

LIGHT EMITTING DIODE LAMPS (L.E.D's)

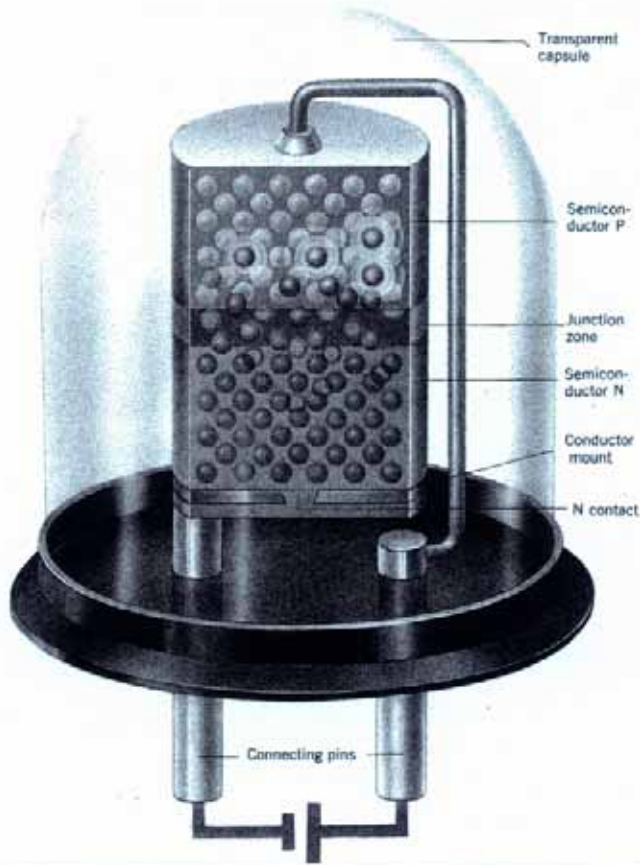


Fig 11.7 Light Emitting Diode (L.E.D)

Operating principle of the solid state lamp is known as "Electroluminescence". The spontaneous emission of light from a semi-conductor diode junction.

With reference to fig 11.7. An electric current is comprised of a stream of negatively charged particles, electrons. These are emitted from the N type semiconductor, which is connected to the negative terminal of the battery or power supply. The electrons travel across the P/N junction zone, and fall into positively charged "holes" within the P type semiconductor. As they do so, energy is released in the form of photon's of light. Interestingly, this is exactly the reverse action of a photo-voltaic solar cell, where photon's of light strike a semi-conductor junction, and are converted into a flow of electric current.

The active element of a typical 5mm diameter L.E.D is about the size of a grain of sand, and encapsulated within a transparent, or opaque moulding. The original units produced in the 1970's were red, the semiconducting material being GaAsP (Gallium Arsenide Phosphide) but many colours are now available from various compounds. For general illumination of course, white is the most appropriate, and these were

not available until after the advent of the blue L.E.D in the mid 1990's. White L.E.D's are available in two basic types, Blue + phosphor, or compound R.G.B. Blue + phosphor is simply a blue L.E.D chip, covered with a phosphor that absorbs some blue light, and fluoresces red and green. (blue + red + green = white) Compound R.G.B led's are formed by combining three separate chips, blue, green and red into the same device. They normally have four leads so that each colour chip can be driven independently to achieve a perfect white balance. The standard 5mm white LED as in fig 11.7, is now just one of many packages available, as manufactures strive to deliver higher efficacy and lower cost.

The latest white, high power LED, known as the "Luxeon Emitter", is rated at 1000 mW and can deliver 45 lumens. They are often clustered together, forming a single lamp. (Fig 11.11) They require far less individual components than lamps constructed with the traditional 5mm LED's, thus reducing construction costs.

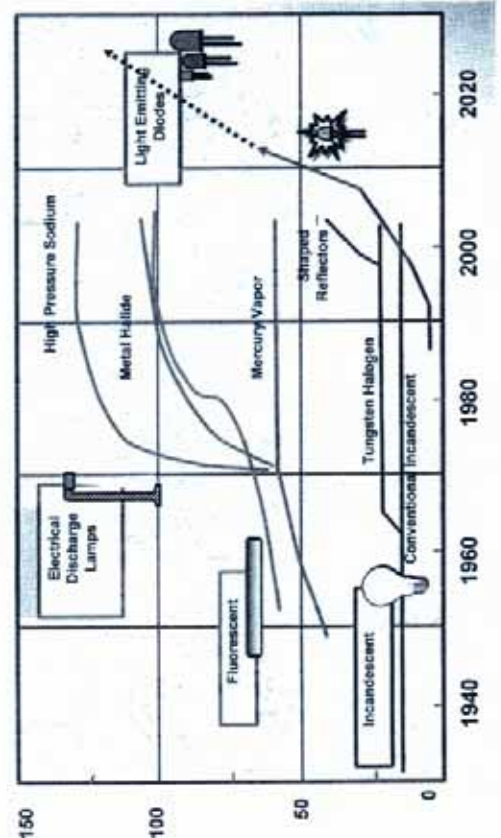


Fig 11.8 Relative light source efficiencies
L.E.D performance is doubling every 18 months. this phenomenon is known as "Moore's law".