

# SM30KPA-HR Series

## Surface Mount – 30 kW



### Maximum Ratings and Thermal Characteristics ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation ( $I_{PP} \times V_C$ ) by 10/1000 $\mu\text{s}$ Test Waveform (Fig.2) (Note 1)	$P_{PPM}$	30	kW
Steady State Power Dissipation on Infinite Heat Sink at $T_L = 100\text{ }^\circ\text{C}$ (Fig. 6)	$P_D$	50	W
Peak Forward Surge Current, 8.3 ms Single Half Sine Wave Unidirectional Only (Note 2)	$I_{FSM}$	2500	A
Maximum Instantaneous Forward Voltage at 500 A for Unidirectional Only	$V_F$	3.5	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Typical Thermal Resistance Junction to Case	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	20	$^\circ\text{C/W}$

#### Notes:

1. Non-repetitive current pulse per Fig. 4 and derated above  $T_J$  (initial) =  $25\text{ }^\circ\text{C}$  per Fig. 3.
2. Measured on 8.3 ms single half sine wave or equivalent square wave, duty cycle = 4 per minute maximum.
3. Case temperature controlled on heat sink as specified.

## Description

The SM30KPA-HR high reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

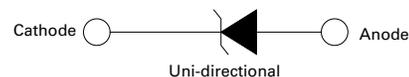
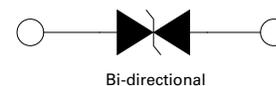
## Features & Benefits

- 30 kW peak pulse capability at 10/1000  $\mu\text{s}$  waveform, repetition rate (duty cycles):0.01 %
- Low profile package
- For surface mounted applications to optimize board space
- Low incremental surge resistance
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- ESD protection of data lines in accordance with IEC 61000-4-2, 30 kV(Air), 30 kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Typical  $I_R$  less than 2  $\mu\text{A}$  when  $V_{BR\text{ min}} > 66.7\text{ V}$
- Fast response time: typically less than 1.0 ps from 0 volts to  $V_{BR\text{ min}}$
- High temperature to reflow soldering guaranteed: 245  $^\circ\text{C}/10\text{ sec}$
- $V_{BR} @ T_J = V_{BR} @ 25\text{ }^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha$ : Temperature Coefficient, typical value is 0.1%)
- Meet MSL level 1, per J-STD-020, LF maximum peak of 245  $^\circ\text{C}$
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2<sup>nd</sup> level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

## Applications

TVS components are ideal for the protection of I/O interfaces,  $V_{CC}$  bus and other vulnerable circuits used in aviation and eVTOL applications.

### Functional Diagram



# SM30KPA-HR Series

## Surface Mount – 30 kW

### Electrical Characteristics

Part Number (Uni)	Part Number (Bi)	Marking		Reverse Stand off Voltage $V_R$ (V)	Breakdown Voltage $V_{BR} @ I_T$ (V)		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)
		Uni	Bi		Min	Max				
SM30KPA28A-HR	SM30KPA28CA-HR	30028A	30028C	28	31.1	34.4	5	46.4	645	10
SM30KPA30A-HR	SM30KPA30CA-HR	30030A	30030C	30	33.3	36.8	5	48.8	618	10
SM30KPA33A-HR	SM30KPA33CA-HR	30033A	30033C	33	36.7	40.6	5	53.3	564	10
SM30KPA36A-HR	SM30KPA36CA-HR	30036A	30036C	36	40.0	44.2	5	58.1	516	10
SM30KPA40A-HR	SM30KPA40CA-HR	30040A	30040C	40	44.4	49.1	5	64.5	468	5
SM30KPA43A-HR	SM30KPA43CA-HR	30043A	30043C	43	47.8	52.8	5	69.4	432	5
SM30KPA45A-HR	SM30KPA45CA-HR	30045A	30045C	45	50.0	55.3	5	72.7	414	5
SM30KPA48A-HR	SM30KPA48CA-HR	30048A	30048C	48	53.3	58.9	5	77.4	390	5
SM30KPA51A-HR	SM30KPA51CA-HR	30051A	30051C	51	56.7	62.7	5	82.4	366	5
SM30KPA54A-HR	SM30KPA54CA-HR	30054A	30054C	54	60.0	66.3	5	87.1	342	5
SM30KPA58A-HR	SM30KPA58CA-HR	30058A	30058C	58	64.4	71.2	5	93.6	318	5
SM30KPA60A-HR	SM30KPA60CA-HR	30060A	30060C	60	66.7	73.7	5	96.8	312	2
SM30KPA64A-HR	SM30KPA64CA-HR	30064A	30064C	64	71.1	78.6	5	103.0	294	2
SM30KPA70A-HR	SM30KPA70CA-HR	30070A	30070C	70	77.8	86.0	5	113.0	264	2
SM30KPA75A-HR	SM30KPA75CA-HR	30075A	30075C	75	83.3	92.1	5	121.0	246	2
SM30KPA78A-HR	SM30KPA78CA-HR	30078A	30078C	78	86.7	95.8	5	126.0	240	2
SM30KPA85A-HR	SM30KPA85CA-HR	30085A	30085C	85	94.4	104.0	5	137.0	216	2
SM30KPA90A-HR	SM30KPA90CA-HR	30090A	30090C	90	100.0	111.0	5	146.0	204	2
SM30KPA100A-HR	SM30KPA100CA-HR	30100A	30100C	100	111.0	123.0	5	162.0	186	2
SM30KPA110A-HR	SM30KPA110CA-HR	30110A	30110C	110	122.0	135.0	5	177.0	168	2
SM30KPA120A-HR	SM30KPA120CA-HR	30120A	30120C	120	133.0	147.0	5	193.0	156	2
SM30KPA130A-HR	SM30KPA130CA-HR	30130A	30130C	130	144.0	159.0	5	209.0	142	2
SM30KPA150A-HR	SM30KPA150CA-HR	30300A	30300C	150	167.0	185.0	5	243.0	124	2
SM30KPA160A-HR	SM30KPA160CA-HR	30160A	30160C	160	178.0	197.0	5	259.0	116	2
SM30KPA170A-HR	SM30KPA170CA-HR	30170A	30170C	170	189.0	209.0	5	275.0	110	2
SM30KPA180A-HR	SM30KPA180CA-HR	30180A	30180C	180	200.0	221.0	5	291.0	104	2
SM30KPA200A-HR	SM30KPA200CA-HR	30200A	30200C	200	222.0	245.0	5	322.0	94	2
SM30KPA220A-HR	SM30KPA220CA-HR	30220A	30220C	220	245.0	271.0	5	356.0	84	2
SM30KPA260A-HR	SM30KPA260CA-HR	30260A	30260C	260	289.0	320.0	5	419.0	71	2
SM30KPA280A-HR	SM30KPA280CA-HR	30280A	30280C	280	311.0	345.0	5	451.0	66	2
SM30KPA300A-HR	SM30KPA300CA-HR	30300A	30300C	300	333.0	369.0	5	483.0	62	2
SM30KPA350A-HR	SM30KPA350CA-HR	30350A	30350C	350	389.0	431.0	5	564.0	53	2
SM30KPA400A-HR	SM30KPA400CA-HR	30400A	30400C	400	444.0	492.0	5	644.0	46	2

**Note:**

Each lot of parts will pass group B test requirement.

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### Screen Process

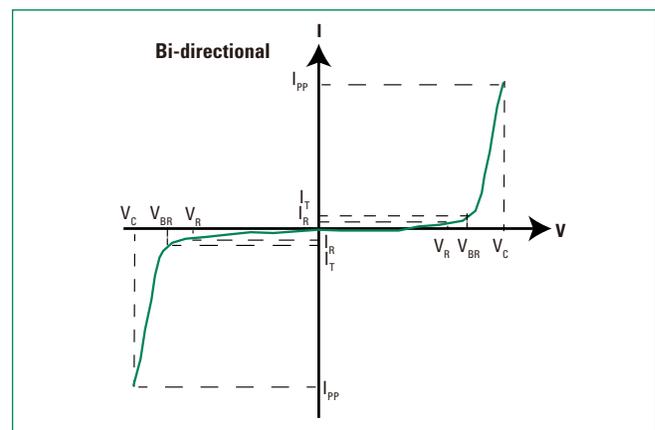
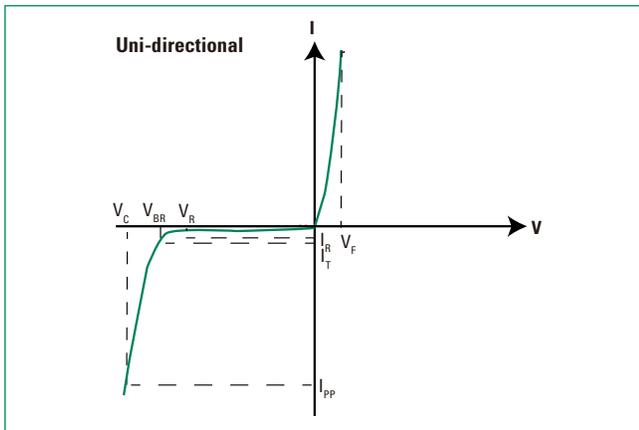
100 % Vision Inspection	MIL-STD-750 method 2074
100 % High Temperature Storage Life (168 hrs,150 °C)	MIL-STD-750 method 1031
100 % X-RAY Inspection	MIL-STD-750 method 2076
100 % Temperature Cycle Test (-55 to150 °C, 20 cycles, dwell time 15 min)	MIL-STD-750 method 1051
100 % Surge Test (2x)	MIL-STD-750 method 4066
100 % HTRB 150 °C Bias = $V_R$ (80 % breakdown voltage, 96 hrs, 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

### Group B Test Requirement

Screen	Method	Condition	Requirement
Surge Test	10/1000 $\mu$ s Peak Pulse Waveform	Maximum Clamping Voltage ( $V_C$ ) @ Peak Pulse Current ( $I_{PP}$ )	Sample size 45 perform 10x Accept 0 failures Sample size 45
Burn - In (HTRB)	MIL -STD-750, Method 1038.5	Applied Voltage 100 % $V_R$ @ 150 °C	340 hours (680 hours for bidirection products, each direction 340 hours) Accept 0 failures Sample size 45
Electrical Test	-	$I_R$ @ $V_R$ , $V_{BR}$ @ $I_T$	Accept 0 failures

### I-V Curve Characteristics



- $P_{PPM}$  **Peak Pulse Power Dissipation ( $I_{PP} \times V_C$ )** – 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 suppressor 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**

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

Figure 1 - TVS Transients Clamping Waveform

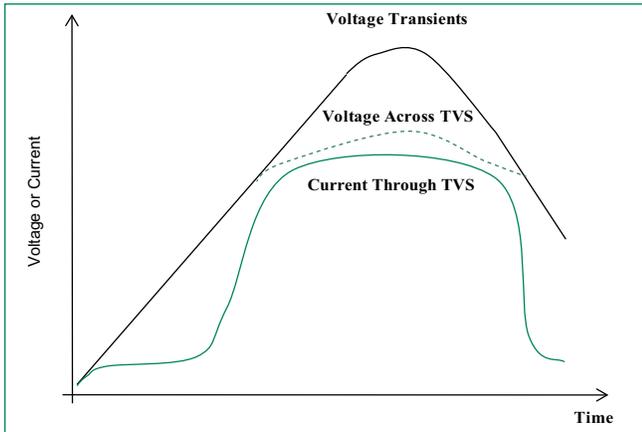


Figure 2 - Peak Pulse Power Rating Curve

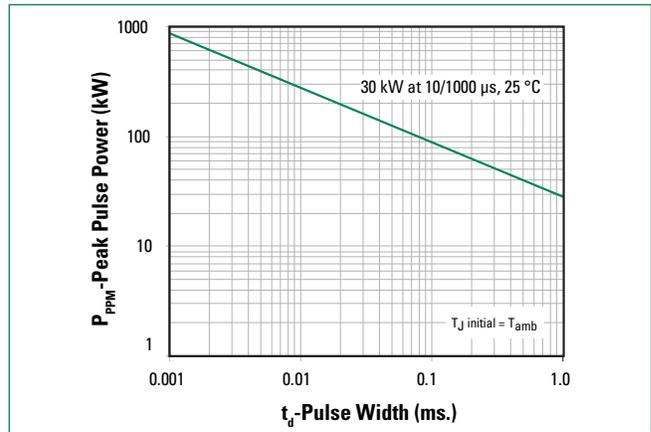


Figure 3 - Peak Pulse Power Derating Curve

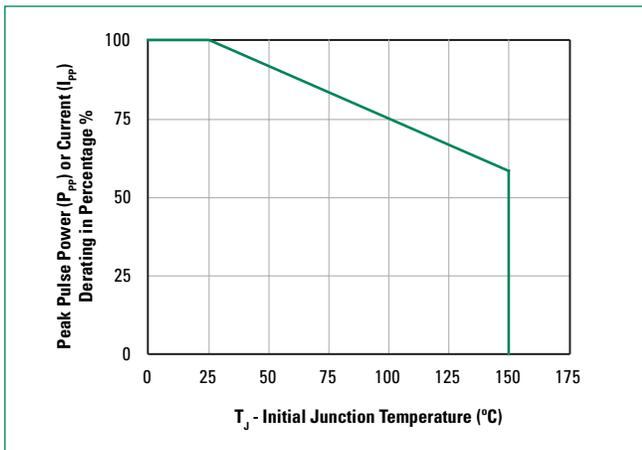


Figure 4 - Test Pulse Waveform

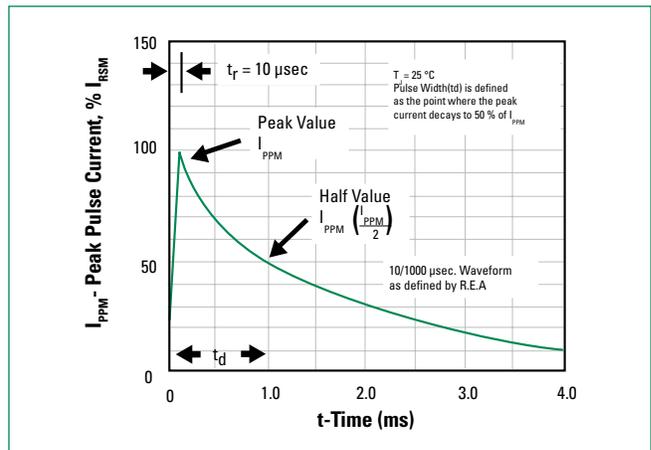


Figure 5 - Typical Junction Capacitance

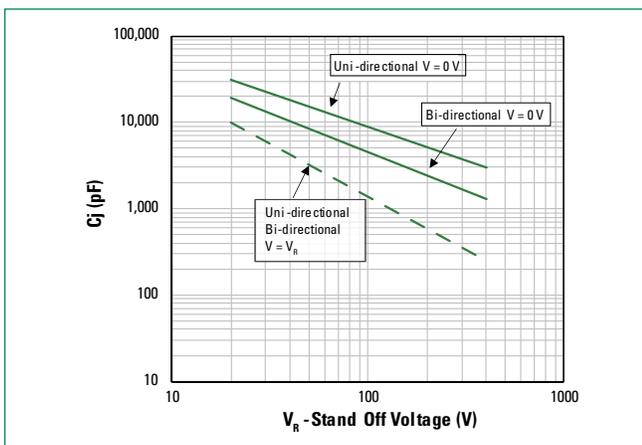
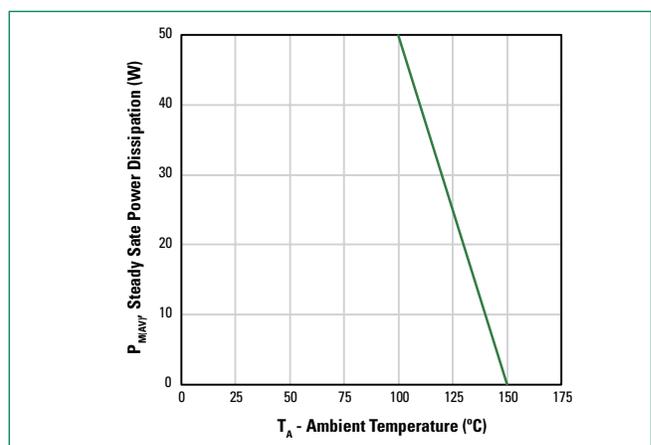


Figure 6 - Steady State Power Derating Curve

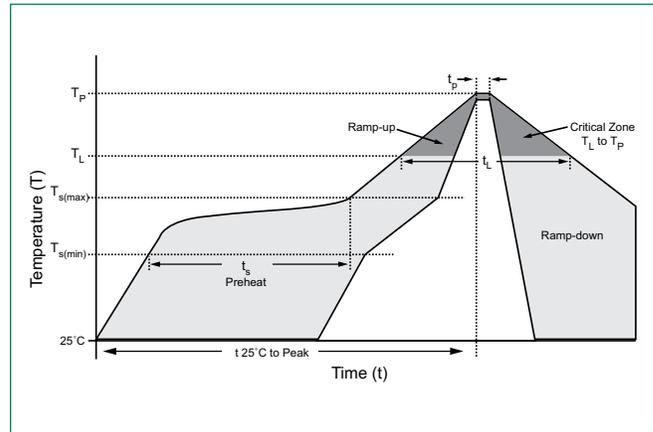


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### Soldering Parameters

<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 seconds
<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>		245 <sup>+0/-5</sup> °C
<b>Time Within 5 °C of Actual Peak Temperature (<math>t_p</math>)</b>		30 seconds max
<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>		245 °C



### Physical Specifications

<b>Weight</b>	0.092 ounce, 2.6 grams
<b>Case</b>	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

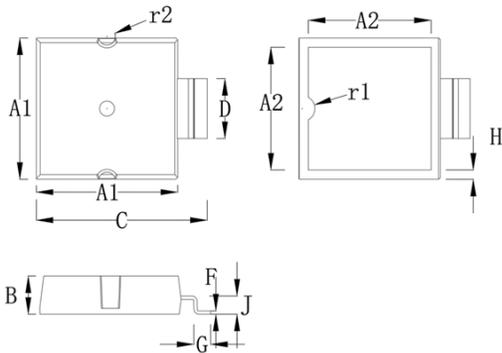
### Environmental Specifications

<b>High Temperature 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

### Packaging

Part number	Component Package	Quantity	Packaging Option	Packaging Specification
SM30KPAxxxXX-HR	SPD4-1	500	Tape & Reel - 24 mm tape/ 7" reel	EIA STD RS-481

### Dimensions

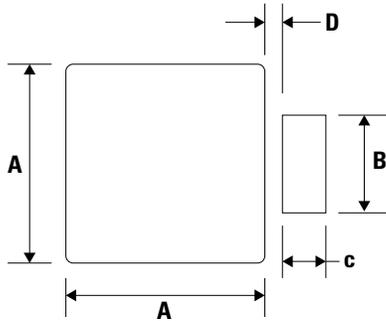


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
<b>A1</b>	0.488	0.498	12.40	12.66
<b>A2</b>	0.414	0.442	10.52	11.22
<b>B</b>	0.128	0.144	3.24	3.66
<b>C</b>	0.587	0.610	14.90	15.50
<b>D</b>	0.208	0.214	5.28	5.43
<b>F</b>	0.009	0.014	0.23	0.35
<b>G</b>	0.054	0.066	1.37	1.67
<b>J</b>	0.057	0.069	1.45	1.75
<b>H</b>	0.032 TYP		0.83 TYP	
<b>r1</b>	0.045 TYP		1.14 TYP	
<b>r2</b>	0.027 TYP		0.70 TYP	

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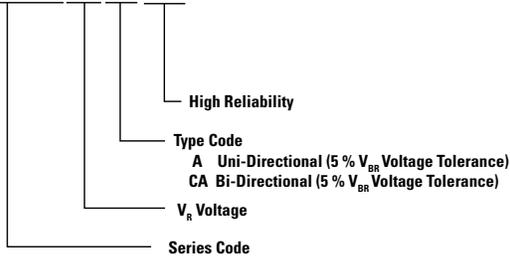
### Pad Layout



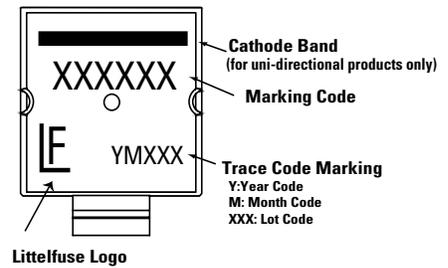
Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
<b>A</b>	0.465	0.475	11.81	12.07
<b>B</b>	0.225	0.235	5.72	5.97
<b>C</b>	0.095	0.105	2.41	2.67
<b>D</b>	0.04	0.05	1.02	1.27

### Part Numbering System

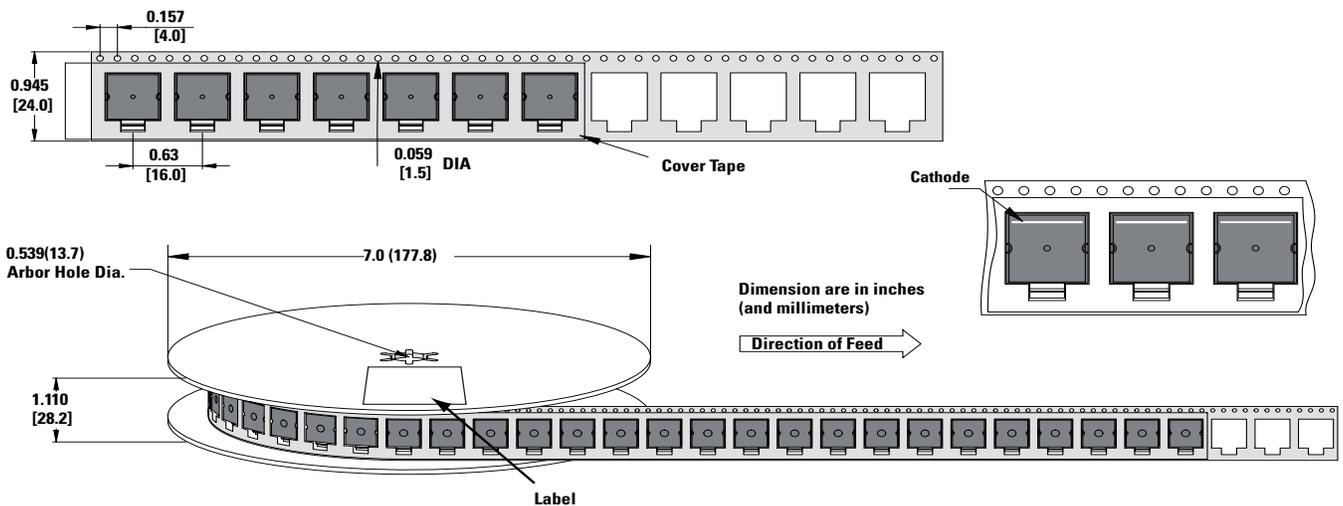
**SM30KPA xxxXX -HR**



### Part Marking System



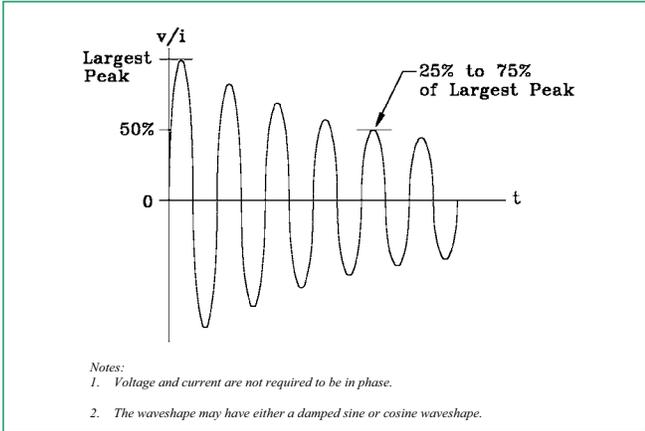
### Tape and Reel Specification



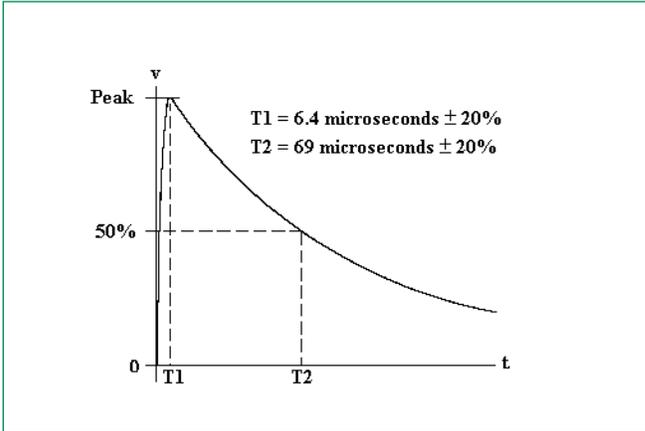
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Surface Mount – 30 kW

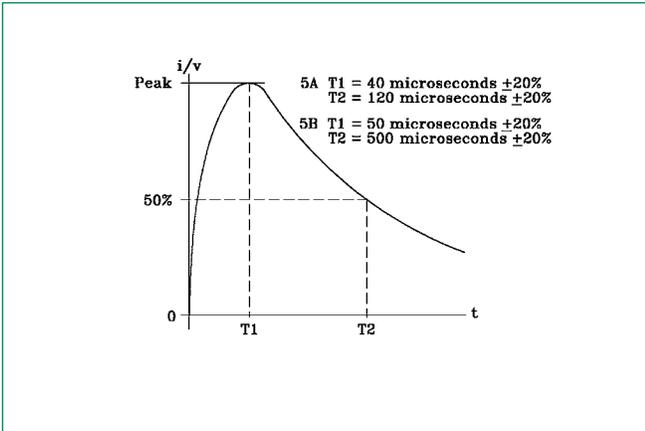
RTCA/DO-160G Wave 3



RTCA/DO-160G Wave 4



RTCA/DO-160G Wave 5



# SM30KPA-HR Series

## Surface Mount – 30 kW

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

Part Number (Uni)	Part Number (Bi)	25 °C							70 °C							120 °C						
		Wave 3		Wave 4 (6.4/69 µs)			Wave 5 (40/120 µs)		Wave 3		Wave 4 (6.4/69 µs)			Wave 5 (40/120 µs)		Wave 3		Wave 4 (6.4/69 µs)			Wave 5 (40/120 µs)	
		L5	L3	L4	L5	L3	L4	L5	L5	L3	L4	L5	L3	L4	L5	L5	L3	L4	L5	L3	L4	L5
		128A	60A	150A	320A	300A	750A	1600A	128A	60A	150A	320A	300A	750A	1600A	128A	60A	150A	320A	300A	750A	1600A
SM30KPA28A-HR	SM30KPA28CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA30A-HR	SM30KPA30CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA33A-HR	SM30KPA33CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA36A-HR	SM30KPA36CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA40A-HR	SM30KPA40CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA43A-HR	SM30KPA43CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA45A-HR	SM30KPA45CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA48A-HR	SM30KPA48CA-HR	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA51A-HR	SM30KPA51CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA54A-HR	SM30KPA54CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA58A-HR	SM30KPA58CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA60A-HR	SM30KPA60CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA64A-HR	SM30KPA64CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA70A-HR	SM30KPA70CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA75A-HR	SM30KPA75CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA78A-HR	SM30KPA78CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA85A-HR	SM30KPA85CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA90A-HR	SM30KPA90CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA100A-HR	SM30KPA100CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA110A-HR	SM30KPA110CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA120A-HR	SM30KPA120CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA130A-HR	SM30KPA130CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA150A-HR	SM30KPA150CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA160A-HR	SM30KPA160CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA170A-HR	SM30KPA170CA-HR	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA180A-HR	SM30KPA180CA-HR	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA200A-HR	SM30KPA200CA-HR	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA220A-HR	SM30KPA220CA-HR	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA260A-HR	SM30KPA260CA-HR	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA280A-HR	SM30KPA280CA-HR	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA300A-HR	SM30KPA300CA-HR	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA350A-HR	SM30KPA350CA-HR	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA400A-HR	SM30KPA400CA-HR	Pass	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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