

# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB



### 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 by 10/1000 $\mu\text{s}$ Waveform (Fig.1)(Note 1), (Note 2) | $P_{PPM}$       | 5000       | W                  |
| Power dissipation on infinite heatsink at $T_A = 50^\circ\text{C}$                       | $P_{M(AV)}$     | 6.5        | W                  |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                         | $I_{FSM}$       | 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. 4 and derated above  $T_J$  (initial) =  $25^\circ\text{C}$  per Fig. 3.
- Voltage of 6.0V–60V products's peak pulse power dissipation is 5000W, and 64V and 70V is 4500W. Bidirectional products 33V–58V are also 4500W.
- Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional components only, duty cycle=4 per minute maximum.
- Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.

### Functional Diagram



### Description

The 5.0SMDJxxS-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 upscreening 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 in order to optimize board space
- Low profile package
- Built-in strain relief
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha$ : Temperature Coefficient)
- Glass passivated chip junction
- 5000W 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  $V_{BR \text{ min}}$
- Excellent clamping capability
- Low incremental surge resistance
- Typical  $I_r$  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-O
- 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

5.0SMDJxxS-HRA components are ideal for the high reliability protection of I/O Interfaces, VCC bus and other vulnerable circuits.

# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB

### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi)  | Marking |       | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub> |      | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>pp</sub> (V) | Maximum Peak Pulse Current I <sub>pp</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (μA) | Agency Approval  |
|-------------------|-------------------|---------|-------|--|--|------|----------------------------------|---|--|--|---|
|                   |                   | UNI     | BI    |  | MIN  | MAX  |                                  |   |  |  |   |
| 5.0SMDJ6.0AS-HRA  | 5.0SMDJ6.0CAS-HRA | 5PABH   | 5BABH | 6.0  | 6.67   | 7.37 | 10                               | 10.3  | 485.4  | 800.0  | X   |
| 5.0SMDJ6.5AS-HRA  | 5.0SMDJ6.5CAS-HRA | 5PAEH   | 5BAEH | 6.5  | 7.22   | 7.98 | 10                               | 11.2  | 446.4  | 500.0  | X   |
| 5.0SMDJ7.0AS-HRA  | 5.0SMDJ7.0CAS-HRA | 5PAFH   | 5BAFH | 7.0  | 7.78   | 8.60 | 10                               | 12.0  | 416.7  | 200.0  | X   |
| 5.0SMDJ7.5AS-HRA  | 5.0SMDJ7.5CAS-HRA | 5PAGH   | 5BAGH | 7.5  | 8.33   | 9.21 | 1                                | 12.9  | 387.6  | 100.0  | X   |
| 5.0SMDJ8.0AS-HRA  | 5.0SMDJ8.0CAS-HRA | 5PAKH   | 5BAKH | 8.0  | 8.89   | 9.83 | 1                                | 13.6  | 367.6  | 50.0   | X   |
| 5.0SMDJ8.5AS-HRA  | 5.0SMDJ8.5CAS-HRA | 5PAMH   | 5BAMH | 8.5  | 9.44   | 10.4 | 1                                | 14.4  | 347.2  | 20.0   | X   |
| 5.0SMDJ9.0AS-HRA  | 5.0SMDJ9.0CAS-HRA | 5PAPH   | 5BAPH | 9.0  | 10.0   | 11.1 | 1                                | 15.4  | 324.7  | 10.0   | X   |
| 5.0SMDJ10AS-HRA   | 5.0SMDJ10CAS-HRA  | 5PARH   | 5BARH | 10.0   | 11.1   | 12.3 | 1                                | 17.0  | 294.1  | 5.0  | X   |
| 5.0SMDJ11AS-HRA   | 5.0SMDJ11CAS-HRA  | 5PATH   | 5BATH | 11.0   | 12.2   | 13.5 | 1                                | 18.2  | 274.7  | 2.0  | X   |
| 5.0SMDJ12AS-HRA   | 5.0SMDJ12CAS-HRA  | 5PAVH   | 5BAVH | 12.0   | 13.3   | 14.7 | 1                                | 19.9  | 251.3  | 2.0  | X   |
| 5.0SMDJ13AS-HRA   | 5.0SMDJ13CAS-HRA  | 5PAXH   | 5BAXH | 13.0   | 14.4   | 15.9 | 1                                | 21.5  | 232.6  | 2.0  | X   |
| 5.0SMDJ14AS-HRA   | 5.0SMDJ14CAS-HRA  | 5PAZH   | 5BAZH | 14.0   | 15.6   | 17.2 | 1                                | 23.2  | 215.5  | 2.0  | X   |
| 5.0SMDJ15AS-HRA   | 5.0SMDJ15CAS-HRA  | 5PBEH   | 5BBEH | 15.0   | 16.7   | 18.5 | 1                                | 24.4  | 204.9  | 2.0  | X   |
| 5.0SMDJ16AS-HRA   | 5.0SMDJ16CAS-HRA  | 5PBGH   | 5BBGH | 16.0   | 17.8   | 19.7 | 1                                | 26.0  | 192.3  | 2.0  | X   |
| 5.0SMDJ17AS-HRA   | 5.0SMDJ17CAS-HRA  | 5PBKH   | 5BBKH | 17.0   | 18.9   | 20.9 | 1                                | 27.6  | 181.2  | 2.0  | X   |
| 5.0SMDJ18AS-HRA   | 5.0SMDJ18CAS-HRA  | 5PBMH   | 5BBMH | 18.0   | 20.0   | 22.1 | 1                                | 29.2  | 171.2  | 2.0  | X   |
| 5.0SMDJ20AS-HRA   | 5.0SMDJ20CAS-HRA  | 5PBPH   | 5BBPH | 20.0   | 22.2   | 24.5 | 1                                | 32.4  | 154.3  | 2.0  | X   |
| 5.0SMDJ22AS-HRA   | 5.0SMDJ22CAS-HRA  | 5PBRH   | 5BBRH | 22.0   | 24.4   | 26.9 | 1                                | 35.5  | 140.8  | 2.0  | X   |
| 5.0SMDJ24AS-HRA   | 5.0SMDJ24CAS-HRA  | 5PBTH   | 5BBTH | 24.0   | 26.7   | 29.5 | 1                                | 38.9  | 128.5  | 2.0  | X   |
| 5.0SMDJ26AS-HRA   | 5.0SMDJ26CAS-HRA  | 5PBVH   | 5BBVH | 26.0   | 28.9   | 31.9 | 1                                | 42.1  | 118.8  | 2.0  | X   |
| 5.0SMDJ28AS-HRA   | 5.0SMDJ28CAS-HRA  | 5PBXH   | 5BBXH | 28.0   | 31.1   | 34.4 | 1                                | 45.4  | 110.1  | 2.0  | X   |
| 5.0SMDJ30AS-HRA   | 5.0SMDJ30CAS-HRA  | 5PBZH   | 5BBZH | 30.0   | 33.3   | 36.8 | 1                                | 48.4  | 103.3  | 2.0  | X   |
| 5.0SMDJ33AS-HRA   | -                 | 5PCBH   | -     | 33.0   | 36.7   | 40.6 | 1                                | 53.3  | 93.9   | 2.0  | X   |
| -                 | 5.0SMDJ33CAS-HRA  | -       | 5BCBH | 33.0   | 36.7   | 40.6 | 1                                | 53.3  | 84.4   | 2.0  | X   |
| 5.0SMDJ36AS-HRA   | -                 | 5PCEH   | -     | 36.0   | 40.0   | 44.2 | 1                                | 58.1  | 86.1   | 2.0  | X   |
| -                 | 5.0SMDJ36CAS-HRA  | -       | 5BCEH | 36.0   | 40.0   | 44.2 | 1                                | 58.1  | 77.5   | 2.0  | X   |
| 5.0SMDJ40AS-HRA   | -                 | 5PCFH   | -     | 40.0   | 44.4   | 49.1 | 1                                | 64.5  | 77.6   | 2.0  | X   |
| -                 | 5.0SMDJ40CAS-HRA  | -       | 5BCFH | 40.0   | 44.4   | 49.1 | 1                                | 64.5  | 69.8   | 2.0  | X   |
| 5.0SMDJ43AS-HRA   | -                 | 5PCGH   | -     | 43.0   | 47.8   | 52.8 | 1                                | 69.4  | 72.1   | 2.0  | X   |
| -                 | 5.0SMDJ43CAS-HRA  | -       | 5BCGH | 43.0   | 47.8   | 52.8 | 1                                | 69.4  | 64.8   | 2.0  | X   |
| 5.0SMDJ45AS-HRA   | -                 | 5PCKH   | -     | 45.0   | 50.0   | 55.3 | 1                                | 72.7  | 68.8   | 2.0  | X   |
| -                 | 5.0SMDJ45CAS-HRA  | -       | 5BCKH | 45.0   | 50.0   | 55.3 | 1                                | 72.7  | 61.9   | 2.0  | X   |
| 5.0SMDJ48AS-HRA   | -                 | 5PCMH   | -     | 48.0   | 53.3   | 58.9 | 1                                | 77.4  | 64.7   | 2.0  | X   |
| -                 | 5.0SMDJ48CAS-HRA  | -       | 5BCMh | 48.0   | 53.3   | 58.9 | 1                                | 77.4  | 58.1   | 2.0  | X   |
| 5.0SMDJ51AS-HRA   | -                 | 5PCPH   | -     | 51.0   | 56.7   | 62.7 | 1                                | 82.4  | 60.7   | 2.0  | X   |
| -                 | 5.0SMDJ51CAS-HRA  | -       | 5BCPH | 51.0   | 56.7   | 62.7 | 1                                | 82.4  | 54.6   | 2.0  | X   |
| 5.0SMDJ54AS-HRA   | -                 | 5PCRH   | -     | 54.0   | 60.0   | 66.3 | 1                                | 87.1  | 57.5   | 2.0  | X   |
| -                 | 5.0SMDJ54CAS-HRA  | -       | 5BCRH | 54.0   | 60.0   | 66.3 | 1                                | 87.1  | 51.7   | 2.0  | X   |
| 5.0SMDJ58AS-HRA   | -                 | 5PCTH   | -     | 58.0   | 64.4   | 71.2 | 1                                | 93.6  | 53.5   | 2.0  | X   |
| -                 | 5.0SMDJ58CAS-HRA  | -       | 5BCTH | 58.0   | 64.4   | 71.2 | 1                                | 93.6  | 48.1   | 2.0  | X   |
| 5.0SMDJ60AS-HRA   | -                 | 5PCVH   | -     | 60.0   | 66.7   | 73.7 | 1                                | 96.8  | 51.7   | 2.0  | X   |

## Notes:

- 5.0SMDJxxS-HRA voltage binning can be specified by customer's request via contacting Littelfuse service
- For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.

# 5.0SMDJxxS-HRA

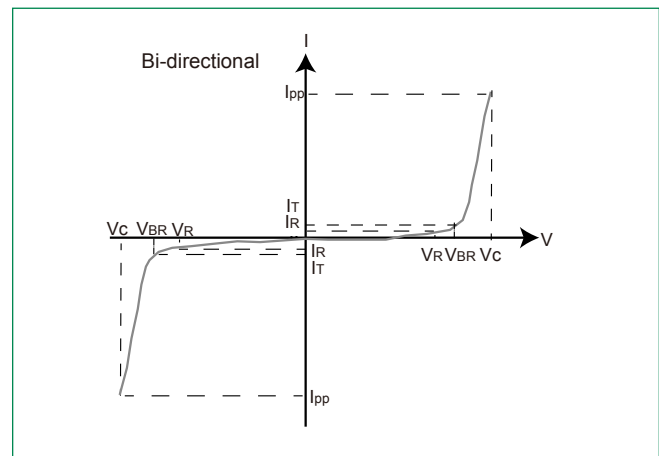
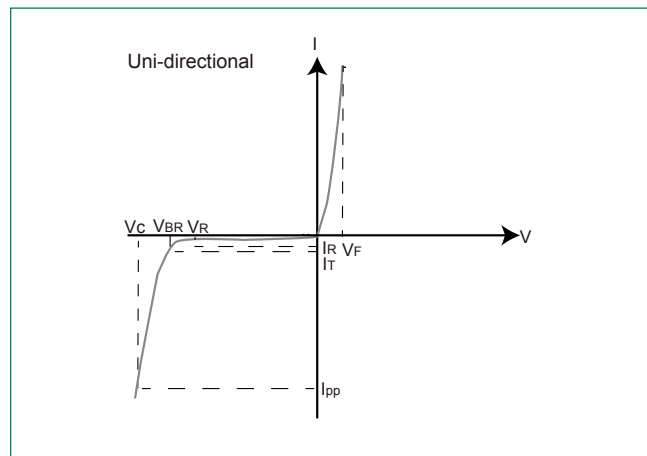
Surface Mount – 5000W – DO-214AB

## 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= $V_R$ (80% breakdown voltage, 96hrs, and each direction 96hrs 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

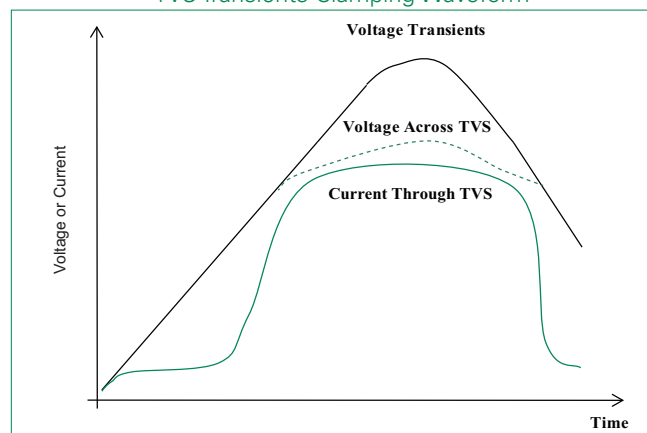
## I-V Curve Characteristics



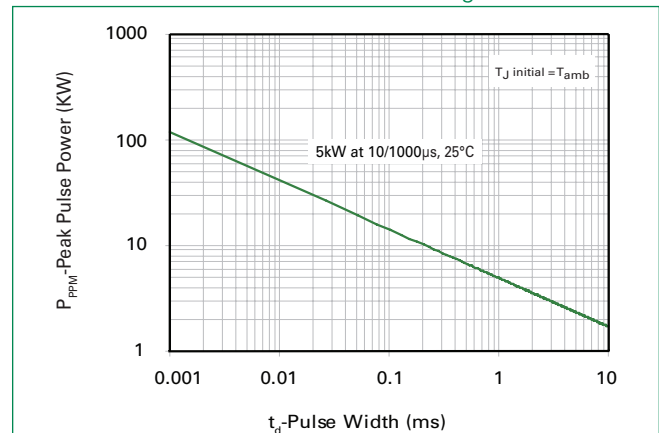
- $P_{PPM}$  **Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  **Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  **Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  **Clamping 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



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**Figure 3:**  
Peak Pulse Power Derating Curve



**Figure 4:**  
Pulse Waveform



**Figure 5:**  
Typical Junction Capacitance



**Figure 6:**  
Typical Transient Thermal Impedance



# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB

### 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_A</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>  |                                    | 30 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>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-214AB (SMC J-Bend)



| 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          | -      | 0.008 | -           | 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       | -     |

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## Surface Mount – 5000W – DO-214AB

### Part Numbering System



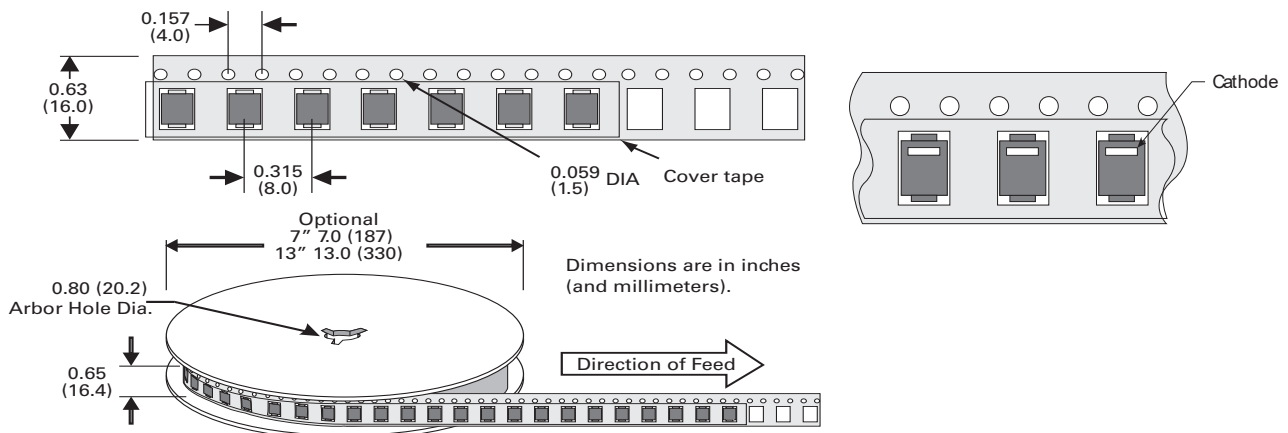
### Part Marking System



### Packing Options

| Part Number     | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-----------------|-------------------|----------|----------------------------------|-------------------------|
| 5.0SMDJxxS-HRA  | DO-214AB          | 3000     | Tape & Reel - 16mm tape/13" reel | EIA STD RS-481          |
| 5.0SMDJxxSHRAT7 | DO-214AB          | 500      | Tape & Reel - 16mm tape/7" reel  | EIA STD RS-481          |

### Tape and Reel Specification



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