



# THE DATASHEET OF SMBJ350



**SMBJ Series**



**Agency Approvals**

| Agency | Agency File Number |
|--------|--------------------|
|        | E230531            |

**Maximum Ratings and Thermal Characteristics**  
(T<sub>A</sub> = 25°C unless otherwise noted)

| Parameter   | Symbol           | Value      | Unit |
|---|------------------|------------|------|
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4) (Note 1),(Note 2)-Single Die Parts            | P <sub>PPM</sub> | 600        | W    |
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4) (Note 1), (Note 2)-Stacked Die Parts (Note 5) | P <sub>PPM</sub> | 800        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50°C   | P <sub>D</sub>   | 5.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)  | I <sub>FSM</sub> | 100        | A    |
| Maximum Instantaneous Forward Voltage at 50A for Unidirectional Only (Note 4)                                       | V <sub>F</sub>   | 3.5/5.0    | V    |
| Operating Temperature Range   | T <sub>J</sub>   | -65 to 150 | °C   |
| Storage Temperature Range   | T <sub>STG</sub> | -65 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead   | R <sub>θJL</sub> | 20         | °C/W |
| Typical Thermal Resistance Junction to Ambient  | R <sub>θJA</sub> | 100        | °C/W |

- Notes:**
1. Non-repetitive current pulse, per Fig. 4 and derated above T<sub>J</sub> (initial) = 25°C per Fig. 3.
  2. Mounted on copper pad area of 0.2x0.2" (5.0 x 5.0mm) to each terminal.
  3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.
  4. V<sub>F</sub> < 3.5V for single die parts and V<sub>F</sub> < 5.0V for stacked-die parts.
  5. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.

**Functional Diagram**



**Description**

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

**Features**

- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA when V<sub>BR</sub> min > 12V
- For surface mounted applications to optimize board space
- Low profile package
- 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 30kV(Air), 30kV (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
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to VBR min
- 600W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- High temperature to reflow soldering guaranteed: 260°C/30sec
- V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub> @ 25°C x (1 + α T x (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability classification V-0
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- 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)
- UL Recognized to ANSI/UL 497B: Protectors for Data Communications and Fire-Alarm Circuits.

**Applications**

TVS components are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

**Electrical Characteristics** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking |    | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | Maximum Temperature coefficient of $V_{BR}$ (%/C) | Agency Approval  |
|-------------------|------------------|---------|----|---|--|--------|-------------------------|---|---|---|---|---|
|                   |                  | UNI     | BI |   | MIN  | MAX    |                         |   |   |   |   |   |
| SMBJ5.0A          | SMBJ5.0CA        | KE      | AE | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2   | 65.3                                    | 800   | 0.041   | X   |
| SMBJ6.0A          | SMBJ6.0CA        | KG      | AG | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3  | 58.3                                    | 800   | 0.046   | X   |
| SMBJ6.5A          | SMBJ6.5CA        | KK      | AK | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2  | 53.6                                    | 500   | 0.052   | X   |
| SMBJ7.0A          | SMBJ7.0CA        | KM      | AM | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0  | 50.0                                    | 200   | 0.058   | X   |
| SMBJ7.5A          | SMBJ7.5CA        | KP      | AP | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9  | 46.6                                    | 100   | 0.061   | X   |
| SMBJ8.0A          | SMBJ8.0CA        | KR      | AR | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6  | 44.2                                    | 50  | 0.064   | X   |
| SMBJ8.5A          | SMBJ8.5CA        | KT      | AT | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4  | 41.7                                    | 20  | 0.066   | X   |
| SMBJ9.0A          | SMBJ9.0CA        | KV      | AV | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4  | 39.0                                    | 10  | 0.069   | X   |
| SMBJ10A           | SMBJ10CA         | KX      | AX | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0  | 35.3                                    | 5   | 0.071   | X   |
| SMBJ11A           | SMBJ11CA         | KZ      | AZ | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2  | 33.0                                    | 1   | 0.074   | X   |
| SMBJ12A           | SMBJ12CA         | LE      | BE | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9  | 30.2                                    | 1   | 0.075   | X   |
| SMBJ13A           | SMBJ13CA         | LG      | BG | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5  | 28.0                                    | 1   | 0.076   | X   |
| SMBJ14A           | SMBJ14CA         | LK      | BK | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2  | 25.9                                    | 1   | 0.080   | X   |
| SMBJ15A           | SMBJ15CA         | LM      | BM | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4  | 24.6                                    | 1   | 0.083   | X   |
| SMBJ16A           | SMBJ16CA         | LP      | BP | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0  | 23.1                                    | 1   | 0.084   | X   |
| SMBJ17A           | SMBJ17CA         | LR      | BR | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6  | 21.8                                    | 1   | 0.085   | X   |
| SMBJ18A           | SMBJ18CA         | LT      | BT | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2  | 20.6                                    | 1   | 0.088   | X   |
| SMBJ20A           | SMBJ20CA         | LV      | BV | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4  | 18.6                                    | 1   | 0.091   | X   |
| SMBJ22A           | SMBJ22CA         | LX      | BX | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5  | 16.9                                    | 1   | 0.092   | X   |
| SMBJ24A           | SMBJ24CA         | LZ      | BZ | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9  | 15.5                                    | 1   | 0.092   | X   |
| SMBJ26A           | SMBJ26CA         | ME      | CE | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1  | 14.3                                    | 1   | 0.093   | X   |
| SMBJ28A           | SMBJ28CA         | MG      | CG | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4  | 13.3                                    | 1   | 0.094   | X   |
| SMBJ30A           | SMBJ30CA         | MK      | CK | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4  | 12.4                                    | 1   | 0.096   | X   |
| SMBJ33A           | SMBJ33CA         | MM      | CM | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3  | 11.3                                    | 1   | 0.097   | X   |
| SMBJ36A           | SMBJ36CA         | MP      | CP | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1  | 10.4                                    | 1   | 0.098   | X   |
| SMBJ40A           | SMBJ40CA         | MR      | CR | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5  | 9.3                                     | 1   | 0.099   | X   |
| SMBJ43A           | SMBJ43CA         | MT      | CT | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4  | 8.7                                     | 1   | 0.100   | X   |
| SMBJ45A           | SMBJ45CA         | MV      | CV | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7  | 8.3                                     | 1   | 0.101   | X   |
| SMBJ48A           | SMBJ48CA         | MX      | CX | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4  | 7.8                                     | 1   | 0.101   | X   |
| SMBJ51A           | SMBJ51CA         | MZ      | CZ | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4  | 7.3                                     | 1   | 0.101   | X   |
| SMBJ54A           | SMBJ54CA         | NE      | DE | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1  | 6.9                                     | 1   | 0.102   | X   |
| SMBJ58A           | SMBJ58CA         | NG      | DG | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6  | 6.5                                     | 1   | 0.103   | X   |
| SMBJ60A           | SMBJ60CA         | NK      | DK | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8  | 6.2                                     | 1   | 0.103   | X   |
| SMBJ64A           | SMBJ64CA         | NM      | DM | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0   | 5.9                                     | 1   | 0.104   | X   |
| SMBJ70A           | SMBJ70CA         | NP      | DP | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0   | 5.3                                     | 1   | 0.105   | X   |
| SMBJ75A           | SMBJ75CA         | NR      | DR | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0   | 5.0                                     | 1   | 0.106   | X   |
| SMBJ78A           | SMBJ78CA         | NT      | DT | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0   | 4.8                                     | 1   | 0.106   | X   |
| SMBJ85A           | SMBJ85CA         | NV      | DV | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0   | 4.4                                     | 1   | 0.106   | X   |
| SMBJ90A           | SMBJ90CA         | NX      | DX | 90.0                                    | 100.00                                     | 111.00 | 1                       | 146.0   | 4.1                                     | 1   | 0.107   | X   |
| SMBJ100A          | SMBJ100CA        | NZ      | DZ | 100.0                                   | 111.00                                     | 123.00 | 1                       | 162.0   | 3.7                                     | 1   | 0.107   | X   |
| SMBJ110A          | SMBJ110CA        | PE      | EE | 110.0                                   | 122.00                                     | 135.00 | 1                       | 177.0   | 3.4                                     | 1   | 0.107   | X   |
| SMBJ120A          | SMBJ120CA        | PG      | EG | 120.0                                   | 133.00                                     | 147.00 | 1                       | 193.0   | 3.1                                     | 1   | 0.108   | X   |
| SMBJ130A          | SMBJ130CA        | PK      | EK | 130.0                                   | 144.00                                     | 159.00 | 1                       | 209.0   | 2.9                                     | 1   | 0.108   | X   |
| SMBJ150A          | SMBJ150CA        | PM      | EM | 150.0                                   | 167.00                                     | 185.00 | 1                       | 243.0   | 2.5                                     | 1   | 0.108   | X   |
| SMBJ160A          | SMBJ160CA        | PP      | EP | 160.0                                   | 178.00                                     | 197.00 | 1                       | 259.0   | 2.3                                     | 1   | 0.108   | X   |
| SMBJ170A          | SMBJ170CA        | PR      | ER | 170.0                                   | 189.00                                     | 209.00 | 1                       | 275.0   | 2.2                                     | 1   | 0.108   | X   |
| SMBJ180A          | SMBJ180CA        | PT      | ET | 180.0                                   | 201.00                                     | 222.00 | 1                       | 292.0   | 2.1                                     | 1   | 0.108   | X   |
| SMBJ188A          | SMBJ188CA        | PB      | EB | 188.0                                   | 209.00                                     | 231.00 | 1                       | 304.0   | 2.0                                     | 1   | 0.110   | X   |
| SMBJ200A          | SMBJ200CA        | PV      | EV | 200.0                                   | 224.00                                     | 247.00 | 1                       | 324.0   | 1.9                                     | 1   | 0.110   | X   |
| SMBJ220A          | SMBJ220CA        | PX      | EX | 220.0                                   | 246.00                                     | 272.00 | 1                       | 356.0   | 1.7                                     | 1   | 0.110   | X   |
| SMBJ250A          | SMBJ250CA        | PZ      | EZ | 250.0                                   | 279.00                                     | 309.00 | 1                       | 405.0   | 1.5                                     | 1   | 0.110   | X   |
| SMBJ300A*         | SMBJ300CA*       | QE      | FE | 300.0                                   | 335.00                                     | 371.00 | 1                       | 486.0   | 1.7                                     | 1   | 0.112   | X   |
| SMBJ350A*         | SMBJ350CA*       | QG      | FG | 350.0                                   | 391.00                                     | 432.00 | 1                       | 567.0   | 1.5                                     | 1   | 0.112   | X   |
| SMBJ400A*         | SMBJ400CA*       | QK      | FK | 400.0                                   | 447.00                                     | 494.00 | 1                       | 648.0   | 1.3                                     | 1   | 0.112   | X   |
| SMBJ440A*         | SMBJ440CA*       | QM      | FM | 440.0                                   | 492.00                                     | 543.00 | 1                       | 713.0   | 1.1                                     | 1   | 0.112   | X   |

**Notes:**

For bidirectional type having  $V_R$  of 10 volts and less, the  $I_R$  limit is double.  
 For stack-die parts, use \* to label the part number.

**I-V Curve Characteristics**



- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_s$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_s$ )
- $V_c$  Clamping Voltage** – Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)
- $I_R$  Reverse Leakage Current** – Current measured at  $V_R$
- $V_F$  Forward Voltage Drop for Uni-directional**

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

**Figure 1 - TVS Transients Clamping Waveform**



**Figure 2 - Peak Pulse Power Rating**



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

**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 Peak Forward Surge Current Uni-Directional Only**



**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



**Soldering Parameters**

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| <b>Reflow Condition</b>  |                                    | Lead-free assembly      |
| <b>Pre Heat</b>  | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 120 secs           |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b> |                                    | 3°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 3°C/second max          |
| <b>Reflow</b>  | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Time (min to max) ( $t_L$ )      | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                             |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 30 seconds max          |
| <b>Ramp-down Rate</b>  |                                    | 6°C/second max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>   |                                    | 260°C                   |



**Physical Specifications**

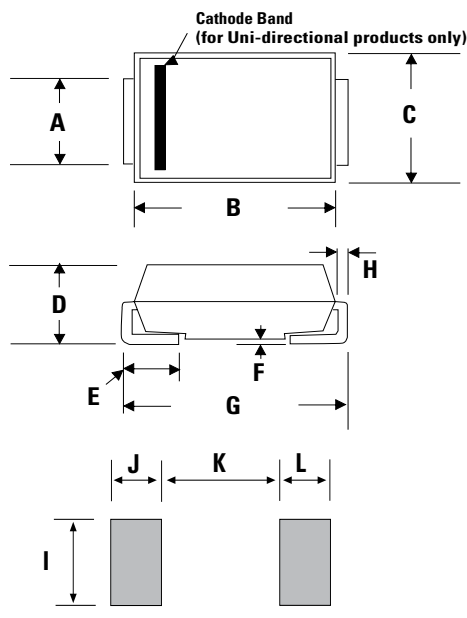
|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.003 ounce, 0.093 grams  |
| <b>Case</b>     | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except Bidirectional                   |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102                |

**Environmental Specifications**

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

**Dimensions**

**DO-214AA (SMB J-Bend)**



| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.076  | 0.086 | 1.930       | 2.200 |
| B          | 0.160  | 0.187 | 4.060       | 4.750 |
| C          | 0.130  | 0.155 | 3.300       | 3.940 |
| D          | 0.078  | 0.103 | 1.990       | 2.610 |
| E          | 0.030  | 0.060 | 0.760       | 1.520 |
| F          | -      | 0.008 | -           | 0.203 |
| G          | 0.205  | 0.220 | 5.210       | 5.590 |
| H          | 0.006  | 0.012 | 0.152       | 0.305 |
| I          | 0.089  | -     | 2.260       | -     |
| J          | 0.085  | -     | 2.160       | -     |
| K          | -      | 0.107 | -           | 2.740 |
| L          | 0.085  | -     | 2.160       | -     |

### Part Numbering System



### Part Marking System



### Packaging



| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| SMBJxxxXX   | DO-214AA          | 3000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

### Tape and Reel Specification



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