Realizing maximum system level benefits with High-Voltage DC LEDs

The improving performance and falling prices of light emitting diodes (LED) has led to a wider consumer acceptance of LEDs in the global market for commercial lighting products. In 2012 for the first time the general lighting sector became the largest end application for packaged LEDs, having finally overtaken the backlighting segment. With the rapid decline of LED retail lamp prices more consumers are realizing the cost savings of LED lamps further fueling the penetration of LEDs into the lighting market. This has led to an intensified competition among LED manufacturers vying to capture this market to come out with innovate packages that meet the demands of the lighting segment.

High-Voltage LEDs

One such innovation is the introduction of high-voltage LEDs. High-voltage LEDs, as indicated by their name, usually have a higher turn-on voltage, greater than 20V, as compared to conventional LEDs which is typically around 3V (for white LEDs). High- voltage LEDs have the right specifications of flux, efficacy and size to enable space constraint retrofit lamp designs such as candelabras, E10, E17 and A19 lamp types. A major distinction of the high voltage LED packages over their conventional low voltage counterparts is their forward current, which is typically an order of magnitude smaller for the high voltage LEDs.

Low Cost

This low current high voltage architecture enables simpler, smaller, cheaper and more efficient driver topologies in luminare designs. The low current operation leads to the selection of smaller and fewer electronic components used in the driver design allowing more space for thermal management within the luminare. It also reduces the overall cost of the driver. The driver assembly in replacement lamp designs typically accounts for 15%-20% of the overall lamp cost. Utilizing smaller and fewer components in the design of these lamps would allow for additional cost reductions in this highly competitive and price sensitive market.

Higher Efficiency

A high voltage low current LED string matches the LED output voltage more closely to its AC input voltage as compared to a low voltage high current string, utilizing the same number of LEDs and lumen output. This voltage matching significantly reduces the AC-DC conversion efficiency losses in the driver design thereby improving the efficacy of the lamp.

Better Thermal Management

The improved efficiency of the driver electronics results in less heat generated making it easier to dissipate the heat in the luminare. This architecture maximizes the space available for thermal management by reducing the space occupied by the driver circuit, permitting an increase in the maximum operating temperature of the LEDs. Smaller heat sink designs also allow the designer more flexibility in the aesthetics of the lamp design. It could result in additional savings on material costs and reduction in total fixture weight of the luminare by utilizing a lighter and more effective heatsink solution.

High Reliability

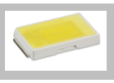
The low current operation also leads to an improvement in the reliability of the driver design. The low current means less storage capacitance, allowing the use of long-life, inexpensive ceramic capacitors. Using such capacitors eliminates the need for electrolytic capacitors and increases the overall life of the luminare. Typical long-life electrolytic capacitors are rated upto 20,000 hours of lifetime. But this lifetime projection is dramatically reduced if these capacitors are operated at elevated temperatures. LEDs on the other hand, in a good system design, could achieve much longer lifetimes (> 50,000 hours). Thus the elimination of electrolytic capacitors from the driver design significantly improves the overall reliability and lifetime of the luminare.

Multi-junction high voltage LEDs (MJT's) with multiple junctions on a single monolithic chip eliminate the usage of multiple wire bonds between several die's to create the high voltage architecture. This construction vastly improves the reliability of the LED package since it reduces the potential number of open or short failure modes associated with wire bonds within the LED package.

Footprint Compatibility

Retrofit lamps constitute one of the most important segments in the general lighting market. With the large number of lamp sockets around the globe LED retrofit lamps are important to both lamp manufacturers who are looking to proliferate the SSL technology and to end users for energy cost savings. The basic size and type of the sockets has remained the same but LED luminare manufacturers are taking vastly different approaches to penetrate this market. One approach that has gained wide acceptance is the use of mid-power LED packages (5630, 3030) with their high performance to price ratio in the design of these retrofit lamps. With the introduction of high-voltage mid-power packages that share the same footprint as that of their conventional low voltage counterparts retrofit lamp designs where space is at a premium can be realized with no tradeoffs between form factor and efficiency.

Typical Performance Characteristics at 25°C, 3000K for CRI 80

Product	Package Dimensions (mm x mm x mm)	Typical Luminous Flux (lm)	Typical Forward Voltage (V)	Typical Forward Current (mA)	Efficacy (lm/W)	Image
MJT 5630	5.6 x 3.0 x 0.75	55	21.5	20	126	
MJT 3528	3.5 x 2.8 x 0.6	125	32.5	40	96	
MJT 4040	4.0 x 4.0 x 2.2	150	62.5	20	120	
MJT 6540	6.5 x 4.0 x 0.80	30	13	20	115	
MJT 2525	2.5 x 2.5 x1.14	100	23	40	109	
COB Array	13.5 x 13.5 x 2.3 19.0 x 19.0 x 2.3 28.0 x 28.0 x 2.3	750 - 4500	37		115	

Please visit our website for more information on these high-voltage LEDs and other high-power products: http://www.seoulsemicon.com/en/html/product/power.asp?gubun=3

Seoul Semiconductor – About Us

Seoul Semiconductor (SeoulSemicon.com) manufacturers and packages a wide selection of light emitting diodes (LEDs) for the automotive, general illumination/lighting, appliance, signage and back lighting markets. The company is the world's fifth largest LED supplier, holding more than 10,000 patents globally, while offering a wide range of LED technology and production capacity in areas such as "nPola", deep UV LEDs, "Acrich", the world's first commercially produced AC LED, and "Acrich MJT - Multi-Junction Technology" a proprietary family of high-voltage LEDs.

The company's broad product portfolio includes a wide array of package and device choices such as AC driven LEDs, high-brightness LEDs, mid-power LEDs, side-view LEDs, through-hole type LED lamps, custom displays, and sensors.

The company is vertically integrated from epitaxial growth and chip manufacture in it's fully owned subsidiary, Seoul Optodevice, through packaged LEDs and LED modules in three Seoul Semiconductor manufacturing facilities. Seoul Optodevice also manufactures a wide range of unique deep-UV wavelength devices. The packaged LEDs and LED modules are available in North America through Digi-Key Corporation, Avnet Electronics and Mouser Electronics.