

Soldering and Handling of Surface Mount Devices

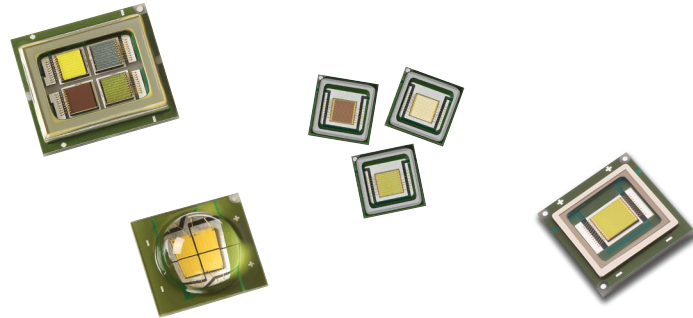


Table of Contents

- 1. Board Design.....1
 - 1.1 Circuit-Board Pattern Layout.....1
- 2. Processing2
 - 2.1 Applying Solder to the Circuit Board2
 - 2.2 Solder Temperature Profile2
 - 2.3 Cleaning Post Solder Reflow..... 20
- 3. Other Assembly Concerns3
 - 3.1 Handling and Mechanical Stresses.....3
 - 3.2 Reworking or Desoldering3
 - 3.3 Manual Handling3
- 4. Moisture and sensitivity3

Introduction:

This document describes soldering of all Luminus Devices’s surface mount LEDs to circuit boards and provides information on land pattern geometries, solder reflow profiles and component handling.

Board Design:

The choice of mounting surface mount LEDs on MCPCB (Metal Core PCB) or FR4 circuit boards depends on several factors, the most prominent being cost and thermal performance requirements of the system. An MCPCB will result in better thermal performance than the FR4, but it comes at a higher price. However, processing and solder pad layouts are the same for both solutions.

Circuit-Board Pattern Layout

Luminus recommends that users follow the solder pad layouts shown in product datasheets of all surface mount products; the solder pad layout of the SST-50 is shown in Figure 1 as an example. To achieve optimum alignment and minimization of solder voiding, land patterns and pad sizes should be tested and qualified in the manufacturing process.

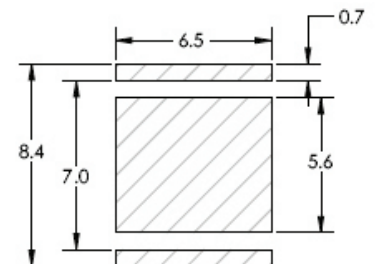


Figure 1: Recommended solder pad layout and size for SST-50. All dimensions in mm.

Processing:

Applying Solder to the Circuit Board

Solder paste can be applied to the PCB solder landing pads by a screen or stencil at a thickness of 0.15mm (0.006") to 0.25mm (0.010"). For solder paste printing, Luminus recommends that the equipment be located in a controlled environment maintained at a temperature of 23 +/- 5 C and a relative humidity less than 60%.

Solder Temperature Profile

Convection reflow, not wave soldering, is the preferred technique of soldering surface mount products, as the latter may deteriorate the integrity of the package. The reflow process consists of applying solder paste to a circuit board, placing devices onto the paste using standard pick and place techniques or manually, and then conveying the board through a convection oven with successive heating zones of varying temperatures. In the convection oven, each board goes through:

1. Gradual preheating
2. Brief duration at liquidous alloy temperature
3. Controlled cooling

Luminus recommends solder profiles as shown in the following figures and tables. The optimum profile for any given build may differ due to solder type, oven type, circuit board or assembly layout. All temperatures are monitored at the component dielectric layer. Recommended lead free, no-clean solders include: AIM NC254- SAC305, FD7024582-SAC305, SHENMAO Formosa PF606-P-SAC305. Recommended leaded, no-clean solders include: EFD7019530- SN63, SHENMAO Formosa SH-6309RMA-SN63.

Reliability and solder tests have demonstrated that 250° C is both a satisfactory and safe maximum body temperature for surface mount products during reflow.

SAC 305 Reflow Profile Window For Low Density Boards

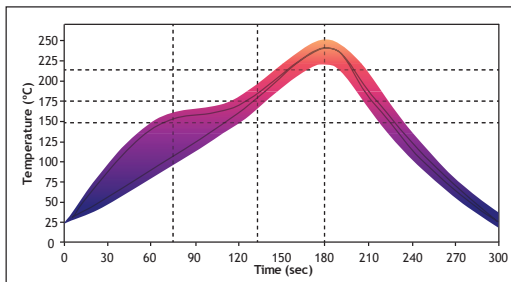


Figure 2: Recommended lead free solder profile.

Sn63 & Sn62 Reflow Profile Window for Low Density Boards

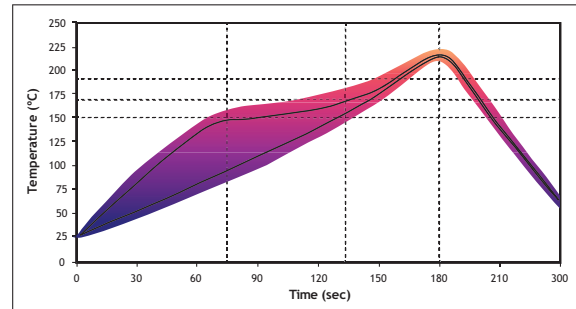


Figure 3: Recommended lead based solder profile.

Solder Profile Stage	Lead-free solder
Profile length, Ambient to Peak	2.75 - 3.5 minutes
Time above 217° C	30 - 60 seconds
Cooldown Rate	≤ 4° C/sec
Cooldown Duration	45 ± 15 sec

Table 1: Lead free solder guideline for low density boards

Solder Profile Stage	Lead-based solder
Profile length, Ambient to Peak	2.75 - 3.5 minutes
Time above 183° C	30 - 60 seconds
Cooldown Rate	≤ 4° C/sec
Cooldown Duration	45 ± 15 sec

Table 2: Lead based solder guideline for low density boards

Cleaning Post Solder Reflow

Luminus recommends using a no-clean flux solder paste. Cleaning the circuit board is not required, but if necessary, isopropyl alcohol may be used. Ultrasonic cleaners or vapor degreasers are not recommended and may damage the device.

Other Assembly Concerns:

Handling and Mechanical Stresses

Luminus recommends a vacuum pick-up tool for the pick and place of surface mount products. Care should be exercised when handling the devices and sudden forces on the dome or window, such as those caused by dropping the device on a hard surface, may damage the device. During the pick and place process, axial forces on the dome (or window) must not exceed 0.5 N.

Reworking or Desoldering

Luminus recommends only a one time rework using an automatic hot air rework system capable of heating the device uniformly with a convection nozzle that exceeds the device outline. Rework parameters should not exceed the temperatures and soak times listed in the solder profile chart.

Manual Handling

If manual assembly or manual handling is necessary, handle the device only at the base of the substrate as shown in Figure 4. Do not touch the lens (or window) or the interface between the lens (or window) and the substrate.

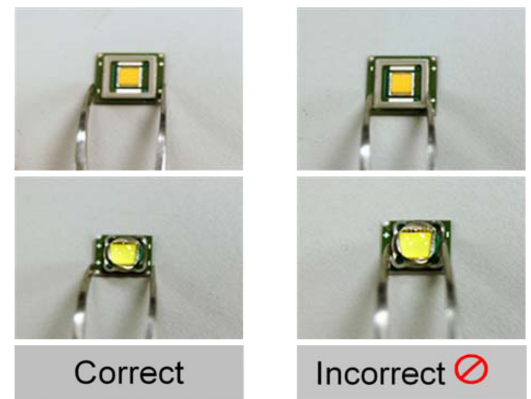


Figure 4: Proper manual handling procedure.

Moisture and Sensitivity:

Luminus ships Surface Mount Devices (SMDs) in a 'dry pack' consisting of a Humidity Indicator Card (HIC) and desiccant material sealed with the SMD inside a Moisture Barrier Bag (MBB). Once the SMDs are removed from the MBB, they have a specific floor life, defined by IPC/JEDEC J-STD-033B.1 as 'the allowable time period after removal from a moisture barrier bag, dry storage or dry bake and before the solder reflow process'. All high temperature processes including solder reflow and rework must be completed within the specified floor life. Contact Luminus for the floor life and the moisture sensitivity level (MSL) classification of different SMDs. To keep the plated surfaces solderable, it is recommended that new packages, partial trays and reels be stored in a nitrogen cabinet or in resealed dry bags containing a desiccant until they are required.

Luminus SMDs can be stored in an unopened moisture barrier bag (MBB) for 12 months. If the actual shelf life has exceeded 12 months and the humidity indicator card (HIC) indicates that baking is not required, it is safe to reflow the SMDs per their original MSL rating. Otherwise, a rebake is required- refer to IPC/JEDEC J-STD-033B.1 for further details.

The products, their specifications and other information appearing in this document are subject to change by Luminus Devices without notice. Luminus Devices assumes no liability for errors that may appear in this document, and no liability otherwise arising from the application or use of the product or information contained herein. None of the information provided herein should be considered to be a representation of the fitness or suitability of the product for any particular application or as any other form of warranty. Luminus Devices' product warranties are limited to only such warranties as accompany a purchase contract or purchase order for such products. Nothing herein is to be construed as constituting an additional warranty. No information contained in this publication may be considered as a waiver by Luminus Devices of any intellectual property rights that Luminus Devices may have in such information. Big Chip LEDs™ is a registered trademark of Luminus Devices, Inc., all rights reserved.

This product is protected by U.S. Patents 6,831,302; 7,074,631; 7,083,993; 7,084,434; 7,098,589; 7,105,861; 7,138,666; 7,166,870; 7,166,871; 7,170,100; 7,196,354; 7,211,831; 7,262,550; 7,274,043; 7,301,271; 7,341,880; 7,344,903; 7,345,416; 7,348,603; 7,388,233; 7,391,059 Patents Pending in the U.S. and other countries.