91CA
  - Class 4: M1.5KE6.8A to M1.5KE43CA
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  - Class 1: M1.5KE6.8A to M1.5KE110CA
  - Class 2: M1.5KE6.8A to M1.5KE56CA
  - Class 3: M1.5KE6.8A to M1.5KE27CA
  - Class 4: M1.5KE6.8A to M1.5KE13CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  - Class 2: M1.5KE6.8A to M1.5KE24CA
  - Class 3: M1.5KE6.8A to M1.5KE12CA

MSC – Lawrence
6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
Fax: (978) 689-0803

MSC – Ireland
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:
www.microsemi.com

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MAXIMUM RATINGS

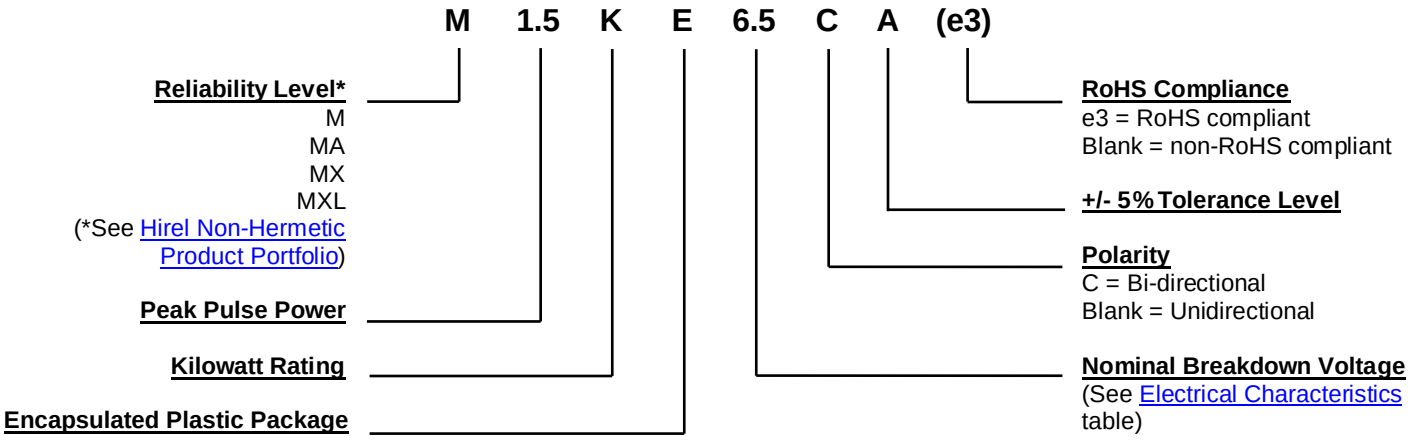
Parameters/Test Conditions		Symbol	Value	Unit
Junction and Storage Temperature		T_J and T_{STG}	-65 to +150	ºC
Thermal Resistance, Junction to Lead @ 0.375 inch (10 mm) from body		$R_{\Theta JL}$	22	ºC/W
Thermal Resistance, Junction to Ambient [1]		$R_{\Theta JA}$	82	ºC/W
Peak Pulse Power @ T_L = +25 ºC [2]		P_{PP}	1500	W
Rated Average Power Dissipation	@ T_L = +40 ºC @ T_A = +25 ºC	$P_{M(AV)}$	5 1.52[1]	W
$T_{clamping}$ (0 volts to $V_{(BR)}$ min)	Unidirectional Bidirectional		< 100 < 5	ps ns
Surge Peak Forward Current [3]		I_{FSM}	200	A
Solder Temperature @ 10 s		T_{SP}	260	°C

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 10/1000 µs with repetition rate of 0.01% or less (see Figure 1).
3. At 8.3 ms half-sine wave for unidirectional devices 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 readily solderable per MIL-STD-750 method 2026
- MARKING: Part number and polarity band
- 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 1.5 grams
- See Package Dimensions on last page.

PART NOMENCLATURE



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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.
$I_{(BR)}$	Breakdown Current: The current used for measuring breakdown voltage $V_{(BR)}$.
$V_{(BR)}$	Breakdown Voltage: The voltage across the device at a specified current $I_{(BR)}$ in the breakdown region.
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.
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_{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.
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.
I_D	Standby Current: The current through the device at rated stand-off voltage.

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ELECTRICAL CHARACTERISTICS @ 25 °C

Industry Type Number	Rated Standoff Voltage V_{WM} (Note 1)	Breakdown Voltage $V_{(BR)}$ @ $I_{(BR)}$		Maximum Clamping Voltage V_C @ I_{PP}	Maximum Standby Current I_D @ V_{WM}	Maximum Peak Pulse Current I_{PP} (Fig. 2)	Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha V_{(BR)}$
	Volts	Volts Min. Max.	mA	Volts	µA	A	%/°C
M1.5KE6.8A	5.80	6.45 – 7.14	10	10.5	1000	143.0	0.057
M1.5KE7.5A	6.40	7.13 – 7.88	10	11.3	500	132.0	0.061
M1.5KE8.2A	7.02	7.79 – 8.61	10	12.1	200	124.0	0.065
M1.5KE9.1A	7.78	8.65 – 9.55	1	13.4	50	112.0	0.068
M1.5KE10A	8.55	9.50 – 10.50	1	14.5	10	103.0	0.073
M1.5KE11A	9.40	10.50 – 11.60	1	15.6	5	96.0	0.075
M1.5KE12A	10.22	11.40 – 12.60	1	16.7	5	90.0	0.078
M1.5KE13A	11.10	12.40 – 13.70	1	18.2	5	82.0	0.081
M1.5KE15A	12.80	14.30 – 15.80	1	21.2	1	71.0	0.084
M1.5KE16A	13.60	15.20 – 16.80	1	22.5	1	67.0	0.086
M1.5KE18A	15.30	17.10 – 18.90	1	25.2	1	59.5	0.088
M1.5KE20A	17.10	19.00 – 21.00	1	27.7	1	54.0	0.090
M1.5KE22A	18.80	20.90 – 23.10	1	30.6	1	49.0	0.092
M1.5KE24A	20.50	22.80 – 25.20	1	33.2	1	45.0	0.094
M1.5KE27A	23.10	25.70 – 28.40	1	37.5	1	40.0	0.096
M1.5KE30A	25.60	28.50 – 31.50	1	41.4	1	36.0	0.097
M1.5KE33A	28.20	31.40 – 34.70	1	45.7	1	33.0	0.098
M1.5KE36A	30.80	34.20 – 37.80	1	49.9	1	30.0	0.099
M1.5KE39A	33.30	37.10 – 41.00	1	53.9	1	28.0	0.100
M1.5KE43A	36.80	40.90 – 45.20	1	59.3	1	25.3	0.101
M1.5KE47A	40.20	44.70 – 49.40	1	64.8	1	23.2	0.101
M1.5KE51A	43.60	48.50 – 53.60	1	70.1	1	21.4	0.102
M1.5KE56A	47.80	53.20 – 58.80	1	77.0	1	19.5	0.103
M1.5KE62A	53.00	58.90 – 65.10	1	85.0	1	17.7	0.104
M1.5KE68A	58.10	64.60 – 71.40	1	92.0	1	16.3	0.104
M1.5KE75A	64.10	71.30 – 78.80	1	103.0	1	14.6	0.105
M1.5KE82A	70.10	77.90 – 86.10	1	113.0	1	13.3	0.105
M1.5KE91A	77.80	86.50 – 95.50	1	125.0	1	12.0	0.106
M1.5KE100A	85.50	95.00 – 105.00	1	137.0	1	11.0	0.106
M1.5KE110A	94.00	105.00 – 116.00	1	152.0	1	9.9	0.107
M1.5KE120A	102.00	114.00 – 126.00	1	165.0	1	9.1	0.107
M1.5KE130A	111.00	124.00 – 137.00	1	179.0	1	8.4	0.107
M1.5KE150A	128.00	143.00 – 158.00	1	207.0	1	7.2	0.108
M1.5KE160A	136.00	152.00 – 168.00	1	219.0	1	6.8	0.108
M1.5KE170A	145.00	162.00 – 179.00	1	234.0	1	6.4	0.108
M1.5KE180A	154.00	171.00 – 189.00	1	246.0	1	6.1	0.108
M1.5KE200A	171.00	190.00 – 210.00	1	274.0	1	5.5	0.108
M1.5KE220A	185.00	209.00 – 231.00	1	328.0	1	4.6	0.110
M1.5KE250A	214.00	237.00 – 263.00	1	344.0	1	5.0	0.110
M1.5KE300A	256.00	285.00 – 315.00	1	414.0	1	5.0	0.111
M1.5KE350A	300.00	332.00 – 368.00	1	482.0	1	4.0	0.111
M1.5KE400A	324.00	380.00 – 420.00	1	548.0	1	4.0	0.111

NOTES:
1. Normal selection criteria for TVS devices is by rated stand-off voltage (V_{WM}) and should be equal or greater than dc or continuous peak operating voltage.
2. TVS devices are tested to maximum peak pulse current (I_{PP}) with clamping voltage monitored. This surge capability is one of the most significant electrical characteristics of the device and should be considered as part of customer quality inspections.
3. For Bidirectional types having V_{WM} of 8 volts and under, the I_D leakage current is doubled. Also for bidirectional parts, the capacitance will be half that shown in Fig. 2 for zero bias.
4. For unidirectional, the forward voltage (V_F) is 3.5 volts maximum at 100 Amps peak for 8.3 ms half-sine wave.

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GRAPHS

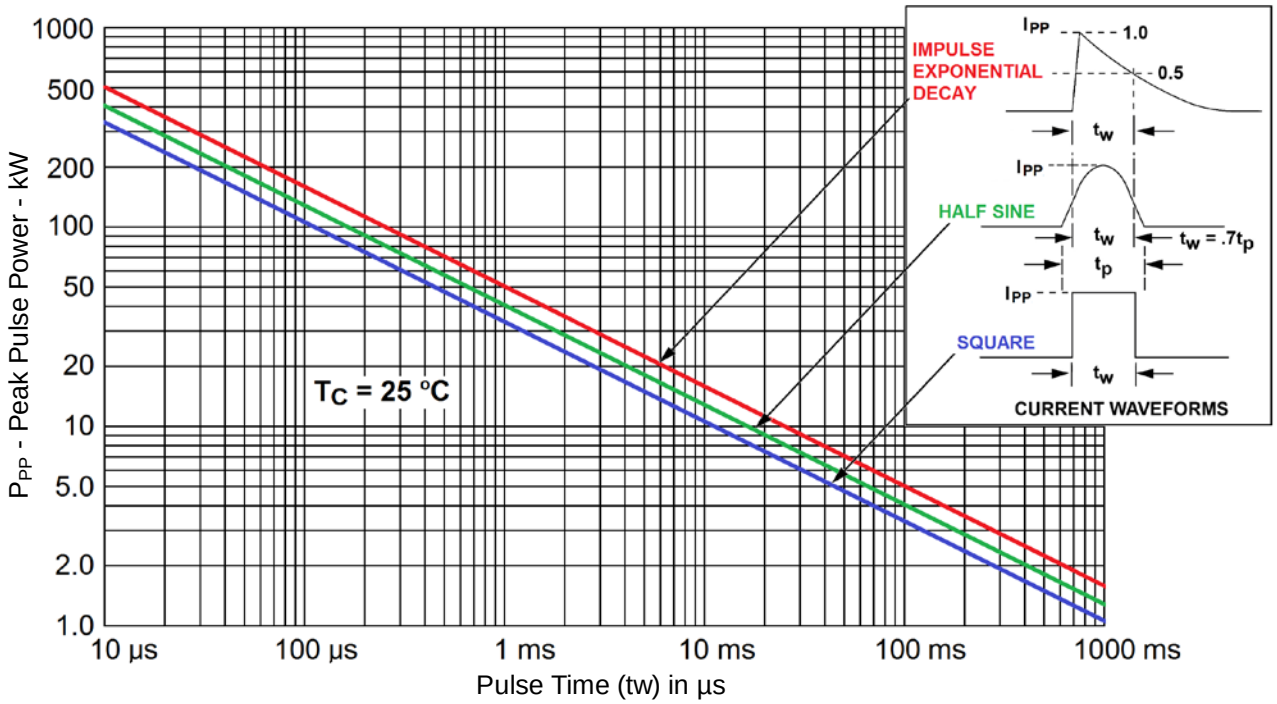
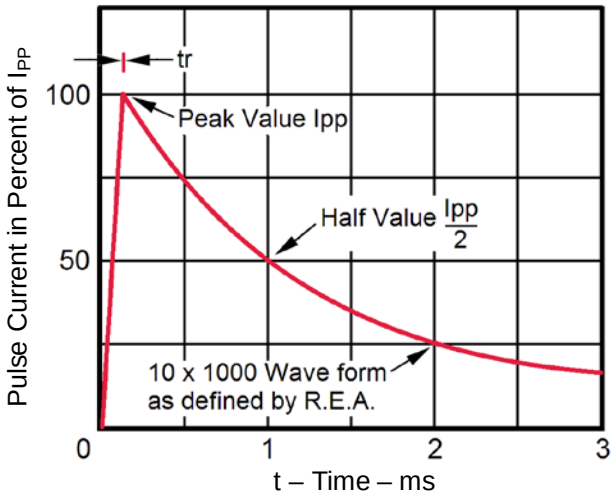


FIGURE 1
Peak Pulse Power vs Pulse Time (tw) in µs



Test waveform parameters: tr=10 µs, tp=1000µs

FIGURE 2
Pulse Waveform for 10/1000 Exponential Surge

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GRAPHS (continued)

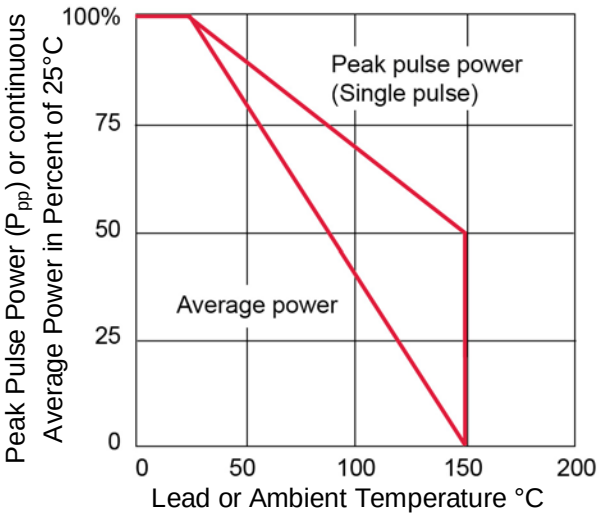

FIGURE 3
Derating Curve

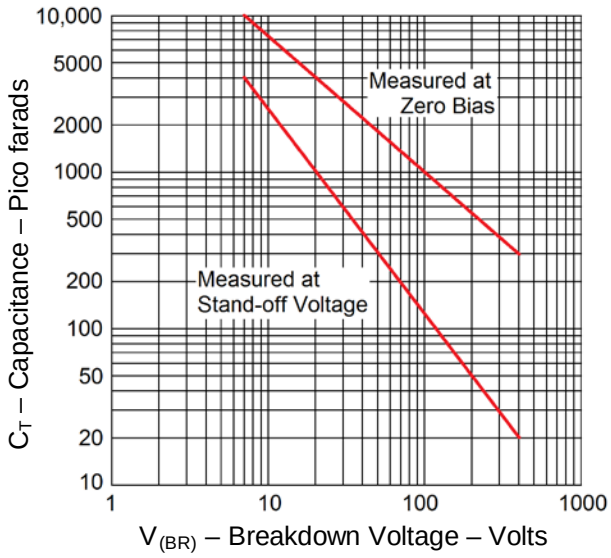

FIGURE 4
Typical Capacitance vs. Breakdown Voltage

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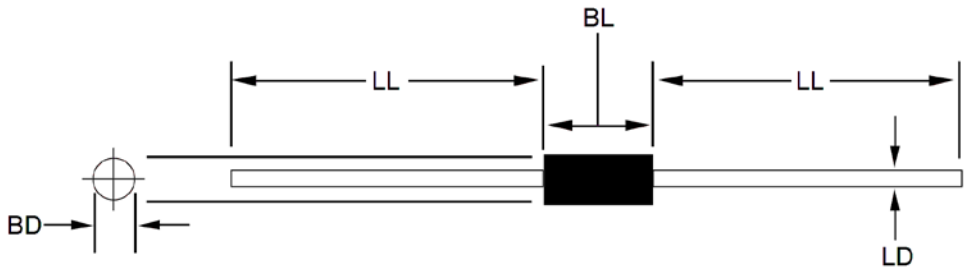
PACKAGE DIMENSIONS



NOTES:

1. Dimensions are in inches.
2. Millimeter equivalents are given for information only.
3. The major diameter is essentially constant along its length.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BD	0.190	0.205	4.826	5.207
BL	0.360	0.375	9.146	9.527
LD	0.038	0.042	0.958	1.074
LL	1.10	1.625	27.9	41.28

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