

An alternate way of driving LEDs

Several lighting manufacturers have recently incorporated AC-driven LEDs into their lighting fixtures. **Tim Whitaker** looks at this emerging technology.

Most LEDs are designed to be driven by a DC current, and LED systems are built accordingly. However, with the correct design at the device or circuit level, it is also possible to drive certain LEDs with an alternating current. One obvious advantage of this approach is the elimination of the otherwise essential AC-DC converter, which converts line (AC) voltage down to low (DC) voltage. (Note that LED replacement lamps, although plugged directly into an AC light socket, usually contain converter circuitry within the lamp so that the LEDs themselves are driven by a DC current.)

AC-driven LEDs have been available for more than a year, and lighting manufacturers are now starting to take advantage. Nexxus Lighting recently introduced what it claims is the industry's first LED floodlight for general illumination that operates directly from line voltage (i.e. 120V AC), without the need for an internal or external power supply. The SAVI™ SHO White floodlight is intended for interior and exterior applications, and contains a total of 17 Seoul Semiconductor 4-watt Acriche LEDs.

According to Nexxus, the elimination of power supplies is an important factor: these normally add cost, can have a shorter life than the LEDs and can potentially be a weak link in the system. Nexxus built the new floodlight using an existing housing for one of its other products; the AC-driven version looks the same but weighs less due to the absence of the power supply. The spec sheet shows that the floodlight has a color temperature of 5600K and operates at 68W (4W per emitter) with a total lumen output of 1394lm (equivalent to 20.5lm/W). The company says it has patents pending on the technology, and plans to launch additional direct 120V products for the commercial lighting market in 2008.

Another lighting fixture using AC LEDs is the Trac 12 LED linear lighting system from Juno Lighting Group. The Juno LED modules are available in 3000K and 5000K color temperatures and operate

from a 12V AC supply. Juno told LEDs Magazine that the purpose of using AC LEDs is that Juno's existing Trac 12 Lighting System is powered by 12VAC. "We wanted to use the identical infrastructure to run LEDs," said a Juno spokesperson. "Juno customers can easily convert from xenon to LED by swapping out modules."

Lucifer works with Lynk

Another lighting manufacturer working with AC LEDs is Lucifer Lighting, which has incorporated devices from Lynk Labs into its PukLED under-cabinet light released in late March. The company is also using XyLite LEDs from Lynk in several products under development. The 3-watt PukLED contains 3 LEDs and has an output exceeding the company's 10W halogen Puklight. Running at 12V AC, the fixture accepts a Class II 60W electronic or magnetic transformer with the ability to power up to 18 PukLEDs.

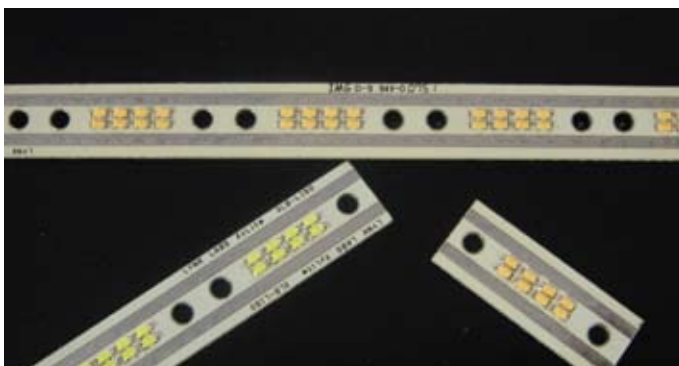
Patrick Ward, Lucifer's VP of Research & Development, says that AC LED technology provides some major advantages relating to infrastructure. "In general, the lower component count and reduced complexity are desirable features of AC LED technology," he says. "With conventional LED fixtures, the end user routinely has to place multiple constant-current DC power supplies."

Dimming is a consistent feature in the high-end applications served by Lucifer. "With DC LEDs, dimming is problematic, requiring additional dimming modules that are not always compatible with the LED drivers," says Ward. "In contrast, AC-driven LED fixtures are compatible with more-conventional dimmers, and many fixtures can be run from the same (AC) power supply."

Lucifer's fixtures run from a 12 or 24V AC supply, allowing retrofitting in certain applications. "This also means we can maintain Class II [low voltage] safety certification, and use simpler wiring compared with line voltage applications," says Ward. A 12V or 24V system requires a step-down transformer, and this has to be sourced



Trac 12 LED linear lighting module



Multiple 8-chip hybrid AC XyLite modules from Lynk Labs.



PukLED recessed under-cabinet light from Lucifer Lighting.

carefully to make sure it is compatible with the LED light engine.

Advantages of LEDs

In general, says Ward, Lucifer believes that LEDs have tremendous potential in lighting. “Lucifer was in at the ground floor,” he says. “We’ve been working for several years to identify the best applications. New systems such as Lynk Labs’ XyLite offer new opportunities to exploit the benefits of LEDs.”

Ward says that the lighting industry is at an important juncture where designers and specifiers need to reconsider conventional lighting technologies and explore new possibilities. “The biggest issue is that lamp-configured LEDs are not the ones that function best for our applications,” he says. “Application-specific LEDs are good for the fixture they’re installed in, but don’t open up the technology to consumers. The industry needs quality products to help build comfort levels. We also need to make installation less painful, reduce component counts and make systems more reliable.”

AC LED technology

The AC-driven emitters supplied by Seoul Semiconductor and Lynk Labs are designed to use AC at the device and circuit levels, respectively. Acriche chips from Seoul comprise two parallel strings of emitters, so that different sections of the chip are illuminated during the opposite phases of the AC flow. Lynk Labs uses conventional chips supplied by Citizen, Cree, Intematix and others, and designs multichip circuits or light engines for a given AC voltage that can operate efficiently when AC is applied.

Lynk Labs’ XyLite modules are driven by the company’s newly

patented “Hybrid AC LED” technology at the circuit and light engine design level. The XyLite modules contain 8 LED chips per circuit and are designed to operate in a notional 12V AC environment, explains Lynk Labs’ Bob Kottritsch. In a “classical” AC LED circuit configuration, the 8 LEDs would be connected in an anti-parallel configuration so that 4 different LEDs were illuminated during each half of the AC cycle. “In our hybrid AC design, some of the LEDs are illuminated all the time,” explains Kottritsch. “This helps to reduce the flicker that might be observed at 50 or 60 Hz.” The hybrid design also improves the lumen-per-die figure for the module, and ensures that the circuit is optimized for the 12V AC environment.

The XyLite modules are designed to be used as building blocks in the X and Y directions. Lynk says these “enable luminaire and OEM manufacturers to significantly accelerate and simplify their product design strategy for almost any LED lighting application.” XyLite uses very small die, which can be placed very close together and arranged into different form factors. The standard 4x2 module measures 15mm wide by 13.5mm long, and consumes only 1.1 W.

AC LEDs are not quite at the leading edge of performance, but are not far off. Seoul introduced in February a 4-watt Acriche with 80 lm/W efficiency, and expects to introduce a 100 /m/W model by the end of this year. Kottritsch acknowledges that “As individual light engines, the XyLite modules do not have the highest efficacy, compared for example to some of the best DC-driven LEDs. However, in terms of overall system (wall-plug) efficacy, they perform very well, one reason being the absence of an LED driver.” Typical values are for XyLite are more than 40 lm/W for warm-white (3000K) and 65 lm/W for 5000K at the system level.