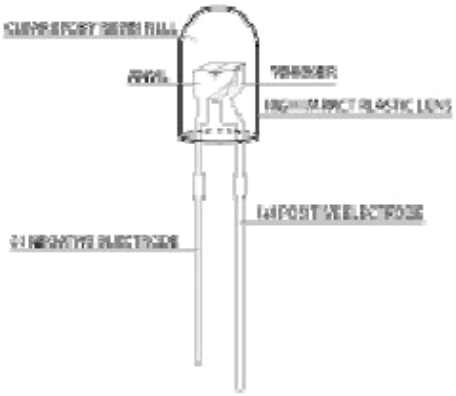
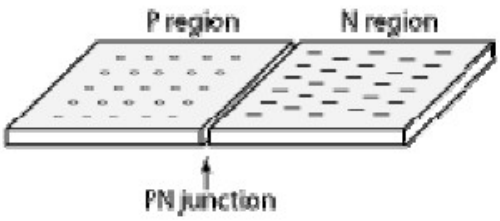
What is an LED?

An LED, or Light Emitting Diode, is a semiconductor device that emits light when electrical energy is applied to it. It consists of a computer chip that is attached to a positive power lead and a negative power lead.The'anvil'on the top of the negative lead holds one side of the chip and the'whisker' on top of the positivelead holds the other side. The LED is encased in clear epoxy resin.



Light Emitting Diode

The semiconductor chip contains two sides: the P-side has missing electrons called 'holes' that cover the area and the N-side is covered with electrons. Where the two sides meet, a PN junction is formed. When a current is applied to the electrodes, electrons from the N-region flow into the P-region where energy is then released in the form of photons of light. The color of the light depends on the type of materials used to construct the LED chip.



What are the benefits of using LEDs?

The inherent characteristic features of the LED earn it a reputation as a viable alternative to conventional light sources.

Compact Size

An LED is simply a tiny chip surrounded by high impact plastic, so it can be very small and lightweight.

Small Amount of Energy Consumption

An LED uses very little power. Typically, an LED is made to operate at 2-3.6 volts, meaning that it requires no more than 0.1 watts to function.

Long Lasting Lifetime

An LED properly driven (with a constant current or regulated voltage) in an environment where heat cannot build up generally has a lifespan of 100,000 hours.

High Light Efficiency and Low Heat

LEDs mostly emit electromagnetic energy in visible parts of the light range. Incandescent light bulbs, on the other hand, emit around 90% of their total energy as heat and only 10% is visible light.

Environmentally Friendly

An LED is made from non-toxic materials and, unlike fluorescent, does not contain mercury.

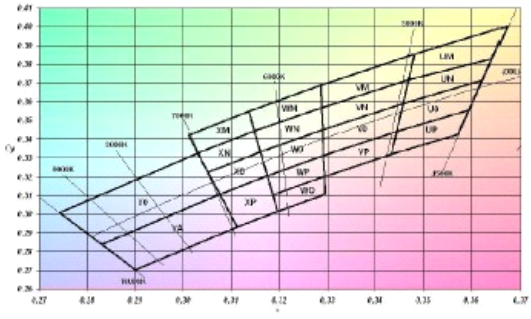
Durability

Since there are no moving or loose parts, such as a filament, to break, and since the LED is entirely encapsulated in high impact plastic with an epoxy resin fill, it is virtually unbreakable.

How are white LEDs made and typed?

The first practical LED was created in 1962 and used as a long life indicator light (only available in Red and shortly thereafter, Green). In 1993, a blue light LED was created by using gallium nitride on the chip. From the technology of the blue light LED, in 1997, the first white light LED was produced.

However, the process of making virtually all white LEDs involves combining a blue LED with a luminescent yellowish phosphor. How much phosphor is used, how the lens is coated and how the exact 'recipe' of the phosphor mix is created, mean there will be up to 10% variance in color temperature due to production tolerances. Therefore LEDs are classified and categorized into 'bins' based on their color temperature and level of efficiency. LED manufacturers have their own specific binning chart to identify the types of white LEDs they make.



Luxeon Binning Chart for Cool White LEDs

What are best applications for LEDs?

Although, LED technology is advancing rapidly, it is not yet suitable for replacement of the common light bulb for general lighting. However it is very well suited for localized accent or display lighting, linear lighting effects such as coves and building outlines, mood and decorative lighting, backlighting, sign lighting,task lighting, stair safety and anywhere color changing light is desired.

What power supply is needed for LEDs?

LEDs require DC (Direct Current) power. If AC (Alternating Current) is used to power LEDs without properly converting it to DC, the LEDs will have an 'AC flicker' that can be quite distracting and undesirable for most applications.

There are two types of LEDs. Low power LEDs are fractional wattage low voltage devices, typically less than 0.1 watt and 3.2 volts. They are usually wired in 'series parallel' (think rope light cuttability) and powered with regulated DC voltage power supplies. **High power LEDs** come in 1 to 3 watt packages and are typically wired in series configuration and powered with constant current **LED drivers**.

In addition to DC power, LEDs also require a constant current or
regulated voltage to maintain their long life. Fluctuations in output that are inherent in AC power supplies will shorten the expected life as well as cause AC flicker. The Power Supply Matrix on the facing page identifies whether a product requires constant current or DC voltage input.

How far away can the power supply be?

If you locate a power supply too far away from the last light bulb or LED in a lighting system, you will end up with a noticeably dimmer output at the end of the run than at the beginning. This is called voltage drop. In the case of LEDs, relatively small wattages are involved, which helps the voltage maintain its strength for longer than conventional low voltage systems.

In general, these are the guidelines for avoiding voltage drop:

- For LED systems, use 16-gauge or better lead wire and keep the power supply within 35 feet of the last LED
- For incandescent systems powered with electronic transformers, use 12-gauge wire or better and keep the power supply within 10 feet of the last lamp
- For incandescent systems powered with magnetic transformers, use 12-gauge wire or better and keep the power supply within 25 feet of the last lamp

What is the difference between power supplies, transformers and drivers?

- "Power supplies" is a general term for anything that provides a regulated output for lighting loads. A somewhat familiar example of this is a ballast, which is the power supply for fluorescent and HID sources. LED power supplies convert 120V AC input to regulated DC output (typically 12V DC or 24V DC) to provide the best operating condition for the LED to last its full life.
- Transformers step down the 120V AC input to 12V or 24V AC output and although they have circuit protection, they do not regulate the output from voltage spikes.
- Drivers are power supplies for LED loads. They are available in both constant current and constant voltage types and they isolate the LEDs from line voltage spikes.