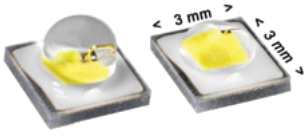
Light Matters

Designing illumination systems with high-brightness LEDs

This month's column is a "Guide to the Stars" (or at least a guide to LEDs on star boards).

There are several categories of LEDs, with many targeting specific applications. In some of these applications it's desirable to use the smallest LED package with the smallest light emitting surface available. Small packages allow for more compact end products, and the product designer has the option to place the LEDs adjacent to each other. Close spacing improves the light mixing from a group of LEDs, particularly important if there are various colors used.

LEDs with small light emitting areas (i.e., small dies) are preferred for applications requiring narrow beams such as spotlights, or when secondary lenses are needed. That's because the physical size of a lens scales up nearly exponentially as the light emitting source area grows larger. In other words, if you need a focused beam, it's best to start with a small, intense source. By contrast, if the light needs to spread outwards across a wide area, reflectors are used. Generally, reflectors work best when the light emitted from the LED die is at a wide angle, say > 130°. Can one high-intensity, small-packaged LED family fill both requirements?



Osram Oslon 80° and 150° LEDs from Avnet

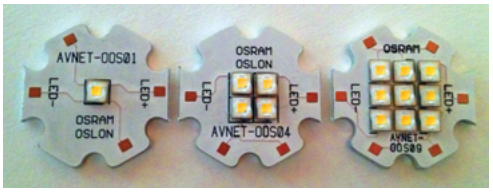
Yes, with a new high-power LED from Osram that offers several beam angles across a wide variety of white and colors, in the same 3mm² thermally-optimized footprint. They are the Osram Square, Oslon SSL 80° and SSL 150°.

The packages are so small, however, that it can be hard to prototype with them. Furthermore, just soldering the LEDs to a plain PCB is not enough; if they're driven at high power levels a metal core PCB is needed to conduct away the heat. Without proper thermal management, high-power LEDs fail quickly.

To speed evaluation and prototyping, we placed Oslons on few hundred "star boards" for our customers. Star boards are a common LED industry form factor. Most are a 20mm diameter hexagonal shape. High-power surface mount LEDs are attached in the center using commercial reflow technology, and the cathode and anode contacts are brought out to edge pads which are hand-solderable.

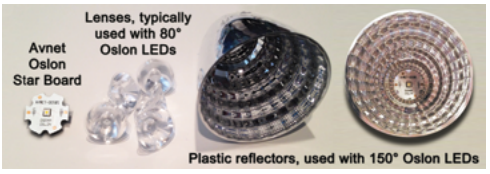
By the way, the fastest and easiest way to attach wires to a star board is to place it on a small hot plate, allowing the metal substrate to heat up before soldering to the pads. After wire leads are attached, the star board should be mounted to a flat metal surface (or inside your prototype). Always use a dab of thermal paste or a thermal pad underneath. It's important that neither you nor anyone in your production line presses on the LED itself; this will damage the device.

I laid out the traces to support a single Oslon, a 2x2 Oslon array, and a 3x3 Oslon array. By default all of the LEDs in the array versions are wired in series, so their effective forward voltages are about 14V (4 x 3.5) and 31V (9 x 3.5). By carefully cutting small traces on the 2x2 and 3x3 star boards, they become 2 individual strings of 2 Oslons in series and 3 individual strings of 3 Oslons in series. Most of our customers will prefer the single Oslon version, which is pictured at the far left.



White Oslons are available in 2700, 3000, 3500, 4000, and 5000 K color temperatures, and also in blue, deep blue, true green, yellow, amber, red and "hyper red". Light output is characterized in lumens; it (currently) ranges up to 304 lm for a 5000 K Oslon Square driven at 1.5A. That's intense.

Avnet also supplies lenses and metalized plastic reflectors tailored for the Oslon series from Ledil Oy.



We're making a limited number of these Avnet Oslon star boards available to qualified engineers on new projects, while quantities last. If you're interested, click on the "Osram Oslon Star Board" link on www.em.avnet.com/LightSpeed or ask your local Avnet representative. As always, feel free to contact me if you have any questions.

Cary Eskow
is Global Director of the Solid State Lighting and Advanced LED business unit of Avnet Electronics Marketing. An ardent advocate of energy efficient LED-based illumination, he has worked closely with LED manufacturers, advanced analog IC and secondary optics vendors since his first patent using LEDs was issued two decades ago. Avnet works with customers through their national team of illumination-focused sales engineers who are experienced in thermal, drive stage and optics design. Prior to his LED lighting focus, Cary was Avnet's technical director and managed Avnet's North American FAE team.

To submit questions or ideas, e-mail Cary at LightSpeed@Avnet.com

AVNET electronics marketing

To learn more about designing an LED-based illumination system, go to:

www.em.avnet.com/LightSpeed