SNS COLLEGE OF TECHNOLOGY
Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF BIOMEDICAL ENGINEERING

19BMT202– BIOMEDICAL SENSORS AND MEASUREMENT

II Year / III Semester

Unit 2 – SIGNAL RECORDERS

Topic :LCD

Welcome you all Design Thinkers to Today's Class

INTRODUCTION

- A liquid crystal is a material (normally organic for LCDs) that flows like a liquid but whose molecular structure has some properties associated with solids, i.e., liquid crystals are substances that exist in an odd state: sort of like a liquid & sort of like a solid
- Thus, their molecules tend to maintain their orientation (like the molecules in a solid) but also move around to different positions (like the molecules in a liquid)
- Depending on the temperature & particular nature of a substance, liquid crystals can be in one of the several distinct phases, whose nematic phase makes LCDs possible
- Liquid crystals are affected by electric current
- A particular type of nematic liquid crystal, called twisted nematic (TN), is naturally twisted and applying a varying electric current to these liquid crystals will untwist them to varying degrees
- LCDs use these liquid crystals because they react predictably to electric current in such a way as to control light passage

TYPES OF LCD

Types of LCDs:

- Dynamic Scattering Type (Nematic Crystal)
- Field Effect Type (Twisted Nematic Crystal)
- **Dynamic Scattering Type (Nematic Crystal)**
- the individual molecules have a rod like appearance
- The liquid crystals are layered between glass sheets with transparent electrodes (Indium Oxide) deposited on the inside faces
- Under no bias condition, the incident light will pass through & the liquid crystal structure appears clear
- If a voltage (6-20 V) is applied across the conducting surfaces, the molecular arrangement is disturbed and regions of different refractive indices are established which reflect the incident light in different directions at the interface of different refractive indices
- This phenomenon is referred to as dynamic scattering and causes a frosted-glass (bright) appearance

CHARACTERISTICS

- The LCD does not generate its own light but depends on a external or internal light source
- Therefore, during the day or in lighted areas, a reflector can be put behind LCD to reflect light back (reflective mode) & under dark condition, the LCD must have its own internal light source either behind or side of LCD (transmissive mode)

Field Effect Type (Twisted Nematic Crystal):

- The construction of field effect LCD is similar to that of dynamic scattering type with the exception that two thin polarizing optical filters are placed at the outside of each glass sheet
- Similar to dynamic scattering LCD, the field effect can be operated in the reflective or transmissive mode
- In case of transmissive field effect LCD, the internal light source is on the right & the viewer.
- Only the vertical component of the incident light can pass through the vertical polarizer.

FUNCTIONS

- In between the two walls of the liquid crystal, there is a general drift from one polarization to the other
- The left-hand vertical light polarizer only permits the passage of vertical polarized light
- If there is no applied voltage then the viewer sees a uniformly dark pattern across the entire display but when a threshold voltage is applied (2-8 V), the rod like molecules align themselves with the field (perpendicular to the wall) and the light passes directly through without the 90^0 shift and can pass through the second vertically polarizer and the light area is seen by the viewer
- Through proper excitation of the segments of each digit, the pattern will appear
- In case of reflective type field effect LCD, the horizontally polarized light at the far left encounters a horizontally polarized filter and passes through to the other vertical polarization, & returned to the observer
- If there is no applied voltage, there is a uniformly lit display

LCD

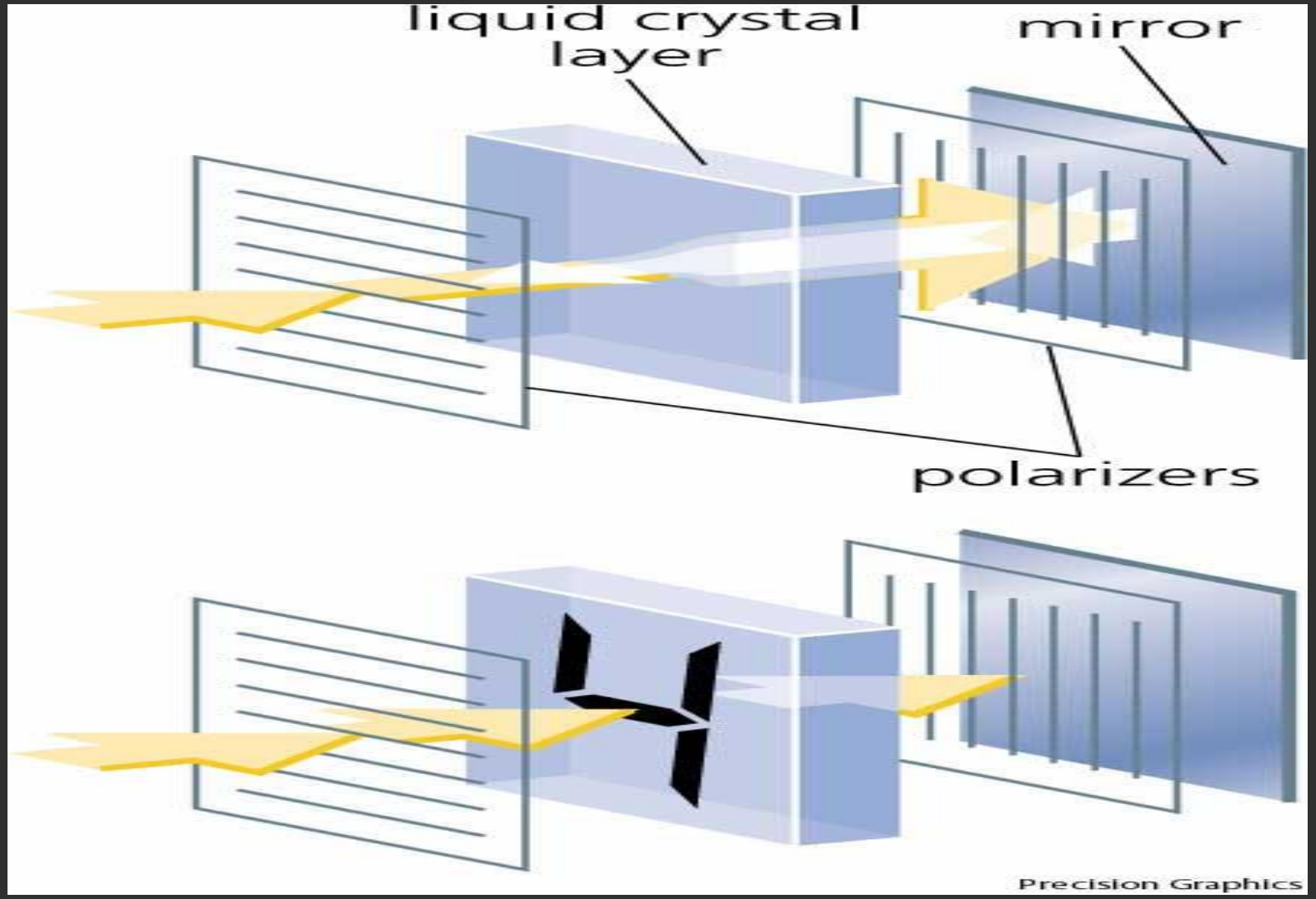
- The application of a voltage results in a vertically polarized incident light encountering a horizontally polarized filter at the left which will not be able to pass through and be reflected which results a dark area on the crystal and the pattern.
- Field effect LCDs are normally used when a source of energy is prime factor (e.g. in watches, cell phones, portable instruments, etc.), since they consume very small power (in µW range) as compared to the dynamic scattering types (in mW range)
- The cost is higher for field effect LCDs and their height is limited to about 2”, while dynamic scattering LCDs are available upto 8” in height.

DEFLECTION SYSTEM

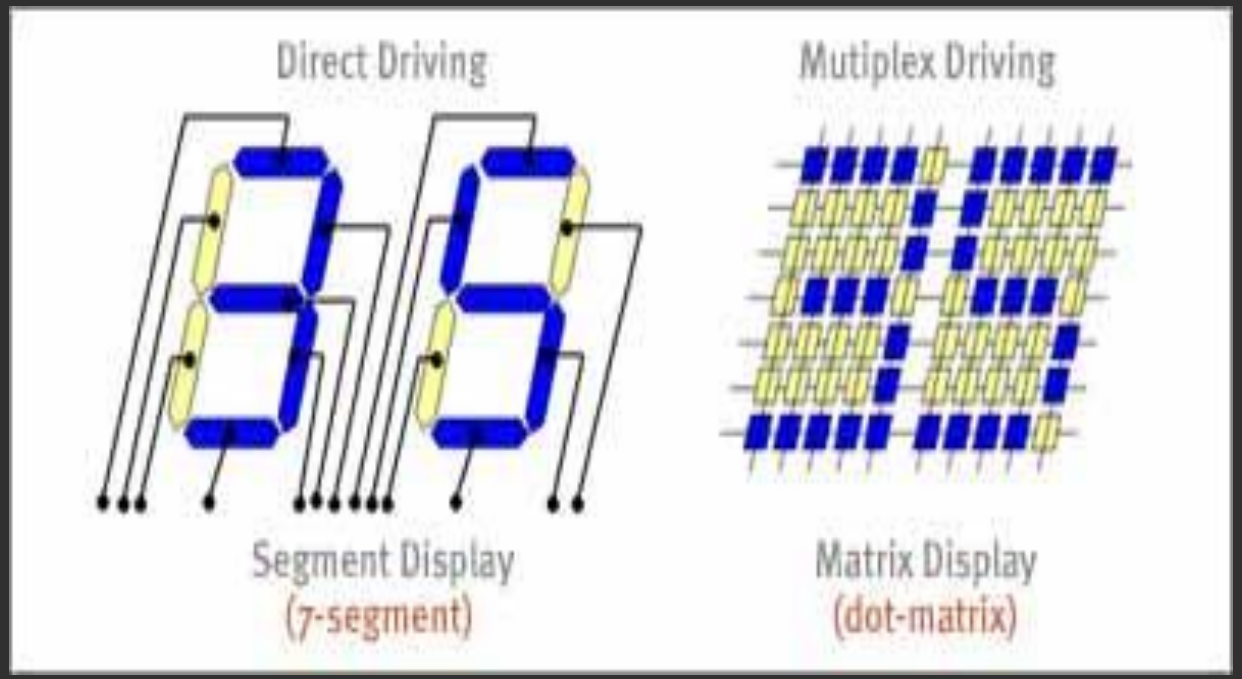
- **Advantages of LCDs:**
- They have low power (in µW) consumption as compared to LEDs (in mW)
- They have low cost
- Since the color generated by LCD units is dependent on the source of illumination, so there is greater range of color choice (16.8 million colors)

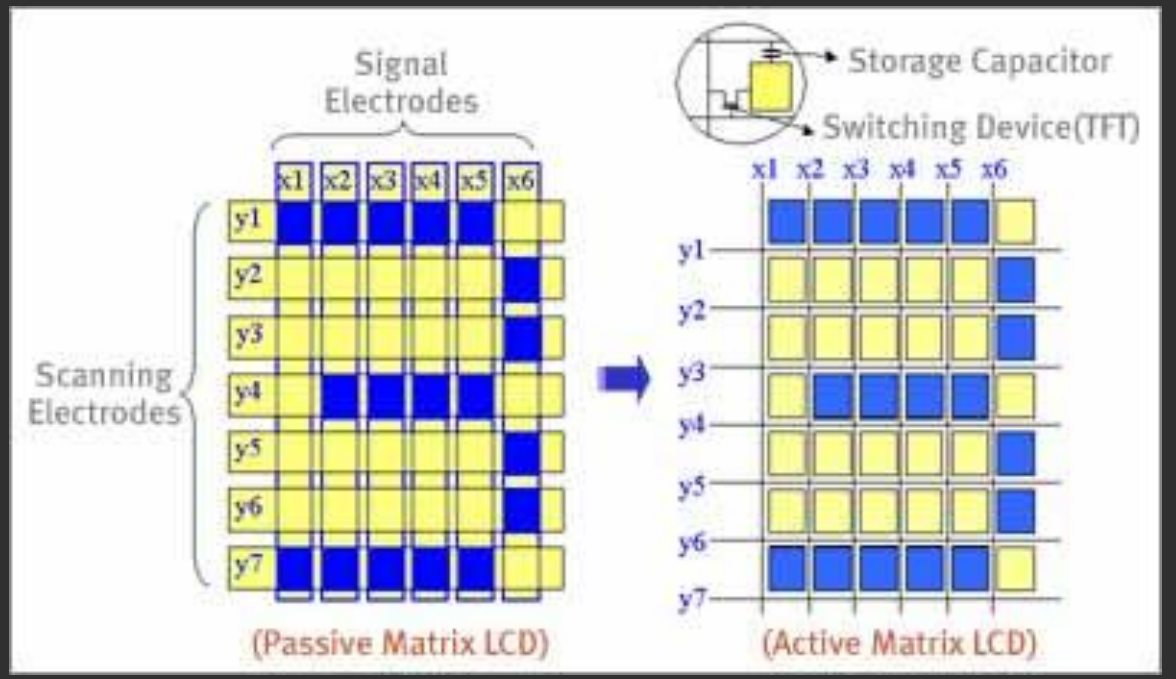
- **Disadvantages of LCDs:**
- They are very slow devices, having response time in the range of 100-300 ms
- They occupy a large area
- When operated on dc, their life-span is quite small because LCDs degrade chemically, therefore, they are used with ac supplies having a frequency less than 500 Hz

SCHEMATIC VIEW

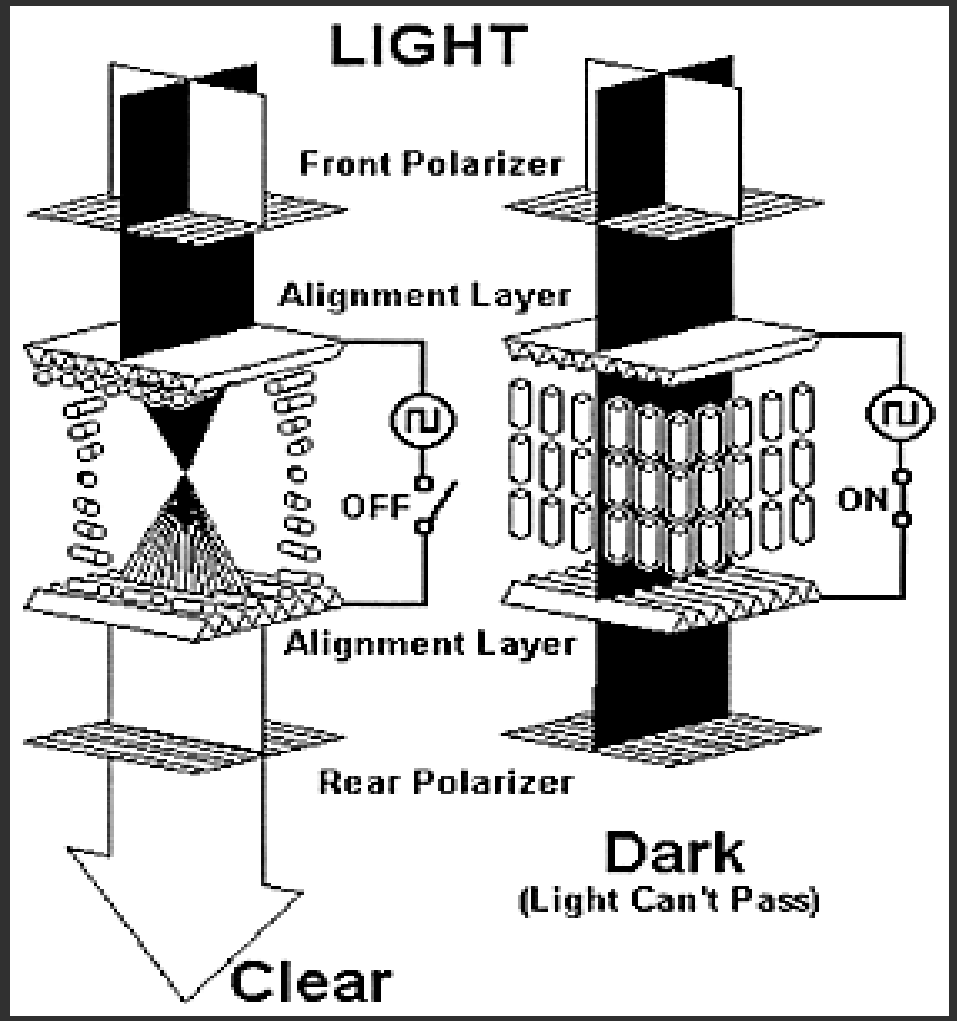


FLUORESCENT SCREEN





DISPLAY WAVEFORM ON THE SCREEN




Thank
you