Masked Point-Source LEDs

General-purpose high-brightness LEDs (HB LEDs) have been available for many years and are commonly used in automotive and street lighting today. However, more sophisticated applications like measurement (optical encoders, triangulation) and safety (light curtains) require a higher-precision light source. In these applications, a circular radiation pattern and uniform light intensity across the LED is required.

Such point-source LEDs have been developed as custom products to provide the required specifications. But these application-specific solutions are engineering-intensive to design and costly to produce for all but the highest volume applications (~ 1 million pieces per year). Industrial measurement and safety applications typically have lower volume expectations (10,000 – 100,000 pieces per year) and thus a fully custom point-source HB LED is impractical due to its high cost.

The solution for these medium-volume applications is a standard HB-LED with a glass mask or reticle having a circular (or other shape) aperture to provide a cost-effective point-source LED. Engineering cost for the mask is minimal and the cost to install it on the LED is small—even at low to medium volumes. Thus, custom sizes and shapes of masked point-source LEDs can be produced quickly and inexpensively simply by changing the glass reticle, not the underlying LED.

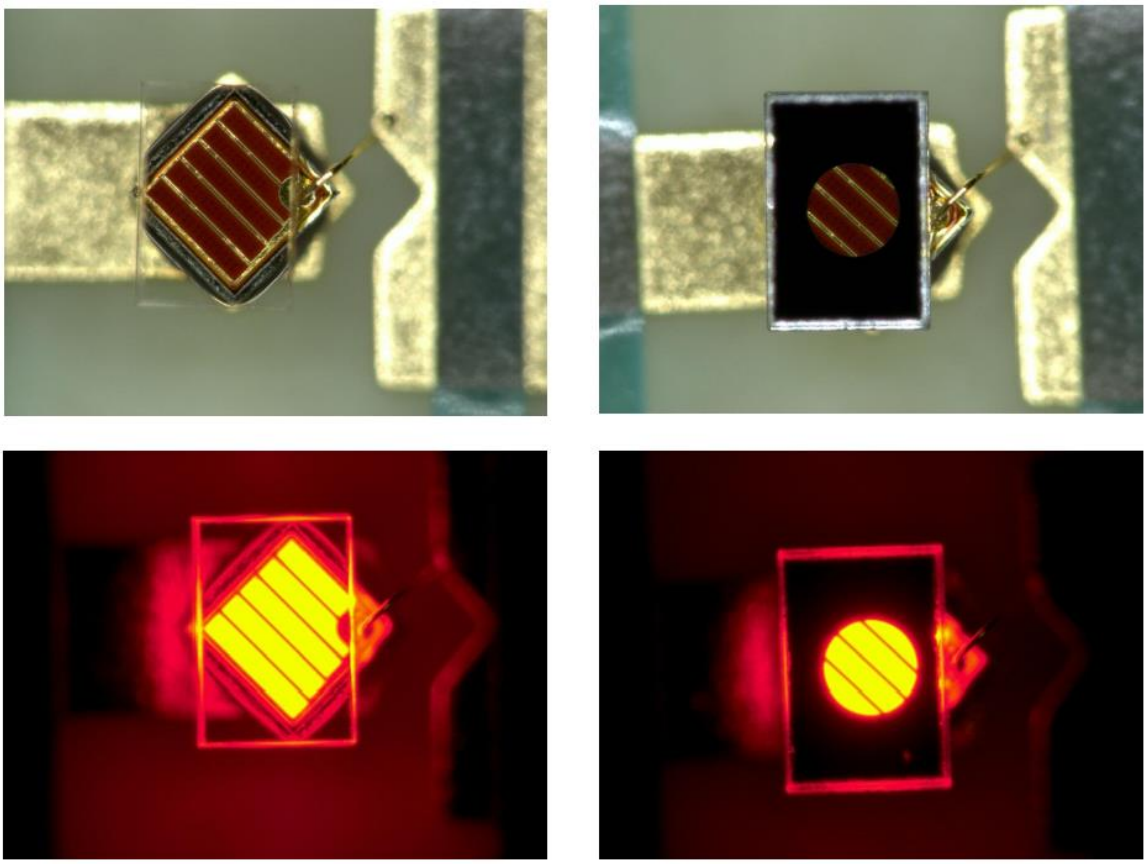

Figure 1: Masked High-Brightness Point-Source LED

Figure 1 shows a standard HB-LED on the left in its unpowered (top) and powered (bottom) states. The same HB-LED with a 300 µm circular glass reticle is shown on the right to produce a masked point-source LED.

As shown in Figure 2, the finished device is packaged as a standard 1206 RoHS compliant SMT device, compatible with all automated assembly methods.

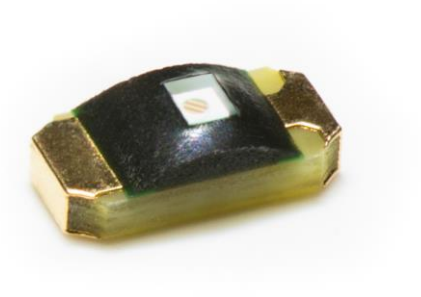

Figure 2: Finished SMT Point-Source LED

LED Technology

Traditional LEDs are constructed as shown in Figure 3.

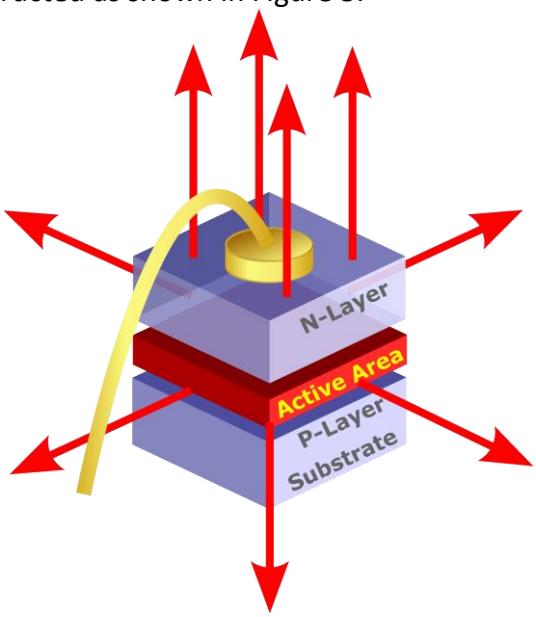

Figure 3: Traditional LED with Volumetric Emission

The volumetric emission and the bond pad and contact wire (shown in gold in Figure 3) in the center of the LED produce undesirable dark spots and distortions in the emitted light pattern. By enclosing the active area of the LED and moving the bond pad to a corner of the die, these disadvantages are eliminated, resulting in a well-defined, homogeneous light output.

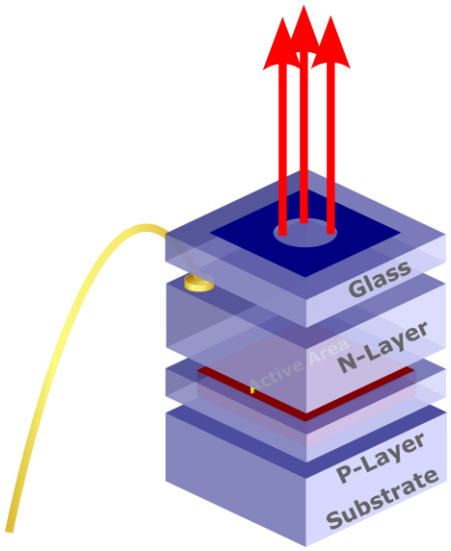

Figure 4: Masked Point-Source LED With Surface Emission

The dark stripes on the surface of the iC-TL6 point-source LED are due to electrical traces used to enhance current distribution. Their effect on the output of the LED can be eliminated by de-focusing the optics slightly.

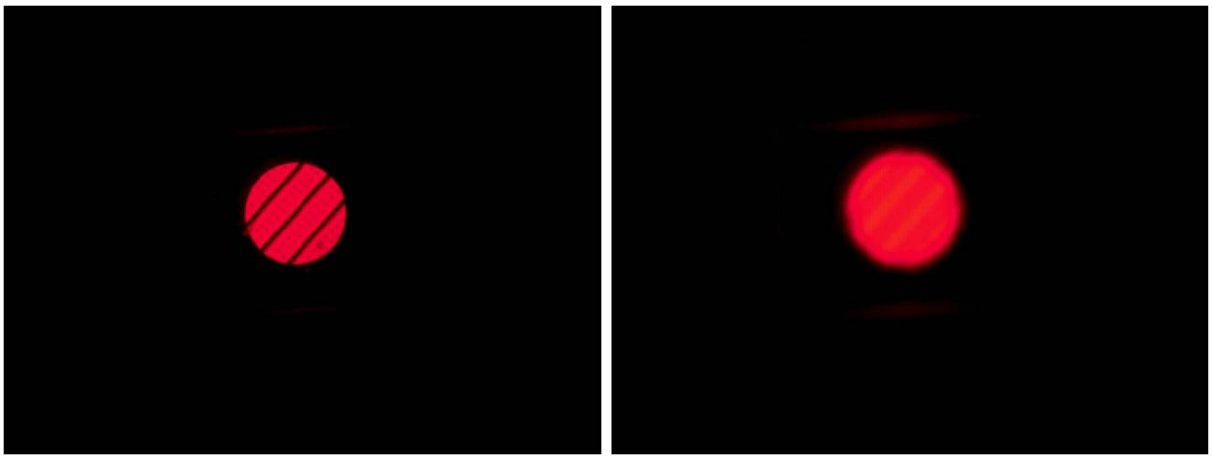

Figure 5: Focused (Left) and Out-of-Focus Near-Field Image (Right)

Figure 5 (left) shows the near-field image of the iC-TL6 emission pattern which results when the optics are focused on the surface of the chip. In this case, the metallization stripes are clearly visible. Figure 5 (right) shows an out-of-focus near field image that eliminates the dark stripes in the emission pattern.

Advantages and Applications

Masked point-source high-brightness LEDs provide a well-defined circular (or geometric) light source with no shadowing or dark spots due to a wire bond pad or wire in the light path. Different light source shapes and sizes are available cost-effectively by changing the reticle, not the underlying LED. Applications benefitting from this homogeneous illumination include optical encoders, triangulation and distance measurement, and vision systems in industrial and medical environments.

About iC-Haus

iC-Haus GmbH is a leading, independent German manufacturer of standard iCs (ASSP) and customized ASiC semiconductor solutions with worldwide representation. For more than 30 years the company has been active in the design, production, and sales of application-specific iCs for industrial, automotive, and medical applications.

The iC-Haus cell libraries in CMOS, bipolar, and BCD technologies are specifically suited to realize the design of sensor, laser/opto, and actuator ASiCs, amongst others. The iCs are assembled in standard plastic packages or using the iC-Haus chip-on-board technology to manufacture complete microsystems, multichip modules, and optoBGA/QFN in conjunction with sensors.
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