

## Description

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

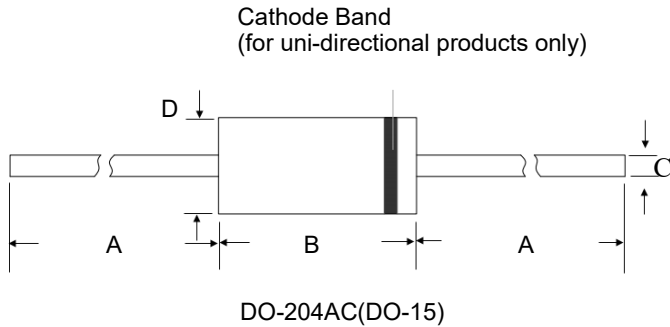
## Applications

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

## Features

- 500 W peak pulse capability at 10/1000  $\mu$ s waveform, repetition rate (duty cycles):0.01%
- Glass passivated chip junction in DO-15 Package
- Fast response time: typically less than 1.0 PS from 0 Volts to BV min
- 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
- Low incremental surge resistance
- EFT protection of data lines in accordance with IEC 61000-4-4
- High temperature to reflow soldering guaranteed: 260 °C/30 sec / 0.375", (9.5 mm) lead length, 5 lbs., (2.3 kg) tension
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Matte tin lead-free plated
- Ideal for data line applications
- Halogen free and RoHS compliant
- Pb-free E3 means 2<sup>nd</sup> level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

## Package Outline Dimensions (DO-204AC / DO-15)



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	25.40	-	1.000	-
B	5.80	7.60	0.230	0.300
C	0.71	0.86	0.028	0.034
D	2.60	3.60	0.104	0.140

## Maximum Ratings and Characteristics

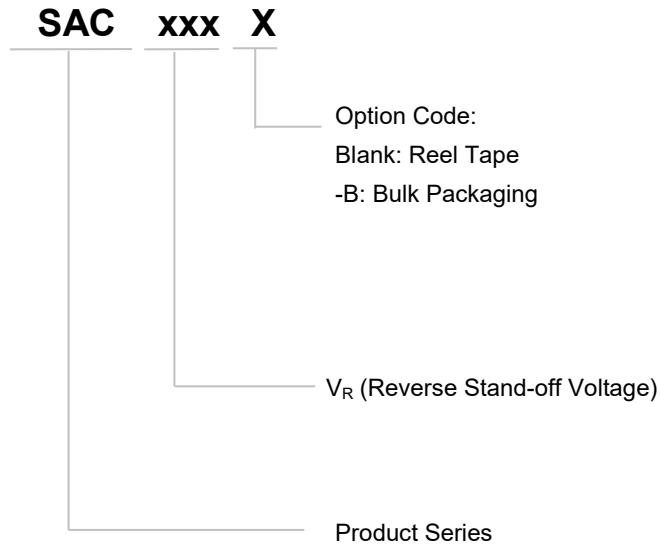
( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise specified.)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000 $\mu\text{s}$ Test Waveform (Fig.1)(Note 1)	$P_{PPM}$	500	W
Steady State Power Dissipation on Infinite Heat Sink at $T_L=75\text{ }^\circ\text{C}$	$P_D$	3.0	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-65 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	20	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	75	$^\circ\text{C/W}$

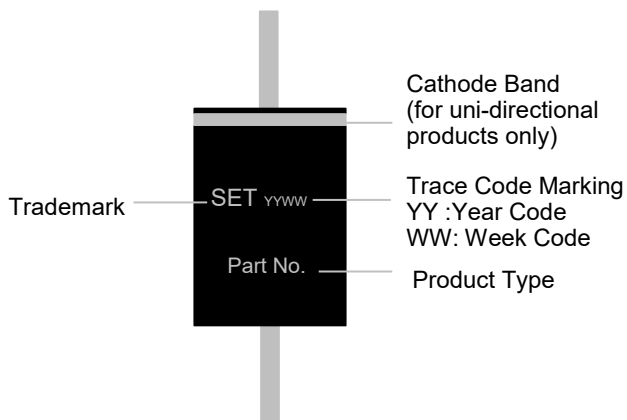
Note

1. Non-repetitive current pulse, per Fig. 3 and derated above  $T_J(\text{initial})=25\text{ }^\circ\text{C}$  per Fig. 2.

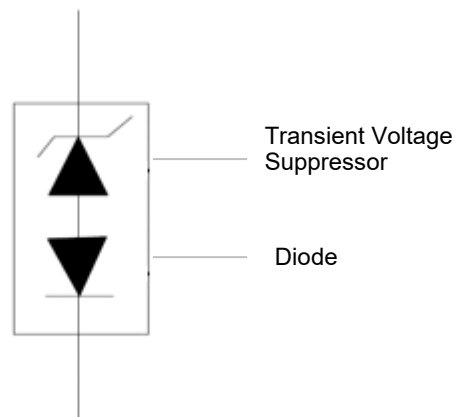
## Part Numbering System



## Marking



## Functional Diagram



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

Part Number	Reverse Stand-off Voltage V <sub>R</sub>	Breakdown Voltage V <sub>BR</sub>		Max. Reverse Leakage I <sub>R</sub> @V <sub>R</sub>	Max. Clamping Voltage at V <sub>C</sub> @I <sub>PP</sub>	Max. Peak Pulse Current I <sub>PP</sub>	Max. Junction Capacitance @0 Volts	Working Inverse Blocking Voltage V <sub>WIB</sub>	Inverse Blocking Leakage Current at I <sub>IB</sub> @ V <sub>WIB</sub>	Peak Inverse Blocking Voltage V <sub>PIB</sub>
		Min	Max							
Uni	(V)	(V)	(V)	(μA)	(V)	(A)	(pF)	(V)	(mA)	(V)
SAC5.0	5.00	7.60	8.30	300.00	13.20	46.20	50	700	1	800
SAC6.0	6.00	7.90	9.30	300.00	12.20	43.10	50	700	1	800
SAC7.0	7.00	8.30	10.50	300.00	13.70	39.90	50	700	1	800
SAC8.0	8.00	8.90	10.90	100.00	13.90	37.80	50	700	1	800
SAC8.5	8.50	9.40	11.50	50.00	14.70	35.70	50	700	1	800
SAC10	10.00	11.10	13.60	5.00	17.20	30.50	50	700	1	800
SAC12	12.00	13.30	16.30	1.00	20.00	26.30	50	700	1	800
SAC15	15.00	16.70	20.40	1.00	25.00	21.00	50	700	1	800
SAC18	18.00	20.00	24.40	1.00	33.30	15.80	50	700	1	800
SAC22	22.00	24.40	29.80	1.00	35.70	14.70	50	700	1	800
SAC26	26.00	28.90	35.30	1.00	45.00	11.70	50	700	1	800
SAC30	30.00	33.30	41.10	1.00	50.00	10.50	50	700	1	800
SAC36	36.00	40.00	48.90	1.00	58.10	9.00	50	700	1	800
SAC45	45.00	50.00	61.10	1.00	73.50	7.10	50	700	1	800
SAC50	50.00	55.50	66.60	1.00	86.20	6.10	50	700	1	800
SAC55	55.00	60.50	66.90	1.00	87.00	5.70	50	700	1	800
SAC60	60.00	66.00	72.90	1.00	95.00	5.30	50	700	1	800
SAC65	65.00	71.50	79.00	1.00	103.00	4.90	50	700	1	800
SAC70	70.00	77.00	85.10	1.00	111.00	4.50	50	700	1	800
SAC75	75.00	82.50	91.20	1.00	119.00	4.20	50	700	1	800
SAC80	80.00	88.00	97.20	1.00	127.00	3.90	50	700	1	800
SAC85	85.00	93.50	103.30	1.00	135.00	3.70	45	700	1	800
SAC90	90.00	99.00	109.40	1.00	143.00	3.50	45	700	1	800
SAC95	95.00	104.50	115.50	1.00	151.00	3.30	45	700	1	800
SAC100	100.00	110.00	121.00	1.00	158.00	3.20	40	700	1	800
SAC110	110.00	120.00	133.00	1.00	173.00	2.90	40	700	1	800
SAC120	120.00	131.00	145.00	1.00	189.00	2.60	40	700	1	800
SAC130	130.00	142.00	160.00	1.00	209.00	2.40	35	700	1	800
SAC140	140.00	153.00	170.00	1.00	219.00	2.30	35	700	1	800
SAC150	150.00	164.00	182.00	1.00	237.00	2.10	35	700	1	800

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

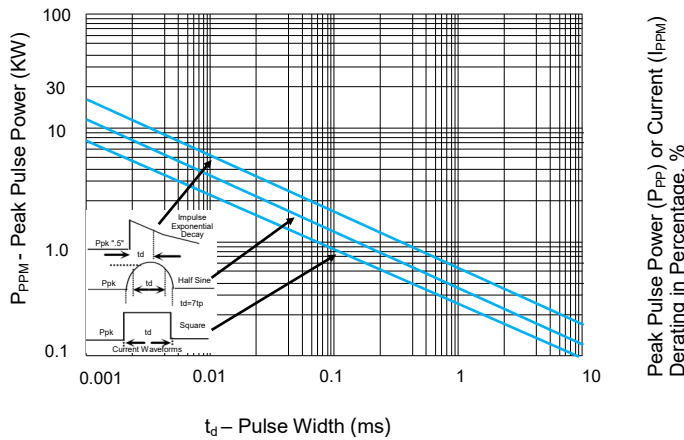


FIGURE 1 Peak Pulse Power Rating Curve

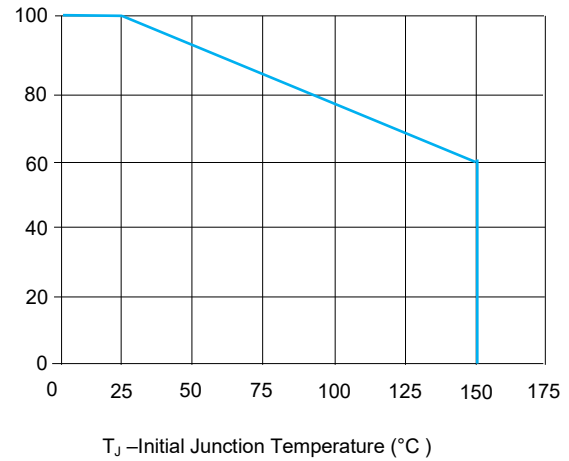


FIGURE 2 Peak Pulse Power Derating Curve

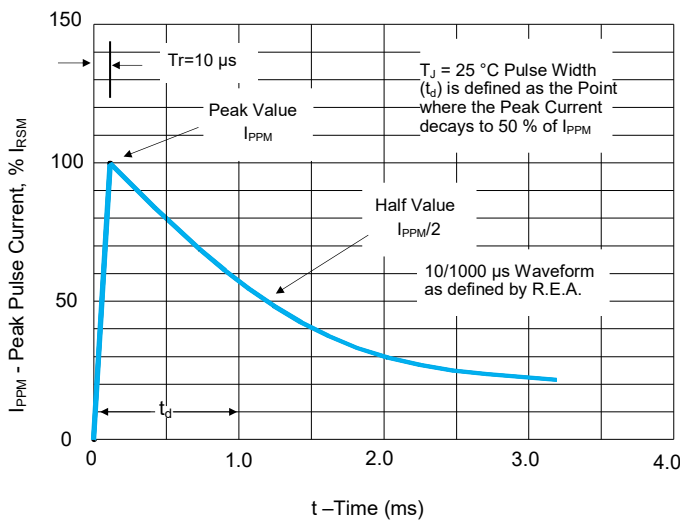
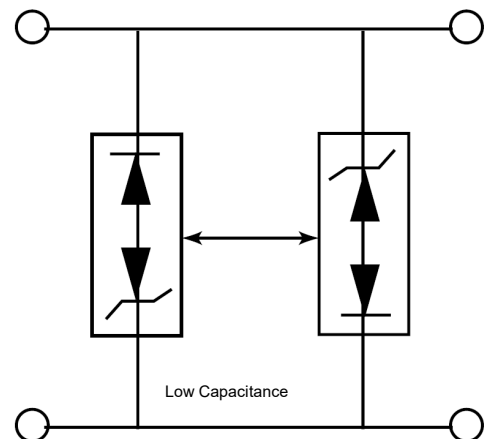


FIGURE 3 Pulse Waveform



**Application Note:** Device must be used with two units in parallel, opposite in polarity as shown on circuit for AC signal line protection.

FIGURE 4 AC Line Protection Application

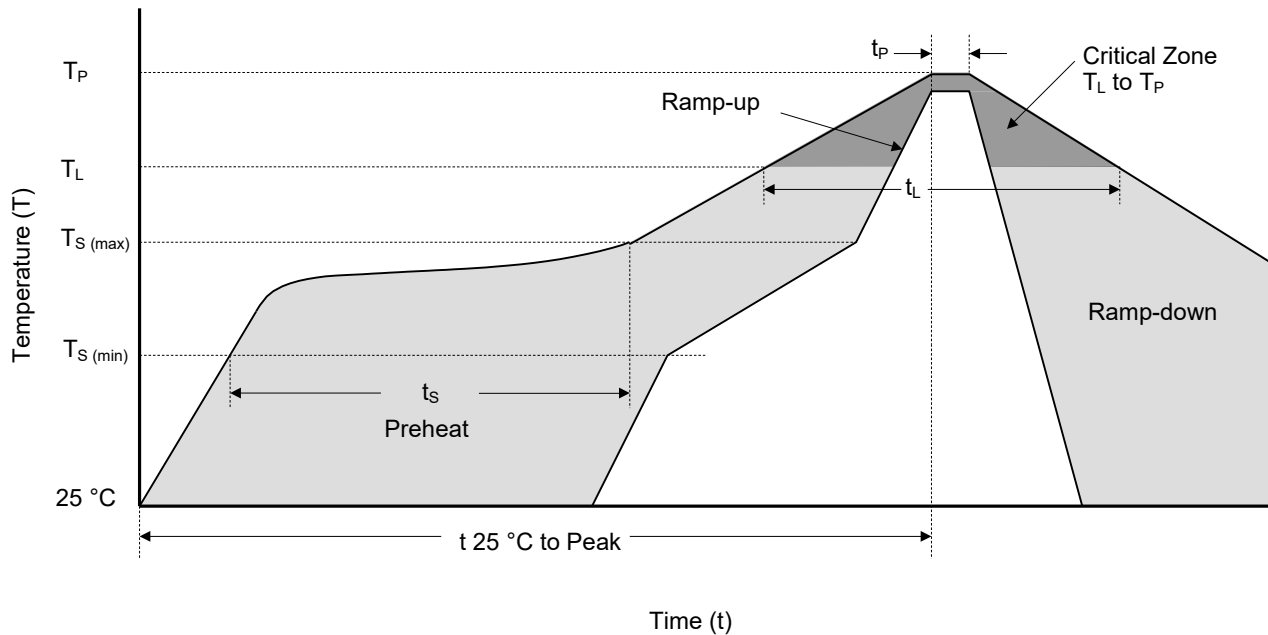
## Environmental Specifications

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

## Physical Specifications

Weight	0.015 oz., 0.4 g
Case	JEDEC DO-204AC (DO-15) 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



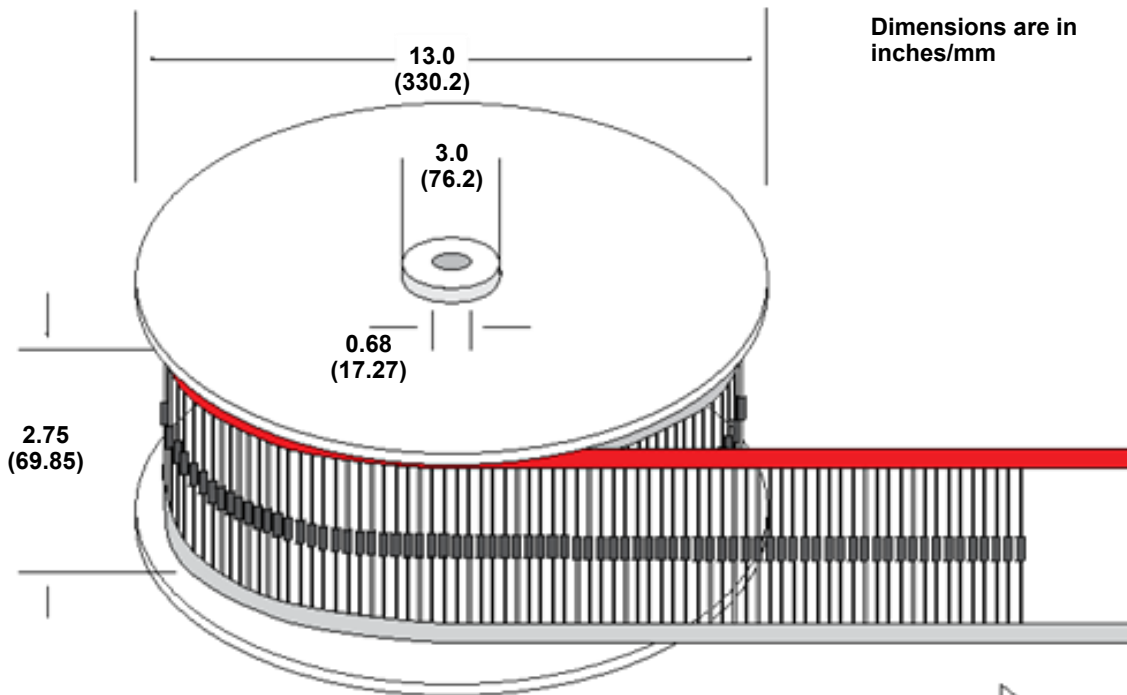
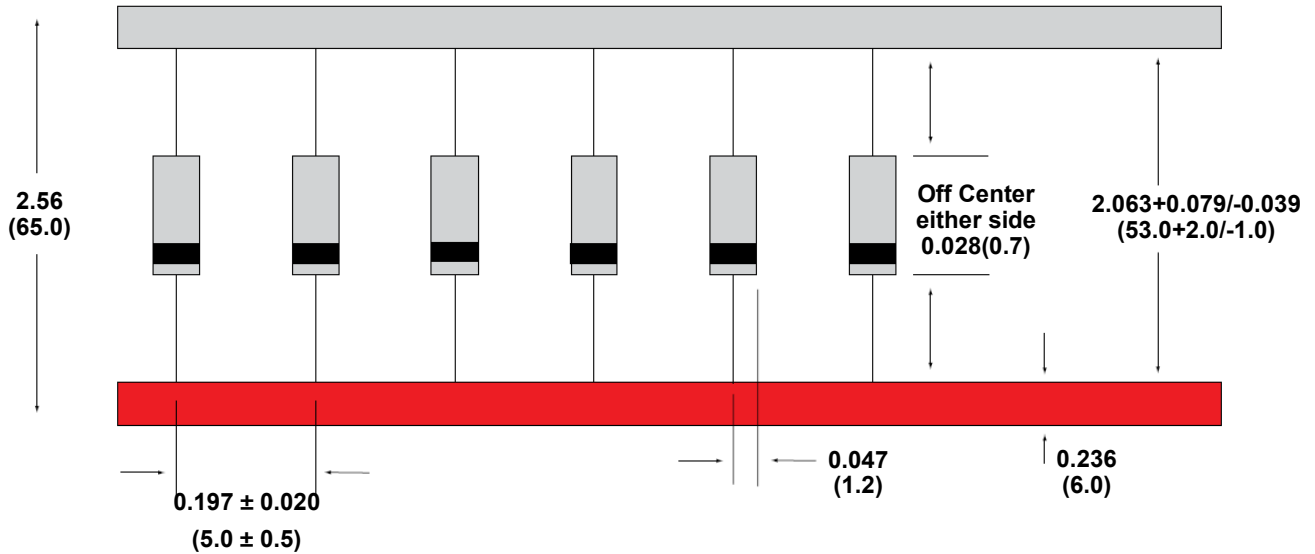
Reflowing Condition

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



Recess Depth Max. 0.75 (19.05)

Part Number	Package	QTY's (Reel)	Packaging Option	Packaging Specification
SACxxxXX	DO-204AC	4000 PCS	Tape & Reel	EIA STD RS-296
SACxxxXX-TB	DO-204AC	3000 PCS	TB	/
SACxxxXX-B	DO-204AC	1000 PCS	BULK	SETsafe   SETfuse Spec

## 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)





## 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.

## Transient Voltage Suppressor ( Surface Mount ) Features Overview

Package Type	Series								
DO-221AC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SMA6L	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DO-214AA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SACB	SMBJ	P6SMB
DO-214AB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DO-214AC	<input type="checkbox"/>	<input type="checkbox"/>	SMAJ	P4SMA	SMA6J	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SOD-123FL	SMF	P4SMF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SMT0-218	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product Outline (mm)									
$V_R / V_{WM} (V)$ Reverse Stand-off Voltage	5.0 ~ 250	5.0 ~ 85	5.0 ~ 440	5.8 ~ 468	5.0 ~ 250	5.0 ~ 50	5.0 ~ 440	5.8 ~ 512	
$P_{PPM} (W)$ (10/1000 $\mu s$ ) Rated Peak ImPulse Power Dissipation	200		400		600	500	600		
$I_{PPM} (kA)$ (8/20 $\mu s$ ) Rated Peak ImPulse Current					<input type="checkbox"/>				
Operating Temperature (°C)	-55 to +150								

## Transient Voltage Suppressor ( Surface Mount ) Features Overview

Package Type	Series									
DO-221AC	○	○	○	○	○	○	○	○	○	○
DO-214AA	○	○	○	○	○	○	○	○	○	○
DO-214AB	SMCJ	1.5SMC	3.0SMCJ	SMDJ	5.0SMDJ	○	○	○	○	○
DO-214AC	○	○	○	○	○	○	○	○	○	○
SOD-123FL	○	○	○	○	○	○	○	○	○	○
SMT0-218	○	○	○	○	○	SPC1	SPC3	SPC6	SPC10	
Product Outline (mm)										
$V_R / V_{WM}$ (V) Reverse Stand-off Voltage	5.0 ~ 440	5.8 ~ 512	5.0 ~ 440	12 ~ 170	380 / 430	66	58 ~ 76	58 ~ 86		
$P_{PPM}$ (W) (10/1000 $\mu$ s) Rated Peak ImPulse Power Dissipation	1500		3000	5000			○			
$I_{PPM}$ (kA)(8/20 $\mu$ s) Rated Peak ImPulse Current			○		1	3	6	10		
Operating Temperature (°C)			-55 to +150				-55 to +125			

## Transient Voltage Suppressor ( Axial Lead ) Features Overview

Package Type	Series																
	DO-201	DO-41	DO-15	P600	Radial lead	1.5KE	LCE										
	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	P4KE	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○	SAC	P6KE	○	○	○	○	○	○	○	○	○	○	○	○	○	
	○	○	○	○	○	○	○	5KP	15KPA	20KPA	30KPA	○	○	○	○	○	
	○	○	○	○	○	○	○	○	○	○	○	SPCL1	SPCL3	SPCL6	SPCL10	SPCL15	SPCL20
Product Outline (mm)																	
$V_R / V_{WM}$ (V) Reverse Stand-off Voltage	5.8 ~ 468	5.0 ~ 50	5.8 ~ 512	5.8 ~ 512	6.5 ~ 90	5.0 ~ 250	17 ~ 280	20 ~ 300	28 ~ 360	76	15 ~ 430	30 ~ 430	15 ~ 530	58 ~ 380	16 ~ 76		
$P_{PPM}$ (W) (10/1000 $\mu$ s) Rated Peak Impulse Power Dissipation	400	500	600	1500	5000	15000	20000	30000					○				
$I_{PPM}$ (kA)(8/20 $\mu$ s) Rated Peak Impulse Current					○					1	3	6	10	15	20		
Operating Temperature (°C)					-55 to +150											-55 to +125	