

# 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

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### 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.

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## 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 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



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## 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)

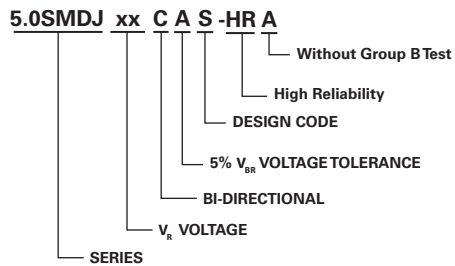


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.114	0.126	2.900	3.200
B	0.260	0.280	6.600	7.110
C	0.220	0.245	5.590	6.220
D	0.079	0.103	2.060	2.620
E	0.030	0.060	0.760	1.520
F	-	0.008	-	0.203
G	0.305	0.320	7.750	8.130
H	0.006	0.012	0.152	0.305
I	0.129	-	3.300	-
J	0.094	-	2.400	-
K	-	0.165	-	4.200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

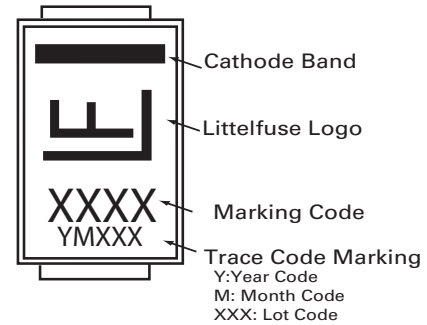
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## Part Numbering System



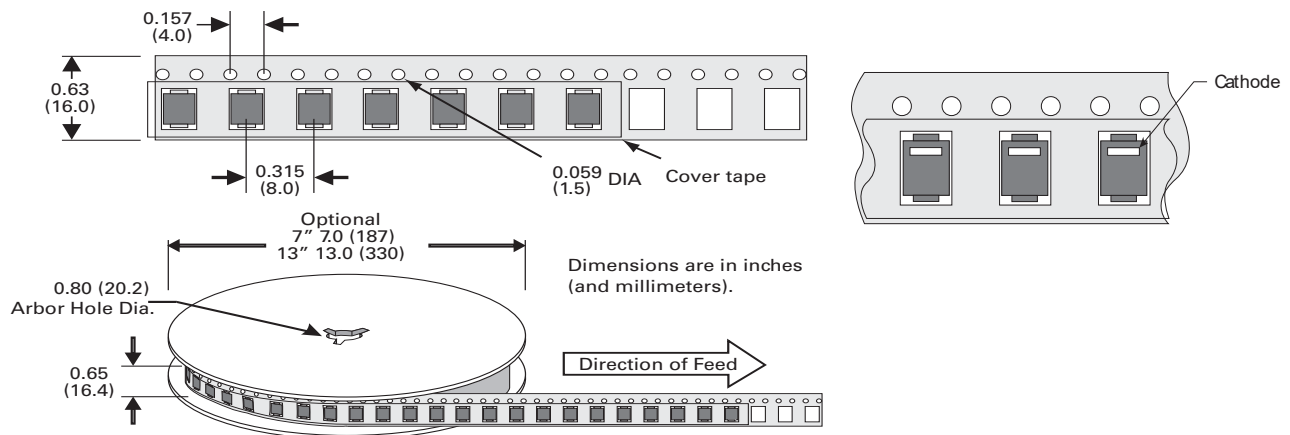
## Part Marking System



## 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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