SM30KPA-HRA Series

Surface Mount – 30 kW

Maximum Ratings and Thermal Characteristics (T_A = 25 °C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation (I_{PP} x V_C) by 10/1000 µs Test Waveform (Fig.2) (Note 1)	P_{PPM}	30	kW
Steady State Power Dissipation on Infinite Heat Sink at T_L = 100 °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	°C
Typical Thermal Resistance Junction to Case	$R_{\theta JC}$	1.0	°C/W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	20	°C/W

Notes:
1. Non-repetitive current pulse per Fig. 4 and derated above T_J (initial) = 25 °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-HRA high reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

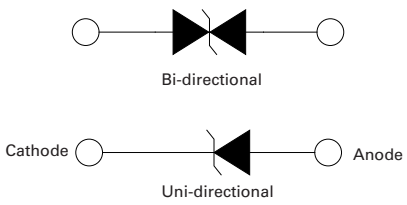
Features & Benefits

- 30 kW peak pulse capability at 10/1000 µs 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 µA when V_{BR} min > 66.7 V
- Fast response time: typically less than 1.0 ps from 0 volts to V_{BR} min
- High temperature to reflow soldering guaranteed: 245 °C/10 sec
- V_{BR} @ T_J = V_{BR} @ 25 °C x (1+αT x (T_J -25))(αT:Temperature Coefficient, typical value is 0.1%)
- Meet MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Matte tin lead–free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd 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 inavionics, aviation and EVTOL applications.

Functional Diagram



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SM30KPA-HRA 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 (µA)
		Uni	Bi		Min	Max				
SM30KPA28A-HRA	SM30KPA28CA-HRA	30028AH	30028CH	28	31.1	34.4	5	46.4	645	10
SM30KPA30A-HRA	SM30KPA30CA-HRA	30030AH	30030CH	30	33.3	36.8	5	48.8	618	10
SM30KPA33A-HRA	SM30KPA33CA-HRA	30033AH	30033CH	33	36.7	40.6	5	53.3	564	10
SM30KPA36A-HRA	SM30KPA36CA-HRA	30036AH	30036CH	36	40.0	44.2	5	58.1	516	10
SM30KPA40A-HRA	SM30KPA40CA-HRA	30040AH	30040CH	40	44.4	49.1	5	64.5	468	5
SM30KPA43A-HRA	SM30KPA43CA-HRA	30043AH	30043CH	43	47.8	52.8	5	69.4	432	5
SM30KPA45A-HRA	SM30KPA45CA-HRA	30045AH	30045CH	45	50.0	55.3	5	72.7	414	5
SM30KPA48A-HRA	SM30KPA48CA-HRA	30048AH	30048CH	48	53.3	58.9	5	77.4	390	5
SM30KPA51A-HRA	SM30KPA51CA-HRA	30051AH	30051CH	51	56.7	62.7	5	82.4	366	5
SM30KPA54A-HRA	SM30KPA54CA-HRA	30054AH	30054CH	54	60.0	66.3	5	87.1	342	5
SM30KPA58A-HRA	SM30KPA58CA-HRA	30058AH	30058CH	58	64.4	71.2	5	93.6	318	5
SM30KPA60A-HRA	SM30KPA60CA-HRA	30060AH	30060CH	60	66.7	73.7	5	96.8	312	2
SM30KPA64A-HRA	SM30KPA64CA-HRA	30064AH	30064CH	64	71.1	78.6	5	103.0	294	2
SM30KPA70A-HRA	SM30KPA70CA-HRA	30070AH	30070CH	70	77.8	86.0	5	113.0	264	2
SM30KPA75A-HRA	SM30KPA75CA-HRA	30075AH	30075CH	75	83.3	92.1	5	121.0	246	2
SM30KPA78A-HRA	SM30KPA78CA-HRA	30078AH	30078CH	78	86.7	95.8	5	126.0	240	2
SM30KPA85A-HRA	SM30KPA85CA-HRA	30085AH	30085CH	85	94.4	104.0	5	137.0	216	2
SM30KPA90A-HRA	SM30KPA90CA-HRA	30090AH	30090CH	90	100.0	111.0	5	146.0	204	2
SM30KPA100A-HRA	SM30KPA100CA-HRA	30100AH	30100CH	100	111.0	123.0	5	162.0	186	2
SM30KPA110A-HRA	SM30KPA110CA-HRA	30110AH	30110CH	110	122.0	135.0	5	177.0	168	2
SM30KPA120A-HRA	SM30KPA120CA-HRA	30120AH	30120CH	120	133.0	147.0	5	193.0	156	2
SM30KPA130A-HRA	SM30KPA130CA-HRA	30130AH	30130CH	130	144.0	159.0	5	209.0	142	2
SM30KPA150A-HRA	SM30KPA150CA-HRA	30300AH	30300CH	150	167.0	185.0	5	243.0	124	2
SM30KPA160A-HRA	SM30KPA160CA-HRA	30160AH	30160CH	160	178.0	197.0	5	259.0	116	2
SM30KPA170A-HRA	SM30KPA170CA-HRA	30170AH	30170CH	170	189.0	209.0	5	275.0	110	2
SM30KPA180A-HRA	SM30KPA180CA-HRA	30180AH	30180CH	180	200.0	221.0	5	291.0	104	2
SM30KPA200A-HRA	SM30KPA200CA-HRA	30200AH	30200CH	200	222.0	245.0	5	322.0	94	2
SM30KPA220A-HRA	SM30KPA220CA-HRA	30220AH	30220CH	220	245.0	271.0	5	356.0	84	2
SM30KPA260A-HRA	SM30KPA260CA-HRA	30260AH	30260CH	260	289.0	320.0	5	419.0	71	2
SM30KPA280A-HRA	SM30KPA280CA-HRA	30280AH	30280CH	280	311.0	345.0	5	451.0	66	2
SM30KPA300A-HRA	SM30KPA300CA-HRA	30300AH	30300CH	300	333.0	369.0	5	483.0	62	2
SM30KPA350A-HRA	SM30KPA350CA-HRA	30350AH	30350CH	350	389.0	431.0	5	564.0	53	2
SM30KPA400A-HRA	SM30KPA400CA-HRA	30400AH	30400CH	400	444.0	492.0	5	644.0	46	2

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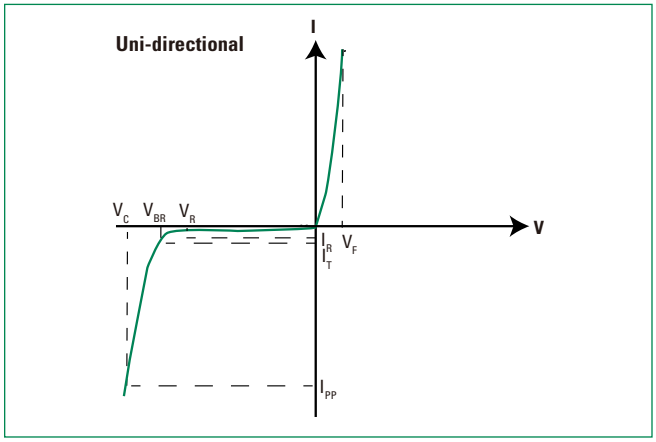
SM30KPA-HRA Series
Surface Mount – 30 kW

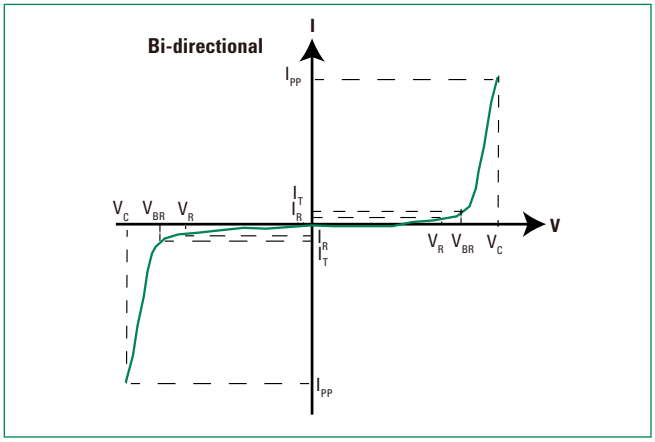
Screen Process

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

I-V Curve Characteristics





P_{PPM} **Peak Pulse Power Dissipation (I_{PP} x 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 Ippm (peak impulse current)
I_R **Reverse Leakage Current** – Current measured at V_R
V_F **Forward Voltage Drop for Uni-directional**

SM30KPA-HRA Series
Surface Mount – 30 kW

Ratings and Characteristic Curves (T_A = 25 °C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

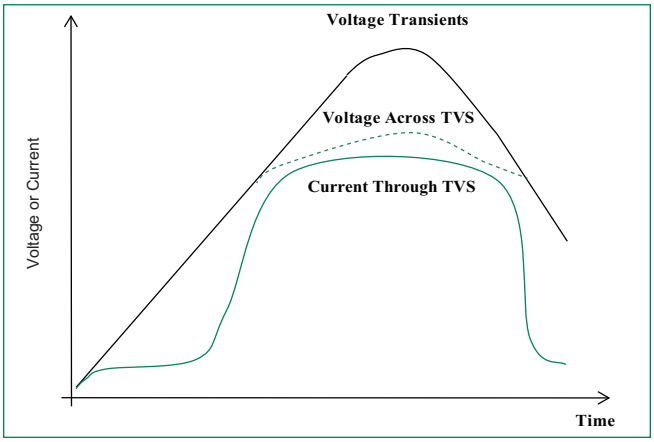


Figure 2 - Peak Pulse Power Rating Curve

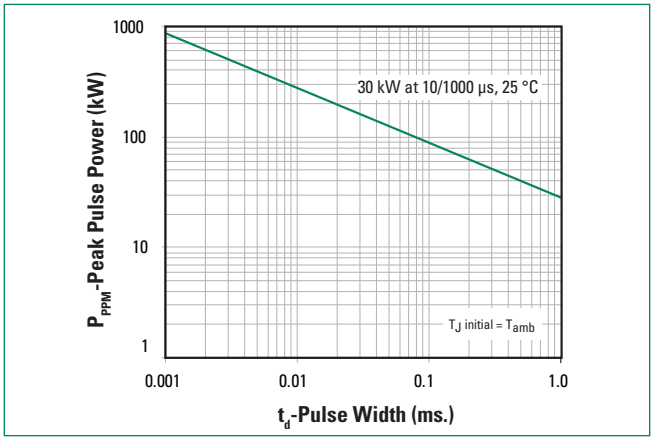


Figure 3 - Peak Pulse Power Derating Curve

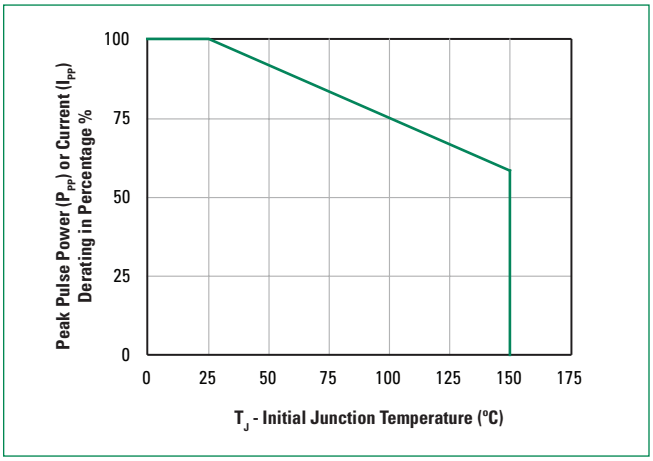


Figure 4 - Test Pulse Waveform

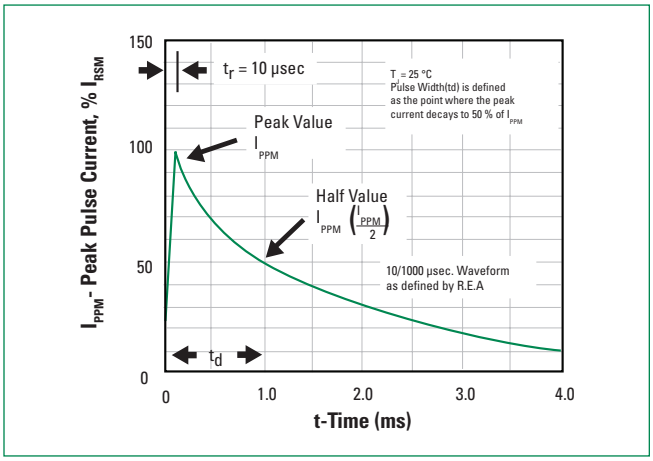


Figure 5 - Typical Junction Capacitance

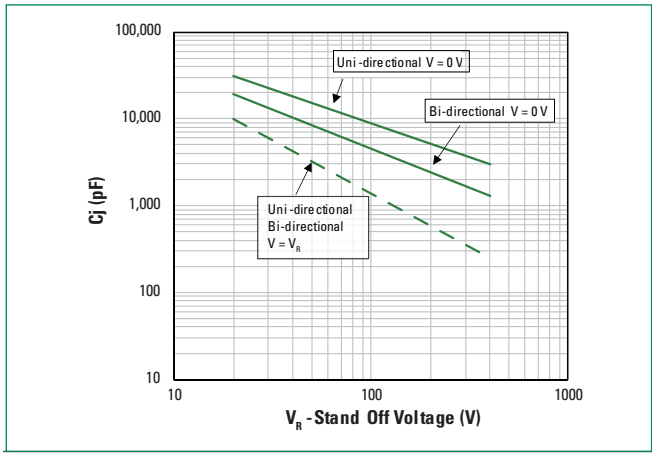
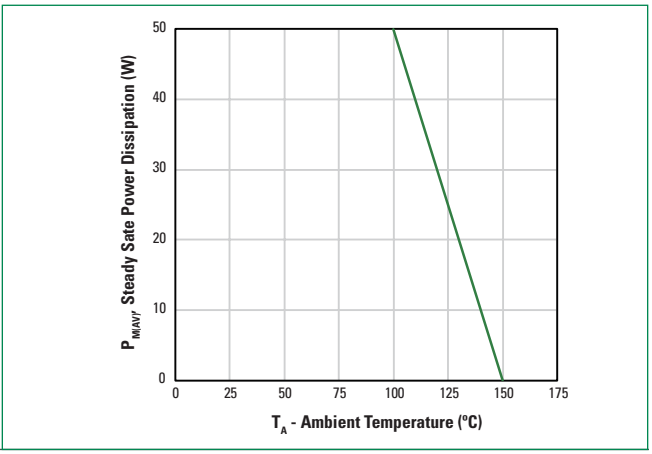


Figure 6 - Steady State Power Derating Curve

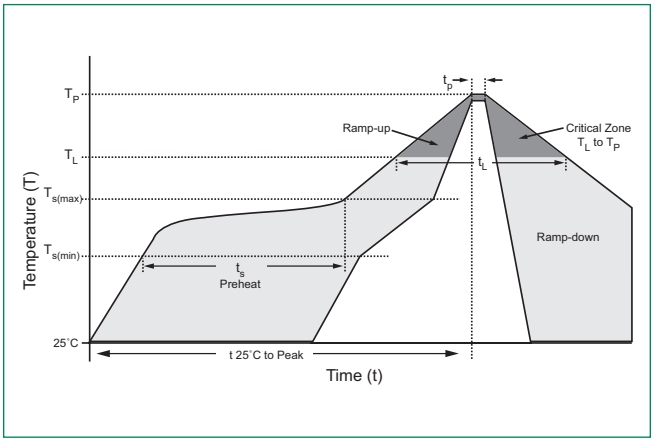


SM30KPA-HRA Series

Surface Mount – 30 kW

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 seconds
Average Ramp Up Rate (Liquidus Temp (T_L) to peak		3 °C/second max
$T_{S(max)}$ to T_L - 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)		$245^{+0/-5}$ °C
Time Within 5 °C of Actual Peak Temperature (t_p)		30 seconds max
Ramp-down Rate		6°C/second max
Time 25°C to Peak Temperature (T_P)		8 minutes max
Do Not Exceed		245 °C



Physical Specifications

Weight	0.092 ounce, 2.6 grams
Case	Molded plastic body over glass passivated junction
Polarity	Color band denotes positive end (cathode) except bidirectional.
Terminal	Matte tin-plated leads, solderable per JESD22-B102

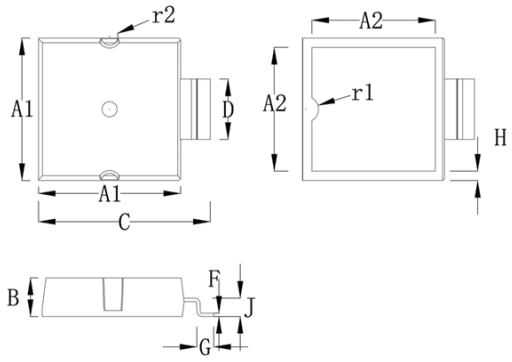
Environmental Specifications

High Temperature Storage	JESD22-A103
HTRB	JESD22-A108
Temperature Cycling	JESD22-A104
MSL	JEDEC-J-STD-020, Level 1
H3TRB	JESD22-A101
RSH	JESD22-A111

Packaging

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

Dimensions



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

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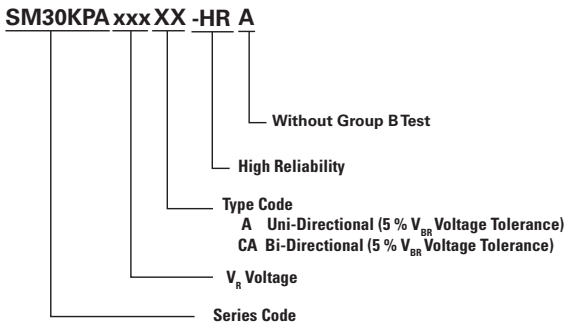
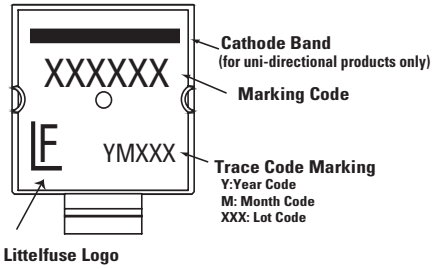
SM30KPA-HRA Series

Surface Mount – 30 kW

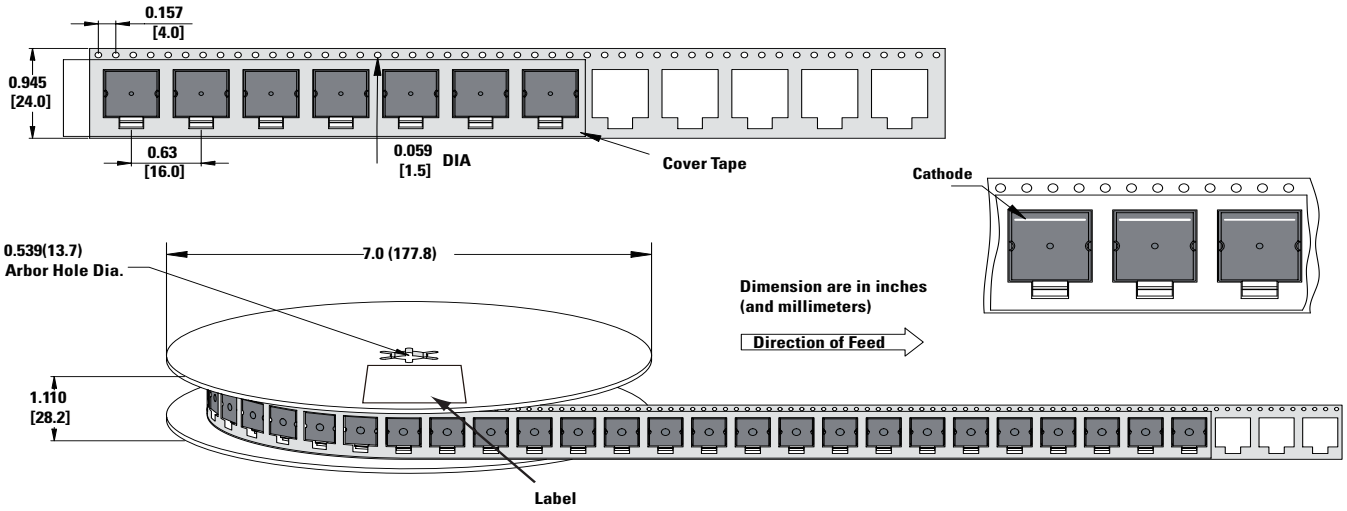
Part Numbering System



Part Marking System



Tape and Reel Specification



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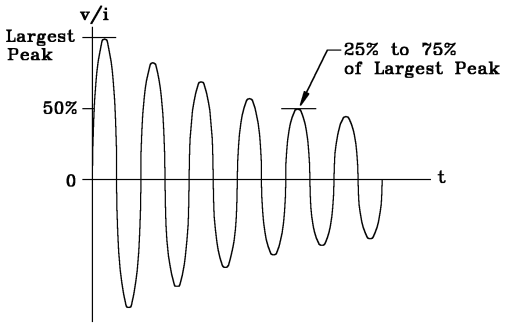
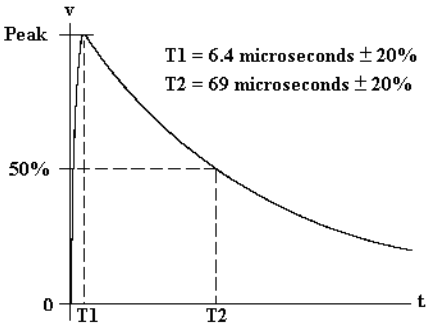
SM30KPA-HRA Series
Surface Mount – 30 kW

RTCA/DO-160G Wave 3

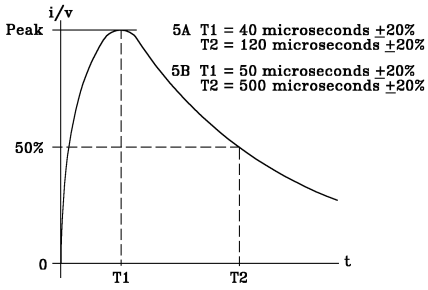


Notes:
1. *Voltage and current are not required to be in phase.*
2. *The waveshape may have either a damped sine or cosine waveshape.*

RTCA/DO-160G Wave 4



RTCA/DO-160G Wave 5



SM30KPA-HRA 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-HRA	SM30KPA28CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA30A-HRA	SM30KPA30CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA33A-HRA	SM30KPA33CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA36A-HRA	SM30KPA36CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA40A-HRA	SM30KPA40CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA43A-HRA	SM30KPA43CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA45A-HRA	SM30KPA45CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA48A-HRA	SM30KPA48CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SM30KPA51A-HRA	SM30KPA51CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA54A-HRA	SM30KPA54CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA58A-HRA	SM30KPA58CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA60A-HRA	SM30KPA60CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA64A-HRA	SM30KPA64CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA70A-HRA	SM30KPA70CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA75A-HRA	SM30KPA75CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA78A-HRA	SM30KPA78CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA85A-HRA	SM30KPA85CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA90A-HRA	SM30KPA90CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA100A-HRA	SM30KPA100CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA110A-HRA	SM30KPA110CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA120A-HRA	SM30KPA120CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA130A-HRA	SM30KPA130CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA150A-HRA	SM30KPA150CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA160A-HRA	SM30KPA160CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA170A-HRA	SM30KPA170CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	-	-
SM30KPA180A-HRA	SM30KPA180CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA200A-HRA	SM30KPA200CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA220A-HRA	SM30KPA220CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA260A-HRA	SM30KPA260CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA280A-HRA	SM30KPA280CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA300A-HRA	SM30KPA300CA-HRA	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA350A-HRA	SM30KPA350CA-HRA	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-
SM30KPA400A-HRA	SM30KPA400CA-HRA	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-

Note:

1. L1 = Level1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5