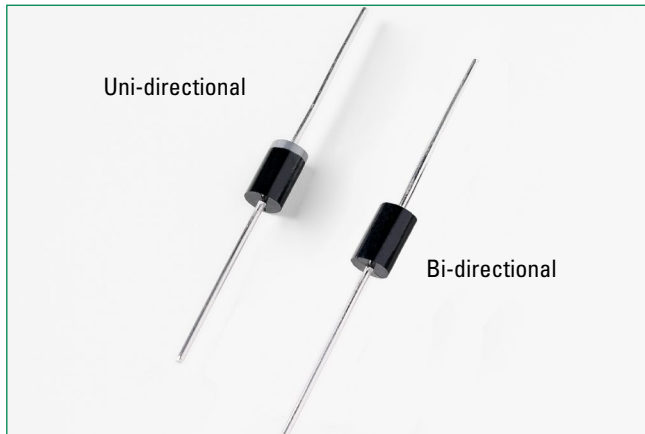


# TP1.5KE Series

## Axial Leaded – 1500W



### Additional Information



Resources




Accessories



Samples

### Agency Approvals

Agency	Agency File Number
	E230531

### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000 $\mu\text{s}$ Test Waveform (Fig.2)(Note 1)	$P_{PPM}$	1500	W
Steady State Power Dissipation on Infinite Heat Sink at $T_c=75^\circ\text{C}$	$P_D$	6.5	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)	$I_{FSM}$	200	A
Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 3)	$V_F$	3.5	V
Operating Junction Temperature Range	$T_J$	-55 to 175	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	15	$^\circ\text{C}/\text{W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	75	$^\circ\text{C}/\text{W}$

#### Notes:

- Non-repetitive current pulse, per Fig. 4 and derated above  $T_J$  (initial) =  $25^\circ\text{C}$  per Fig. 3.
- Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.



### Description

The TP1.5KE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

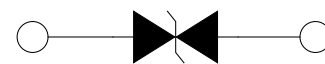
### Features & Benefits

- High reliability application and automotive grade AEC-Q101 rev D qualified
- Glass passivated chip junction in DO-201 Package
- 1500W peak pulse capability at 10/1000 $\mu\text{s}$  waveform, repetition rate (duty cycles):0.01%
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- High temperature to reflow soldering guaranteed: 260 $^\circ\text{C}$ /10sec / 0.375"(9.5mm) lead length, 5 lbs., (2.3kg) tension
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha T$ : Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

### Applications

TVS devices are ideal for the protection of I/O interfaces,  $V_{CC}$  bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

### Functional Diagram



Bi-directional



Uni-directional

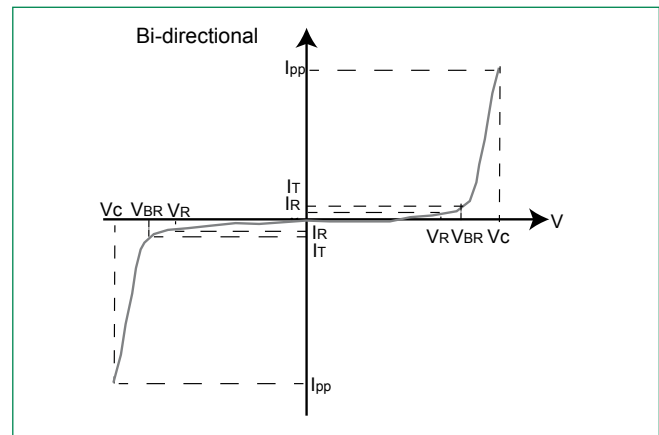
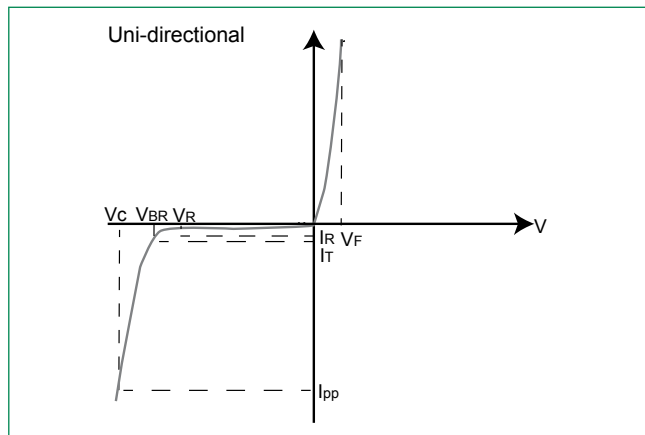
# TP1.5KE Series

## Axial Leaded – 1500W

### Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Part Number (Uni)	Part Number (Bi)	Reverse Stand off Voltage $V_R$ (Volts)	Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$		Test Current $I_T$ (mA)	Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (Volts)	Maximum Peak Pulse Current $I_{PP}$ (A)	Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ )	Agency Approval
			MIN	MAX					
TP1.5KE12A	TP1.5KE12CA	10.20	11.40	12.60	1	16.7	91.0	5	X
TP1.5KE13A	TP1.5KE13CA	11.10	12.40	13.70	1	18.2	83.5	1	X
TP1.5KE15A	TP1.5KE15CA	12.80	14.30	15.80	1	21.2	71.7	1	X
TP1.5KE16A	TP1.5KE16CA	13.60	15.20	16.80	1	22.5	67.6	1	X
TP1.5KE18A	TP1.5KE18CA	15.30	17.10	18.90	1	25.2	60.3	1	X
TP1.5KE20A	TP1.5KE20CA	17.10	19.00	21.00	1	27.7	54.9	1	X
TP1.5KE22A	TP1.5KE22CA	18.80	20.90	23.10	1	30.6	49.7	1	X
TP1.5KE24A	TP1.5KE24CA	20.50	22.80	25.20	1	33.2	45.8	1	X
TP1.5KE27A	TP1.5KE27CA	23.10	25.70	28.40	1	37.5	40.5	1	X
TP1.5KE30A	TP1.5KE30CA	25.60	28.50	31.50	1	41.4	36.7	1	X
TP1.5KE33A	TP1.5KE33CA	28.20	31.40	34.70	1	45.7	33.3	1	X
TP1.5KE36A	TP1.5KE36CA	30.80	34.20	37.80	1	49.9	30.5	1	X
TP1.5KE39A	TP1.5KE39CA	33.30	37.10	41.00	1	53.9	28.2	1	X
TP1.5KE43A	TP1.5KE43CA	36.80	40.90	45.20	1	59.3	25.6	1	X
TP1.5KE47A	TP1.5KE47CA	40.20	44.70	49.40	1	64.8	23.5	1	X

### I-V Curve Characteristics



$P_{PPM}$  Peak Pulse Power Dissipation -- Max power dissipation

$V_R$  Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation

$V_{BR}$  Breakdown Voltage -- Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )

$V_C$  Clamping Voltage -- Peak voltage measured across the TVS at a specified  $I_{PPM}$  (peak impulse current)

$I_R$  Reverse Leakage Current -- Current measured at  $V_R$

$V_F$  Forward Voltage Drop for Uni-directional

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## Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

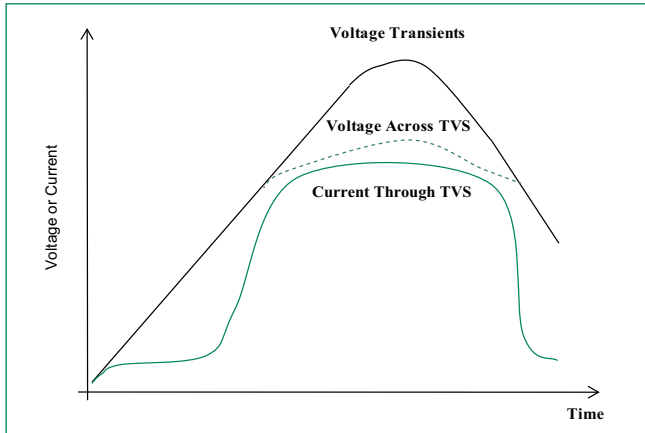


Figure 2 - Peak Pulse Power Rating

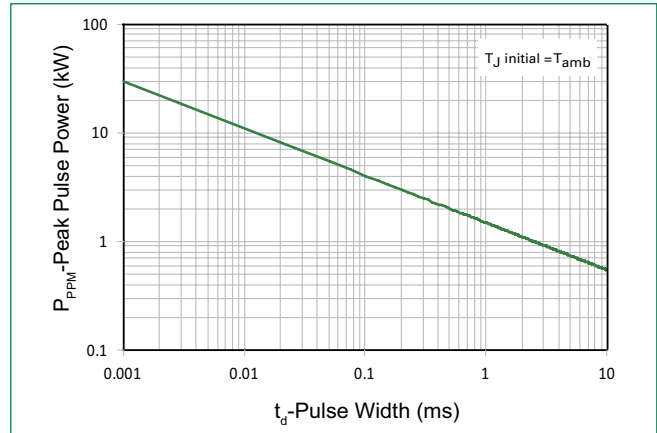


Figure 3 - Peak Pulse Power Derating Curve

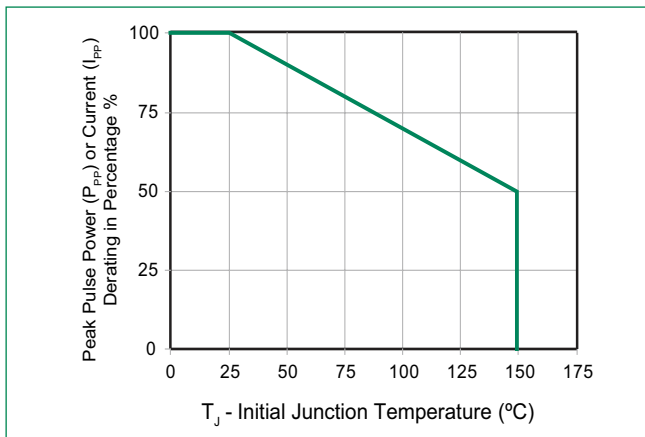


Figure 4 - Pulse Waveform

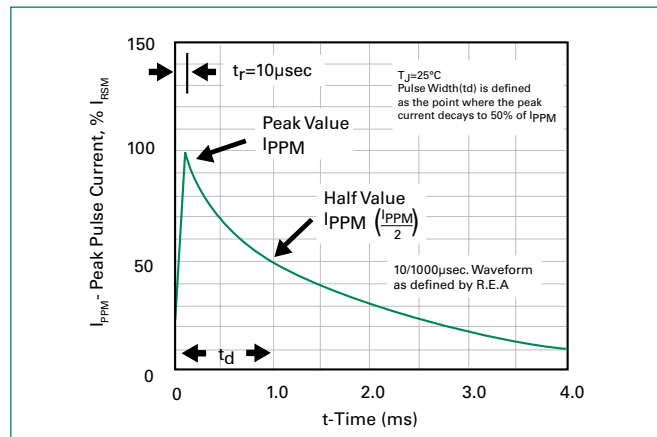


Figure 5 - Typical Junction Capacitance

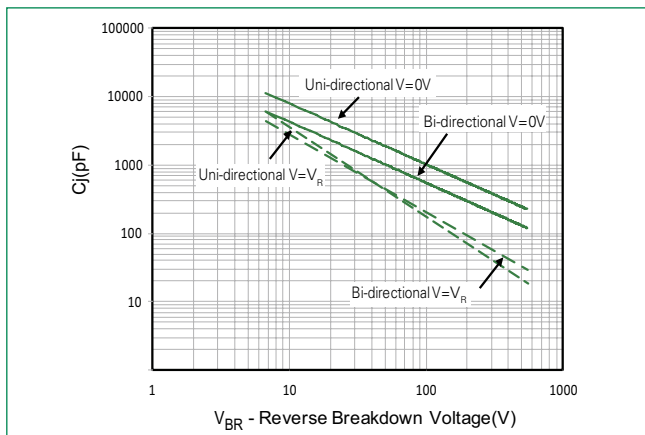
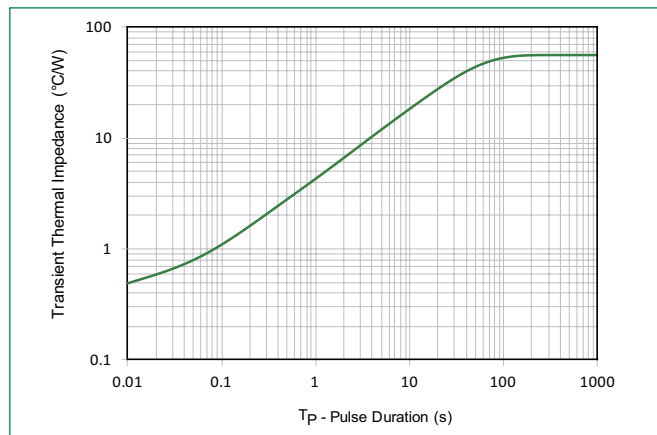


Figure 6 - Typical Transient Thermal Impedance



# TP1.5KE Series

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### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

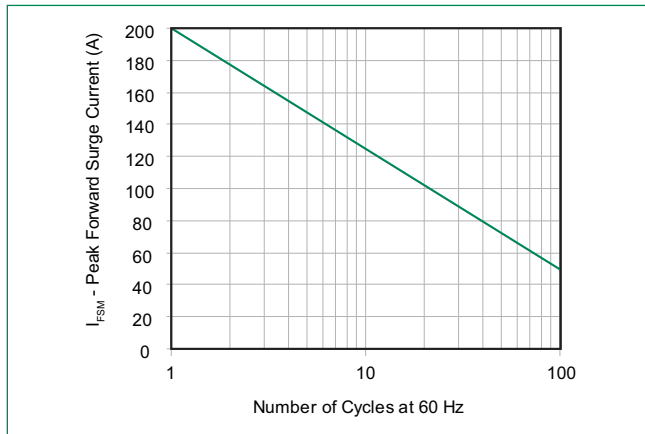
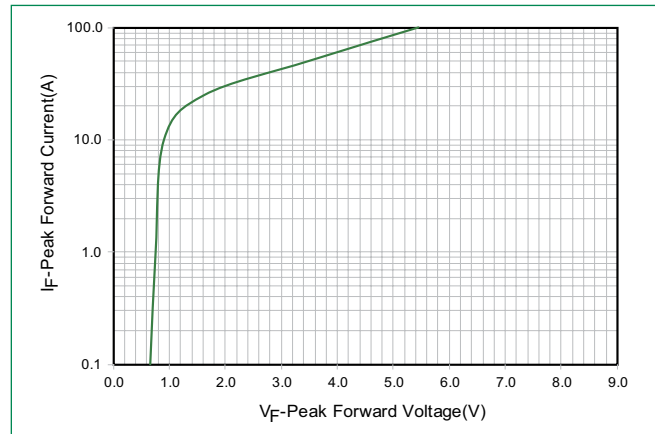
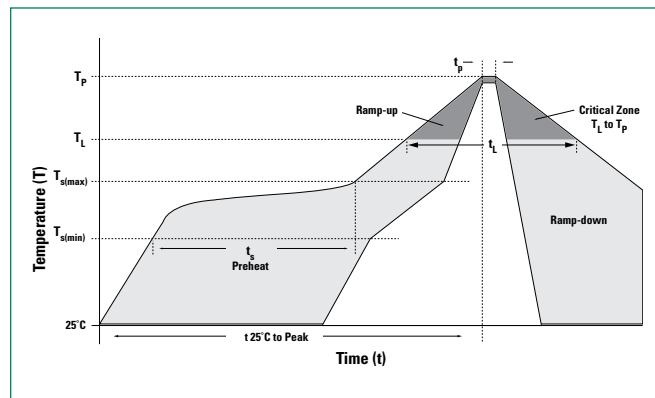


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



### Soldering Parameters

<b>Reflow Condition</b>		Lead-free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(\min)}$ )	150°C
	- Temperature Max ( $T_{s(\max)}$ )	200°C
	- Time (min to max) ( $t_p$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b>		3°C/second max
<b><math>T_{s(\max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Time (min to max) ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		30 seconds max
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes max.
<b>Do not exceed</b>		260°C



### Physical Specifications

<b>Weight</b>	0.045oz., 1.2g
<b>Case</b>	JEDEC DO-201 molded plastic body over passivated junction.
<b>Polarity</b>	Color band denotes the cathode except Bipolar.
<b>Terminal</b>	Matte Tin axial leads, solderable per JESD22-B102.

### Environmental Specifications

<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Temperature Cycling</b>	JESD22-A104
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-B106

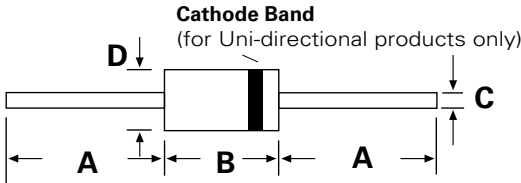
### Flow/Wave Soldering (Solder Dipping)

<b>Peak Temperature :</b>	265°C
<b>Dipping Time :</b>	10 seconds
<b>Soldering :</b>	1 time

# TP1.5KE Series

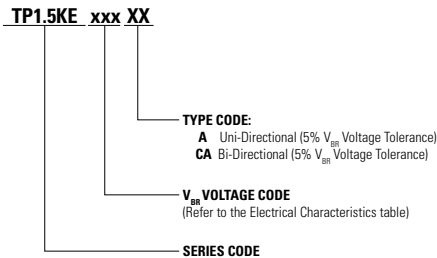
## Axial Leaded – 1500W

### Dimensions

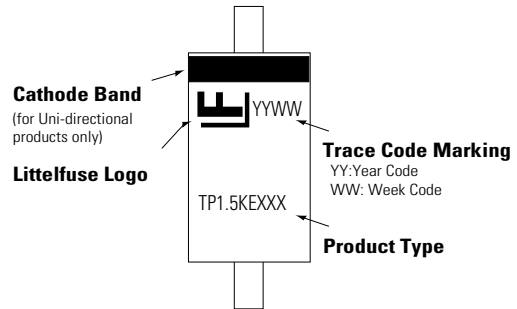


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
<b>A</b>	1.000	-	25.40	-
<b>B</b>	0.285	0.375	7.20	9.50
<b>C</b>	0.038	0.042	0.96	1.07
<b>D</b>	0.190	0.210	4.80	5.30

### Part Numbering System



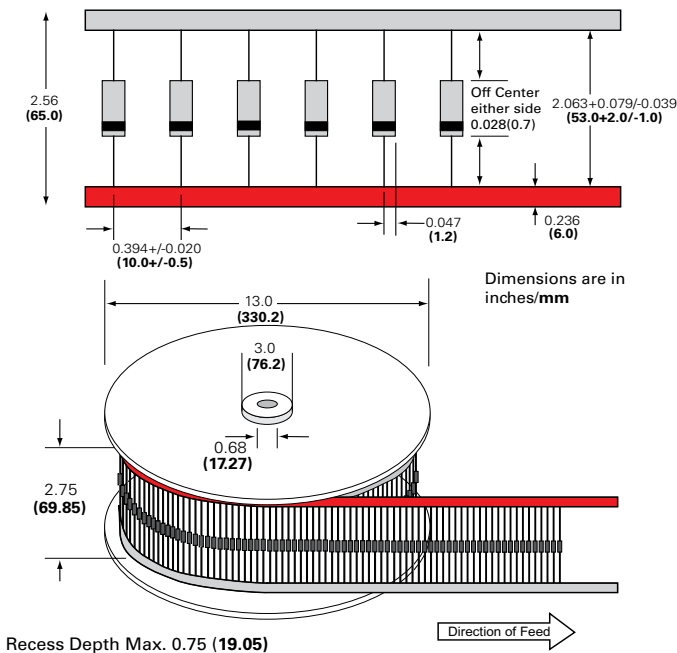
### Part Marking System



### Packaging

Part Number	Component Package	Quantity	Packaging Option	Packaging Specification
TP1.5KExxxXX	DO-201	1200	Tape & Reel	EIA STD RS-296

### Tape and Reel Specification



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