

# Combination Solder Pad for Single-chip LEDs with P-LCC-2 and P-LCC-4 Housings

## Application Note

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### Introduction

For many years, surface mounted devices (SMDs) have been the standard component form used for construction of printed circuit assemblies.

During the last decade, the new SMD packaging for light emitting diodes (LEDs) has replaced the classical radial LED in a majority of application areas.

This trend is based in part on the availability of numerous SMT packages from micro devices to high-power components, but is primarily due to the advantages that SMT offers for further processing in the assembly line.

The most familiar and widely-used package type for LEDs is the P-LCC-2, followed by the newer P-LCC-4 packages (P-LCC - Plastic Leaded Chip Carrier).



**Figure 1: TOPLED® – P-LCC-2 device**

OSRAM Opto Semiconductors produces LEDs with P-LCC-2 packaging under the product name “TOPLED®” (**Figure 1**); the newer P-LCC-4 package is known as the “Power TOPLED®” (**Figure 2**).

Due to their similar design, both package types are suited for the same application areas, for example:

- Outside information displays
- Backlighting (LCD, controls, etc.)
- Interior automotive lighting
- Signal and symbol illumination
- etc.



**Figure 2: Power TOPLED® – P-LCC-4 device**

The primary advantage of the Power TOPLED® device over that of the TOPLED® is the lower thermal resistance of the housing. For applications using the Power TOPLED®, that means that a higher ambient temperature can be specified relative to the TOPLED® at the same current level; likewise, at the same ambient temperature, the Power TOPLED® can be driven at higher current levels.

With higher currents, increased brightness can also be achieved relative to the TOPLED®, which is also reflected in the price.

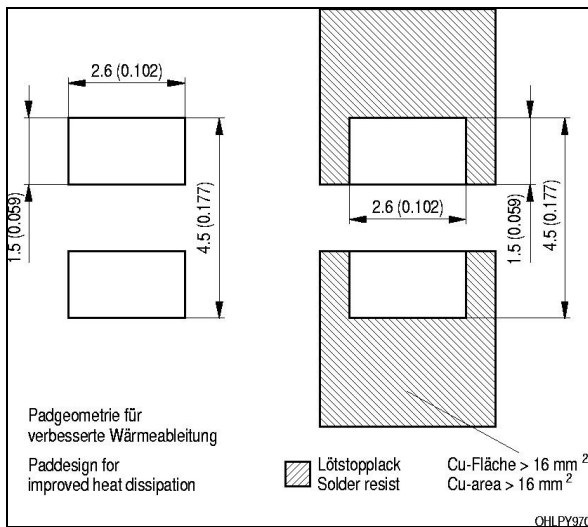
The goal of this application note is to introduce a solder pad which is suitable for both single-chip LEDs with P-LCC-2 and P-LCC-4 packages for use in the IR reflow soldering process, and in addition, is independent of anode/cathode pin assignment for various chip technologies (p-up/p-down technology).

In contrast to standard solder pads, the combination solder pad allows applications to use a single layout to handle differing requirements regarding brightness, temperature range and price considerations (for example, low cost, standard and high end).

For Power TOPLED® applications, this permits a cost reduction option, since the less expensive TOPLED® variant can be substituted without additional outlay, as soon as more efficient chip technology fulfills these requirements.

### Standard Solder Pad for P-LCC-2

The recommended standard solder pad for the TOPLED (Figure 5) is exclusively for use with P-LCC-2 packages.



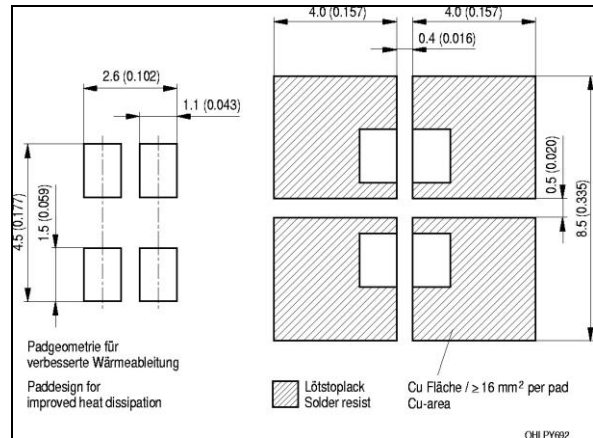
**Figure 5: Recommended standard solder pad for TOPLED® (P-LCC-2)**

The pad geometry is specifically designed for the two connection pins, and is not

suitable for P-LCC-4 packages, since a short circuit would arise.

### Standard Solder Pad for P-LCC-4

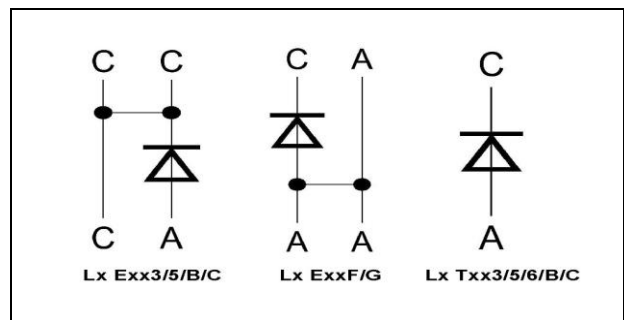
The standard solder pad for P-LCC-4 packages (Figure 6) consists of four solder pads so that each pin is in contact with a separate pad.



**Figure 6: Recommended standard solder pad for Power TOPLED® (P-LCC-4)**

This is due to the pin assignment of the P-LCC-4 package. In this case, three pins have the same voltage.

Depending on the chip technology employed, this results in three connections for the cathode or anode (Figure 7).



**Figure 7: Pin assignment for P-LCC-4/2 for various chip technologies**

For single-chip LEDs, the three pads for the cathode or anode are normally electrically connected to each other or combined into a single large pad.

If all pads are electrically connected, however, the layout is predefined for LEDs with a P-LCC-4 package. Changing to another chip technology or to an LED with a P-LCC-2 package can only be accomplished with a new layout.

### Combination Solder Pad for TOPLED® and Power TOPLED®

The common solder pad (**Figure 8**) is based on the design for the P-LCC-4 package for single-chip LEDs.

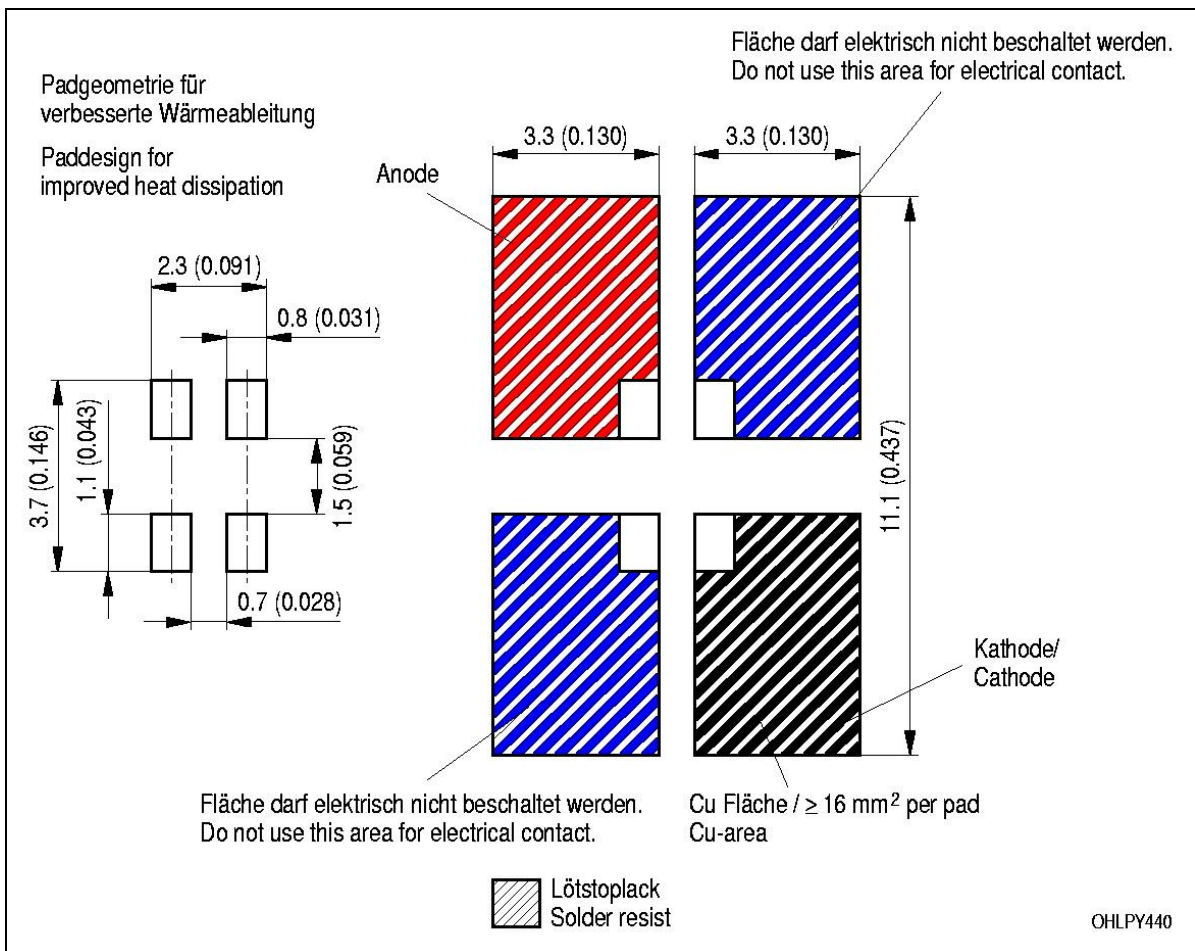
Like the standard pad, the combination pad consists of four individual solder pads. However, only two diagonally adjacent pad areas for the cathode and anode are electrically connected.

The two other solder pad areas serve only to assist in mounting and to provide heat dissipation.

A direct wiring as cathode or anode would restrict the flexibility of the solder pads, and would predetermine the use of a particular LED type.

In comparison to the two standard pads, the dimensions of the combination pad are slightly smaller. This provides a better self-centering of the device and less displacement in the X and Y directions.

Due to the tighter tolerances between solder pad and LED contacts, however, optical evaluation of the solder joint can be more difficult.



**Figure 8: Combination solder pad for TOPLED® and Power TOPLED®**

## Summary

The design of the combination solder pad for the TOPLED® and Power TOPLED® shows equally good results regarding the processibility – a better self-centering and less displacement in the X and Y directions.

Due to the tighter tolerances between the solder pad and LED pins in consequence of the smaller pad geometry, the optical evaluation of the solder joints may be more difficult.

The primary advantage of the combination solder pad over standard solder pads is that the applications can use a single layout to accommodate all individual advantages of various LED types (efficiency, brightness and price).

With Power TOPLED® applications there is also the option for cost reduction during the product life time. Without additional outlay a change-over to the less expensive TOPLED® variant is possible, as soon as these package is able to fulfill the requested requirements with more efficient chip technologies.

Author: Stich Andreas

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