

## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- Glass passivated junction
- Low inductance
- Excellent clamping capability
- 500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1µA above 10V
- High Temperature soldering guaranteed: 265°C/10 seconds/.375", (9.5mm) lead length, 5lbs (2.3kg) tension
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020
- Safety certification: UL: E244458



### Mechanical Data

- Case: JEDEC DO-15 Moulded plastic
- Terminal: Axial leads, solderable per MIL-STD-750, Method 2026
- Polarity: Color band denotes cathode except bi-directional models
- Mounting Position: Any
- Weight: 0.42g

### Applications

- I/O interface
- AC/DC power supply
- Low frequency signal transmission line (RS232, RS485, etc.)

### Maximum Ratings and Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

| Rating  | Symbol          | Value       | Units |
|---|-----------------|-------------|-------|
| Peak pulse power dissipation at 10/1000µs waveform (Note1, Note2, Fig.1)  | $P_{PPM}$       | Minimum 500 | Watts |
| Peak pulse current of at 10/1000µs waveform (Note 1, Fig.3)   | $I_{PPM}$       | See Table   | Amps  |
| Steady state power dissipation at $T_A=50^\circ\text{C}$ (Fig.5)  | $P_{M(AV)}$     | 3.0         | Watts |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | $I_{FSM}$       | 70          | Amps  |
| Operating junction and Storage Temperature Range.   | $T_J, T_{STG}$  | -55 to +150 | °C    |
| Typical thermal resistance junction to lead   | $R_{\theta JL}$ | 20          | °C/W  |
| Typical thermal resistance junction to ambient  | $R_{\theta JA}$ | 75          | °C/W  |

Notes: 1. Non-repetitive current pulse, per Fig.3 and derated above  $T_A=25^\circ\text{C}$  per Fig.2.

2. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.

**Dimensions (DO-204AC/DO-15)**

|   | Symbol | Millimeters |       | Inches |      |
|---|--------|-------------|-------|--------|------|
|   |        | Min.        | Max.  | Min.   | Max. |
| L | 25.40  | -           | 1.000 | -      |      |
| T | 5.80   | 7.60        | 0.230 | 0.300  |      |
| d | 2.60   | 3.60        | 0.104 | 0.140  |      |
| s | 0.71   | 0.86        | 0.028 | 0.034  |      |

**Electrical Characteristics (T<sub>A</sub>=25°C)**

| Part Number    |               | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>RWM</sub> |
|----------------|---------------|---------------------------|-----------------------------------|---------------------|---|---------------------|-----------------------------------|
| Unidirectional | Bidirectional | V <sub>RWM</sub> (V)      | V <sub>BR</sub> (V)               | I <sub>T</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>PP</sub> (A) | I <sub>R</sub> (μA)               |
| SA5.0A         | SA5.0CA       | 5.0                       | 6.40~7.00                         | 10                  | 9.2                                       | 55.4                | 600                               |
| SA6.0A         | SA6.0CA       | 6.0                       | 6.67~7.37                         | 10                  | 10.3                                      | 49.5                | 600                               |
| SA6.5A         | SA6.5CA       | 6.5                       | 7.22~7.98                         | 10                  | 11.2                                      | 45.5                | 400                               |
| SA7.0A         | SA7.0CA       | 7.0                       | 7.78~8.60                         | 10                  | 12.0                                      | 42.5                | 150                               |
| SA7.5A         | SA7.5CA       | 7.5                       | 8.33~9.21                         | 1                   | 12.9                                      | 39.5                | 50                                |
| SA8.0A         | SA8.0CA       | 8.0                       | 8.89~9.83                         | 1                   | 13.6                                      | 37.5                | 25                                |
| SA8.5A         | SA8.5CA       | 8.5                       | 9.44~10.40                        | 1                   | 14.4                                      | 35.4                | 10                                |
| SA9.0A         | SA9.0CA       | 9.0                       | 10.00~11.10                       | 1                   | 15.4                                      | 33.1                | 5                                 |
| SA10A          | SA10CA        | 10.0                      | 11.10~12.30                       | 1                   | 17.0                                      | 30.0                | 3                                 |
| SA11A          | SA11CA        | 11.0                      | 12.20~13.50                       | 1                   | 18.2                                      | 28.0                | 1                                 |
| SA12A          | SA12CA        | 12.0                      | 13.30~14.70                       | 1                   | 19.9                                      | 25.6                | 1                                 |
| SA13A          | SA13CA        | 13.0                      | 14.40~15.90                       | 1                   | 21.5                                      | 23.7                | 1                                 |
| SA14A          | SA14CA        | 14.0                      | 15.60~17.20                       | 1                   | 23.2                                      | 22.0                | 1                                 |
| SA15A          | SA15CA        | 15.0                      | 16.70~18.50                       | 1                   | 24.4                                      | 20.9                | 1                                 |
| SA16A          | SA16CA        | 16.0                      | 17.80~19.70                       | 1                   | 26.0                                      | 19.6                | 1                                 |
| SA17A          | SA17CA        | 17.0                      | 18.90~20.90                       | 1                   | 27.6                                      | 18.5                | 1                                 |
| SA18A          | SA18CA        | 18.0                      | 20.00~22.10                       | 1                   | 29.2                                      | 17.5                | 1                                 |
| SA20A          | SA20CA        | 20.0                      | 22.20~24.50                       | 1                   | 32.4                                      | 15.7                | 1                                 |
| SA22A          | SA22CA        | 22.0                      | 24.40~26.90                       | 1                   | 35.5                                      | 14.4                | 1                                 |
| SA24A          | SA24CA        | 24.0                      | 26.70~29.50                       | 1                   | 38.9                                      | 13.1                | 1                                 |
| SA26A          | SA26CA        | 26.0                      | 28.90~31.90                       | 1                   | 42.1                                      | 12.1                | 1                                 |
| SA28A          | SA28CA        | 28.0                      | 31.10~34.40                       | 1                   | 45.4                                      | 11.2                | 1                                 |
| SA30A          | SA30CA        | 30.0                      | 33.30~36.80                       | 1                   | 48.4                                      | 10.5                | 1                                 |

| Part Number    |               | Reverse Stand-Off Voltage | Breakdown Voltage @ $I_T$ | Test Current | Maximum Clamping Voltage @ $I_{PP}$ | Peak Pulse Current | Reverse Leakage @ $V_{RWM}$ |
|----------------|---------------|---------------------------|---------------------------|--------------|-------------------------------------|--------------------|-----------------------------|
| Unidirectional | Bidirectional | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| SA33A          | SA33CA        | 33.0                      | 36.70~40.60               | 1            | 53.3                                | 9.6                | 1                           |
| SA36A          | SA36CA        | 36.0                      | 40.00~44.20               | 1            | 58.1                                | 8.8                | 1                           |
| SA40A          | SA40CA        | 40.0                      | 44.40~49.10               | 1            | 64.5                                | 7.9                | 1                           |
| SA43A          | SA43CA        | 43.0                      | 47.80~52.80               | 1            | 69.4                                | 7.3                | 1                           |
| SA45A          | SA45CA        | 45.0                      | 50.00~55.30               | 1            | 72.7                                | 7.0                | 1                           |
| SA48A          | SA48CA        | 48.0                      | 53.30~58.90               | 1            | 77.4                                | 6.6                | 1                           |
| SA51A          | SA51CA        | 51.0                      | 56.70~62.70               | 1            | 82.4                                | 6.2                | 1                           |
| SA54A          | SA54CA        | 54.0                      | 60.00~66.30               | 1            | 87.1                                | 5.9                | 1                           |
| SA58A          | SA58CA        | 58.0                      | 64.40~71.20               | 1            | 93.6                                | 5.4                | 1                           |
| SA60A          | SA60CA        | 60.0                      | 66.70~73.70               | 1            | 96.8                                | 5.3                | 1                           |
| SA64A          | SA64CA        | 64.0                      | 71.10~78.60               | 1            | 103.0                               | 5.0                | 1                           |
| SA70A          | SA70CA        | 70.0                      | 77.80~86.00               | 1            | 113.0                               | 4.5                | 1                           |
| SA75A          | SA75CA        | 75.0                      | 83.30~92.10               | 1            | 121.0                               | 4.2                | 1                           |
| SA78A          | SA78CA        | 78.0                      | 86.70~95.80               | 1            | 126.0                               | 4.0                | 1                           |
| SA85A          | SA85CA        | 85.0                      | 94.40~104.00              | 1            | 137.0                               | 3.7                | 1                           |
| SA90A          | SA90CA        | 90.0                      | 100.00~111.00             | 1            | 146.0                               | 3.5                | 1                           |
| SA100A         | SA100CA       | 100.0                     | 111.00~123.00             | 1            | 162.0                               | 3.1                | 1                           |
| SA110A         | SA110CA       | 110.0                     | 122.00~135.00             | 1            | 177.0                               | 2.9                | 1                           |
| SA120A         | SA120CA       | 120.0                     | 133.00~147.00             | 1            | 193.0                               | 2.6                | 1                           |
| SA130A         | SA130CA       | 130.0                     | 144.00~159.00             | 1            | 209.0                               | 2.4                | 1                           |
| SA150A         | SA150CA       | 150.0                     | 167.00~185.00             | 1            | 243.0                               | 2.1                | 1                           |
| SA160A         | SA160CA       | 160.0                     | 178.00~197.00             | 1            | 259.0                               | 2.0                | 1                           |
| SA170A         | SA170CA       | 170.0                     | 189.00~209.00             | 1            | 275.0                               | 1.9                | 1                           |
| SA180A         | SA180CA       | 180.0                     | 201.00~222.00             | 1            | 292.0                               | 1.7                | 1                           |
| SA190A         | SA190CA       | 190.0                     | 211.00~233.00             | 1            | 308.0                               | 1.6                | 1                           |
| SA200A         | SA200CA       | 200.0                     | 224.00~247.00             | 1            | 324.0                               | 1.5                | 1                           |
| SA210A         | SA210CA       | 210.0                     | 237.00~263.00             | 1            | 340.0                               | 1.5                | 1                           |
| SA220A         | SA220CA       | 220.0                     | 246.00~272.00             | 1            | 356.0                               | 1.4                | 1                           |

Notes: For bidirectional type having  $V_{RWM}$  of 10V and less, the  $I_R$  limit is double.

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

**Figure 1. Peak Pulse Power Rating Curve**



**Figure 2. Pulse Derating Curve**



**Figure 3. Pulse Waveform**



**Figure 4. Typical Junction Capacitance**



**Figure 5. Steady State Power Dissipation Derating Curve**



**Figure 6. Maximum Non-Repetitive Forward Surge Current Uni-Directional Only**



## Recommended Soldering Conditions

### Wave Soldering



### Recommended Conditions

| Item             | Conditions |
|------------------|------------|
| Peak Temperature | 265°C      |
| Dipping Time     | 10 seconds |
| Soldering        | 1 time     |

## Marking Code



**Part Number Code**



**Ordering Code for Different Package**

Box package: Add suffix "/B" at the end of the part number, such as SA7.0A/B

Reel package: Add suffix "/TR13" at the end of the part number, such as SA15CA/TR13

**Packaging**

| Tape |  | Symbol            | Dimension (mm) |
|------|--|-------------------|----------------|
|      |  | A                 | 5.0±0.5        |
|      |  | B                 | 53.0±1.0       |
|      |  | Z                 | 1.2Max.        |
|      |  | T                 | 6.0±0.4        |
|      |  | E                 | 0.8Max.        |
|      |  | L1-L2             | 1.0Max.        |
|      |  | Box               |                |
|      |  | W                 | 75.0±5.0       |
|      |  | H                 | 114.0±5.0      |
|      |  | Quantity: 2000PCS |                |
| Reel |  | D                 | 330.0±3.0      |
|      |  | D0                | 16.4±2.0       |
|      |  | D1                | 86.0±2.0       |
|      |  | W1                | 76.0±3.0       |
|      |  | Quantity: 4000PCS |                |

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