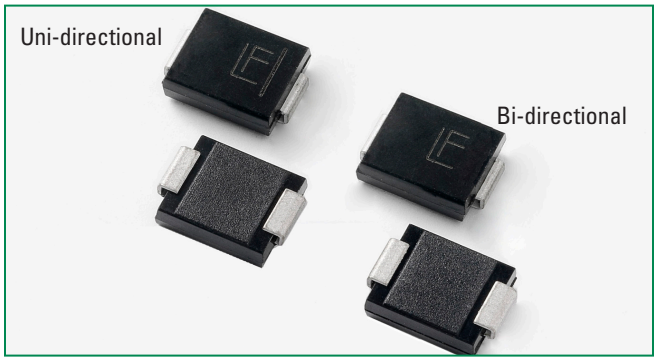
# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB




## Agency Approvals

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

## Maximum Ratings and Thermal Characteristics

($T_A$=25°C unless otherwise noted)

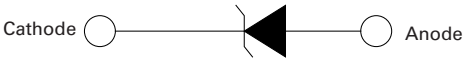
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Peak Pulse Power Dissipation by 10/1000µs Waveform (Fig.1)(Note 1), (Note 2) | $P_{PPM}$ | 5000 | W |
| Power dissipation on infinite heatsink at $T_A$ = 50 °C | $P_{M(AV)}$ | 6.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (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 | °C |
| Typical Thermal Resistance Junction to Lead | $R_{\theta JL}$ | 15 | °C/W |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 75 | °C/W |

**Notes:**

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

## Functional Diagram

Bi-directional




Uni-directional

## 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°C x (1+ $\alpha$T x ($T_J$ - 25)) ($\alpha$T:Temperature Coefficient)
- Glass passivated chip junction
- 5000W 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 $V_{BR}$ min
- Excellent clamping capability
- Low incremental surge resistance
- Typical $I_R$ less than 2µA above 12V
- High Temperature soldering guaranteed: 260°C/40 seconds at terminals
- Plastic package has Underwriters laboratory flammability 94V-O
- Meet MSL level1, per J-STD-020, LF maximun 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

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



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# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB

## Electrical Characteristics ($T_A$=25°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 $I_R$ @ $V_R$ (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:
1. 5.0SMDJxxS-HRA voltage binning can be specified by customer's request via contacting Littlefuse service
2. For bidirectional type having $V_R$ of 10 volts and less, the $I_R$ limit is double.



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# 5.0SMDJxxS-HRA

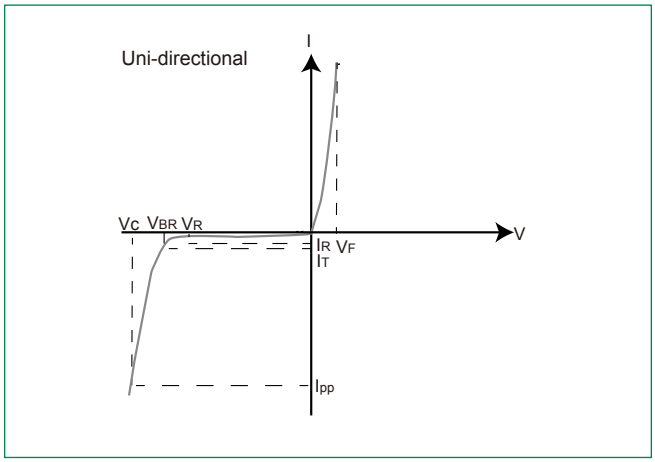
Surface Mount – 5000W – DO-214AB

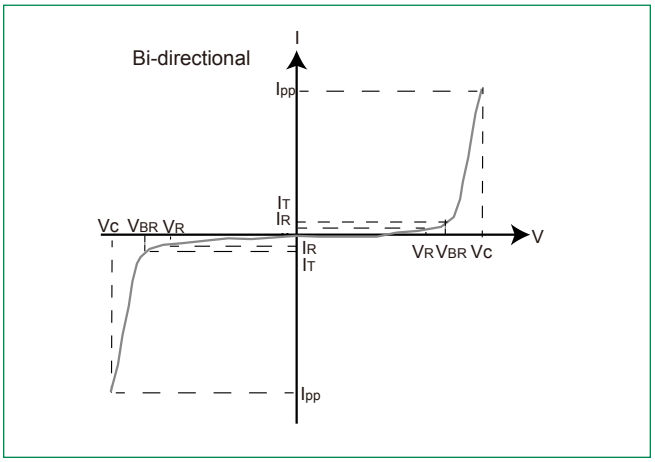
## Screen Process

| | |
|---|---|
| **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 to150°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 Littlefuse 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 though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** -- Peak voltage measured across the TVS at a specified Ippm (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°C unless otherwise noted)

**Figure 1:**
TVS Transients Clamping Waveform

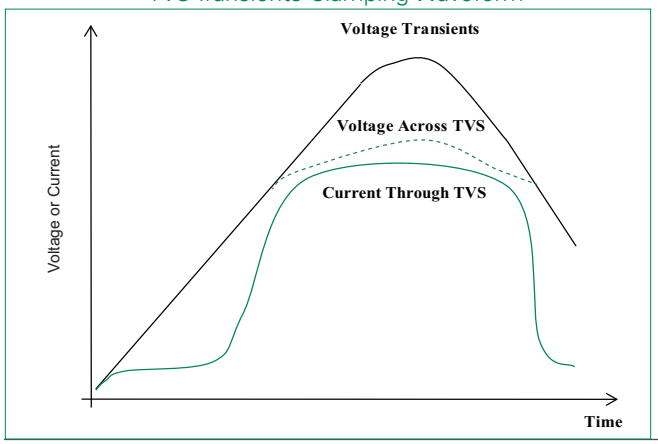
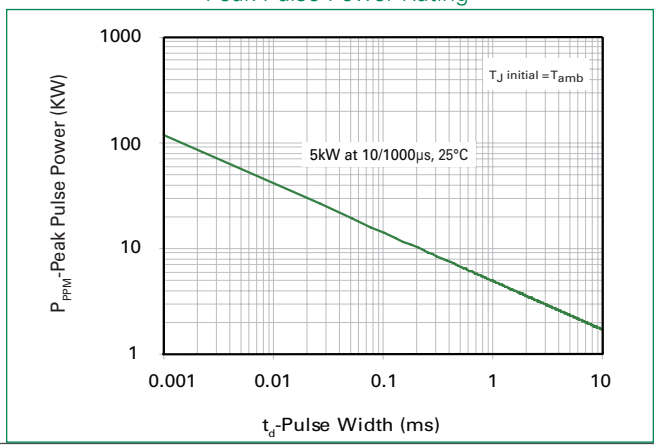



**Figure 2:**
Peak Pulse Power Rating

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# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB

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

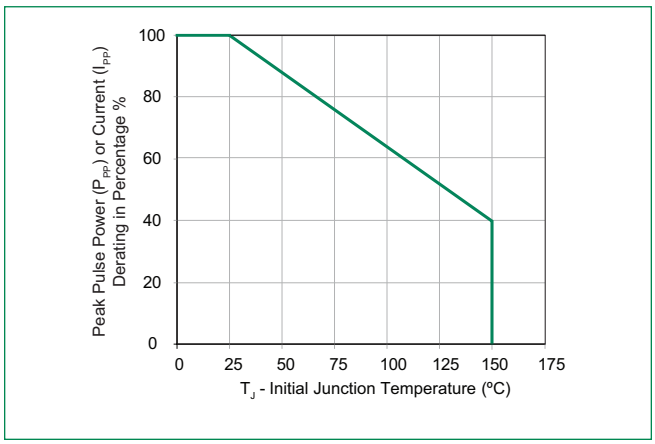



**Figure 4:**
Pulse Waveform

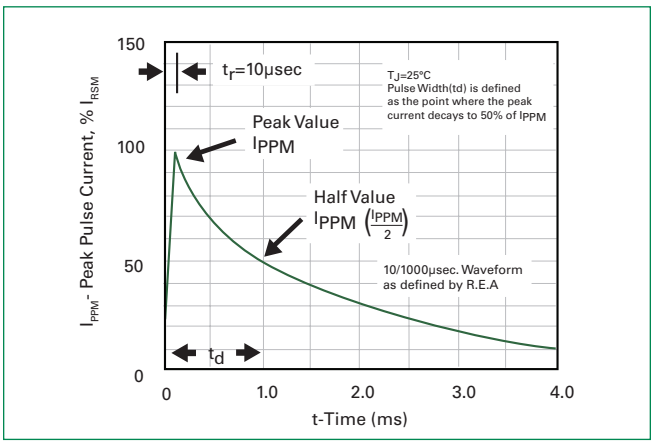



**Figure 5:**
Typical Junction Capacitance

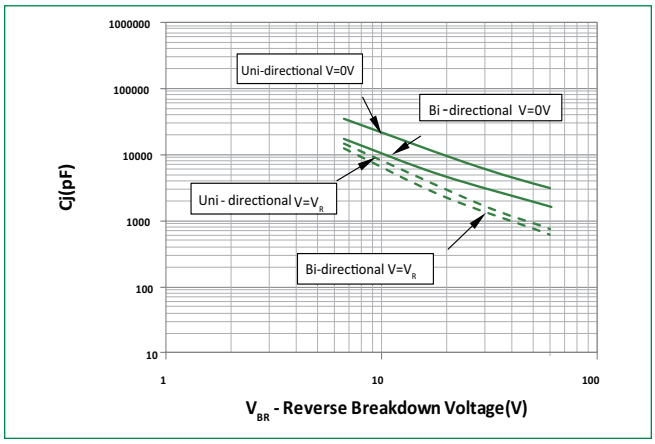
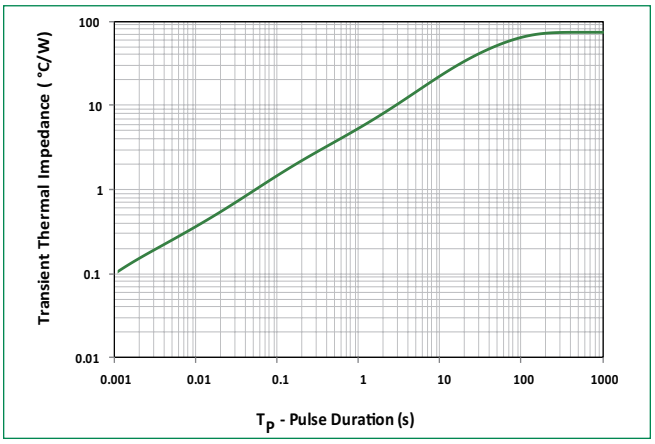



**Figure 6:**
Typical Transient Thermal Impedance



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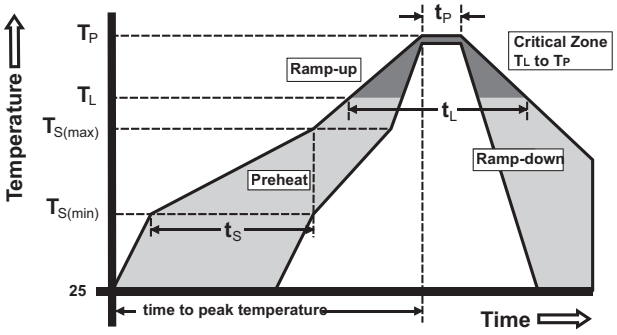
# 5.0SMDJxxS-HRA

## Surface Mount – 5000W – DO-214AB

## Soldering Parameters

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




## Physical Specifications

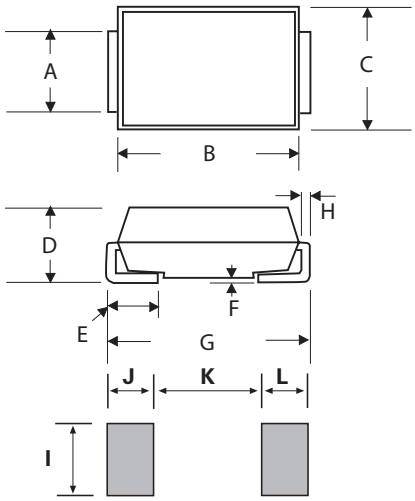
| | |
|---|---|
| **Weight** | 0.007 ounce, 0.21 grams |
| **Case** | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| **Terminal** | Matte Tin-plated leads, Solderable per JESD22-B102 |

## Environmental Specifications

| | |
|---|---|
| **High Temp. Storage** | JESD22-A103 |
| **HTRB** | JESD22-A108 |
| **Temperature Cycling** | JESD22-A104 |
| **MSL** | JEDEC-J-STD-020, LEVEL 1 |
| **H3TRB** | JESD22-A101 |
| **RSH** | 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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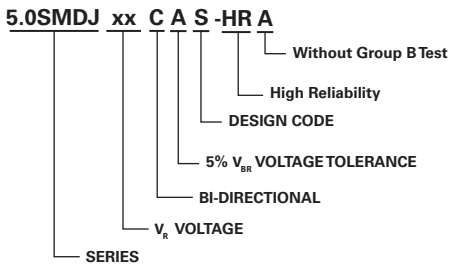
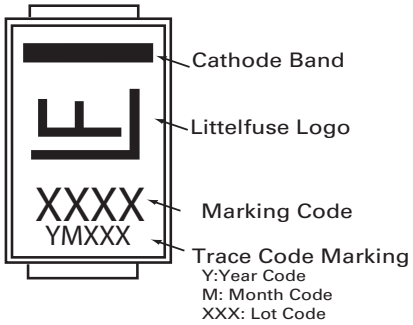
# 5.0SMDJxxS-HRA

Surface Mount – 5000W – DO-214AB

## Part Numbering System



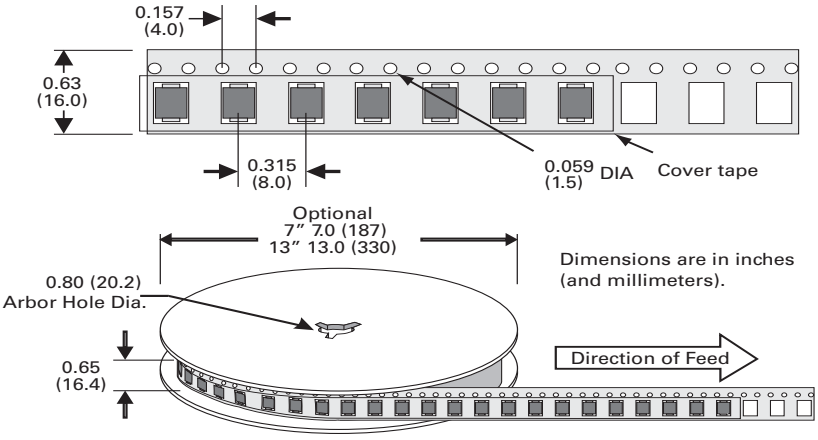

## Part Marking System

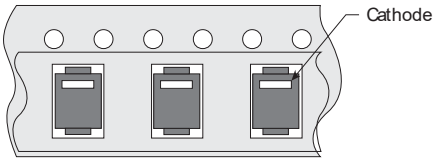



## Packing Options

| 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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