

# SM4NT22(C)A-Q1 THRU SM4NT440(C)A-Q1

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## SM4NT22(C)A-Q1 THRU SM4NT440(C)A-Q1

## 400W Dual Flat No-Lead Unidirectional and Bidirectional Transient Voltage Suppressors 22V-440V

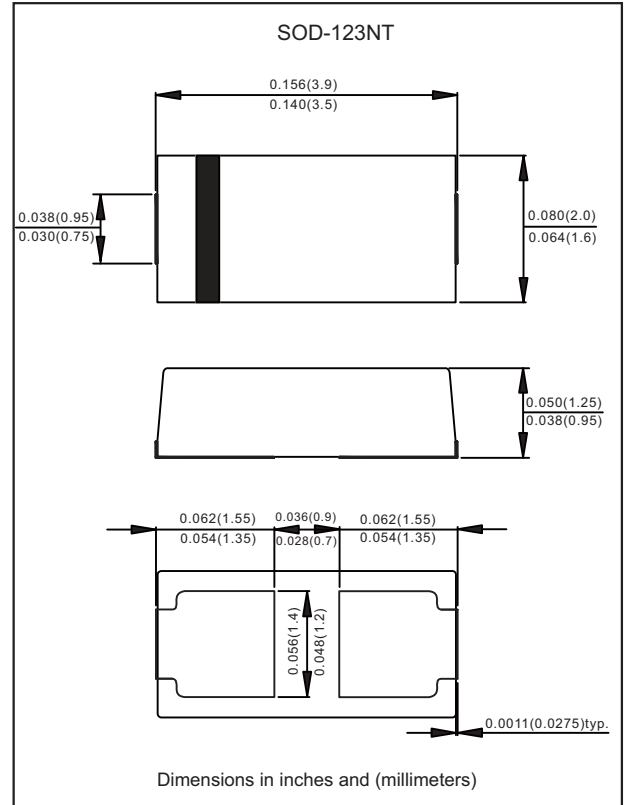
## Features

- Well package design with solder pad on the bottom for best thermal performance
- Leads on two opposing sides of the body
- Tiny plastic DFN package
- 400W 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. SM4NT22A-Q1-H

## Mechanical data

- Epoxy: UL94-V0 rated flame retardant
- Case : Molded plastic, SOD-123NT
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band(Uni-directional types only)
- Mounting Position : Any
- Weight : Approximated 0.022 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        | 400         | 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                  | $P_{M(AV)}$ | 1.0         | 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

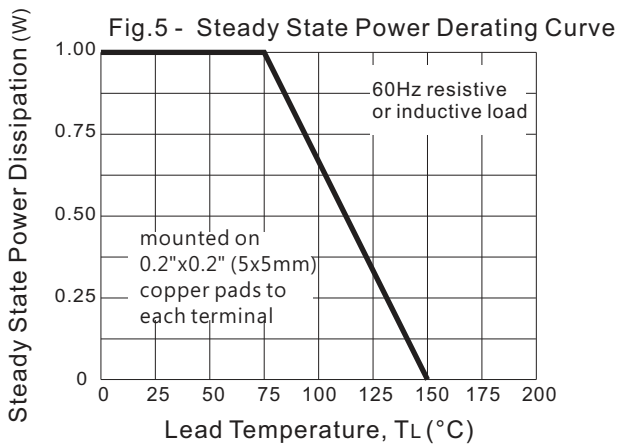
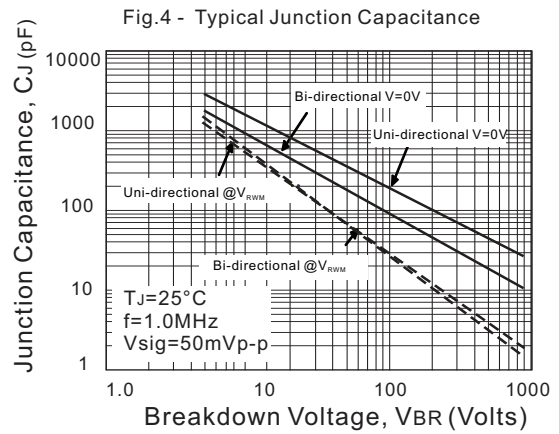
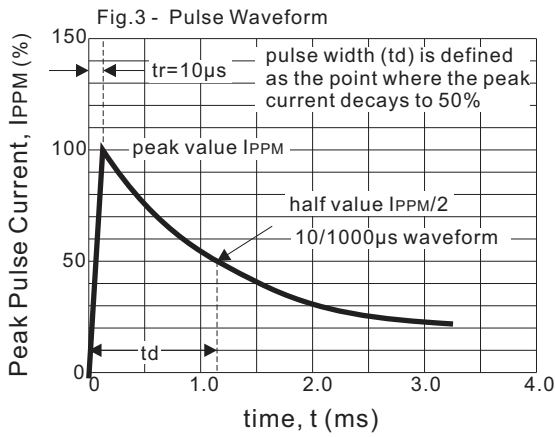
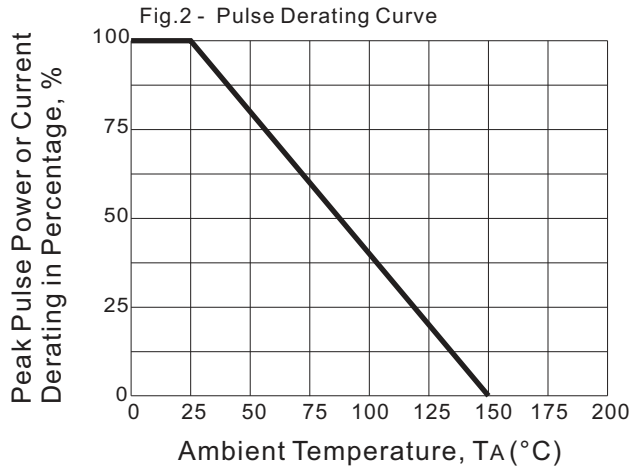
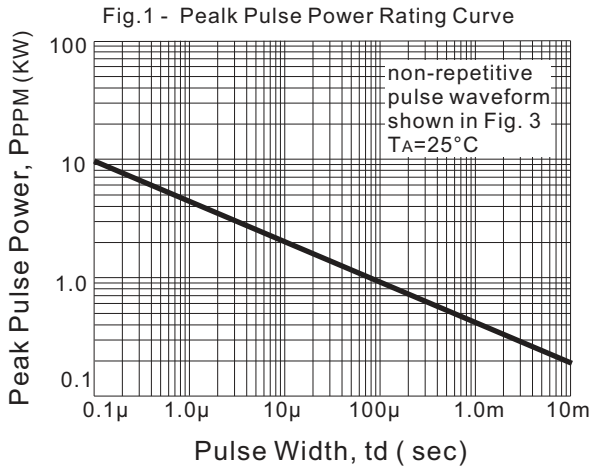
**Electrical characteristics** (at  $T_A=25^\circ\text{C}$  unless otherwise noted)

| Part No.<br>(Uni) | Part No.<br>(Bi) | Reverse<br>Stand-off<br>Voltage | Breakdown Voltage @ $I_T$ |             | Test<br>Current | Maximum Clamping<br>Voltage @ $I_{PP}$ |          | Maximum<br>Reverse<br>Leakage<br>Current | Marking Code |     |
|-------------------|------------------|---------------------------------|---------------------------|-------------|-----------------|--|----------|--|--------------|-----|
|                   |                  | $V_{RWM}$                       | $V_{BRMin}$               | $V_{BRMax}$ | $I_T$           | $V_C$                                  | $I_{PP}$ | $I_R@V_{RWM}$                            | Uni          | Bi  |
|                   |                  | Volts                           | Volts                     | Volts       | mA              | Volts                                  | A        | $\mu\text{A}$                            |              |     |
| SM4NT22A-Q1       | SM4NT22CA-Q1     | 22                              | 24.4                      | 26.9        | 1.0             | 35.5                                   | 11.27    | 5  | 4LX          | 4BX |
| SM4NT24A-Q1       | SM4NT24CA-Q1     | 24                              | 26.7                      | 29.5        | 1.0             | 38.9                                   | 10.29    | 5  | 4LZ          | 4BZ |
| SM4NT26A-Q1       | SM4NT26CA-Q1     | 26                              | 28.9                      | 31.9        | 1.0             | 42.1                                   | 9.51     | 5  | 4ME          | 4CE |
| SM4NT28A-Q1       | SM4NT28CA-Q1     | 28                              | 31.1                      | 34.4        | 1.0             | 45.4                                   | 8.82     | 5  | 4MG          | 4CG |
| SM4NT30A-Q1       | SM4NT30CA-Q1     | 30                              | 33.3                      | 36.8        | 1.0             | 48.4                                   | 8.27     | 5  | 4MK          | 4CK |
| SM4NT33A-Q1       | SM4NT33CA-Q1     | 33                              | 36.7                      | 40.6        | 1.0             | 53.3                                   | 7.51     | 5  | 4MM          | 4CM |
| SM4NT36A-Q1       | SM4NT36CA-Q1     | 36                              | 40.0                      | 44.2        | 1.0             | 58.1                                   | 6.89     | 5  | 4MP          | 4CP |
| SM4NT40A-Q1       | SM4NT40CA-Q1     | 40                              | 44.4                      | 49.1        | 1.0             | 64.5                                   | 6.21     | 5  | 4MR          | 4CR |
| SM4NT43A-Q1       | SM4NT43CA-Q1     | 43                              | 47.8                      | 52.8        | 1.0             | 69.4                                   | 5.77     | 5  | 4MT          | 4CT |
| SM4NT45A-Q1       | SM4NT45CA-Q1     | 45                              | 50.0                      | 55.3        | 1.0             | 72.7                                   | 5.51     | 5  | 4MV          | 4CV |
| SM4NT48A-Q1       | SM4NT48CA-Q1     | 48                              | 53.3                      | 58.9        | 1.0             | 77.4                                   | 5.17     | 5  | 4MX          | 4CX |
| SM4NT51A-Q1       | SM4NT51CA-Q1     | 51                              | 56.7                      | 62.7        | 1.0             | 82.4                                   | 4.86     | 5  | 4MZ          | 4CZ |
| SM4NT54A-Q1       | SM4NT54CA-Q1     | 54                              | 60.0                      | 66.3        | 1.0             | 87.1                                   | 4.60     | 5  | 4NE          | 4DE |
| SM4NT58A-Q1       | SM4NT58CA-Q1     | 58                              | 64.4                      | 71.2        | 1.0             | 93.6                                   | 4.28     | 5  | 4NG          | 4DG |
| SM4NT60A-Q1       | SM4NT60CA-Q1     | 60                              | 66.7                      | 73.7        | 1.0             | 96.8                                   | 4.14     | 5  | 4NK          | 4DK |
| SM4NT64A-Q1       | SM4NT64CA-Q1     | 64                              | 71.1                      | 78.6        | 1.0             | 103                                    | 3.89     | 5  | 4NM          | 4DM |
| SM4NT70A-Q1       | SM4NT70CA-Q1     | 70                              | 77.8                      | 86.0        | 1.0             | 113                                    | 3.54     | 5  | 4NP          | 4DP |
| SM4NT75A-Q1       | SM4NT75CA-Q1     | 75                              | 83.3                      | 92.1        | 1.0             | 121                                    | 3.31     | 5  | 4NR          | 4DR |
| SM4NT78A-Q1       | SM4NT78CA-Q1     | 78                              | 86.7                      | 95.8        | 1.0             | 126                                    | 3.18     | 5  | 4NT          | 4DT |
| SM4NT85A-Q1       | SM4NT85CA-Q1     | 85                              | 94.4                      | 104         | 1.0             | 137                                    | 2.92     | 5  | 4NV          | 4DV |
| SM4NT90A-Q1       | SM4NT90CA-Q1     | 90                              | 100                       | 111         | 1.0             | 146                                    | 2.74     | 5  | 4NX          | 4DX |
| SM4NT100A-Q1      | SM4NT100CA-Q1    | 100                             | 111                       | 123         | 1.0             | 162                                    | 2.47     | 5  | 4NZ          | 4DZ |
| SM4NT110A-Q1      | SM4NT110CA-Q1    | 110                             | 122                       | 135         | 1.0             | 177                                    | 2.26     | 5  | 4PE          | 4EE |
| SM4NT120A-Q1      | SM4NT120CA-Q1    | 120                             | 133                       | 147         | 1.0             | 193                                    | 2.08     | 5  | 4PG          | 4EG |
| SM4NT130A-Q1      | SM4NT130CA-Q1    | 130                             | 144                       | 159         | 1.0             | 209                                    | 1.92     | 5  | 4PK          | 4EK |
| SM4NT150A-Q1      | SM4NT150CA-Q1    | 150                             | 167                       | 185         | 1.0             | 243                                    | 1.65     | 5  | 4PM          | 4EM |
| SM4NT160A-Q1      | SM4NT160CA-Q1    | 160                             | 178                       | 197         | 1.0             | 259                                    | 1.55     | 5  | 4PP          | 4EP |
| SM4NT170A-Q1      | SM4NT170CA-Q1    | 170                             | 189                       | 209         | 1.0             | 275                                    | 1.46     | 5  | 4PR          | 4ER |
| SM4NT180A-Q1      | SM4NT180CA-Q1    | 180                             | 201                       | 222         | 1.0             | 292                                    | 1.37     | 5  | 4PT          | 4ET |
| SM4NT200A-Q1      | SM4NT200CA-Q1    | 200                             | 224                       | 247         | 1.0             | 324                                    | 1.24     | 5  | 4PV          | 4EV |
| SM4NT220A-Q1      | SM4NT220CA-Q1    | 220                             | 246                       | 272         | 1.0             | 356                                    | 1.13     | 5  | 4PX          | 4EX |
| SM4NT240A-Q1      | SM4NT240CA-Q1    | 240                             | 269                       | 296         | 1.0             | 387                                    | 1.04     | 5  | 4PY          | 4EY |
| SM4NT250A-Q1      | SM4NT250CA-Q1    | 250                             | 279                       | 309         | 1.0             | 405                                    | 0.99     | 5  | 4PZ          | 4EZ |
| SM4NT300A-Q1      | SM4NT300CA-Q1    | 300                             | 335                       | 371         | 1.0             | 486                                    | 0.83     | 5  | 4QE          | 4FE |
| SM4NT330A-Q1      | SM4NT330CA-Q1    | 330                             | 369                       | 408         | 1.0             | 534                                    | 0.75     | 5  | 4QF          | 4FF |
| SM4NT350A-Q1      | SM4NT350CA-Q1    | 350                             | 391                       | 432         | 1.0             | 567                                    | 0.71     | 5  | 4QG          | 4FG |
| SM4NT360A-Q1      | SM4NT360CA-Q1    | 360                             | 403                       | 444         | 1.0             | 582                                    | 0.69     | 5  | 4QH          | 4FH |
| SM4NT400A-Q1      | SM4NT400CA-Q1    | 400                             | 447                       | 494         | 1.0             | 648                                    | 0.62     | 5  | 4QK          | 4FK |
| SM4NT440A-Q1      | SM4NT440CA-Q1    | 440                             | 492                       | 544         | 1.0             | 713                                    | 0.57     | 5  | 4QM          | 4FM |

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

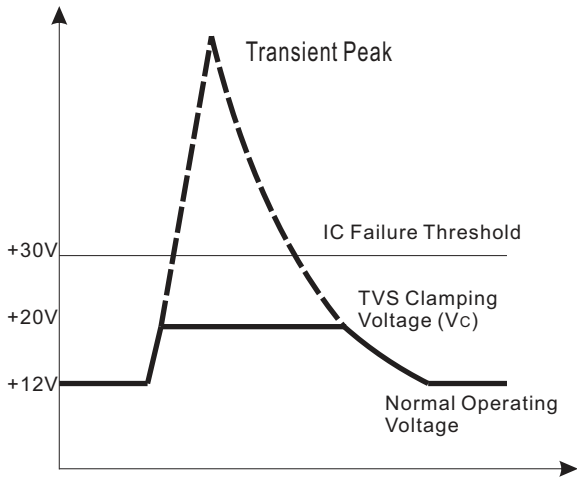
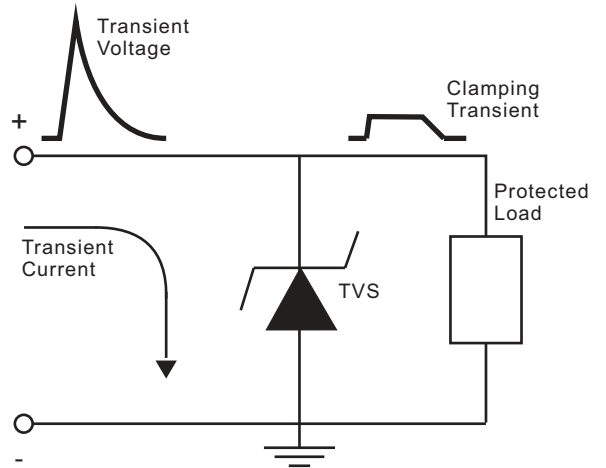






Fig. 7 - Transient current is diverted to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level

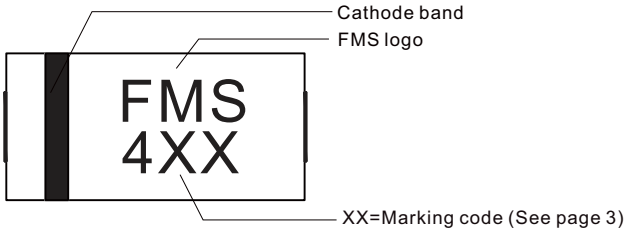
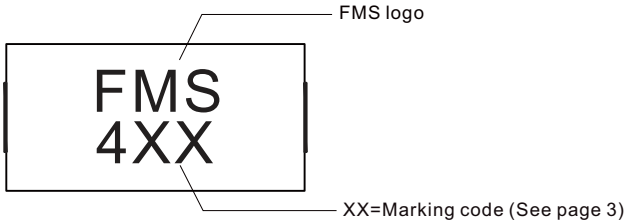


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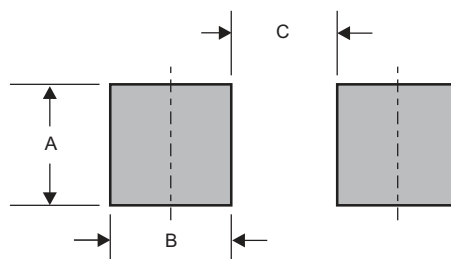
## Pinning information

| Pin   | Simplified outline   | Symbol  |
|---|--|---|
| Uni-Directional<br>Pin1 cathode<br>Pin2 anode |  |  |
| Bi-Directional                                |   |  |

## Marking

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

## Suggested solder pad layout

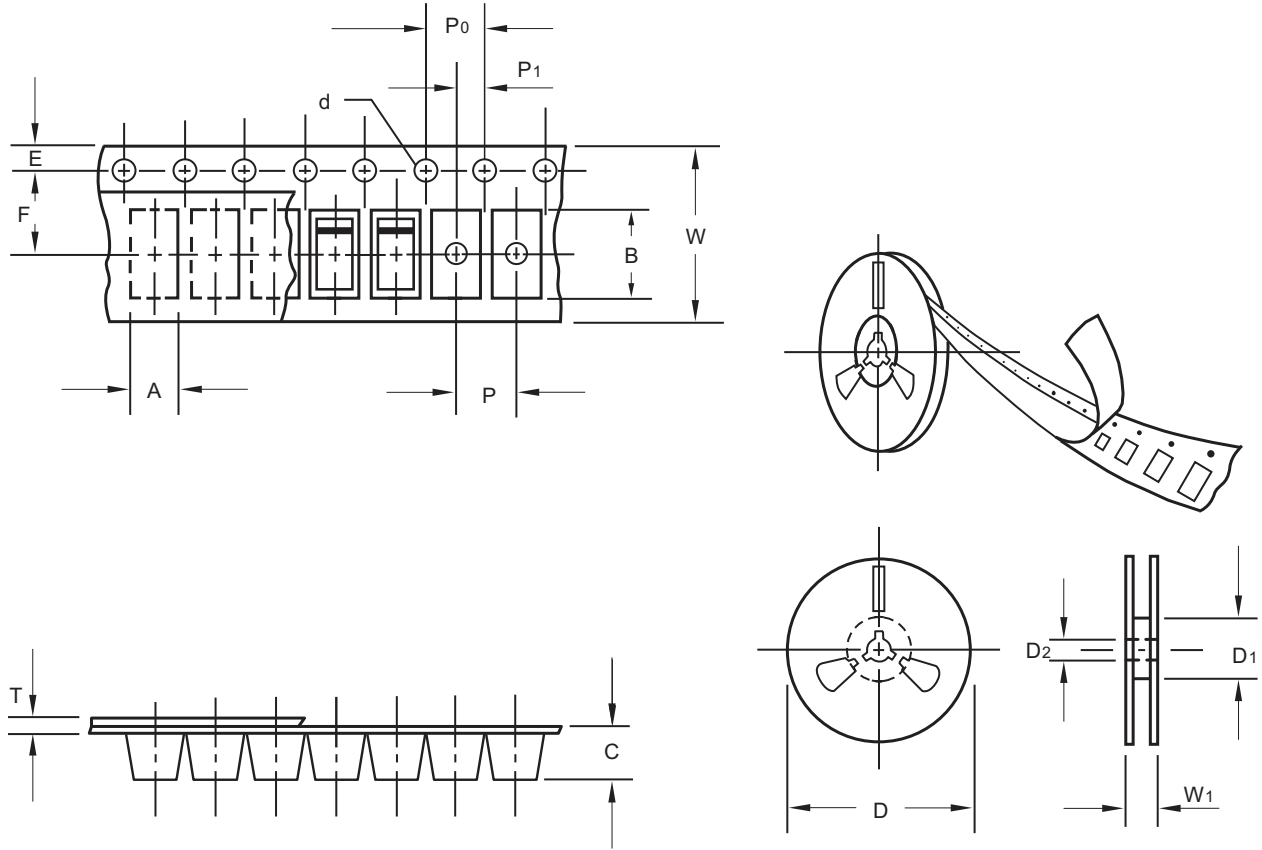


Dimensions in inches and (millimeters)

| PACKAGE   | A            | B           | C            |
|-----------|--------------|-------------|--------------|
| SOD-123NT | 0.056 (1.40) | 0.062(1.55) | 0.028 (0.70) |

# SM4NT22(C)A-Q1 THRU SM4NT440(C)A-Q1

## Packing information



unit:mm

| Item                      | Symbol | Tolerance | SOD-123NT |
|---------------------------|--------|-----------|-----------|
| Carrier width             | A      | 0.1       | 2.00      |
| Carrier length            | B      | 0.1       | 3.85      |
| Carrier depth             | C      | 0.1       | 1.10      |
| Sprocket hole             | d      | 0.1       | 1.50      |
| 13" Reel outside diameter | D      | 2.0       | -         |
| 13" Reel inner diameter   | D1     | min       | -         |
| 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       | 3.50      |
| 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       | 8.00      |
| Reel width                | W1     | 1.0       | 11.40     |

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

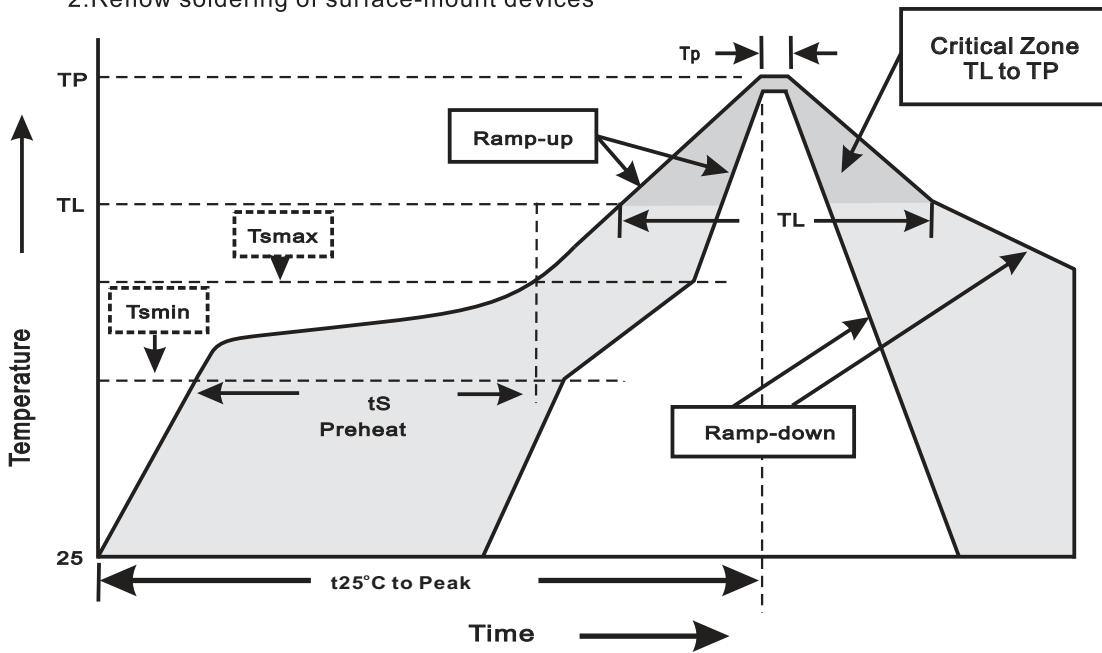
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## Reel packing

| 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) |
|-----------|-----------|------------|-------------------------|-----------|-----------------|-----------------|-------------------|--------------|---------------------------|
| SOD-123NT | 7"        | 3,000      | 4.0                     | 30,000    | 183*123*183     | 178             | 382*257*387       | 240,000      | 9.5                       |

## 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<br>-Temperature Min(Tsmin)<br>-Temperature Max(Tsmax)<br>-Time(min to max)(ts) | 150°C<br>200°C<br>60~120sec |
| Tsmax to TL<br>-Ramp-upRate  | <3°C/sec                    |
| Time maintained above:<br>-Temperature(TL)<br>-Time(tL)                                | 217°C<br>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                   |



**SM4NT22(C)A-Q1 THRU SM4NT440(C)A-Q1****High reliability test capabilities**

| Item Test                                      | Conditions   | Reference                     |
|--|--|-------------------------------|
| 1. MSL Preconditioning                         | 24hr bake@125°C+168hrs@85°C<br>/85%RH+3xIR@260°C+1flux<br>immersion+alcohol+DI H2O rinse   | JESD22-A113                   |
| 2. High Temperature Reverse Bias               | $V_{BR}=V_{BR\ NOM} * 80\%$ ( $T_j=150^\circ\text{C}$ ) 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<br>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                   |