AN-1389
APPLICATION NOTE

One Technology Way • P.O. Box 9106 • Norwood, MA 02062-9106, U.S.A. • Tel: 781.329.4700 • Fax: 781.461.3113 • www.analog.com

Recommended Rework Procedure for the Lead Frame Chip Scale Package (LFCSP)

by Ramon Navarro

INTRODUCTION

This application note provides a recommended procedure for removing the lead frame chip scale package (LFCSP) from the printed circuit board (PCB). The LFCSP is compliant with the JEDEC MO-220 and MO-229 outlines. This application note is supplementary to the AN-772 Application Note, *A Design and Manufacturing Guide for the Lead Frame Chip Scale Package (LFCSP)*.

PACKAGE DESCRIPTION

The LFCSP is a plastic encapsulated package that is lead frame based and has a footprint close in size to the chip or die, thus being chip scale (see Figure 1). Interconnection inside the package is typically achieved through wire bonding.

Make external electrical connections by soldering the perimeter leads to the PCB. In addition to the leads, the LFCSP commonly has a large exposed thermal paddle, which can be soldered to the PCB for improved heat dissipation.

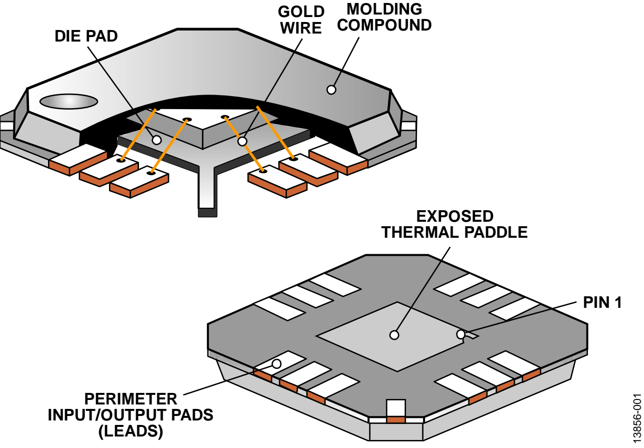

Figure 1. Isometric, Cut Away View of the LFCSP

REWORK FOR LFCSP COMPONENTS

If defects are present after attaching the LFCSP component to the PCB, rework to remove the defective component and replace it with a functioning device. Before removing the device, note that the defective component must be heated until the solder underneath the leads and the exposed thermal paddle (if soldered as well) is liquefied, which makes removing the component from the board easier.

The conventional rework process includes the following:

1. Board preparation
2. Component removal
3. PCB land clean up
4. Application of the solder paste
5. Component alignment and placement
6. Component attachment
7. Inspection of rework

See the AN-772 Application Note for a more detailed description of Step 3 to Step 7.

COMPONENT REMOVAL AND DELAMINATION

The manner of component removal can impart mechanical stress on the LFCSP and/or the PCB. Remove the defective device carefully to avoid damage not only to the PCB or nearby components but also to the device itself, particularly if a user plans to subject it to failure analysis. Excessive stresses on the LFCSP component (such as heating the component beyond the specified peak temperature or overexposure to heat) can lead to package delamination or external physical damage (see Figure 2 to Figure 4). For a component that must undergo further analysis, delamination caused by improper component removal makes identifying the true failure mechanism more difficult. Consequently, proper removal of the defective component is necessary to conduct effective failure analysis.

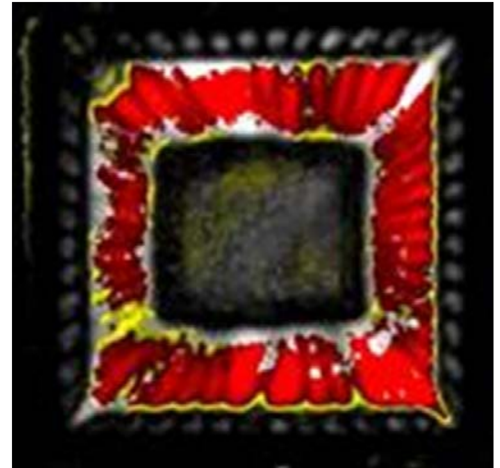

Figure 2. LFCSP Die Pad Delamination Due to Improper Removal (Observed Through Scanning Acoustic Microscopy)

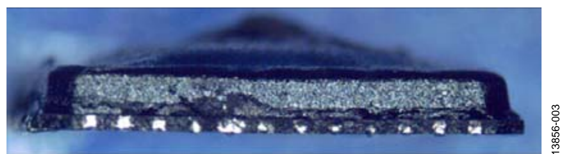
13856-003

Figure 3. Low Magnification, Side View Image of LFCSP Showing Damage Due to Excessive Rework Settings (Bulging Mold Compound)

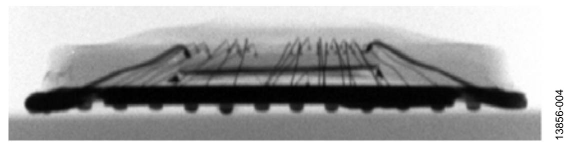
13856-004

Figure 4. X-Ray Image of LFCSP Showing Internal Damage Due to Excessive Rework Settings (Lifted Die)

BOARD PREPARATION

It is strongly recommended to dry bake the PCB assembly prior to the rework procedure to eliminate residual moisture. If not removed, this residual moisture can cause damage to the component during reflow due to popcorn cracking. Bake the PCB assembly for a minimum of 4 hours at 125°C, as long as these conditions do not exceed those specified for other components on the PCB. When the conditions exceed other component specifications, use alternative baking conditions detailed in the Joint Industry Standard IPC/JEDEC J-STD-033.

COMPONENT REMOVAL

Different tools are available for component removal. Component removal can involve heating the component until solder reflow occurs, then mechanically removing the component while the solder is still in a liquid state. A programmable hot air rework system can provide controlled temperature and time settings.

Follow the temperature profile used for component attachment when performing the rework. Rework temperature must not exceed the peak temperature specified on the moisture sensitivity level (MSL) label. It is acceptable to shorten the duration of heating (for the liquidus region, for example) as long as full solder reflow is attained. Keep the time at which the package temperature is at the solder reflow region less than 60 seconds. Maintain vacuum pressure for the pick-up tool less than 0.5 kg/cm^2 to prevent the component from lifting out before full reflow is reached and to avoid pad lift. Do not reuse any components that are removed from the PCB.

Control the rework temperature to avoid damage to the LFCSP component and the PCB. Note that covering the area immediately surrounding the component with thermal tape provides further protection. In addition, it is recommended to heat the PCB underneath to reduce the temperature difference between both PCB sides and to minimize board warping.

When defining the rework tool settings, perform characterization of the temperature profile. This characterization is particularly important when reworking a specific component for the first time. It is also necessary to perform characterization on LFCSP components with different body sizes or different PCB materials, configurations, thicknesses, and so on, because these may have different thermal masses. Characterization must include monitoring of the temperature and time and other equipment tool settings (see Figure 5). Thermocouples can be attached to different parts of the board assembly, such as the top of the LFCSP component and the top of the PCB (see Figure 6). Analyze the temperature-time profile data and obtain working parameters for the component removal from the evaluation.

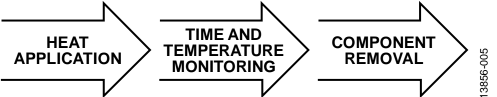

Figure 5. Simplified Flowchart for Component Removal Evaluation

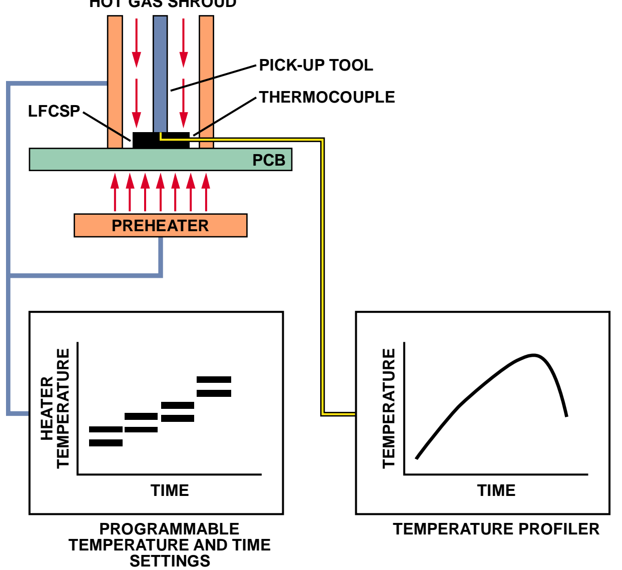

Figure 6. Sample Illustration of a Component Removal Characterization Setup

©2016 Analog Devices, Inc. All rights reserved. Trademarks and registered trademarks are the property of their respective owners.
AN13856-0-1/16(0)