

TVS

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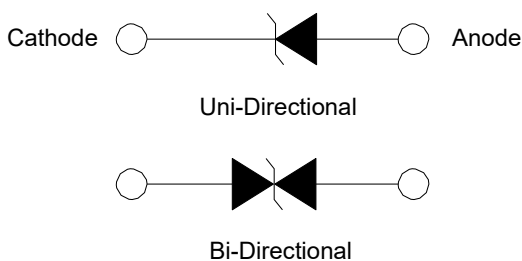
## Description

The 30KPA Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

## Applications

- Communication Equipment
- Security & Protection
- Industrial Control Equipment
- Power Supply
- Automotive Electronics
- New Energy
- Lightning Protection

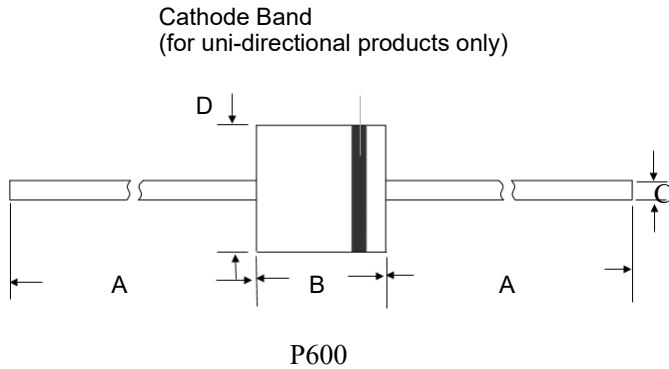
## Functional Diagram



## Features

- 30 kW peak pulse capability at 10/1000  $\mu$ S waveform, repetition rate (duty cycles):0.01%
- Glass passivated chip junction in P600 Package
- Fast response time: typically less than 1.0 PS 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 30 kV (Air), 30 kV (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
- Typical  $I_R$  less than 2  $\mu$ A when  $V_{BR}$  min > 73 V
- High temperature to reflow soldering guaranteed: 260 °C/40 sec / 0.375", (9.5 mm) lead length, 5 lbs., (2.3 kg) tension
- $V_{BR} @ T_J = V_{BR}@25^\circ C \times (1 + \alpha T \times (T_J - 25))$   
( $\alpha T$ : Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability rating V-0
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 indicates that 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

## Package Outline Dimensions (P600)



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	25.40	-	1.000	-
B	8.60	9.10	0.340	0.360
C	1.22	1.36	0.048	0.054
D	8.60	9.10	0.340	0.360

## Maximum Ratings and Characteristics

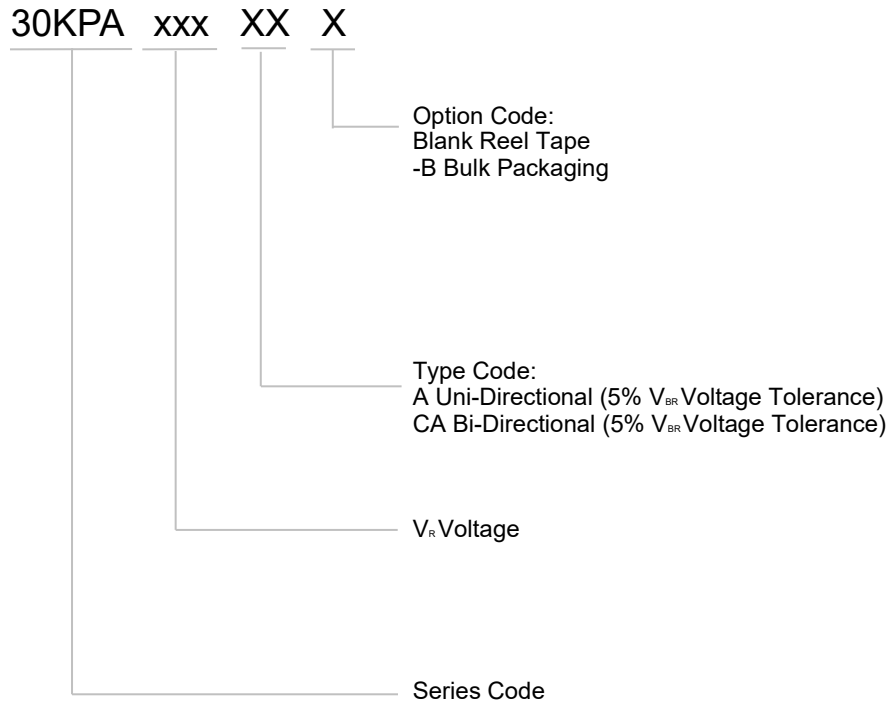
( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise specified.)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000 $\mu\text{S}$ Test Waveform (Fig.2)(Note 1)	$P_{PPM}$	30	kW
Steady State Power Dissipation on Infinite Heat Sink at $T_L=75\text{ }^\circ\text{C}$	$P_D$	8.0	W
Peak Forward Surge Current, 8.3 ms Single Half Sine Wave Unidirectional Only (Note 2)	$I_{FSM}$	400	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	8.0	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$

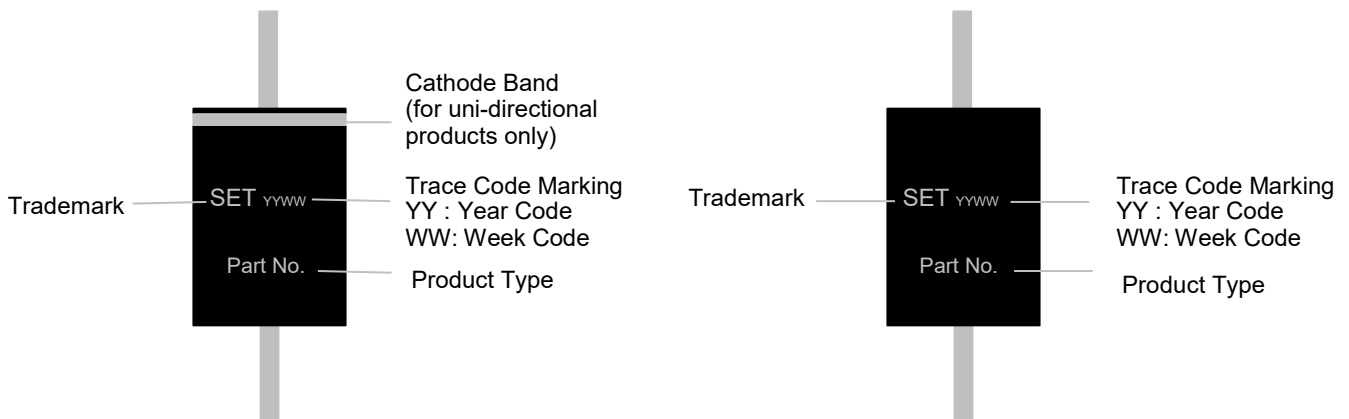
### Notes

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

## Part Numbering System



## Marking



## Glossary

Item	Description
$V_C$	<b>Clamping Voltage</b> Voltage across TVS in a region of low differential resistance that serves to limit the voltage across the device terminals.
$V_R$	<b>Reverse Stand-off Voltage</b> Maximum voltage that can be applied to the TVS without operation. NOTE : It is also shown as $V_{WM}$ (maximum working voltage (maximum d.c. voltage)) and known as rated stand-off voltage ( $V_{so}$ ).
$I_R$	<b>Reverse Leakage Current</b> Current measured at $V_R$ . NOTE : Also shown as $I_D$ for stand-by current.
$V_{BR}$	<b>Breakdown Voltage</b> Voltage across TVS at a specified current $I_T$ in the breakdown region.
$I_{PPM}$	<b>Rated Random Recurring Peak Impulse Current</b> Maximum-rated value of random recurring peak impulse current that may be applied to a device.
$P_{M(AV)}$	<b>Rated Average Power Dissipation</b> Maximum-rated value of power dissipation resulting from all sources, including transients and standby current, averaged over a short period of time.
$P_{PPM}$	<b>Rated Random Recurring Peak Impulse Power Dissipation</b> Maximum-rated value of the product of rated random recurring peak impulse current ( $I_{PPM}$ ) multiplies by specified maximum clamping voltage ( $V_C$ ).
$C_J$	<b>Capacitance</b> Capacitance across the TVS measured at a specified frequency and voltage.
$V_{FS}$	<b>Peak Forward Surge Voltage</b> Peak voltage across an TVS for a specified forward surge current ( $I_{FS}$ ) and time duration. NOTE : Also shown as $V_F$ .
$I_{FS}$	<b>Forward Surge Current</b> Pulsed current through TVS in the forward conducting region. NOTE : Also shown as $I_F$ .
$\alpha_{V(BR)}$	<b>Temperature Coefficient of Breakdown Voltage</b> The change of breakdown voltage divided by the change of temperature.
$I_{PP}$	<b>Peak pulse Current</b> Peak pulse current value applied across the TVS to determine the clamping voltage $V_C$ for a specified wave shape.
$I_T$	<b>Pulsed D.C. Test Current</b> Test current for measurement of the breakdown voltage $V_{BR}$ . This is defined by the manufacturer and usually given in milliamperes with a pulse duration of less than 40 ms. NOTE : Also shown as $I_{BR}$ .

—(GB-T 18802.321 / IEC 61643-321 / JESD210A)

### Electrical Characteristics (T<sub>A</sub>=25 °C unless otherwise noted )Table 1

Part Number		Breakdown Voltage V <sub>BR</sub> @I <sub>T</sub>		Test Current I <sub>T</sub>	Reverse Stand-off Voltage V <sub>R</sub>	Max. Reverse Leakage I <sub>R</sub> @V <sub>R</sub>	Max. Peak Pulse Current I <sub>PPM</sub>	Max. Clamping Voltage V <sub>C</sub> @I <sub>PPM</sub>
		Min	Max					
Uni	Bi	(V)		(mA)	(V)	(μA)	(A)	(V)
30KPA28A	30KPA28CA	31.28	34.41	50	28	5000	606.0	50.0
30KPA30A	30KPA30CA	33.51	36.86	50	30	5000	548.9	55.2
30KPA33A	30KPA33CA	36.90	40.59	50	33	5000	517.9	58.5
30KPA36A	30KPA36CA	40.20	44.22	50	36	5000	490.3	61.8
30KPA39A	30KPA39CA	43.60	47.96	20	39	2000	450.9	67.2
30KPA42A	30KPA42CA	46.90	51.59	10	42	1000	420.8	72.0
30KPA43A	30KPA43CA	48.00	52.80	10	43	1000	415.1	73.0
30KPA45A	30KPA45CA	50.30	55.33	5	45	250	391.5	77.4
30KPA48A	30KPA48CA	53.60	58.96	5	48	150	371.3	81.6
30KPA51A	30KPA51CA	57.00	62.70	5	51	50	350.7	86.4
30KPA54A	30KPA54CA	60.30	66.33	5	54	20	331.5	91.4
30KPA58A	30KPA58CA	64.80	71.28	5	58	20	327.9	92.4
30KPA60A	30KPA60CA	67.00	73.70	5	60	15	297.1	102.0
30KPA64A	30KPA64CA	71.50	78.65	5	64	10	291.3	104.0
30KPA66A	30KPA66CA	73.70	81.07	5	66	2	283.2	107.0
30KPA70A	30KPA70CA	78.20	86.02	5	70	2	278.0	109.0
30KPA71A	30KPA71CA	79.30	87.23	5	71	2	271.7	111.5
30KPA72A	30KPA72CA	80.40	88.44	5	72	2	265.8	114.0
30KPA75A	30KPA75CA	83.80	92.18	5	75	2	253.8	119.4
30KPA78A	30KPA78CA	87.10	95.81	5	78	2	234.9	129.0
30KPA84A	30KPA84CA	93.80	103.18	5	84	2	217.7	139.2
30KPA90A	30KPA90CA	100.50	110.55	5	90	2	207.0	146.4
30KPA96A	30KPA96CA	107.20	117.92	5	96	2	194.2	156.0
30KPA102A	30KPA102CA	113.90	125.29	5	102	2	183.0	165.6
30KPA108A	30KPA108CA	120.60	132.66	5	108	2	172.9	175.2

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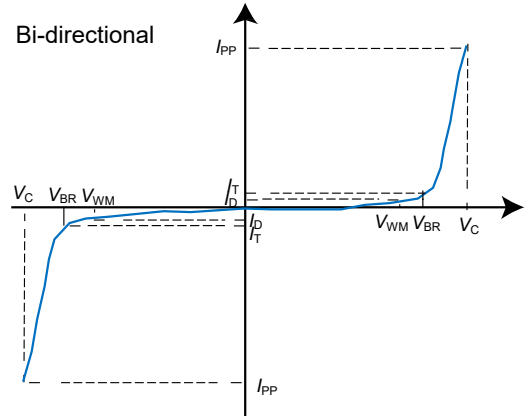
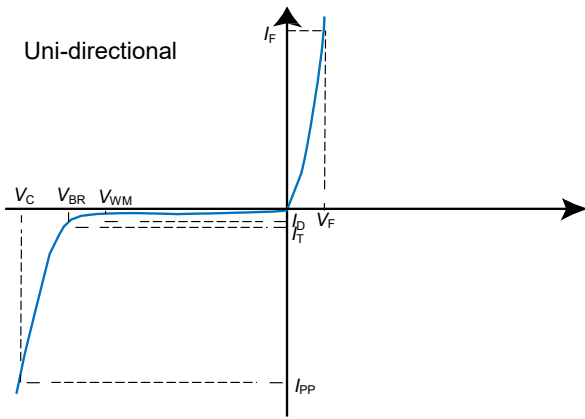
TVS

Part Number		Breakdown Voltage $V_{BR@I_T}$		Test Current $I_T$	Reverse Stand-off Voltage $V_R$	Max. Reverse Leakage $I_R@V_R$	Max. Peak Pulse Current $I_{PPM}$	Max. Clamping Voltage $V_C@I_{PPM}$
		Min	Max					
Uni	Bi	(V)		(mA)	(V)	( $\mu$ A)	(A)	(V)
30KPA120A	30KPA120CA	134.00	147.40	5	120	2	155.9	194.4
30KPA132A	30KPA132CA	147.40	162.14	5	132	2	142.3	213.0
30KPA144A	30KPA144CA	160.80	176.88	5	144	2	135.8	223.2
30KPA150A	30KPA150CA	167.60	184.36	5	150	2	129.8	233.4
30KPA156A	30KPA156CA	174.30	191.73	5	156	2	123.7	245.0
30KPA160A	30KPA160CA	178.70	196.57	5	160	2	120.0	252.6
30KPA168A	30KPA168CA	187.70	206.47	5	168	2	111.2	272.4
30KPA170A	30KPA170CA	189.90	208.89	5	170	2	110.2	275.0
30KPA180A	30KPA180CA	201.10	221.21	5	180	2	104.3	290.4
30KPA198A	30KPA198CA	221.20	243.32	5	198	2	94.7	319.8
30KPA216A	30KPA216CA	241.30	265.43	5	216	2	86.9	348.6
30KPA240A	30KPA240CA	268.10	294.91	5	240	2	78.3	387.0
30KPA258A	30KPA258CA	288.20	317.02	5	258	2	72.8	416.4
30KPA260A	30KPA260CA	290.40	319.44	5	260	2	72.8	416.0
30KPA270A	30KPA270CA	301.60	331.76	5	270	2	69.5	436.2
30KPA280A	30KPA280CA	312.80	344.08	5	280	2	65.3	464.0
30KPA288A	30KPA288CA	321.70	353.87	5	288	2	64.5	469.9
30KPA300A	30KPA300CA	334.00	367.40	5	300	2	62.0	484.0
30KPA320A	30KPA320CA	357.40	391.40	5	320	2	57.2	530.0
30KPA350A	30KPA350CA	391.00	428.10	5	350	2	53.4	567.0
30KPA360A	30KPA360CA	402.10	440.30	5	360	2	47.3	640.0

Notes:

1. Measured of 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum.
2.  $V_F < 3.5$  V for single die parts and  $V_F < 5.0$  V for stacked-die parts.
3. For bidirectional type having  $V_R$  of 60 volts and less, the  $I_R$  should be doubled.

## I-V Curve Characteristics



## Performance Curve for Reference ( $T_A=25^\circ\text{C}$ unless otherwise noted)

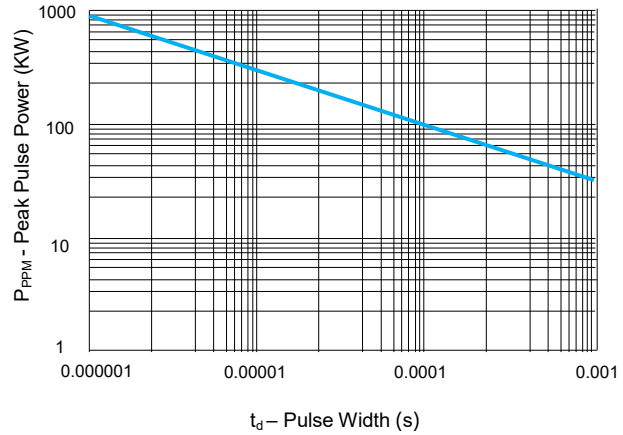
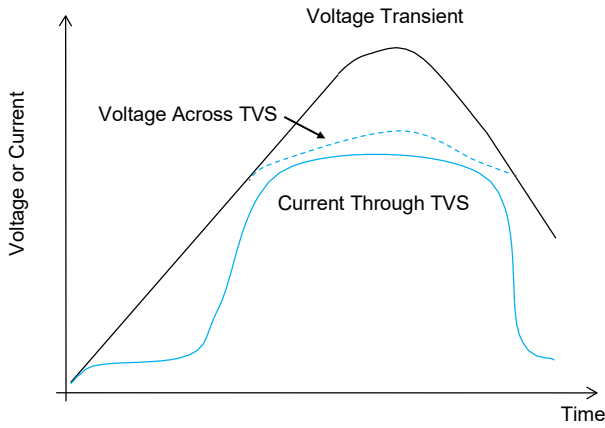


FIGURE 1 TVS Transients Clamping Waveform

FIGURE 2 Peak Pulse Power Rating Curve

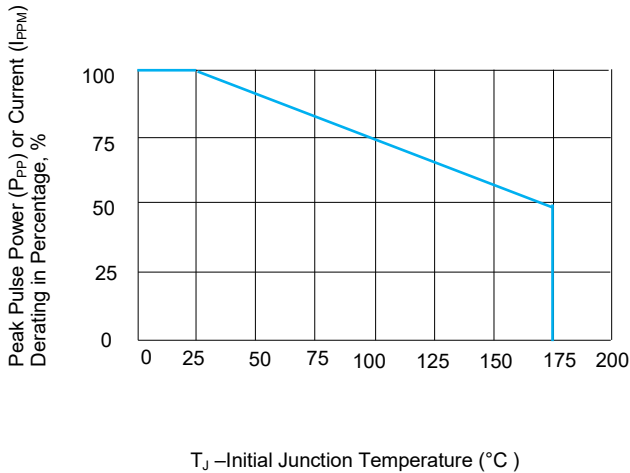


FIGURE 3 Peak Pulse Power Derating Curve

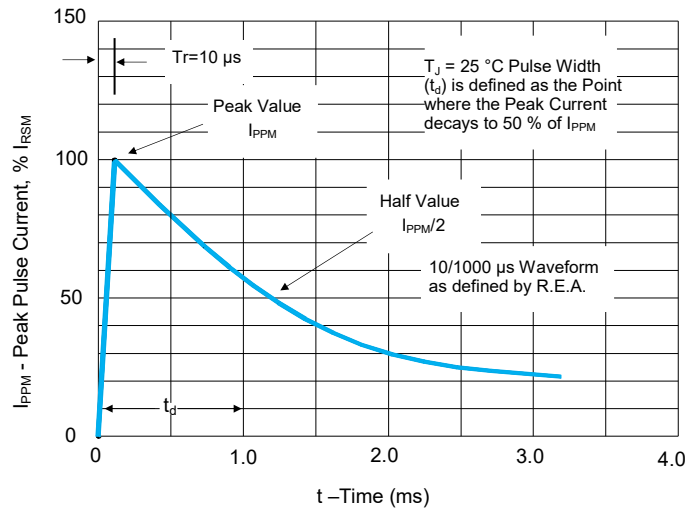


FIGURE 4 Pulse Waveform

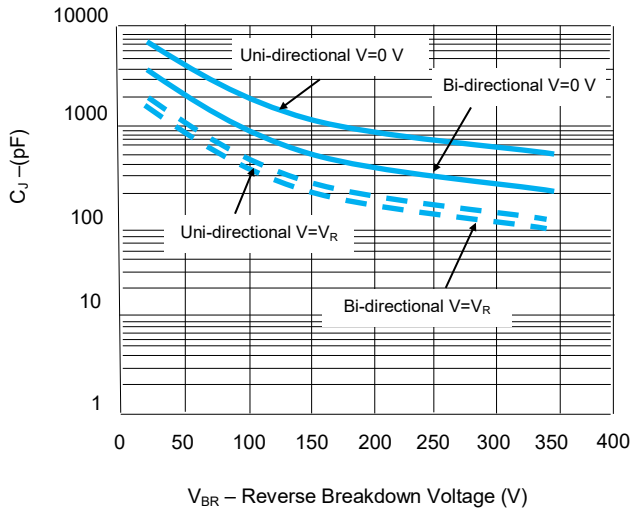


FIGURE 5 Typical Junction Capacitance

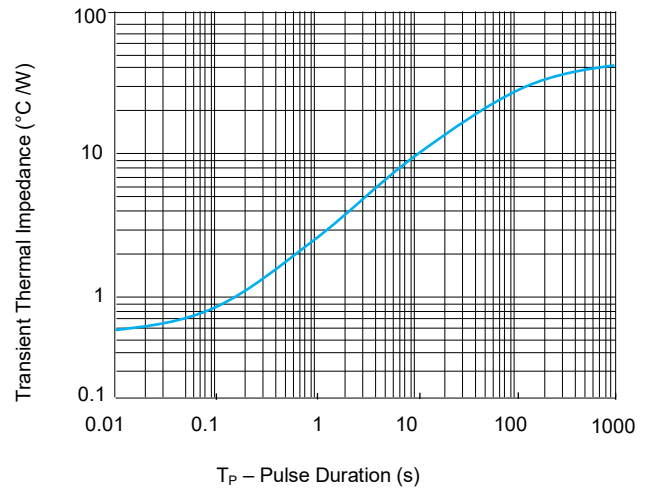


FIGURE 6 Typical Transient Thermal Impedance

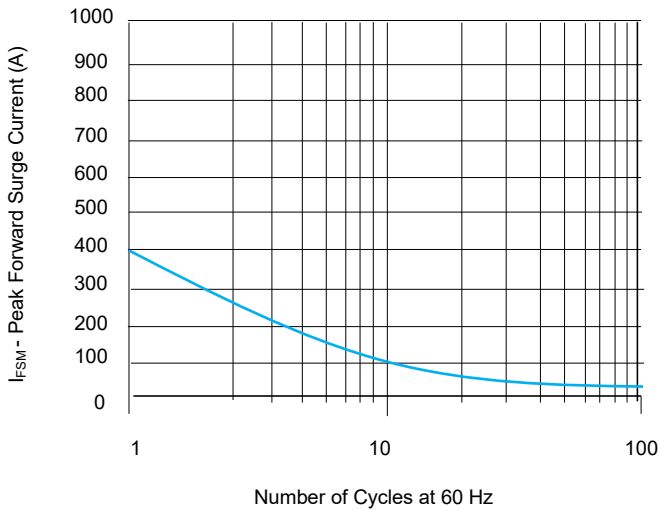


FIGURE 7 Maximum Non-Repetitive Forward Surge Current  
Uni-Directional only

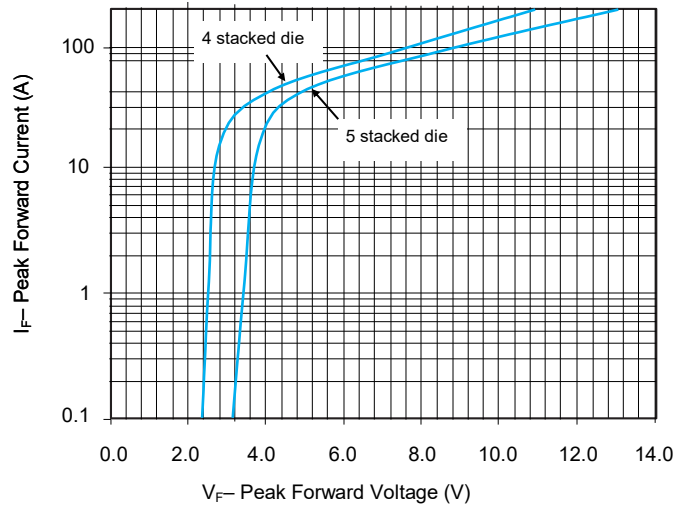


FIGURE 8 Peak Forward Drop vs Peak Forward Current  
(Typical Values)

### Environmental Specifications

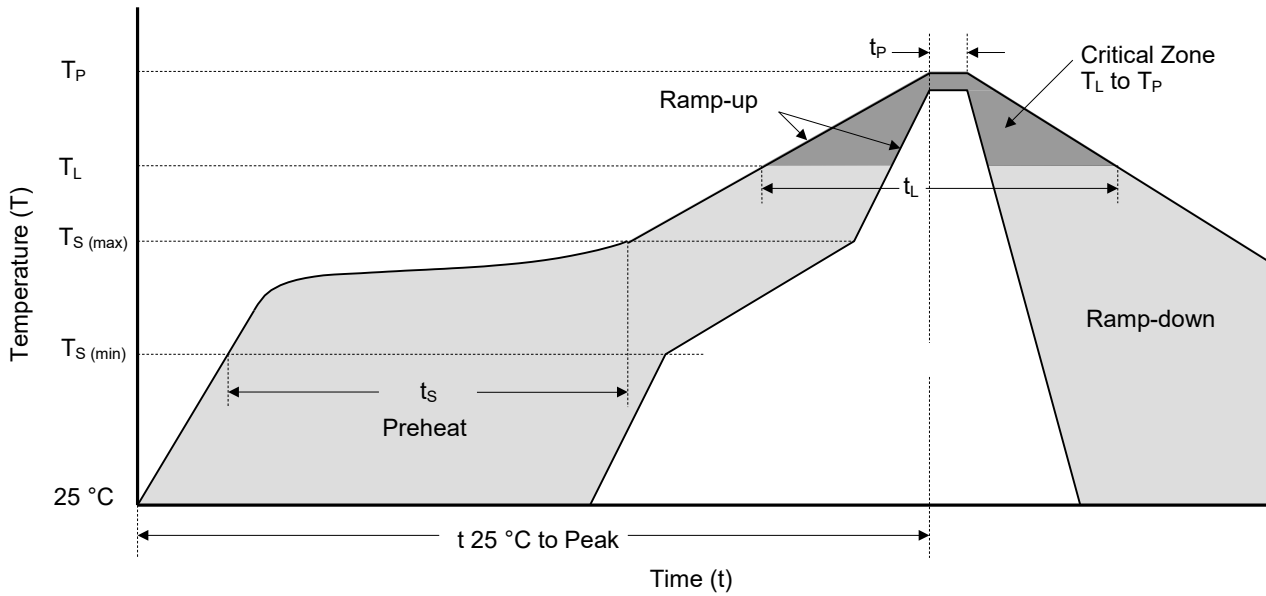
High Temp. Storage	JESD22-A103
HTRB	JESD22-A108
Temperature Cycling	JESD22-A104
H3TRB	JESD22-A101
RSH	JESD22-B106

### Physical Specifications

Weight	0.07 oz., 2.5 g
Case	P600 molded plastic body over passivated junction.
Polarity	Color band denotes the cathode except Bipolar.
Terminal	Matte Tin axial leads, solderable per JESD22-B102.



## Soldering Parameters



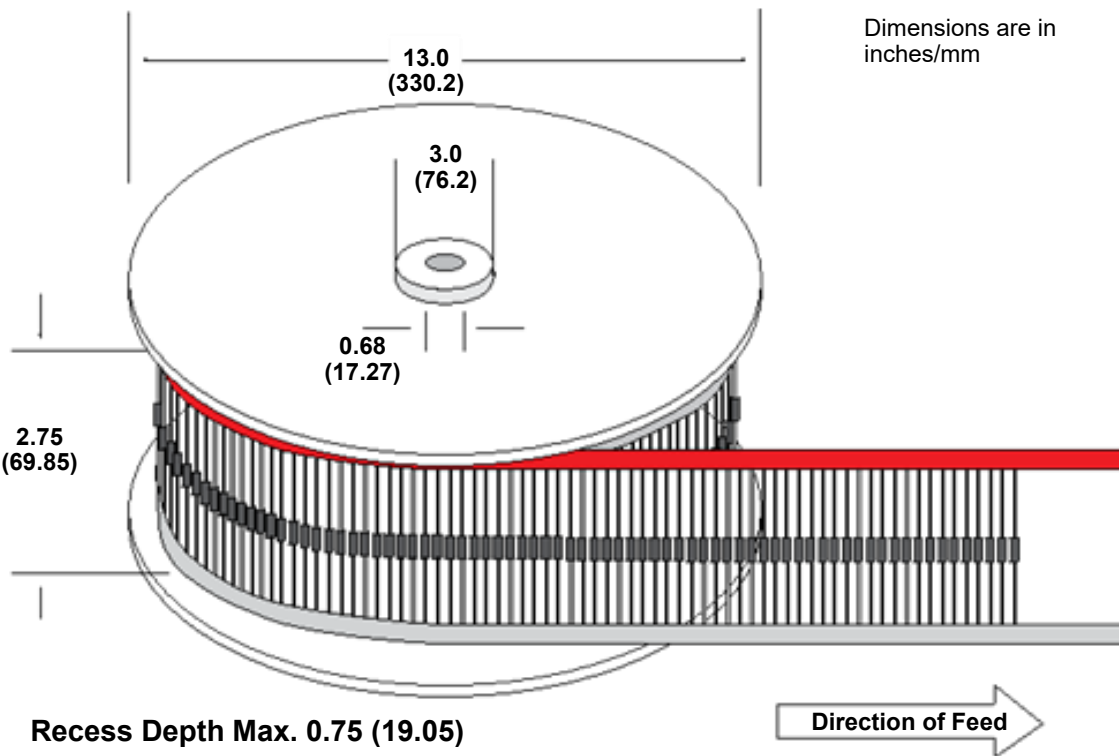
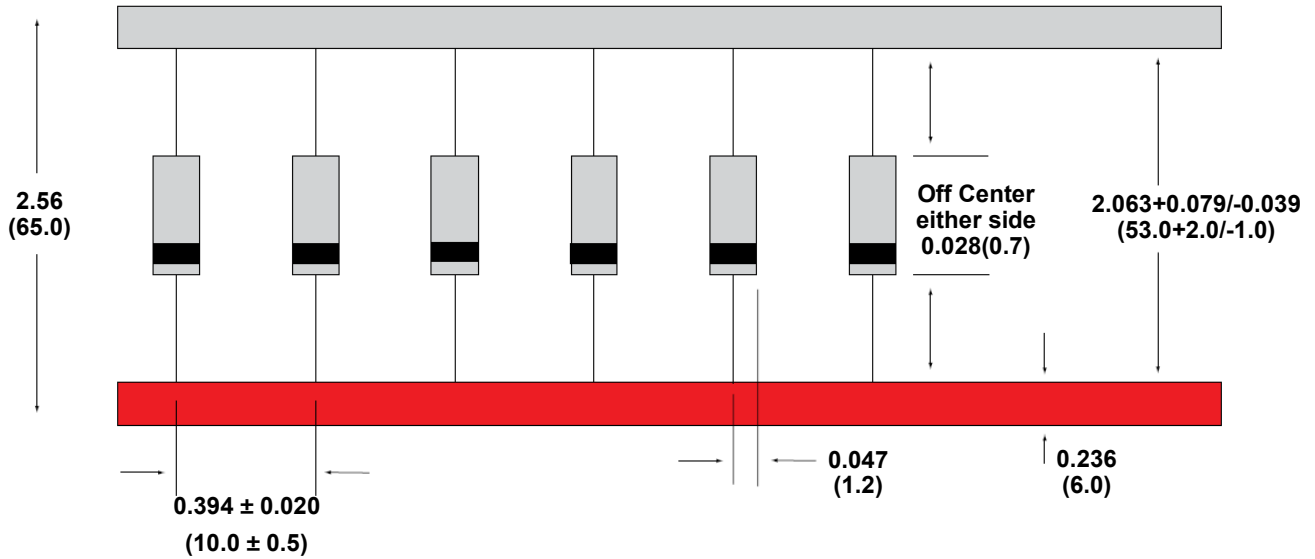
Reflowing Condition

Reflow Soldering Parameters		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 seconds
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 <sup>+0/-5</sup> °C
Time of within 5 °C of Actual Peak Temperature ( $t_p$ )		20 ~ 40 seconds
Ramp-down Rate		6 °C / second max.
Time from 25 °C to Peak Temperature		8 Minutes max.
Do Not Exceed		260 °C

## Flow/Wave Soldering (Solder Dipping)

Peak Temperature	260 °C+0 /- 5 °C
Dipping Time	10 seconds
Soldering Number	1 time

## Packaging Information



Part Number	Package	QTY' s (Reel)	Packaging Option	Packaging Specification
30KPAxxxXX	P600	800 PCS	Tape & Reel	EIA STD RS-296
30KPAxxxXX-TB	P600	300 PCS	TB	/
30KPAxxxXX-B	P600	100 PCS	BULK	SETsafe   SETfuse Spec



## ATTENTION

### Usage

1. TVS must be operated in the specified ambient temp.
2. Do not clean the TVS with strong polar solvent such as ketone, esters, benzene and halogenated hydrocarbon, to avoid damaging the encapsulating layer.
3. Please do not apply severe vibration, shock or pressure to TVS, to avoid element cracking.

### Replacement

1. If TVS is visually damaged, please replace it.
2. TVS is a non-repairable product. For safety sake, please use equivalent TVS for replacement.

### Storage

1. Storage Temp. Range: (-55 to 150) °C.
2. Do not store the TVS at the high temp., high humidity or corrosive gas environment, to avoid influencing the solder-ability of the lead wires. The product shall be used up within 1 year after receiving the goods.

### Environmental Conditions

1. TVS should not be exposed to the open air, nor direct sunshine.
2. TVS should avoid rain, water vapor or other condition of high temp. and high humidity.
3. TVS should avoid sand dust, salt mist, or other harmful gases.

### Max. Typical Capacitance of TVS

The typical capacitance of TVS is listed in the specifications. Designers may refer to it when designing TVS in High frequency circuit.

### Installation Mechanical Stress

1. Do not knock TVS when installing, to avoid mechanical damage.
2. Please do not apply severe vibration, shock or pressure to TVS, to avoid surface resin or element cracking.