



# THE DATASHEET OF SMDJ12A-HRA



# SMDJ-HRA Series

## Surface Mount – 3000W



### Additional Information



Resources



Accessories



Samples

### Agency Approvals

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

### Maximum Ratings and Thermal Characteristics

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

| Parameter  | Symbol          | Value      | Unit               |
|--|-----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A = 25^\circ\text{C}$ by 10/1000 $\mu\text{s}$ waveform (Fig.1) <sup>(Note 1), (Note 2)</sup> | $P_{PPM}$       | 3000       | W                  |
| Power Dissipation on infinite heat sink at $T_A = 50^\circ\text{C}$  | $P_{M(AV)}$     | 6.5        | W                  |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave <sup>(Note 3)</sup>  | $I_{FSM}$       | 300        | A                  |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only  | $V_F$           | 3.5        | V                  |
| Operating Junction and Storage Temperature Range   | $T_J, T_{STG}$  | -65 to 150 | $^\circ\text{C}$   |
| Typical Thermal Resistance Junction to Lead  | $R_{\theta JL}$ | 15         | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient   | $R_{\theta JA}$ | 75         | $^\circ\text{C/W}$ |

#### Notes:

- Non-repetitive current pulse, per Fig. 3 and derated above  $T_A = 25^\circ\text{C}$  per Fig. 2.
- Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.
- Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.

### Description

The SMDJ-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.

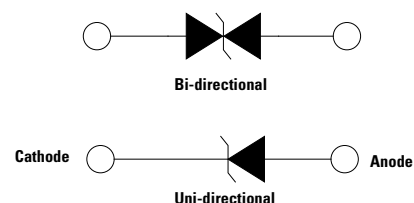
### Features & Benefits

- 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 in order to optimize board space
- Low profile package
- Built-in strain relief
- $VBR @ T_J = VBR @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha T$ : Temperature Coefficient)
- Glass passivated chip junction
- 3000W peak pulse power capability at 10/1000 $\mu\text{s}$  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 IR less than 2 $\mu\text{A}$  above 12V
- High Temperature soldering guaranteed: 260 $^\circ\text{C}$ /40 seconds at terminals
- Plastic package has Underwriters laboratory flammability 94V-0
- Meet MSL level1, per J-STD-020, LF maximum peak of 260 $^\circ\text{C}$
- 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

SMDJ-HRA devices are ideal for the high reliability protection of I/O Interfaces, VCC bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

### Functional Diagram



# SMDJ-HRA Series

## Surface Mount – 3000W

### 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    |                         |   |   |  |   |
| SMDJ5.0A-HRA      | SMDJ5.0CA-HRA    | RDEH    | DDEH | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2   | 326.1                                   | 800  | X   |
| SMDJ6.0A-HRA      | SMDJ6.0CA-HRA    | RDGH    | DDGH | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3  | 291.3                                   | 800  | X   |
| SMDJ6.5A-HRA      | SMDJ6.5CA-HRA    | RDKH    | DDKH | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2  | 267.9                                   | 500  | X   |
| SMDJ7.0A-HRA      | SMDJ7.0CA-HRA    | PDMH    | DDMH | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0  | 250.0                                   | 200  | X   |
| SMDJ7.5A-HRA      | SMDJ7.5CA-HRA    | PDPH    | DDPH | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9  | 232.6                                   | 100  | X   |
| SMDJ8.0A-HRA      | SMDJ8.0CA-HRA    | PDRH    | DDRH | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6  | 220.6                                   | 50   | X   |
| SMDJ8.5A-HRA      | SMDJ8.5CA-HRA    | PDTH    | DDTH | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4  | 208.3                                   | 20   | X   |
| SMDJ9.0A-HRA      | SMDJ9.0CA-HRA    | PDVH    | DDVH | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4  | 194.8                                   | 10   | X   |
| SMDJ10A-HRA       | SMDJ10CA-HRA     | PDXH    | DDXH | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0  | 176.5                                   | 5  | X   |
| SMDJ11A-HRA       | SMDJ11CA-HRA     | PDZH    | DDZH | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2  | 164.8                                   | 2  | X   |
| SMDJ12A-HRA       | SMDJ12CA-HRA     | PEEH    | DEEH | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9  | 150.8                                   | 2  | X   |
| SMDJ13A-HRA       | SMDJ13CA-HRA     | PEGH    | DEGH | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5  | 139.5                                   | 2  | X   |
| SMDJ14A-HRA       | SMDJ14CA-HRA     | PEKH    | DEKH | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2  | 129.3                                   | 2  | X   |
| SMDJ15A-HRA       | SMDJ15CA-HRA     | PEMH    | DEMH | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4  | 123.0                                   | 2  | X   |
| SMDJ16A-HRA       | SMDJ16CA-HRA     | PEPH    | DEPH | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0  | 115.4                                   | 2  | X   |
| SMDJ17A-HRA       | SMDJ17CA-HRA     | PERH    | DERH | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6  | 108.7                                   | 2  | X   |
| SMDJ18A-HRA       | SMDJ18CA-HRA     | PETH    | DETH | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2  | 102.7                                   | 2  | X   |
| SMDJ20A-HRA       | SMDJ20CA-HRA     | PEVH    | DEVH | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4  | 92.6                                    | 2  | X   |
| SMDJ22A-HRA       | SMDJ22CA-HRA     | PEXH    | DEXH | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5  | 84.5                                    | 2  | X   |
| SMDJ24A-HRA       | SMDJ24CA-HRA     | PEZH    | DEZH | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9  | 77.1                                    | 2  | X   |
| SMDJ26A-HRA       | SMDJ26CA-HRA     | PFEH    | DFEH | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1  | 71.3                                    | 2  | X   |
| SMDJ28A-HRA       | SMDJ28CA-HRA     | PFGH    | DFGH | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4  | 66.1                                    | 2  | X   |
| SMDJ30A-HRA       | SMDJ30CA-HRA     | PFKH    | DFKH | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4  | 62.0                                    | 2  | X   |
| SMDJ33A-HRA       | SMDJ33CA-HRA     | PFMH    | DFMH | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3  | 56.3                                    | 2  | X   |
| SMDJ36A-HRA       | SMDJ36CA-HRA     | PFPH    | DFPH | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1  | 51.6                                    | 2  | X   |
| SMDJ40A-HRA       | SMDJ40CA-HRA     | PFRH    | DFRH | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5  | 46.5                                    | 2  | X   |
| SMDJ43A-HRA       | SMDJ43CA-HRA     | PFTH    | DFTH | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4  | 43.2                                    | 2  | X   |
| SMDJ45A-HRA       | SMDJ45CA-HRA     | PFVH    | DFVH | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7  | 41.3                                    | 2  | X   |
| SMDJ48A-HRA       | SMDJ48CA-HRA     | PFXH    | DFXH | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4  | 38.8                                    | 2  | X   |
| SMDJ51A-HRA       | SMDJ51CA-HRA     | PFZH    | DFZH | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4  | 36.4                                    | 2  | X   |
| SMDJ54A-HRA       | SMDJ54CA-HRA     | RGEH    | DGEH | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1  | 34.4                                    | 2  | X   |
| SMDJ58A-HRA       | SMDJ58CA-HRA     | PGGH    | DGGH | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6  | 32.1                                    | 2  | X   |
| SMDJ60A-HRA       | SMDJ60CA-HRA     | PGKH    | DGKH | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8  | 31.0                                    | 2  | X   |
| SMDJ64A-HRA       | SMDJ64CA-HRA     | PGMH    | DGMH | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0   | 29.1                                    | 2  | X   |
| SMDJ70A-HRA       | SMDJ70CA-HRA     | PGPH    | DGPH | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0   | 26.5                                    | 2  | X   |
| SMDJ75A-HRA       | SMDJ75CA-HRA     | PGRH    | DGRH | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0   | 24.8                                    | 2  | X   |
| SMDJ78A-HRA       | SMDJ78CA-HRA     | PGTH    | DGTH | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0   | 23.8                                    | 2  | X   |
| SMDJ85A-HRA       | SMDJ85CA-HRA     | PGVH    | DGVH | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0   | 21.9                                    | 2  | X   |
| SMDJ90A-HRA       | SMDJ90CA-HRA     | PGXH    | DGXH | 90.0                                    | 100.00                                     | 111.00 | 1                       | 146.0   | 20.5                                    | 2  | X   |
| SMDJ100A-HRA      | SMDJ100CA-HRA    | PGZH    | DGZH | 100.0                                   | 111.00                                     | 123.00 | 1                       | 162.0   | 18.5                                    | 2  | X   |
| SMDJ110A-HRA      | SMDJ110CA-HRA    | PHEH    | DHEH | 110.0                                   | 122.00                                     | 135.00 | 1                       | 177.0   | 16.9                                    | 2  | X   |
| SMDJ120A-HRA      | SMDJ120CA-HRA    | PHGH    | DHGH | 120.0                                   | 133.00                                     | 147.00 | 1                       | 193.0   | 15.5                                    | 2  | X   |
| SMDJ130A-HRA      | SMDJ130CA-HRA    | PHKH    | DHKH | 130.0                                   | 144.00                                     | 159.00 | 1                       | 209.0   | 14.4                                    | 2  | X   |
| SMDJ150A-HRA      | SMDJ150CA-HRA    | PHMH    | DHMH | 150.0                                   | 167.00                                     | 185.00 | 1                       | 243.0   | 12.3                                    | 2  | X   |
| SMDJ170A-HRA      | SMDJ170CA-HRA    | PHRH    | DHRH | 170.0                                   | 189.00                                     | 209.00 | 1                       | 275.0   | 10.9                                    | 2  | X   |

**Note:**

1. SMDJ-HRA voltage binning can be specified by customer's request via contacting Littelfuse service

# SMDJ-HRA Series

## Surface Mount – 3000W

### Screen Process

|   |                                   |
|---|-----------------------------------|
| 100% Vision Inspection  | MIL-STD-750 method 2074           |
| 100% High Temperature Storage Life (168hrs,175°C)   | MIL-STD-750 method 1031           |
| 100% X-RAY inspection   | MIL-STD-750 method 2076           |
| 100% Temperature Cycle Test (-55 to 150°C, 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 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction at 96 hrs for Bi-directional products) | 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



# SMDJ-HRA Series

## Surface Mount – 3000W

### 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 Derating Curve



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



# SMDJ-HRA Series

## Surface Mount – 3000W

### 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) ( $t_s$ )      | 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>   |                                    | 260°C                   |



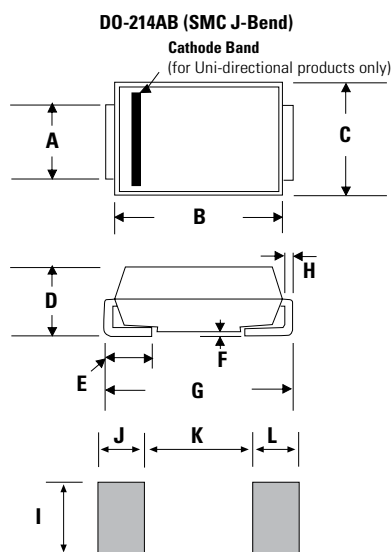
### Physical Specifications

|                 |   |
|-----------------|---|
| <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-A111              |

### Dimensions



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

# SMDJ-HRA Series

Surface Mount – 3000W

### Part Numbering System



### Part Marking System



### Packaging

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

### Tape and Reel Specification



# SMDJ-HRA Series

Surface Mount – 3000W

**RTCA/DO-160G Wave 3**



**RTCA/DO-160G Wave 4**



**RTCA/DO-160G Wave 5**



# SMDJ-HRA Series

## Surface Mount – 3000W

### Pin Injection Protection Per RTCA/DO-160G

| Part Number (Uni) | Part Number (Bi) | 25C    |      |                   |      |                    |      | 70C    |      |                   |      |                    |      | 120C   |      |                   |      |                    |      |
|-------------------|------------------|--------|------|-------------------|------|--------------------|------|--------|------|-------------------|------|--------------------|------|--------|------|-------------------|------|--------------------|------|
|                   |                  | Wave 3 |      | Wave 4 (6.4/69us) |      | Wave 5a (40/120us) |      | Wave 3 |      | Wave 4 (6.4/69us) |      | Wave 5a (40/120us) |      | Wave 3 |      | Wave 4 (6.4/69us) |      | Wave 5a (40/120us) |      |
|                   |                  | L5     | L3   | L4                | L5   | L3                 | L4   | L5     | L3   | L4                | L5   | L3                 | L4   | L5     | L3   | L4                | L5   | L3                 | L4   |
|                   |                  | 128A   | 60A  | 150A              | 320A | 300A               | 750A | 128A   | 60A  | 150A              | 320A | 300A               | 750A | 128A   | 60A  | 150A              | 320A | 300A               | 750A |
| SMDJ5.0A-HRA      | SMDJ5.0CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ6.0A-HRA      | SMDJ6.0CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ6.5A-HRA      | SMDJ6.5CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ7.0A-HRA      | SMDJ7.0CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ7.5A-HRA      | SMDJ7.5CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ8.0A-HRA      | SMDJ8.0CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ8.5A-HRA      | SMDJ8.5CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ9.0A-HRA      | SMDJ9.0CA-HRA    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ10A-HRA       | SMDJ10CA-HRA     | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | pass |
| SMDJ11A-HRA       | SMDJ11CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ12A-HRA       | SMDJ12CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ13A-HRA       | SMDJ13CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ14A-HRA       | SMDJ14CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ15A-HRA       | SMDJ15CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ16A-HRA       | SMDJ16CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ17A-HRA       | SMDJ17CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ18A-HRA       | SMDJ18CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ20A-HRA       | SMDJ20CA-HRA     | pass   | pass | pass              | pass | pass               | -    | pass   | pass | pass              | pass | pass               | pass | pass   | pass | pass              | pass | pass               | -    |
| SMDJ22A-HRA       | SMDJ22CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ24A-HRA       | SMDJ24CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ26A-HRA       | SMDJ26CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ28A-HRA       | SMDJ28CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ30A-HRA       | SMDJ30CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ33A-HRA       | SMDJ33CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ36A-HRA       | SMDJ36CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ40A-HRA       | SMDJ40CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ43A-HRA       | SMDJ43CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ45A-HRA       | SMDJ45CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ48A-HRA       | SMDJ48CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ51A-HRA       | SMDJ51CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ54A-HRA       | SMDJ54CA-HRA     | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ58A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ60A-HRA       | SMDJ60CA-HRA     | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ64A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ70A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ75A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ78A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ85A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ90A-HRA       | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ100A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ110A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ120A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ130A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ150A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |
| SMDJ170A-HRA      | -                | pass   | pass | -                 | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    | pass   | pass | pass              | -    | -                  | -    |

**Note:**

1. L1 = Level 1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5

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