



### Description

SACB series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

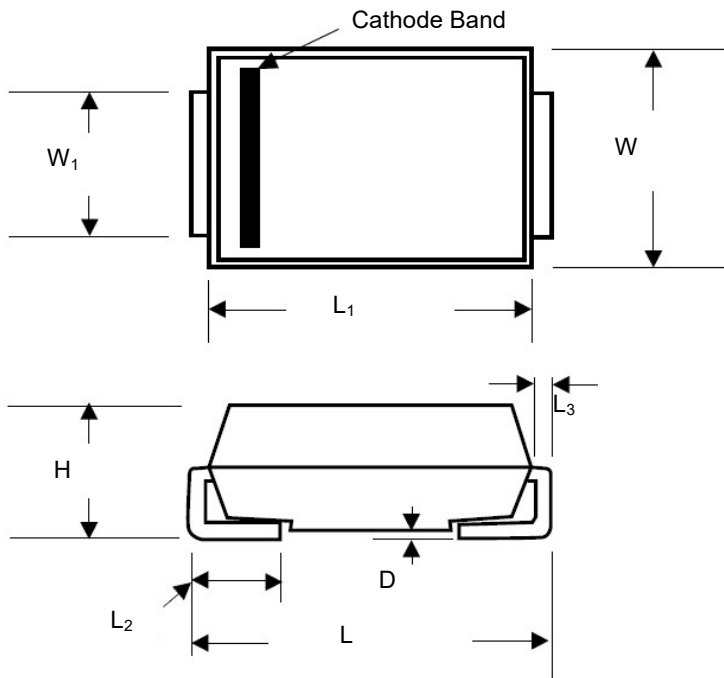
### Applications

- 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%
- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- 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
- $V_{BR} @ T_J = V_{BR}@25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$   
( $\alpha T$ : Temperature Coefficient, typical value is 0.1%)
- Glass passivated chip junction
- Fast response time: typically less than 1.0 PS from 0 V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- High temperature reflow soldering guaranteed: 260  $^{\circ}\text{C}$  / 40 sec
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Meet MSL level1, per J-STD-020
- 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)

### Package Outline Dimensions (DO-214AA)



DO-214AA (SMB J-Bend)

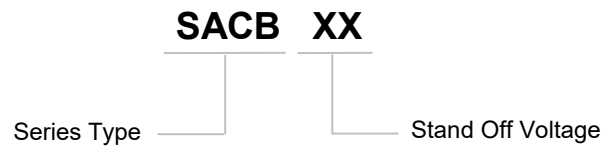
| Symbol         | Millimeters |       | Inches |       |
|----------------|-------------|-------|--------|-------|
|                | Min.        | Max.  | Min.   | Max.  |
| W <sub>1</sub> | 1.950       | 2.200 | 0.077  | 0.086 |
| L <sub>1</sub> | 4.060       | 4.570 | 0.160  | 0.180 |
| W              | 3.300       | 3.940 | 0.130  | 0.155 |
| H              | 2.130       | 2.440 | 0.084  | 0.096 |
| L <sub>2</sub> | 0.760       | 1.520 | 0.030  | 0.060 |
| D              | -           | 0.203 | -      | 0.008 |
| L              | 5.210       | 5.590 | 0.205  | 0.220 |
| L <sub>3</sub> | 0.152       | 0.305 | 0.006  | 0.012 |

### Maximum Ratings and Characteristics

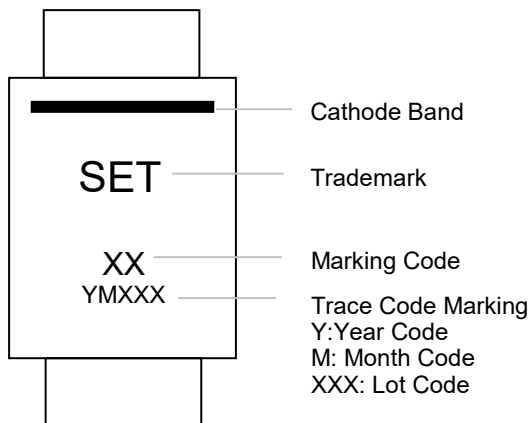
(T<sub>A</sub> = 25 °C unless otherwise specified.)

| Parameter                                                                                     | Symbol           | Value      | Unit |
|-----------------------------------------------------------------------------------------------|------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>L</sub> =25 °C by 10/1000 μS Waveform (fig.1)( Note 1) | P <sub>PPM</sub> | 500        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50 °C                              | P <sub>D</sub>   | 3.0        | W    |
| Operating Temperature Range                                                                   | T <sub>J</sub>   | -65 to 150 | °C   |
| Storage Temperature Range                                                                     | T <sub>STG</sub> | -65 to 175 | °C   |

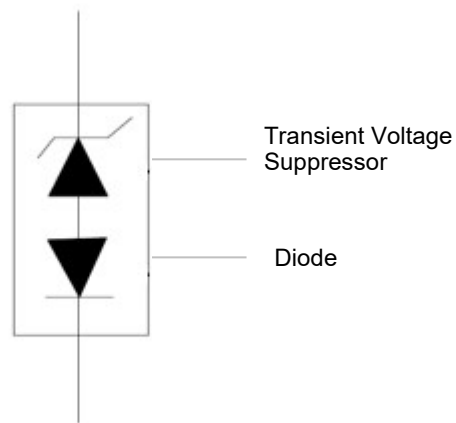
### **Part Numbering System**



### **Marking**



Functional Diagram



### Glossary

| Item             | Description                                                                                                                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $V_C$            | <b>Clamping Voltage</b><br>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><br>Maximum voltage that can be applied to the TVS without operation.<br>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><br>Current measured at $V_R$ .<br>NOTE : Also shown as $I_D$ for stand-by current.                                                                                                                                      |
| $V_{BR}$         | <b>Breakdown Voltage</b><br>Voltage across TVS at a specified current $I_T$ in the breakdown region.                                                                                                                                                   |
| $I_{PPM}$        | <b>Rated Random Recurring Peak Impulse Current</b><br>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><br>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><br>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><br>Capacitance across the TVS measured at a specified frequency and voltage.                                                                                                                                                        |
| $V_{FS}$         | <b>Peak Forward Surge Voltage</b><br>Peak voltage across an TVS for a specified forward surge current ( $I_{FS}$ ) and time duration.<br>NOTE : Also shown as $V_F$ .                                                                                  |
| $I_{FS}$         | <b>Forward Surge Current</b><br>Pulsed current through TVS in the forward conducting region.<br>NOTE : Also shown as $I_F$ .                                                                                                                           |
| $\alpha_{V(BR)}$ | <b>Temperature Coefficient of Breakdown Voltage</b><br>The change of breakdown voltage divided by the change of temperature.                                                                                                                           |
| $I_{PP}$         | <b>Peak pulse Current</b><br>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><br>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.<br>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 | Device Marking Code | Min. Breakdown Voltage at I <sub>r</sub> =1 mA<br>V <sub>BR</sub> | Reverse Stand-off Voltage<br>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 at V <sub>C</sub> @I <sub>PPM</sub> =5.0A | 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> |
|-------------|---------------------|-------------------------------------------------------------------|---------------------------------------------|-----------------------------------------------------|------------------------------------------|-----------------------------------------------------------------|------------------------------------|---------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------|
| Uni         | Uni                 | (V)                                                               | (V)                                         | (μA)                                                | (A)                                      | (V)                                                             | (pF)                               | (V)                                               | (mA)                                                                   | (V)                                            |
| SACB5.0     | SKE                 | 7.60                                                              | 5.0                                         | 300                                                 | 44.0                                     | 10.0                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB6.0     | SKG                 | 7.90                                                              | 6.0                                         | 300                                                 | 41.0                                     | 11.2                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB7.0     | SKM                 | 8.33                                                              | 7.0                                         | 300                                                 | 38.0                                     | 12.6                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB8.0     | SKR                 | 8.89                                                              | 8.0                                         | 100                                                 | 36.0                                     | 13.4                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB8.5     | SKT                 | 9.44                                                              | 8.5                                         | 50                                                  | 34.0                                     | 14.0                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB10      | SKX                 | 11.10                                                             | 10.0                                        | 5                                                   | 29.0                                     | 16.3                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB12      | SLE                 | 13.30                                                             | 12.0                                        | 5                                                   | 25.0                                     | 19.0                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB15      | SLM                 | 16.70                                                             | 15.0                                        | 5                                                   | 20.0                                     | 23.6                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB18      | SLT                 | 20.00                                                             | 18.0                                        | 5                                                   | 15.0                                     | 28.8                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB22      | SLX                 | 24.40                                                             | 22.0                                        | 5                                                   | 14.0                                     | 35.4                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB26      | SME                 | 28.90                                                             | 26.0                                        | 5                                                   | 11.1                                     | 42.3                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB30      | SMK                 | 33.30                                                             | 30.0                                        | 5                                                   | 10.0                                     | 48.6                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB36      | SMP                 | 40.00                                                             | 36.0                                        | 5                                                   | 8.6                                      | 60.0                                                            | 45                                 | 75                                                | 1.0                                                                    | 100                                            |
| SACB45      | SMV                 | 50.00                                                             | 45.0                                        | 5                                                   | 6.8                                      | 77.0                                                            | 45                                 | 150                                               | 1.0                                                                    | 200                                            |
| SACB50      | SMZ                 | 55.50                                                             | 50.0                                        | 5                                                   | 5.8                                      | 88.0                                                            | 45                                 | 150                                               | 1.0                                                                    | 200                                            |

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

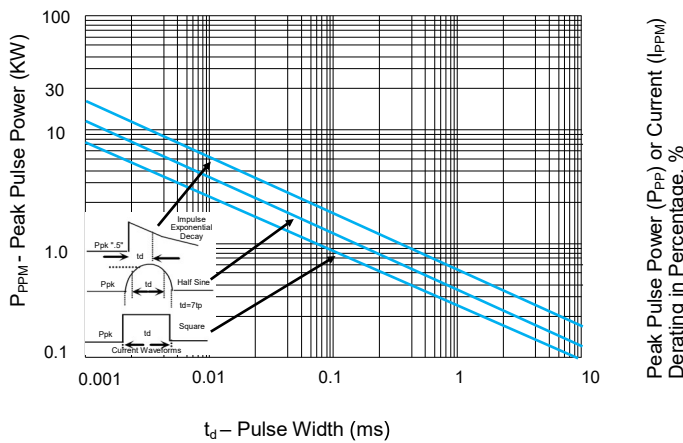


FIGURE 1 Peak Pulse Power Rating Curve

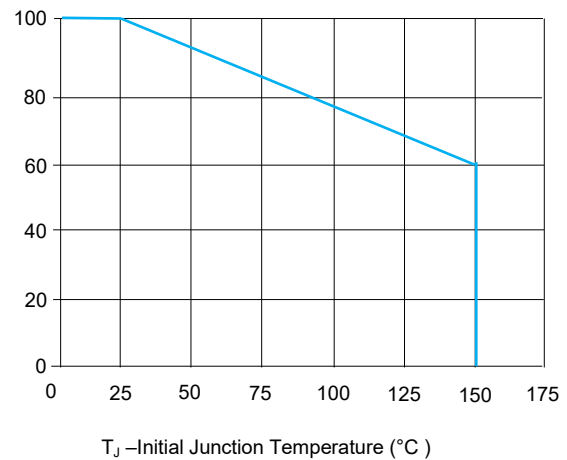


FIGURE 2 Peak Pulse Power Derating Curve

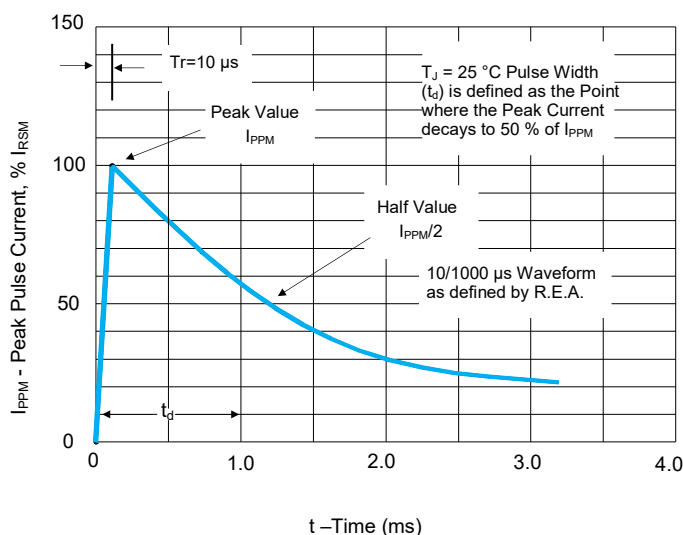
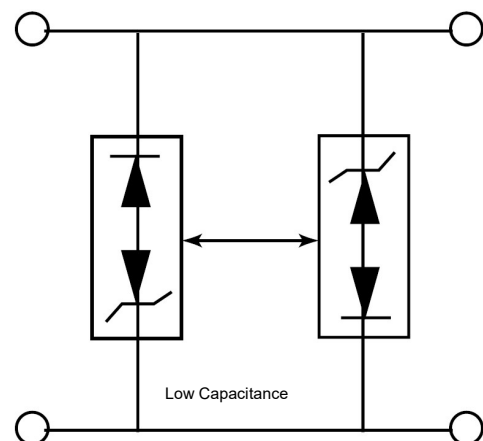


FIGURE 3 Pulse Waveform



**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

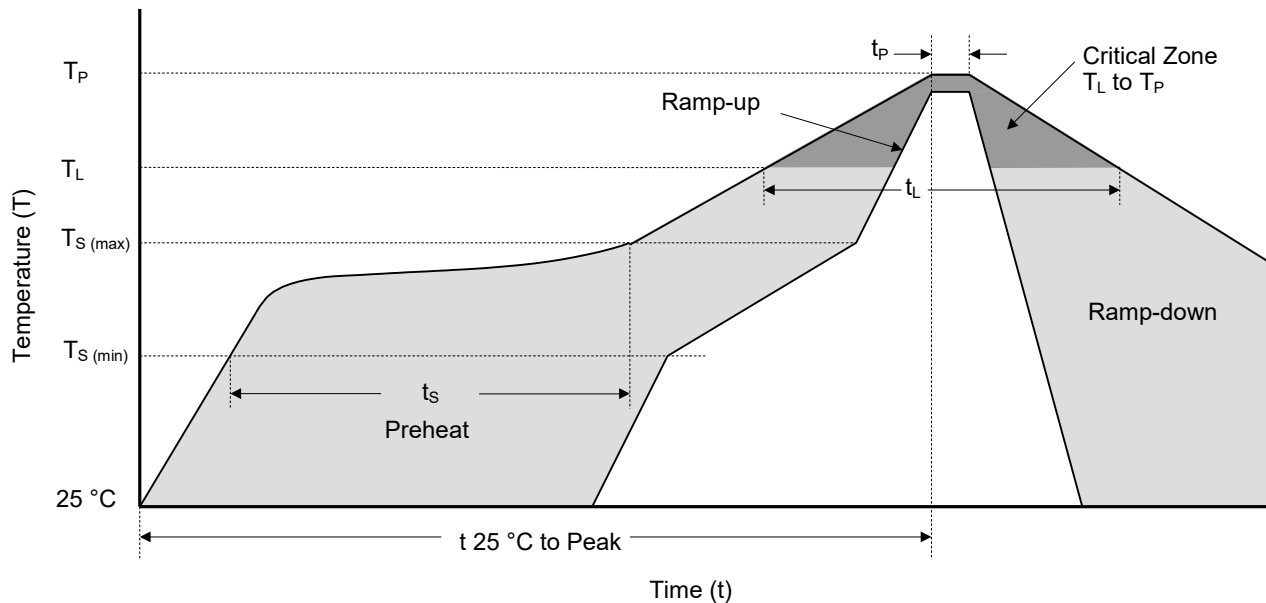
### Environmental Specifications

|                     |                          |
|---------------------|--------------------------|
| High Temp. Storage  | JESD22-A103              |
| HTRB                | JESD22-A108              |
| Temperature Cycling | JESD22-A104              |
| MSL                 | JEDEC-J-STD-020, Level 1 |
| H3TRB               | JESD22-A101              |
| RSH                 | JESD22-A111              |

### Physical Specifications

|          |                                                                    |
|----------|--------------------------------------------------------------------|
| Weight   | 0.003 oz., 0.093 g                                                 |
| Case     | JEDEC DO-214AA molded plastic body over glass passivated junction. |
| Polarity | Color band denotes cathode except Bidirectional                    |
| Terminal | Matte Tin-plated leads. Solderable per JESD22-B102.                |

### Soldering Parameters



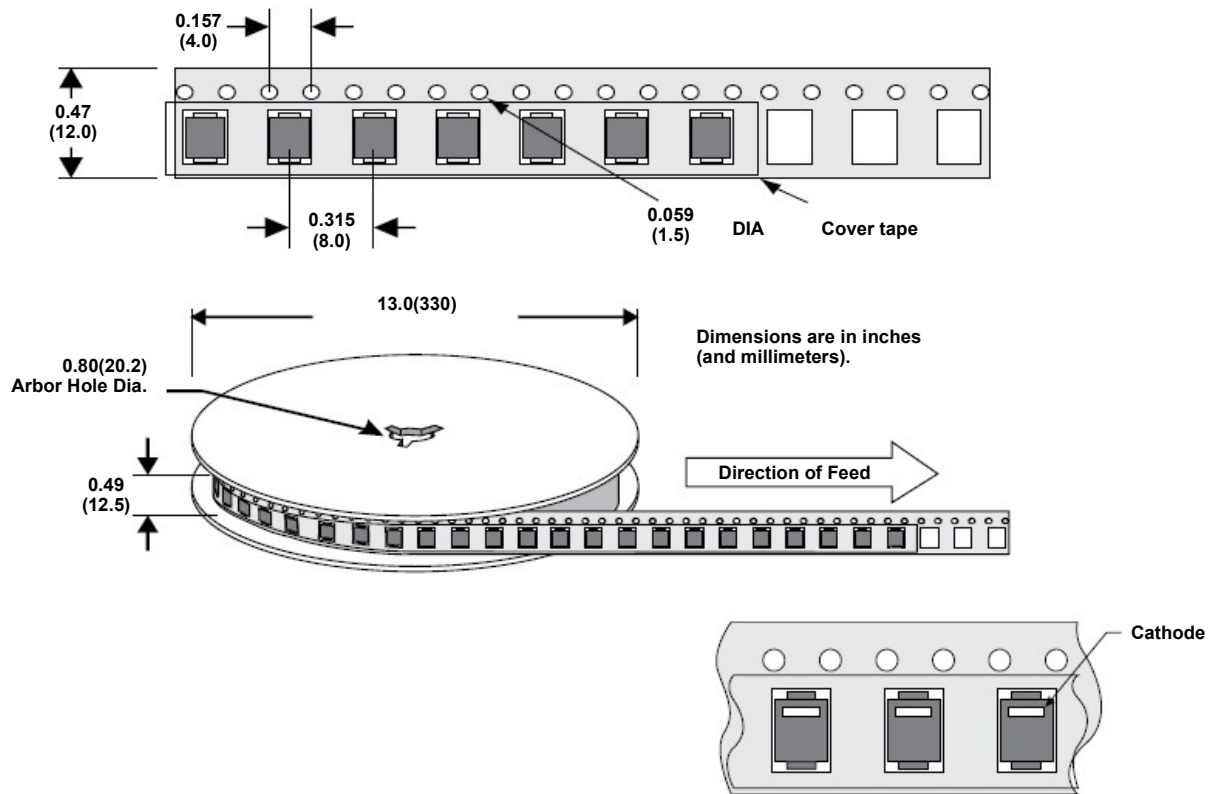
Reflowing Condition

| 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 (Reel) | Packaging Option                  | Packaging Specification |
|-------------|----------|------------|-----------------------------------|-------------------------|
| SACBXX      | DO-214AA | 3000 PCS   | Tape & Reel - 12 mm tape/13" reel | EIA RS-481              |



# 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 solderability 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.