Light Matters

Designing illumination systems with high-brightness LEDs

In last month's column, I introduced a new platform for developing high-power infrared LED applications that we call "OLIROS" (OSRAM LightSpeed IR Observation System). Today, several manufacturers of constant-current driver ICs offer small evaluation boards targeting visible high-brightness LEDs (HBLEDs), but it isn't quite as easy to find a platform optimized for infrared (IR) applications—so we designed our own.

Figure 1 – OLIROS (Osram LightSpeed IR Observation System)

From the onset, a key goal was flexibility. This is important because the required IR power levels vary greatly by end-product type. For example, the usefulness of an outdoor night time surveillance camera might be enhanced considerably if the area "made visible" with an IR source is doubled or tripled; but a similar IR-sensitive camera mounted inside a vehicle to monitor the driver would normally be limited to a few hundred milliwatts or less.

There are also wavelength options to consider. With the IR-cutoff filter removed, most CMOS imagers have reasonable sensitivity at 850 nm (near-IR). LEDs at this wavelength will exhibit a faint visible glow. If that's unacceptable, 940 nm IR LEDs are the way to go. They are completely invisible, although you may need an imager optimized for this region.

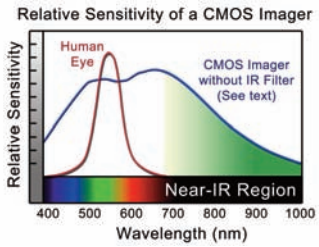

Figure 2 – CMOS imager sensitivity to various IR wavelengths

We partnered with OSRAM to offer the widest possible selection of IR LEDs. Devices in their high-power IR portfolio have outputs ranging from about 500 mW to 3.6 W, and include surface-mounted IR lasers… even cooled IR laser diodes with power levels over 100 W.

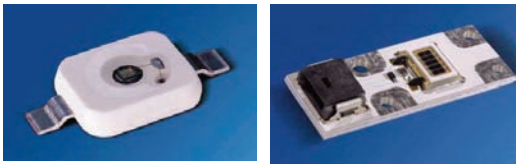

Figure 3 – An SFH4230 (500 mW) and SFH4740 (3.6 W)

You'll notice a small module and reflector mounted on the right side of the heat sink in Figure 1 – that's an SFH4740. The area surrounding it has a pattern of tapped holes for mounting other OSRAM LEDs or an SMD laser.

The nominal forward voltage (V_f) for an IR LED is about 1.8 V. The SFH4740 is an array of ten IR die in series, so its V_f is about 18 V. The constant-current supply driving those LEDs must be able to provide a "compliance voltage" at or above the total V_f to keep them in regulation. This is a challenge when the system's input voltage is lower, as it would be driving an IR array from a 12 V vehicle. There are also cases when a single IR LED might need to be driven from a much higher input voltage source. OLIROS uses a National Semiconductor LM3423 constant-current controller to switch dynamically from buck to boost mode, so single LEDs as well as IR arrays can be accommodated with input voltages ranging from 9 - 40 VDC. Jumpers set the LED's drive current at 350 mA, 1 Amp or adjustable over a 2 - 4 Amp span. Both continuous mode and internal/external PWM are supported.

The whole system is controlled with an MC9S08 microcontroller from Freescale. In can be programmed on-board to measure heat sink and LED temperature, report ambient light and IR levels, fast-blank the LED, execute user code and communicate to a host computer.

Lastly, OLIROS has an integral tripod mount on its base (not visible in the photo). This makes it easier for system-level testing alongside standard CMOS imagers and simplifies mounting to "police-style" light bars atop emergency vehicles.

We've assembled a modest number of OLIROS IR platforms for OEM customers involved in or considering IR applications. Check the LightSpeed webpage for more information and availability: **www.em.avnet.com/LightSpeed**

Cary Eskow

is director of LightSpeed, the solid state lighting and 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. LightSpeed works with customers through their national team of illumination-focused engineers called "Illumineers," experienced in thermal, drive stage and optics design. Prior to LightSpeed, Cary was Avnet's technical director and managed Avnet's North American FAE team.

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To learn more about designing an LED-based illumination system, go to:
www.em.avnet.com/LightSpeed