DISPLAY DEVICES

Introduction :

In digital instruments, the output device of the instrument indicate the value of measured quantity using the digital display device. This digital display device may receive the digital information in any form but it converts the information in decimal form. Thus the digital display device indicates the value in decimal digits directly. The basic element in a digital display is the display for a single digit. By grouping such displays for single digits, we can get multiple digit display. In general, digital display is classified as planar and non-planar display. A planar display is a display in which entire characters are displayed in one plane. A non-planar display is a display in which characters are displayed in different planes. In this chapter we will discuss different display dl:\'ices. In general, LED's are most commmonly used in the digital displays. The LED's have advantages such as low voltage, long life, high reliability, low cost, fast swi~ching characteristics.

Classification of display:

In the digital electronic field, the most commonly used displays include cathode ray tube (CRT), light emitting diode (LED) and liquid crystal display (LCD), gas discharge plasma displays, electro-luminescent displays, incandescent displays.. liquid vapour displays etc.

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A] Classification on the basis of conversion of electrical signal into the visible light :

There are two types of such displays.

a) **Active Displays** - CRT, gas discharge plasma display, LED

b) **Passive Displays** - LCD, electrophoretic image displays

B] Classification on the basis of applications :

a) **Analog Displays** - Bar graph display, CRT

b) **Digital Displays** - Nixie tubes, alphanumeric display, LED.

C] Classification on the basis of physical dimensions and sizes :

a) **Symbolic Displays** - Alphanumeric, Nixie tube, LED

b) **Console Displays** - LED, CRT

c) **Large Screen Displays** - Enlarged projectors

D] Classification on the basis of display format

a) **Direct View Type (Flat Panel)** - Segmental display, dot matrix

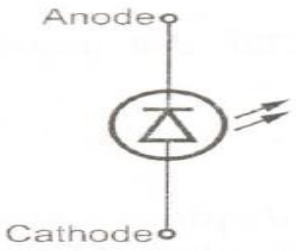
b) **Stacked Non-planar Type** - Nixie tube

E] Classification on the basis of resolution

a) Simple single element indicator

b) Multielement displays

Light Emitting Diodes (LED)

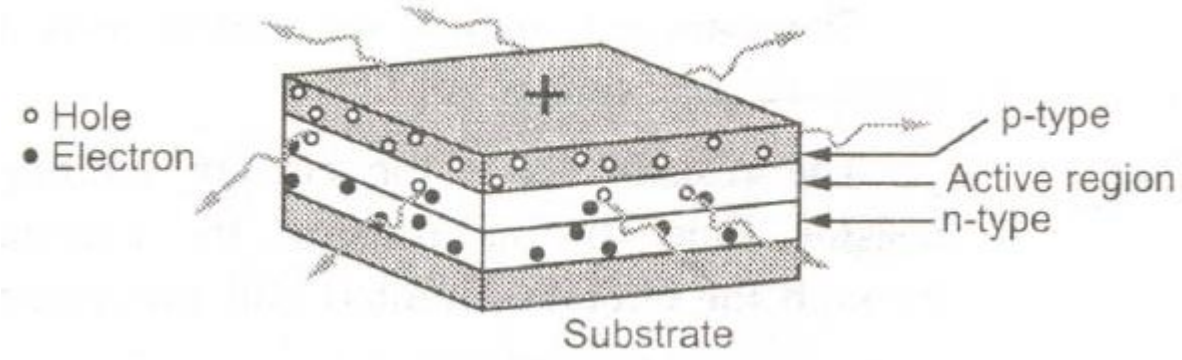


The LED is an optical diode, which emits light when forward biased. The Fig. shows the symbol of LED which is similar to p-n junction diode apart from the two arrows indicating that the device emits the light energy.

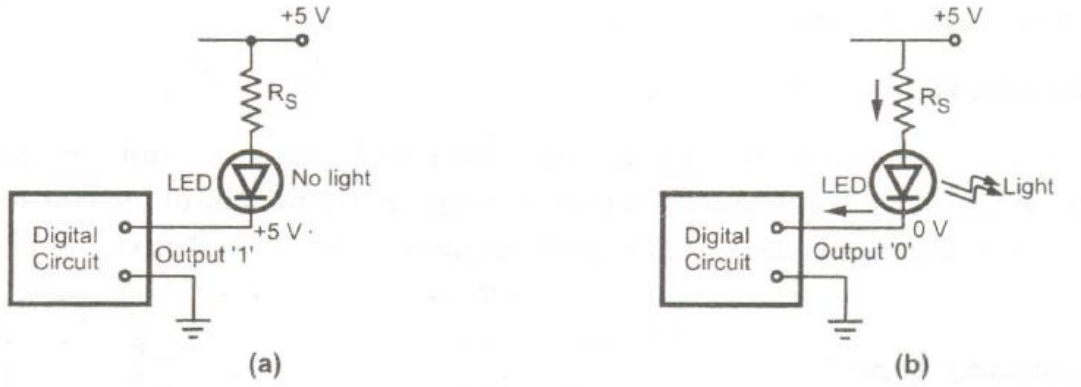
Basic Operation:

VVhenevL'r ,1 p-n junction is forward biased, the electrons cross the p-n junction from till' 11 type semiconductor material c1nd recombine with the holes in the p type "ellliconductor material. The free electrons are in the conduction band while the holes are prl'"ent in the valence bcllld. Thus the free electrons are at higher energy level with respect to the holes. When a free electron recombines with hole, it falls from conduction band to a valence band. Thus the energy level associated with it changes from higher value to lower value. The energy corresponding to the difference between higher level and lower level is released by an electron while travelling from the conduction band to the valence band. In *flormif} diodes, this* energy released is in *the* form of neat. 5ut LED j·s made up some special material which release this energy in the form of photons which emit the light energy. Hence such diodes are called light emitting diodes.

Construction of LEDs:



One of the methods used for the LED construction is to deposite three semiconductor layers on the substrate as shown in the Fig In between p type and n type, there exists an active region. **LED Driver Circuit:**



The output of a digital circuit is logical i.e. either'O' or '1'. The '0' means low while '1' means high. In the high state the output voltage is nearly 5 V while in low state, it is almost 0 V. If LED is to be driven by such digital circuit, it can be connected as shown in the Fig. 10.10. When output of digital circuit is high, both ends of LED are at 5 V and it can not be forward biased hence will not give light. While when output of digital circuit is *!nw*, then high current will flow through LED as it becomes forward biased, and it will give light.

To improve the brightness of display, a dynamic display system is used. In thIS, the LEOs are not lit continuously but are sequentially lit by scanning in a "vertical strobe" or "horizontal strobe" mode. This is similar to "running lights" used Jl1 modern advertisements.

In the vertical strobe mode, a single row is selected at a time, the appropnatp LEOs are energized in that row, and then the signal is applied to next row. On the contrary, in horizontal strobe mode, a single column is selected at a time.

Alphanumenc displays using LEOs employ a number of square and oblong emitting areas, arriJnged either as dot matrix or segmented bar matrix.Alphanumeric LEOs are normally laid out on a single slice of semiconductor material, all the chips being enclosed in a package, similar to an IC, except that the packaging compound is transparent, and not opaque,

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