LUXEON®
never before possible

Benefits of Philips Lumileds Solid State Lighting Solutions vs. Conventional Lighting

LUXEON, SuperFlux and SnapLED for the Lighting World

Lasts Longer Than Any Other Light Source - Greater Than 10 Years in Many Applications

Light Emitting Diodes (LEDs) contain solid-state technology made in Silicon Valley using similar technologies that are used in the latest microprocessors. These solid-state devices have no moving parts, no fragile glass environments, no mercury, no toxic gasses, and no filament. There is nothing to break, rupture, shatter, leak, or contaminate.

Unlike typical conventional light sources, LEDs are not subject to sudden failure or burnout. There is no point in time at which the light source ceases to function; instead, LEDs gradually degrade in performance over time. Philips Lumileds LUXEON® product line, for example, is predicted to still deliver an average of 70% of initial intensity after 50,000 hours of operation. In an application where the light source would be used for 12 hours per day, 365 days per year, this would result in a system lifetime of over 11 years with only a 30% degradation (70% lumen maintenance) from initial luminous output and no catastrophic failures.





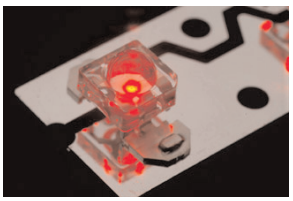


Table of Contents

Lasts Longer Than Any Other Light Source -Greater Than 10 Years in Many Applications 1
Reduced Maintenance Costs . . .2
More Energy Efficient—Be the Environmental Solution 2
Design Flexibility and Unobtrusive Hidden Light 2
Vivid Saturated Colors—Without Filters 2
Directed Light for Increased System Efficiency 2
Robust, Vibration Proof, Solid State Lighting 3
Dynamic Color Control, White-Point Tunable 3
Fully Dimmable Without Color Variation 3
Instant On, Full Color, 100% Light 3
No Mercury in the Light Source .3
No Heat or UV in the Light Beam 3
Cold Start Capable 4
Low-Voltage DC Operation 4

PHILIPS

LUMILEDS
LIGHT FROM SILICON VALLEY

Reduced Maintenance Costs

Since LED based light sources last at least 10 times longer than a normal light source, there is no need to replace the light source, reducing or even eliminating ongoing maintenance costs and periodic relamping expenses. Many regulated and critical lighting applications such as buoys, beacon lights, emergency exit lighting, back up lighting, and security lighting require scheduled, periodic, bulb replacement. Unlike other sources that fail as a burnout at the end of their useful life, LUXEON and SuperFlux devices remain lit. This means that there is no need for standby or emergency call in personnel to change a light source in safety critical applications.

Light emitting diodes provide even greater advantages in applications where location makes replacement difficult. Radio towers, offshore marine buoys, aircraft warning lights, and bridge and tunnel lights all require expensive maintenance fees due to their prohibitive location. Eliminating or dramatically reducing the frequency of required maintenance can save thousands of dollars per maintenance call in these applications.

The long life of a solid state solution also allows for trouble-free designs. For example, even with the temperature extremes, high shock and vibration environment of trucks and cars, SnapLED based designs offer life of vehicle performance. This provides enhanced design freedom, as no provisions for accessibility and replacement need to be considered in the system design.

More Energy Efficient—Be the Environmental Solution

LUXEON power light sources are more efficient than incandescent and most halogen light sources. White LUXEON today delivers more than 20 lumens per Watt, and is predicted to achieve greater than 50 lumens per Watt by 2005.

When viewing solid-state lighting as an alternative, it is important to consider the total system level benefits. For example, due to the decrease in energy used for the lighting of a building, air handling costs drop, generating both additional initial and ongoing investment savings. Additional benefits such as the directionality of light for general lighting and vivid true colors without the need for filters in signaling applications add to the energy efficiency on a system level.

Design Flexibility and Unobtrusive Hidden Light

LEDs are typically much smaller than conventional light sources, allowing for dramatically different lighting designs capitalizing on the unobtrusiveness of the source. Designing with LUXEON, for example, can enable completely hidden sources of light, eliminating large visual luminaries, and creating a magical effect when illuminated.

Light emitting diodes provide the lighting designer with additional options and choices compared to conventional technologies. Instead of taking one very bright source and mounting it in a reflector optic to distribute light, LEDs can enable alternative lighting concepts where the light source can be divided into multiple points of light, distributed across a surface, or placed in multiple planes. SnapLED technology allows for complex three-dimensional lighting solutions. The flexibility of LEDs allows for new, playful, and innovative lighting solutions, allowing for never before possible designs.

Vivid Saturated Colors—Without Filters

Light Emitting Diodes require no filters to create colored light, resulting in deeper saturated colors without wasted light. Deep reds, greens, blues and other colors can be produced in monochromatic form directly form the solid state element. Many lighting applications, such as signs, signals, and warning lights, are colored. Usually this light is created through filtering a broad band white light to the desired hue. These filters block the undesirable portions of the white light and let only the desired wavelengths through. The blocked light that is not of the correct color is therefore lost energy. Philips Lumileds produces devices in a spectrum of colors from red to blue and white. Therefore, to make a red sign, one can use a monochromatic LED that generates only red light and therefore does not require an additional color filter. There is no need for expensive filters, and there is no wasted energy. It is common for a 12W LUXEON array to fully replace a 150W bulb used in red traffic signals, resulting in dramatic power savings due to the higher efficiency of colored light generation.

Directed Light for Increased System Efficiency

The light emitted from an LED is directional. Typical conventional sources such as incandescent, halogen, or fluorescent lights are omni-directional, emitting light in all directions. In order to direct the light onto the object to be illuminated, light that is not directed toward the desired location must be redirected using secondary optics. Each time a light beam is reflected it looses some of its intensity, resulting in a fixture loss.

Typical fixture losses range from 40 to 60%, meaning that in some cases less than half of the light generated by the source is directed in the desired direction. The directed nature of LEDs can result in fixture efficiencies of 80 to 90%, requiring less total lumens to provide the same level of illuminance. The LUXEON STAR/O, for example, produces a narrow 2x5 degree beam with 85% optical efficiency. When considering LEDs as a light source it is important to consider all factors in determining the appropriate solution. For example, if you are replacing a 500-lumen source in a fixture with 50% efficiency with an LED based source in a fixture with 85% efficiency, less than 300 lumens will be required

from the LED source for an equivalent illuminance. A side benefit from the directionality of light emitted from the LED solution is the reduction of light pollution.

Robust, Vibration Proof, Solid State Lighting

Light emitting diodes are solid-state devices containing no moving parts and no filaments to break. As such, LEDs handle rough environments including heavy vibration and impact. Unlike conventional light sources, which typically contain a fragile filament enclosed in a breakable glass enclosure, LEDs are built using solid-state technology made in Silicon Valley using similar technologies that are used in the latest microprocessors. These solid-state devices have no moving parts, no fragile glass environments, no mercury, no toxic gasses, and no filament. There is nothing to break, rupture, shatter, leak, or contaminate. The solid-state nature of LEDs make them extremely rugged and durable-an excellent choice for applications where reliability and dependability are paramount.

Dynamic Color Control, White-Point Tunable

LUXEON and SuperFlux offer intense deep reds, greens, and blues for dynamic color changing applications. With fast turn-on times (measured in microseconds) it is easy to instantly change from one hue to another. Further, you can generate more brilliant colors than are currently possible on conventional LCD or CRT monitors through using LUXEON, which offers a larger color range than is possible using conventional lighting technologies. Not only can you use LEDs for viewing applications (such as TVs or computer screens); the endless choices of color are available for almost any application. Imagine everything from a stadium replay panel, your laptop screen, wall up-lighters, pools and fountains, even your personal work or home environment, with unlimited color selection capability.

As white light is the combination of red, green, and blue (RGB), you can easily create any color of white (CCT) from warm to cool-blue by changing the relative intensity of each color component. LEDs switch on and off so quickly and have an exceptional dimming range, all without compromising Color Rendering Index (CRI) or, more importantly, Color Acceptance Index (CAI). Recent studies show improving CAI dramatically increases consumer acceptance of merchandise packaging. Unlike other conventional lighting technologies, with LEDs CAI (and CRI) is not intensity dependent.

The use of an LED based lighting system enables a wide color gamut of saturated static and dynamic lighting effects. Whether the desired effect is a tunable white source or a single light capable of digitally producing any color under the rainbow, LEDs offer a new dimension to the lighting world.

Fully Dimmable Without Color Variation

Light emitting diodes are fully dimmable with straightforward driver topologies. For example, LUXEON power light sources can be dimmed by over 1000 times without sacrificing any characteristic of the light. This dimmability, through the common technique of pulse width modulation (PWM) of the drive current, allows for environmentally friendly illumination without sacrificing either the Color Acceptance Index (CAI) or the Color Rendering Index (CRI). With PWM control, the color provided is independent of the set intensity. Therefore it is easy to optimize the desired color and then adjust the intensity to suit the needs of virtually any application.

Instant On, Full Color, 100% Light

Light emitting diodes have turn-on times measured in microseconds. The instant on feature of LEDs provides additional reaction time in safety critical applications. There is no flickering or warm up period as the source reaches ignition temperature in an LED lighting system and the emitted wavelength is reached instantaneously. The fast turn-on times allow for rapid switching systems enabling an instant change from one hue to another in a dynamic color changing RGB based lighting system.

No Mercury in the Light Source

Unlike most fluorescent sources, LEDs contains no Mercury. LUXEON is Solid State technology made in Silicon Valley using similar technologies that are used in the latest microprocessors. As it is a solid-state device, it has no moving parts, no fragile glass environments, no mercury, no toxic gasses, and no filament. Eliminating Mercury from your lighting system will enable you to meet new and future increasingly stringent environmental regulations.

No Heat or UV in the Light Beam

Conventional light sources (as well as some LEDs) contain invisible radiation as well as the visible component of light in the beam. This radiation can be very short wavelength blue, known as ultraviolet light, or long wavelength red, known as infrared, which causes heat. Ultraviolet light can, and will, damage materials, cause color changes and eventually breakdown many materials. Museums and other applications where ultraviolet light is a liability use expensive low flexibility light pipes to filter out this harmful component of the generated light. Frequently the light sources used for these light pipes is a very bright, hot, incandescent or halogen sources, generating most of their light as heat. Infrared light can damage displayed objects, increases air conditioning costs, decreases environmental comfort, and when reflected off reading surfaces increases eyestrain.

LUXEON, SuperFlux, and SnapLED only generate light in the range that a person can see. There are no ultraviolet rays or infrared radiation contained in the light beams of these products. Eliminating these harmful and non-useful components of the spectrum results in a light beam that will not degrade illuminated objects while providing a cool beam with a light source that is safe to touch.

Cold Start Capable

Many light sources in use today are not well suited to cold environments. In some cases, such as walk in refrigerators, cool outdoor climates, or automotive applications expensive drivers are required to enable ignition at low temperatures. LEDs do not require any special equipment or drivers, regardless of the temperature. Cold start is not a problem for this solid state technology, down to -40°C. This cold start ability allows for instant on/off control without specially designed circuitry, simplifying your system design while lowering the cost of the electronic driver.

Low-Voltage DC Operation

Unlike conventional light sources, light emitting diodes are current driven low voltage devices. This enables never before solutions that meet regulatory requirements without expensive safety interactions. For example, LUXEON is fully compatible with UL and other international safety standards for use in all environments. The low voltage aspects of LEDs allow for safe system solutions and do not require running high voltage mains connections between the driver and the light source. The drive current required for these devices is relatively low, further enhancing the safety aspect of LEDs as a lighting solution. Due to the low voltages required, disposable and rechargeable battery operation or alternative energy sources (such as solar or wind) can be easily used to power the light source.

PHILIPS

LUMILEDS
LIGHT FROM SILICON VALLEY

Company Information

LUXEON® is developed, manufactured and marketed by Philips Lumileds Lighting Company. Philips Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Philips Lumileds has R&D centers in San Jose, California and in The Netherlands and production capabilities in San Jose and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high-flux LED technology leader and is dedicated to bridging the gap between solid-state LED technology and the lighting world. Philips Lumileds technology, LEDs and systems are enabling new applications and markets in the lighting world.

Philips Lumileds may make process or materials changes affecting the performance or other characteristics of our products. These products supplied after such changes will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.

LUMILEDS™
FUTURE ELECTRONICS

WWW.LUXEON.COM
WWW.LUMILEDSFUTURE.COM

FOR TECHNICAL ASSISTANCE OR THE LOCATION OF YOUR NEAREST SALES OFFICE CONTACT ANY OF THE FOLLOWING:

NORTH AMERICA:
+1 888 589 3662 OR
ASKLUXEON@FUTUREELECTRONICS.COM

EUROPE:
00 800 443 88 873 OR
LUXEON.EUROPE@FUTUREELECTRONICS.COM

ASIA:
800 5864 5337 OR
LUMILEDS.ASIA@FUTUREELECTRONICS.COM

©2006 Philips Lumileds Lighting Company. All rights reserved. Product specifications are subject to change without notice. Luxeon is a registered trademark of the Philips Lumileds Lighting Company in the United States and other countries.