# Flat Panel Displays

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# Flat Panel Displays

- A class of video devices that have reduce volume and weight compared to a CRT.

- A significant feature of flat panel displays is that they are **thinner** than CRTs.

# Flat Panel Displays

## Current uses for flat panel displays:

- Small TV monitors
- Calculators
- Pocket video games
- Laptop computers
- Advertisement boars in elevators

# Flat Panel Displays

**Flat panel displays:**

- **Emissive** or **Emitters** Displays

- **Non-emissive** or **Non-emitters** Displays

# Emissive (or Emitters) Displays

- Emissive displays convert **electrical energy** into light.

- Examples: Plasma panel, thin-film electroluminescent displays, Light-Emitting Diodes (LED) and flat CRT.

# Non-Emissive (or Non-Emitters) Displays

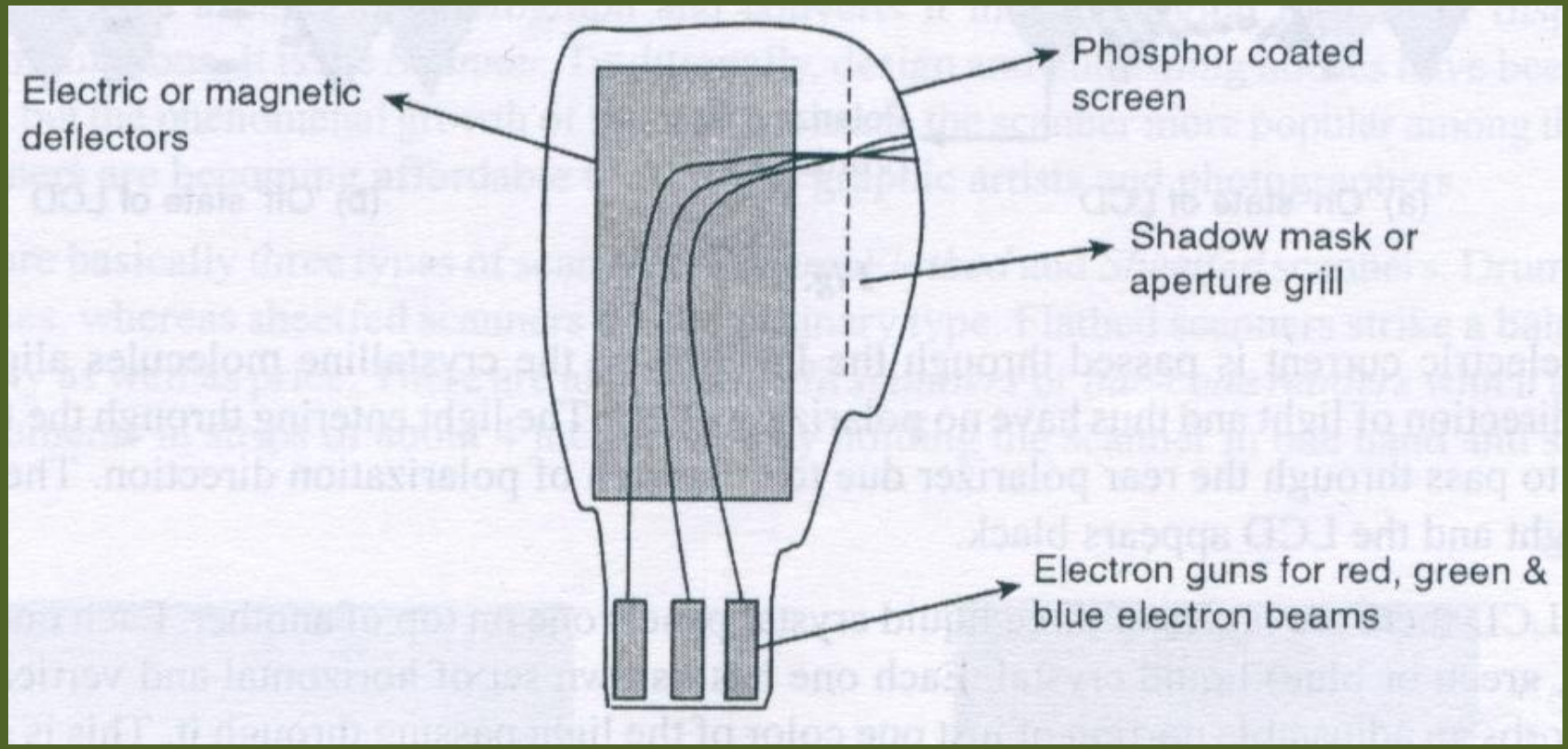
- Use **optical effects** to convert sunlight or light from some other source into graphics pattern.

- Example: **L**iquid-**C**rystal **D**evice (**LCD**)

# Flat CRT

# Flat CRT

- Electron beams are accelerated parallel to the screen, then deflected 90° to the screen.



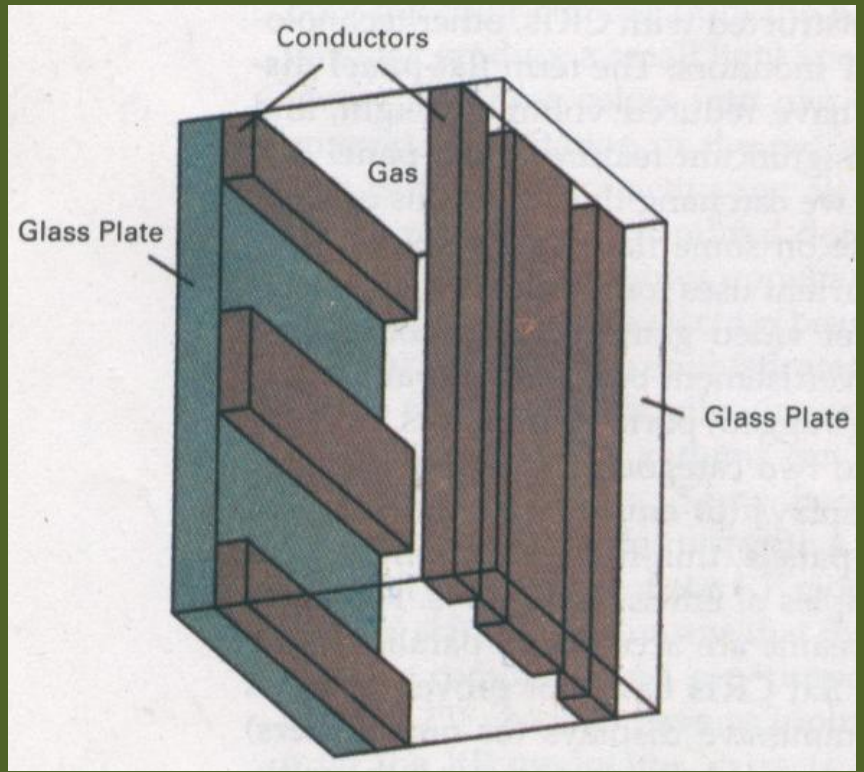
# Plasma Panel

# Plasma Panel

- A **layer of gas** (usually neon) is sandwiched between two glass plates.

# Plasma Panel

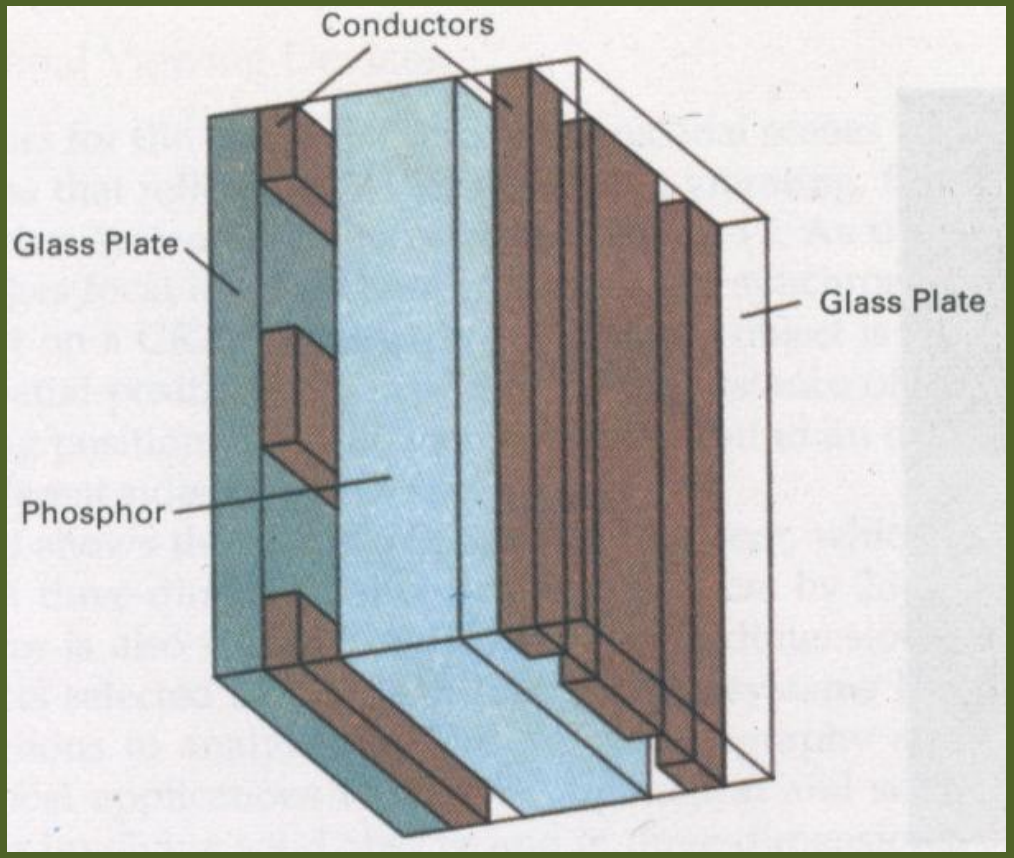
- By applying high voltage to a pair of horizontal and vertical conductors, a small section of the gas (tiny neon bulb) at the intersection of the conductors break down into glowing plasma of electrons and ions.



# Thin Film Electroluminescent

# Thin Film Electroluminescent

- The region between the glass plates is filled with a phosphor, such as zinc sulfide doped with manganese.



# Light Emitting Diode (LED)

# Light Emitting Diode (LED)

- A matrix of **diodes** is arranged to form the pixel positions in the display, and picture definition is stored in a refresh buffer.

- Information is read from the refreshed buffer and converted to voltage levels that are applied to the diodes to produce the light patterns in the display.

# Liquid Crystal Displays (LCD)

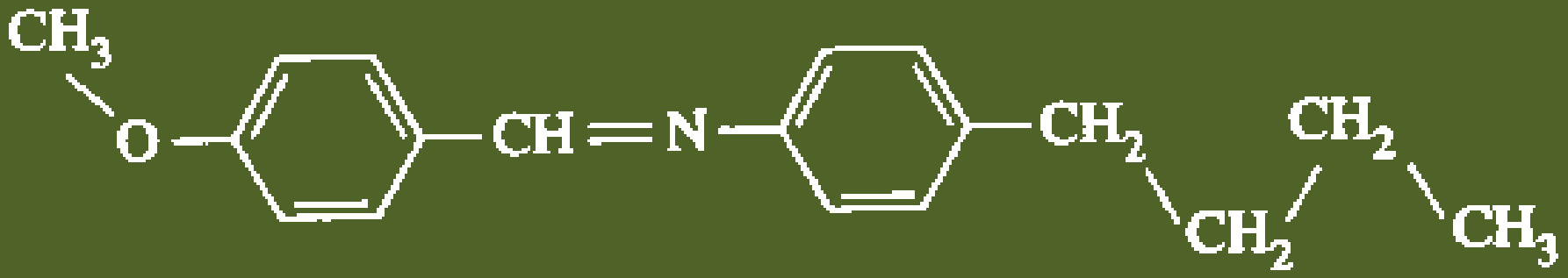
# Liquid Crystal Displays (LCD)

- Used in small systems, such as calculators, laptop computers.

- Produce a picture by passing polarized light (from the surrounding or from an internal light source) through a liquid-crystal material that can be aligned to either block or transmit the light.

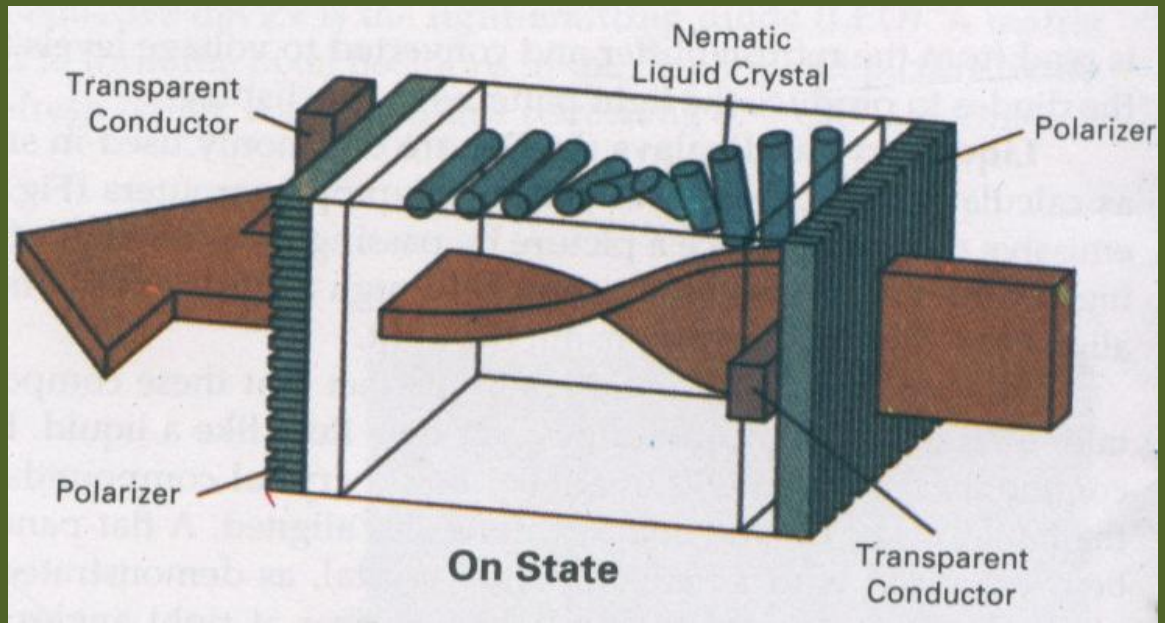
# Liquid Crystal Displays (LCD)

- **Liquid crystal:** These compounds have a crystalline arrangement of molecules, yet they flow like a liquid.



# Liquid Crystal Displays (LCD)

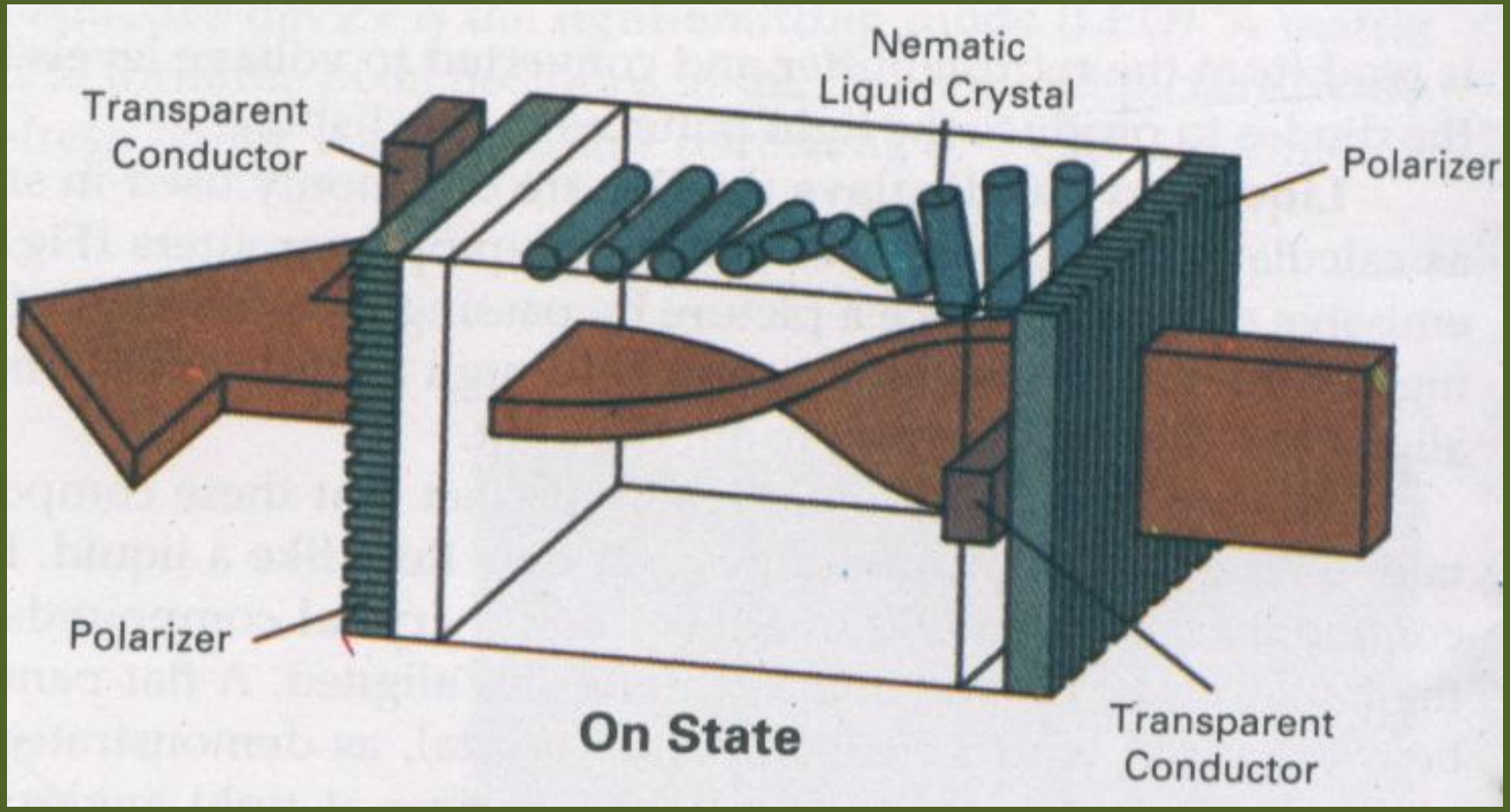
- Two glass plates, each containing a light polarizer at right angles to the other plate, sandwich the liquid crystal materials.
- Rows of horizontal transparent conductor & columns of vertical conductors (put into glass plates)



# Liquid Crystal Displays (LCD)

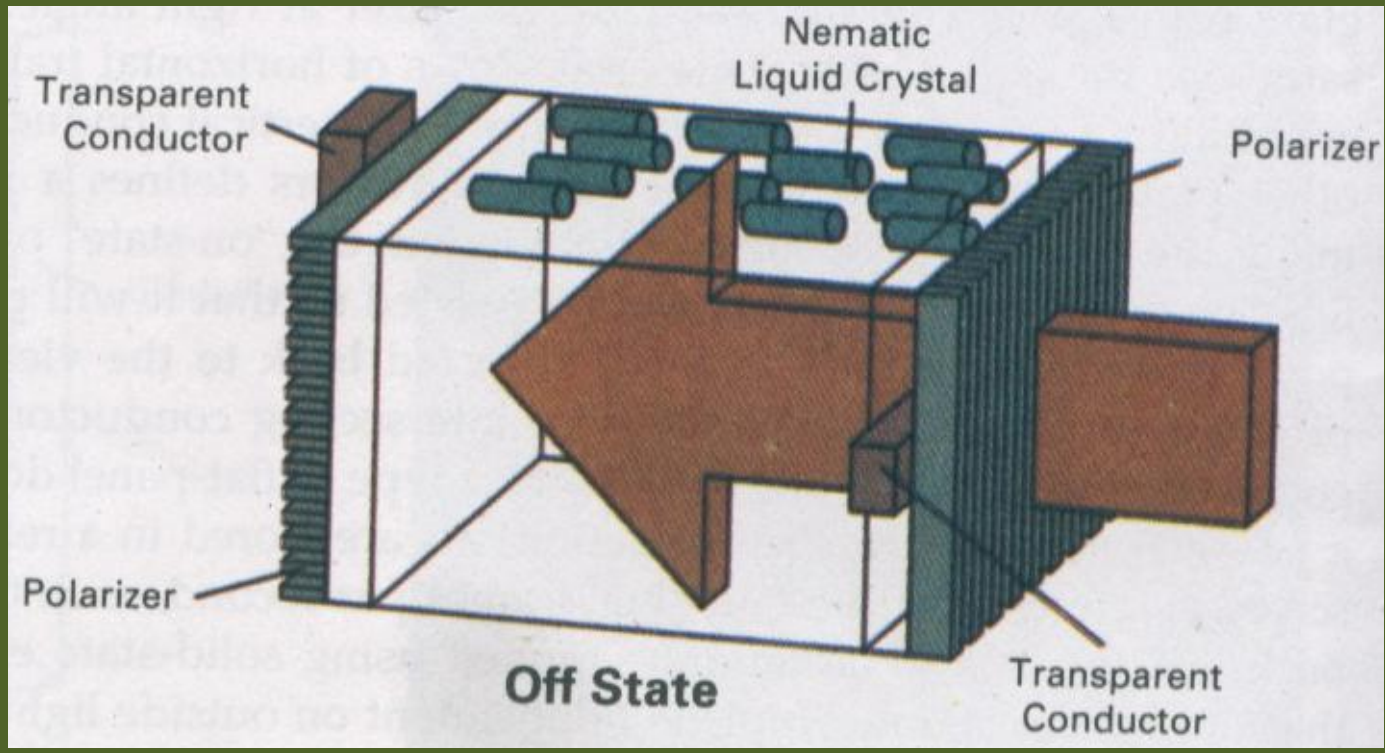
- Polarized light passing through the material is ***twisted*** so that it will pass through the opposite polarizer.
- The light is then reflected back t the viewer.

# Liquid Crystal Displays (LCD)

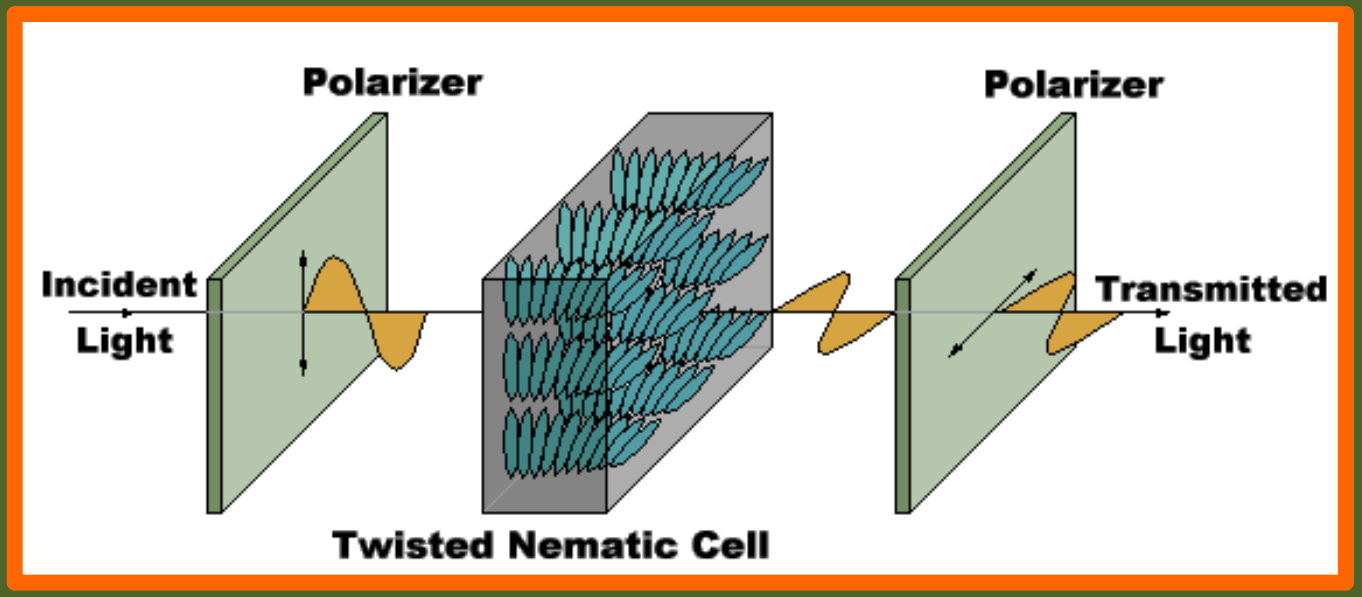


# Liquid Crystal Displays (LCD)

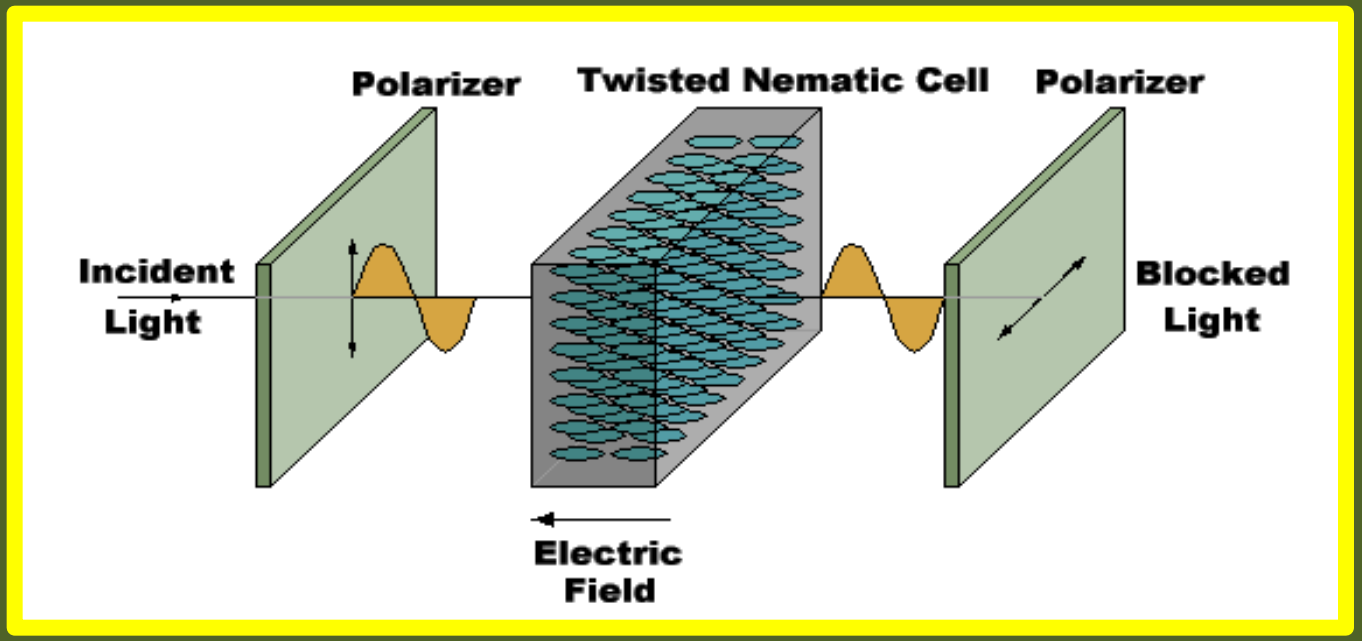
- To turn off the pixel, we apply a voltage to the two intersecting conductor to align the molecules so that the light is not twisted.



# Liquid Crystal Displays (LCD)




*On State*




*Off State*