

## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- 600W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1µA above 12V
- High Temperature soldering: 260°C/10 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020
- Safety certification: UL: E244458
- AEC-Q101 qualified



### Mechanical Data

- Case: JEDEC DO-214AA. Molded plastic over glass passivated junction
- Terminal: Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: Color band denotes cathode except bi-directional models
- Standard Packaging: 12mm tape (EIA STD RS-481)
- Weight: 0.10g

### 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 600 | 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)  | $P_{M(AV)}$     | 5.0         | Watts |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | $I_{FSM}$       | 100         | 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  | $R_{\theta JA}$ | 100         | °C/W  |

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

2. Mounted on 5.0mmx5.0mm (0.03mm thick) copper pads to each terminal.

3. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.

**Dimensions (SMB/DO-214AA)**

| Symbol | Millimeters |       | Inches |       |
|--------|-------------|-------|--------|-------|
|        | Min.        | Max.  | Min.   | Max.  |
| L      | 4.06        | 4.57  | 0.160  | 0.180 |
| D      | 3.30        | 3.94  | 0.130  | 0.155 |
| D1     | 1.95        | 2.20  | 0.077  | 0.086 |
| T      | 5.21        | 5.59  | 0.205  | 0.220 |
| T1     | 0.76        | 1.52  | 0.030  | 0.060 |
| d      | -           | 0.203 | -      | 0.008 |
| H      | 2.15        | 2.65  | 0.085  | 0.104 |
| H1     | 2.13        | 2.47  | 0.084  | 0.097 |

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

| Part Number    |               | Device Marking Code |    | 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 | UNI                 | BI | 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)               |
| SMBJ5.0A-AT    | SMBJ5.0CA-AT  | KE                  | AE | 5.0                       | 6.40~7.00                         | 10                  | 9.2                                       | 65.3                | 800                               |
| SMBJ6.0A-AT    | SMBJ6.0CA-AT  | KG                  | AG | 6.0                       | 6.67~7.37                         | 10                  | 10.3                                      | 58.3                | 800                               |
| SMBJ6.5A-AT    | SMBJ6.5CA-AT  | KK                  | AK | 6.5                       | 7.22~7.98                         | 10                  | 11.2                                      | 53.6                | 500                               |
| SMBJ7.0A-AT    | SMBJ7.0CA-AT  | KM                  | AM | 7.0                       | 7.78~8.60                         | 10                  | 12.0                                      | 50.0                | 200                               |
| SMBJ7.5A-AT    | SMBJ7.5CA-AT  | KP                  | AP | 7.5                       | 8.33~9.21                         | 1                   | 12.9                                      | 46.6                | 100                               |
| SMBJ8.0A-AT    | SMBJ8.0CA-AT  | KR                  | AR | 8.0                       | 8.89~9.83                         | 1                   | 13.6                                      | 44.2                | 50                                |
| SMBJ8.5A-AT    | SMBJ8.5CA-AT  | KT                  | AT | 8.5                       | 9.44~10.40                        | 1                   | 14.4                                      | 41.7                | 20                                |
| SMBJ9.0A-AT    | SMBJ9.0CA-AT  | KV                  | AV | 9.0                       | 10.00~11.10                       | 1                   | 15.4                                      | 39.0                | 10                                |
| SMBJ10A-AT     | SMBJ10CA-AT   | KX                  | AX | 10.0                      | 11.10~12.30                       | 1                   | 17.0                                      | 35.3                | 5                                 |
| SMBJ11A-AT     | SMBJ11CA-AT   | KZ                  | AZ | 11.0                      | 12.20~13.50                       | 1                   | 18.2                                      | 33.0                | 1                                 |
| SMBJ12A-AT     | SMBJ12CA-AT   | LE                  | BE | 12.0                      | 13.30~14.70                       | 1                   | 19.9                                      | 30.2                | 1                                 |
| SMBJ13A-AT     | SMBJ13CA-AT   | LG                  | BG | 13.0                      | 14.40~15.90                       | 1                   | 21.5                                      | 28.0                | 1                                 |
| SMBJ14A-AT     | SMBJ14CA-AT   | LK                  | BK | 14.0                      | 15.60~17.20                       | 1                   | 23.2                                      | 25.9                | 1                                 |
| SMBJ15A-AT     | SMBJ15CA-AT   | LM                  | BM | 15.0                      | 16.70~18.50                       | 1                   | 24.4                                      | 24.6                | 1                                 |
| SMBJ16A-AT     | SMBJ16CA-AT   | LP                  | BP | 16.0                      | 17.80~19.70                       | 1                   | 26.0                                      | 23.1                | 1                                 |
| SMBJ17A-AT     | SMBJ17CA-AT   | LR                  | BR | 17.0                      | 18.90~20.90                       | 1                   | 27.6                                      | 21.8                | 1                                 |
| SMBJ18A-AT     | SMBJ18CA-AT   | LT                  | BT | 18.0                      | 20.00~22.10                       | 1                   | 29.2                                      | 20.6                | 1                                 |
| SMBJ20A-AT     | SMBJ20CA-AT   | LV                  | BV | 20.0                      | 22.20~24.50                       | 1                   | 32.4                                      | 18.6                | 1                                 |
| SMBJ22A-AT     | SMBJ22CA-AT   | LX                  | BX | 22.0                      | 24.40~26.90                       | 1                   | 35.5                                      | 16.9                | 1                                 |

| Part Number    |               | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @ $I_T$ | Test Current | Maximum Clamping Voltage @ $I_{PP}$ | Peak Pulse Current | Reverse Leakage @ $V_{RWM}$ |
|----------------|---------------|---------------------|----|---------------------------|---------------------------|--------------|-------------------------------------|--------------------|-----------------------------|
| Unidirectional | Bidirectional | UNI                 | BI | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| SMBJ24A-AT     | SMBJ24CA-AT   | LZ                  | BZ | 24.0                      | 26.70~29.50               | 1            | 38.9                                | 15.5               | 1                           |
| SMBJ26A-AT     | SMBJ26CA-AT   | ME                  | CE | 26.0                      | 28.90~31.90               | 1            | 42.1                                | 14.3               | 1                           |
| SMBJ28A-AT     | SMBJ28CA-AT   | MG                  | CG | 28.0                      | 31.10~34.40               | 1            | 45.4                                | 13.3               | 1                           |
| SMBJ30A-AT     | SMBJ30CA-AT   | MK                  | CK | 30.0                      | 33.30~36.80               | 1            | 48.4                                | 12.4               | 1                           |
| SMBJ33A-AT     | SMBJ33CA-AT   | MM                  | CM | 33.0                      | 36.70~40.60               | 1            | 53.3                                | 11.3               | 1                           |
| SMBJ36A-AT     | SMBJ36CA-AT   | MP                  | CP | 36.0                      | 40.00~44.20               | 1            | 58.1                                | 10.4               | 1                           |
| SMBJ40A-AT     | SMBJ40CA-AT   | MR                  | CR | 40.0                      | 44.40~49.10               | 1            | 64.5                                | 9.3                | 1                           |
| SMBJ43A-AT     | SMBJ43CA-AT   | MT                  | CT | 43.0                      | 47.80~52.80               | 1            | 69.4                                | 8.7                | 1                           |
| SMBJ45A-AT     | SMBJ45CA-AT   | MV                  | CV | 45.0                      | 50.00~55.30               | 1            | 72.7                                | 8.3                | 1                           |
| SMBJ48A-AT     | SMBJ48CA-AT   | MX                  | CX | 48.0                      | 53.30~58.90               | 1            | 77.4                                | 7.8                | 1                           |
| SMBJ51A-AT     | SMBJ51CA-AT   | MZ                  | CZ | 51.0                      | 56.70~62.70               | 1            | 82.4                                | 7.3                | 1                           |
| SMBJ54A-AT     | SMBJ54CA-AT   | NE                  | DE | 54.0                      | 60.00~66.30               | 1            | 87.1                                | 6.9                | 1                           |
| SMBJ58A-AT     | SMBJ58CA-AT   | NG                  | DG | 58.0                      | 64.40~71.20               | 1            | 93.6                                | 6.5                | 1                           |
| SMBJ60A-AT     | SMBJ60CA-AT   | NK                  | DK | 60.0                      | 66.70~73.70               | 1            | 96.8                                | 6.2                | 1                           |
| SMBJ64A-AT     | SMBJ64CA-AT   | NM                  | DM | 64.0                      | 71.10~78.60               | 1            | 103.0                               | 5.9                | 1                           |
| SMBJ70A-AT     | SMBJ70CA-AT   | NP                  | DP | 70.0                      | 77.80~86.00               | 1            | 113.0                               | 5.3                | 1                           |
| SMBJ75A-AT     | SMBJ75CA-AT   | NR                  | DR | 75.0                      | 83.30~92.10               | 1            | 121.0                               | 5.0                | 1                           |
| SMBJ78A-AT     | SMBJ78CA-AT   | NT                  | DT | 78.0                      | 86.70~95.80               | 1            | 126.0                               | 4.8                | 1                           |
| SMBJ85A-AT     | SMBJ85CA-AT   | NV                  | DV | 85.0                      | 94.40~104.00              | 1            | 137.0                               | 4.4                | 1                           |
| SMBJ90A-AT     | SMBJ90CA-AT   | NX                  | DX | 90.0                      | 100.00~111.00             | 1            | 146.0                               | 4.1                | 1                           |
| SMBJ100A-AT    | SMBJ100CA-AT  | NZ                  | DZ | 100.0                     | 111.00~123.00             | 1            | 162.0                               | 3.7                | 1                           |
| SMBJ110A-AT    | SMBJ110CA-AT  | PE                  | EE | 110.0                     | 122.00~135.00             | 1            | 177.0                               | 3.4                | 1                           |
| SMBJ120A-AT    | SMBJ120CA-AT  | PG                  | EG | 120.0                     | 133.00~147.00             | 1            | 193.0                               | 3.1                | 1                           |
| SMBJ130A-AT    | SMBJ130CA-AT  | PK                  | EK | 130.0                     | 144.00~159.00             | 1            | 209.0                               | 2.9                | 1                           |
| SMBJ150A-AT    | SMBJ150CA-AT  | PM                  | EM | 150.0                     | 167.00~185.00             | 1            | 243.0                               | 2.5                | 1                           |
| SMBJ160A-AT    | SMBJ160CA-AT  | PP                  | EP | 160.0                     | 178.00~197.00             | 1            | 259.0                               | 2.3                | 1                           |
| SMBJ170A-AT    | SMBJ170CA-AT  | PR                  | ER | 170.0                     | 189.00~209.00             | 1            | 275.0                               | 2.2                | 1                           |
| SMBJ180A-AT    | SMBJ180CA-AT  | PT                  | ET | 180.0                     | 201.00~222.00             | 1            | 292.0                               | 2.1                | 1                           |
| SMBJ190A-AT    | SMBJ190CA-AT  | PA                  | EC | 190.0                     | 211.00~233.00             | 1            | 308.0                               | 2.0                | 1                           |
| SMBJ200A-AT    | SMBJ200CA-AT  | PV                  | EV | 200.0                     | 224.00~247.00             | 1            | 324.0                               | 1.9                | 1                           |
| SMBJ210A-AT    | SMBJ210CA-AT  | PB                  | ED | 210.0                     | 237.00~263.00             | 1            | 340.0                               | 1.8                | 1                           |
| SMBJ220A-AT    | SMBJ220CA-AT  | PX                  | EX | 220.0                     | 246.00~272.00             | 1            | 356.0                               | 1.7                | 1                           |
| SMBJ250A-AT    | SMBJ250CA-AT  | PZ                  | EZ | 250.0                     | 279.00~309.00             | 1            | 405.0                               | 1.5                | 1                           |

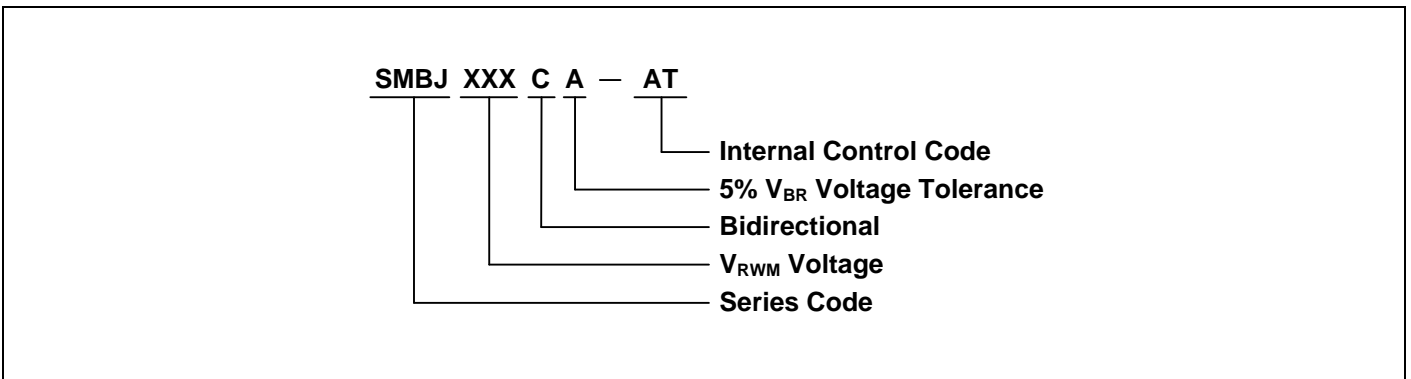
| Part Number    |               | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @ $I_T$ | Test Current | Maximum Clamping Voltage @ $I_{PP}$ | Peak Pulse Current | Reverse Leakage @ $V_{RWM}$ |
|----------------|---------------|---------------------|----|---------------------------|---------------------------|--------------|-------------------------------------|--------------------|-----------------------------|
| Unidirectional | Bidirectional | UNI                 | BI | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| SMBJ300A-AT    | SMBJ300CA-AT  | QE                  | FE | 300.0                     | 335.00~371.00             | 1            | 486.0                               | 1.3                | 1                           |
| SMBJ350A-AT    | SMBJ350CA-AT  | QG                  | FG | 350.0                     | 391.00~432.00             | 1            | 567.0                               | 1.1                | 1                           |
| SMBJ400A-AT    | SMBJ400CA-AT  | QK                  | FK | 400.0                     | 447.00~494.00             | 1            | 648.0                               | 0.9                | 1                           |
| SMBJ440A-AT    | SMBJ440CA-AT  | QM                  | FM | 440.0                     | 492.00~543.00             | 1            | 713.0                               | 0.9                | 1                           |

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

### Marking Code



### Part Number Code



**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**



Recommended Conditions

| Profile Feature   | Pb-Free Assembly                 |
|---|----------------------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )   | 3°C/second max.                  |
| Preheat<br>-Temperature Min ( $T_{S \min}$ )<br>-Temperature Max ( $T_{S \max}$ )<br>-Time (min to max) ( $t_s$ ) | 150°C<br>200°C<br>60-180 seconds |
| $T_{S \max}$ to $T_L$<br>-Ramp-up Rate  | 3°C/second max.                  |
| Time maintained above:<br>-Temperature ( $T_L$ )<br>-Time ( $t_L$ )   | 217°C<br>60-150 seconds          |
| Peak Temperature ( $T_P$ )  | 260°C                            |
| Time within 5°C of actual Peak Temperature ( $t_p$ )  | 20-40 seconds                    |
| Ramp-down Rate  | 6°C/second max.                  |
| Time 25°C to Peak Temperature   | 8 minutes max.                   |

### Ordering Code for Different Package

7 inch reel package: Add suffix "/TR7" at the end of the part number, such as SMBJ15A-AT/TR7

13 inch reel package: Add suffix "/TR13" at the end of the part number, such as SMBJ40CA-AT/TR13

### Packaging

| Tape             |  | Symbol            | Dimension (mm) |
|------------------|--|-------------------|----------------|
|                  |  | W                 | 12.00±0.20     |
|                  |  | P0                | 4.00±0.10      |
|                  |  | P1                | 8.00±0.10      |
|                  |  | P2                | 2.00±0.10      |
|                  |  | D0                | Φ1.55±0.10     |
|                  |  | D1                | Φ1.5±0.10      |
|                  |  | E                 | 1.75±0.10      |
|                  |  | F                 | 5.50±0.10      |
|                  |  | A0                | 3.86±0.15      |
|                  |  | B0                | 5.65±0.10      |
|                  |  | K0                | 2.75±0.15      |
|                  |  | T                 | 0.25±0.05      |
|                  |  | D2                | Φ178.0±2.0     |
|                  |  | D3                | Φ50.0Min.      |
|                  |  | D4                | Φ13.0±0.5      |
|                  |  | W1                | 16.0±2.0       |
| Quantity: 500PCS |  |                   |                |
|                  |  | D5                | Φ330.0±2.0     |
|                  |  | D6                | Φ13.5±0.5      |
|                  |  | H                 | 2.5±1.0        |
|                  |  | W2                | 16.0±2.0       |
|                  |  | Quantity: 3000PCS |                |
|                  |  |                   |                |

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