



# THE DATASHEET OF SMAJ28CA-AT/TR13



# DATA SHEET

## TRANSIENT VOLTAGE SUPPRESSORS

### AC/DC POWER SUPPLY

SMAJ-AT series

RoHS compliant & Halogen free

Product specification— June 30, 2023 V.4



## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- 400W peak pulse power capability at 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1 $\mu$ A above 10V
- High Temperature soldering: 260 $^{\circ}$ C/10 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020
- Safety certification: UL
- AEC-Q101 qualified
- IEC61000-4-2 ESD 30KV Air, 30KV contact compliance



### Mechanical Data

- Case: JEDEC DO-214AC. Molded plastic over glass passivated junction
- Terminal: Tin plated, solderable per MIL-STD-750, Method 2026
- Polarity: Color band denotes cathode except bi-directional models
- Standard Packaging: 12mm tape (EIA STD RS-481)
- Weight: 0.07g

### Applications

- I/O interface
- AC/DC power supply
- Low frequency signal transmission line (RS232, RS485, etc.)

### Maximum Ratings and Characteristics

Ratings at 25 $^{\circ}$ C ambient temperature unless otherwise specified.

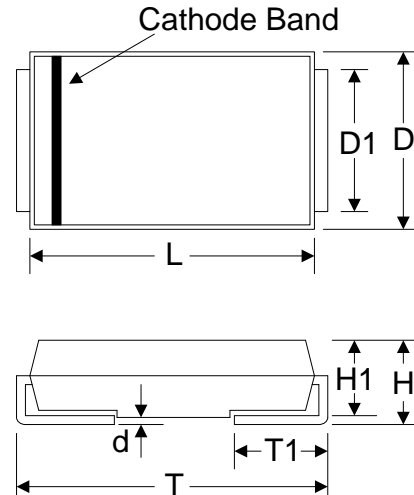
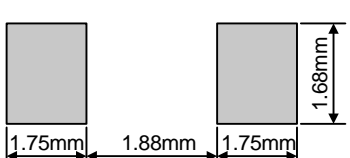
Rating	Symbol	Value	Units
Peak pulse power dissipation at 10/1000 $\mu$ s waveform (Note1, Note2, Fig.1)	$P_{PPM}$	Minimum 400	Watts
Peak pulse current of at 10/1000 $\mu$ s waveform (Note 1, Fig.3)	$I_{PPM}$	See Table	Amps
Steady state power dissipation at $T_A=50^{\circ}$ C (Fig.5)	$P_{M(AV)}$	3.3	Watts
Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6)	$I_{FSM}$	40	Amps
Operating junction and Storage Temperature Range.	$T_J, T_{STG}$	-55 to +150	$^{\circ}$ C
Typical thermal resistance junction to lead	$R_{\theta JL}$	30	$^{\circ}$ C/W
Typical thermal resistance junction to ambient	$R_{\theta JA}$	120	$^{\circ}$ C/W

Notes: 1. Non-repetitive current pulse, per Fig.3 and derated above  $T_A=25^{\circ}$ C per Fig.2.

2. Mounted on 5.0mm $\times$ 5.0mm (0.03mm thick) copper pads to each terminal.

3. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.

**Dimensions (SMA/DO-214AC)**

<p>Product:</p>  <p>Pad:</p> 	Symbol	Millimeters		Inches	
		Min.	Max.	Min.	Max.
	L	3.99	4.50	0.157	0.177
	D	2.54	2.79	0.100	0.110
	D1	1.25	1.65	0.049	0.065
	T	4.93	5.28	0.194	0.208
	T1	0.76	1.52	0.030	0.060
	d	-	0.203	-	0.008
	H	2.00	2.50	0.079	0.098
	H1	1.98	2.29	0.078	0.090

**Electrical Characteristics (T<sub>A</sub>=25°C)**

Part Number		Device Marking Code		Reverse Stand-Off Voltage	Breakdown Voltage @I <sub>T</sub>	Test Current	Maximum Clamping Voltage @I <sub>PP</sub>	Peak Pulse Current	Reverse Leakage @V <sub>RWM</sub>
Unidirectional	Bidirectional	UNI	BI	V <sub>RWM</sub> (V)	V <sub>BR</sub> (V)	I <sub>T</sub> (mA)	V <sub>C</sub> (V)	I <sub>PP</sub> (A)	I <sub>R</sub> (μA)
SMAJ5.0A-AT	SMAJ5.0CA-AT	AE	WE	5.0	6.40~7.00	10	9.2	43.5	800
SMAJ6.0A-AT	SMAJ6.0CA-AT	AG	WG	6.0	6.67~7.37	10	10.3	38.8	800
SMAJ6.5A-AT	SMAJ6.5CA-AT	AK	WK	6.5	7.22~7.98	10	11.2	35.7	500
SMAJ7.0A-AT	SMAJ7.0CA-AT	AM	WM	7.0	7.78~8.60	10	12.0	33.3	200
SMAJ7.5A-AT	SMAJ7.5CA-AT	AP	WP	7.5	8.33~9.21	1	12.9	31.0	100
SMAJ8.0A-AT	SMAJ8.0CA-AT	AR	WR	8.0	8.89~9.83	1	13.6	29.4	50
SMAJ8.5A-AT	SMAJ8.5CA-AT	AT	WT	8.5	9.44~10.40	1	14.4	27.8	20
SMAJ9.0A-AT	SMAJ9.0CA-AT	AV	WV	9.0	10.00~11.10	1	15.4	26.0	10
SMAJ10A-AT	SMAJ10CA-AT	AX	WX	10.0	11.10~12.30	1	17.0	23.5	5
SMAJ11A-AT	SMAJ11CA-AT	AZ	WZ	11.0	12.20~13.50	1	18.2	22.0	1
SMAJ12A-AT	SMAJ12CA-AT	BE	XE	12.0	13.30~14.70	1	19.9	20.1	1
SMAJ13A-AT	SMAJ13CA-AT	BG	XG	13.0	14.40~15.90	1	21.5	18.6	1
SMAJ14A-AT	SMAJ14CA-AT	BK	XK	14.0	15.60~17.20	1	23.2	17.2	1
SMAJ15A-AT	SMAJ15CA-AT	BM	XM	15.0	16.70~18.50	1	24.4	16.4	1
SMAJ16A-AT	SMAJ16CA-AT	BP	XP	16.0	17.80~19.70	1	26.0	15.4	1
SMAJ17A-AT	SMAJ17CA-AT	BR	XR	17.0	18.90~20.90	1	27.6	14.5	1
SMAJ18A-AT	SMAJ18CA-AT	BT	XT	18.0	20.00~22.10	1	29.2	13.7	1

**Transient Voltage Suppressors** SMAJ-AT

Part Number		Device Marking Code		Reverse Stand-Off Voltage	Breakdown Voltage @ $I_T$	Test Current	Maximum Clamping Voltage @ $I_{PP}$	Peak Pulse Current	Reverse Leakage @ $V_{RWM}$
Unidirectional	Bidirectional	UNI	BI	$V_{RWM}(V)$	$V_{BR}(V)$	$I_T(mA)$	$V_C(V)$	$I_{PP}(A)$	$I_R(\mu A)$
SMAJ20A-AT	SMAJ20CA-AT	BV	XV	20.0	22.20~24.50	1	32.4	12.3	1
SMAJ22A-AT	SMAJ22CA-AT	BX	XX	22.0	24.40~26.90	1	35.5	11.3	1
SMAJ24A-AT	SMAJ24CA-AT	BZ	XZ	24.0	26.70~29.50	1	38.9	10.3	1
SMAJ26A-AT	SMAJ26CA-AT	CE	YE	26.0	28.90~31.90	1	42.1	9.5	1
SMAJ28A-AT	SMAJ28CA-AT	CG	YG	28.0	31.10~34.40	1	45.4	8.8	1
SMAJ30A-AT	SMAJ30CA-AT	CK	YK	30.0	33.30~36.80	1	48.4	8.3	1
SMAJ33A-AT	SMAJ33CA-AT	CM	YM	33.0	36.70~40.60	1	53.3	7.5	1
SMAJ36A-AT	SMAJ36CA-AT	CP	YP	36.0	40.00~44.20	1	58.1	6.9	1
SMAJ40A-AT	SMAJ40CA-AT	CR	YR	40.0	44.40~49.10	1	64.5	6.2	1
SMAJ43A-AT	SMAJ43CA-AT	CT	YT	43.0	47.80~52.80	1	69.4	5.8	1
SMAJ45A-AT	SMAJ45CA-AT	CV	YV	45.0	50.00~55.30	1	72.7	5.5	1
SMAJ48A-AT	SMAJ48CA-AT	CX	YX	48.0	53.30~58.90	1	77.4	5.2	1
SMAJ51A-AT	SMAJ51CA-AT	CZ	YZ	51.0	56.70~62.70	1	82.4	4.9	1
SMAJ54A-AT	SMAJ54CA-AT	RE	ZE	54.0	60.00~66.30	1	87.1	4.6	1
SMAJ58A-AT	SMAJ58CA-AT	RG	ZG	58.0	64.40~71.20	1	93.6	4.3	1
SMAJ60A-AT	SMAJ60CA-AT	RK	ZK	60.0	66.70~73.70	1	96.8	4.1	1
SMAJ64A-AT	SMAJ64CA-AT	RM	ZM	64.0	71.10~78.60	1	103.0	3.9	1
SMAJ70A-AT	SMAJ70CA-AT	RP	ZP	70.0	77.80~86.00	1	113.0	3.5	1
SMAJ75A-AT	SMAJ75CA-AT	RR	ZR	75.0	83.30~92.10	1	121.0	3.3	1
SMAJ78A-AT	SMAJ78CA-AT	RT	ZT	78.0	86.70~95.80	1	126.0	3.2	1
SMAJ85A-AT	SMAJ85CA-AT	RV	ZV	85.0	94.40~104.00	1	137.0	2.9	1
SMAJ90A-AT	SMAJ90CA-AT	RX	ZX	90.0	100.00~111.00	1	146.0	2.7	1
SMAJ100A-AT	SMAJ100CA-AT	RZ	ZZ	100.0	111.00~123.00	1	162.0	2.5	1
SMAJ110A-AT	SMAJ110CA-AT	SE	VE	110.0	122.00~135.00	1	177.0	2.3	1
SMAJ120A-AT	SMAJ120CA-AT	SG	VG	120.0	133.00~147.00	1	193.0	2.1	1
SMAJ130A-AT	SMAJ130CA-AT	SK	VK	130.0	144.00~159.00	1	209.0	1.9	1
SMAJ150A-AT	SMAJ150CA-AT	SM	VM	150.0	167.00~185.00	1	243.0	1.6	1
SMAJ160A-AT	SMAJ160CA-AT	SP	VP	160.0	178.00~197.00	1	259.0	1.5	1
SMAJ170A-AT	SMAJ170CA-AT	SR	VR	170.0	189.00~209.00	1	275.0	1.5	1
SMAJ180A-AT	SMAJ180CA-AT	ST	VT	180.0	201.00~222.00	1	292.0	1.4	1
SMAJ190A-AT	SMAJ190CA-AT	SU	YU	190.0	211.00~233.00	1	308.0	1.3	1
SMAJ200A-AT	SMAJ200CA-AT	SV	VV	200.0	224.00~247.00	1	324.0	1.2	1
SMAJ210A-AT	SMAJ210CA-AT	SW	YW	210.0	237.00~263.00	1	340.0	1.2	1
SMAJ220A-AT	SMAJ220CA-AT	GE	VX	220.0	246.00~272.00	1	356.0	1.1	1
SMAJ250A-AT	SMAJ250CA-AT	SZ	VZ	250.0	279.00~309.00	1	405.0	1.0	1
SMAJ300A-AT	SMAJ300CA-AT	TE	UE	300.0	335.00~371.00	1	486.0	0.8	1
SMAJ350A-AT	SMAJ350CA-AT	TG	UG	350.0	391.00~432.00	1	567.0	0.7	1
SMAJ400A-AT	SMAJ400CA-AT	TK	UK	400.0	447.00~494.00	1	648.0	0.6	1
SMAJ440A-AT	SMAJ440CA-AT	TM	UM	440.0	492.00~543.00	1	713.0	0.6	1

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

Figure 1. Peak Pulse Power Rating Curve

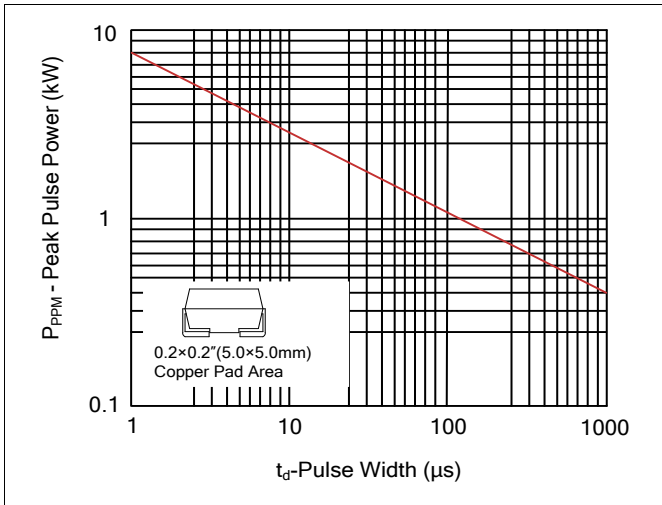


Figure 2. Pulse Derating Curve

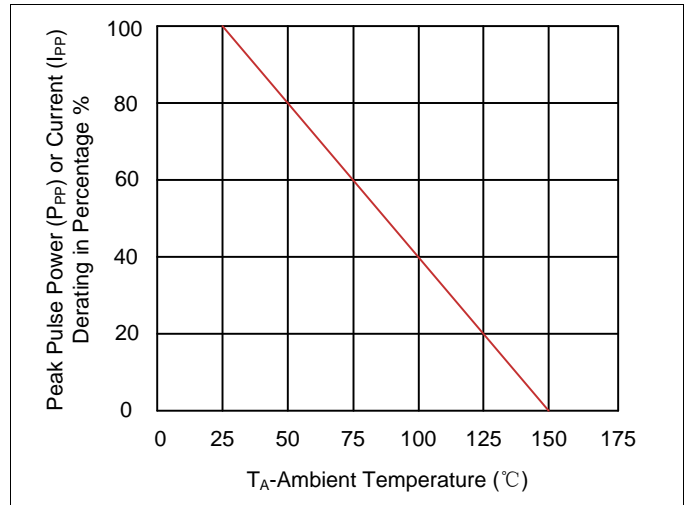


Figure 3. Pulse Waveform

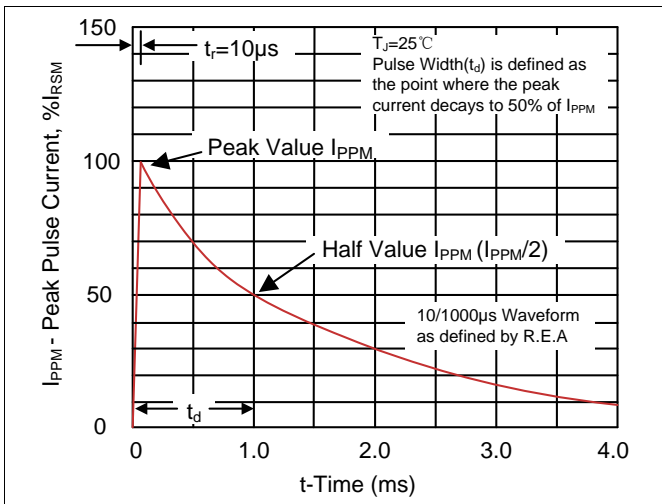


Figure 4. Typical Junction Capacitance

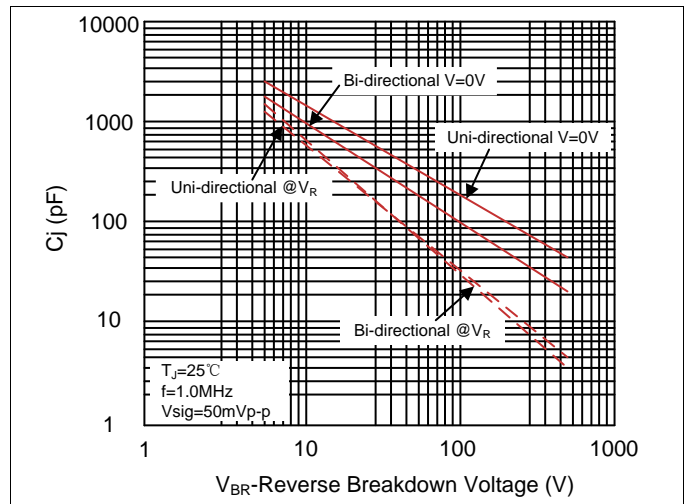


Figure 5. Steady State Power Dissipation Derating Curve

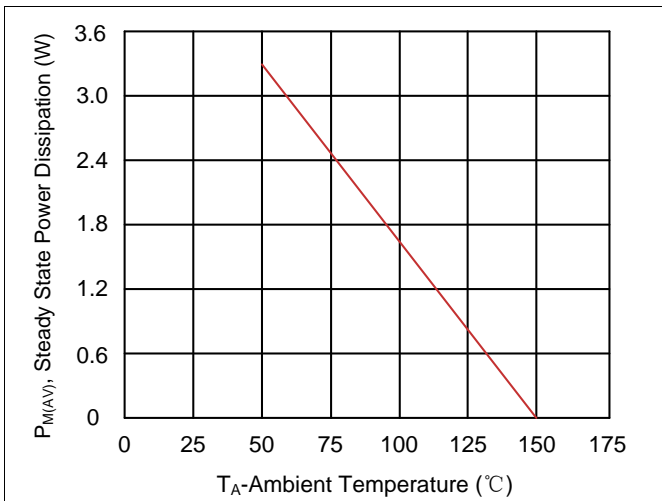
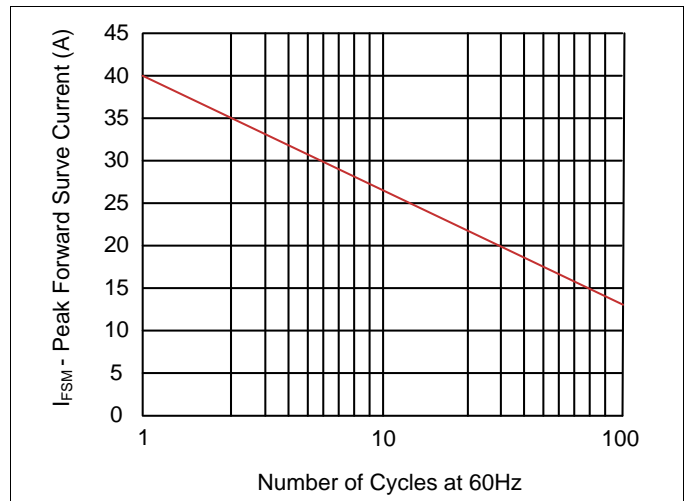
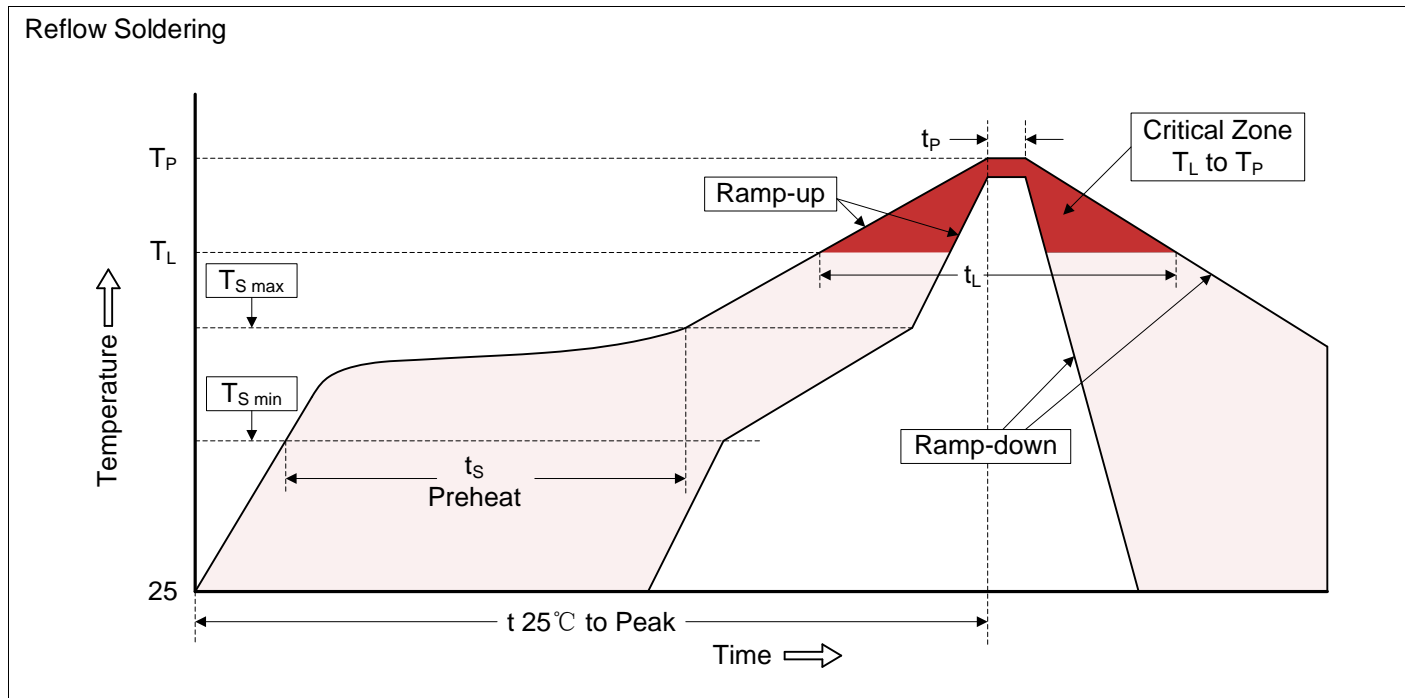


Figure 6. Maximum Non-Repetitive Forward Surge Current Uni-Directional Only



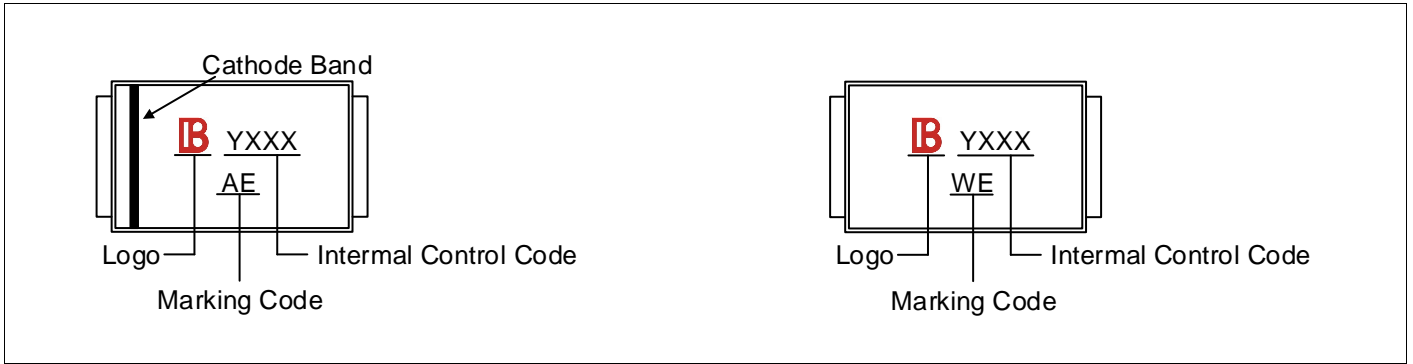
**Recommended Soldering Conditions**



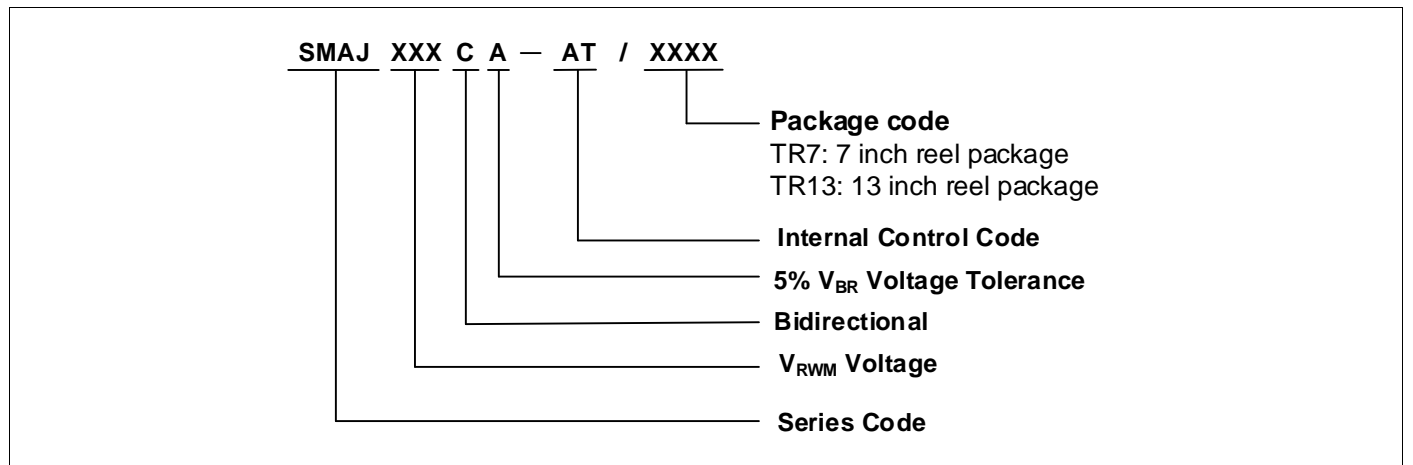
Recommended Conditions

Profile Feature	Pb-Free Assembly
Average ramp-up rate (T <sub>L</sub> to T <sub>P</sub> )	3°C/second max.
Preheat	
-Temperature Min (T <sub>S min</sub> )	150°C
-Temperature Max (T <sub>S max</sub> )	200°C
-Time (min to max) (t <sub>s</sub> )	60-180 seconds
T <sub>S max</sub> to T <sub>L</sub>	
-Ramp-up Rate	3°C/second max.
Time maintained above:	
-Temperature (T <sub>L</sub> )	217°C
-Time (t <sub>L</sub> )	60-150 seconds
Peak Temperature (T <sub>P</sub> )	260°C
Time within 5 °C of actual Peak	20-40 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

**Marking Code**



**Part Number Code**

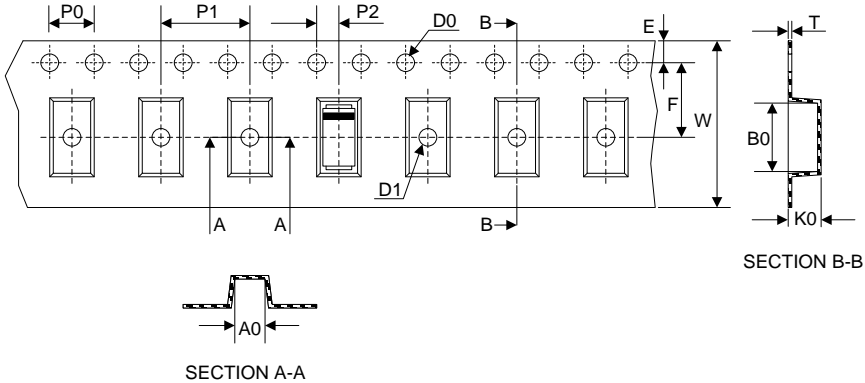
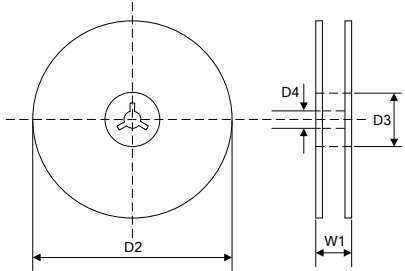
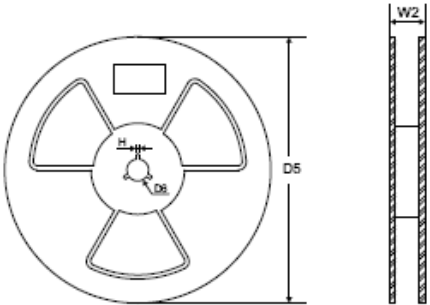


**Ordering Code for Different Package**

7 inch reel package: Add suffix “ /TR7 ” at the end of the part number, such as SMAJXXXCA-AT/TR7

13 inch reel package: Add suffix “ /TR13 ” at the end of the part number, such as SMAJXXXCA-AT/TR13

**Packaging**

Tape	Symbol	Dimension (mm)
	W	12.00±0.20
	P0	4.00±0.10
	P1	4.00±0.10
	P2	2.00±0.10
	D0	Φ1.5±0.10
	D1	Φ1.5±0.10
	E	1.75±0.10
	F	5.50±0.05
	A0	2.79±0.10
	B0	5.33±0.10
	K0	2.55±0.15
	T	0.25±0.05
	<p><b>7" Reel</b></p> 	D2
D3		Φ50.0Min.
D4		Φ13.0±0.5
W1		16.0±2.0
Quantity: 1000PCS		
<p><b>13" Reel</b></p> 	D5	Φ330.0±2.0
	D6	Φ13.5±0.5
	H	2.5±1.0
	W2	16.0±2.0
	Quantity: 5000PCS	

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