

# TI recommendations for setting up a reflow profile for a TI package

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# TI recommendations for reflow profile setup

## History

With the increasing package complexity and package outline variations, the reflow equipment temperature profile setup is getting more complex.

Beside long time used SnPb solder alloys, the lead free SnAgCu alloys mainly used in current production raised multiple questions for the 'perfect' reflow profile from TI's customers.

# TI recommendations for reflow profile setup

## General reflow profile considerations

The reflow profile needs to enable the flux contained in the solder paste to start the chemical activation before the solder melting point is reached, without get burned / used up before the reflow peak temperature point is reached. Also during the time the solder is melting and wetting to the component terminal surface and the PCB pad surface the flux needs to be active to break up any surface oxides and other contaminations to allow the solder wetting to the metal termination. The solder paste supplier typically provide a recommended reflow profile, which can be used as a start point.

The component are rated to a maximum reflow temperature in combination with storing the components in a certain environment. The qualification of the component to a so called 'Moisture level' is described in the JEDEC standard J-STD020xx and is downloadable from the [www.JEDEC.org](http://www.jedec.org) web page after free registration. <http://www.jedec.org/sites/default/files/docs/JSTD020D-01.pdf>

Smaller components are typically rated with a maximum reflow temperature of 260°C, which should not be exceeded by the end user assembly process.

The JSTD020 standard is a qualification standard, customer should set up the actual reflow process temperatures below the maximum package rating in the standard.

# TI recommendations for reflow profile setup

## Starting a reflow profile setup

The reflow profile shown in the J-STD020 standard can be used as a start point if no recommendations from the solder paste supplier are available.

The temperatures should be measured at least on the PCB top and bottom side, on small and large components on the top side which is in the active solder process, and temperature critical components which can be passive parts or connectors.

The setup starts usually with the speed setup of the reflow oven transport system to achieve the solder paste recommended total process time, followed by setting the air temperature in the individual oven zones.

It will not be the goal to achieve the maximum soldering temperature the components are rated in the J-STD20 standard, usually for leadfree soldering with SnAgCu alloy, a peak temperature of 235-245°C for 30-90 seconds is sufficient to create the solder interconnection between the component and the board. The temperature needs to be measured on the component top package side, and if possible for large components terminations on the leads itself.

# TI recommendations for reflow profile setup

## Solder wetting considerations

When the reflow profile is using too hot temperatures or a too long process time before reaching the liquid stage of the used solder alloy, the flux will be used up or burned before the solder is getting liquid. In this case, the solder wetting on the component termination may not be sufficient, the surfaces can not be cleaned up and the liquid solder surface is carrying a lot of oxides. These oxides increase the solder surface tension, which results in less solder wicking up a component termination.

For package lead side solder wetting it is necessary to provide a certain PCB pad distance from the package lead terminal to allow a solder meniscus in this area.

# TI recommendations for reflow profile setup

## Vapor phase soldering

If vapor phase soldering is used, commonly a 230-235°C medium is used for leadfree (SnAgCu solder alloy) soldering. The equipment chosen need to allow for a pre heating in this case to minimize the temperature shock when the board is transferred from room temperature into the vapor phase chamber.

The J-STD020 maximum reflow temperature limits and ramp up/down rates for the temperature should not be exceeded for vapor phase soldering process.

The total process time can be shorter for a vapor phase process due to the higher temperature transfer of the used vapor. The process times should not exceed the limits given in J-STD020.

The solder paste supplier may have also a vapor phase profile recommendation for this case.

# TI recommendations for reflow profile setup

## Comment

TI can not provide a reflow profile which will fit the customer requirements perfect since TI usually do not know all the circumstances and have not the equipment / process to fully test this.

The reflow oven, board layout and board properties, mix of components on the board, used Solder paste and Flux system are out of supplier control.

From previous evaluation it is known that a Nitrogen reflow atmosphere provides less solder failures and solder wetting issues than Air atmosphere for lead free soldering processes. This is due to the Tin (Sn) Oxide residuals on the liquid solder surface which is very limited in Nitrogen atmosphere once removed by the flux.

Board pad design showed larger influence on achievable side solder wetting than the reflow profile. TI application note [SCEA038](http://focus.ti.com/lit/an/scea038/scea038.pdf)  
( <http://focus.ti.com/lit/an/scea038/scea038.pdf> )

## TI recommendations for reflow profile setup

### In case of problems:

If customer claims soldering problems with TI packages, please provide through the TI Sales / CQE channel the following information:

- images showing the problem (non wetting lead or open interconnection for example) and 'good solder joint' reference image.
- reflow temperature profile measured on the top of the 'claimed' TI package, thermocouple attached to the package,  
if possible a 2nd Thermocouple attached to the board surface near by, and measurement of the 'good' reference unit. Please provide pictures of the measurement setup on the board.
- solder paste used (Alloy, Flux water soluble / no clean), if possible datasheet and supplier name / part#
- Solder stencil thickness and layout/dimension of the lead pad, the solder pad opening dimensions.
- PCB pad layout dimension / or top side image showing the lead on the pad. Large components on the second PCB side or thermal pads / heat sink can influence the soldering performance of the package in question too.
- Reflow atmosphere used. Air shows less good solder wetting than N2 (nitrogen)
- Shipping Label information from the affected material