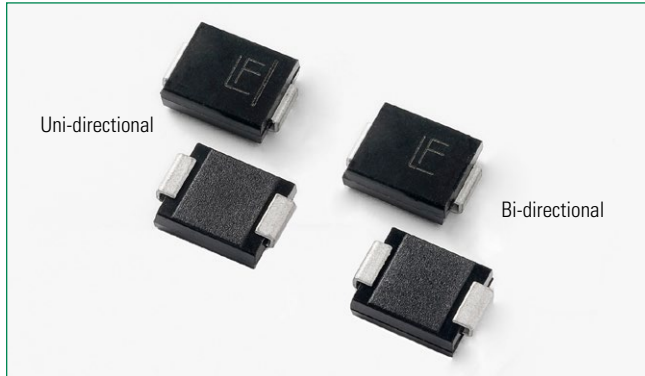




# THE DATASHEET OF SMCJ51CA-HRA



**SMCJ-HRA 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 at T <sub>A</sub> = 25°C by 10/1000µs waveform (Fig. 1)(Note 1), (Note 2) | P <sub>PPM</sub>                  | 1500       | W    |
| Power Dissipation on infinite heat sink at T <sub>A</sub> = 50°C                                       | P <sub>M(AV)</sub>                | 6.5        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                       | I <sub>FSM</sub>                  | 200        | A    |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only (Note 4)                         | V <sub>F</sub>                    | 3.5/5.0    | V    |
| Operating Junction and Storage Temperature Range   | T <sub>J</sub> , T <sub>STG</sub> | -65 to 150 | °C   |
| Typical Thermal Resistance Junction to Lead  | R <sub>θJL</sub>                  | 15         | °C/W |
| Typical Thermal Resistance Junction to Ambient   | R <sub>θJA</sub>                  | 75         | °C/W |

- Notes:**
1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub> = 25°C per Fig. 2.
  2. Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) 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 V<sub>BR</sub> ≤ 200V and V<sub>F</sub><5.0V for V<sub>BR</sub> ≥ 201V.

**Functional Diagram**



**Description**

The SMCJ-HRA High Reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events. These are available with a variety of up-screening options for enhanced reliability.

**Features**

- High reliability devices with fabrication and assembly lots traceability
- Enhanced reliability screening options are available in reference to MIL-PRF-19500. Refer to screen process table for more detail on screening options
- For surface mounted applications to optimize board space
- Low profile package
- Built-in strain relief
- V<sub>BR</sub> @T<sub>J</sub> = V<sub>BR</sub> @25°C x (1 + αT x (T<sub>J</sub> - 25)) (αT: Temperature Coefficient)
- Glass passivated chip junction
- 1500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles): 0.01 %
- Fast response time: typically less than 1.0ps from 0V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA above 12V
- High Temperature soldering guaranteed: 260°C/40 seconds at terminals
- Plastic package has Underwriters laboratory flammability 94V-0
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01
- Recognized to UL 497B as an Isolated Loop Circuit Protector

**Applications**

SMCJ-HRA devices are ideal for the high reliability 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

| 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 $I_R$ @ $V_R$ ( $\mu$ A) | Agency Approval  |
|-------------------|------------------|---------|------|---|--|--------|-------------------------|---|---|--|---|
|                   |                  | Uni     | Bi   |   | Min  | Max    |                         |   |   |  |   |
| SMCJ5.0A-HRA      | SMCJ5.0CA-HRA    | GDEH    | BDEH | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2   | 163.0                                   | 800  | X   |
| SMCJ6.0A-HRA      | SMCJ6.0CA-HRA    | GDGH    | BDGH | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3  | 145.7                                   | 800  | X   |
| SMCJ6.5A-HRA      | SMCJ6.5CA-HRA    | GDKH    | BDKH | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2  | 134.0                                   | 500  | X   |
| SMCJ7.0A-HRA      | SMCJ7.0CA-HRA    | GDMH    | BDMH | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0  | 125.0                                   | 200  | X   |
| SMCJ7.5A-HRA      | SMCJ7.5CA-HRA    | GDPH    | BDPH | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9  | 116.3                                   | 100  | X   |
| SMCJ8.0A-HRA      | SMCJ8.0CA-HRA    | GDRH    | BDRH | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6  | 110.3                                   | 50   | X   |
| SMCJ8.5A-HRA      | SMCJ8.5CA-HRA    | GDTH    | BDTH | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4  | 104.2                                   | 20   | X   |
| SMCJ9.0A-HRA      | SMCJ9.0CA-HRA    | GDVH    | BDVH | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4  | 97.4                                    | 10   | X   |
| SMCJ10A-HRA       | SMCJ10CA-HRA     | GDXH    | BDXH | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0  | 88.3                                    | 5  | X   |
| SMCJ11A-HRA       | SMCJ11CA-HRA     | GDZH    | BDZH | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2  | 82.5                                    | 1  | X   |
| SMCJ12A-HRA       | SMCJ12CA-HRA     | GEEH    | BEEH | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9  | 75.4                                    | 1  | X   |
| SMCJ13A-HRA       | SMCJ13CA-HRA     | GEGH    | BEGH | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5  | 69.8                                    | 1  | X   |
| SMCJ14A-HRA       | SMCJ14CA-HRA     | GEKH    | BEKH | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2  | 64.7                                    | 1  | X   |
| SMCJ15A-HRA       | SMCJ15CA-HRA     | GEMH    | BEMH | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4  | 61.5                                    | 1  | X   |
| SMCJ16A-HRA       | SMCJ16CA-HRA     | GEPH    | BEPH | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0  | 57.7                                    | 1  | X   |
| SMCJ17A-HRA       | SMCJ17CA-HRA     | GERH    | BERH | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6  | 54.4                                    | 1  | X   |
| SMCJ18A-HRA       | SMCJ18CA-HRA     | GETH    | BETH | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2  | 51.4                                    | 1  | X   |
| SMCJ20A-HRA       | SMCJ20CA-HRA     | GEVH    | BEVH | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4  | 46.3                                    | 1  | X   |
| SMCJ22A-HRA       | SMCJ22CA-HRA     | GEXH    | BEXH | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5  | 42.3                                    | 1  | X   |
| SMCJ24A-HRA       | SMCJ24CA-HRA     | GEZH    | BEZH | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9  | 38.6                                    | 1  | X   |
| SMCJ26A-HRA       | SMCJ26CA-HRA     | GFEH    | BFEH | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1  | 35.7                                    | 1  | X   |
| SMCJ28A-HRA       | SMCJ28CA-HRA     | GFGH    | BFGH | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4  | 33.1                                    | 1  | X   |
| SMCJ30A-HRA       | SMCJ30CA-HRA     | GFKH    | BFKH | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4  | 31.0                                    | 1  | X   |
| SMCJ33A-HRA       | SMCJ33CA-HRA     | GFMH    | BFMH | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3  | 28.2                                    | 1  | X   |
| SMCJ36A-HRA       | SMCJ36CA-HRA     | GFPH    | BFPH | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1  | 25.9                                    | 1  | X   |
| SMCJ40A-HRA       | SMCJ40CA-HRA     | GFRH    | BFRH | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5  | 23.3                                    | 1  | X   |
| SMCJ43A-HRA       | SMCJ43CA-HRA     | GFTH    | BFTH | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4  | 21.7                                    | 1  | X   |
| SMCJ45A-HRA       | SMCJ45CA-HRA     | GFVH    | BFVH | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7  | 20.6                                    | 1  | X   |
| SMCJ48A-HRA       | SMCJ48CA-HRA     | GFXH    | BFXH | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4  | 19.4                                    | 1  | X   |
| SMCJ51A-HRA       | SMCJ51CA-HRA     | GFZH    | BFZH | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4  | 18.2                                    | 1  | X   |
| SMCJ54A-HRA       | SMCJ54CA-HRA     | GGEH    | BGEH | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1  | 17.3                                    | 1  | X   |
| SMCJ58A-HRA       | SMCJ58CA-HRA     | GGGH    | BGGH | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6  | 16.1                                    | 1  | X   |
| SMCJ60A-HRA       | SMCJ60CA-HRA     | GGKH    | BGKH | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8  | 15.5                                    | 1  | X   |
| SMCJ64A-HRA       | SMCJ64CA-HRA     | GGMH    | BGMH | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0   | 14.6                                    | 1  | X   |
| SMCJ70A-HRA       | SMCJ70CA-HRA     | GGPH    | BGPH | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0   | 13.3                                    | 1  | X   |
| SMCJ75A-HRA       | SMCJ75CA-HRA     | GGRH    | BGRH | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0   | 12.4                                    | 1  | X   |
| SMCJ78A-HRA       | SMCJ78CA-HRA     | GGTH    | BGTH | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0   | 11.9                                    | 1  | X   |
| SMCJ85A-HRA       | SMCJ85CA-HRA     | GGVH    | BGVH | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0   | 11.0                                    | 1  | X   |
| SMCJ90A-HRA       | SMCJ90CA-HRA     | GGXH    | BGXH | 90.0                                    | 100.00                                     | 111.00 | 1                       | 146.0   | 10.3                                    | 1  | X   |
| SMCJ100A-HRA      | SMCJ100CA-HRA    | GGZH    | BGZH | 100.0                                   | 111.00                                     | 123.00 | 1                       | 162.0   | 9.3                                     | 1  | X   |
| SMCJ110A-HRA      | SMCJ110CA-HRA    | GHEH    | BHEH | 110.0                                   | 122.00                                     | 135.00 | 1                       | 177.0   | 8.5                                     | 1  | X   |
| SMCJ120A-HRA      | SMCJ120CA-HRA    | GHGH    | BHGH | 120.0                                   | 133.00                                     | 147.00 | 1                       | 193.0   | 7.8                                     | 1  | X   |
| SMCJ130A-HRA      | SMCJ130CA-HRA    | GHKH    | BHKH | 130.0                                   | 144.00                                     | 159.00 | 1                       | 209.0   | 7.2                                     | 1  | X   |
| SMCJ150A-HRA      | SMCJ150CA-HRA    | GHHH    | BHHH | 150.0                                   | 167.00                                     | 185.00 | 1                       | 243.0   | 6.2                                     | 1  | X   |
| SMCJ160A-HRA      | SMCJ160CA-HRA    | GHPH    | BHPH | 160.0                                   | 178.00                                     | 197.00 | 1                       | 259.0   | 5.8                                     | 1  | X   |
| SMCJ170A-HRA      | SMCJ170CA-HRA    | GHRH    | BHRH | 170.0                                   | 189.00                                     | 209.00 | 1                       | 275.0   | 5.5                                     | 1  | X   |

**Note:**  
 1.SMCJ-HRA voltage binning can be specified by customer's request via contacting Littelfuse service

### Screen Process

|   |                                   |
|---|-----------------------------------|
| 100% vision inspection  | MIL-STD-750 method 2074           |
| 100% High Temperature Storage Life (168hrs, 150C)   | MIL-STD-750 method 1031           |
| 100% X-RAY inspection   | MIL-STD-750 method 2076           |
| 100% Temperature cycle test (-55-150C, 20 cycles, dwell time 15 min)  | MIL-STD-750 method 1051           |
| 100% Reflow (2X)  | JEDEC J-STD-020                   |
| 100% surge test (2x)  | MIL-STD-750 method 4066           |
| 100% HTRB(150C, Bias=VR(80% breakdown voltage), 96hrs), for Bi-direction products, 96hrs for each direction | MIL-STD-750 method 1038           |
| Final electrical test( 100% 3 sigma limit, 100% dynamic test and PAT limit)                                 | MIL-STD-750 method 4016.4021.4011 |

**Note:** Up-screen program can be specified by customer's request via contacting Littelfuse service

### I-V Curve Characteristics



**P<sub>PPM</sub>** Peak Pulse Power Dissipation – Max power dissipation

**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation

**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)

**V<sub>C</sub>** Clamping Voltage – Peak voltage measured across the suppressor at a specified I<sub>PPM</sub> (peak impulse current)

**I<sub>R</sub>** Reverse Leakage Current – Current measured at V<sub>R</sub>

**V<sub>F</sub>** Forward Voltage Drop for Uni-directional

### Ratings and Characteristic Curves (T<sub>A</sub>=25°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 - Pulse Derating Curve**



**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**



**Figure 6 - Steady State Power Dissipation Derating Curve**



**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



**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 – 180 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) ( $t_p$ )      | 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>   |                                    | 20 – 40 seconds         |
| <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>   |                                    | 280°C                   |



**Physical Specifications**

|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.007 ounce, 0.21 grams   |
| <b>Case</b>     | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes positive end (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>Thermal Shock</b>      | JESD22-A106              |
| <b>MSL</b>                | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>              | JESD22-A101              |
| <b>RSH</b>                | JESD22-B106              |

**Dimensions**



| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.114  | 0.126 | 2.900       | 3.200 |
| <b>B</b>   | 0.260  | 0.280 | 6.600       | 7.110 |
| <b>C</b>   | 0.220  | 0.245 | 5.590       | 6.220 |
| <b>D</b>   | 0.079  | 0.103 | 2.060       | 2.620 |
| <b>E</b>   | 0.030  | 0.060 | 0.760       | 1.520 |
| <b>F</b>   | 0.002  | 0.008 | 0.051       | 0.203 |
| <b>G</b>   | 0.305  | 0.320 | 7.750       | 8.130 |
| <b>H</b>   | 0.006  | 0.012 | 0.152       | 0.305 |
| <b>I</b>   | 0.129  | -     | 3.300       | -     |
| <b>J</b>   | 0.094  | -     | 2.400       | -     |
| <b>K</b>   | -      | 0.165 | -           | 4.200 |
| <b>L</b>   | 0.094  | -     | 2.400       | -     |

**Part Numbering System**



**Part Marking System**



**Packaging**

| Part number     | Component Package | Quantity | Packaging Option                  | Packaging Specification |
|-----------------|-------------------|----------|-----------------------------------|-------------------------|
| SMCJxxxXX-HRA   | DO-214AB          | 3000     | Tape & Reel – 16mm tape /13" reel | EIA STD RS-481          |
| SMCJxxxXX-HRAT7 | DO-214AB          | 500      | Tape & Reel – 16mm tape /7" reel  | EIA STD RS-481          |

**Tape and Reel Specification**



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