

LCD Displays

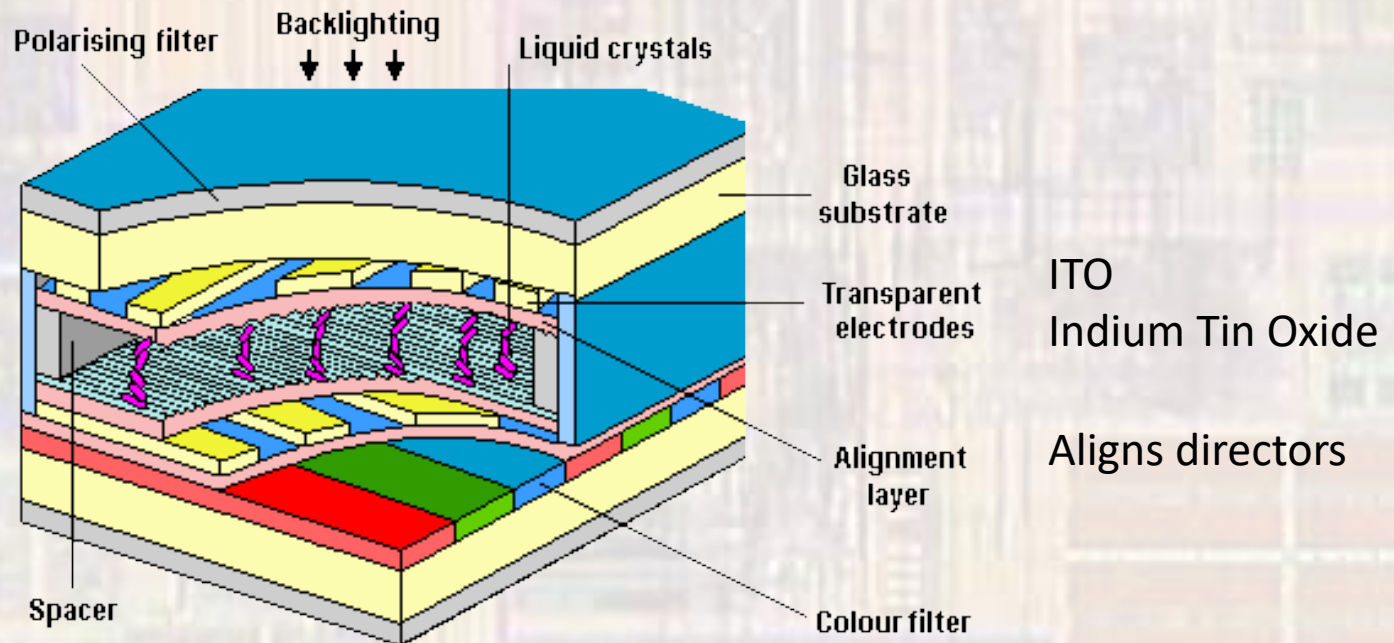
Last updated 2/29/24

LCD Displays

- LCD vs LED Displays (TVs)
 - The vast majority of what are labeled LED displays are actually LCD displays
 - True LED displays are available – at a premium price (OLEDs)

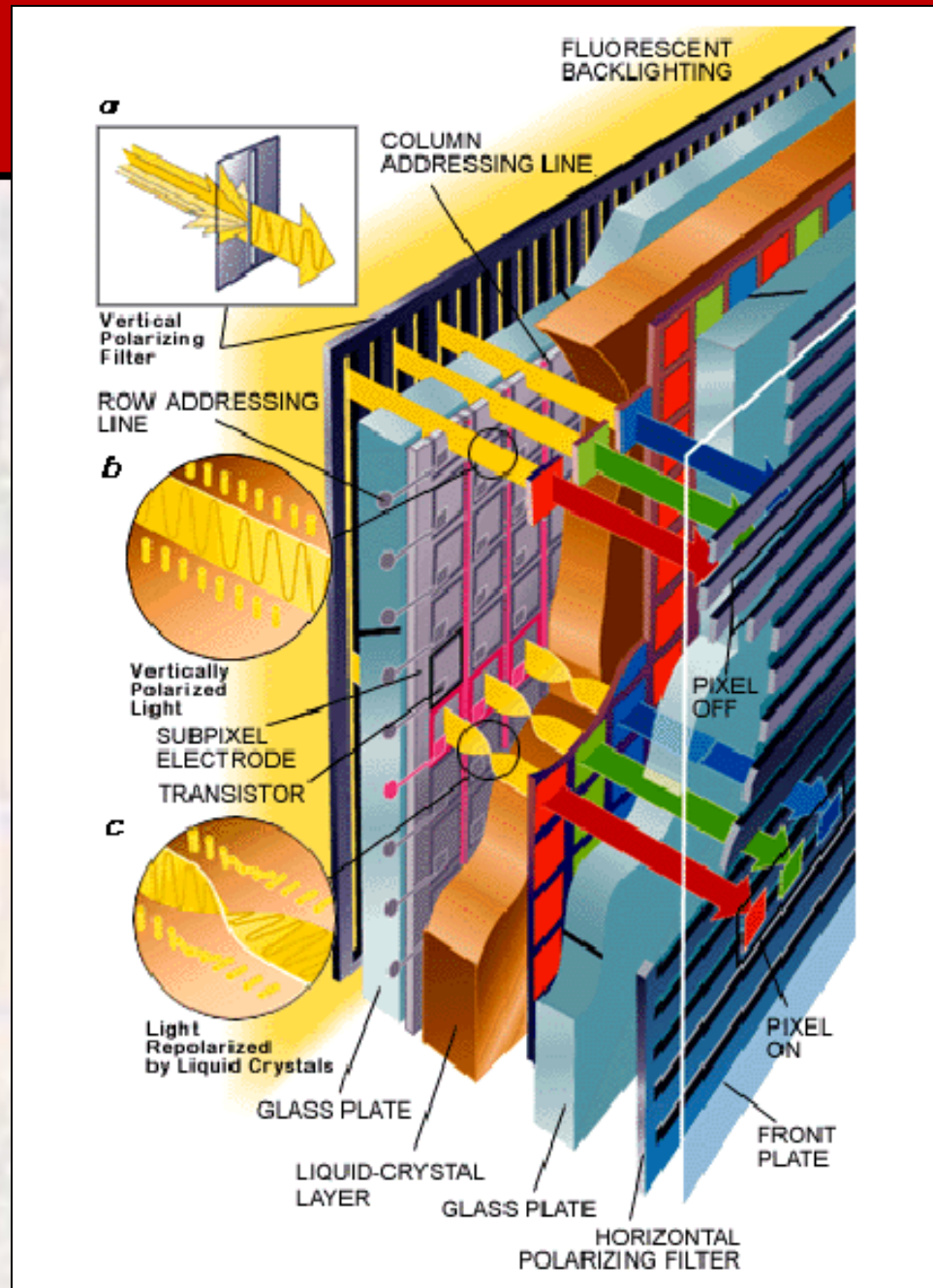
LCD Displays

- Passive Matrix
 - Rows and columns used to address pixels
 - Create an electric field or not
 - Depends on persistence of the color filter
 - Similar to old CRT displays
 - Still used in small LCD displays (e.g., 7seg)



LCD Displays

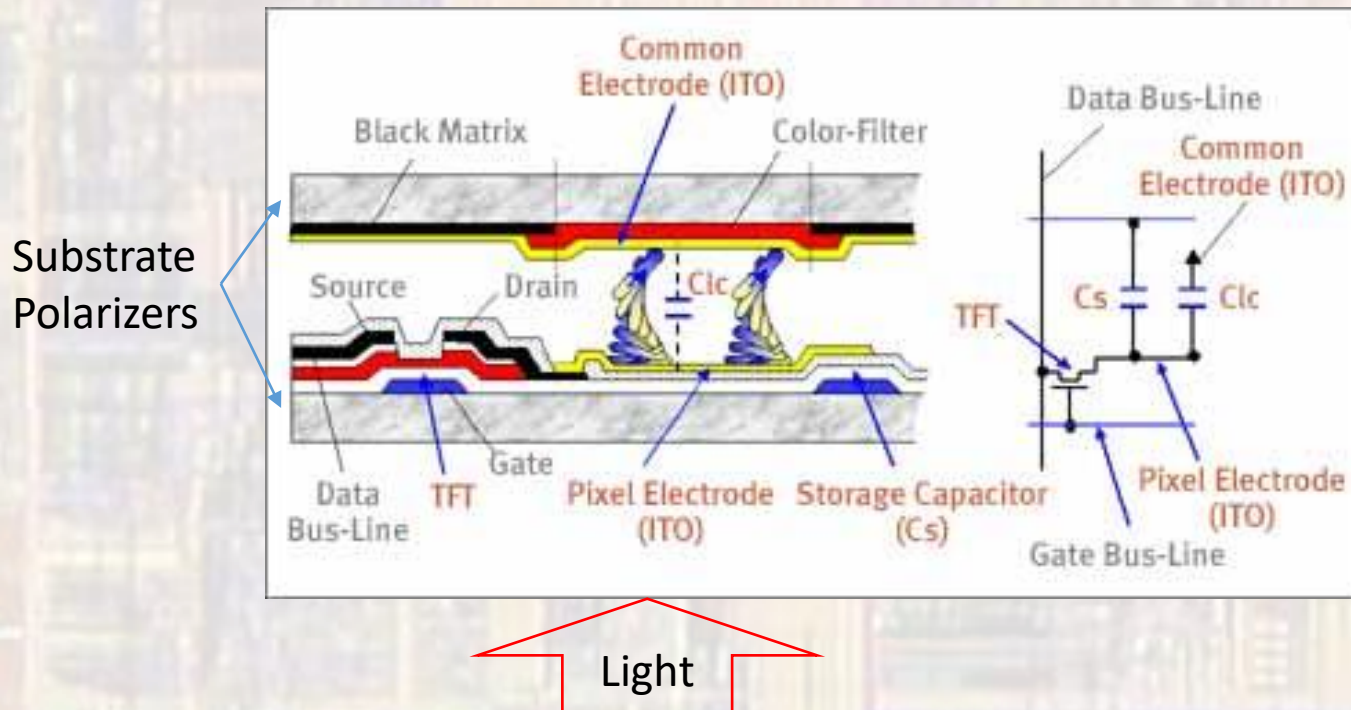
- Active Matrix



LCD Displays

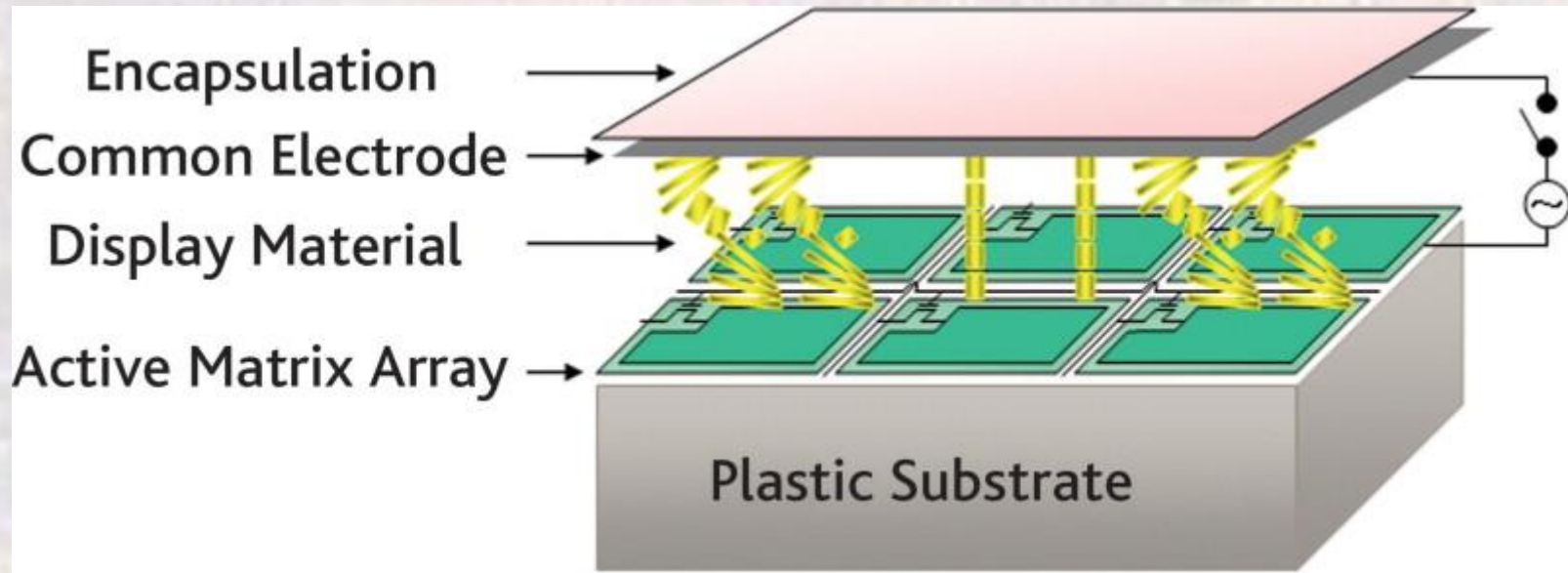
- Active Matrix
 - Rows and columns used to address pixels
 - Thin film transistors used for selection
 - Capacitors used for persistence

Single Pixel – 1 color



LCD Displays

- Active Matrix
 - Rows and columns used to address pixels
 - Thin film transistors used for selection
 - Capacitors used for persistence

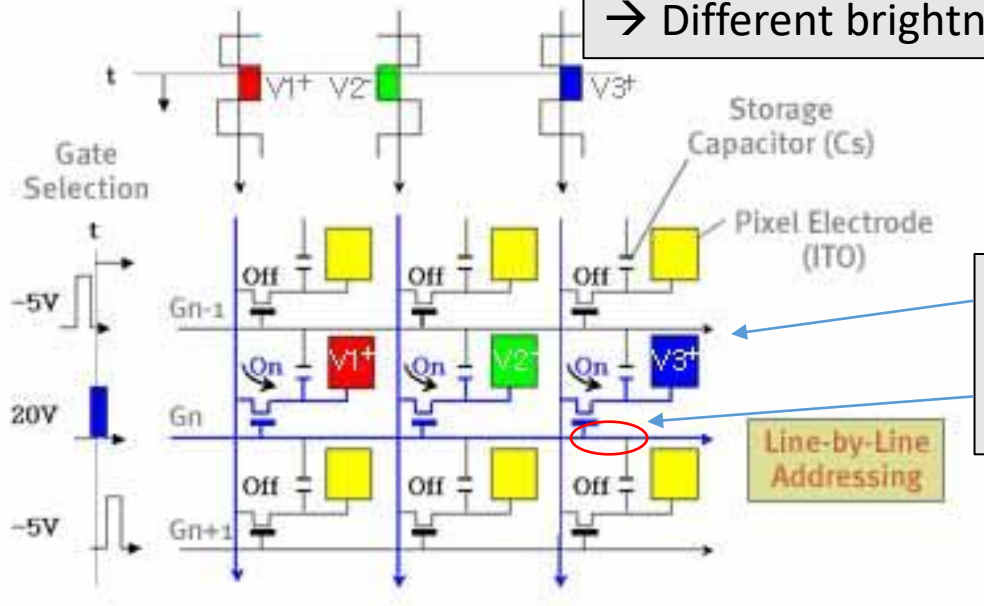


LCD Displays

- Active Matrix
 - Scan 1 row at a time
 - 1 column for each sub-pixel
 - 3 columns within a sub-pixel – RGB
 - Voltage differential determines brightness ($V_{\text{stored}} - (-5\text{v})$)

Different voltages \rightarrow different values stored
 \rightarrow Different brightness

Nominal Row and common electrode voltage = -5V
FET OFF



FET on HARD

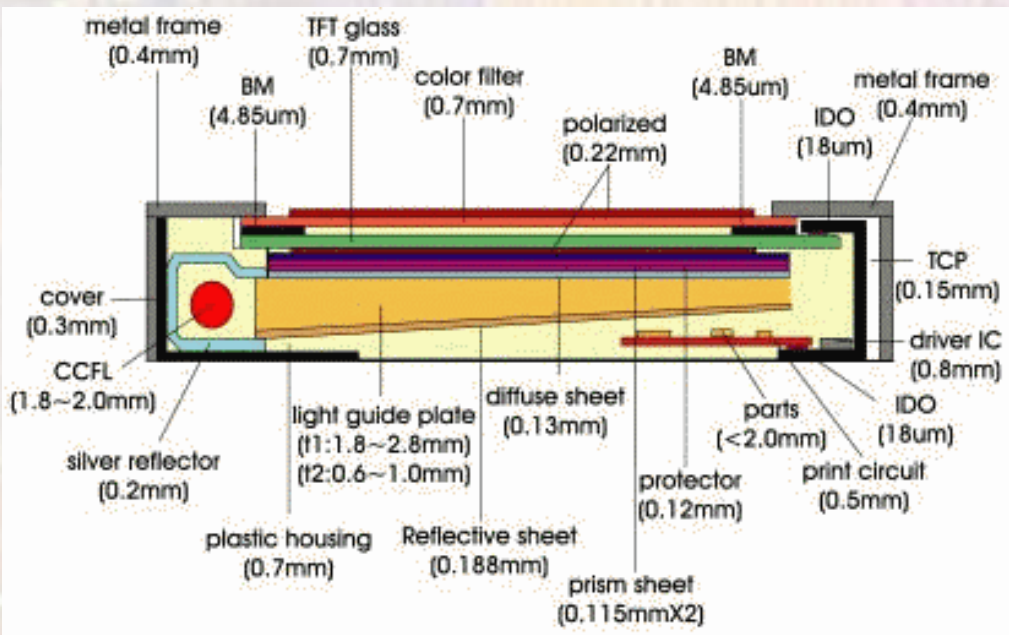
Common Electrode per row

Shared row access and common electrode

Line-by-Line Addressing

LCD Displays

- Where does the light come from?
 - Edge lit with Diffuser
 - Cold Cathode Florescent or LEDs



LCD Displays

- Where does the light come from?
 - Back lit with Diffuser
 - Cold Cathode Florescent or LEDs
 - Full LED backlight allows for local dimming

