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

## List

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

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

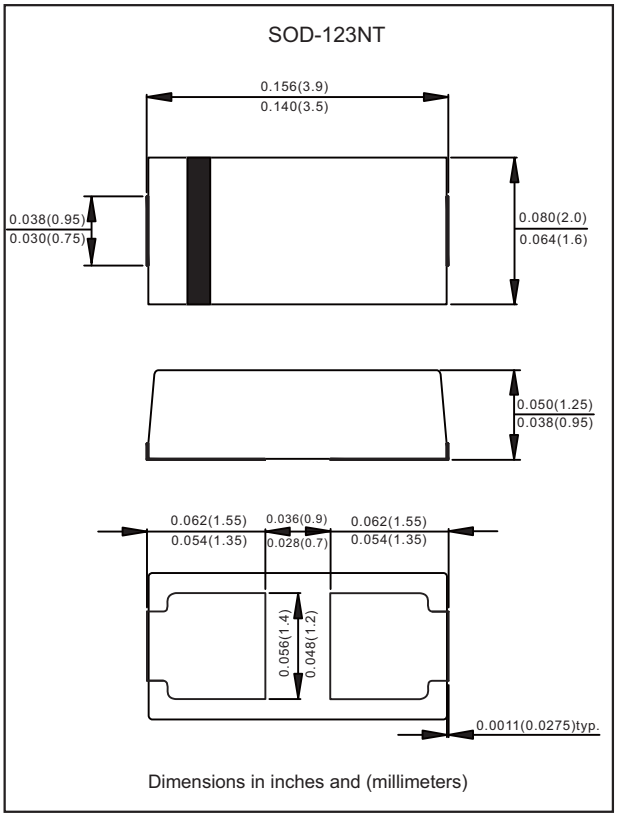
## Features

- 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 10/1000μs 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
- Suffix "-H" indicates Halogen-free part, ex. SM4NT22A-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




Dimensions in inches and (millimeters)

## Maximum ratings (AT $T_A$=25°C unless otherwise noted)

| Parameter | Conditions | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak power dissipation | with a 10/1000μs waveform, Note 1, 2 & Fig. 1 | $P_{PPM}$ | 400 | W |
| Peak pulse current | with a 10/1000μs waveform | $I_{PPM}$ | See Table | A |
| Steady state power dissipation | at $T_L$=75°C, Note 2 | $P_{M(AV)}$ | 1.0 | W |
| Operating junction temperature range | | $T_J$ | -55 to +150 | °C |
| Storage temperature range | | $T_{STG}$ | -65 to +175 | °C |

Notes 1: Non-repetitive current pulse, per Fig. 3 and derated above $T_A$=25°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°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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{RWM}$ | $V_{BR\,Min}$ | $V_{BR\,Max}$ | $I_T$ | $V_C$ | $I_{PP}$ | $I_R$@$V_{RWM}$ | | |
| | | Volts | Volts | Volts | mA | Volts | A | μA | Uni | Bi |
| SM4NT22A | SM4NT22CA | 22 | 24.4 | 26.9 | 1.0 | 35.5 | 11.27 | 5 | 4LX | 4BX |
| SM4NT24A | SM4NT24CA | 24 | 26.7 | 29.5 | 1.0 | 38.9 | 10.29 | 5 | 4LZ | 4BZ |
| SM4NT26A | SM4NT26CA | 26 | 28.9 | 31.9 | 1.0 | 42.1 | 9.51 | 5 | 4ME | 4CE |
| SM4NT28A | SM4NT28CA | 28 | 31.1 | 34.4 | 1.0 | 45.4 | 8.82 | 5 | 4MG | 4CG |
| SM4NT30A | SM4NT30CA | 30 | 33.3 | 36.8 | 1.0 | 48.4 | 8.27 | 5 | 4MK | 4CK |
| SM4NT33A | SM4NT33CA | 33 | 36.7 | 40.6 | 1.0 | 53.3 | 7.51 | 5 | 4MM | 4CM |
| SM4NT36A | SM4NT36CA | 36 | 40.0 | 44.2 | 1.0 | 58.1 | 6.89 | 5 | 4MP | 4CP |
| SM4NT40A | SM4NT40CA | 40 | 44.4 | 49.1 | 1.0 | 64.5 | 6.21 | 5 | 4MR | 4CR |
| SM4NT43A | SM4NT43CA | 43 | 47.8 | 52.8 | 1.0 | 69.4 | 5.77 | 5 | 4MT | 4CT |
| SM4NT45A | SM4NT45CA | 45 | 50.0 | 55.3 | 1.0 | 72.7 | 5.51 | 5 | 4MV | 4CV |
| SM4NT48A | SM4NT48CA | 48 | 53.3 | 58.9 | 1.0 | 77.4 | 5.17 | 5 | 4MX | 4CX |
| SM4NT51A | SM4NT51CA | 51 | 56.7 | 62.7 | 1.0 | 82.4 | 4.86 | 5 | 4MZ | 4CZ |
| SM4NT54A | SM4NT54CA | 54 | 60.0 | 66.3 | 1.0 | 87.1 | 4.60 | 5 | 4NE | 4DE |
| SM4NT58A | SM4NT58CA | 58 | 64.4 | 71.2 | 1.0 | 93.6 | 4.28 | 5 | 4NG | 4DG |
| SM4NT60A | SM4NT60CA | 60 | 66.7 | 73.7 | 1.0 | 96.8 | 4.14 | 5 | 4NK | 4DK |
| SM4NT64A | SM4NT64CA | 64 | 71.1 | 78.6 | 1.0 | 103 | 3.89 | 5 | 4NM | 4DM |
| SM4NT70A | SM4NT70CA | 70 | 77.8 | 86.0 | 1.0 | 113 | 3.54 | 5 | 4NP | 4DP |
| SM4NT75A | SM4NT75CA | 75 | 83.3 | 92.1 | 1.0 | 121 | 3.31 | 5 | 4NR | 4DR |
| SM4NT78A | SM4NT78CA | 78 | 86.7 | 95.8 | 1.0 | 126 | 3.18 | 5 | 4NT | 4DT |
| SM4NT85A | SM4NT85CA | 85 | 94.4 | 104 | 1.0 | 137 | 2.92 | 5 | 4NV | 4DV |
| SM4NT90A | SM4NT90CA | 90 | 100 | 111 | 1.0 | 146 | 2.74 | 5 | 4NX | 4DX |
| SM4NT100A | SM4NT100CA | 100 | 111 | 123 | 1.0 | 162 | 2.47 | 5 | 4NZ | 4DZ |
| SM4NT110A | SM4NT110CA | 110 | 122 | 135 | 1.0 | 177 | 2.26 | 5 | 4PE | 4EE |
| SM4NT120A | SM4NT120CA | 120 | 133 | 147 | 1.0 | 193 | 2.08 | 5 | 4PG | 4EG |
| SM4NT130A | SM4NT130CA | 130 | 144 | 159 | 1.0 | 209 | 1.92 | 5 | 4PK | 4EK |
| SM4NT150A | SM4NT150CA | 150 | 167 | 185 | 1.0 | 243 | 1.65 | 5 | 4PM | 4EM |
| SM4NT160A | SM4NT160CA | 160 | 178 | 197 | 1.0 | 259 | 1.55 | 5 | 4PP | 4EP |
| SM4NT170A | SM4NT170CA | 170 | 189 | 209 | 1.0 | 275 | 1.46 | 5 | 4PR | 4ER |
| SM4NT180A | SM4NT180CA | 180 | 201 | 222 | 1.0 | 292 | 1.37 | 5 | 4PT | 4ET |
| SM4NT200A | SM4NT200CA | 200 | 224 | 247 | 1.0 | 324 | 1.24 | 5 | 4PV | 4EV |
| SM4NT220A | SM4NT220CA | 220 | 246 | 272 | 1.0 | 356 | 1.13 | 5 | 4PX | 4EX |
| SM4NT240A | SM4NT240CA | 240 | 269 | 296 | 1.0 | 387 | 1.04 | 5 | 4PY | 4EY |
| SM4NT250A | SM4NT250CA | 250 | 279 | 309 | 1.0 | 405 | 0.99 | 5 | 4PZ | 4EZ |
| SM4NT300A | SM4NT300CA | 300 | 335 | 371 | 1.0 | 486 | 0.83 | 5 | 4QE | 4FE |
| SM4NT330A | SM4NT330CA | 330 | 369 | 408 | 1.0 | 534 | 0.75 | 5 | 4QF | 4FF |
| SM4NT350A | SM4NT350CA | 350 | 391 | 432 | 1.0 | 567 | 0.71 | 5 | 4QG | 4FG |
| SM4NT360A | SM4NT360CA | 360 | 403 | 444 | 1.0 | 582 | 0.69 | 5 | 4QH | 4FH |
| SM4NT400A | SM4NT400CA | 400 | 447 | 494 | 1.0 | 648 | 0.62 | 5 | 4QK | 4FK |
| SM4NT440A | SM4NT440CA | 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 & Fig. 7

## Rating and characteristic curves

Fig.1 - Pealk Pulse Power Rating Curve

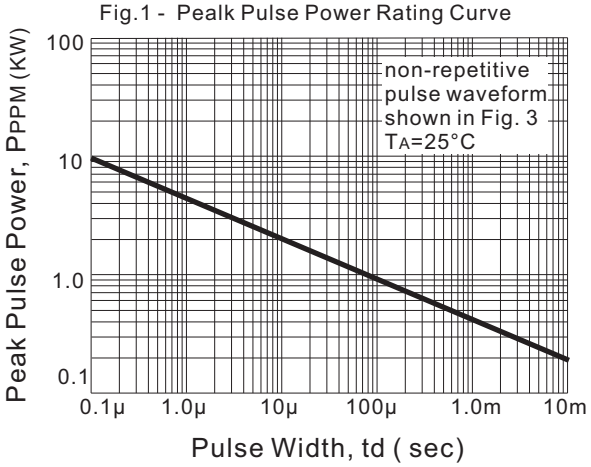



Fig.2 - Pulse Derating Curve

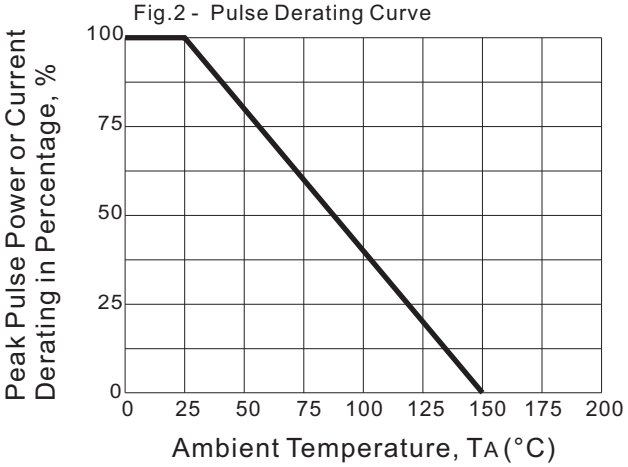



Fig.3 - Pulse Waveform

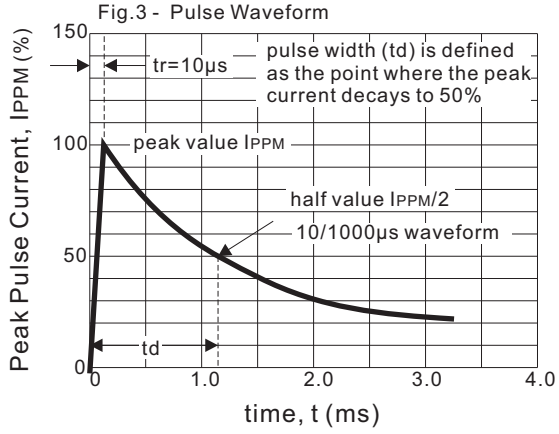



Fig.4 - Typical Junction Capacitance

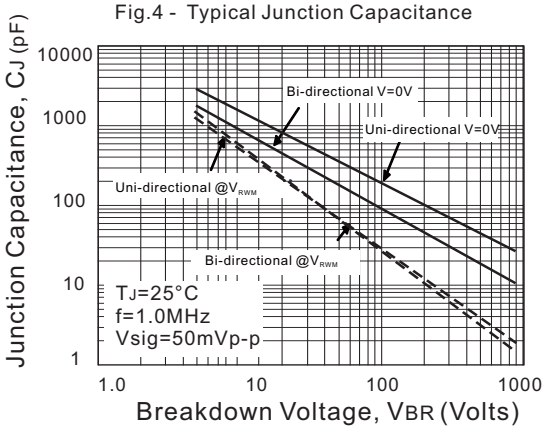
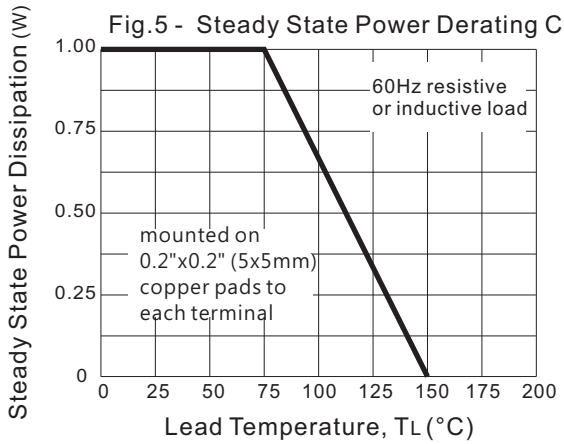



Fig.5 - Steady State Power Derating Curve



## Rating and characteristic curves

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

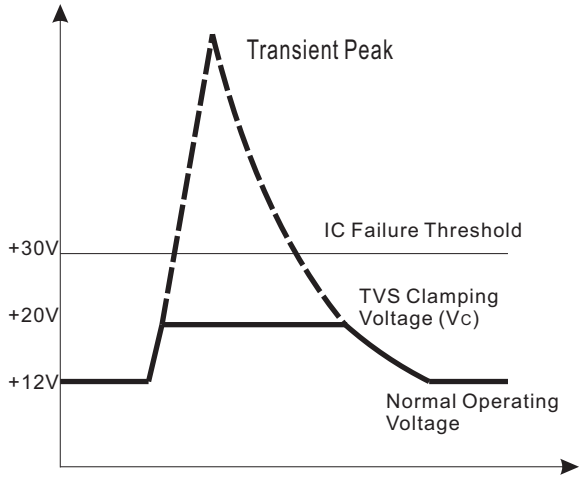
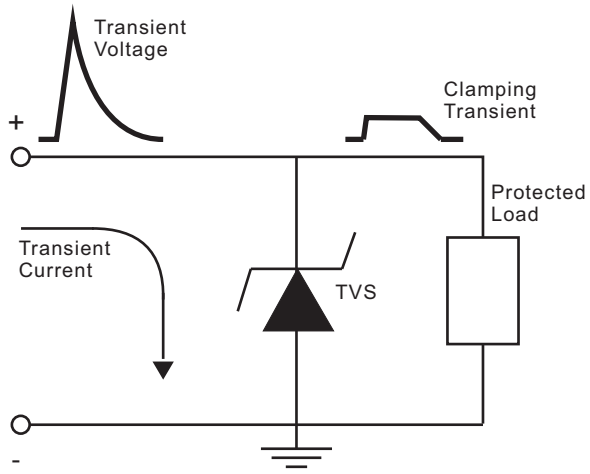
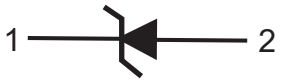



Fig. 7 - Transient current is divered to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level

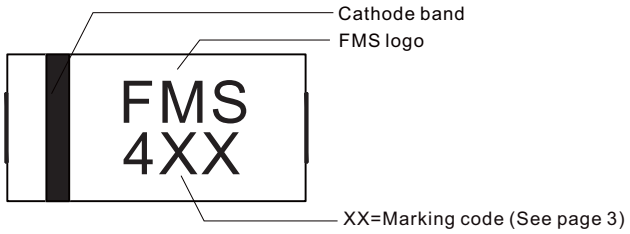
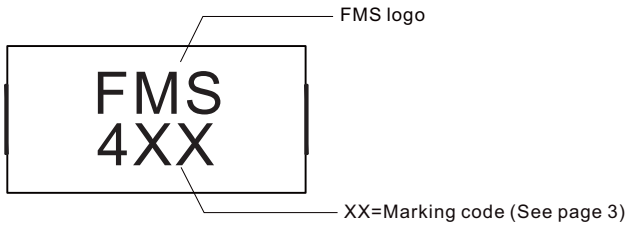


# SM4NT22(C)A THRU SM4NT440(C)A

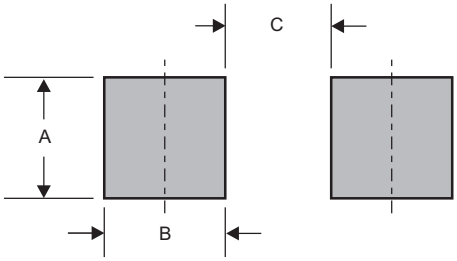
## Pinning information

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

## Marking

| Type number | Example |
|---|---|
| Uni-Directional |  |
| Bi-Directional |  |

## Suggested solder pad layout

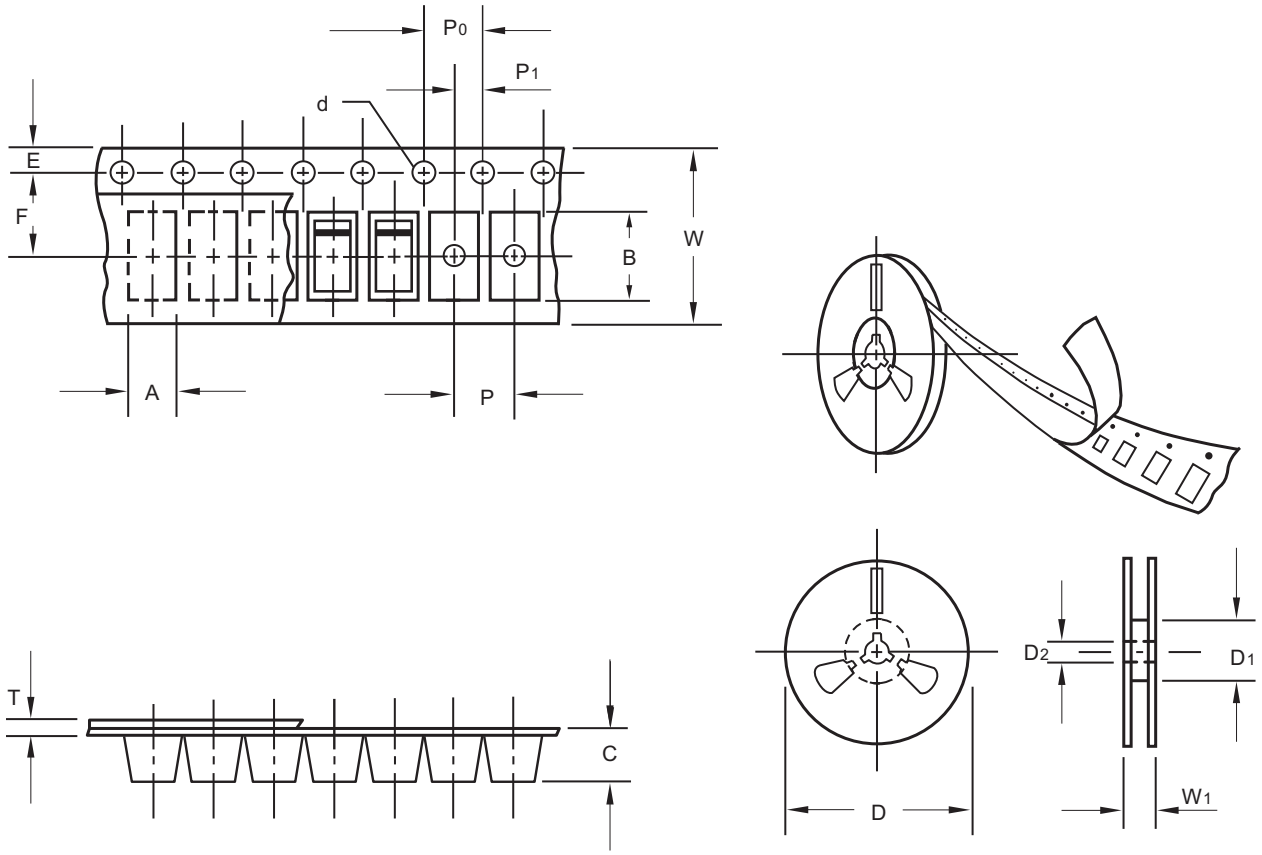



Dimensions in inches and (millimeters)

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

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

## 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 | $D_1$ | min | - |
| 7" Reel outside diameter | D | 2.0 | 178.00 |
| 7" Reel inner diameter | $D_1$ | min | 62.00 |
| Feed hole diameter | $D_2$ | 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 | $P_0$ | 0.1 | 4.00 |
| Embossment center | $P_1$ | 0.1 | 2.00 |
| Overall tape thickness | T | 0.1 | 0.23 |
| Tape width | W | 0.3 | 8.00 |
| Reel width | $W_1$ | 1.0 | 11.40 |

Note:Devices are packed in accor dance with EIA standar RS-481-A and specifications listed above.

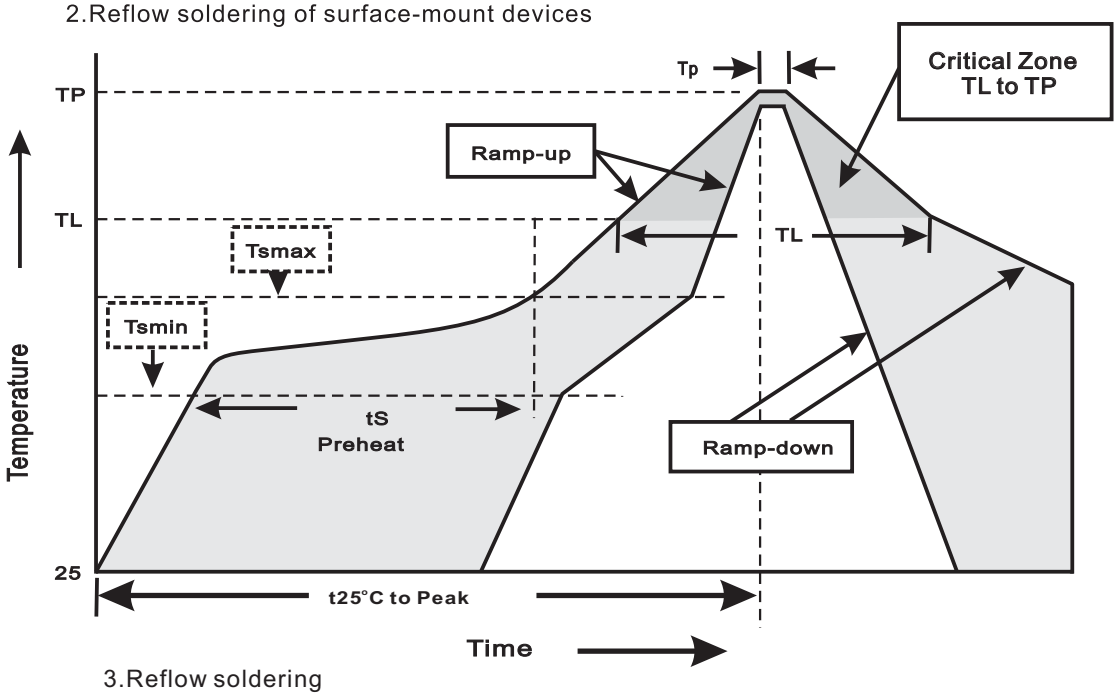
# SM4NT22(C)A THRU SM4NT440(C)A

## 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($T_L$ to $T_P$) | <3°C/sec |
| Preheat<br>-Temperature Min(Tsmin)<br>-Temperature Max(Tsmax)<br>-Time(min to max)($t_s$) | <br>150°C<br>200°C<br>60~120sec |
| Tsmax to $T_L$<br>-Ramp-upRate | <br><3°C/sec |
| Time maintained above:<br>-Temperature($T_L$)<br>-Time($t_L$) | <br>217°C<br>60~260sec |
| Peak Temperature($T_P$) | 255°C-0/+5°C |
| Time within 5°C of actual Peak Temperature($t_P$) | 10~30sec |
| Ramp-down Rate | <3°C/sec |
| Time 25°C to Peak Temperature | <6minutes |

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

## High reliability test capabilities

| Item Test | Conditions | Reference |
|---|---|---|
| 1. Solder Resistance | at 260±5°C for 10±2sec. | MIL-STD-750D METHOD-2031 |
| 2. Solderability | at 245±5°C for 5 sec. | MIL-STD-202F METHOD-208 |
| 3. High Temperature Reverse Bias | $V_{BR}$=$V_{BR}$ $N_{OM}$*80% at $T_J$=150°C for 168 hrs. | MIL-STD-750D METHOD-1038 |
| 4. Pressure Cooker | 15$P_{SIG}$ at $T_A$=121°C for 4 hrs. | JESD22-A102 |
| 5. Temperature Cycling | -55°C to +125°C dwelled for 30 min. and transferred for 5min. total 10 cycles. | MIL-STD-750D METHOD-1051 |
| 6. Humidity | at $T_A$=85°C, RH=85% for 1000hrs. | MIL-STD-750D METHOD-1021 |
| 7. High Temperature Storage Life | at 175°C for 1000 hrs. | MIL-STD-750D METHOD-1031 |