



# **SNS COLLEGE OF TECHNOLOGY**

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



## **19EET103 / ELECTRIC CIRCUITS AND ELECTRON DEVICES**

### **UNIT 4- ELECTRONIC DEVICES AND APPLICATIONS**

19EET103 / ECED

Dr.MVP / Professor & Senior Innovator (IHub)

# Liquid Crystal Display

# Introduction

- A Liquid Crystal Display (LCD) is a thin , flat panel display device used for electronically displaying information such as text ,images and moving picture.
- LCD is used in Computer monitors, Televisions , Instrument panels, Gaming devices etc.
- Polarization of lights is used here to display objects.

# Why LCD ?

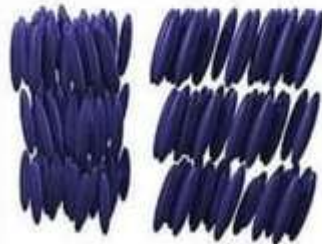
- **Smaller size** —LCDs occupy approximately 60 percent less space than CRT displays an important feature when office space is limited.
- **Lower power consumption**—LCDs typically consume about half the power and emit much less heat than CRT displays.
- **Lighter weight** —LCDs weigh approximately 70 percent less than CRT displays of comparable size.
- **No electromagnetic fields** —LCDs do not emit electromagnetic fields and are not susceptible to them. Thus, they are suitable for use in areas where CRTs cannot be used.
- **Longer life** —LCDs have a longer useful life than CRTs.

# Liquid crystals

- Two liquid crystal materials which are important in display technology are nematic and smectic.



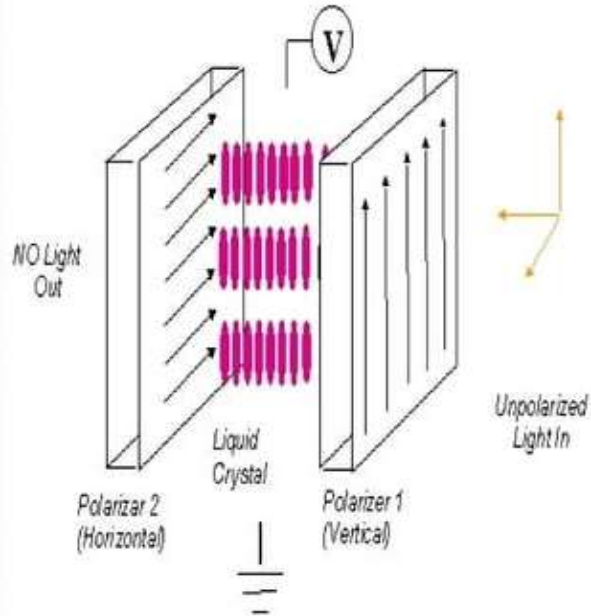
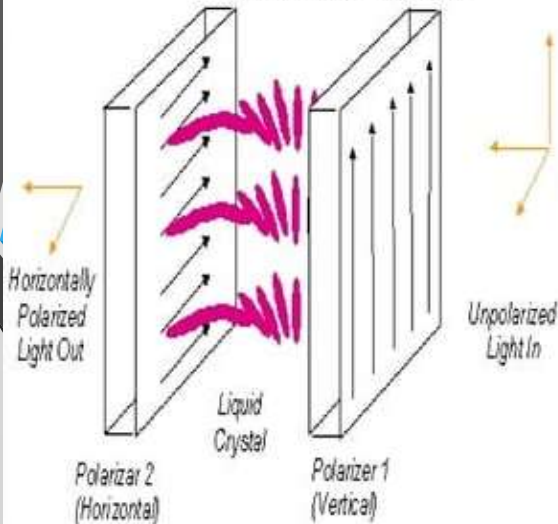
Nematic phase



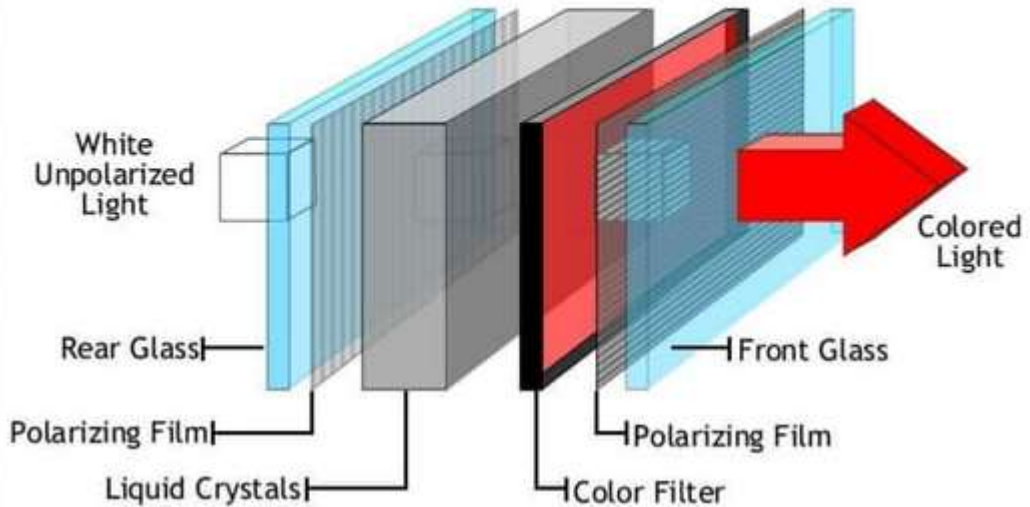
smectic phase

# LCD working

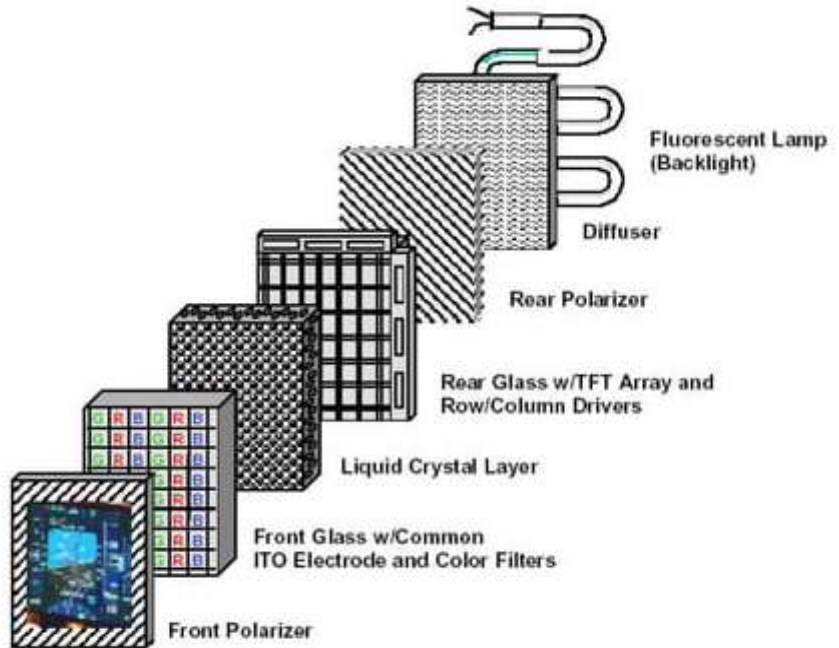
No applied voltage: optical polarization follows twist of LC molecules



# LCD working



# LCD working



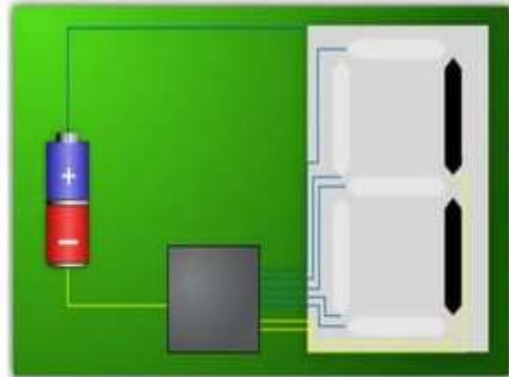


# Types of LCD

- Direct Address Display
- Passive Matrix Display
- Active Matrix Display

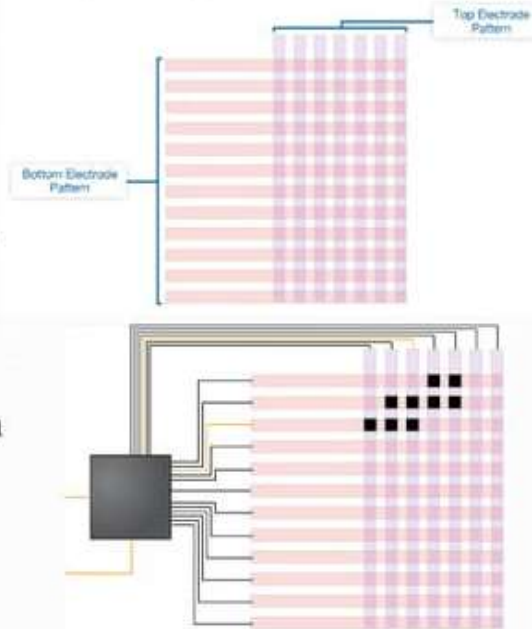
# Direct Address Display

- When the display include limited variable components such as
  - Watches
  - Calculators
- Simple electronics is used to control the components



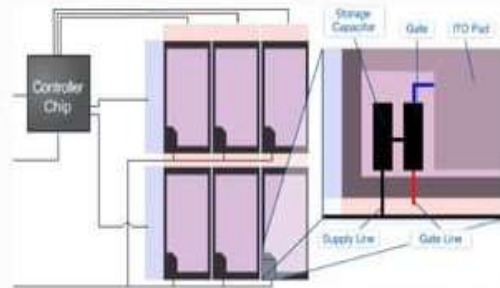
# Passive Matrix Display

- Passive matrix display has
  - Rows of electrodes on one piece of glass.
  - Columns of electrodes on the opposing piece of glass.
  - Complex electrical waveform control the voltage differential at the intersection of the electrodes.
- The intersection of the columns and rows are the pixels



# Active Matrix Display

- Allow very high resolution
- Each sub-pixel is individually controlled by an isolated thin-film transistor (TFT).
- It allows the electrical signal for each sub-pixel to avoid influencing adjacent elements.
- The TFT is patterned into the glass layer



A display with  
1024x768 resolution  
Include 1024x768x3  
= 2,359,296 sub-pixels

# Twisted Nematic (TN) Display

- Is the most common LCD Display.
- The two alignments layer for the liquid crystal material are orthogonal.
- The light entering the polarize panel rotates by the twist in the liquid crystal and allowing it to pass through the second polarize



# Disadvantages of Passive Matrix Display

- As more rows and columns are added the range of the allowed voltage is reduced.
  - At high range adjacent channels interferes
  - Range limit reduces contrast
  - Limit the types of useful liquid crystal.
- It is usually limited to about 50 rows
- Twisted nematic (TN) Display work best with large voltage variation.
  - It can not be used in Passive Matrix Display

# Advantage of Active Matrix Display

- Higher sizes
- Higher contrast
- Higher gray scale
- Higher resolution
- Higher viewing angle
- Faster response. Eliminates “ghosting”
- Better control of the color

# Advantage of Twisted Nematic Display

- Shortest response time.
- Higher brightness.
- They are cheap to manufacture, resulting in low prices for end user.