



# THE DATASHEET OF SMB10J8.5A



# SMAHS5.0A THRU SMAHS170A

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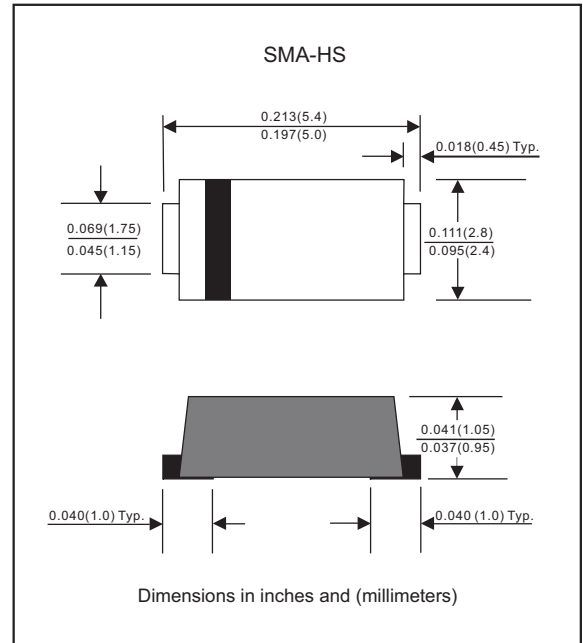
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**SMAHS5.0A THRU SMAHS170A****400W Surface Mount Transient Voltage Suppressors 5.0V-170V****Features**

- Uni-directional
- Very low profile - typical height of 1.0 mm
- 400W peak pulse power capability with a 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- Excellent clamping capability
- Low incremental surge resistance
- Fast response time from 0V to V<sub>BR</sub>, typically less than 1 ps for uni-directional
- Lead-free parts meet RoHS requirements
- Suffix "-H" indicates Halogen-free part, ex. SMAHS5.0A-H

**Mechanical data**

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic,DO-221AC / SMA-HS
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band
- Mounting Position : Any
- Weight : Approximated 0.037 gram

**Package outline****Maximum ratings** (AT T<sub>A</sub>=25°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                                  | I <sub>PPM</sub>                     | See Table 1 | A    |
| Steady state power dissipation        | at T <sub>L</sub> =75°C, Note 2                                  | P <sub>M(AV)</sub>                   | 2.0         | W    |
| Peak forward surge current            | 8.3ms single half sine-wave, Note 3                              | I <sub>FSM</sub>                     | 40          | A    |
| Maximum instantaneous forward voltage | at I <sub>F</sub> =25A<br>For uni-directional types only, Note 4 | V <sub>F</sub>                       | 3.5/6.5     | V    |
| Typical thermal resistance            | Junction to case<br>Junction to ambient                          | R <sub>θJC</sub><br>R <sub>θJA</sub> | 32<br>54    | °C/W |
| Operating junction temperature range  |  | T <sub>J</sub>                       | -55 to +150 | °C   |
| Storage temperature range             |  | T <sub>STG</sub>                     | -65 to +175 | °C   |

Notes 1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub>=25°C per Fig. 2

2. Mounted on copper pad area of minimum recommended pad layout per Fig 5

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

4. V<sub>F</sub> < 3.5V for V<sub>BR</sub> < 200V and V<sub>F</sub> < 6.5V for V<sub>BR</sub> > 201V

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

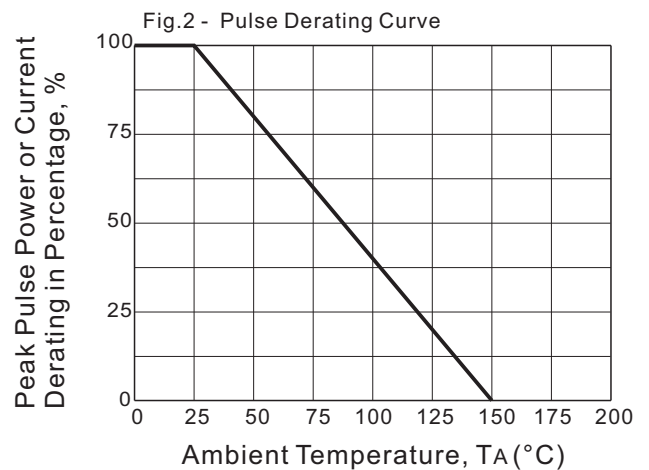
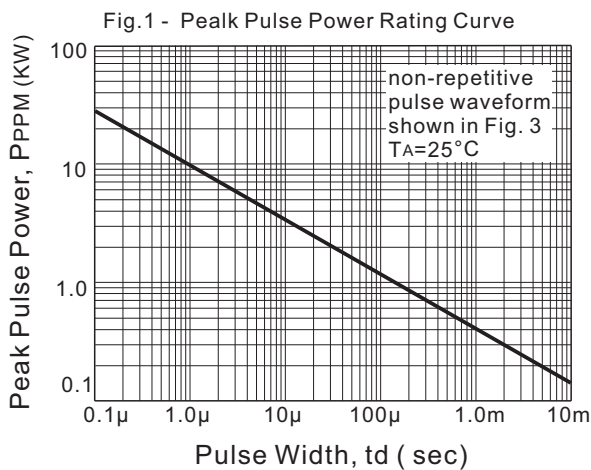
| Part No.<br>(Uni) | Reverse<br>Stand-off<br>Voltage | Breakdown Voltage @ $I_T$ |                    | Test<br>Current | Maximum Clamping<br>Voltage @ $I_{PP}$ |          | Maximum<br>Reverse<br>Leakage<br>Current | Marking Code |
|-------------------|---------------------------------|---------------------------|--------------------|-----------------|--|----------|--|--------------|
|                   | $V_{RWM}$                       | $V_{BR\text{Min}}$        | $V_{BR\text{Max}}$ | $I_T$           | $V_c$                                  | $I_{PP}$ | $I_R@V_{RWM}$                            |              |
|                   | Volts                           | Volts                     | Volts              | mA              | Volts                                  | A        | $\mu\text{A}$                            |              |
| SMAHS5.0A         | 5.0                             | 6.40                      | 7.00               | 10              | 9.2                                    | 43.5     | 800                                      | AE           |
| SMAHS6.0A         | 6.0                             | 6.67                      | 7.37               | 10              | 10.3                                   | 38.8     | 800                                      | AG           |
| SMAHS6.5A         | 6.5                             | 7.22                      | 7.98               | 10              | 11.2                                   | 35.7     | 500                                      | AK           |
| SMAHS7.0A         | 7.0                             | 7.78                      | 8.60               | 10              | 12.0                                   | 33.3     | 200                                      | AM           |
| SMAHS7.5A         | 7.5                             | 8.33                      | 9.21               | 1.0             | 12.9                                   | 31.0     | 100                                      | AP           |
| SMAHS8.0A         | 8.0                             | 8.89                      | 9.83               | 1.0             | 13.6                                   | 29.4     | 50                                       | AR           |
| SMAHS8.5A         | 8.5                             | 9.44                      | 10.4               | 1.0             | 14.4                                   | 27.7     | 20                                       | AT           |
| SMAHS9.0A         | 9.0                             | 10.0                      | 11.1               | 1.0             | 15.4                                   | 26.0     | 10                                       | AV           |
| SMAHS10A          | 10                              | 11.1                      | 12.3               | 1.0             | 17.0                                   | 23.5     | 5  | AX           |
| SMAHS11A          | 11                              | 12.2                      | 13.5               | 1.0             | 18.2                                   | 22.0     | 5  | AZ           |
| SMAHS12A          | 12                              | 13.3                      | 14.7               | 1.0             | 19.9                                   | 20.1     | 5  | BE           |
| SMAHS13A          | 13                              | 14.4                      | 15.9               | 1.0             | 21.5                                   | 18.6     | 5  | BG           |
| SMAHS14A          | 14                              | 15.6                      | 17.2               | 1.0             | 23.2                                   | 17.2     | 5  | BK           |
| SMAHS15A          | 15                              | 16.7                      | 18.5               | 1.0             | 24.4                                   | 16.4     | 5  | BM           |
| SMAHS16A          | 16                              | 17.8                      | 19.7               | 1.0             | 26.0                                   | 15.4     | 5  | BP           |
| SMAHS17A          | 17                              | 18.9                      | 20.9               | 1.0             | 27.6                                   | 14.5     | 5  | BR           |
| SMAHS18A          | 18                              | 20.0                      | 22.1               | 1.0             | 29.2                                   | 13.7     | 5  | BT           |
| SMAHS20A          | 20                              | 22.2                      | 24.5               | 1.0             | 32.4                                   | 12.3     | 5  | BV           |
| SMAHS22A          | 22                              | 24.4                      | 26.9               | 1.0             | 35.5                                   | 11.2     | 5  | BX           |
| SMAHS24A          | 24                              | 26.7                      | 29.5               | 1.0             | 38.9                                   | 10.3     | 5  | BZ           |
| SMAHS26A          | 26                              | 28.9                      | 31.9               | 1.0             | 42.1                                   | 9.5      | 5  | CE           |
| SMAHS28A          | 28                              | 31.1                      | 34.4               | 1.0             | 45.4                                   | 8.8      | 5  | CG           |
| SMAHS30A          | 30                              | 33.3                      | 36.8               | 1.0             | 48.4                                   | 8.3      | 5  | CK           |
| SMAHS33A          | 33                              | 36.7                      | 40.6               | 1.0             | 53.3                                   | 7.5      | 5  | CM           |
| SMAHS36A          | 36                              | 40.0                      | 44.2               | 1.0             | 58.1                                   | 6.9      | 5  | CP           |
| SMAHS40A          | 40                              | 44.4                      | 49.1               | 1.0             | 64.5                                   | 6.2      | 5  | CR           |
| SMAHS43A          | 43                              | 47.8                      | 52.8               | 1.0             | 69.4                                   | 5.7      | 5  | CT           |
| SMAHS45A          | 45                              | 50.0                      | 55.3               | 1.0             | 72.7                                   | 5.5      | 5  | CV           |
| SMAHS48A          | 48                              | 53.3                      | 58.9               | 1.0             | 77.4                                   | 5.1      | 5  | CX           |
| SMAHS51A          | 51                              | 56.7                      | 62.7               | 1.0             | 82.4                                   | 4.8      | 5  | CZ           |
| SMAHS54A          | 54                              | 60.0                      | 66.3               | 1.0             | 87.1                                   | 4.6      | 5  | RE           |
| SMAHS58A          | 58                              | 64.4                      | 71.2               | 1.0             | 93.6                                   | 4.3      | 5  | RG           |
| SMAHS60A          | 60                              | 66.7                      | 73.7               | 1.0             | 96.8                                   | 4.1      | 5  | RK           |
| SMAHS64A          | 64                              | 71.1                      | 78.6               | 1.0             | 103.0                                  | 3.8      | 5  | RM           |
| SMAHS70A          | 70                              | 77.8                      | 86.0               | 1.0             | 113.0                                  | 3.5      | 5  | RP           |
| SMAHS75A          | 75                              | 83.3                      | 92.1               | 1.0             | 121.0                                  | 3.3      | 5  | RR           |
| SMAHS78A          | 78                              | 86.7                      | 95.8               | 1.0             | 126.0                                  | 3.1      | 5  | RT           |
| SMAHS85A          | 85                              | 94.4                      | 104                | 1.0             | 137.0                                  | 2.9      | 5  | RV           |

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

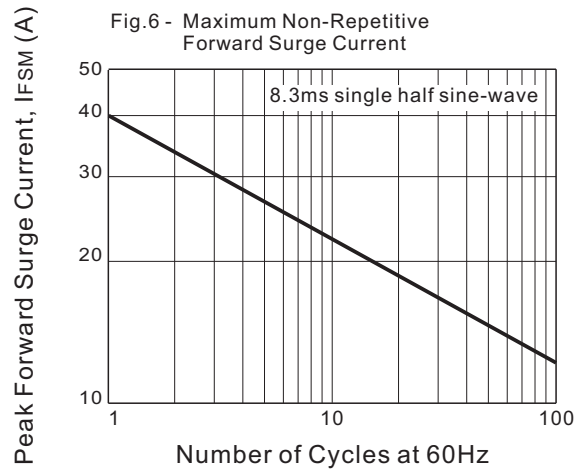
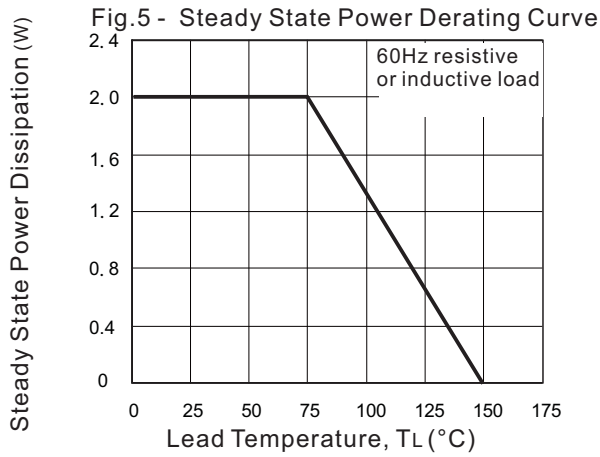
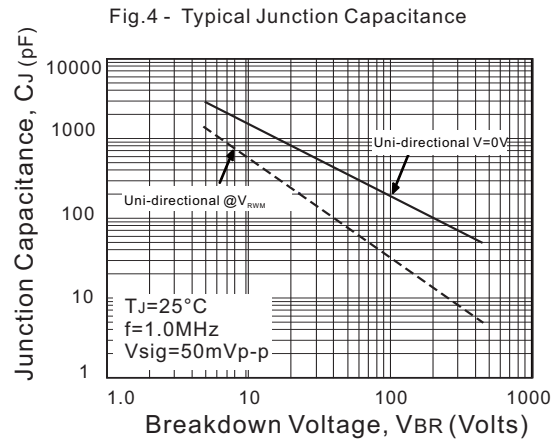
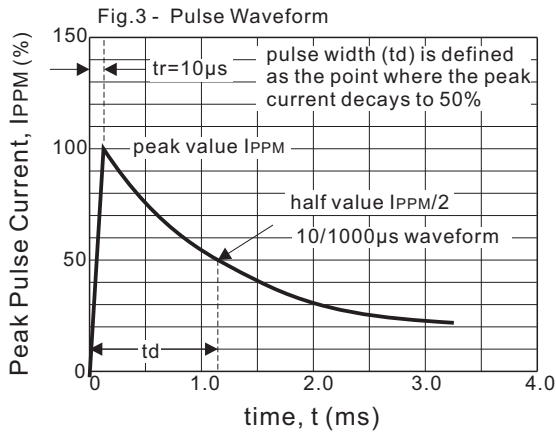
| Part No.<br>(Uni) | Reverse Stand-off Voltage | Breakdown Voltage @ $I_T$ |             | Test Current | Maximum Clamping Voltage @ $I_{PP}$ |          | Maximum Reverse Leakage Current | Marking Code |
|-------------------|---------------------------|---------------------------|-------------|--------------|-------------------------------------|----------|---------------------------------|--------------|
|                   | $V_{RWM}$                 | $V_{BRMin}$               | $V_{BRMax}$ | $I_T$        | $V_C$                               | $I_{PP}$ | $I_R@V_{RWM}$                   |              |
|                   | Volts                     | Volts                     | Volts       | mA           | Volts                               | A        | $\mu\text{A}$                   |              |
| SMAHS90A          | 90                        | 100                       | 111         | 1.0          | 146.0                               | 2.7      | 5                               | RX           |
| SMAHS100A         | 100                       | 111                       | 123         | 1.0          | 162.0                               | 2.4      | 5                               | RZ           |
| SMAHS110A         | 110                       | 122                       | 135         | 1.0          | 177.0                               | 2.2      | 5                               | SE           |
| SMAHS120A         | 120                       | 133                       | 147         | 1.0          | 193.0                               | 2.0      | 5                               | SG           |
| SMAHS130A         | 130                       | 144                       | 159         | 1.0          | 209.0                               | 1.9      | 5                               | SK           |
| SMAHS150A         | 150                       | 167                       | 185         | 1.0          | 243.0                               | 1.6      | 5                               | SM           |
| SMAHS160A         | 160                       | 178                       | 197         | 1.0          | 259.0                               | 1.5      | 5                               | SP           |
| SMAHS170A         | 170                       | 189                       | 209         | 1.0          | 275.0                               | 1.4      | 5                               | SR           |

- Notes 1.  $V_{BR}$  measured after  $I_T$  applied for  $300\mu\text{s}$ ,  $I_T$ =square wave pulse or equivalent  
 2. Surge current waveform per Fig. 3 and derated per Fig. 2  
 3. Suffix 'A' denotes 5% tolerance devices  
 4. All terms and symbols are consistent with ANS/IEEE C62.35  
 5. 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. 7 & Fig. 8

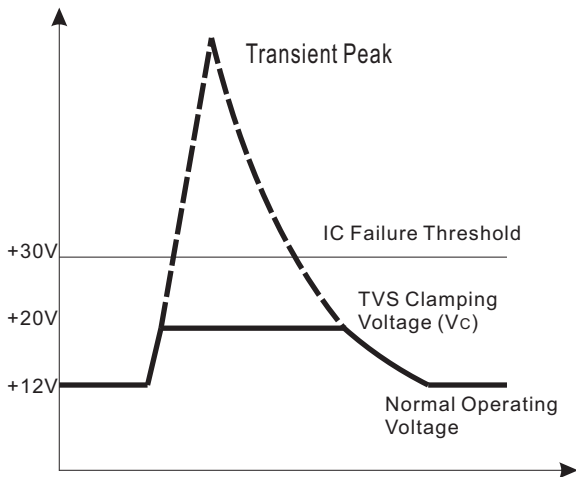
**Rating and characteristic curves (SMAHS SERIES)**



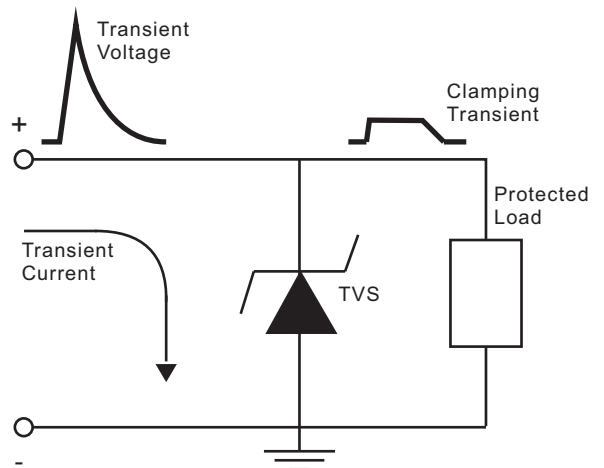
## Rating and characteristic curves (SMAHS SERIES)



**Fig. 7 - Transients of several thousand volts can be clamped to a safe level by the TVS**



**Fig. 8 - Transient current is diverted to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level**



# SMAHS5.0A THRU SMAHS170A

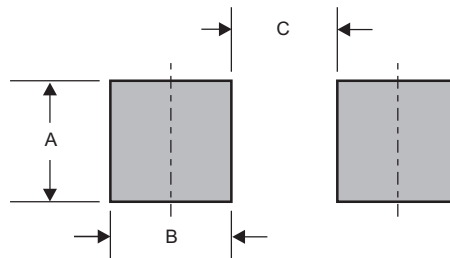
## Pinning information

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

## Marking

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

## Suggested solder pad layout

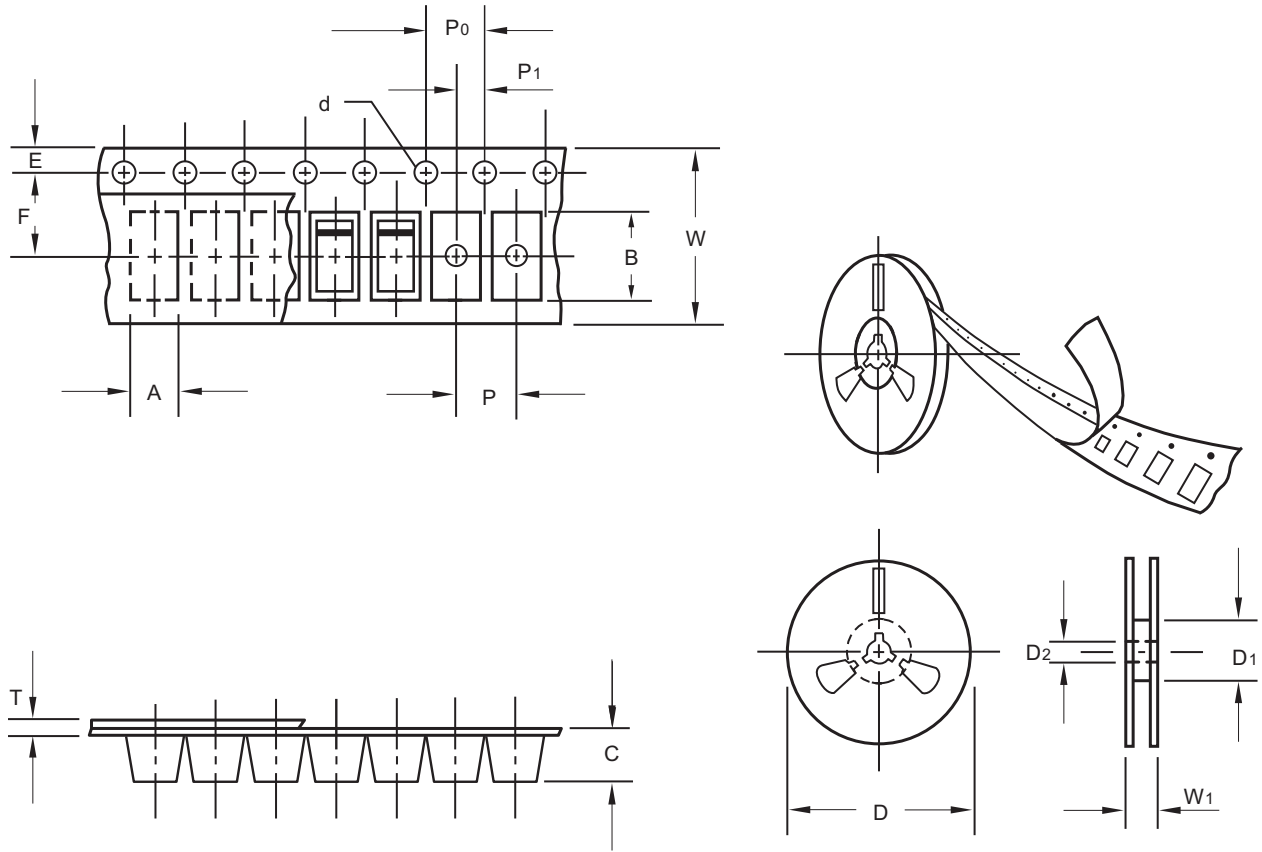


Dimensions in inches and (millimeters)

| PACKAGE | A            | B            | C            |
|---------|--------------|--------------|--------------|
| SMA-HS  | 0.060 (1.52) | 0.048 (1.20) | 0.123 (3.12) |

# SMAHS5.0A THRU SMAHS170A

## Packing information



unit:mm

| Item                      | Symbol | Tolerance | SMA-HS |
|---------------------------|--------|-----------|--------|
| Carrier width             | A      | 0.1       | 3.00   |
| Carrier length            | B      | 0.1       | 5.50   |
| Carrier depth             | C      | 0.1       | 1.20   |
| 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       | 0.25   |
| Tape width                | W      | 0.3       | 12.00  |
| Reel width                | W1     | 1.0       | 11.40  |

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

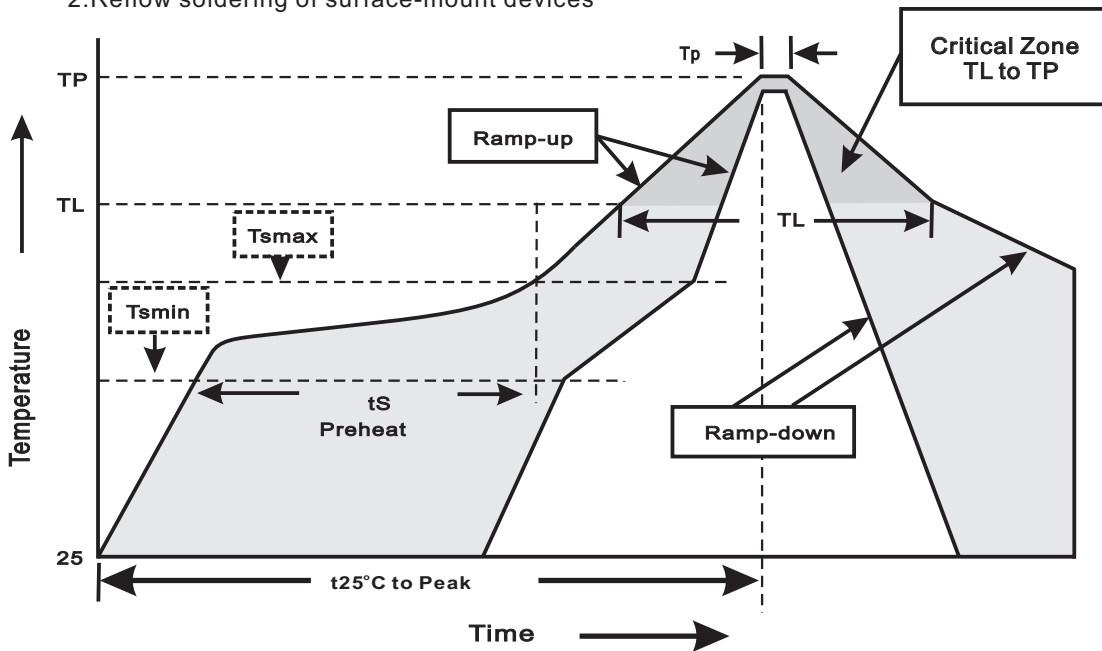
# SMAHS5.0A THRU SMAHS170A

## 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-HS  | 7"        | 3,000      | 4.0                     | 30,000    | 183*155*183     | 178             | 382*356*392       | 240,000      | 18.0                      |
|         | 13"       | 10,000     | 4.0                     | 20,000    | 335*335*38      | 330             | 350*330*360       | 160,000      | 15.5                      |

## 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   | <6°C/sec                    |
| Time 25°C to Peak Temperature  | <6minutes                   |

**SMAHS5.0A THRU SMAHS170A****High reliability test capabilities**

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

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