Light Matters

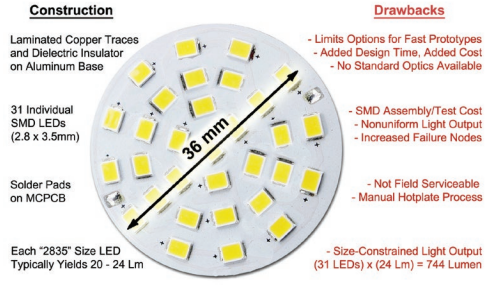
Designing illumination systems with high-brightness LEDs

I frequently mention a type of high-power LED called "Chip on Board" (CoB). A CoB device isn't really a single LED; it's a dense array of individual LED die, typically wired in a series/parallel arrangement, placed on a small thermally-optimized metal or ceramic base and covered with a layer of phosphor. For many applications, especially general lighting, they're nearly ideal.

The CoB form factor is popular due to the benefits of packaging LED die this way- a high amount of optical flux (light output) emitted from a small area with excellent thermal characteristics. Before CoBs were introduced, for many applications the only option was to cluster dozens of small packaged LEDs together on a printed circuit board, preferably a metal core PCB (MCPCB). These LEDs require space between them to allow the heat to spread evenly across the metal substrate and to make room for copper traces. As a result there is wasted surface area with undesirable optical "hot spots" where LEDs are placed, and dark areas in between. Lastly, the cost and time for MCPCB design, fabrication, SMD assembly and testing are unavoidable.

Typical Array of Densly-Packed LEDs on a MCPCB

Light Output: 620 - 744 Lumen



The photograph above is a typical "light engine" made from 31 small surface-mounted LEDs on an aluminum MCPCB. It's a reasonable solution for some applications, especially when a diffuser is used over the board, and light output requirements are limited. The 700 or so lumens it produces will radiate from a large surface— a 36 mm diameter area in this example. MCPCB's aren't something most of us can prototype with quickly or manufacture inexpensively. In addition, the options for selecting the optimum color temperature (warm vs. cool white light) and color rendering (CRI) are limited. Finally, if secondary optics such as a lens or reflector is needed, chances are it won't be an off-the-shelf product. CoBs address all of those issues.

A very high-performance CoB family called "Xnova" was recently introduced by the US-based company Luminus. Luminus began as spinout from MIT, and we've been distributing their LEDs for about eight years. Last year they were acquired by one of the world's largest producers of LED wafers. The influx of ideas and R&D funding has produced some exciting products, and Xnova is at the top of their list. Avnet and EBV independently evaluated them at our LightLab LED Metrology[1] labs. Results are impressive.

Comparable Device from the Xnova CoB Family

Light Output: > 1,150 Lumen

Construction (and Advantages)

Dozens to Hundreds of LED Die Bonded to Thin Aluminum and Covered with a Layer of Phosphor

Compact, Standardized and Uniform Light Emitting Surface ("LES") Areas of 6, 7, 9, 11, 14, 18 and 27 mm Dia

Optiional, Off-the-shelf Xnova CoB Holders Provide Solderless Wire Connections with Snap-in Optics (Can also be Soldered if Needed)

Form-Factor Compatible Devices Available in Various Sizes, CRI, Color Temperatures and Outputs (From 300 to over 10,000 lumen)

The CXM-9, one of many Luminus Xnova CoBs

Xnova CoBs and other Luminus Products are Available from Avnet in the Americas and EBV in Europe

For general lighting applications, customization and time-to-market are important. Each of the standard Xnova CoBs for a given size is available in many different CRI and color temperature options. When using them with solderless CoB holders, this makes changing one version with another very easy (only a screwdriver is needed) whether for JIT manufacturing or on-site adjustments. We supply off-the-shelf reflectors from LEDiL Oy which mount over the device, and also mating high-performance AC and DC LED ballasts from manufacturers such as Aimtec[2]. It really is this easy.

One last note regarding CRI and efficiency. CRI (as you may recall from a previous Light Matters) quantifies a light source's ability to reproduce colors faithfully with respect to an ideal light source. It's increasingly important for high-end interior and retail lighting. As of this writing, Xnova CoBs have the highest commercially available CRI (98), with efficiencies up to 145 lumen/W.

If you have questions on CoBs or other LED-based systems, you're always welcome to send me a note at **LightSpeed@Avnet.com**. Regards, Cary

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

[1] Learn more at **http://www.youtube.com/watch?v=gWUtIO70iyA**

[2] **http://www.youtube.com/watch?v=STfIOAPrZ4c**

AVNET electronics marketing

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

www.em.avnet.com/LightSpeed

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