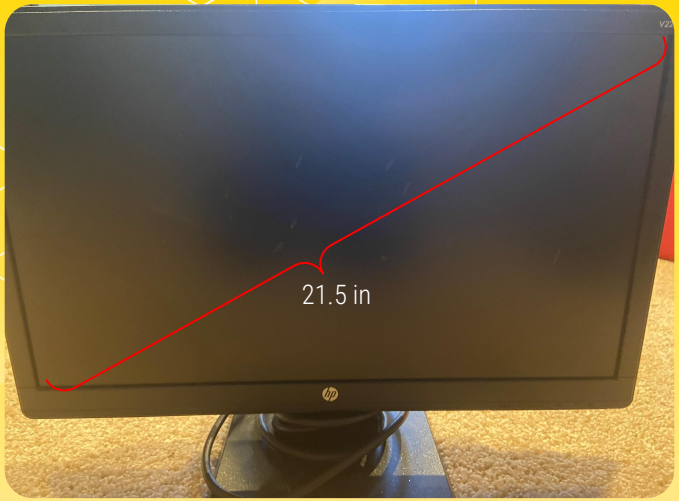
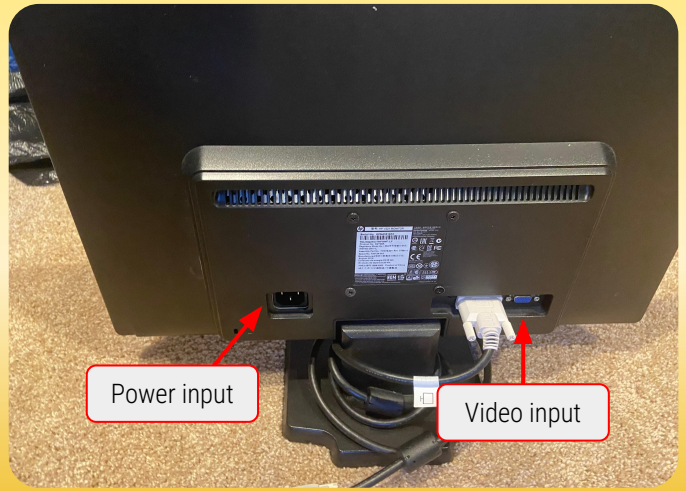
Reverse Engineering Challenge: Monitor

By Ian and Ali on Team 99040 in Birmingham, Alabama





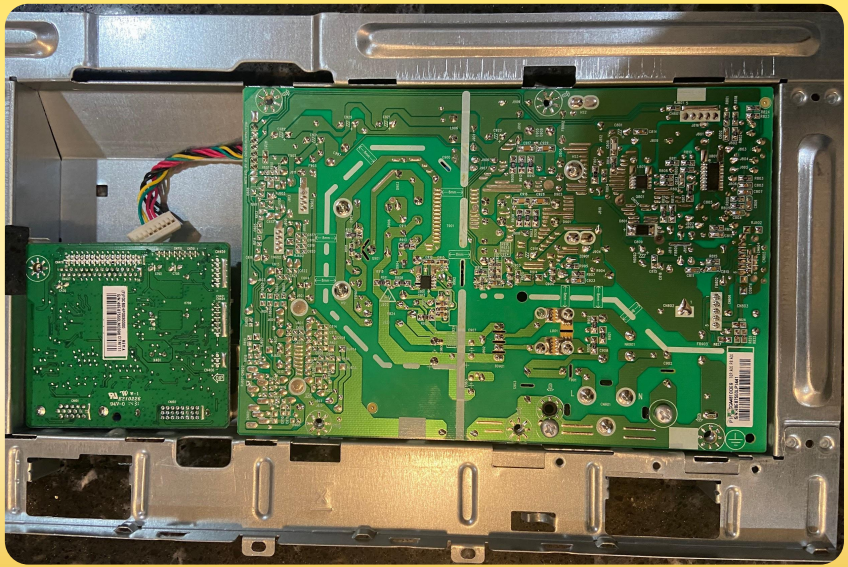
What We Picked and Why

Our team, being teenagers, spends almost our waking hours looking at screens, such as phones or laptops. We want to better understand how such screens work, prompting us to disassemble a computer monitor. We are going to disassemble a HP V221 21.5-inch LED Backlit Monitor, predominantly used in office settings. Our objective is to see how the power and video inputs are managed by the inner mechanisms of the monitor to show a video output on the screen.

The Frame

The frame holds the monitor together. The frame has two parts: the outside frame, which holds the whole monitor together, and the inside frame, which holds the power board and the main board.

The outside frame



The inside frame

The Power Board

The power board, which regulates and controls power, turns AC (alternating current) power, into DC (direct current) power. For this monitor, AC power is is typically 110 volts while DC power is approximately 19 volts. This is done through a four step method, found below.

1:

Transforming

2:

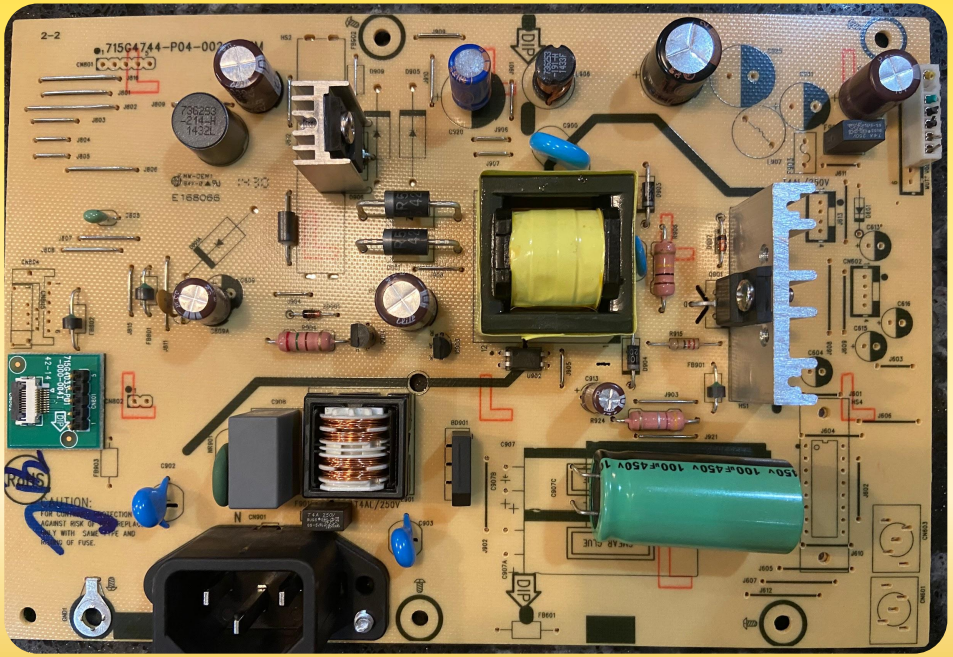
Rectifying

3:

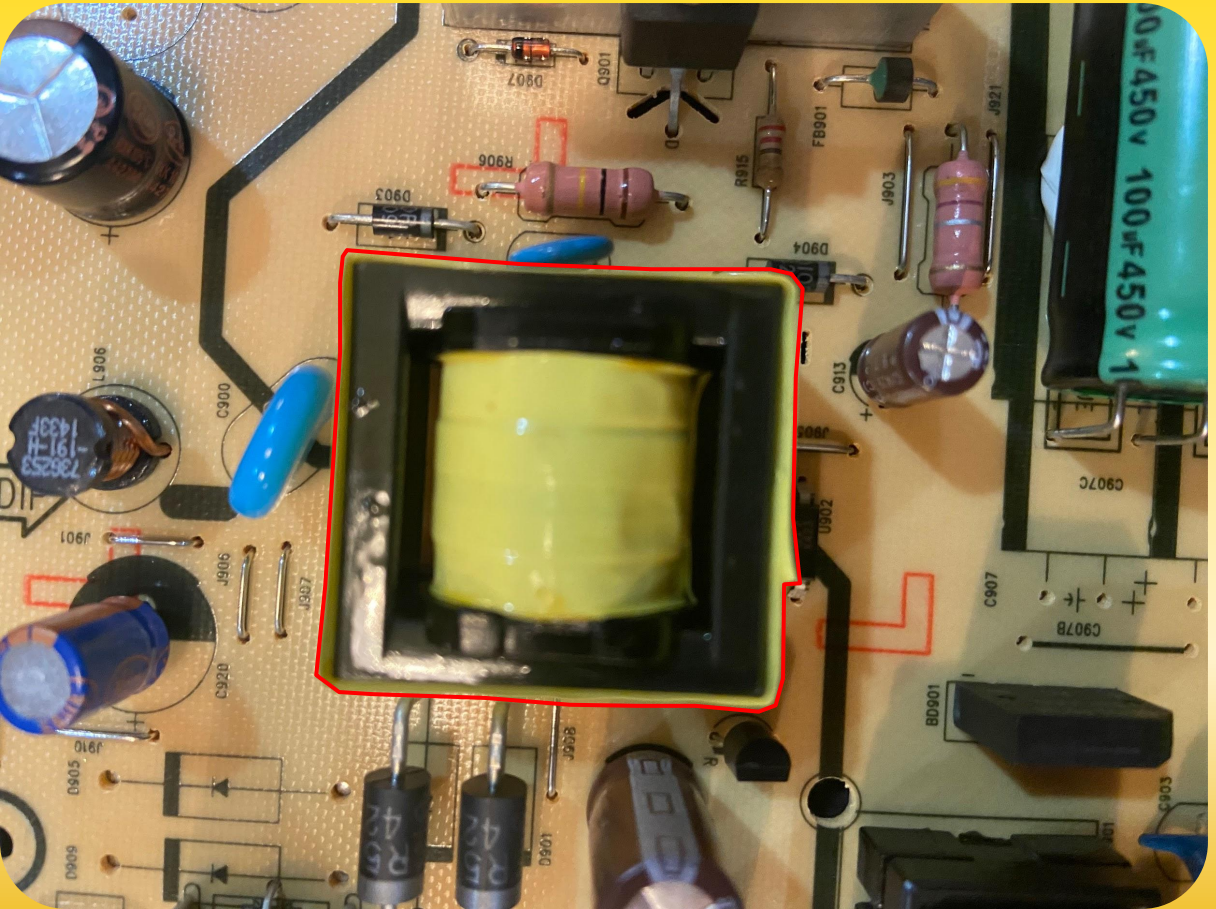
Filtering

4:

Regulating



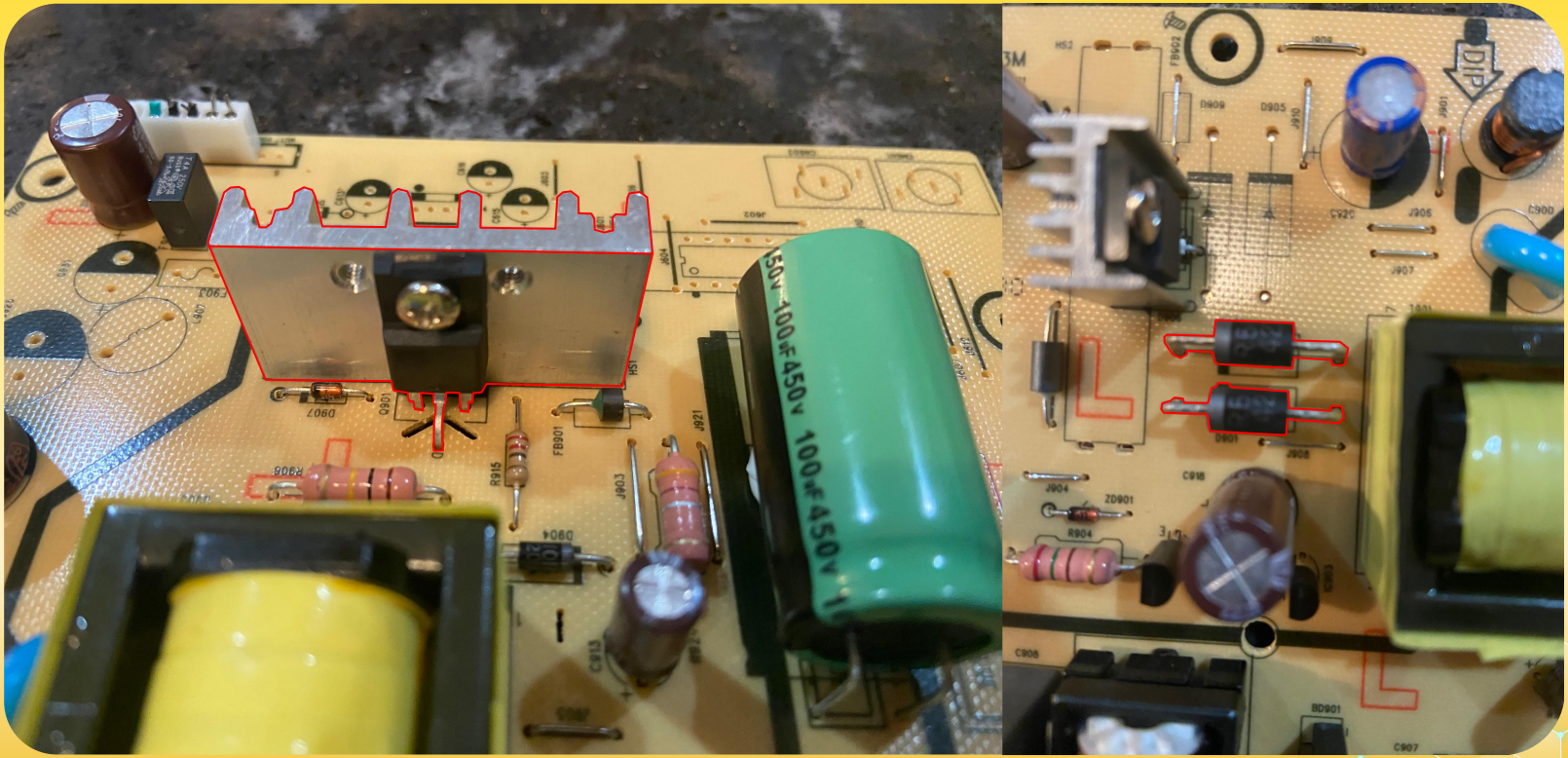
Step I: Transforming



First, a transformer steps-down the 110 AC volts into 19 AC volts so that the components can handle the voltage level given to them.

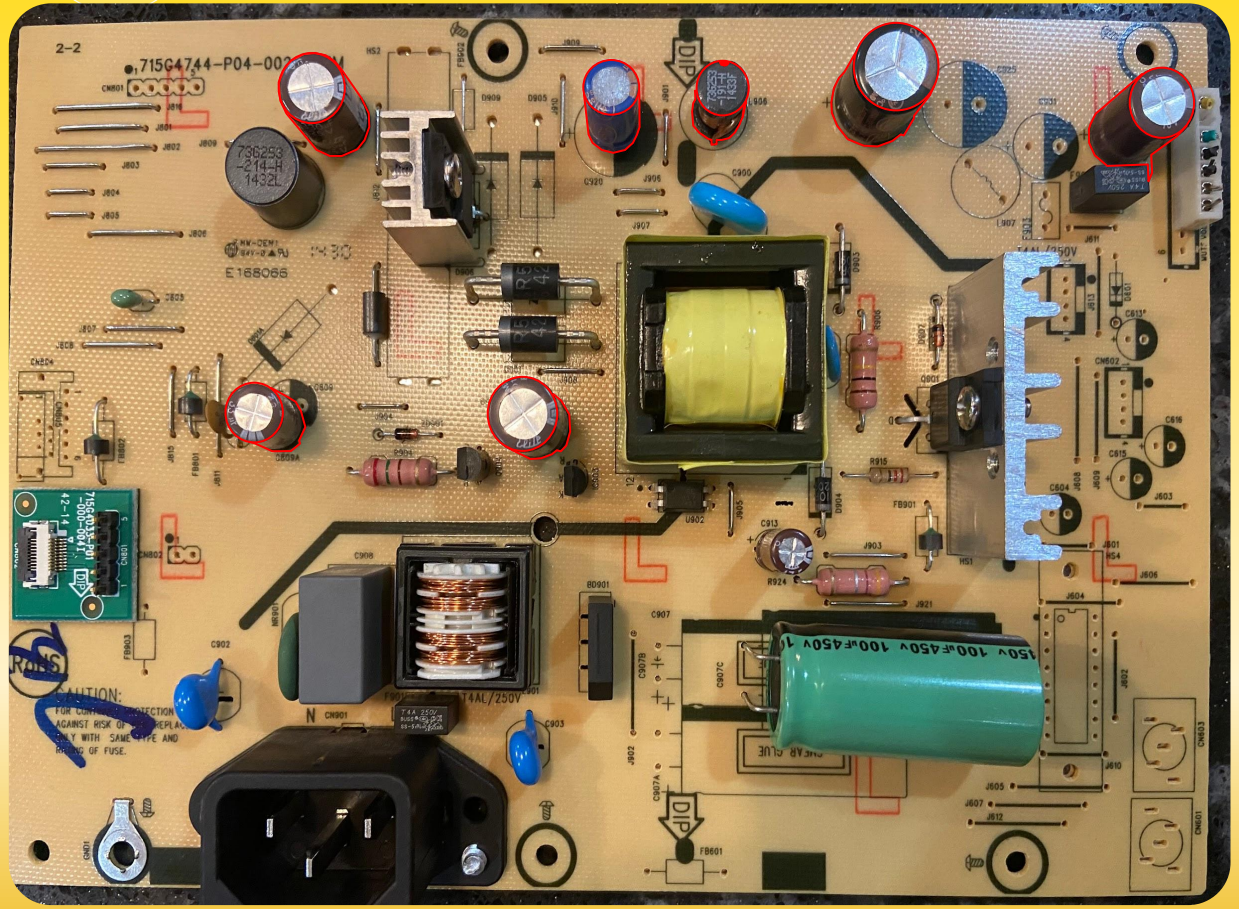
Step 2: Rectifying

The second step, known as rectification, turns the AC current into a DC current. This is done because AC currents can damage intricate electrical components.



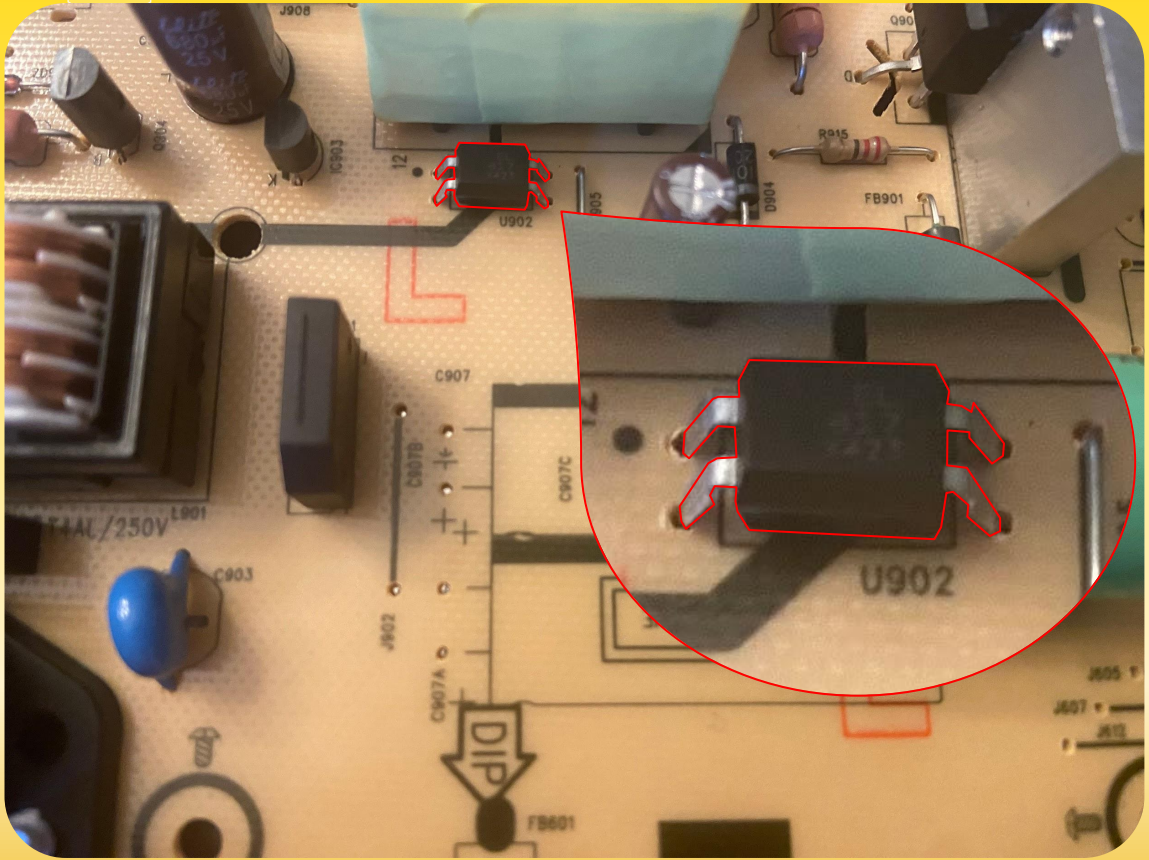
Bridge Rectifiers **Single Diode Rectifiers**

Step 3: Filtering



Next, capacitors filter out waves that are too high or too low. If a wave is out of a component's power range, it can damage the component.

Step 4: Regulating



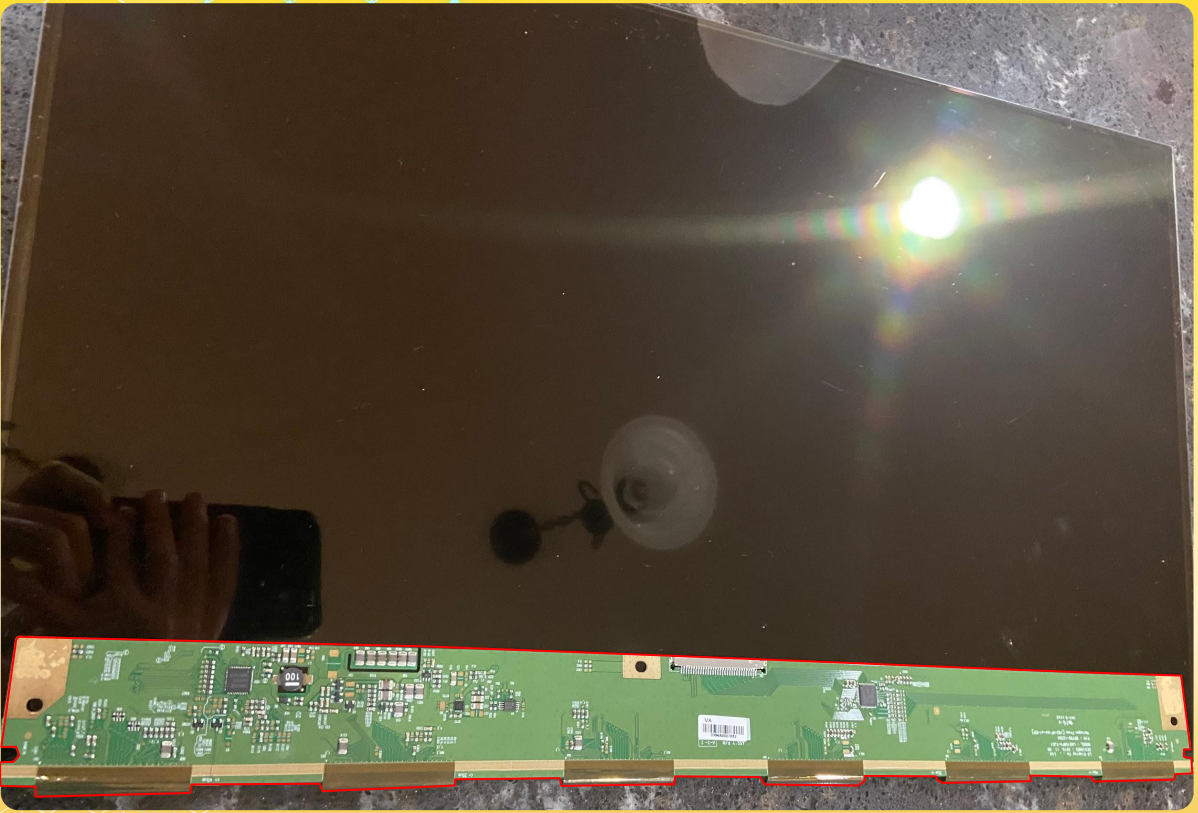
Regulator

Finally, the regulators filter out the capacitors' remaining outlier waves, ensuring a specific amount of power for each component.

LED Backlights

The backlights provide light to shine through the LCD panel.

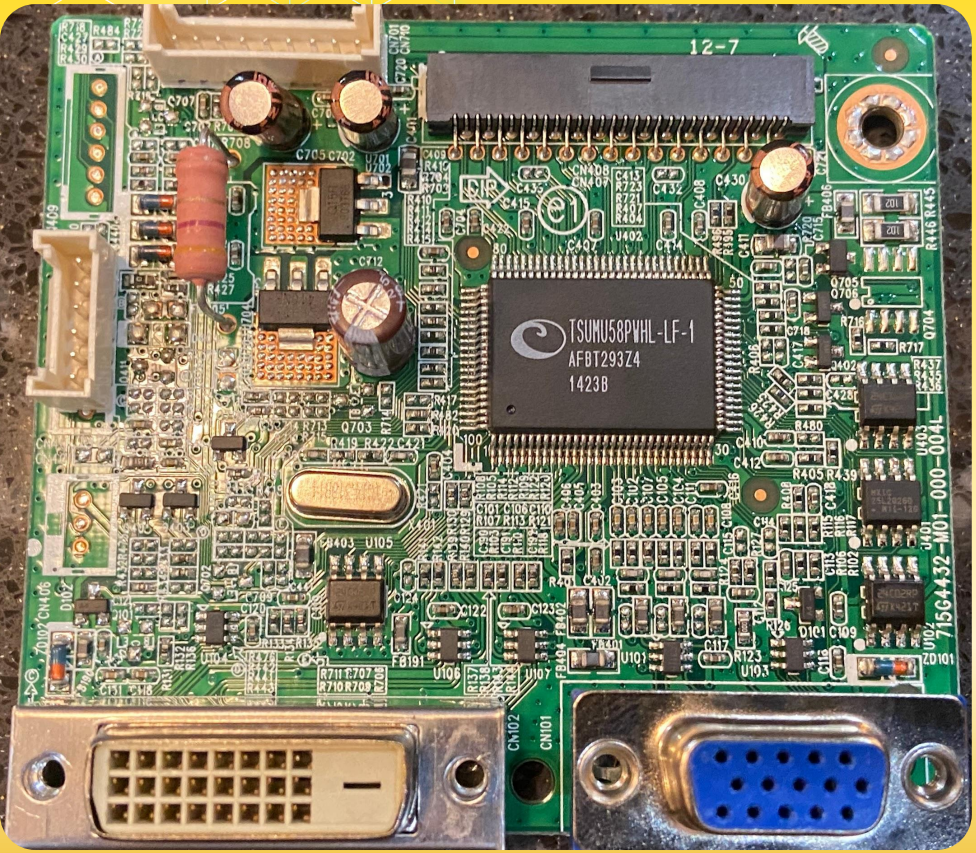
Timing Control Board



The Timing Control board

The timing control board is responsible for making sure each pixel gets its signal at the right time. The timing control board receives a signal from the main board, manages the timing of that data, and sends it to each individual liquid crystal pixel.

Main Board



The main board works alongside the timing control board. The main board translates the signal from the video input for the Timing-control board to understand. It also processes user inputs and manages communication between components.

LCD Panel

The LCD is used for color and image formation. It coordinates the individual pixels to form images. Color is made by turning on and off RGB sub-pixels.

Conclusion

Monitors work in a system revolving around their screen. We learned how the power taken in is managed and supplied to different mechanisms. We also learned how the video input is converted into a signal that coordinates each individual pixel on the LCD screen. This deconstruction taught us the complex yet comprehensible inner workings of monitor.