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POWER MATTERS

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Standard Reflow Profile
for Standard and Lead-Free Packages

Table 1: **SnPb Eutectic Process – Classification Temperature (T_C)**

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥350
<2.5 mm	235 + 0/–5°C	225 + 0/–5°C
≥2.5 mm	225 + 0/–5°C	225 + 0/–5°C

Table 2: **Pb-Free Process – Classification Temperature (T_C)**

Package Thickness	Volume mm^3 <350	Volume mm^3 350–2,000	Volume mm^3 >2,000
<1.6 mm	260 + 0°C [1]	260 + 0°C [1]	260 + 0°C [1]
1.6 mm – 2.5 mm	260 + 0°C [1]	250 + 0°C [1]	245 + 0°C [1]
≥2.5 mm	250 + 0°C [1]	245 + 0°C [1]	245 + 0°C [1]

Notes:

1. *Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature at the rated MSL level (this means peak reflow temperature + 0°C. For example, 260°C +0°C).*
2. *At the discretion of the device manufacturer, but not the board assembler/user, the maximum peak package body temperature (T_p) can exceed the values specified in Table 2 and Table 3 on page 2. The use of a higher T_p does not change the classification temperature (T_C).*
3. *Package volume excludes external terminals (balls, bumps, lands, leads) and/or nonintegral heat sinks.*
4. *The maximum component temperature reached during reflow depends on package thickness and volume. The use of convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of SMD packages may still exist.*
5. *Moisture sensitivity levels of components intended for use in a Pb-free assembly process shall be evaluated using the Pb-free classification temperatures and profiles defined in Table 2 and Table 3 on page 2, whether or not Pb-free.*
6. *SMD packages classified to a given moisture sensitivity level by using Procedures or Criteria defined within any previous version of J-STD-020, JESD22-A112 (rescinded), IPC-SM-786 (rescinded) do not need to be reclassified to the current revision unless a change in classification level or a higher peak classification temperature is desired.*

Table 3: **Classification Reflow Profile**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat and Soak Temperature minimum (T_{smin}) Temperature maximum (T_{smax}) Time (T_{smin} to T_{smax}) (t_s)	100°C 150°C 60–120 seconds	150°C 200°C 60–120 seconds
Average ramp-up rate (T_{smax} to T_p)	3°C/second maximum	3°C/second maximum
Liquidous temperature (T_L) Time at liquidous (t_L)	183°C 60–150 seconds	217°C 60–150 seconds
Peak package body temperature (T_p) [1]	See classification temperature in Table 1 on page 1.	See classification temperature in Table 2 on page 1.
Time (t_p) [2] within 5°C of the specified classification temperature (T_C)	20 [2] seconds	30 [2] seconds
Average ramp-down rate (T_p to T_{smax})	6°C/second maximum	6°C/second maximum
Time 25°C to peak temperature	6 minutes maximum	8 minutes maximum

Notes:

1. *Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.*
2. *Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.*
3. *All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow (e.g., live-bug). If parts are reflowed in other than the normal live-bug assembly reflow orientation (i.e., dead-bug), T_p shall be within ± 2°C of the live-bug T_p and still meet the T_o requirements. Otherwise, the profile shall be adjusted to achieve the latter. To accurately measure actual peak package body temperatures, refer to JEP140 for recommended thermocouple use.*
4. *Reflow profiles in this document are for classification/preconditioning and are not meant to specify board assembly profiles. Actual board assembly profiles should be developed based on specific process needs and board designs and should not exceed the parameters in Table 3.*
   For example, if T_o is 260°C and time t_p is 30 seconds, this means the following for the supplier and the user.
   For a supplier: The peak temperature must be at least 260°C. The time above 255°C must be at least 30 seconds.
   For a user: The peak temperature must not exceed 260°C. The time above 255°C must not exceed 30 seconds.
5. *All components in the test load shall meet the classification profile requirements.*
6. *SMD packages classified to a given moisture sensitivity level by using Procedures or Criteria defined within any previous version of J-STD-020, JESD22-A112 (rescinded), IPC-SM-786 (rescinded) do not need to be reclassified to the current revision unless a change in classification level or a higher peak classification temperature is desired.*

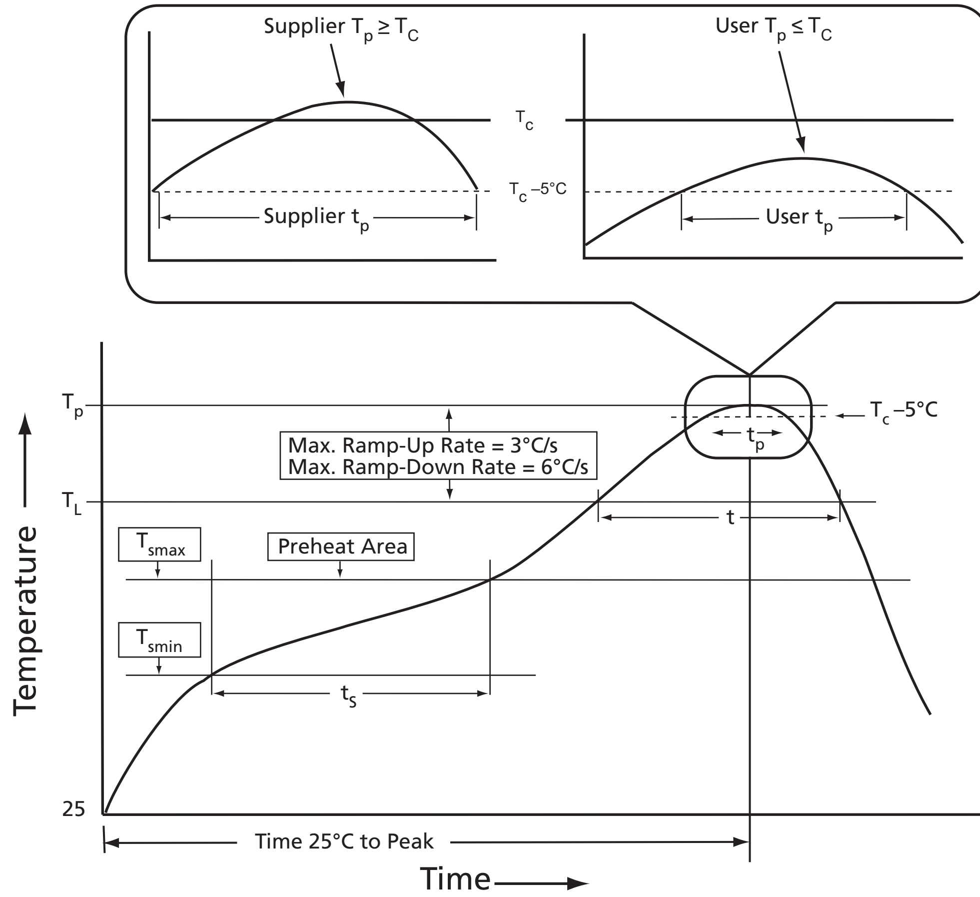

Figure 1: **Reflow Profile**

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