

### 1. Synopsis

#### 1-1. General Description

The SMAJ Series Has Been Designed To Protect Sensitive Equipment Against Electro-Static Discharges According to IEC 61000-4-2, MIL STD 883 Method 3015, And Electrical Over Stress Such as IEC 61000-4-4 and 5. They Are Generally For Surges Below 400 W (10/1000  $\mu$ s).

This Technology Makes It Compatible With High-End Equipment And SMPS Where Low Leakage Current And High Junction Temperature Are Required To Provide Reliability And Stability Over Time. Their Low Clamping Voltages Provide a Better Safety Margin to Protect Sensitive Circuits With Extended Life Time Expectancy.

Packaged in SMAJ, This Minimizes PCB Space Consumption.



SMAJ

#### 1-2. Feature List

- Bi / Uni-Directional Configurations
- Plastic Package Has Underwriters
- Glass Passivated Chip Junction in SMAJ Package
- 400 Watts Peak Pulse Power (  $t_p = 10/1000\mu$ S )
- Halogen Free and RoHS Compliant
- Fast Response Time: Typically Less Than 1.0ps From 0 Volts to V(BR) For Uni-Directional and 5.0ns For Bi-Directional Types
- High Temperature Soldering Guaranteed: 250°C / 10 Seconds at Terminals



Bi-directional



Uni-directional

#### 1-3. Applications

- Power Supply Protection
- Industrial Application
- Power Manager

#### 1-4. IEC Compatibility

- EN61000-4
- 61000-4-2(ESD): Contact:  $>\pm 30$ KV, Air:  $>\pm 30$ KV
- 61000-4-4(EFT)
- 61000-4-5(Surge): 10/1000 $\mu$ S

#### 1-5. Mechanical Characteristics

- Molded JEDEC SMAJ Package
- Packing: Tape and Reel
- Flammability Rating UL 94V-0
- Halogen Free
- JEDEC MSL Classification: Level 1



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### 3. Electrical Property

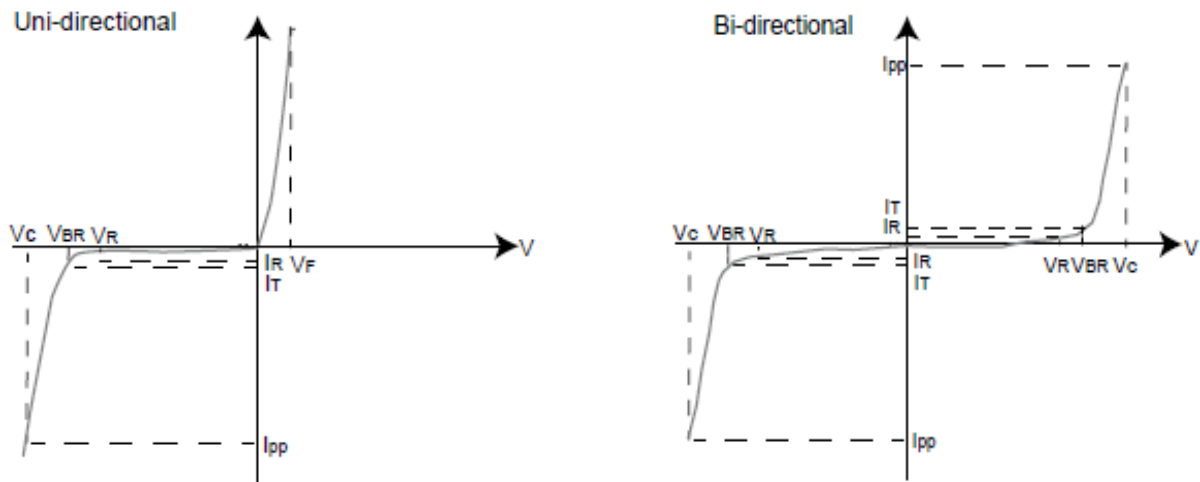
#### 3-1. Absolute Maximum Ratings

<b>Maximum Ratings@25°C Unless Otherwise Specified</b>				
<b>Parameter</b>	<b>Symbol</b>		<b>Value</b>	<b>Units</b>
Peak Pulse Power	$P_{PP}$	( $t_p = 10/1000\mu s$ )	400	W
		( $t_p = 8/20\mu s$ )	2400	
Peak Forward Surge Current, 8.3mS Signal Half Sine Wave Uni-Directional Only	$I_{FSM}$		60	A
Maximum Instantaneous Forward Voltage at 100A For Uni-Direction Only	$V_F$		3.5	V
Power Dissipation on Infinite Heatsink	$P_D$		3.3	W
Peak Pulse Voltage (IEC61000-4-2 Contact)	$V_{PP}$		$\pm 30$	KV
Operating Temperature	$T_J$		-65~+150	°C
Storage Temperature	$T_{STG}$			

### 3-2. Electrical Characteristics (Tamb=25°C)

Part Number	Reverse Stand-off Voltage	Breakdown Voltage		Test Current	Reverse Leakage	Max. Clamp Voltage	Peak Pulse Current	Marking		
		Min	Max							
Uni	Bi	V <sub>BR</sub> @ I <sub>T</sub>		I <sub>T</sub>	I <sub>R</sub> @ V <sub>RWM</sub>	V <sub>C</sub> @ I <sub>PP</sub>	I <sub>PP</sub> (10/1000 <sub>us</sub> )	Uni	Bi	
	V	V	V	mA	μA	V	A			
<b>400W Surface Mount Transient Voltage Suppressors SMAJ Series</b>										
SMAJ5.0A	SMAJ5.0CA	5.0	6.40	7.07	10.0	200.0	9.2	43.48	AE	WE
SMAJ6.0A	SMAJ6.0CA	6.0	6.67	7.37	10.0	200.0	10.3	38.83	AG	WG
SMAJ6.5A	SMAJ6.5CA	6.5	7.22	7.98	10.0	100.0	11.2	35.71	AK	WK
SMAJ7.0A	SMAJ7.0CA	7.0	7.78	8.60	10.0	100.0	12.0	33.33	AM	WM
SMAJ7.5A	SMAJ7.5CA	7.5	8.33	9.21	1.0	100.0	12.9	31.01	AP	WP
SMAJ8.0A	SMAJ8.0CA	8.0	8.89	9.83	1.0	100.0	13.6	29.41	AR	WR
SMAJ8.5A	SMAJ8.5CA	8.5	9.44	10.40	1.0	20.0	14.4	27.78	AT	WT
SMAJ9.0A	SMAJ9.0CA	9.0	10.00	11.10	1.0	10.0	15.4	25.97	AV	WV
SMAJ10A	SMAJ10CA	10.0	11.10	12.30	1.0	10.0	17.0	23.53	AX	WX
SMAJ11A	SMAJ11CA	11.0	12.20	13.50	1.0	1.0	18.2	21.98	AZ	WZ
SMAJ12A	SMAJ12CA	12.0	13.30	14.70	1.0	1.0	19.9	20.10	BE	XE
SMAJ13A	SMAJ13CA	13.0	14.40	15.90	1.0	1.0	21.5	18.60	BG	XG
SMAJ14A	SMAJ14CA	14.0	15.60	17.20	1.0	1.0	23.2	17.24	BK	XK
SMAJ15A	SMAJ15CA	15.0	16.70	18.50	1.0	1.0	24.4	16.39	BM	XM
SMAJ16A	SMAJ16CA	16.0	17.80	19.70	1.0	1.0	26.0	15.38	BP	XP
SMAJ17A	SMAJ17CA	17.0	18.90	20.90	1.0	1.0	27.6	14.49	BR	XR
SMAJ18A	SMAJ18CA	18.0	20.00	22.10	1.0	1.0	29.2	13.70	BT	XT
SMAJ20A	SMAJ20CA	20.0	22.20	24.50	1.0	1.0	32.4	12.35	BV	XV
SMAJ22A	SMAJ22CA	22.0	24.40	26.90	1.0	1.0	35.5	11.27	BX	XX
SMAJ24A	SMAJ24CA	24.0	26.70	29.50	1.0	1.0	38.9	10.28	BZ	XZ
SMAJ26A	SMAJ26CA	26.0	28.90	31.90	1.0	1.0	42.1	9.50	CE	YE
SMAJ28A	SMAJ28CA	28.0	31.10	34.40	1.0	1.0	45.4	8.81	CG	YG
SMAJ30A	SMAJ30CA	30.0	33.30	36.80	1.0	1.0	48.4	8.26	CK	YK
SMAJ33A	SMAJ33CA	33.0	36.70	40.60	1.0	1.0	53.3	7.50	CM	YM
SMAJ36A	SMAJ36CA	36.0	40.00	44.20	1.0	1.0	58.1	6.88	CP	YP
SMAJ40A	SMAJ40CA	40.0	44.40	49.10	1.0	1.0	64.5	6.20	CR	YR
SMAJ43A	SMAJ43CA	43.0	47.80	52.80	1.0	1.0	69.4	5.76	CT	YT
SMAJ45A	SMAJ45CA	45.0	50.00	55.30	1.0	1.0	72.7	5.50	CV	YV
SMAJ48A	SMAJ48CA	48.0	53.30	58.90	1.0	1.0	77.4	5.17	CX	YX
SMAJ51A	SMAJ51CA	51.0	56.70	62.70	1.0	1.0	82.4	4.85	CZ	YZ
SMAJ54A	SMAJ54CA	54.0	60.00	66.30	1.0	1.0	87.1	4.59	RE	ZE
SMAJ58A	SMAJ58CA	58.0	64.40	71.20	1.0	1.0	93.6	4.27	RG	ZG
SMAJ60A	SMAJ60CA	60.0	66.70	73.70	1.0	1.0	96.8	4.13	RK	ZK
SMAJ64A	SMAJ64CA	64.0	71.10	78.60	1.0	1.0	103.0	3.88	RM	ZM
SMAJ70A	SMAJ70CA	70.0	77.80	86.00	1.0	1.0	113.0	3.54	RP	ZP
SMAJ75A	SMAJ75CA	75.0	83.30	92.10	1.0	1.0	121.0	3.31	RR	ZR
SMAJ78A	SMAJ78CA	78.0	86.70	95.80	1.0	1.0	126.0	3.17	RT	ZT
SMAJ85A	SMAJ85CA	85.0	94.40	104.00	1.0	1.0	137.0	2.92	RV	ZV
SMAJ90A	SMAJ90CA	90.0	100.00	111.00	1.0	1.0	146.0	2.74	RX	ZX
SMAJ100A	SMAJ100CA	100.0	111.00	123.00	1.0	1.0	162.0	2.47	RZ	ZZ
SMAJ110A	SMAJ110CA	110.0	122.00	135.00	1.0	1.0	177.0	2.26	SE	VE
SMAJ120A	SMAJ120CA	120.0	133.00	147.00	1.0	1.0	193.0	2.07	SG	VG
SMAJ130A	SMAJ130CA	130.0	144.00	159.00	1.0	1.0	209.0	1.91	SK	VK
SMAJ150A	SMAJ150CA	150.0	167.00	185.00	1.0	1.0	243.0	1.65	SM	VM
SMAJ160A	SMAJ160CA	160.0	178.00	197.00	1.0	1.0	259.0	1.54	SP	VP
SMAJ170A	SMAJ170CA	170.0	189.00	209.00	1.0	1.0	275.0	1.45	SR	VR
SMAJ180A	SMAJ180CA	180.0	200.00	220.00	1.0	1.0	292.0	1.37	ST	VT
SMAJ190A	SMAJ190CA	190.0	211.00	232.00	1.0	1.0	324.0	1.23	SV	VV

3-3. I-V Curve Characteristics



- P<sub>PPM</sub>**     **Peak Pulse Power Dissipation**-Max power dissipation
- V<sub>R</sub>**        **Stand-off Voltage**-Maximum voltage that can be applied to the TVS without operation
- I<sub>R</sub>**        **Reverse Leakage Current**-Current measured at V<sub>R</sub>
- V<sub>F</sub>**        **Forward Voltage Drop for Uni-directional**
- V<sub>BR</sub>**      **Breakdown Voltage**-Maximum voltage that flows though the TVS at a specified test current(I<sub>T</sub>)
- V<sub>C</sub>**        **Clamping Voltage**-Peak voltage measured across the suppressor at a specified I<sub>ppm</sub>  
(peak impulse current)

3-4. Ratings and Characteristics Curve (TA=25°C unless otherwise noted)

Fig 1. Peak Pulse Power Dissipation Versus Initial Junction Temperature

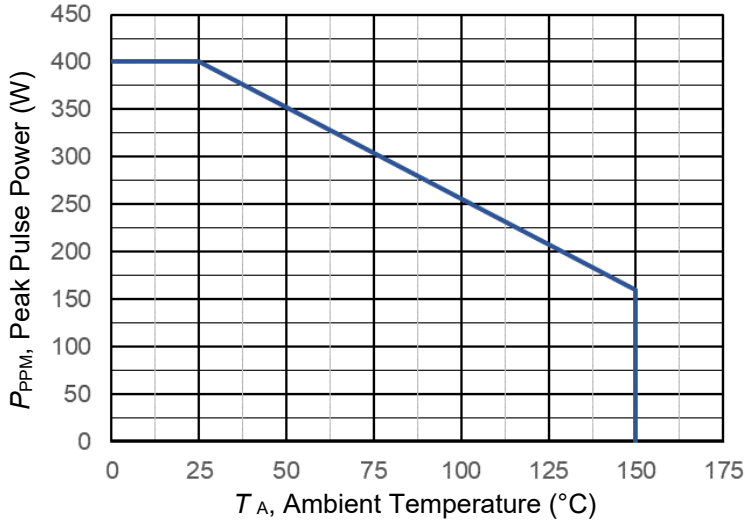


Fig 2. Peak Pulse Power Rating Curve

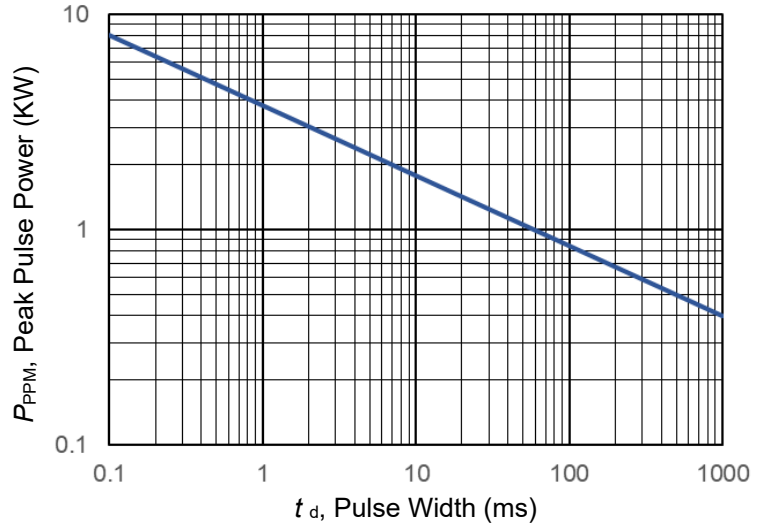


Fig 3. Peak Forward Voltage Drop vs. Peak Forward Current

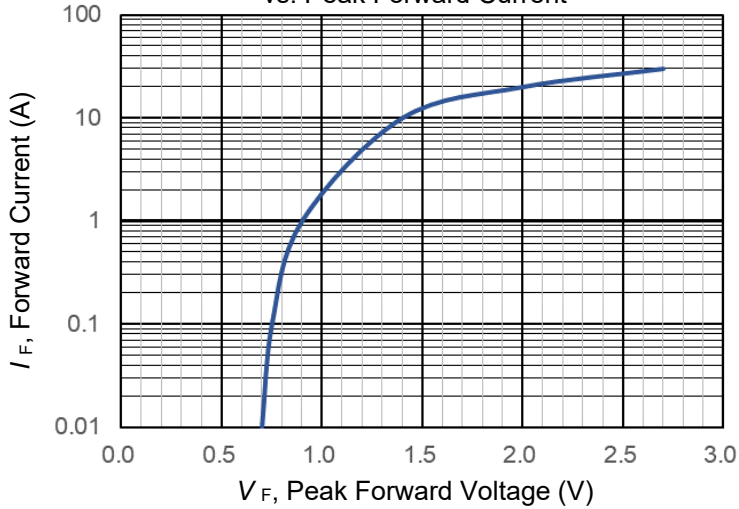


Fig 4. Maximum Non-repetitive Forward Surge Current Uni-direction Only

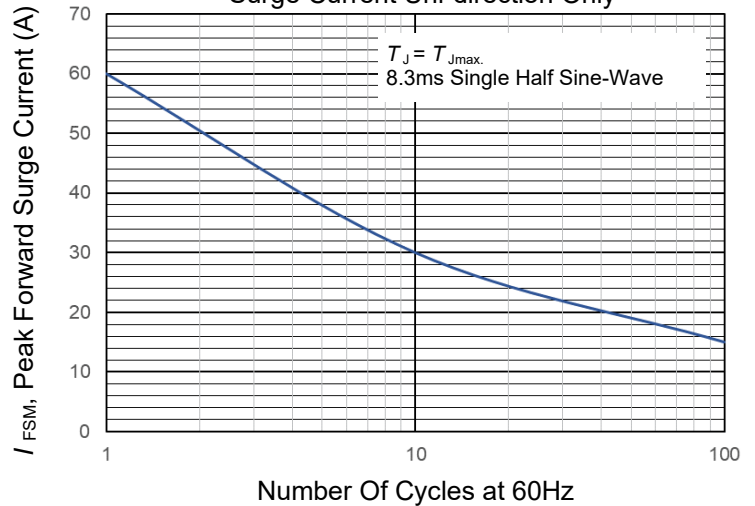


Fig 5. Forward Voltage Curve

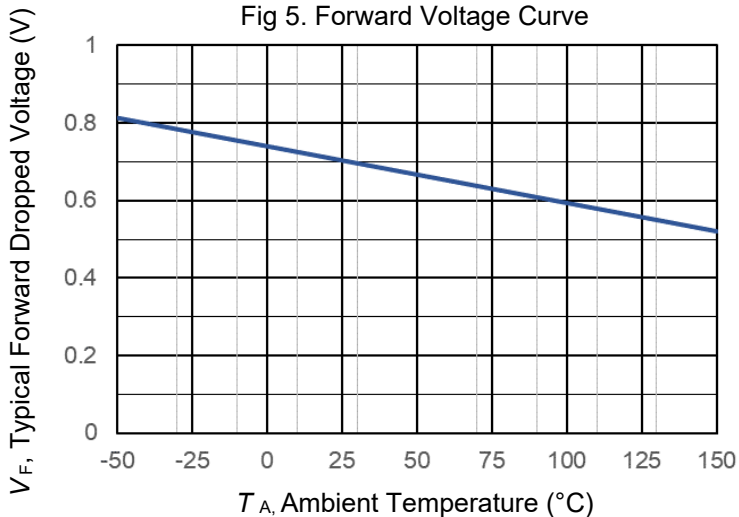
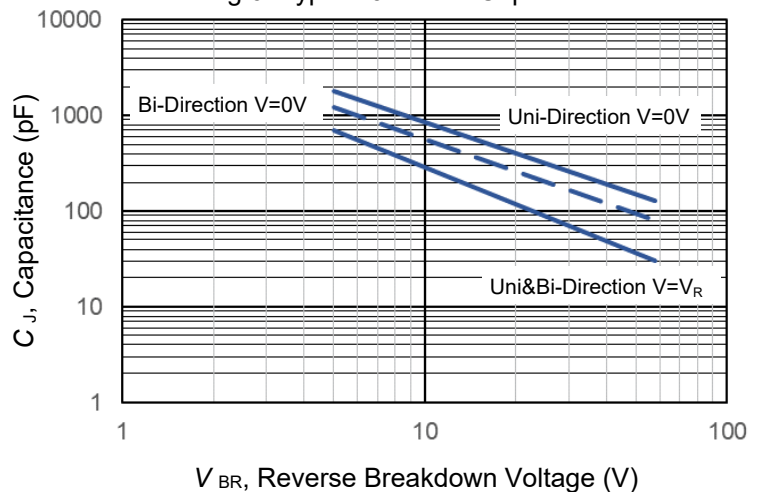


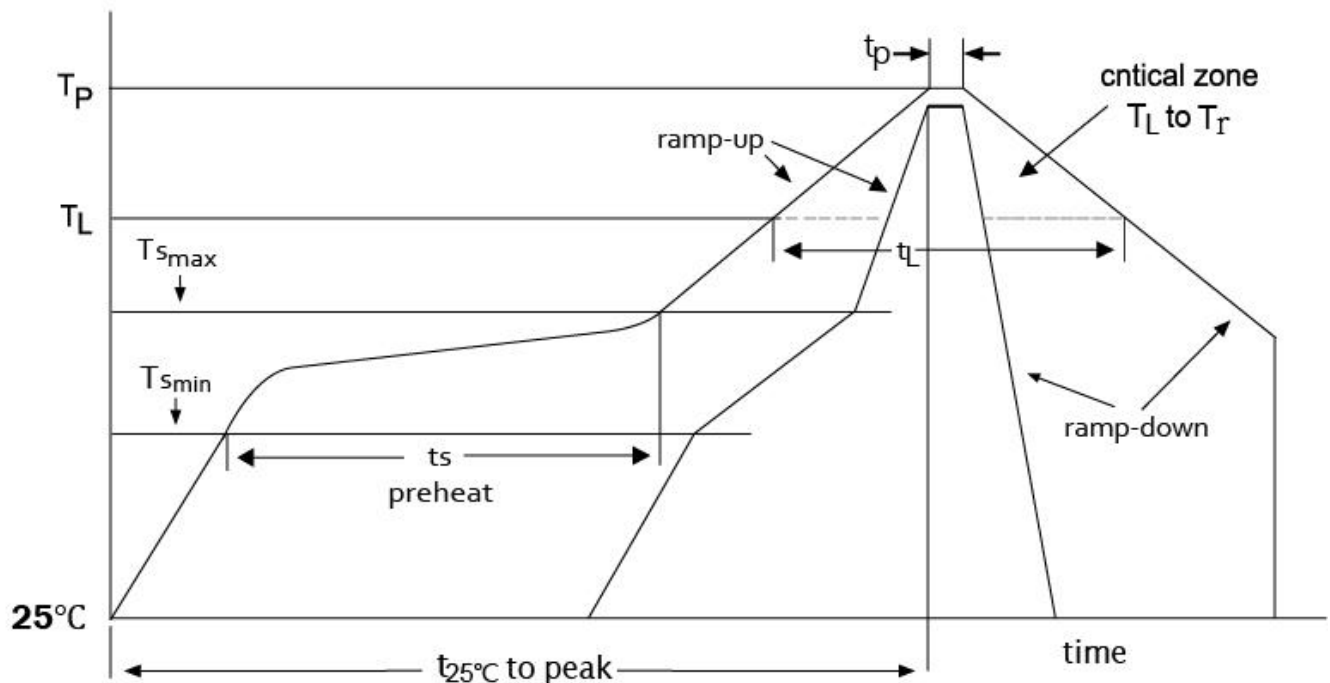
Fig 6. Typical Junction Capacitance



#### 4. Soldering Parameters

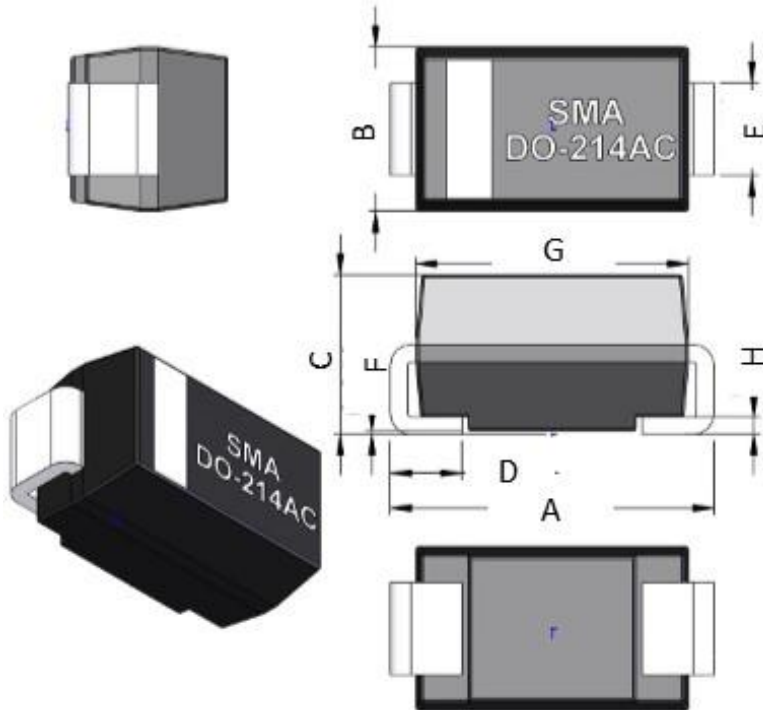
Profile Feature	SnPb eutectic assembly	Pb-free assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3 °C/s maximum	3 °C/s maximum
Preheat		
Temperature minimum (T <sub>smin</sub> )	100 °C	150 °C
Temperature maximum (T <sub>smax</sub> )	150 °C	200 °C
Time (t <sub>smin</sub> to t <sub>smax</sub> )	60 s to 120 s	60 s to 180 s
Time maintained above		
Temperature (T <sub>L</sub> )	183 °C	217 °C
Time (t <sub>L</sub> )	60 s to 150 s	60 s to 150 s
Peak/classification temperature (T)	235 °C	260 °C
Number of allowed reflow cycles	3	3
Time within 5 °C of actual peak temperature (t <sub>p</sub> )	10 s to 30 s	20 s to 40 s
Ramp-down rate	6 °C/s maximum	6 °C/s maximum
Time 25 °C to peak temperature	6 minutes maximum	8 minutes maximum

temperature



**5. Package Information**

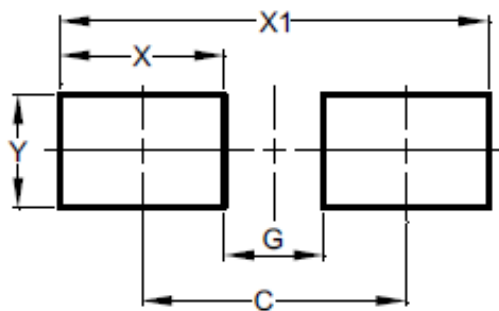
5-1. Dimension



SMAJ		
Dim	Min	Max
A	4.75	5.25
B	2.55	2.85
C	2.00	2.50
D	0.85	1.55
E	1.35	1.65
F	-	0.40
G	4.25	4.55
H	0.15	0.30

Unit:mm

5-2. PCB Pad Layout Recommendation



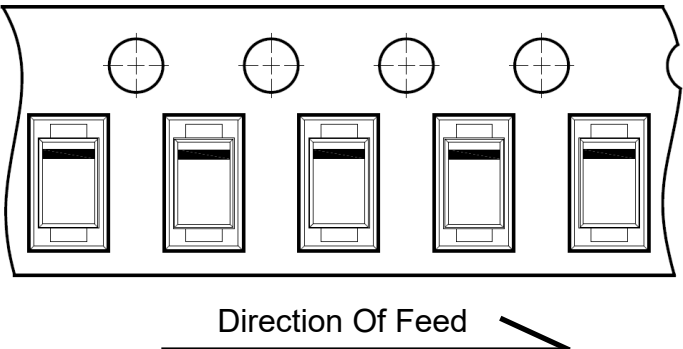
Dimensions	Value (in mm)
C	4.00
G	1.50
X	2.50
X1	6.50
Y	1.70

Unit:mm

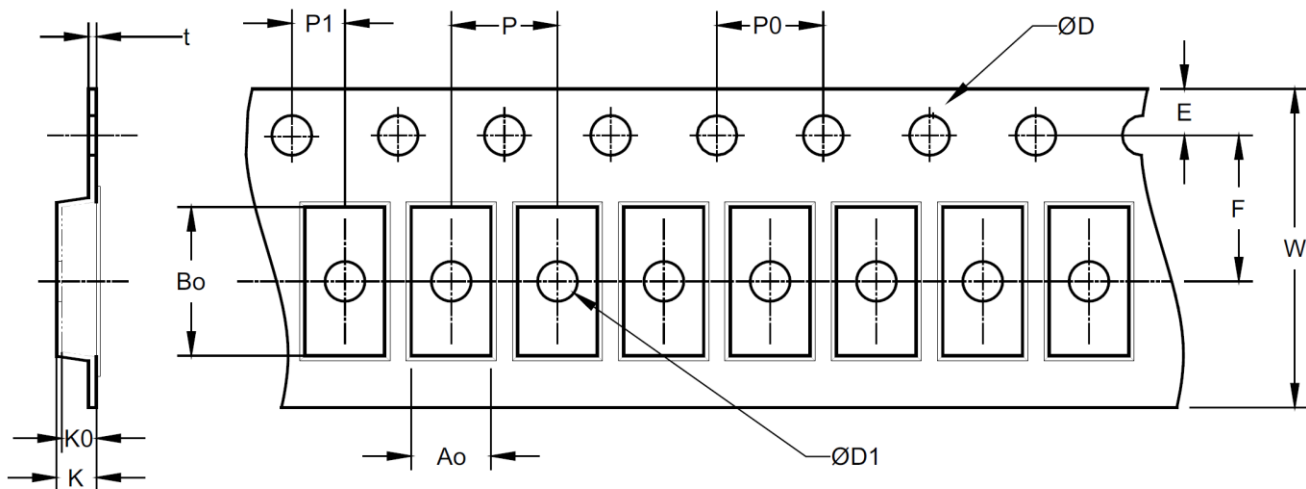


## 6. Packing

### 6-1. Taping and Reel Specification

Taping Width	Tape Orientation
12mm	

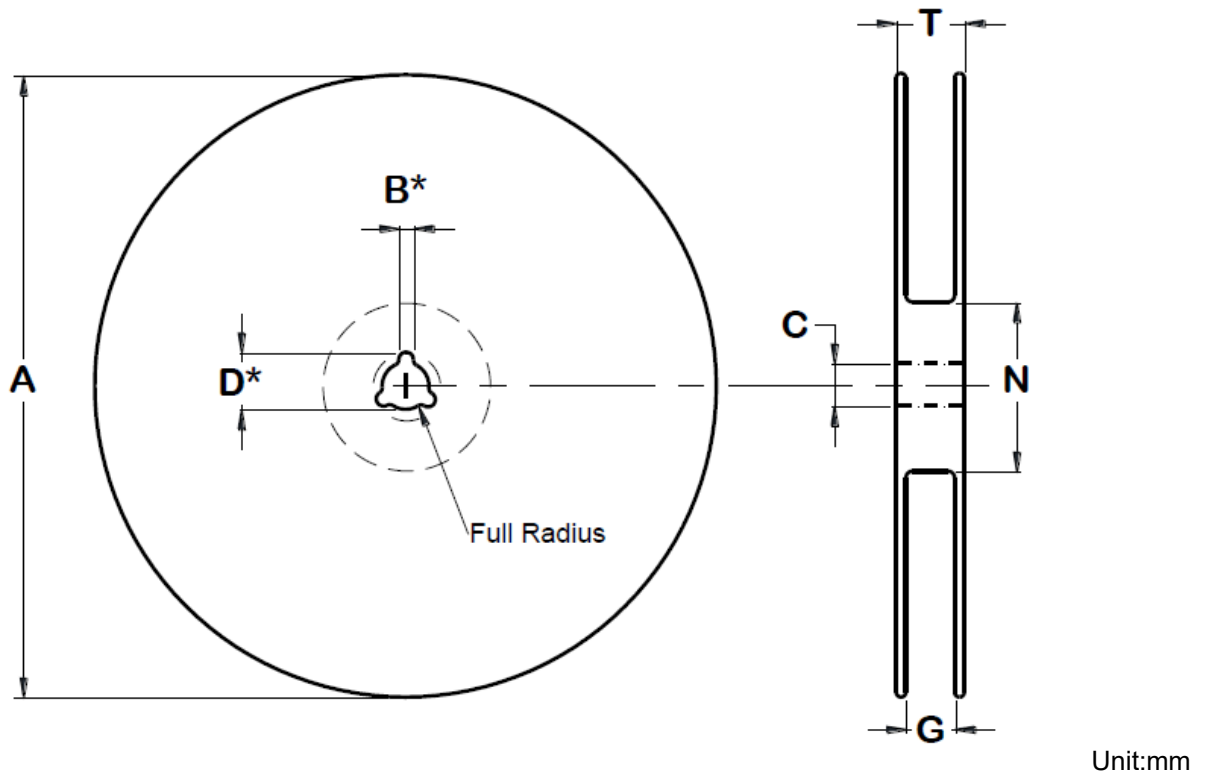
### 6-2. Embossed Carrier Tape Specification



Unit:mm

Dimension	W	Ao	Bo	D	D1	E	F	K	P	P0	P1	t	W
Value	12 mm	3.0 ±0.10	5.6 ±0.10	1.5 ±0.10	1.5 Min	1.75 ±0.10	5.5 ±0.05	1.2 ±0.10	4.0 ±0.10	4.0 ±0.05	2.0 ±0.05	0.25 ±0.05	12 ±0.2
A0 / B0 / K0	Determined by Component Size. The Clearance Between the Component And The Cavity Must Comply to The Rotational And Lateral Movement Requirement Provided in Figures in The "Maximum Component Movement in Tape Pocket" Section.												

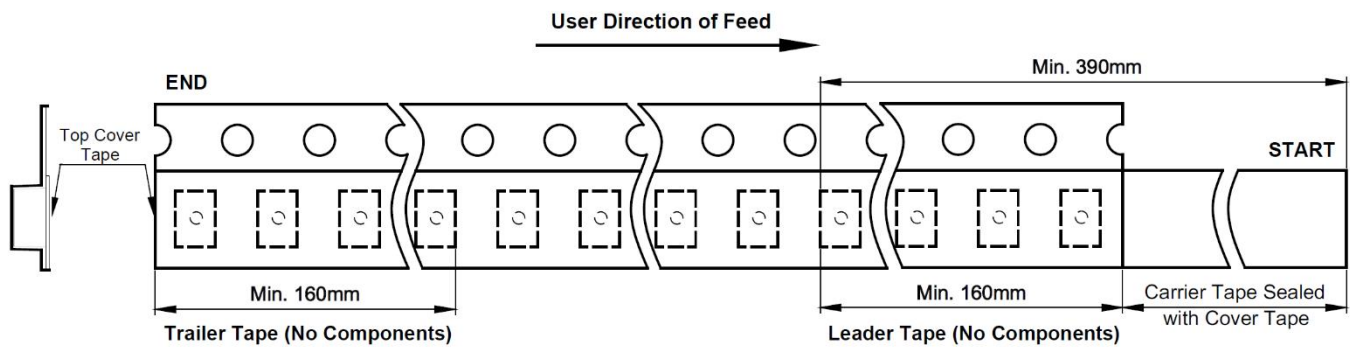
6-3. Surface Mount Reel Specification



Unit:mm

Dimension	Tape Width	Reel Size	A	B	C	D	N	G	T
Value	12 mm	13"	330 ±2	2.0 +0.5-0	13 +0.5-0.2	20.5 ±0.2	100 ±2	12.4 +2.0 -0.0	18.4

6-4. Tape Leader and Trailer Specification



## 7. Family Members

Part Number	Component Package	Watts	Working Voltage $V_{RWM}(V)$
SMF Series	SOD-123FL	300W	5.0V ~ 190V
NVS4M Series		400W	5.0V ~ 58V
NVS4D Series	DFN2020-3L	400W	3.3V ~ 58V
<b>SMAJ Series</b>	<b>SMAJ</b>	<b>400W</b>	<b>5.0V ~ 190V</b>
SMA6J Series		600W	12V ~ 58V
NVS6A Series	SMAF	600W	12V ~ 58V
SMBJ Series	SMBJ	600W	5.0V ~ 190V
SMB10J Series		1000W	
NVS15B Series	SMBF	1500W	5.0V ~ 58V
SMPJ Series	TO-277	1500W	5.0V ~ 200V
SMCJ Series	SMCJ	1500W	5.0V ~ 190V
2.0SMCJ Series		2000W	
3.0SMCJ Series		3000W	
4.0SMCJ Series		4000W	12V ~ 58V
5.0SMCJ Series		5000W	12V ~ 170V
6KA Series		6600W	21V ~ 58V
5KP Series		P600	5000W
10KP Series	10000W		17V ~ 180V
15KP Series	15000W		
20KP Series	20000W		20V ~ 180V

## 8. Ordering Information

Part Number	Marking Code	Quantity	Component Package	Packaging Option
SMAJxxA	Series	5,000PCS	SMAJ	13"reel
SMAJxxCA				

## 9. Version

### 9-1. History

Version	Date	File No.	Recording	Basis
A	06-Dec-2017	F117501	New Create	Market
B	06-May-2020		Update Company Information	System
C	16-Aug-2020		Update Part No.	System
2.0	19-May-2021		Update Version	System
2.1	14-Jul-2021		Update Version	System