

Soldering Requirements for BQFN Packages

ABSTRACT

This document outlines the soldering requirements for power modules in a BQFN package.

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1 Soldering Requirements

- A. Solder Process – Devices in BQFN packages must be attached to the host printed-circuit board (PCB) using industry-standard reflow processes.
 1. Pb-free, high temperature solder reflow process - The solder paste should be an industry-standard SAC alloy with a nominal melting point of 221°C.
 2. Leaded, low temperature solder reflow process - The solder paste should be an industry-standard SN63/Pb37 alloy with a nominal melting point of 183°C.
- B. Quantity of Solder - See the land pattern drawing at the end of the product datasheet for recommended solder paste stencil thickness.
- C. Volume of Solder - See the land pattern drawing at the end of the product datasheet to calculate solder volume based on recommended stencil thickness.
- D. Solder Paste –
 1. Use water-soluble, low residue, or no-clean solder paste (SAC alloy or SN63/Pb37).
 2. Follow paste manufacturer's recommended thermal profile.

2 Developing a Reflow Profile

To avoid component damage, use the following maximum reflow parameters:

- A. Preheat and cool-down ramps should not exceed 3°C/s to prevent internal component failures due to thermal stress.
- B. The reflow temperature must exceed the nominal melting point of the solder paste for at least 30 seconds, not to exceed 90 seconds.
 1. SAC alloy solder paste should reach a minimum peak temperature of 235°C. See the Package Option Addendum at the end of the product data sheet for peak temperature and MSL classification.
 2. SN63/Pb37 alloy solder paste should reach a minimum peak temperature of 195°C. See the Package Option Addendum at the end of the product datasheet for peak temperature and MSL classification.
- C. Do not elevate the product pins or component temperature above a the peak temperature listed in the Package Option Addendum at the end of the product data sheet.
- D. A reliable profile for soldering BQFN packages to a host PCB can be developed using at least three small-gauge (30 to 36 AWG) thermocouples, or other temperature measuring material, secured to the test unit in the following locations:
 - Product power pin on the host PCB
 - Center of the device package
 - Product ground pin on the host PCB

Monitor thermocouples as the unit passes through the oven to verify that the pin temperatures exceed the minimum requirements, and that the soldering requirements detailed herein are not exceeded. See the sample SAC alloy reflow profile section of this document.

3 Surface-Mount Soldering Qualification

BQFN devices are qualified to have no degradation from reflow/IR soldering and aqueous washing by verification through rigorous testing. Sample batches are subjected to reflow through a convection reflow oven and an aqueous wash cleaner. The convection reflow oven is set to achieve maximum peak temperature on any pin or component. These parts are subsequently used for thermal shock, humidity, and life qualification testing. All products must pass this initial qualification testing with zero failures before being released to production.

4 MSL Compliance

BQFN devices are classified to MSL levels per JEDEC standard J-STD-020. See the Package Option Addendum at the end of the product data sheet for MSL classification.

5 Visual Inspection

All pins around the perimeter of the device can be visually inspected for solder fillets.

The exterior fillet formation can vary based on manufacturing factors, such as flux activity, solder volumes, and overall standoff height. Due to factors outside of TI's control, no assurance for consistent solder fillet heights on the package sides during assembly can be made. IPC-A610D does not require a side fillet, since the side terminations are not plated. While it can appear the wetting is reduced on the side of the component, the solder joint underneath is not affected.

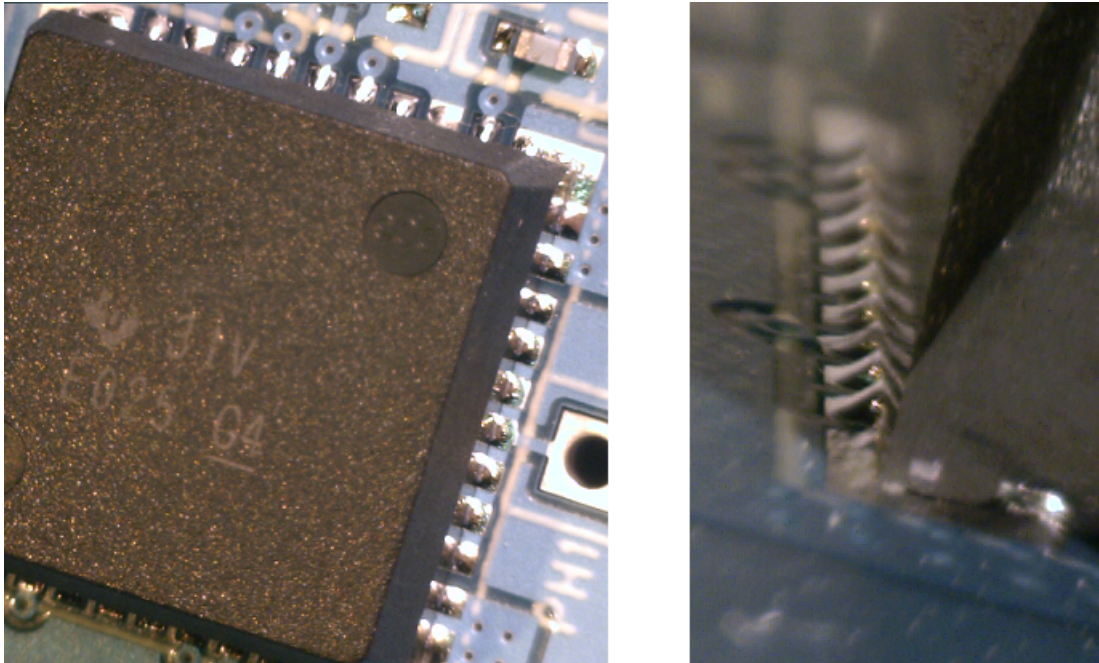


Figure 1. Visual Inspection

6 Removal and Rework

Removal of a BQFN device requires heating the component and printed circuit board to reflow the solder attaching the component to the printed circuit board. Apply hot air directly to the component pins and top of the component by using a dedicated quad flat pack nozzle (see [Figure 2](#)) to concentrate the heat directly on the device. To accelerate the heating process, the board can be heated from the bottom using a hot air pre-heater. Once the solder has reflowed, the device can be lifted using an IC vacuum.

After the component has been removed, the solder must be removed using a conductive tool and desoldering braid. Once the solder is removed, the pad must be cleaned using appropriate flux remover.

To re-attach a new device, paste must be re-applied as described in the [Soldering Requirements](#) section. The solder must then be reflowed as described in the [Developing a Reflow Profile](#) section.

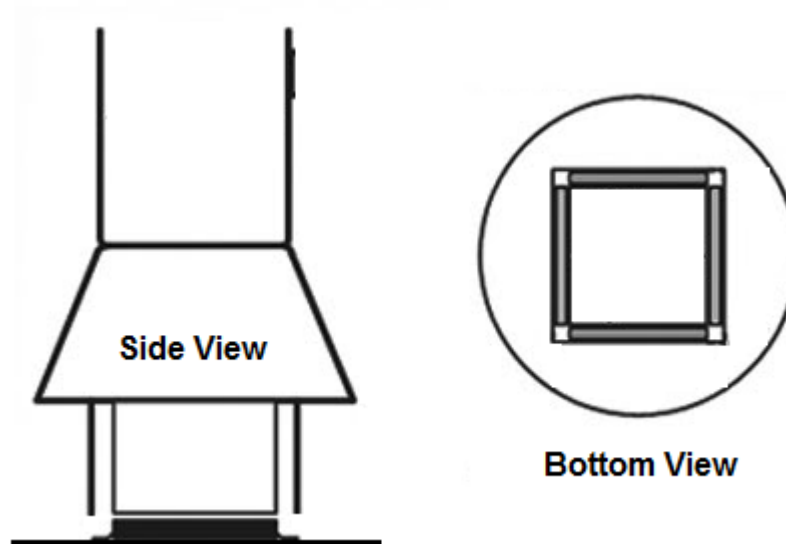


Figure 2. Quad Flat Pack Nozzle

7 Reflow Profile

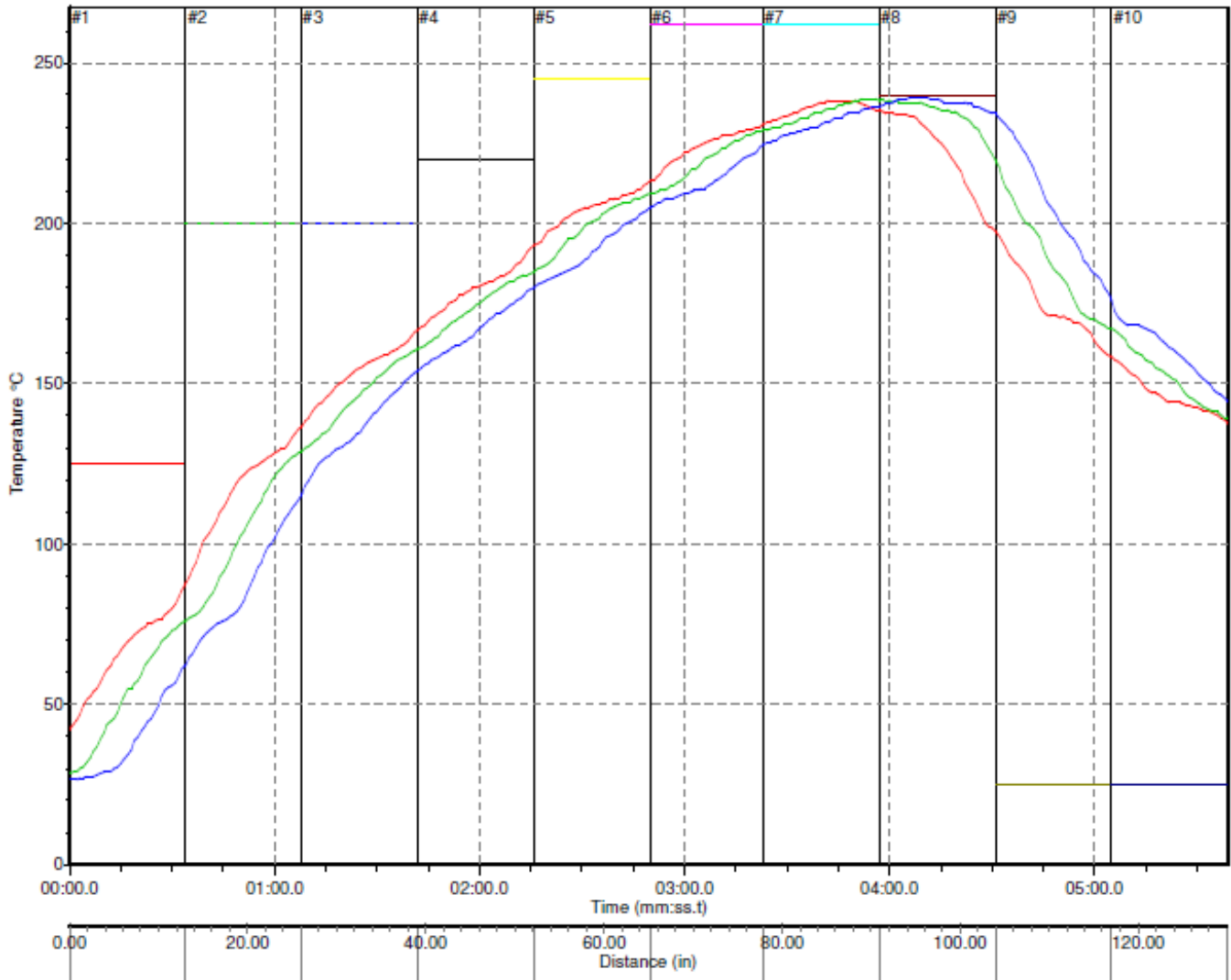


Figure 3. Sample Reflow Profile

Table 1. Sample Reflow Profile

PROBE	MAX TEMP (°C)	REACHED MAX TEMP	TIME ABOVE 235°C	REACHED 235°C	TIME ABOVE 240°C
#1	238.5	3:42	0.30	3:34	0.00
#2	239.0	3:52	0.39	3:41	0.00
#3	239.5	4:06	0.38	3:52	0.00

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from B Revision (June 2017) to C Revision Page

- Added additional information regarding visual inspection..... 3

Changes from A Revision (January 2014) to B Revision Page

- Referenced the Package Option Addendum for peak temperature 2
- Updated sample reflow profile 5

Changes from Original (October 2012) to A Revision Page

- Added Visual Inspection..... 3

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