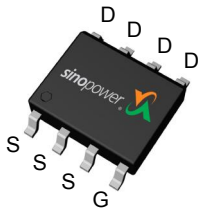
# SM1A06NSK

N-Channel Enhancement Mode MOSFET

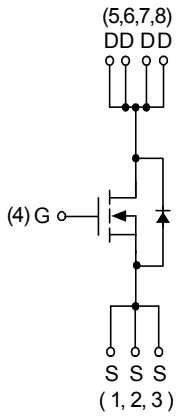
## Features

- 100V/7A,
  $R_{DS(ON)}$= 18mΩ(max.) @ $V_{GS}$= 10V
- 100% UIS + $R_g$ Tested
- Reliable and Rugged
- Lead Free and Green Devices Available
  (RoHS Compliant)

## Pin Description




Top View of SOP-8




N-Channel MOSFET

## Applications

- DC-DC Converter.
- Secondary Side Synchronous Rectification.

## Ordering and Marking Information

| | |
|---|---|
| SM1A06NS □□-□□ □<br>Assembly Material<br>Handling Code<br>Temperature Range<br>Package Code | Package Code<br>K : SOP-8<br>Operating Junction Temperature Range<br>C : -55 to 150 °C<br>Handling Code<br>TR : Tape & Reel<br>Assembly Material<br>G : Halogen and Lead Free Device |
| SM1A06NS K :  | XXXXX - Lot Code |



Note : SINOPOWER lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. SINOPOWER lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. SINOPOWER defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

## Absolute Maximum Ratings ($T_A$ = 25°C Unless Otherwise Noted)

| Symbol | Parameter | | Rating | Unit |
|---|---|---|---|---|
| **Common Ratings** | | | | |
| $V_{DSS}$ | Drain-Source Voltage | | 100 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±25 | |
| $T_J$ | Maximum Junction Temperature | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | |
| $I_S$ | Diode Continuous Forward Current | $T_A$=25°C | 2 | A |
| $I_D$ | Continuous Drain Current | $T_A$=25°C | 7 | A |
| | | $T_A$=70°C | 5.6 | |
| $I_{DM}$ [a] | Pulsed Drain Current | $T_A$=25°C | 28 | |
| $P_D$ | Maximum Power Dissipation | $T_A$=25°C | 1.78 | W |
| | | $T_A$=70°C | 1.14 | |
| $R_{\theta JA}$ [c] | Thermal Resistance-Junction to Ambient | Steady State | 70 | °C/W |
| $I_{AS}$ [b] | Avalanche Current, Single pulse | L=0.5mH | 26 | A |
| $E_{AS}$ [b] | Avalanche Energy, Single pulse | L=0.5mH | 169 | mJ |

Note a：Pulse width limited by max. junction temperature.
Note b：UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature Tj=25°C).
Note c：Surface Mounted on 1in$^2$ pad area.

## Electrical Characteristics ($T_A$ = 25°C Unless Otherwise Noted)

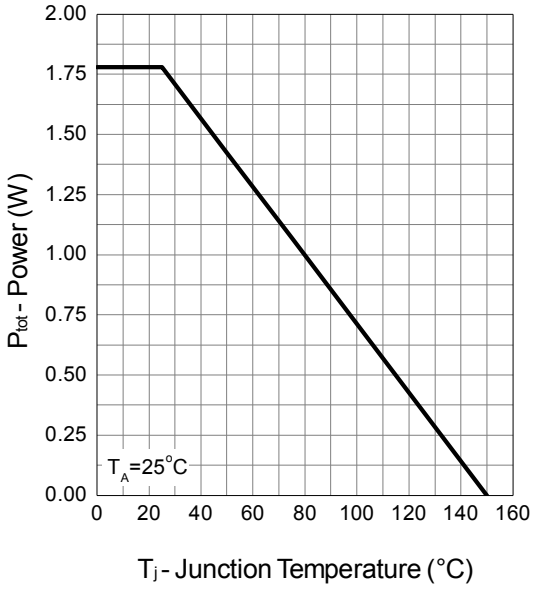
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250μA | 100 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=80V, $V_{GS}$=0V | - | - | 1 | μA |
| | | $T_J$=85°C | - | - | 30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250μA | 2.0 | 3.0 | 4.0 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±25V, $V_{DS}$=0V | - | - | ±100 | nA |
| $R_{DS(ON)}$ [d] | Drain-Source On-state Resistance | $V_{GS}$=10V, $I_{DS}$=7A | - | 15 | 18 | mΩ |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [d] | Diode Forward Voltage | $I_{SD}$=5A, $V_{GS}$=0V | - | 0.8 | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$=8A, $dI_{SD}/dt$=100A/μs | - | 44 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 95 | - | nC |
| **Dynamic Characteristics** [e] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,f=1MHz | - | 1.0 | - | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=30V, Frequency=1.0MHz | - | 2100 | 2730 | pF |
| $C_{oss}$ | Output Capacitance | | - | 255 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 100 | - | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=30V, $R_L$=30Ω, $I_{DS}$=1A, $V_{GEN}$=10V, $R_G$=6Ω | - | 19 | 35 | ns |
| $t_r$ | Turn-on Rise Time | | - | 9 | 17 | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | - | 36 | 65 | |
| $t_f$ | Turn-off Fall Time | | - | 22 | 40 | |
| **Gate Charge Characteristics** [e] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=50V, $V_{GS}$=10V, $I_{DS}$=8A | - | 42 | 59 | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 12 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 12 | - | |

Note d：Pulse test ; pulse width≤300μs, duty cycle≤2%.

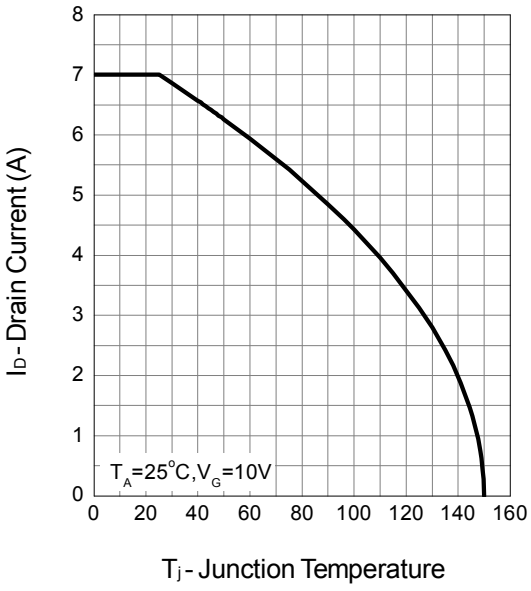
Note e：Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

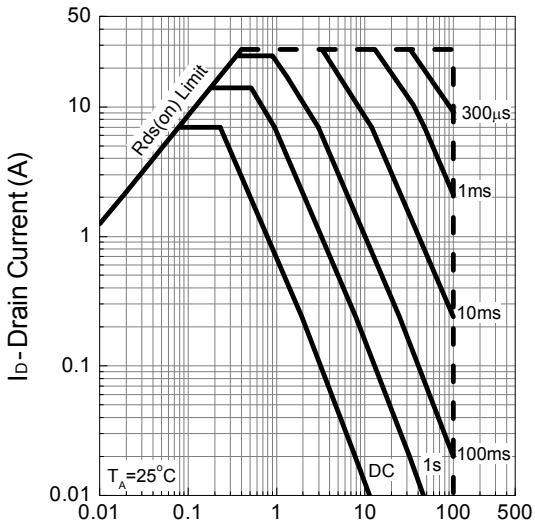
**Power Dissipation**



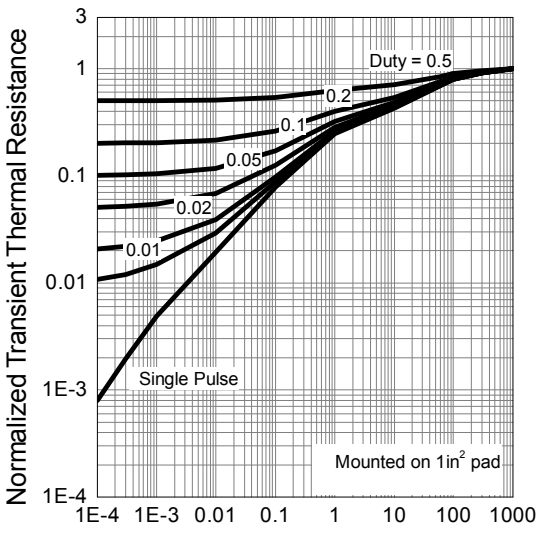

**Drain Current**




**Safe Operation Area**

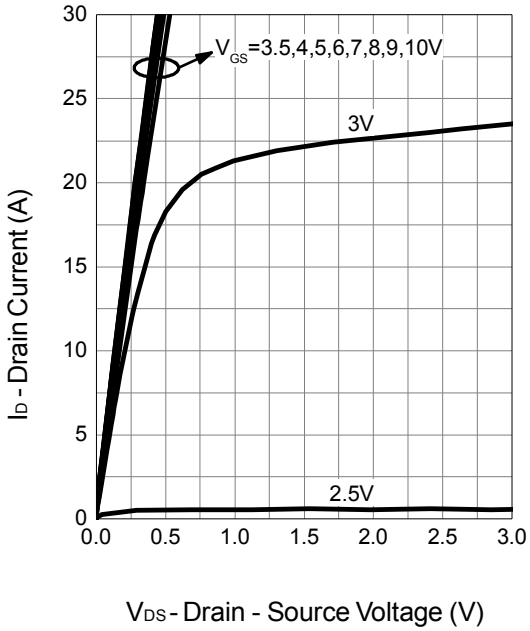



**Thermal Transient Impedance**

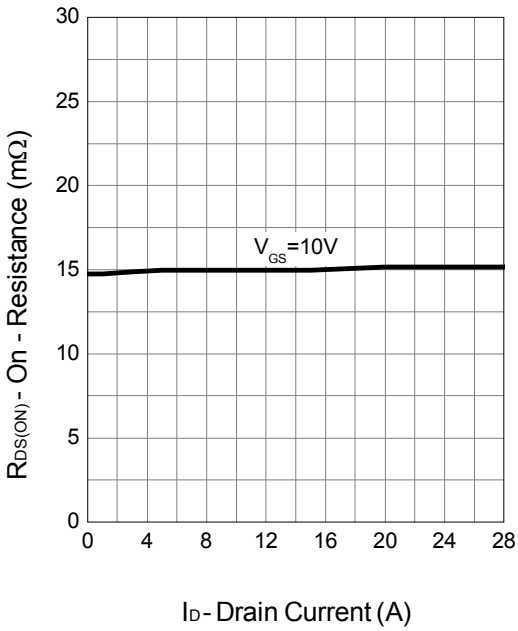


## Typical Operating Characteristics (Cont.)

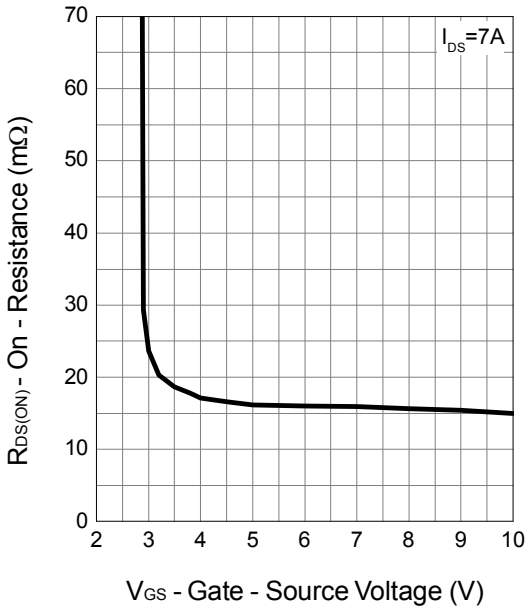
**Output Characteristics**



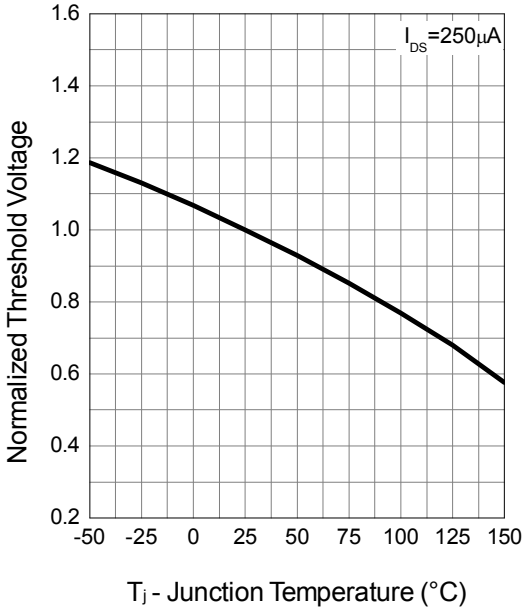

**Drain-Source On Resistance**




**Gate-Source On Resistance**

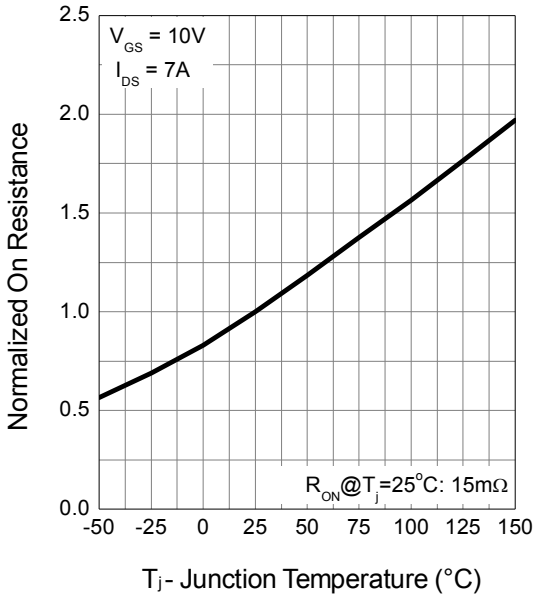



**Gate Threshold Voltage**

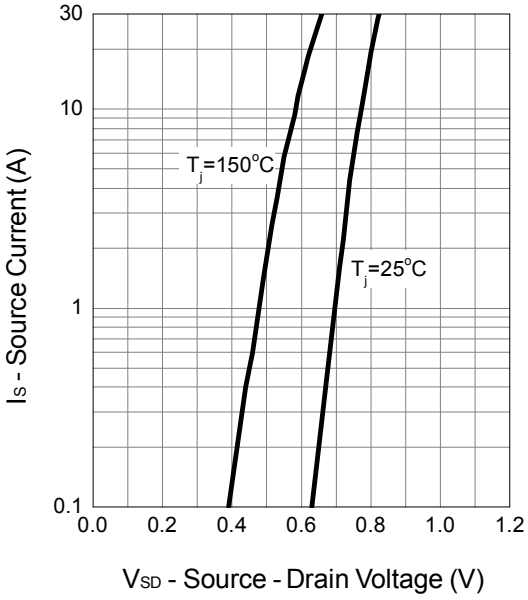


## Typical Operating Characteristics (Cont.)

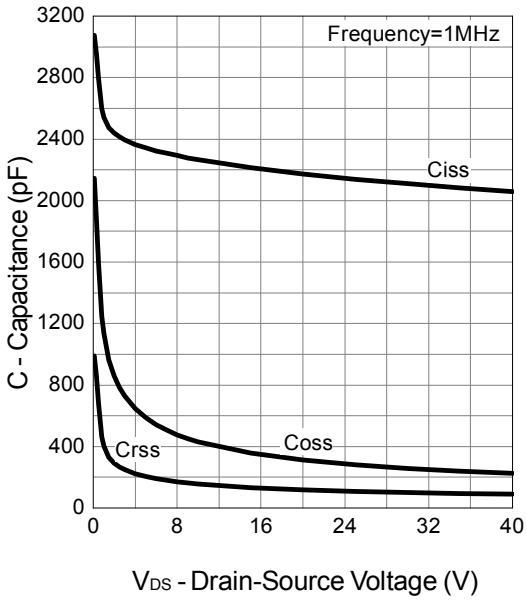
**Drain-Source On Resistance**



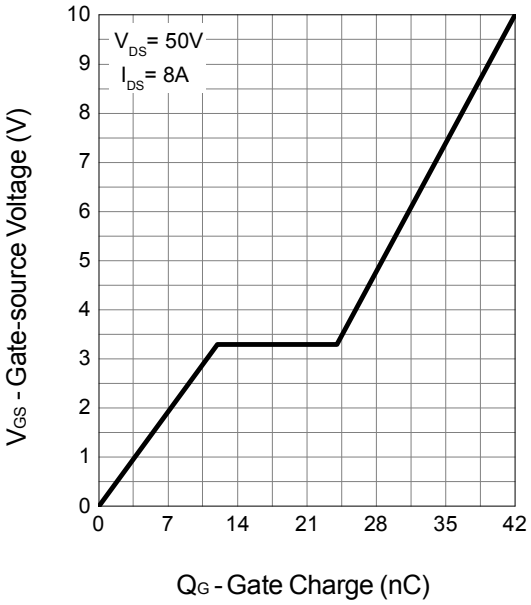

**Source-Drain Diode Forward**



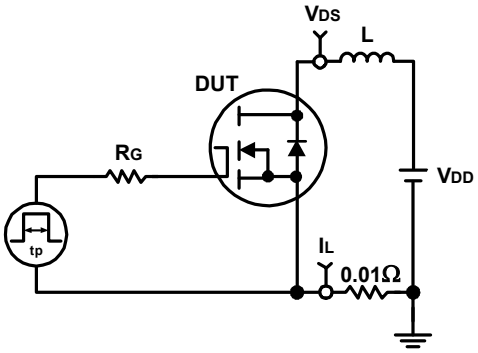

**Capacitance**

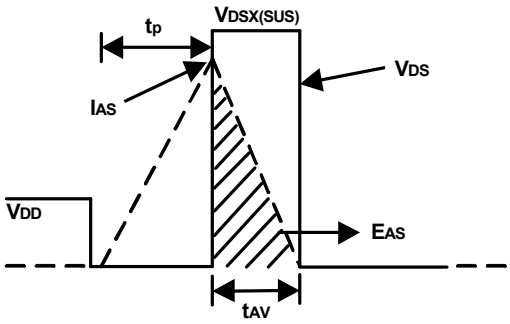



**Gate Charge**

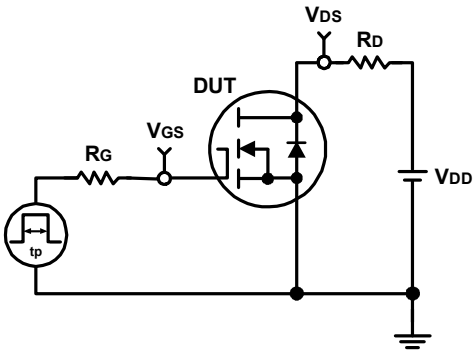


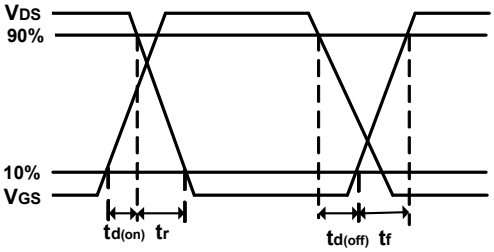
## Avalanche Test Circuit and Waveforms




## Switching Time Test Circuit and Waveforms



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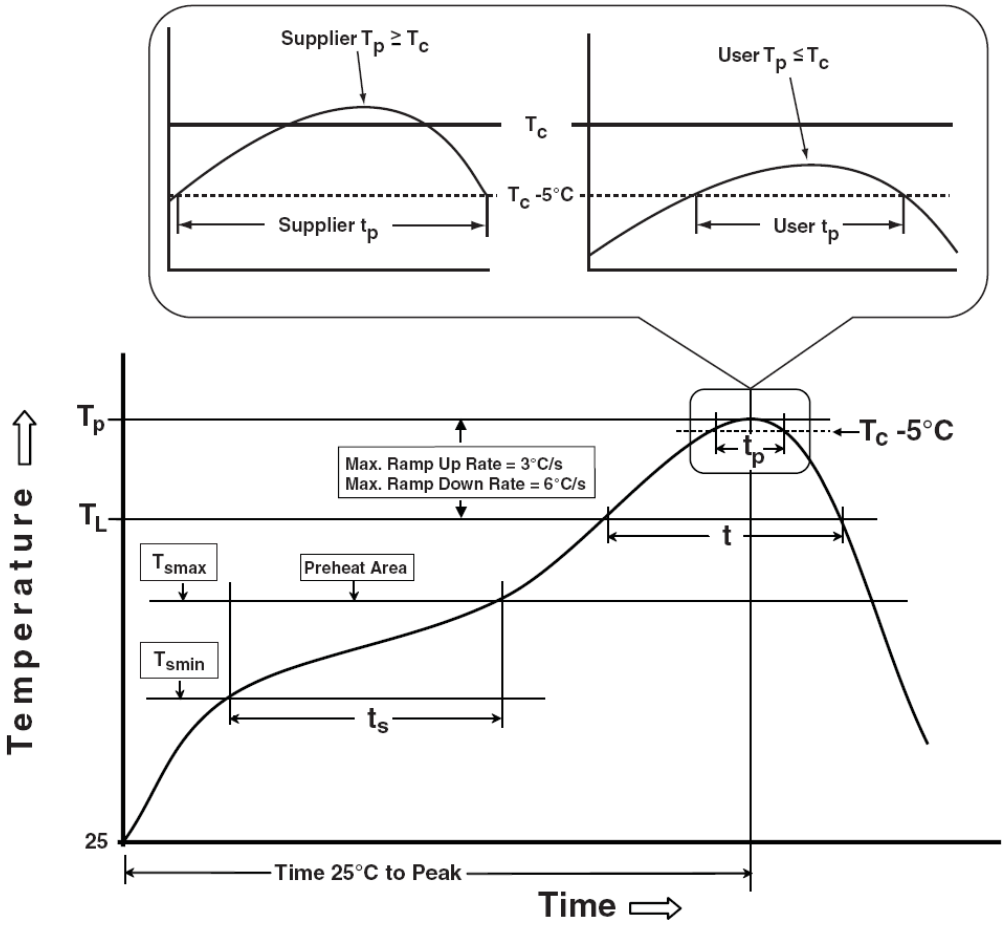
## Classification Profile



## Classification Reflow Profiles

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|---|---|
| **Preheat & Soak**<br>Temperature min ($T_{smin}$)<br>Temperature max ($T_{smax}$)<br>Time ($T_{smin}$ to $T_{smax}$) ($t_s$) | 100 °C<br>150 °C<br>60-120 seconds | 150 °C<br>200 °C<br>60-120 seconds |
| Average ramp-up rate ($T_{smax}$ to $T_P$) | 3 °C/second max. | 3°C/second max. |
| Liquidous temperature ($T_L$)<br>Time at liquidous ($t_L$) | 183 °C<br>60-150 seconds | 217 °C<br>60-150 seconds |
| Peak package body Temperature ($T_p$)* | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ($t_P$)** within 5°C of the specified classification temperature ($T_c$) | 20** seconds | 30** seconds |
| Average ramp-down rate ($T_p$ to $T_{smax}$) | 6 °C/second max. | 6 °C/second max. |
| Time 25°C to peak temperature | 6 minutes max. | 8 minutes max. |
| * Tolerance for peak profile Temperature ($T_p$) is defined as a supplier minimum and a user maximum.<br>** Tolerance for time at peak profile temperature ($t_p$) is defined as a supplier minimum and a user maximum. | | |

Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ ≥350 |
|---|---|---|
| <2.5 mm | 235 °C | 220 °C |
| ≥2.5 mm | 220 °C | 220 °C |

Table 2. Pb-free Process – Classification Temperatures (Tc)

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ 350-2000 | Volume $mm^3$ >2000 |
|---|---|---|---|
| <1.6 mm | 260 °C | 260 °C | 260 °C |
| 1.6 mm – 2.5 mm | 260 °C | 250 °C | 245 °C |
| ≥2.5 mm | 250 °C | 245 °C | 245 °C |

## Reliability Test Program

| Test item | Method | Description |
|---|---|---|
| SOLDERABILITY | JESD-22, B102 | 5 Sec, 245°C |
| HTRB | JESD-22, A108 | 1000 Hrs, 80% of VDS max @ Tjmax |
| HTGB | JESD-22, A108 | 1000 Hrs, 100% of VGS max @ Tjmax |
| PCT | JESD-22, A102 | 168 Hrs, 100%RH, 2atm, 121°C |
| TCT | JESD-22, A104 | 500 Cycles, -65°C~150°C |

## Customer Service

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