

# SM36KPA-HRA Series

## Surface Mount – 36 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)	$P_{PPM}$	36	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:

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

## Description

The SM36KPA-HRA high reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

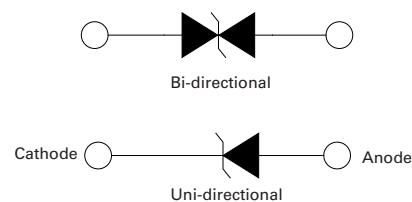
## Features & Benefits

- 36 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  $^\circ\text{C}/10\text{ sec}$
- $V_{BR} @ T_J = V_{BR} @ 25\text{ }^\circ\text{C} \times (1 + \alpha T) \times (T_J - 25)$  ( $\alpha T$ : 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, aviation and eVTOL applications.

### Functional Diagram



# SM36KPA-HRA Series

## Surface Mount – 36 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				
SM36KPA28A-HRA	SM36KPA28CA-HRA	36028AH	36028CH	28	31.1	34.4	5	46.4	776	10
SM36KPA30A-HRA	SM36KPA30CA-HRA	36030AH	36030CH	30	33.3	36.8	5	48.8	738	10
SM36KPA33A-HRA	SM36KPA33CA-HRA	36033AH	36033CH	33	36.7	40.6	5	53.3	676	10
SM36KPA36A-HRA	SM36KPA36CA-HRA	36036AH	36036CH	36	40.0	44.2	5	58.1	620	10
SM36KPA40A-HRA	SM36KPA40CA-HRA	36040AH	36040CH	40	44.4	49.1	5	64.5	559	5
SM36KPA43A-HRA	SM36KPA43CA-HRA	36043AH	36043CH	43	47.8	52.8	5	69.4	519	5
SM36KPA45A-HRA	SM36KPA45CA-HRA	36045AH	36045CH	45	50.0	55.3	5	72.7	496	5
SM36KPA48A-HRA	SM36KPA48CA-HRA	36048AH	36048CH	48	53.3	58.9	5	77.4	466	5
SM36KPA51A-HRA	SM36KPA51CA-HRA	36051AH	36051CH	51	56.7	62.7	5	82.4	437	5
SM36KPA54A-HRA	SM36KPA54CA-HRA	36054AH	36054CH	54	60.0	66.3	5	87.1	414	5
SM36KPA58A-HRA	SM36KPA58CA-HRA	36058AH	36058CH	58	64.4	71.2	5	93.6	385	5
SM36KPA60A-HRA	SM36KPA60CA-HRA	36060AH	36060CH	60	66.7	73.7	5	96.8	372	2
SM36KPA64A-HRA	SM36KPA64CA-HRA	36064AH	36064CH	64	71.1	78.6	5	103	350	2
SM36KPA70A-HRA	SM36KPA70CA-HRA	36070AH	36070CH	70	77.8	86.0	5	113	319	2
SM36KPA75A-HRA	SM36KPA75CA-HRA	36075AH	36075CH	75	83.3	92.1	5	121	298	2
SM36KPA78A-HRA	SM36KPA78CA-HRA	36078AH	36078CH	78	86.7	95.8	5	126	286	2
SM36KPA85A-HRA	SM36KPA85CA-HRA	36085AH	36085CH	85	94.4	104.0	5	137	263	2
SM36KPA90A-HRA	SM36KPA90CA-HRA	36090AH	36090CH	90	100.0	111.0	5	146	247	2
SM36KPA100A-HRA	SM36KPA100CA-HRA	36100AH	36100CH	100	111.0	123.0	5	162	223	2
SM36KPA110A-HRA	SM36KPA110CA-HRA	36110AH	36110CH	110	122.0	135.0	5	177	204	2
SM36KPA120A-HRA	SM36KPA120CA-HRA	36120AH	36120CH	120	133.0	147.0	5	193	187	2
SM36KPA130A-HRA	SM36KPA130CA-HRA	36130AH	36130CH	130	144.0	159.0	5	209	173	2
SM36KPA150A-HRA	SM36KPA150CA-HRA	36150AH	36150CH	150	167.0	185.0	5	243	149	2
SM36KPA160A-HRA	SM36KPA160CA-HRA	36160AH	36160CH	160	178.0	197.0	5	259	139	2
SM36KPA170A-HRA	SM36KPA170CA-HRA	36170AH	36170CH	170	189.0	209.0	5	275	131	2
SM36KPA180A-HRA	SM36KPA180CA-HRA	36180AH	36180CH	180	200.0	221.0	5	291	124	2
SM36KPA200A-HRA	SM36KPA200CA-HRA	36200AH	36200CH	200	222.0	245.0	5	322	112	2
SM36KPA220A-HRA	SM36KPA220CA-HRA	36220AH	36220CH	220	245.0	271.0	5	356	102	2
SM36KPA260A-HRA	SM36KPA260CA-HRA	36260AH	36260CH	260	289.0	320.0	5	419	86	2
SM36KPA280A-HRA	SM36KPA280CA-HRA	36280AH	36280CH	280	311.0	345.0	5	451	80	2
SM36KPA300A-HRA	SM36KPA300CA-HRA	36300AH	36300CH	300	333.0	369.0	5	483	75	2
SM36KPA350A-HRA	SM36KPA350CA-HRA	36350AH	36350CH	350	389.0	431.0	5	564	64	2
SM36KPA400A-HRA	SM36KPA400CA-HRA	36400AH	36400CH	400	444.0	492.0	5	644	56	2

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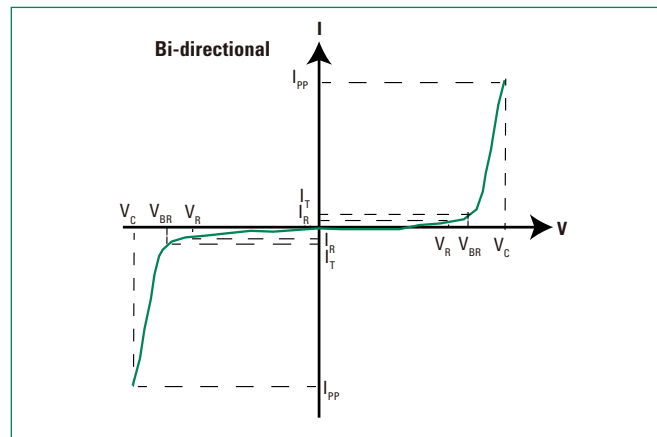
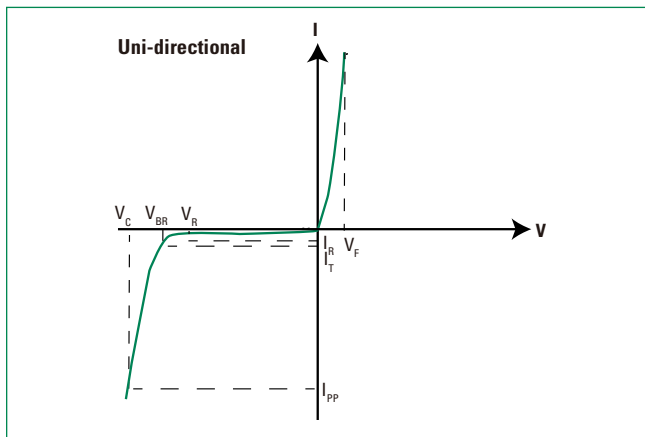
## Surface Mount – 36 kW

### 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 to 150 °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 ( $I_{pp} \times V_C$ )** – 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 through 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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## Surface Mount – 36 kW

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

Figure 1 - TVS Transients Clamping Waveform

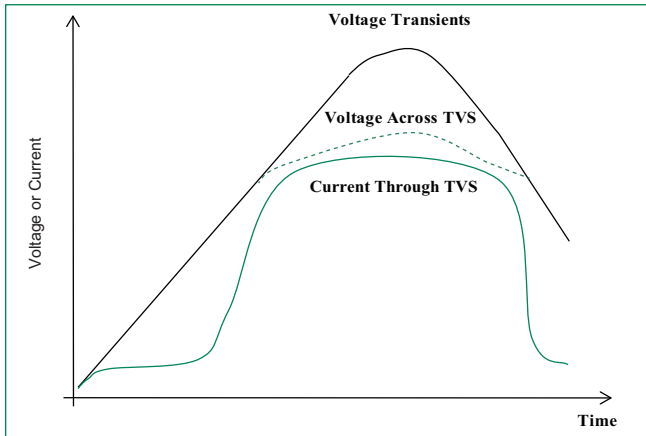


Figure 2 - Peak Pulse Power Rating Curve

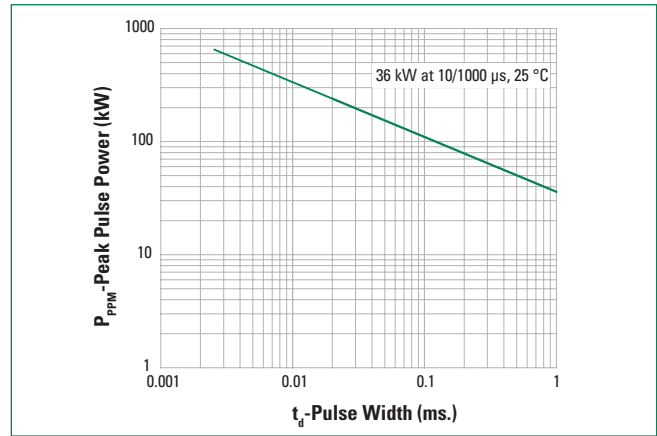


Figure 3 - Peak Pulse Power Derating Curve

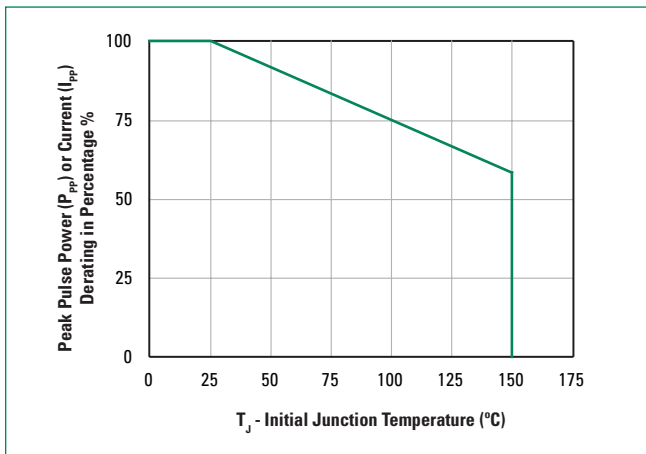


Figure 4 - Test Pulse Waveform

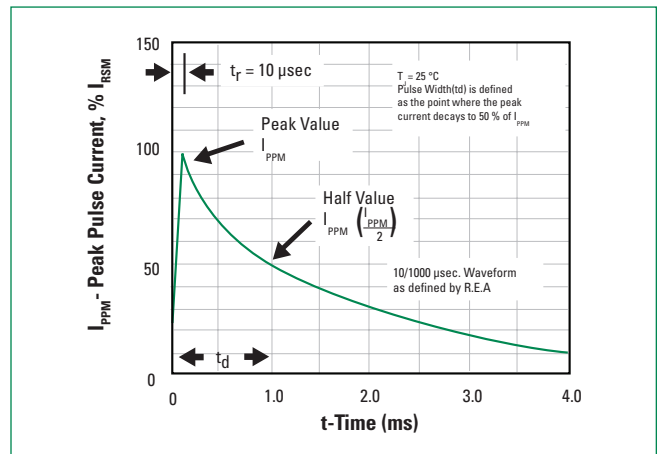


Figure 5 - Typical Junction Capacitance

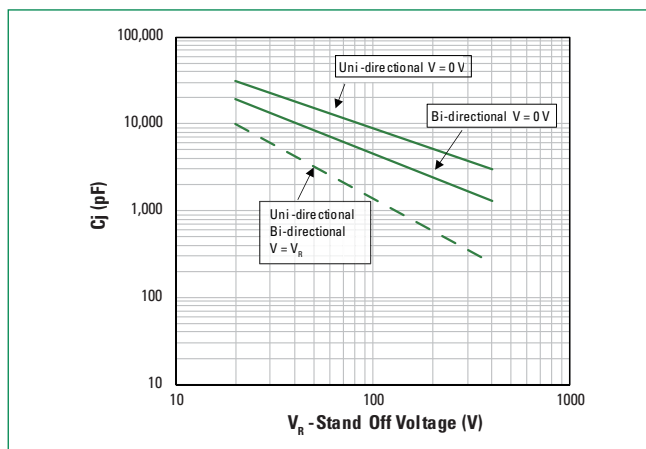
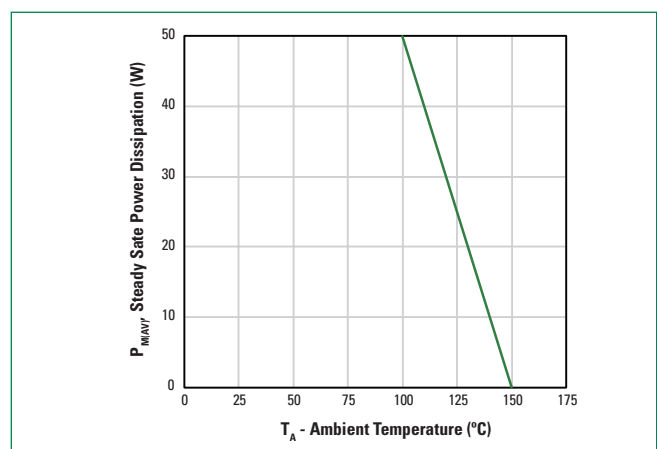


Figure 6 - Steady State Power Derating Curve

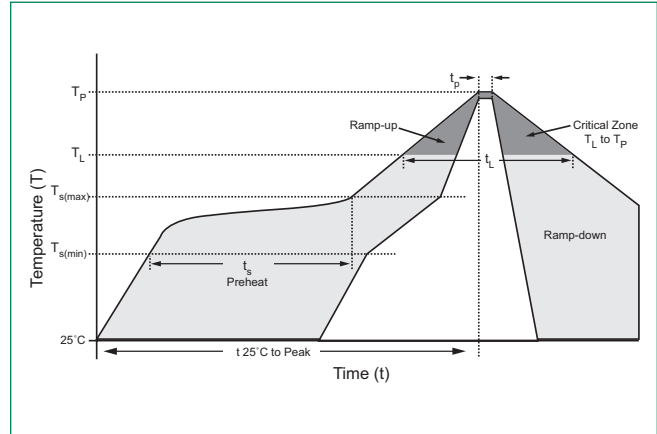


# SM36KPA-HRA Series

## Surface Mount – 36 kW

### 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

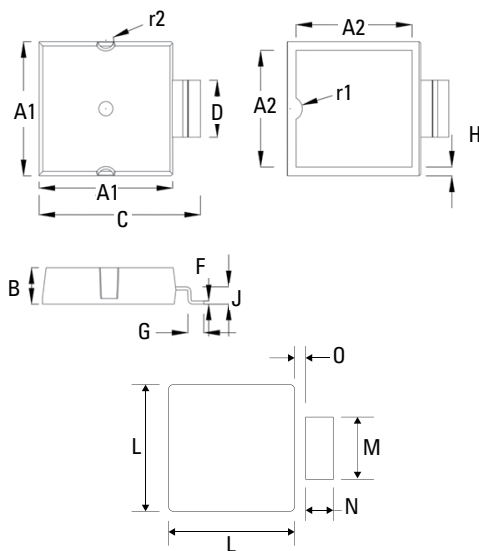
### Environmental Specifications

<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
SM36KPAxxxXX-HRA	SPD4-1	500	Tape & Reel - 24 mm tape/ 7" reel	EIA STD RS-481

### Dimensions



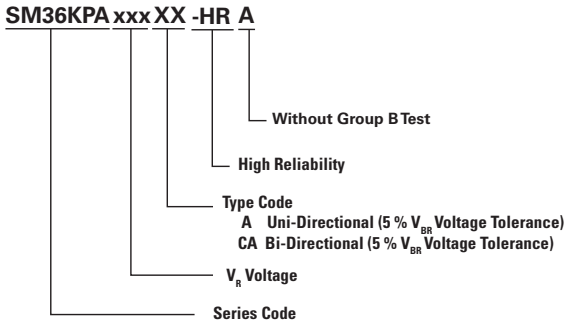
Recommended Soldering Pad Layout

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	
<b>L</b>	0.465	0.475	11.81	12.07
<b>M</b>	0.225	0.235	5.72	5.97
<b>N</b>	0.095	0.105	2.41	2.67
<b>O</b>	0.040	0.050	1.02	1.27

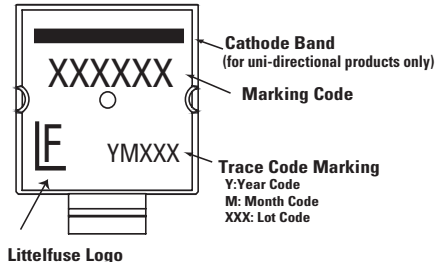
# SM36KPA-HRA Series

Surface Mount – 36 kW

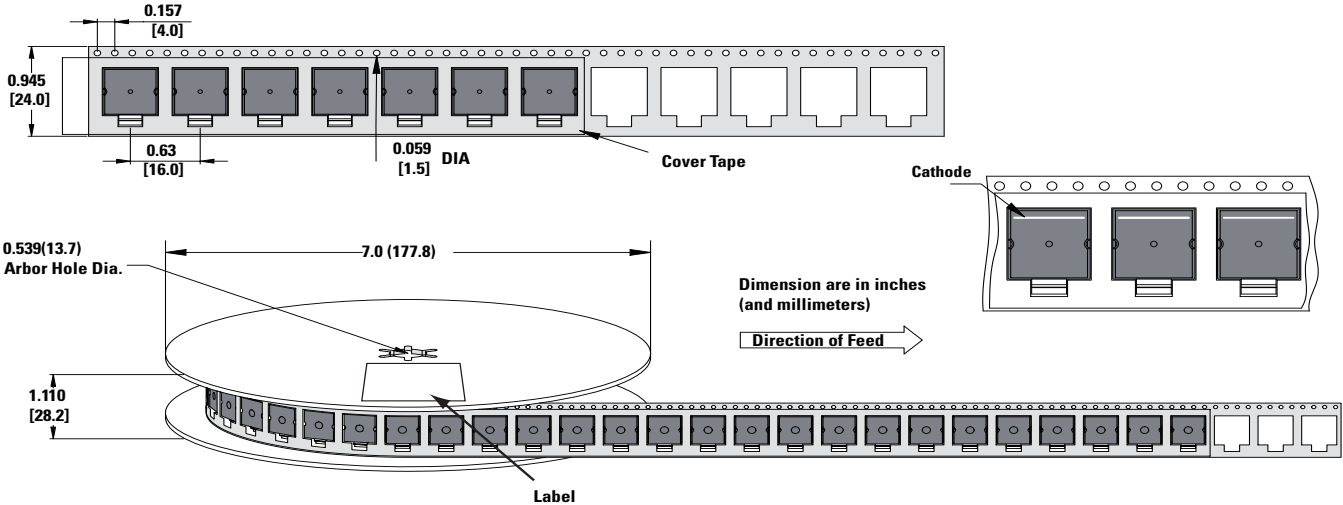
### Part Numbering System



### Part Marking System



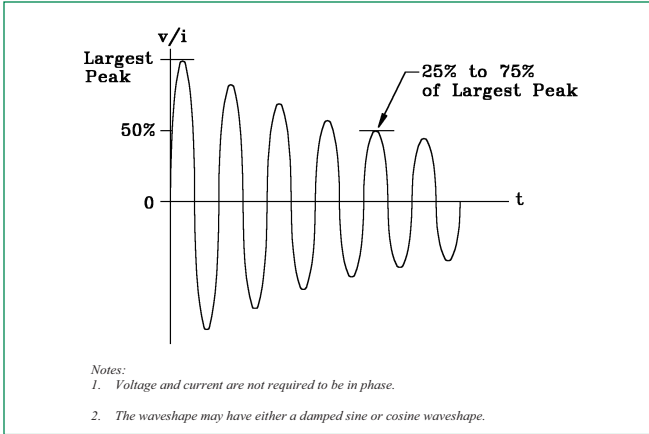
### Tape and Reel Specification



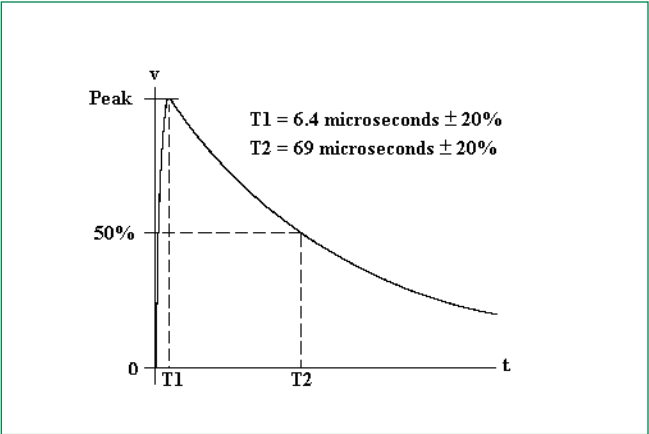
# SM36KPA-HRA Series

Surface Mount – 36 kW

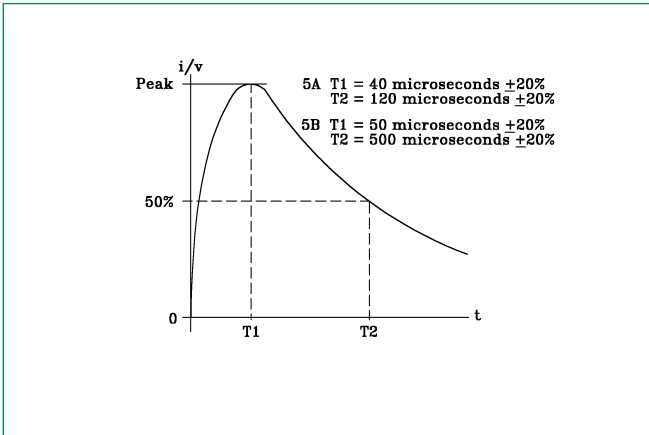
RTCA/DO-160G Wave 3



RTCA/DO-160G Wave 4



RTCA/DO-160G Wave 5



# SM36KPA-HRA Series

## Surface Mount – 36 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	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	128A	60A	150A	320A	300A	750A
SM36KPA28A-HRA	SM36KPA28CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA30A-HRA	SM36KPA30CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA33A-HRA	SM36KPA33CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA36A-HRA	SM36KPA36CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA40A-HRA	SM36KPA40CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA43A-HRA	SM36KPA43CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA45A-HRA	SM36KPA45CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA48A-HRA	SM36KPA48CA-HRA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
SM36KPA51A-HRA	SM36KPA51CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA54A-HRA	SM36KPA54CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA58A-HRA	SM36KPA58CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA60A-HRA	SM36KPA60CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA64A-HRA	SM36KPA64CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA70A-HRA	SM36KPA70CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA75A-HRA	SM36KPA75CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA78A-HRA	SM36KPA78CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
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SM36KPA90A-HRA	SM36KPA90CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA100A-HRA	SM36KPA100CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA110A-HRA	SM36KPA110CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA120A-HRA	SM36KPA120CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA130A-HRA	SM36KPA130CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA150A-HRA	SM36KPA150CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA160A-HRA	SM36KPA160CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA170A-HRA	SM36KPA170CA-HRA	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-	-	-	-	
SM36KPA180A-HRA	SM36KPA180CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA200A-HRA	SM36KPA200CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA220A-HRA	SM36KPA220CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA260A-HRA	SM36KPA260CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA280A-HRA	SM36KPA280CA-HRA	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	Pass	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA300A-HRA	SM36KPA300CA-HRA	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA350A-HRA	SM36KPA350CA-HRA	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	Pass	Pass	Pass	-	-	-	-	-	-	-	-	-	
SM36KPA400A-HRA	SM36KPA400CA-HRA	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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