

AUTOMATIC ASSEMBLY SOP and BGA PACKAGES (SnPb soldering process)

**ONLY APPLICABLE for MODULES GUARANTEED by 3D PLUS for
AUTOMATIC REFLOW**

**(Stated in 3D PLUS Certificate of Conformity (CoC)
and/or End Item Data Package (EIDP))**

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1. HANDLING

Components manufactured by 3D PLUS must be handled with care. Operators are requested to wear antistatic gloves and antistatic brackets.

The use of tools that could damage sides of components is also prohibited.

Note : Manual handling may increase the risk of mechanical and/or ESD damage

2. STORAGE

2.1. Background

The vapor pressure of moisture inside a non hermetic package increases greatly when the package is exposed to the high temperature of solder reflow. Under certain conditions, this pressure can cause internal delamination of the packaging materials from the die and/or leadframe/substrate, internal cracks that do not extend to the outside of the package, bond damage, wire necking, bond lifting, die lifting, thin film cracking, or cratering beneath the bonds. In the most severe case, the stress can result in external package cracks. This is commonly referred to as the “popcorn” phenomenon because the internal stress causes the package to bulge and then crack with an audible “pop”.

2.2. Recommendations

In order to avoid degradation due to humidity, components must be handled according to the following procedure.

- **Opened moisture barrier bag**

Any duration exposure : Components which have been exposed only to ambient conditions of $\leq 60\%$ RH for any length of time may be adequately dried by high temperature baking at 125°C during 24 hours for re-bake prior to reflow or 125°C during 48 hours for drying prior to dry pack.

Short duration exposure : Previously dry components, which have been exposed only to ambient conditions not exceeding 30°C / 60% RH may be adequately dried by room temperature dessication using a dry pack or a dry cabinet. If dry pack is used and the total dessicant exposure is not great than 30 minutes, the original dessicant may be reused. If partial lots are used, the remaining components must be resealed or placed in safe storage within one hour of bag opening.

- **Un-opened moisture barrier bag**

The calculated duration for dry sealed packed components is 12 months from the pack seal date, when stored in a non-condensing atmospheric environment of $< 40^{\circ}\text{C}$ and $< 90\%$ RH. Beyond this period, the reconditioning is mandatory, modules shall be backed at 125°C during 48hours.

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Note :

High temperature Carriers : Unless otherwise indicated by 3D PLUS, modules shipped in high temperature trays can be baked in the trays at 125°C (see annex 1).

Low temperature carriers : Modules shipped in low temperature carriers (e.g. plastic box, low temperature trays, tape and reel,...) may not be baked in the carriers at any temperature higher than 40°C. If a higher bake temperature is required, modules must be removed from the low temperature carriers to thermally safe carriers, baked, and returned to the low temperature carriers (see annex 1).

3. ASSEMBLY RECOMMENDATIONS

3.1. Assembly process

After sealed bag opened, the modules have to be backed at 125°C during 24 hours.

After the sealed bag is opened, the maximum duration is 6 hours under environmental conditions $\leq 30^{\circ}\text{C}$ and $< 60\% \text{ RH}$.

Mass reflow : This recommendations apply to bulk solder reflow assembly by convection, convection/IR, infrared (IR), and vapour phase (VPR), processes. It does not apply to bulk solder reflow processes that immerse the component bodies in molten solder (e.g., wave soldering bottom mounted components).

Multiple reflow passes : if more than one reflow pass is used, care must be taken to ensure that modules, mounted or un-mounted, have exceeded their floor life prior to the final pass. If any module on the board has exceeded its floor life, the board needs to be baked prior the next reflow.

3.2. SOP Packages

The use of scotch tape (e.g. Kapton) on the side of the module during assembly is prohibited.

A wide range of tin-lead solder paste is available in the industry. The solder alloy selected should be non-hazardous, mechanically reliable, thermal fatigue resistant, good wetting, and must be compatible with a variety of lead-bearing and surface coatings.

3D PLUS recommends solder paste Sn(63)Pb(37) with melting point at $+183^{\circ}\text{C}$ (eutectic point).

The temperature profile of the equipment must be defined so that the temperature, measured on body module, is below 215°C . If that temperature exceeds the time-

temperature limitations beyond the scope of this specification may be required ; 3D PLUS should be consulted.

3.3. BGA Packages

The use of scotch tape (e.g. Kapton) on the side of the module during assembly is prohibited.

A wide range of tin-lead solder paste is available in the industry. The solder alloy selected should be non-hazardous, mechanically reliable, thermal fatigue resistant, good wetting, and must be compatible with a variety of lead-bearing and surface coatings.

3D PLUS recommends solder paste Sn(63)Pb(37) with melting point at +183°C (eutectic point) or Sn(62)Pb(36)Ag(2) with melting point at +179°C.

The solder ball alloy of Modules is Sn(10)Pb(90) with melting point at 290°C ; the solder balls are not supposed to melt during reflow process.

The temperature profile of the equipment must be defined so that the temperature, measured on body module, is below 215°C. If that temperature exceeds the time-temperature limitations beyond the scope of this specification may be required; 3D PLUS should be consulted.

4. REFLOW PROFILE SPECIFICATIONS

The characterization and optimization of the reflow process is the most important factor to be considered for tin-lead soldering. The reflow process window (RPW) for conventional soldering is relatively wide. The melting point of the eutectic solder alloy is 183°C. The lower temperature limit for reflow is usually 200°C . The upper limit is 215°C, which is the maximum temperature that body package can be exposed to.

These high and low temperature limits provide a process window of 15°C.

Note :

The major factors contributing to the development of an optimal thermal profile are the size and weight of the assembly, the density of the components, the mix of large and small components and the solder paste chemistry being used. The reflow profiling should be performed by attaching calibrated thermocouples embedded in the spheres of the BGA modules or in the leads of SOP modules as well as other critical locations on the boards to ensure that all components are heated to temperatures above minimum reflow temperatures and that modules do not exceed maximum temperature limits.

5. Convection and/or IR reflow profile recommendations

The reflow profiles studied and recommended by 3D PLUS are based on experiences to ensure that all packages can be successfully and reliably assembled. The Figure 1 shows the range of temperature profiles and the Tableau 1 lists the reflow parameters and peak temperatures as recommended by 3D PLUS.

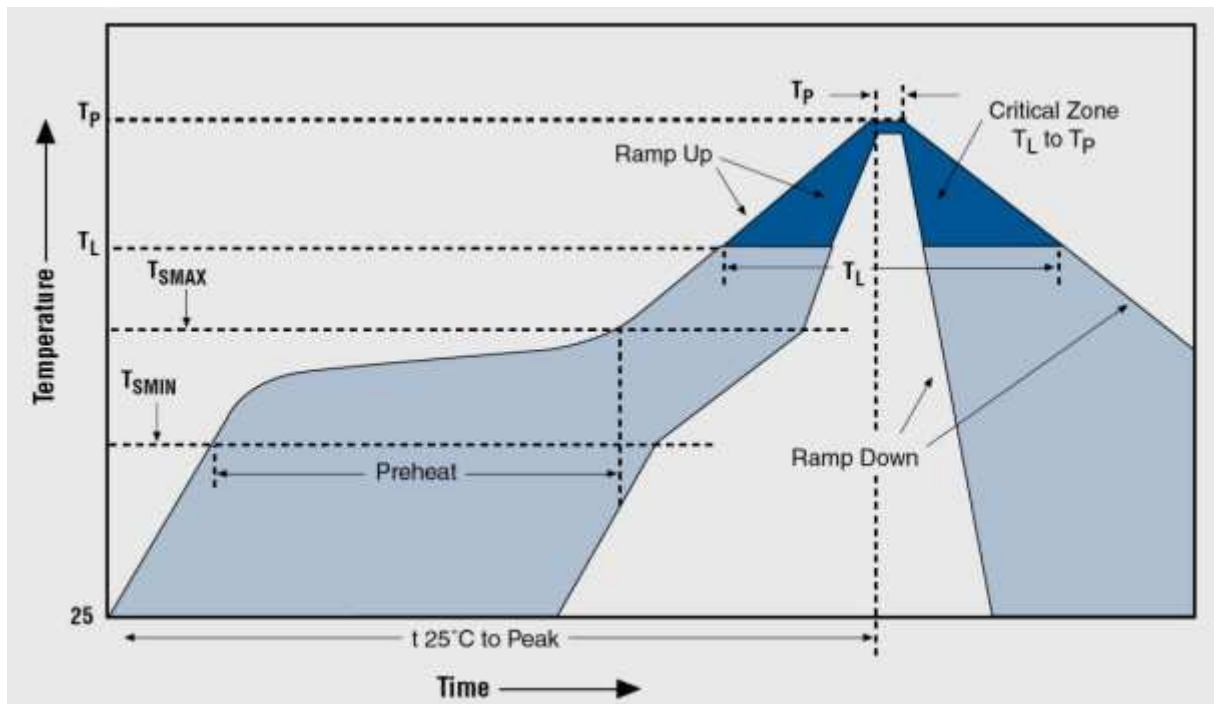


Figure 1 : IR / Convection reflow profile

Reflow parameter	Sn-Pb Eutectic Assembly
Minimum preheat temperature (T_{SMIN})	100°C
Maximum preheat temperature (T_{SMAX})	150°C
Preheat Time	80 to 120 seconds
T_{SMAX} to T_L ramp-up rate	3°C/second maximum
Time above temperature $T_L = 183°C$ (t_L)	60 – 90 seconds
Peak temperature	210°C +5°C/-5°C maximum
Time 25°C to T_P	6 minutes maximum
Time within 5°C of peak T_P	10 – 30 seconds
Ramp-down rate	6°C/second maximum

Tableau 1: Sn-Pb reflow profile recommendation

6. Vapor phase reflow profile recommendations

In a vapor phase process, typically a fluid with a boiling point of 200°C or 215°C was used and thus induced lower thermal stress in comparison to the convection process. The reflow profiles studied and recommended by 3D PLUS are based on experiences to ensure that all packages can be successfully and reliably assembled. The Figure 2 shows the range of temperature profiles and the Tableau 2 lists the reflow parameters and peak temperatures as recommended by 3D PLUS.

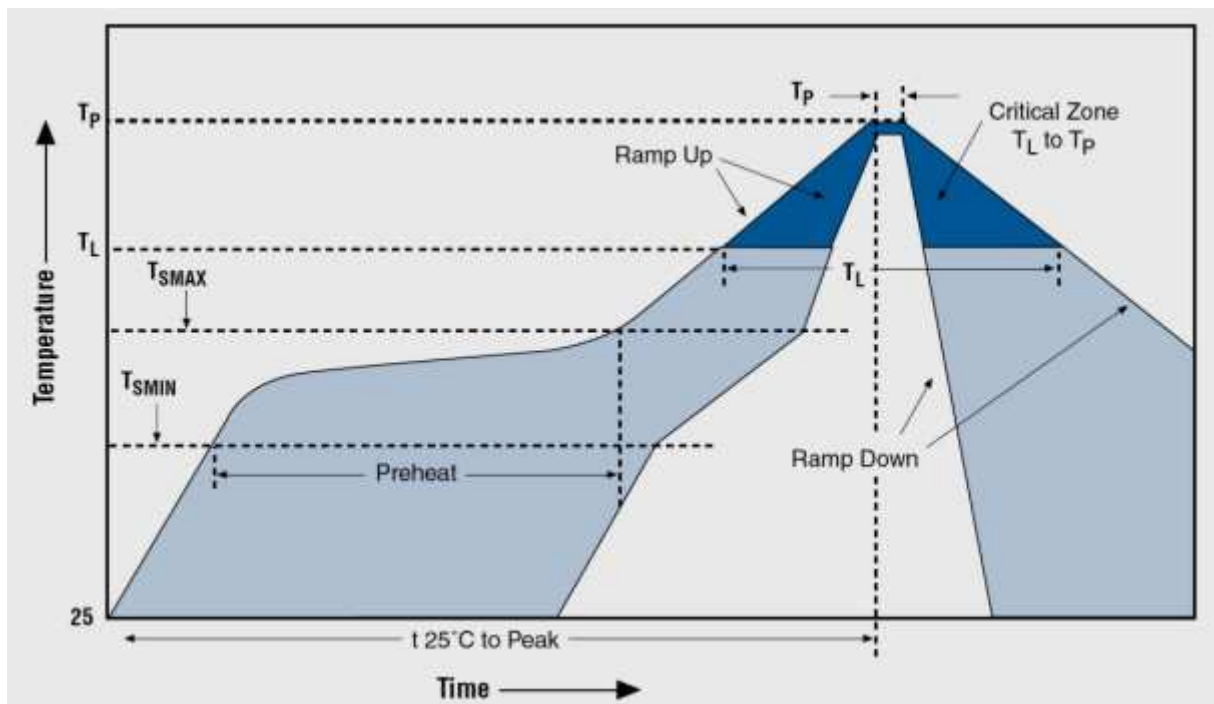


Figure 2 : Vapor phase soldering profile

Reflow parameter	Sn-Pb Eutectic Assembly
Minimum preheat temperature ($T_{S\text{MIN}}$)	100°C
Maximum preheat temperature ($T_{S\text{MAX}}$)	150°C
Preheat Time	80 to 120 seconds
$T_{S\text{MAX}}$ to T_L ramp-up rate	3°C/second maximum
Time above temperature $T_L = 183^\circ\text{C}$ (t_L)	45 – 60 seconds
Peak temperature	200°C or 215°C maximum
Time 25°C to T_P	6 minutes maximum
Time within 5°C of peak T_P	10 – 30 seconds
Ramp-down rate	6°C/second maximum

Tableau 2 : Sn-Pb reflow profile recommendation

7. ANNEX 1 : Carriers Description

7.1. High temperature carrier description



Plastic tray for modules



Maximum temperature 150°C for Baking

7.2. Low temperature carrier description



Plastic box for modules



Low temperature plastic tray