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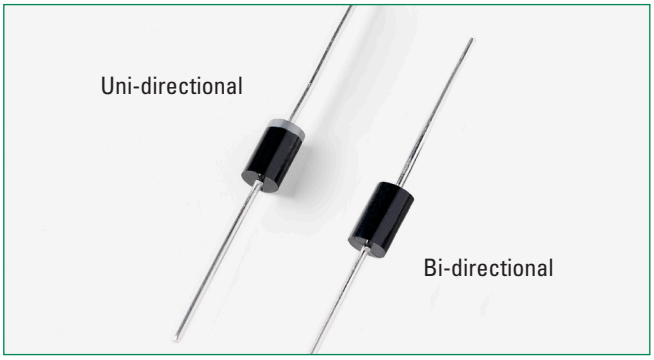
TVS Diodes

Axial Leaded – 1500W > TP1.5KE series

TP1.5KE Series

AUTOMOTIVE GRADE HF RoHS



Agency Approvals

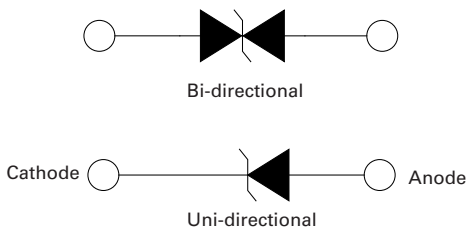
Agency	Agency File Number
	E230531

Maximum Ratings and Thermal Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2)(Note 1)	P_{PPM}	1500	W
Steady State Power Dissipation on Infinite Heat Sink at T_L=75°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 150	°C
Storage Temperature Range	T_{STG}	-55 to 175	°C
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	15	°C/W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	75	°C/W

Notes:
1. Non-repetitive current pulse , per Fig. 4 and derated above T_J (initial) =25°C per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.

Functional Diagram



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

- High reliability application and automotive grade AEC-Q101 rev D qualified
- Glass passivated chip junction in DO-201 Package
- 1500W peak pulse capability at 10/1000µs 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°C/10sec / 0.375",(9.5mm) lead length, 5 lbs., (2.3kg) tension
- V_{BR} @ T_J= V_{BR}@25°C x (1+αT x (T_J - 25)) (αT: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.

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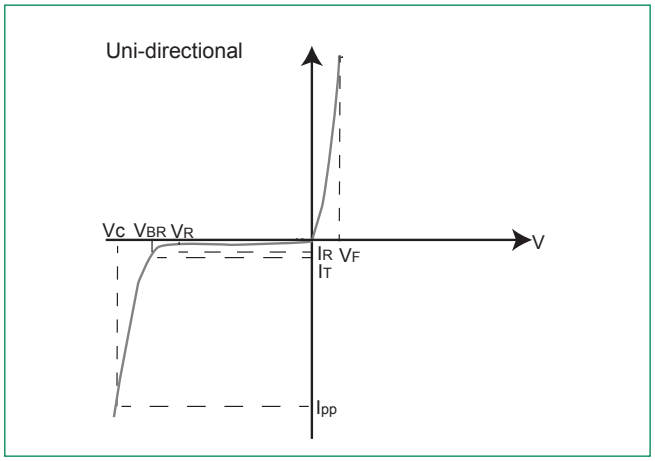
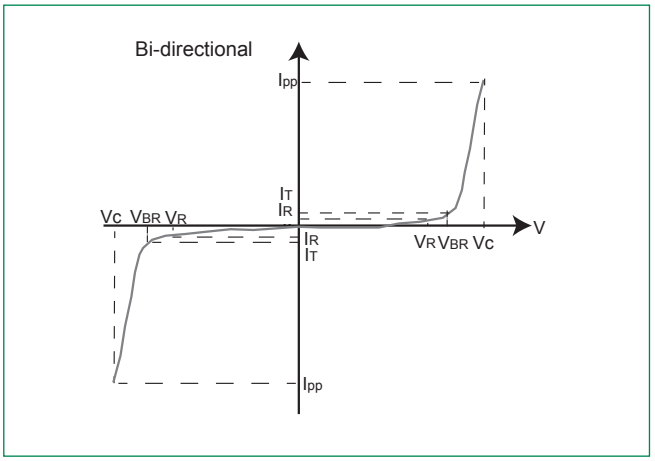
Electrical Characteristics (T_A=25°C unless otherwise noted)

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 (µA)	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 though the TVS at a specified test current (I_T)
V_C Clamping Voltage -- Peak voltage measured across the TVS at a specified Ippm (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°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

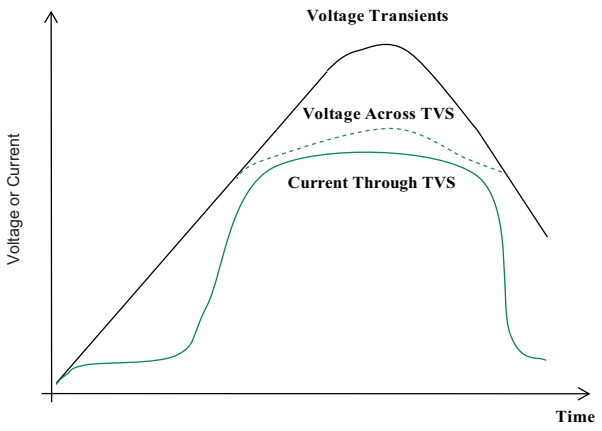


Figure 2 - Peak Pulse Power Rating

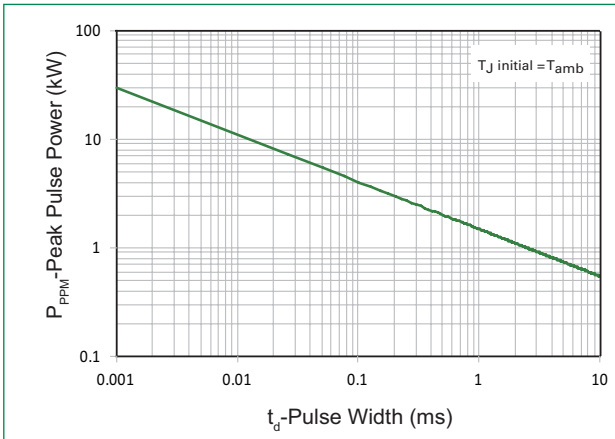


Figure 3 - Peak Pulse Power Derating Curve

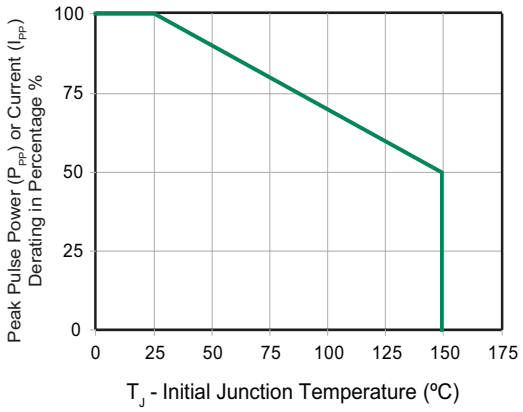


Figure 4 - Pulse Waveform

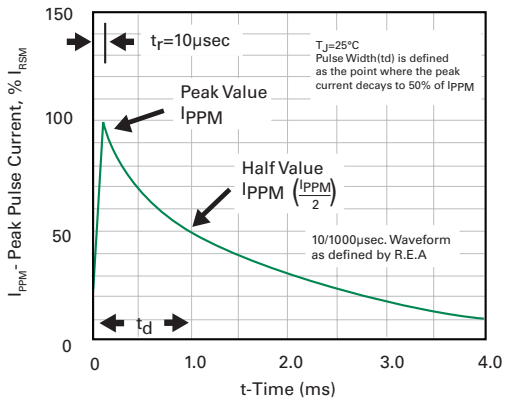


Figure 5 - Typical Junction Capacitance

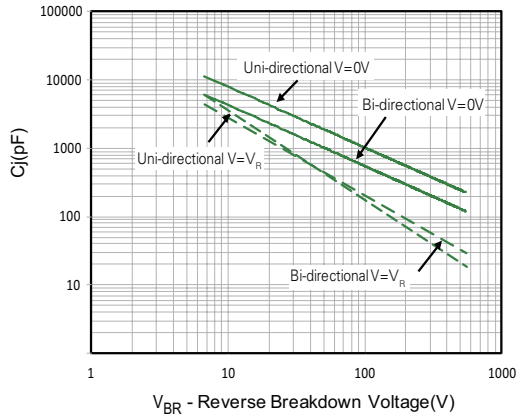
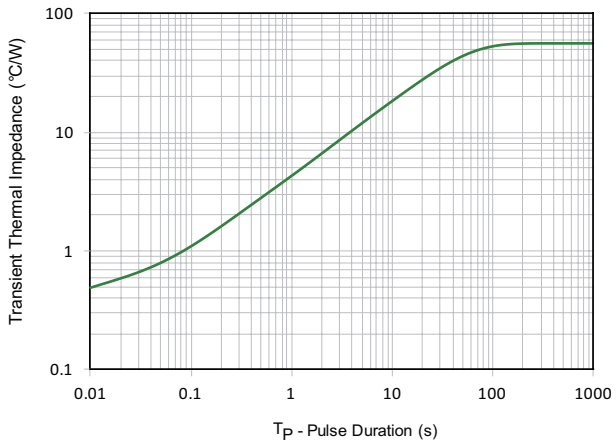


Figure 6 - Typical Transient Thermal Impedance



Revised: GD. 12/16/20

Ratings and Characteristic Curves (T_A=25°C unless otherwise noted) (Continued)

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

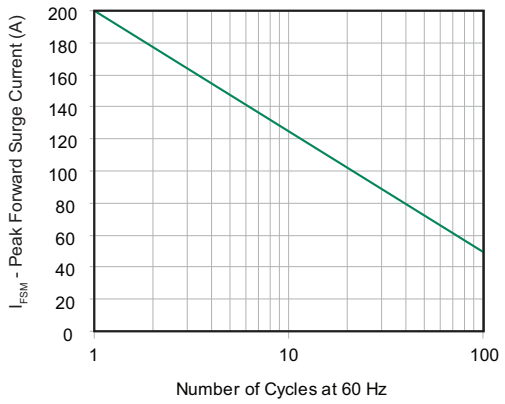
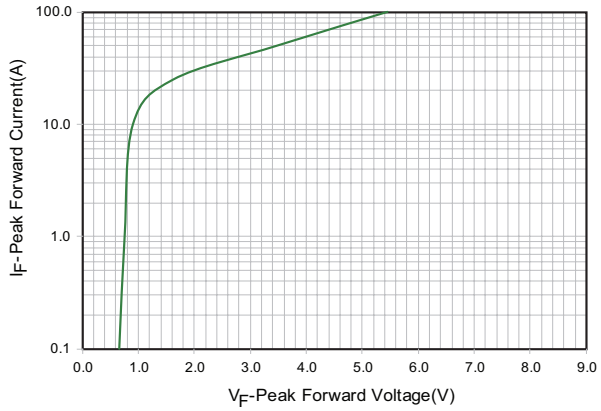
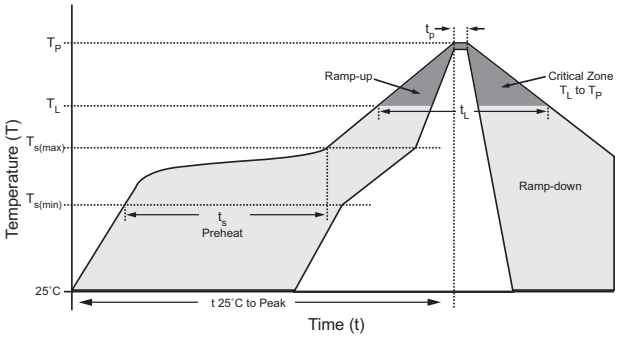


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



Soldering Parameters

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



Flow/Wave Soldering (Solder Dipping)

Peak Temperature :	265°C
Dipping Time :	10 seconds
Soldering :	1 time

Physical Specifications

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

Environmental Specifications

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

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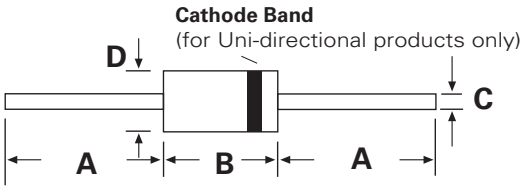
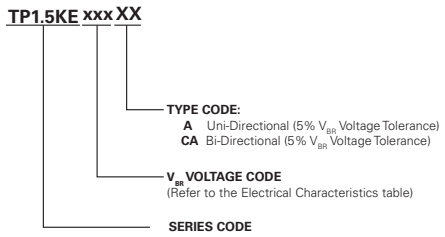
Dimensions

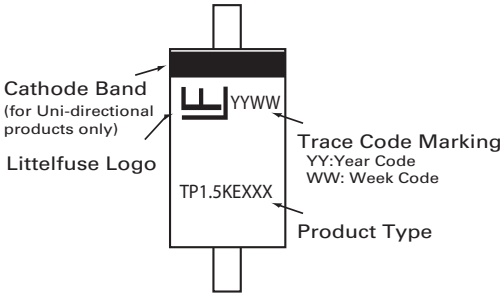


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	1.000	-	25.40	-
B	0.285	0.375	7.20	9.50
C	0.038	0.042	0.96	1.07
D	0.190	0.210	4.80	5.30

Part Numbering System



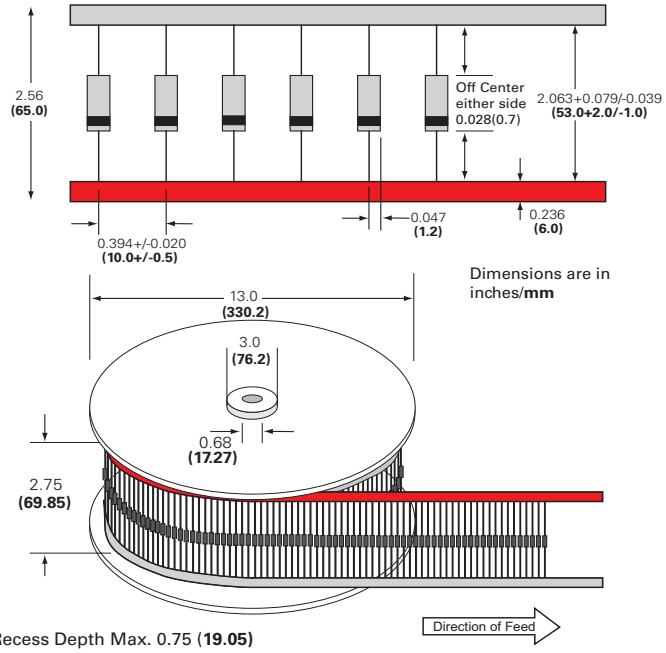
Part Marking System



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



Recess Depth Max. 0.75 (**19.05**)

Mouser Electronics

Authorized Distributor

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Littelfuse:

TP1.5KE20CA TP1.5KE43A TP1.5KE47CA TP1.5KE13A TP1.5KE24CA TP1.5KE16A TP1.5KE22CA TP1.5KE27CA TP1.5KE27A TP1.5KE15A TP1.5KE39CA TP1.5KE30A TP1.5KE43CA TP1.5KE30CA TP1.5KE33A TP1.5KE12A TP1.5KE47A TP1.5KE20A TP1.5KE33CA TP1.5KE36A TP1.5KE39A TP1.5KE36CA TP1.5KE18A TP1.5KE24A TP1.5KE12CA TP1.5KE16CA TP1.5KE22A TP1.5KE13CA TP1.5KE18CA TP1.5KE15CA