

Cree® LED Lamp Soldering & Handling

This application note applies to the following products:

- P4 LEDs
- Surface-mount PLCC LEDs

For XLamp® LED soldering and handling information, refer to the XLamp Soldering & Handling Application Note (CLD-AP04).

This document describes how to use Cree LEDs appropriately. Generally, an LED can be used the same way as other general-purpose semiconductors. When using Cree LEDs, the following precautions must be taken to protect the LED from damage.

2-Pin and 4-Pin LEDs

1. Cleaning

- When necessary, cleaning should occur only with isopropyl alcohol (IPA) at room temperature (25°C) for a duration of no more than one minute. Dry at room temperature for 15 minutes before use.
- The influence of ultrasonic cleaning on the LEDs depends on factors such as ultrasonic power and the way LEDs are mounted. Ultrasonic cleaning shall be pre-qualified to ensure this will not cause damage to the LEDs.

2. Forming

- During lead formation, the leads should be bent at a point at least 3 mm from the base of the package.
- Do not form the leads during or after soldering; if forming is required, this must be done before soldering.
- Avoid stressing the LED package during leads forming.
- When mounting the LEDs onto a PCB, the PCB holes must be aligned exactly with the lead position of the LEDs.

3. Soldering

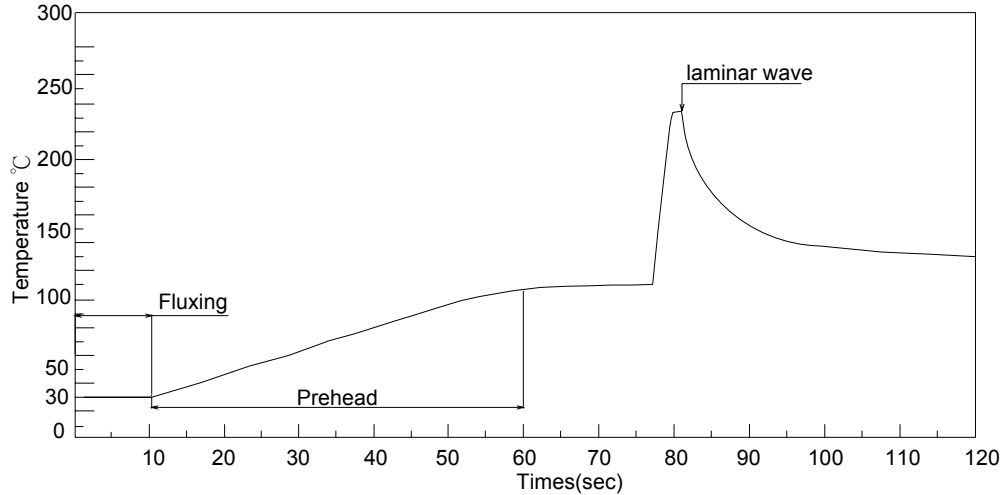
- A minimal cathode area of 0.18 × 0.18 inch² × 2 is recommended for P4 LEDs.
- Soldering LEDs at not less than 3 mm from the base of the package and below the tie-bar is recommended.
- The LED soldering specification is shown as below (suitable for both leaded solder and lead-free solder).

Manual Soldering		Solder Dipping	
Soldering Iron	35 W max.	Preheat	110°C max.
Temperature	280°C max. (63/37 Solder)	Preheat Time	60 seconds max.
	300°C max. (Pb free Solder)		
Soldering Time	3 seconds max.	Solder bath temperature:	63/37 Solder: 235°C (245°C Max)
			Pb-free Solder: 255°C (260°C Max)
Position	Not less than 3 mm from the base of the package.	Dipping Time	3 seconds max.
		Position	Not less than 3 mm from the base of the package.

Manual soldering onto a PCB is not recommended.



Recommended soldering profile:



Solder = Sn63-Pb37	Solder = Lead-Free
Peak preheat temperature: 100°~110°C	Peak preheat temperature: 100~110°C
Total preheat time: 50~60 seconds	Total preheat time: 50~60 seconds
Peak profile fit temperature: 235°C (max 245°C)	Peak profile temperature: 260°C (max) *
Dwell time above 200°C should not exceed 3 seconds.	Dwell time above 200°C should not exceed 3 seconds.
(For individual parts, refer to the product specification.)	(For individual parts, refer to the product specification.)

* Various lead-free solder types are required for different solder conditions. Please contact your Cree sales representative for details.

- Do not apply any stress to the LED package, particularly when heated.
- LEDs must not be re-used once extracted from a PCB.
- After soldering the LEDs, the package should be protected against mechanical shock or vibration until the LEDs have reached 40°C or below.
- Mechanical stress on the LEDs may cause PCB warpage, clinching or cutting of the LED leads.
- When clamping LEDs during soldering is required, be sure that no mechanical stress is exerted on the LEDs.
- Lead cutting must be performed at normal room temperature (25°C). Lead cutting at an elevated temperature can cause LED failures.

4. Electrostatic Discharge and Surge Current

- Electrostatic discharge (ESD) or surge current (EOS) can damage LEDs.
- An ESD wrist strap, ESD shoe strap or antistatic gloves must be worn whenever handling LEDs.
- All devices, equipment and machinery must be properly grounded.
- Electrical tests to screen out ESD failures should be performed at final inspection.
- Eliminate the possibility of surge current during circuitry design.



5. Heat Management

- Heat management of LEDs must be taken into consideration during the design stage of LED application. The current should be de-rated appropriately by referring to the de-rating curve found in each product specification.
- The temperature surrounding the LED in the application should be controlled. Please refer to the data sheet de-rating curve.

6. Others

- Reverse voltage should not exceed the absolute maximum rating on the data sheet.
- The LED leads may become tarnished if they contact hydrogen sulfide or other gaseous chemicals.
- Precaution must be taken to maintain a clean storage atmosphere.
- High-brightness LED light may injure human eyes. Avoid looking directly into lighted LEDs.

SMD LEDs

1. Cleaning

- When necessary, cleaning should occur only with isopropyl alcohol (IPA) at room temperature (25°C) for a duration of no more than one minute. Dry at room temperature for 15 minutes before use.
- The influence of ultrasonic cleaning on the SMD LED depends on factors such as ultrasonic power and the way the SMD LEDs are mounted. Ultrasonic cleaning should be pre-qualified to ensure this will not cause damage to the SMD LEDs.

2. Moisture-Proof Packing

- To prevent moisture absorption into SMD LEDs during the transportation and storage, the LEDs are packed in a moisture-barrier bag. Desiccants and a humidity indicator are packed together with the LEDs as secondary protection.
- A humidity-indicator card inside the packing indicates the humidity level.

3. Storage

- The shelf life of LEDs stored in the original sealed bag at <40°C and <90%RH is 12 months. Baking is required if the shelf life has expired.
- Before opening the packaging, check for air leaks in the bag.
- After the bag is opened, the SMD LEDs must be stored at < 30°C and < 60% RH. Under these conditions, SMD LEDs must be used (subject to reflow) within 24 hours. If the LEDs are not within 24 hours after removal from the bag, baking is required.
- To bake, place the SMD LEDs in an oven at 80°C ±5°C and relative humidity ≤10% RH for 24 hours.
- Take the material out of the packaging bag before baking. Do not open the oven door frequently during the baking process.

4. Soldering

a. Manual Soldering with a Soldering Iron

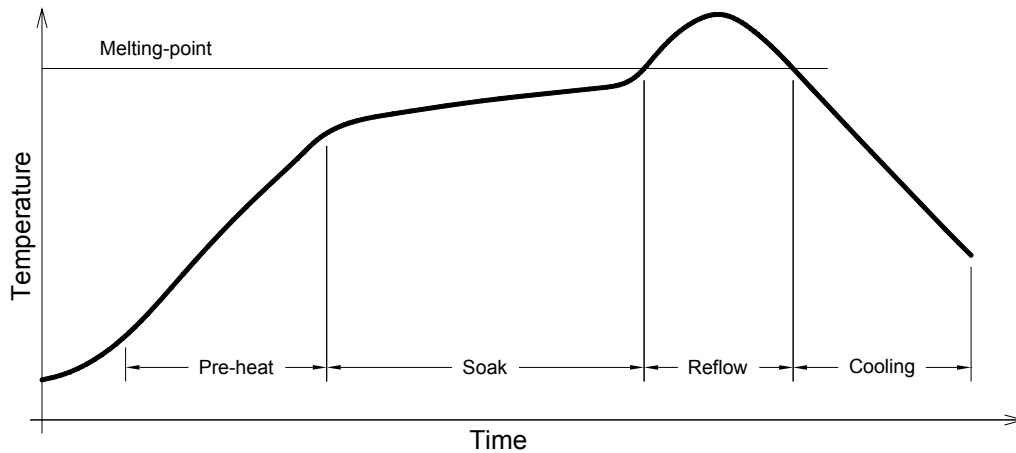
- Use of a soldering iron of less than 25 watts is recommended. The iron temperature must be kept below 315°C and soldering time no more than 2 seconds.
- The epoxy resin of an SMD LED should not contact the tip of the soldering iron.
- No mechanical stress should be exerted on the resin portion of an SMD LED during soldering.



- Handling of an SMD LED should be done only when the package has been cooled down to below 40°C or less. This is to prevent SMD LED failures due to thermal-mechanical stress during handling.

b. Reflow Soldering

Temperature (top surface of the SMD LED) profile:



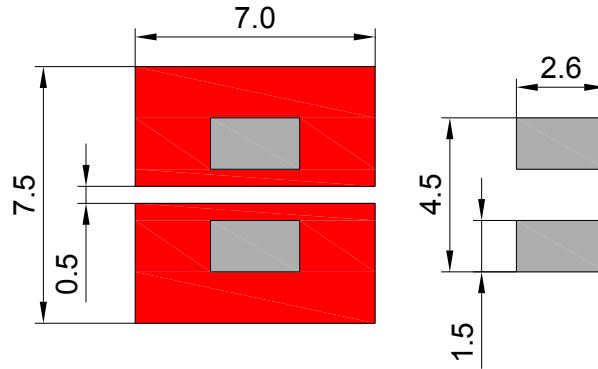
Use with all SMDs except LP6-NPP-01-N1

Solder = Sn63-Pb37	Solder = Lead-Free
Average ramp-up rate = 4°C/sec. max.	Average ramp-up rate = 4°C/sec. max
Preheat temperature: 100°~150°C	Preheat temperature: 150~200°C
Preheat time = 120 sec. max.	Preheat time = 120 sec. max.
Ramp-down rate = 6°C/sec. max.	Ramp-down rate = 6°C/sec. max.
Peak temperature = 230°C max.	Peak temperature = 250°C max.
Time within 5°C of actual peak temperature = 10 sec. max.	Time within 5°C of actual peak temperature = 10 sec. max.
Duration above 183°C is 60 sec. max.	Duration above 217°C is 60 sec. max.

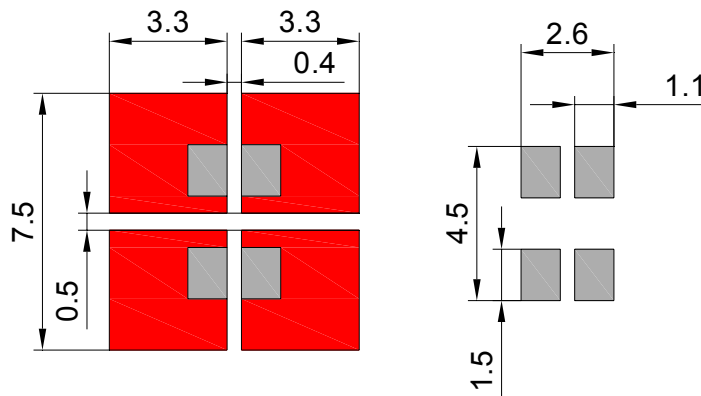
Use only with LP6-NPP1-01-N1

Solder = Low Lead-Free
Average ramp-up rate = 3°C/sec. max.
Preheat temperature: 130°~170°C
Preheat time = 120 sec. max.
Ramp-down rate = 6°C/sec. max.
Peak temperature = 213°C max.
Time within 3°C of actual peak temperature = 25 sec. max.
Duration above 200°C is 40 sec. max.

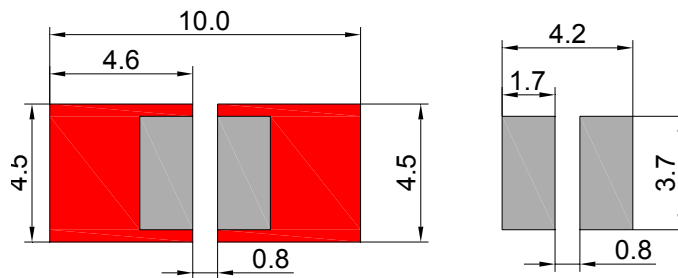
Recommended solder pad design for heat dissipation (2-pin SMD LED):



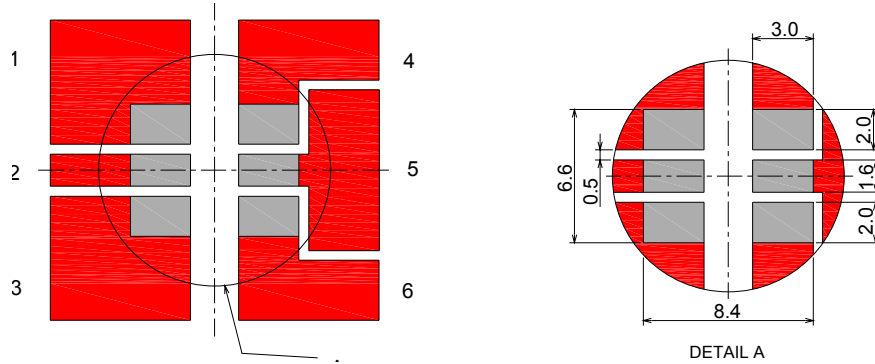
Recommended solder pad design for heat dissipation (4-pin SMD LED):



Recommended solder pad design for heat dissipation (Side SMD LED):

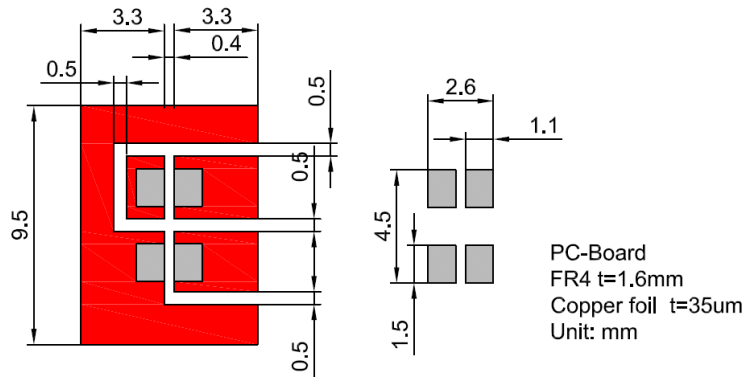


Recommended solder pad design for heat dissipation (6-pin SMD LED):

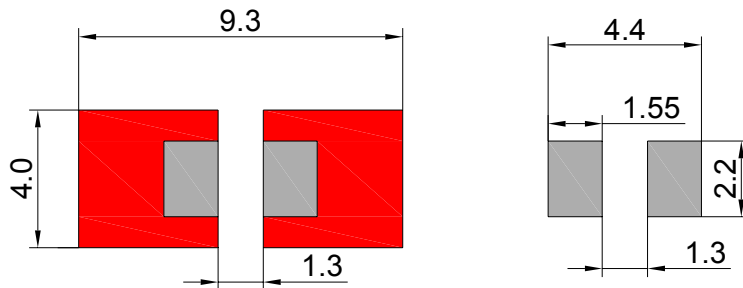


Note: The metal area at 4, 5 and 6 should not be less than 40 mm² each for efficient heat dissipation.

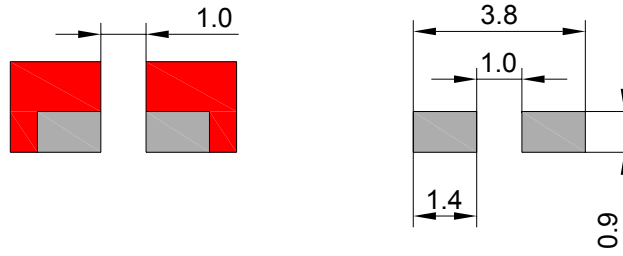
Recommended solder pad design for heat dissipation of CLV1A & CLA1A Model:



Recommended solder pad design for heat dissipation (Small Top SMD):



Recommended solder pad design for heat dissipation (Mini side 0.8 mm SMD)



- SMD LEDs should not be modified after soldering. If modification cannot be avoided, the modifications must be pre-qualified to avoid damaging the SMD LEDs.
- Reflow soldering should not be done more than one time.
- No stress should be exerted on the package during soldering.
- The PCB should not be wrapped after soldering; allow the PCB board and SMD LED to cool naturally.

5. Important Notes (Small Top & Mini side 0.8 mm SMD product)

- The packaging sizes of these SMD products are very small and the resin may still be soft after solder reflow. Users are required to handle with care; never touch the resin surface of the SMD products.
- To avoid damaging surface and interior device of these SMD LEDs during SMT production, choose a special nozzle to pick up the SMD products. If handling is necessary, take care picking up these products. The following two methods are recommended:

Fig. 1a: For small top SMD.

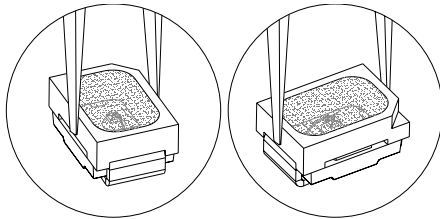
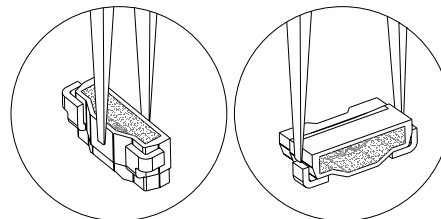


Fig. 1b: For mini side 0.8 mm SMD.



- For small top SMDs, use a rubber nozzle to pick up the LEDs. Here are two sizes for reference:
 - a) Circular nozzle – inner diameter: $\varnothing 1.8 \text{ mm} \pm 0.05 \text{ mm}$; outer diameter: $\varnothing 2.3 \text{ mm} \pm 0.05 \text{ mm}$.
 - b) Rectangular nozzle – inner size: 1.3 mm x 2.3 mm; outer size > SMD size.

6. Electrostatic Discharge and Surge current

- Electrostatic discharge (ESD) or surge current (EOS) can damage LEDs.
- An ESD wrist strap, ESD shoe strap or antistatic gloves must be worn whenever handling LEDs.
- All devices, equipment and machinery must be properly grounded.
- Electrical tests to screen out ESD failures should be performed at final inspection.
- Eliminate the possibility of surge current during circuitry design.



7. Heat Management

Heat management of SMD LEDs must be taken into consideration during the design stage of SMD LED application. The current should be de-rated appropriately by referring to the de-rating curve attached to each product data sheet.