

PointLED® – It's nice to be different

Application Note

Abstract

This application note provides insight into the universally deployable and flexibly mountable light source of the PointLED® product family.

A fundamental overview of the LED construction as well as the optical and electrical characteristics and performance of the LED are presented.

The unique and versatile mounting capability of the PointLED® is examined in detail.

PointLED®

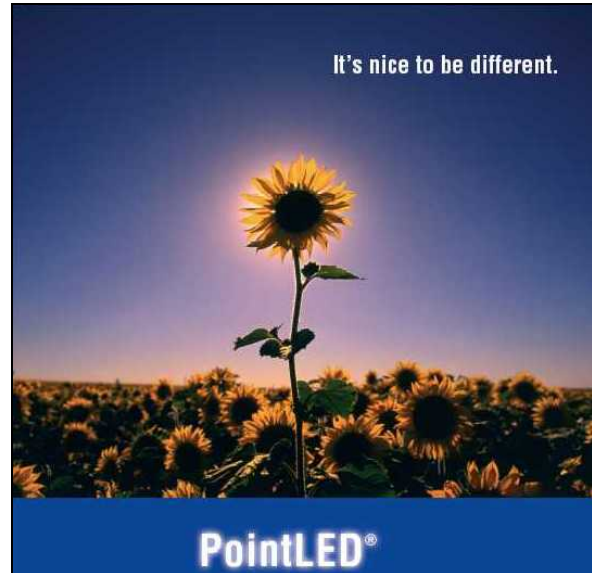
At first glance, the PointLED® product family differs from other commercially available conventional SMT LEDs.

Unlike customary SMT LEDs, the PointLED® does not have a rectangular housing, but was developed and constructed as a round component.



Figure 1: PointLED® from OSRAM Opto Semiconductors

Compared to the rectangular component, the round package has the advantage that it fits exactly in a simple drill hole.



In addition to being mounted in the normal manner on the surface (SMT), this permits a perfectly flat, "through-hole" mounting on the circuit board.

As a result, the housing disappears within the circuit board rather than projecting outward from the surface.

The two surfaces form an even surface, free of obstructions so that the connection or mounting of additional components such as a light guide, a button or keyboard is possible.

Conventional SMT LEDs, however, rest directly on the surface of the circuit board or are mounted with reverse-gullwing contacts on the reverse side of the board, so that their light can shine through an appropriately laid-out hole.

Depending on the diameter of the hole however, a portion of the light radiated by a reverse gullwing LED can be shadowed by the circuit board, and therefore cannot be used by the application.

Furthermore, as the thickness of the circuit board increases, the radiation angle becomes narrower.








For use in a design with several circuit board layers, a reverse-gullwing LED is only conditionally suitable or not at all suitable, due to the full effective component height (≥ 2 mm). The component increases the total thickness of the construction or influences or interferes with the position of other components on the next level.

As an exception for customary rectangular SMT LEDs, the Mini TOPLED Santana[®], with its special bent contacts, offers a similarly comparable mounting technique as that of the PointLED[®].



In comparison, the Mini TOPLED Santana[®] has a larger housing and is optimized for normal circuit boards (≥ 1 mm in thickness). It also shows an approximate 20% reduction in brightness and requires a considerably larger hole for the mounting ($\varnothing = 2.7$ mm). A direct fit can also be realized here, but only with a rectangular cutting. From a cost standpoint, this is 3 to 10 times more expensive than a simple round hole.

The versatile PointLED[®] can be used in many different areas; for applications in which the available space is critical, it represents the ideal choice.

Depending on the chip technology employed, the PointLED[®] can be used as a universal light source in the following areas:

-  Backlighting (LCD, buttons, keyboards, advertising)
-  Replacement for miniature lamps
-  Indicator lighting
(e.g. steps, emergency exits etc.)
-  Signal and symbol illumination
-  Coupled to light guides
-  Optical indicators
-  Effects lighting (mobile telephone, PC, etc.)

Furthermore, due to its high quality and reliability, it is also suitable for applications in the automotive area, such as:

-  Interior lighting
(e.g. instrument lighting etc.)
-  Stop lights (CHMSL)

With its characteristics and extended mounting capability, the PointLED[®] represents ultimate flexibility in LED selection, gives the developer an enormous freedom and opens up new ways and options.

Construction and features

The construction of the PointLED[®] represents the perfect combination of advanced packaging and modern chip technology. With its round, flat miniature housing consisting of white plastic, leadframe and encapsulant, it is the smallest light source with a built-in reflector available on the market (Figure 2).

Specially developed for applications with extremely small space requirements, the PointLED[®] has a diameter of only 2 mm and a total height of 0.775 mm. The reflector itself is only 0.5 mm in height and consequently can be ideally integrated in thin circuit boards.

In development of the housing, particular attention was given to flexibility regarding mounting technology. Due to its design, the PointLED[®] is suited for both variants – for normal surface mount technology (SMT) and for through-hole mounting.

As with all LEDs from OSRAM Opto Semiconductors, the PointLED[®] product family adheres to the RoHS guideline and contains no lead or other hazardous substances.

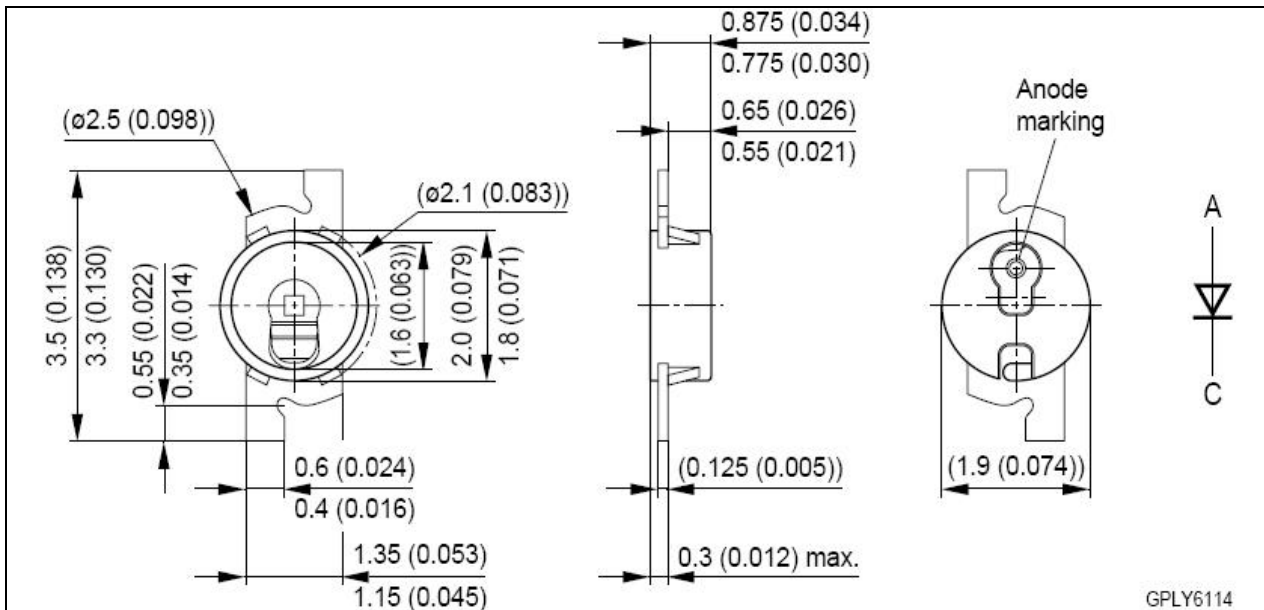


Figure 2: Dimensions of the PointLED® (e.g. LW P4SG)

PointLED® product family

A further significant advantage of the PointLED® product family is shown by the adaptable sealing concept.

This permits the use of either a simple clear encapsulant or colored silicone for color conversion (with white LEDs).

In combination with the various chip technologies, all colors can be produced and a higher LED lifetime can be achieved.

The available product palette ranges from normal LED types with standard chip technology, various low-current LEDs for low power applications and highly efficient PointLED® variants with the latest thin film chip technology.

If one compares the brightness of the various PointLED® types with other larger LEDs such as the TOPLED® for example, it can be seen that in spite of the small dimensions, the same optical efficiency ($\geq 40 \text{ lm/W}$) and brightness level can be achieved.

The following table gives a summary of the various versions with their type designation, color, wavelength and typical brightness for the respective grouping current.

Soldering

The PointLED® is delivered on tape and reel. The tapes are adapted to the appropriate mounting technique, so that an individual tape is available for top or reverse mounting and the LEDs are correspondingly taken from the reel with the correct orientation (Figure 3).

Therefore the necessary taping should be already considered with order of the LED (Figure 4).

In the designation system of the PointLED® the top mount technique is marked by the additional letter "F" (= Flipped).

The reverse mounting - standard technology of the PointLED® group - is not marked in the designation additionally.

Each reel only contains a single brightness group and a single wavelength group.

That is, from the brightness groups within the family, one tape contains only one of the groups.

Generally, the PointLED® is compatible with the existing industrial SMT processing process, so that all prevalent population techniques can be used for the mounting process.

DESIGNATION	COLOR	WAVELENGTH	BRIGHTNESS (TYP.)
POINTLED® WITH STANDARD CHIP TECHNOLOGY			
LA P47B	Amber	617 nm	500 mcd @ 30 mA
LY P47B	Yellow	587 nm	560 mcd @ 30 mA
LY P476	Yellow	587 nm	180 mcd @ 20 mA
LO P476	Orange	605 nm	224 mcd @ 20mA
LW P473	White	x/y 0.32/0.31*	180 mcd @ 10 mA
POINTLED® WITH LOW-CURRENT CHIP TECHNOLOGY			
LS P47K	Super Red	630 nm	6 mcd @ 2 mA
LY P47K	Yellow	587 nm	9 mcd @ 2 mA
LG P47K	Green	570 nm	5 mcd @ 2 mA
POINTLED® WITH THIN FILM CHIP TECHNOLOGY			
LS P47F	Super Red	633 nm	800 mcd @ 30 mA
LR P47F	Red	625 nm	1000 mcd @ 30 mA
LA P47F	Amber	617 nm	1600 mcd @ 30 mA
LY P47F	Yellow	590 nm	1000 mcd @ 30 mA
LT P4SG	True Green	528 nm	1000 mcd @ 20 mA
LB P4SG	Blue	470 nm	350 mcd @ 20 mA
LW P4SG	White	x/y 0.33/0.33*	1200 mcd @ 20 mA

* Color coordinates acc. to CIE 1931(white),

brightness level August 2007

Table 1: Overview of the PointLED® product palette from OSRAM Opto Semiconductors

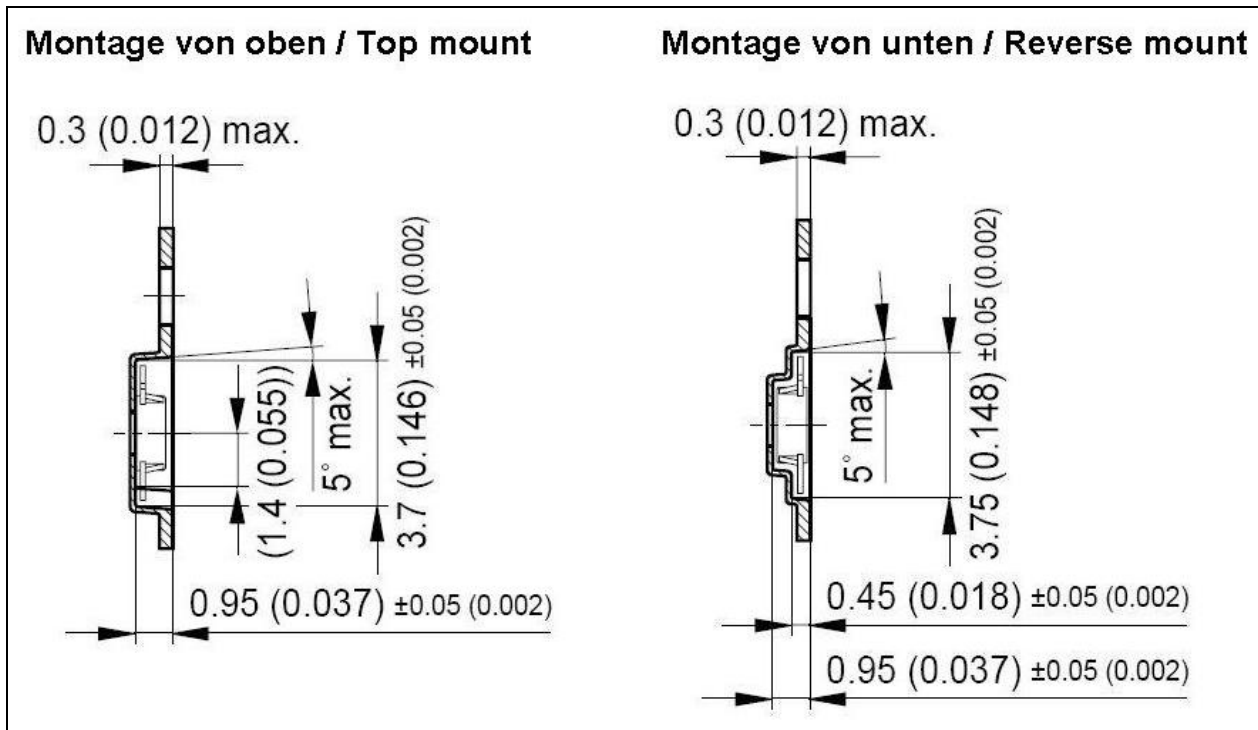


Figure 3: Taping of the PointLED® corresponding to the individual mounting



Figure 4: Individual designation of the PointLED® corresponding to the mounting

With the variants with a silicone encapsulant, it should be noted, however, that direct stress or load on the silicone, e.g. with the ejector, pick-up needle etc., should be avoided. This can lead to damage of the LED (see Application Note - Handling of Silicone Resin LEDs).

For mounting the components, a single-flow IR reflow standard soldering procedure is recommended, in which a customary SnAgCu metal alloy solder is used. Figure 5 shows the soldering conditions and temperature curve for lead-free soldering of the PointLED® product family.

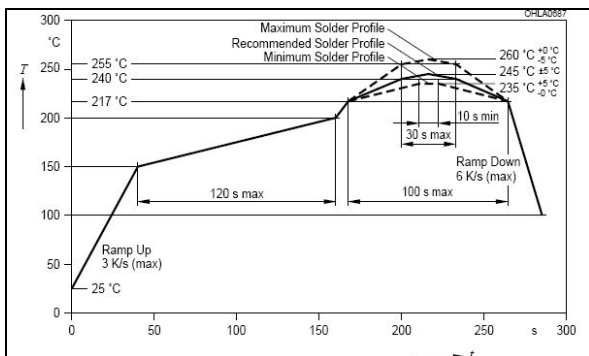


Figure 5: IR reflow soldering profile for lead-free soldering

During processing, it should additionally be noted that due to the miniature housing, the LED does not contain an ESD protective diode.

Depending on the chip technology employed, few PointLED® types are therefore sensitive to electrostatic discharge (ESD). It is recommended to use and adhere to the corresponding protective measures (e.g. grounding armband, grounding of equipment etc.).

The pretreatment of the LEDs should correspond to JEDEC level 2 or level 4, depending on the type.

For optimal mounting of the LED and therefore to guarantee the performance of the LED, it is usually advantageous to make use of the recommended solder pad layout.

When designing the solder pads for the PointLED® product family, in addition to the characteristics of the LED, the thermal behavior and various mounting methods were also taken into consideration. The pad geometry was optimized with respect to an improved heat transfer. In Figure 6, the solder pads for the two individual mounting methods are shown.

For top mounting, it should be noted that the circuit board area underneath the LED should be free of copper and solder resist. If this is not observed, it can happen that an insufficient solder connection between the solder pad and LED contact is formed, due to the larger gap. This can more readily be seen if only a thin layer of solder paste is applied.

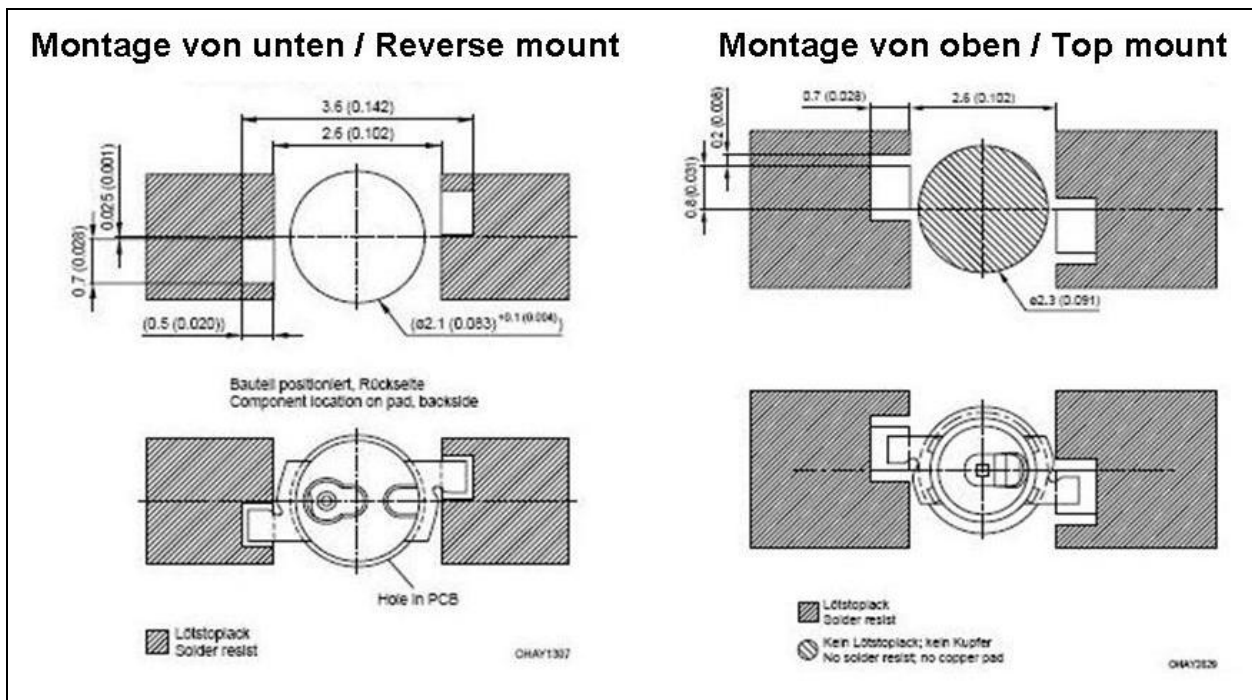


Figure 6: Solder pads of the PointLED® for top – and reverse mounting

Assembly of the PointLED®

The most significant advantage of the PointLED® group is its unique and versatile mounting capability.

Developed for extremely flat through-hole mounting by default, it can also be mounted on the circuit board like a Toplooker LED, directly from above, as usual.

Through-hole mounting

With through-hole mounting, the LED is inserted from the reverse side of the circuit board and sunken in a drilled hole with a diameter of 2.1 mm. Connections to the PointLED® occur on the reverse side.

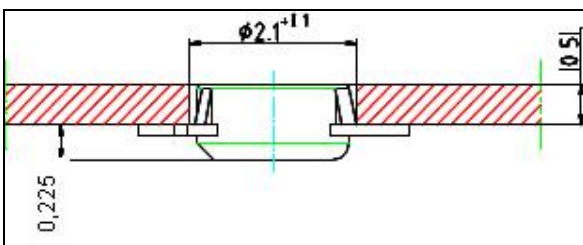


Figure 7: Through-hole mounting

Embedded in a thin circuit board with a thickness of 0.5 mm, a single planar surface

is created when the two surfaces are brought flush with each other.

This area can be used for other structures, mounting of other components or additional circuit traces.

On the reverse side, the LED itself only extends 0.225 mm from the circuit board.

In a multilayer circuit board composite, this has the advantage that components on the following layers have not to be taken into consideration, since the minimum protruding portion of the PointLED® does not represent any interference.

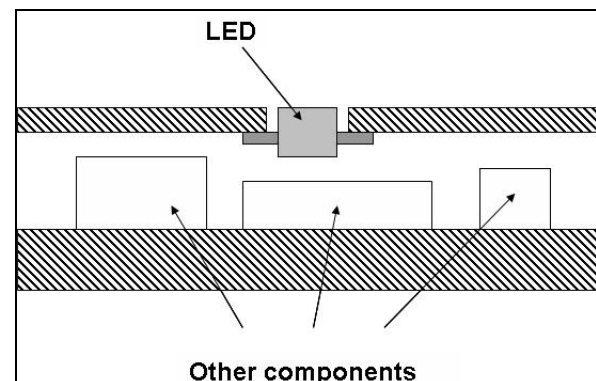


Figure 8: Location of PointLED in a stack construction

With this use of thicker circuit boards (>0.5 mm), The LED lies a bit below the surface.

Depending on the thickness of the circuit board, this also leads to a narrowing of the radiation characteristics, similar to reverse gullwing LEDs. In this case however, it is significantly less important.

As an example, Figure 9 shows a construction of the PointLED® with a 1 mm-thick light guide. The goal here is to couple the radiated light into a light guide and divert the light by 90° by means of the end surface.

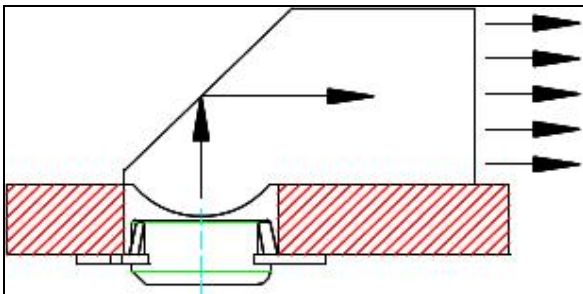


Figure 9: PointLED® with light guide

The drilled hole serves both as an exact alignment and a coupling of the light guide to the LED.

SMT mounting

In consideration of its flat design the corresponding solder pad, the PointLED® is also suited for mounting from the top side (SMT).

The LED is placed directly on the circuit board as normal.

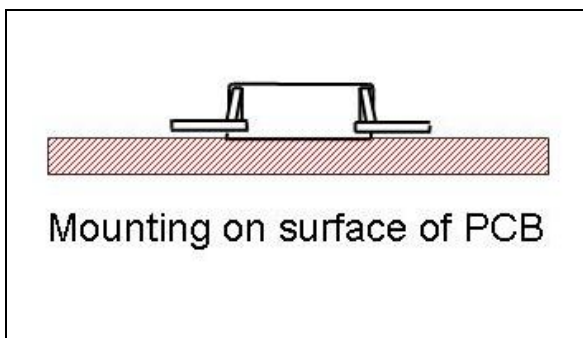


Figure 10: SMT mounting of the PointLED®

Conclusion

With its small dimensions and its versatile mounting ability, the PointLED® represents a universally deployable light source.

In addition, though the possibility of a nearly full integration within the circuit board, it is ideal for applications in which the limited amount of available space plays a decisive role.

If the PointLED® is compared to larger LEDs such as the TOPLED®, it can be ascertained that through the combination of a modern housing and highly efficient chip technology, an equally high brightness and optical efficiency can be achieved.

The white PointLED® for example, with a typical brightness of 1200 mcd and a radiation angle of 120°, is also suited for applications with high brightness requirements.

With its unique characteristics, the PointLED® from OSRAM Opto Semiconductors gives developers and designers enormous degrees of freedom, opening up new ways and application areas.

Appendix



Don't forget: LED Light for you is your place to be whenever you are looking for information or worldwide partners for your LED Lighting project.

www.ledlightforyou.com

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About OSRAM Opto Semiconductors

OSRAM Opto Semiconductors GmbH, Regensburg, is a wholly owned subsidiary of OSRAM GmbH, one of the world's three largest lamp manufacturers, and offers its customers a range of solutions based on semiconductor technology for lighting, sensor and visualisation applications. The company operates facilities in Regensburg (Germany), San José (USA) and Penang (Malaysia). Further information is available at www.osram-os.com.

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