

# SMAKNT20(C)A-Q1 THRU SMAKNT800(C)A-Q1

## List

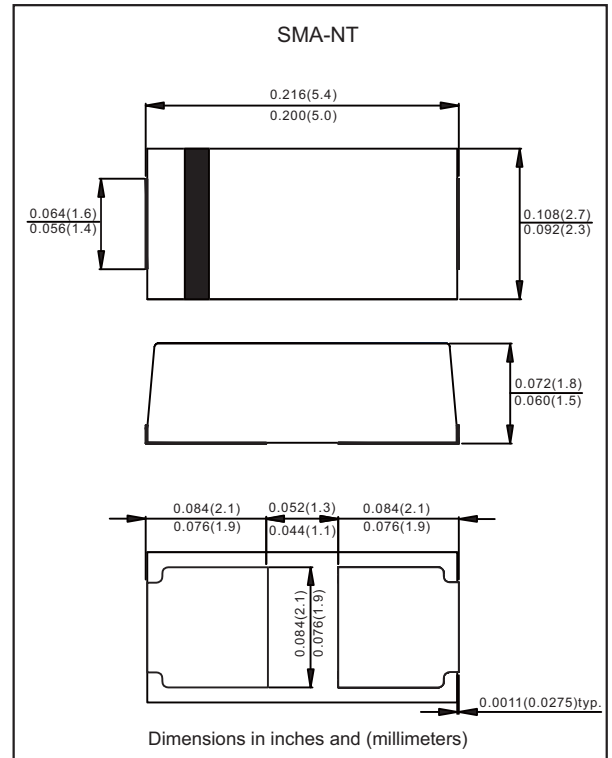
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**SMAKNT20(C)A-Q1 THRU SMAKNT800(C)A-Q1****1000W Dual Flat No-Lead Unidirectional and Bidirectional Transient Voltage Suppressors 20V-800V****Features**

- Well package design with solder pad on the bottom for best thermal performance
- Leads on two opposing sides of the body
- 1000W peak pulse power capability with a 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- Uni and Bidirectional unit
- Glass passivated chip junction
- Excellent clamping capability
- Low incremental surge resistance
- Lead-free parts meet RoHS requirements
- Qualified to AEC-Q101 standards for high reliability
- Suffix "-H" indicates Halogen-free part, ex. SMAKNT20A-Q1-H

**Mechanical data**

- Epoxy: UL94-V0 rated flame retardant
- Case : Molded plastic, SMA-NT
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band(Uni-directional types only)
- Mounting Position : Any
- Weight : Approximated 0.069 gram

**Package outline****Maximum ratings** (AT  $T_A=25^\circ\text{C}$  unless otherwise noted)

Parameter	Conditions	Symbol	Value	Unit
Peak power dissipation	with a 10/1000 $\mu$ s waveform, Note 1, 2 & Fig. 1	PPPM	1000	W
Peak pulse current	with a 10/1000 $\mu$ s waveform	IPPM	See Table	A
Steady state power dissipation	at $T_L=75^\circ\text{C}$ , Note 2	$P_{M(AV)}$	3.0	W
Operating junction temperature range		$T_J$	-55 to +150	$^\circ\text{C}$
Storage temperature range		$T_{STG}$	-65 to +175	$^\circ\text{C}$

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

2: Mounted on copper pad area of 0.2"x0.2" (5.0x5.0 mm) per Fig 5

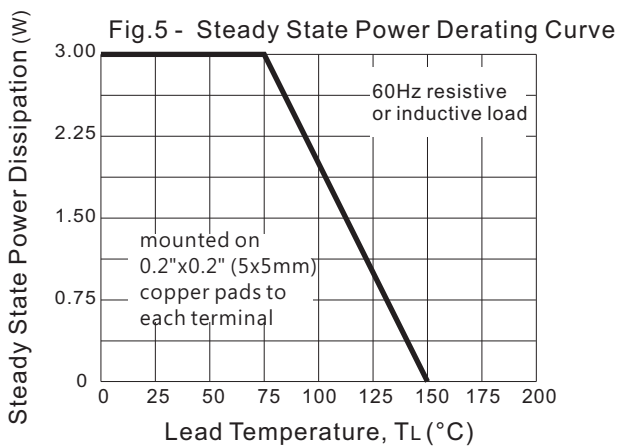
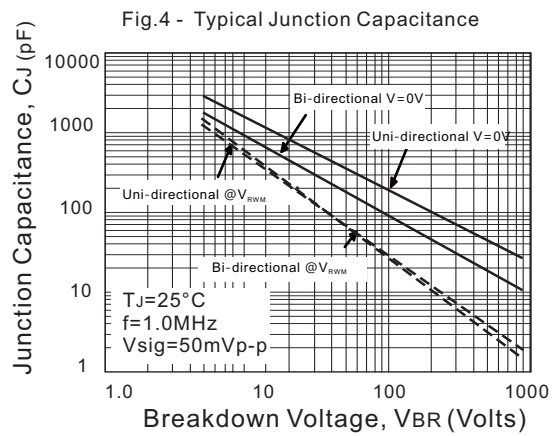
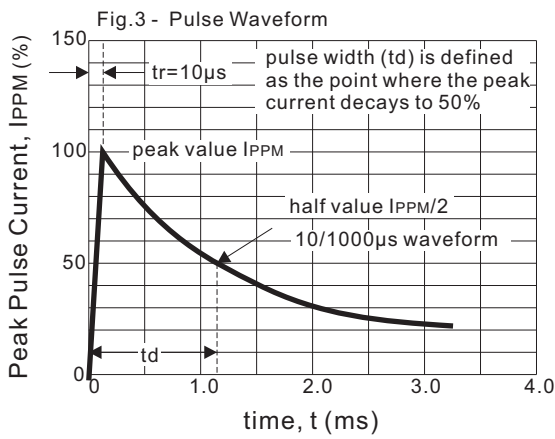
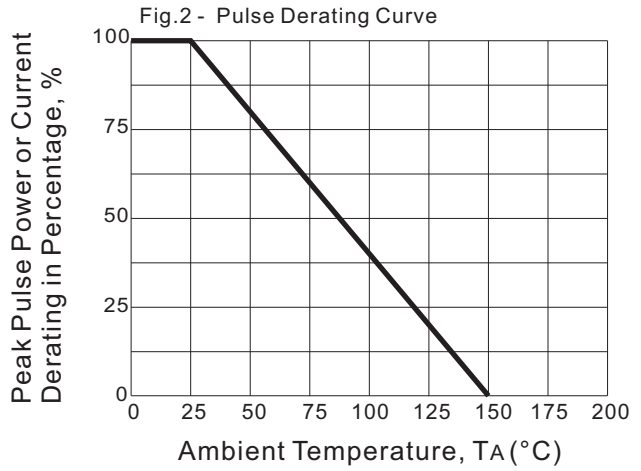
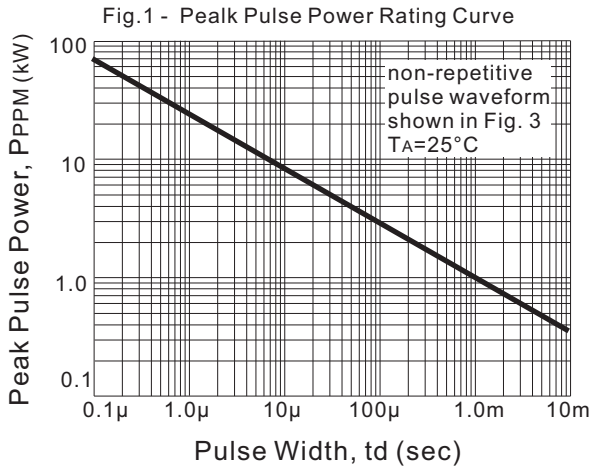
**Electrical characteristics** (at  $T_A=25^{\circ}\text{C}$  unless otherwise noted)

Part No. (Uni)	Part No. (Bi)	Reverse Stand-off Voltage	Breakdown Voltage @ $I_T$		Test Current	Maximum Clamping Voltage @ $I_{PP}$		Maximum Reverse Leakage Current	Marking Code	
		$V_{RWM}$	$V_{BRMin}$	$V_{BRMax}$	$I_T$	$V_C$	$I_{PP}$	$I_R@V_{RWM}$		
		Volts	Volts	Volts	mA	Volts	A	$\mu\text{A}$	Uni	Bi
SMAKNT20A-Q1	SMAKNT20CA-Q1	20	22.2	24.5	1.0	32.4	30.9	5	KBV	KXV
SMAKNT22A-Q1	SMAKNT22CA-Q1	22	24.4	26.9	1.0	35.5	28.2	5	KBX	KXX
SMAKNT24A-Q1	SMAKNT24CA-Q1	24	26.7	29.5	1.0	38.9	25.7	5	KBZ	KXZ
SMAKNT26A-Q1	SMAKNT26CA-Q1	26	28.9	31.9	1.0	42.1	23.8	5	KCE	KYE
SMAKNT28A-Q1	SMAKNT28CA-Q1	28	31.1	34.4	1.0	45.4	22.0	5	KCG	KYG
SMAKNT30A-Q1	SMAKNT30CA-Q1	30	33.3	36.8	1.0	48.4	20.7	5	KCK	KYK
SMAKNT33A-Q1	SMAKNT33CA-Q1	33	36.7	40.6	1.0	53.3	18.8	5	KCM	KYM
SMAKNT36A-Q1	SMAKNT36CA-Q1	36	40.0	44.2	1.0	58.1	17.2	5	KCP	KYP
SMAKNT40A-Q1	SMAKNT40CA-Q1	40	44.4	49.1	1.0	64.5	15.5	5	KCR	KYR
SMAKNT43A-Q1	SMAKNT43CA-Q1	43	47.8	52.8	1.0	69.4	14.4	5	KCT	KYT
SMAKNT45A-Q1	SMAKNT45CA-Q1	45	50.0	55.3	1.0	72.7	13.8	5	KCV	KYV
SMAKNT48A-Q1	SMAKNT48CA-Q1	48	53.3	58.9	1.0	77.4	12.9	5	KCX	KYX
SMAKNT51A-Q1	SMAKNT51CA-Q1	51	56.7	62.7	1.0	82.4	12.1	5	KCZ	KYZ
SMAKNT54A-Q1	SMAKNT54CA-Q1	54	60.0	66.3	1.0	87.1	11.5	5	KRE	KZE
SMAKNT58A-Q1	SMAKNT58CA-Q1	58	64.4	71.2	1.0	93.6	10.7	5	KRG	KZG
SMAKNT60A-Q1	SMAKNT60CA-Q1	60	66.7	73.7	1.0	96.8	10.3	5	KRK	KZK
SMAKNT64A-Q1	SMAKNT64CA-Q1	64	71.1	78.6	1.0	103	9.7	5	KRM	KZM
SMAKNT70A-Q1	SMAKNT70CA-Q1	70	77.8	86.0	1.0	113	8.9	5	KRP	KZP
SMAKNT75A-Q1	SMAKNT75CA-Q1	75	83.3	92.1	1.0	121	8.3	5	KRR	KZR
SMAKNT78A-Q1	SMAKNT78CA-Q1	78	86.7	95.8	1.0	126	7.9	5	KRT	KZT
SMAKNT85A-Q1	SMAKNT85CA-Q1	85	94.4	104	1.0	137	7.3	5	KRV	KZV
SMAKNT90A-Q1	SMAKNT90CA-Q1	90	100	111	1.0	146	6.9	5	KRX	KZX
SMAKNT100A-Q1	SMAKNT100CA-Q1	100	111	123	1.0	162	6.2	5	KRZ	KZZ
SMAKNT110A-Q1	SMAKNT110CA-Q1	110	122	135	1.0	177	5.7	5	KSE	KVE
SMAKNT120A-Q1	SMAKNT120CA-Q1	120	133	147	1.0	193	5.2	5	KSG	KVG
SMAKNT130A-Q1	SMAKNT130CA-Q1	130	144	159	1.0	209	4.8	5	KSK	KVK
SMAKNT150A-Q1	SMAKNT150CA-Q1	150	167	185	1.0	243	4.1	5	KSM	KVM
SMAKNT160A-Q1	SMAKNT160CA-Q1	160	178	197	1.0	259	3.9	5	KSP	KVP
SMAKNT170A-Q1	SMAKNT170CA-Q1	170	189	209	1.0	275	3.6	5	KSR	KVR
SMAKNT180A-Q1	SMAKNT180CA-Q1	180	201	222	1.0	292	3.4	5	KST	KVT
SMAKNT200A-Q1	SMAKNT200CA-Q1	200	224	247	1.0	324	3.1	5	KSV	KVV
SMAKNT220A-Q1	SMAKNT220CA-Q1	220	246	272	1.0	356	2.8	5	KSX	KVX
SMAKNT250A-Q1	SMAKNT250CA-Q1	250	279	309	1.0	405	2.47	5	KSZ	KVZ
SMAKNT300A-Q1	SMAKNT300CA-Q1	300	335	371	1.0	486	2.06	5	KTE	KUE
SMAKNT350A-Q1	SMAKNT350CA-Q1	350	391	432	1.0	567	1.77	5	KTG	KUG
SMAKNT400A-Q1	SMAKNT400CA-Q1	400	447	494	1.0	648	1.55	5	KTK	KUK
SMAKNT440A-Q1	SMAKNT440CA-Q1	440	492	544	1.0	713	1.41	5	KTM	KUM
SMAKNT500A-Q1	SMAKNT500CA-Q1	500	558	618	1.0	810	1.24	5	KTP	KUP
SMAKNT550A-Q1	SMAKNT550CA-Q1	550	614	680	1.0	891	1.13	5	KTR	KUR
SMAKNT600A-Q1	SMAKNT600CA-Q1	600	670	741	1.0	971	1.03	5	KTT	KUT
SMAKNT650A-Q1	SMAKNT650CA-Q1	650	726	803	1.0	1052	0.96	5	KTV	KUV
SMAKNT700A-Q1	SMAKNT700CA-Q1	700	782	865	1.0	1133	0.89	5	KTX	KUX
SMAKNT750A-Q1	SMAKNT750CA-Q1	750	837	927	1.0	1213	0.83	5	KTZ	KUZ
SMAKNT800A-Q1	SMAKNT800CA-Q1	800	893	989	1.0	1298	0.78	5	KXE	KYE

Notes 1: Suffix 'C' denotes bi-directional devices. Suffix 'A' denotes 5% tolerance devices

2: Transient Voltage Suppressors (TVS) are devices used to protect vulnerable circuits from electrical overstress such as that caused by electrostatic discharge, inductive load switching and induced lightning. Within the TVS, damaging voltage spikes are limited by clamping or avalanche action of a rugged silicon pn junction which reduces the amplitude of the transient to a nondestructive level. See Fig. 6 &amp; Fig. 7

## Rating and characteristic curves



## Rating and characteristic curves

Fig. 6 - Transients of several thousand volts can be clamped to a safe level by the TVS

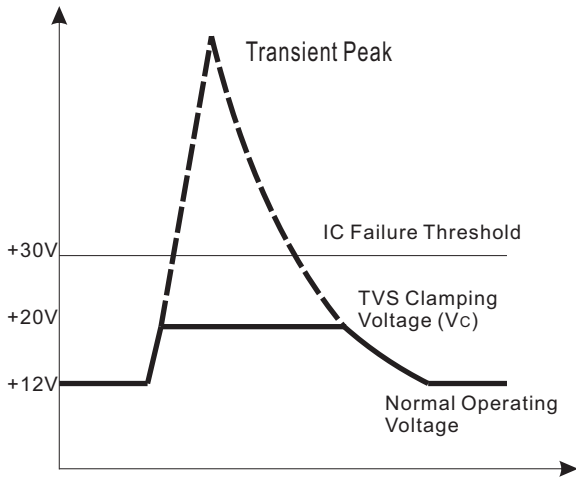
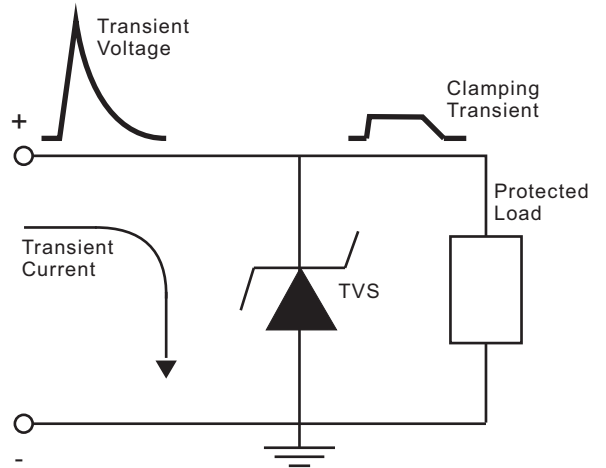
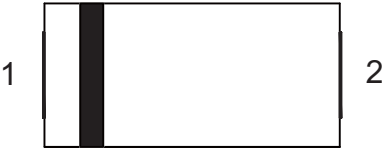





Fig. 7 - Transient current is diverted to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level


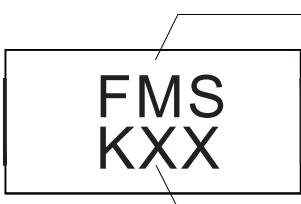


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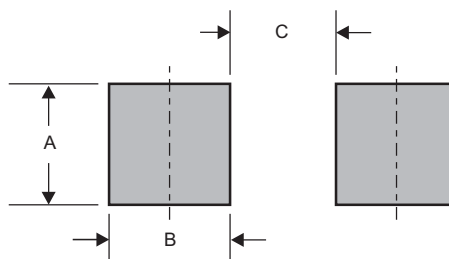
## Pinning information

Pin	Simplified outline	Symbol
Uni-Directional Pin1 cathode Pin2 anode		
Bi-Directional		

## Marking

Type number	Example
Uni-Directional	 <p>Cathode band FMS logo</p> <p>XX=Marking code (See page 3)</p>
Bi-Directional	 <p>FMS logo</p> <p>XX=Marking code (See page 3)</p>

## Suggested solder pad layout

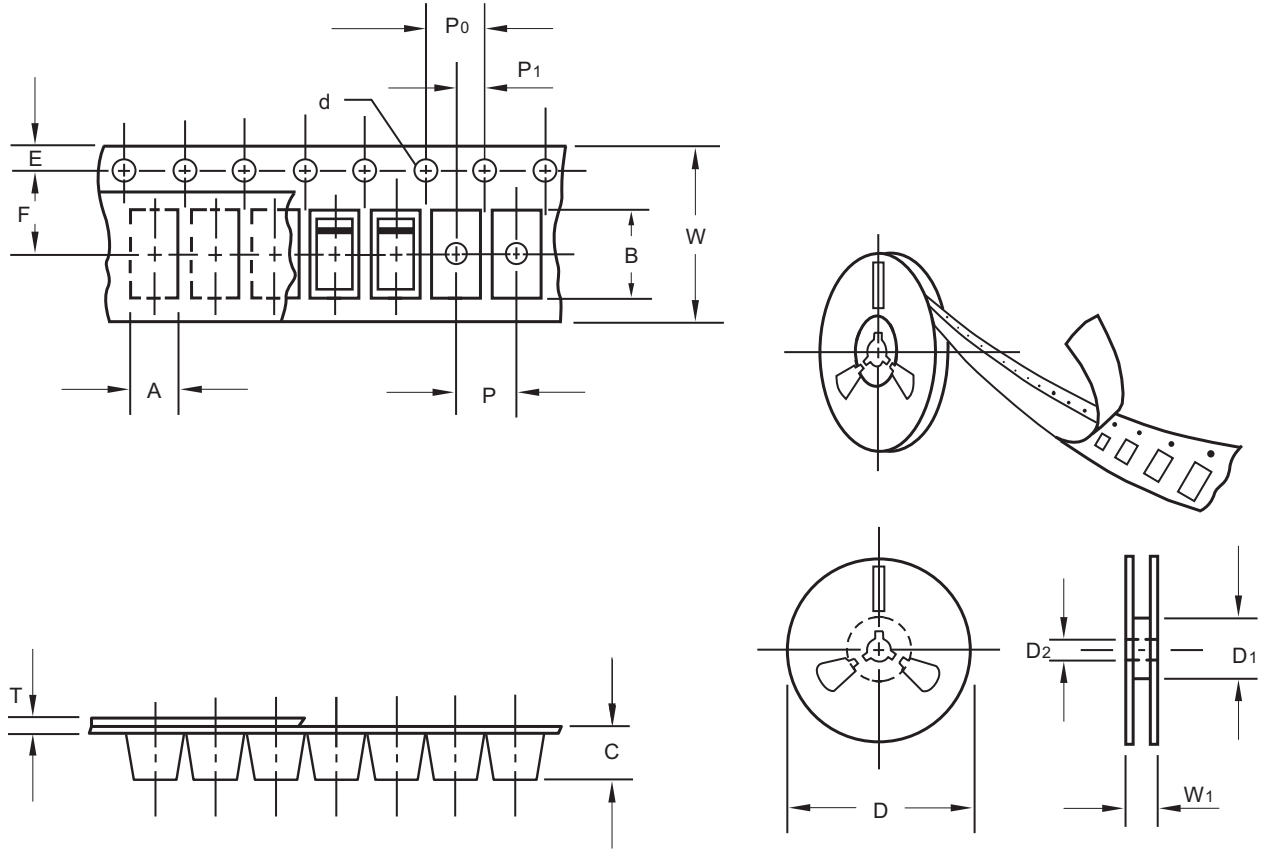


Dimensions in inches and (millimeters)

PACKAGE	A	B	C
SMA-NT	0.084 (2.10)	0.084 (2.10)	0.044 (1.10)

SMAKNT20(C)A-Q1 THRU SMAKNT800(C)A-Q1

Packing information



unit:mm

Item	Symbol	Tolerance	SMA-NT
Carrier width	A	0.1	2.90
Carrier length	B	0.1	5.50
Carrier depth	C	0.1	2.10
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	330.00
13" Reel inner diameter	D1	min	50.00
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	62.00
Feed hole diameter	D2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	5.50
Punch hole pitch	P	0.1	4.00
Sprocket hole pitch	P0	0.1	4.00
Embossment center	P1	0.1	2.00
Overall tape thickness	T	0.1	0.23
Tape width	W	0.3	12.00
Reel width	W1	1.0	18.00

Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

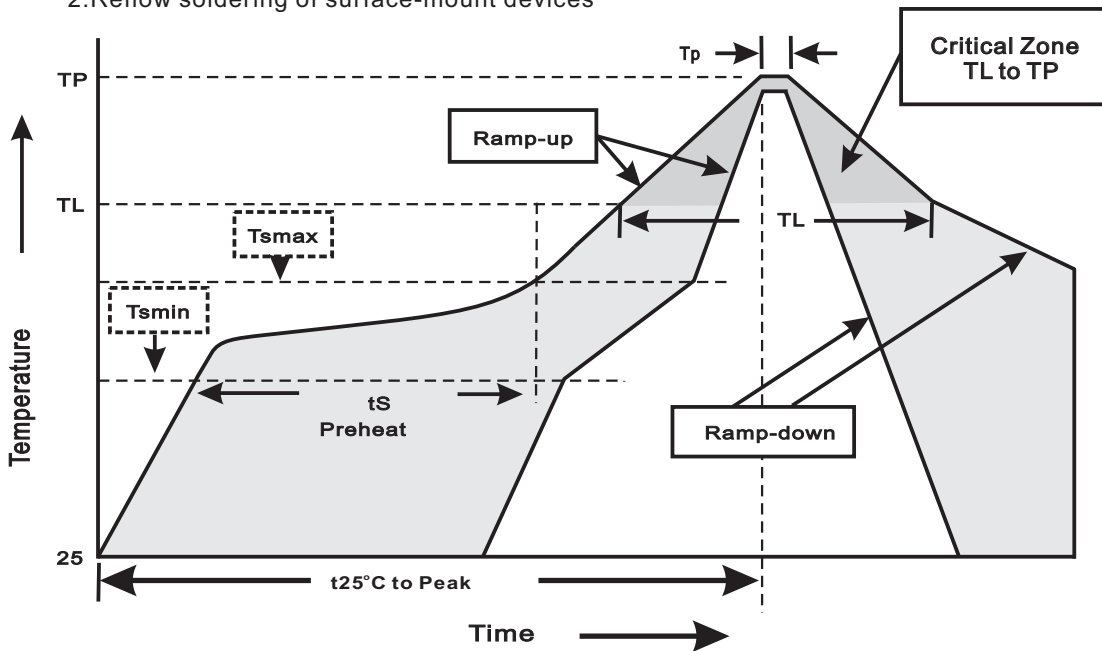
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## Reel packing

PACKAGE	REEL SIZE	REEL (pcs)	COMPONENT SPACING (m/m)	BOX (pcs)	INNER BOX (m/m)	REEL DIA, (m/m)	CARTON SIZE (m/m)	CARTON (pcs)	APPROX. GROSS WEIGHT (kg)
SMA-NT	7"	2,000	4.0	20,000	183*155*183	178	382*356*392	160,000	15.5
	13"	7,500	4.0	15,000	335*335*38	330	350*330*360	120,000	14.5

## Suggested thermal profiles for soldering processes

- 1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices



### 3.Reflow soldering

Profile Feature	Soldering Condition
Average ramp-up rate(TL to TP)	<3°C/sec
Preheat -Temperature Min(Tsmin) -Temperature Max(Tsmax) -Time(min to max)(ts)	150°C 200°C 60~120sec
Tsmax to TL -Ramp-upRate	<3°C/sec
Time maintained above: -Temperature(TL) -Time(tL)	217°C 60~260sec
Peak Temperature(TP)	255°C-0/+5°C
Time within 5°C of actual Peak Temperature(tp)	10~30sec
Ramp-down Rate	<3°C/sec
Time 25°C to Peak Temperature	<6minutes



**SMAKNT20(C)A-Q1 THRU SMAKNT800(C)A-Q1****High reliability test capabilities**

Item Test	Conditions	Reference
1. MSL Preconditioning	24hr bake@125°C+168hrs@85°C /85%RH+3xIR@260°C+1flux immersion+alcohol+DI H2O rinse	JESD22-A113
2. High Temperature Reverse Bias	$V_{BR}=V_{BR\ NOM} * 80\%$ ( $T_J=T_{Jmax}$ ) Test Duration:1000hrs	JESD22-A108
3. High Temperature Storage Life	$T_a=125^\circ\text{C}$ Test Duration:1000hrs	JESD22 A-103
4. Temperature Cycle	$-55^\circ\text{C}$ (15min) to $150^\circ\text{C}$ (15min) Test Cycles:1000cycles	JESD22 A-104
5. Autoclave	$P=2\text{atm}$ $T_a=121^\circ\text{C}$ $\text{RH}=100\%$ Test Duration:96hrs	JESD22 A-102
6. Solderability	$245\pm 5^\circ\text{C}$ for 5sec	J-STD-002
7. Moisture Resistance	$T_a=85^\circ\text{C}$ /85% Relative humidity Test Duration:1000hrs	MIL-STD-750E METHOD 1021.2
8. Resistance To Solder Heat	$260\pm 5^\circ\text{C}$ for 10sec	JESD22 B-106
9. High Temperature High Humidity Reverse Bias	$T_a=85^\circ\text{C}$ , 85%RH, with device reverse biased at 80% of rated breakdown voltage up to a maximum of 100V or limit of chamber Test Duration:1000hrs	JESD22-A101