

# **Soldering Requirements for BQFN Packages**

---



---



---

## **ABSTRACT**

This document outlines the soldering requirements for the TPS84 and LMZ3 device families.

### **Contents**

1	Soldering Requirements .....	2
2	Developing a Reflow Profile .....	2
3	Surface-Mount Soldering Qualification .....	2
4	MSL Compliance .....	2
5	Visual Inspection .....	3
6	Removal and Rework .....	4
7	Reflow Profile .....	5

### **List of Figures**

1	Visual Inspection .....	3
2	Quad Flat Pack Nozzle .....	4
3	Sample Reflow Profile .....	5

### **List of Tables**

1	Sample Reflow Profile .....	5
---	-----------------------------	---

## **Trademarks**

All trademarks are the property of their respective owners.

## 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.
  - (a) 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.
  - (b) 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 –
  - (a) Use water-soluble, low residue, or no-clean solder paste (SAC alloy or SN63/Pb37)
  - (b) 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.
  - (a) SAC alloy solder paste should reach a minimum peak temperature of 235°C. See the Package Option Addendum at the end of the product datasheet for peak temperature and MSL classification.
  - (b) 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 datasheet.
- (D) A reliable profile for soldering BQFN packages to a host PCB may 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 datasheet for MSL classification.

## 5 Visual Inspection

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

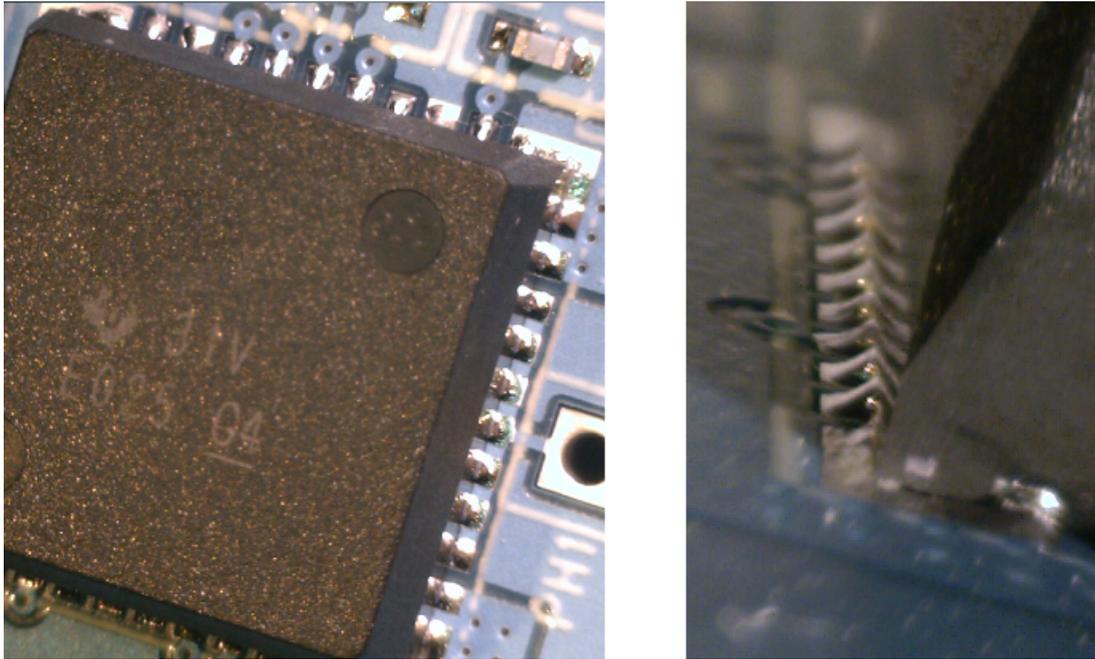


Figure 1. Visual Inspection

## 6 Removal and Rework

Removal of a BQFN device requires heating the component and printed circuit board in order 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.

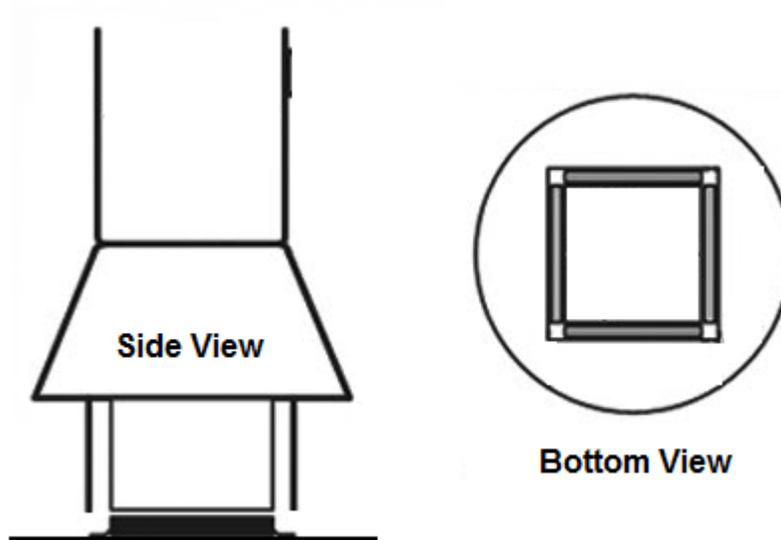
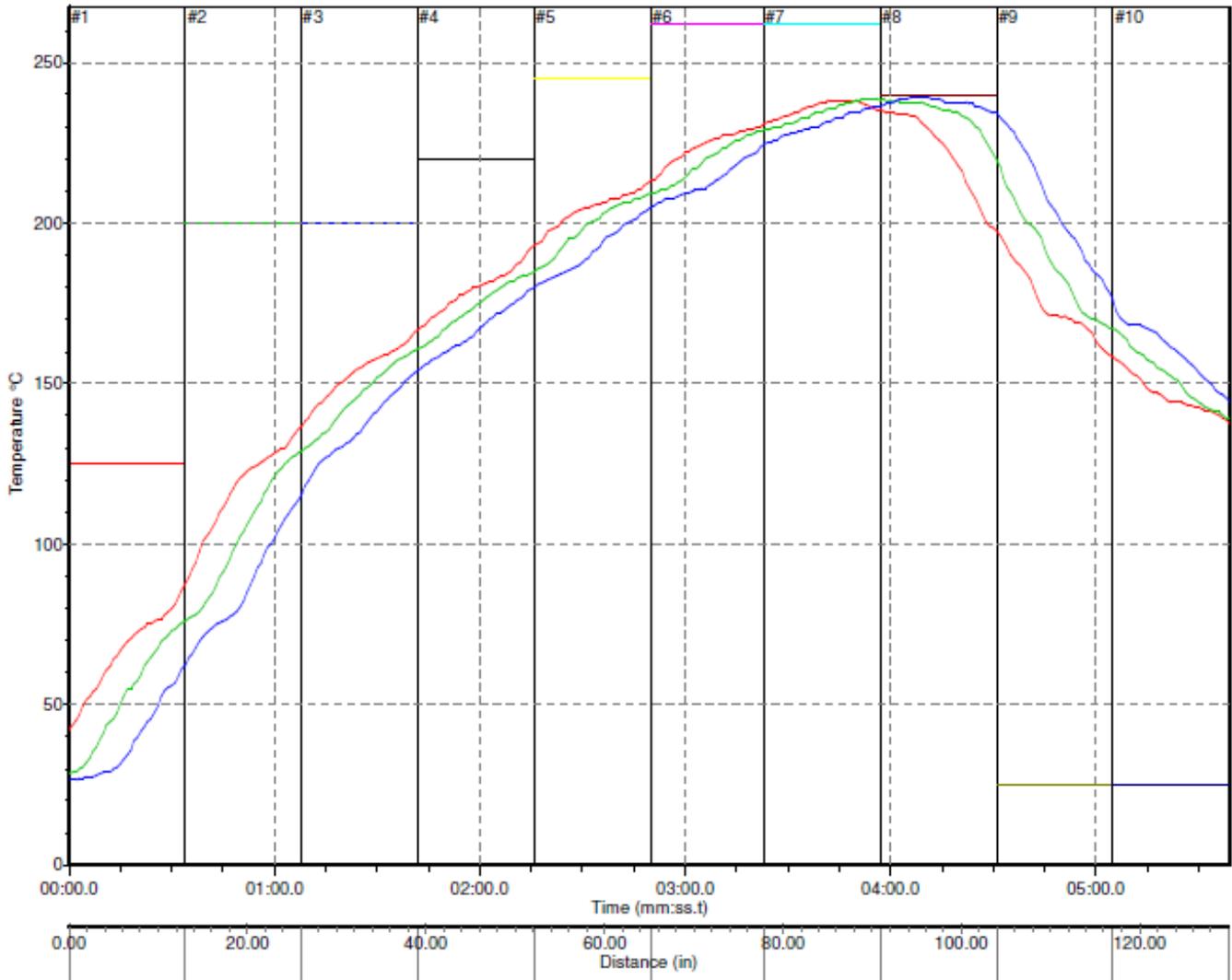


Figure 2. Quad Flat Pack Nozzle

**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.

<b>Changes from A Revision (January 2014) to B Revision</b>	<b>Page</b>
• Referenced the Package Option Addendum for peak temperature .....	2
• Updated sample reflow profile .....	5

<b>Changes from Splat Revision (October 2012) to A Revision</b>	<b>Page</b>
• Added Visual Inspection .....	3

## IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2017, Texas Instruments Incorporated