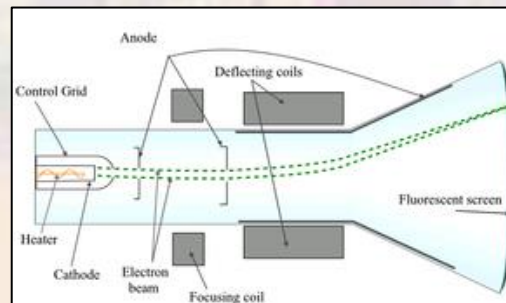


# VGA Basics

Last updated 7/19/23

# VGA Basics

- VGA – Video Graphics Array
  - Originally developed for CRTs (cathode ray tubes)

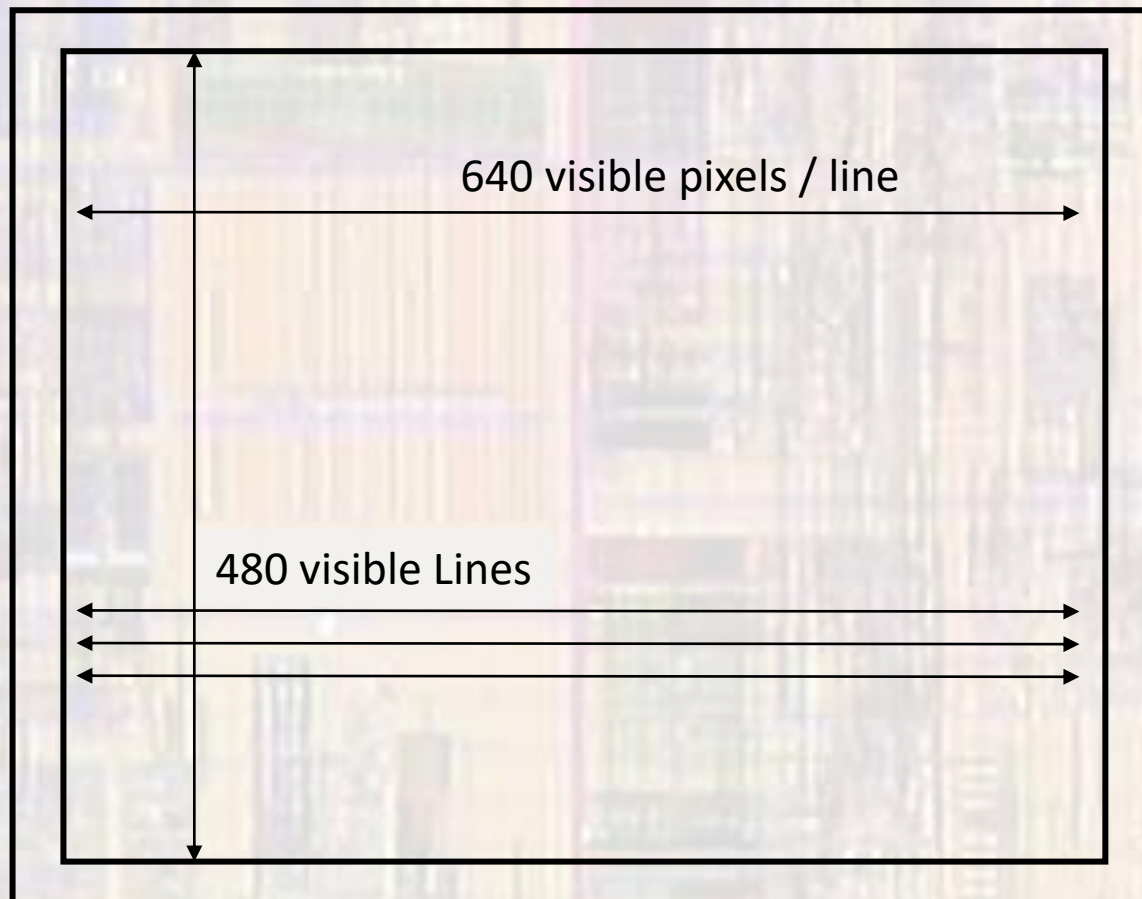


Src: wikipedia

- Electrons are scanned across the tube, energizing phosphorus to luminesce
- The VGA standards describe the order and timing of the scanning process
  - Defines the timing of the input signals
- Continues to be used in newer displays (LCD, LED, ...)

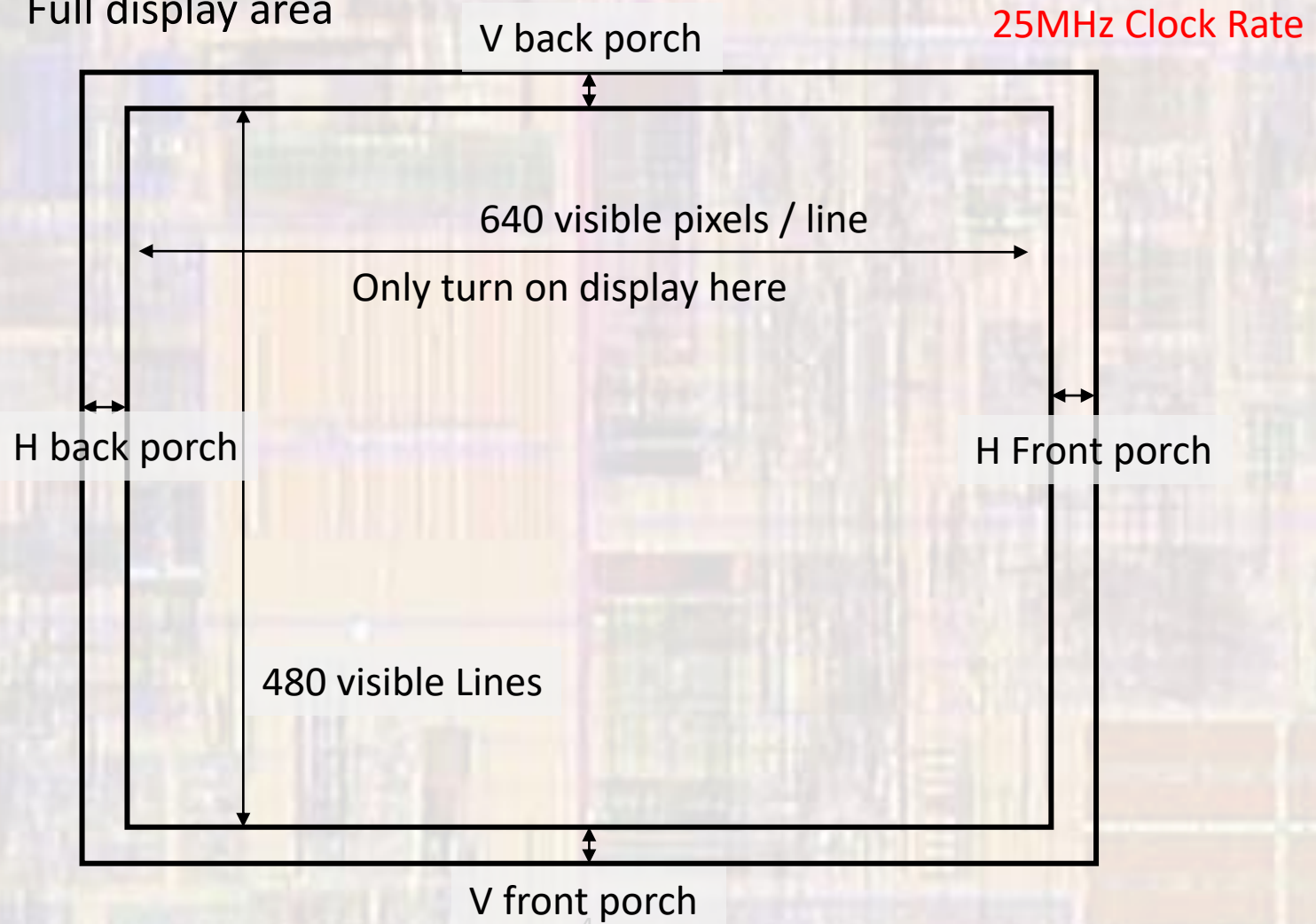
# VGA Basics

- VGA – 640 x 480
  - Visible display area



# VGA Basics

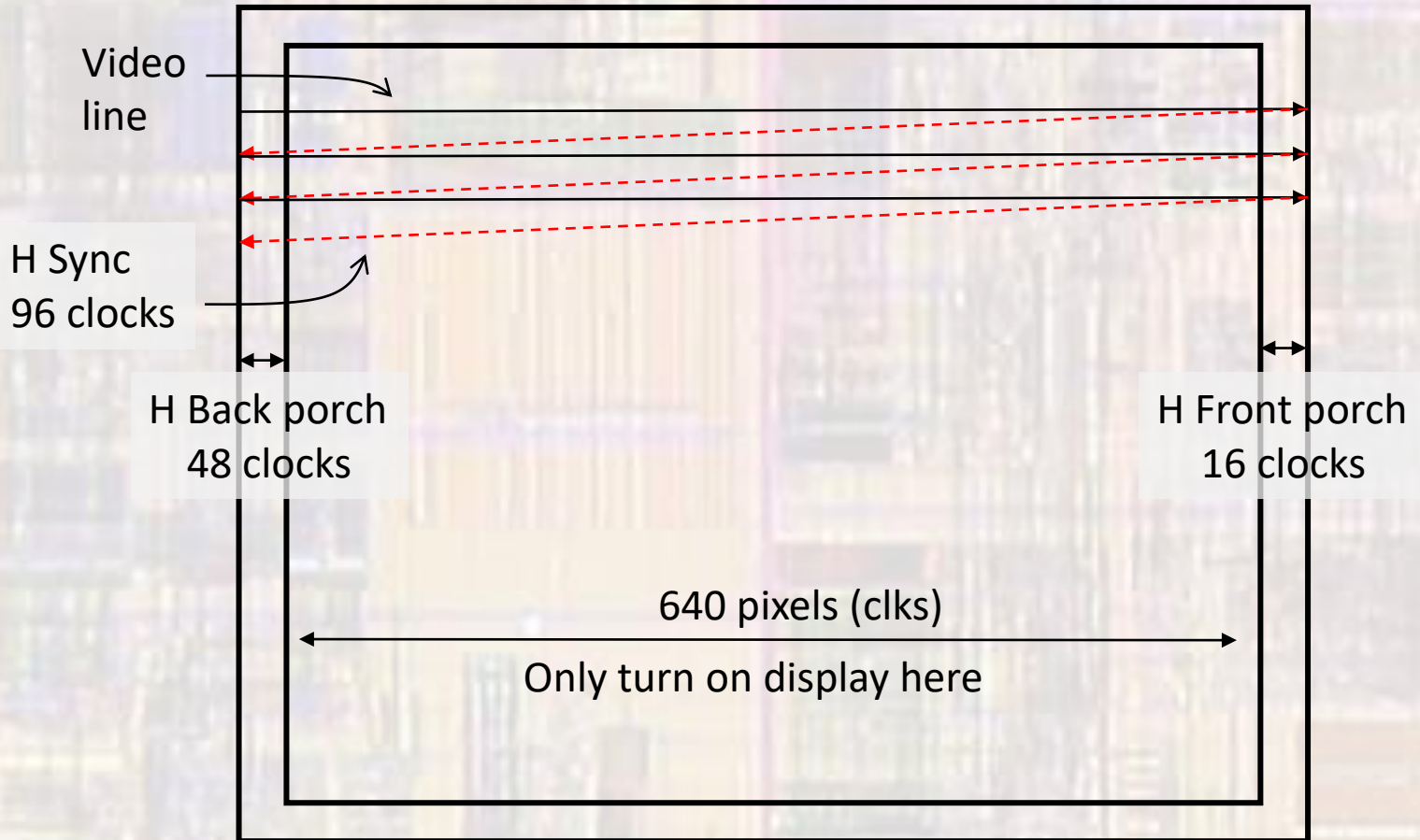
- VGA – 640 x 480
  - Full display area



# VGA Basics

- VGA – 640 x 480
  - Horizontal scan

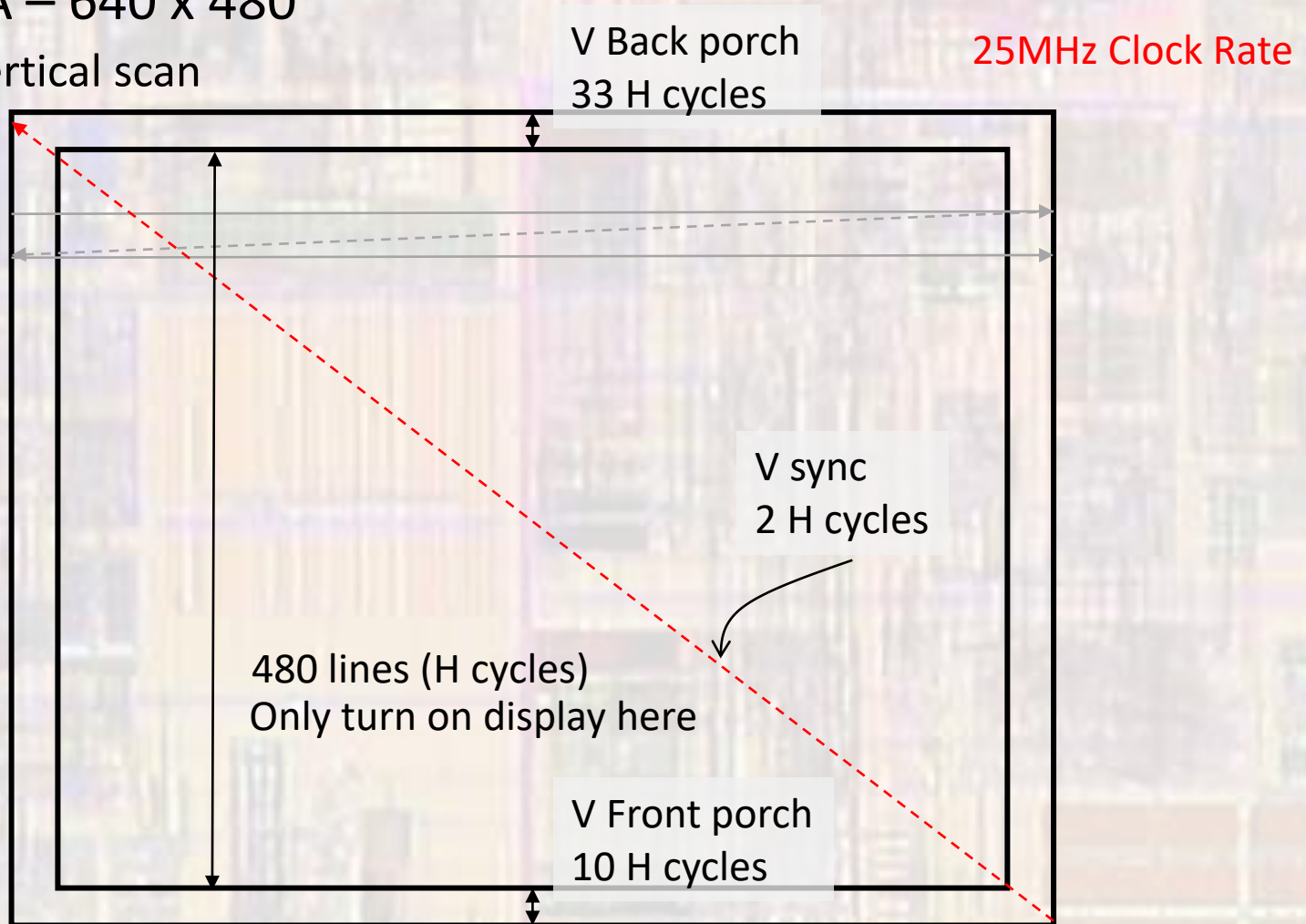
25MHz Clock Rate



$$1 \text{ H cycle} = (48 + 640 + 16 + 96 = 800) \text{ clock cycles}$$

# VGA Basics

- VGA – 640 x 480
- Vertical scan



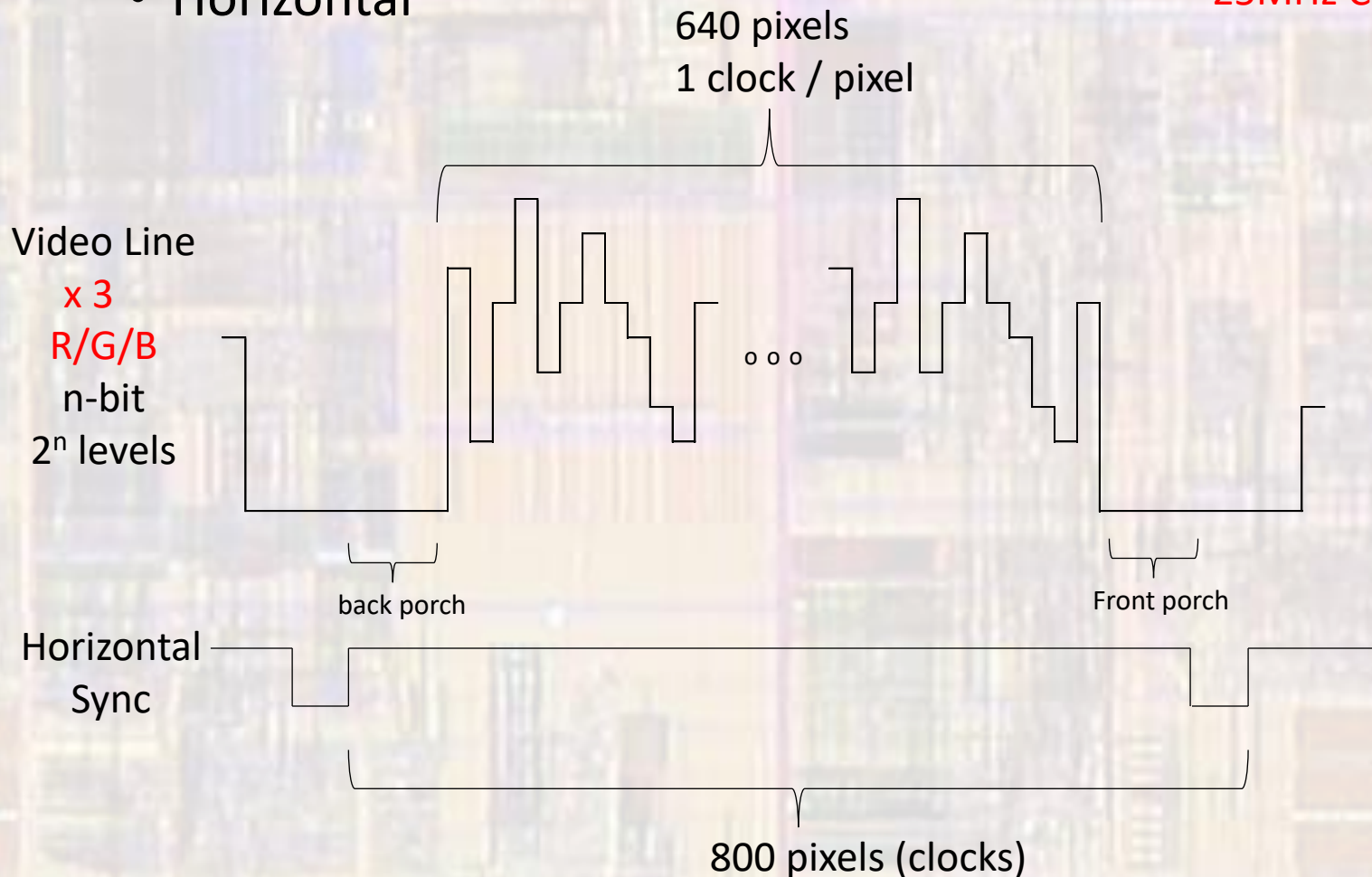
$$1 \text{ V cycle} = (33 + 480 + 10 + 2) \text{ H cycles}$$

# VGA Basics

- VGA Signal Timing – 640x480

- Horizontal

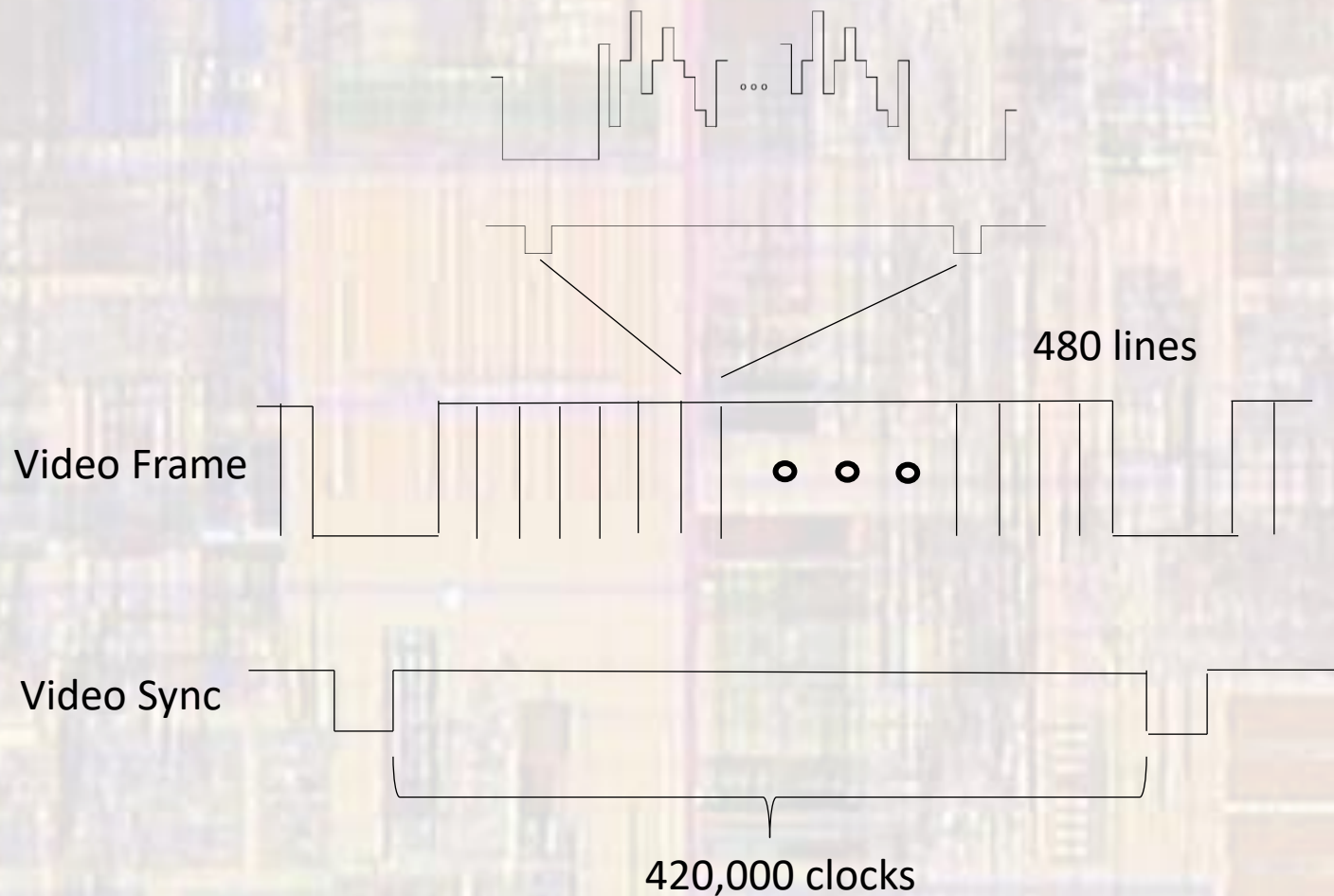
25MHz Clock Rate



# VGA Basics

- VGA Signal Timing – 640x480
  - Vertical

25MHz Clock Rate





# VGA Basics

- VGA Signal Timing – 640x480

$$800 \text{ clocks/H} * 525 \text{ H/V} * (1/(25 \times 10^6 \text{ clocks/sec})) = 0.0168 \text{ sec/refresh}$$

→ 59.524 Hz refresh rate

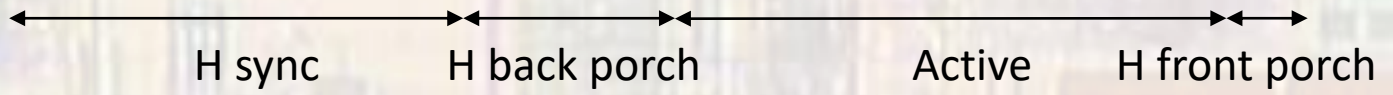
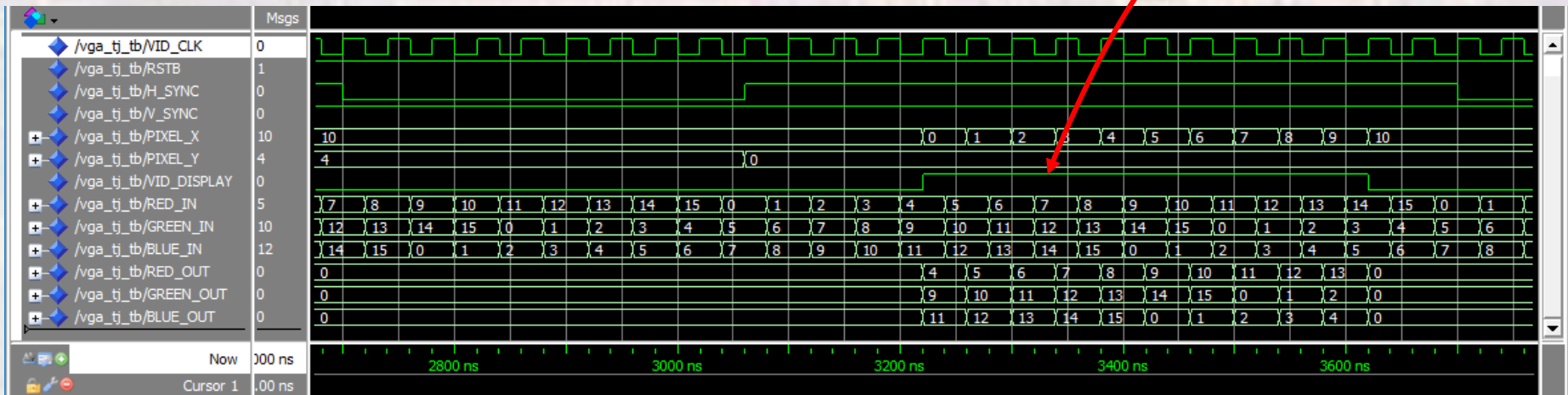
# VGA Basics

- VGA Signal Timing – test case

- Horizontal

- 4 – H Back Porch
- 10 - Active
- 2 – H Front Porch
- 9 – H sync

Display On



# VGA Basics

- VGA Signal Timing – test case

- Vertical

3 – V Back Porch

4 - Active

1 – V Front Porch

2 – V sync

Display On

