SSLs see bright future in automotive platforms

Chris A. Ciufo, Mouser Electronics

The world is positively aglow with rapidly changing technology trends in solid state lighting (SSL) LEDs. According to the Department of Energy (DOE), costs dropped by a third in 2011 to about $12 per thousand lumens and will be on their way down to $2 per thousand lumens by 2015 (Strategies Unlimited, August 2012). In 2013, tech innovation will be focused on volume SSLs, where payback is fastest in streetlights, office buildings, and automobiles per the DOE's *Multi-Year Program Plan 2012*.

SSL costs do not scare automobile OEMs. High Brightness LED SSLs proliferate in vehicles due to their brightness, microsecond diode turn-on speed, long life, and shock/vibration reliability. Exterior and daytime running lamp SSLs using multichip chip-size packages will be molded directly into the vehicle body without consideration for replacement, or used to add design elements. SSLs can change colors, giving owner personalization and brand differentiation. Mercedes recently demonstrated a vehicle with embedded LED panels to create a moving digital sign; high density OLED SSL flex circuits embedded on taxis or service vans are a marketer's dream.

SSLs will find their way inside the vehicle, too, but efficient dimmers remain a challenge as in commercial sectors. SSLs facilitate changeable analog instrument and switchgear backlighting, and OLED SSLs from TVs and smartphone screens will backlight LCD displays in "glass cockpit" instrument and in-vehicle infotainment center stacks. As on the exterior, SSLs will create cabin ambience lighting but here using InGaN medium-power LEDs by illuminating foot wells, door handles/panels and storage compartments. SSLs will be selected for Kelvin color temperature. "Cold" (6000K) white keeps drivers alert, while warm (<4000K) colors accentuate premium interiors.

Automotive SSLs have other benefits including: low current means light-weight alternators in concert with regenerative breaking charging, plus reduced gauge wire weight - possibly satisfied by on-board digital networks such as PoE, CANbus, or Ethernet AVB.

Driven by streetlights and office HID fixture replacement, SSLs as chip-on-board headlights might replace medium reliability (2,000 hour) HID Xenon bulbs, or hot low reliability (450 to 1000 hour) halogens. White LEDs at 5500K approximate daylight, may outlast the vehicle at 25,000 to 50,000 hours, and can be assembled

into intelligent "smart" lamp/sensor arrays that see through rain by DSP-controlled dimming, or adjust from flood, to spot, to "corner."

New technologies for LED light engine arrays containing LEDs, drivers, phosphor/optics, thermal over-protection and heatsinks will be critical to keeping automotive LEDs below maximum $T_{junction}$ due to an automobile's environment.

Other design considerations for 2013 will be reducing headlight output at cold temperatures to stay within regulations. Also, backside emitter heat could move conductively to the lens face to melt snow and ice.

Chris A. Ciufo is a freelance writer with over 29 years of embedded technology skills. He has been a business executive in systems and semiconductor industries, with experience in both commercial and military market segments. He is an editor for a number of industry publications and an associate with The Barr Group, an embedded engineering consultancy with clients including Intel and other recognized companies. He is also a speaker on technology strategy, and has degrees in electrical engineering and in materials science, emphasizing solid state physics.

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