

## Light-emitting diode

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Leds(light emitting diodes) are solid-state lighting devices that produce light when a forward voltage is applied. An LED consists of a semiconductor diode contains two slightly different materials: a P-type semiconductor has “holes” created by a lack of electrons, producing a positive charge. Conversely, the N-type material has an excess of electrons, resulting in a negative charge. The P- and N-type semiconductors are placed in direct contact in the diode and the region where they meet is referred to as the PN junction.

LED is the latest technology that has surpassed all the quality standards, primarily in brighter results and energy consumption. In order to develop the LED lighting technology, developed countries have attached great importance to the test methods and the standard research of LED. High power LEDs are fast becoming the preferred lighting solution of the future.

LED features. Efficiency of Incandescent and halogen tungsten lamps are 12-24 lumens per watt, fluorescent lamps are 50-70 lumen per watt and sodium lamps are 90-140 lumen per watt. The result of this is poor efficiency as most of power consumption is a result of the heat generated by these styles of lamps. LED lighting efficiency will reach upwards of 200 lumens per watt while maintaining 90% efficiency. This will be achieved while delivering benefits such as excellent color rendering index and narrow light spectrum.

Achieving the same light output, the power consumption of LED is only 1/8 of that for the incandescent lamp, and 1/2 of that for the fluorescent lamp.

The lifetime of LED based lighting can be 10 years or more based on hours of daily operation. Products offer advantages such as low heat emission, no heat radiation, low temperature light source, much cooler to the touch, lighting color and angle can be controlled accurately, lighting color is less intensive and damaging to the eye, does not cause headaches, and no mercury, sodium or other hazardous substances used.

LEDs are utilized in many industries for many things. Uses for the interior of automobiles include indicator lights on dashboard gauges, audio status lights, security status lights and warning signals. The mobile phone is the largest market of integration for SMD (surface mount diode) LEDs. As a result, mobile phones create a demand for 3.2 billion LEDs per year. The LED screen has become the

new display medium for advertising and information. It is commonly used in concert, arena and trade show venues. Its popularity has prompted the rapid technological development of large-scale integrated circuits. LEDs are being used in advertising billboards, illumination of commercial building exteriors, landmark buildings, bridges, roads, town centers and landscape lighting because of the numerous advantages they offer.

**LED Benefits.** Saving future maintenance, cost, higher efficiency, lower power usage compared to incandescent. Typically faster switching time and less likely to be damaged by on off cycles. Some LEDs can be setup to dynamically change colour. They are more environmentally friendly. Typically lower infra-red and ultraviolet output. This can also mean a lower fire risk, especially compared to halogen downlights. Faster warm up time (especially compared to fluorescent lights). They are usually more rugged. There is normally no glass to break and no filament to damage via vibration. Today, LEDs have been integrated as warning lights and indicators on most electronics. Many airports, subways, hotels, shopping centers, and individual homes feature LEDs now.

**LED Disadvantages.** LEDs are currently more expensive, price per lumen, on an initial capital cost basis, than most conventional lighting technologies. The additional expense partially stems from the relatively low lumen output and the drive circuitry and power supplies needed. LED performance largely depends on the ambient temperature of the operating environment. Over-driving the LED in high ambient temperatures may result in overheating of the LED package, eventually leading to device failure. LEDs must be supplied with the voltage above the threshold and a current below the rating.

**Current situation and prospect of LED lighting.** At present, lighting accounts for about 20% of the power consumption in the world. Reducing this figure is a crucial means of energy savings from both a financial and environmental standpoint.

LEDs are already beginning to alleviate this energy burden. LEDs unique advantages are attracting a lot of attention around the globe. In the USA, it is predicted that LEDs will replace 55% of incandescent lights and 55% fluorescent lights within the next 15 years. This will save \$35 billion annually in electricity costs and prevent the emission of 7.5 hundred million pounds of carbon dioxide. In Taiwan, LEDs will substitute 25% of incandescent bulbs and 100% of fluorescent lamps in the next 10 years. In Japan, LEDs will replace 100% of fluorescent lamps within 10 years, which will generate a net reduction in electricity consumption equivalent to 1-2 nuclear power plants. This will also reduce annual crude oil consumption by over 1 billion liters.

Unlike other lighting technologies, solid state (LED) lighting as an emerging technology in the general lighting industry is just at its beginning - a kind of new

frontier. As the industry continues to evolve and mature, LED lighting brings with it a bright future. But, until the future arrives, we live in the Wild West where there are few rules, few standards, and little enforcement within the industry. Many luminaire manufacturers have emerged with LED lighting products trying to stake a claim. Some are dedicated to furthering LED lighting's future while many are just trying to cash in. Until law and order becomes the norm, consumers are left with the difficult challenge of trying to determine which products are best suited for their applications.

LEDs have existed for several decades but their use in general lighting applications is still relatively new. The current rapid pace of technological development in this sector coupled with increasingly-strained natural resources will only further encourage the evolution of LEDs. The future of LED lighting is very promising: LEDs are considered the best market in this coming decade on a global scale. Although LEDs may seem confusing to begin with, they do provide some real advantages for the environment and the technological features. Their long life, rich color, and easily-controlled features with integrated electronics offer a scalable lighting solution. As technology continues to bring rapid improvements in luminous efficiency and as cost compression persists, applications expand rapidly.

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