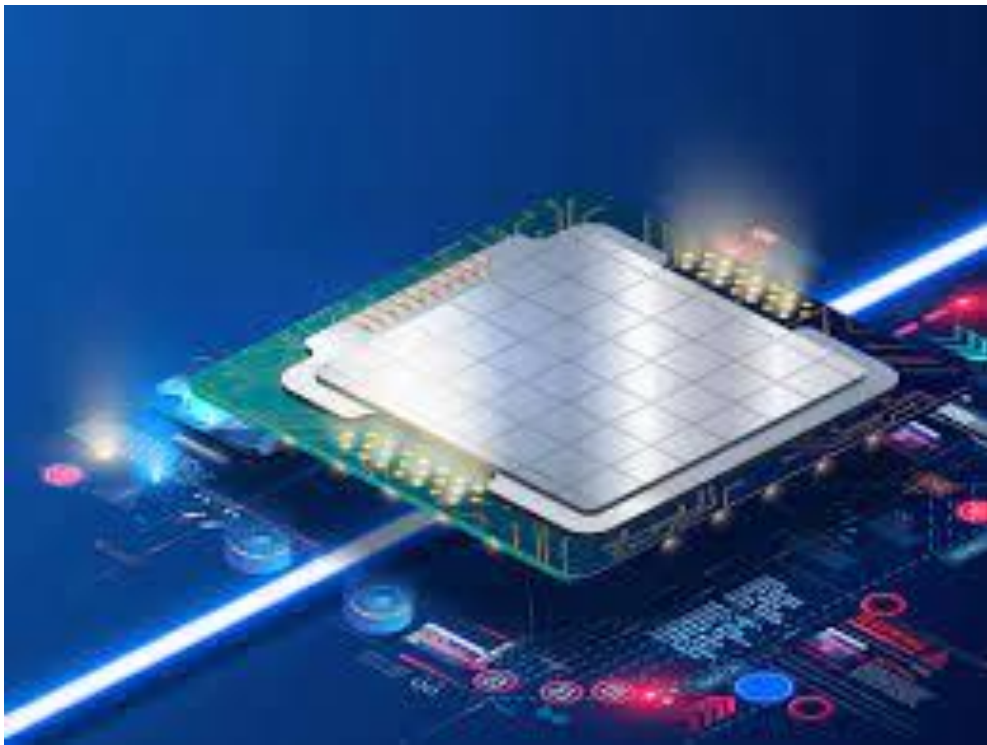


ECE 4514 REPORT

HW6: VGA Display Module



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I have neither given nor received unauthorized assistance on this assignment.

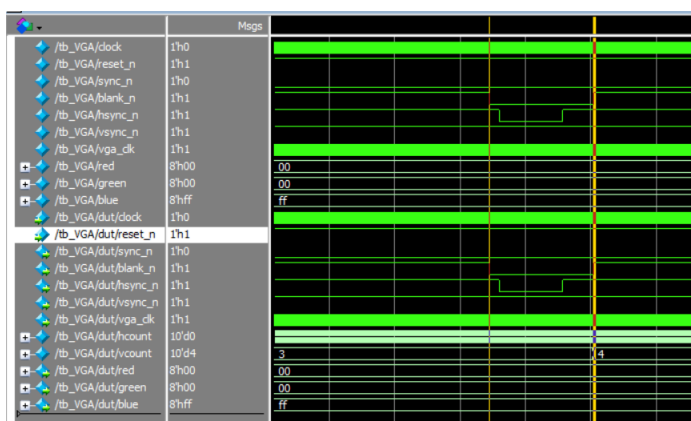
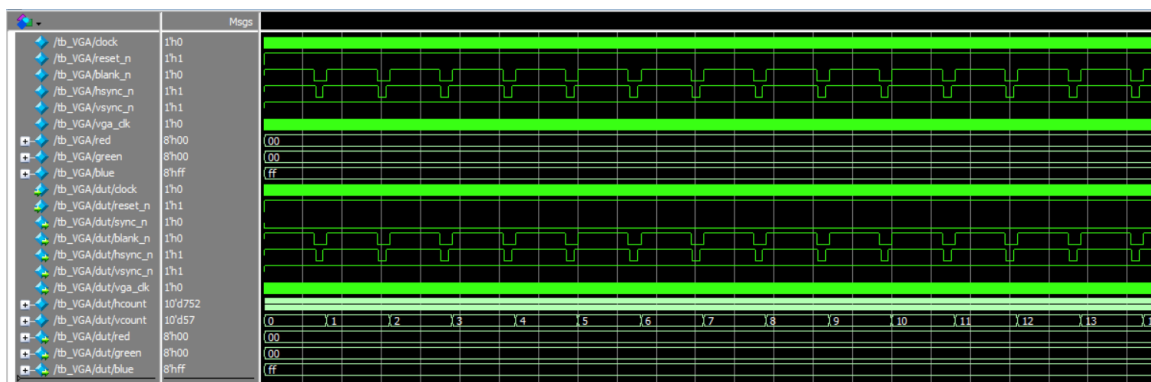
Overview of the Design

The goal of the project is to design a VGA display program. The top file consists of three modules, the PLL module to generate VGA clock at a specific frequency, the vga_controller to generate the VGA-related signals, and the pattern generator to decode the pixels to the colors.

The PLL is IP-based design. The VGA-related signals will be controlled by two counters: hcount and vcount, for visible area, back porch, sync pulse, and front porch. The pattern generator is about assigning a set of 24-bit values to the RGB sections.

Functional Verification

For testing, I just give an initial reset and check the outputs of the VGA signals and values, mainly focusing on the hsync_n, vsync_n, sync_n, and blank_n signals.



One main problem I met is that I didn't use the async_reset at the beginning. In this case, the submodules cannot be initiated by the reset_n signal, therefore no output was generated. It was then solved by applying asynchronous reset_n to the sequential blocks.

Frame Frequency Exploration

The vga_frequency is different from the system clock. Take a refresh frequency of 60Hz for example, the pointer needs to refresh the whole frame 60 times per second.

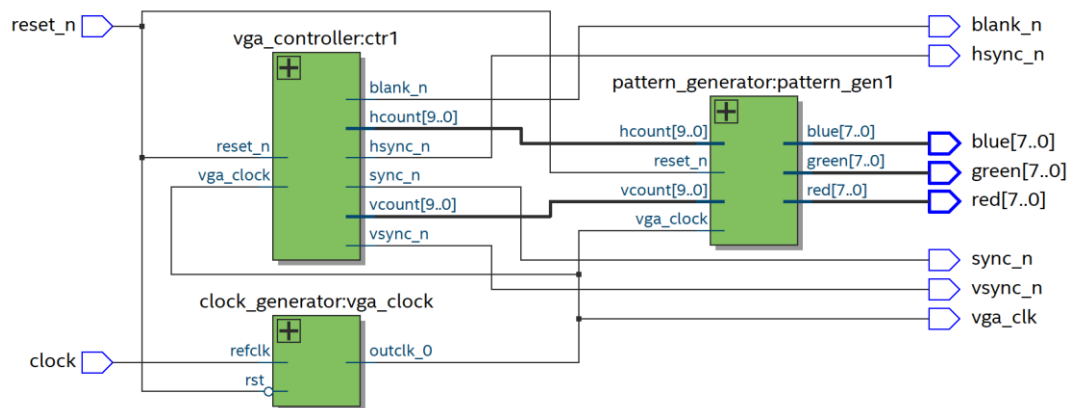
Assume the number of pixel per frame is 800 by 640, which is 5.12×10^5 . Then the number of pixels per second is $60 \times 5.12 \times 10^5 = 3 \times 10^7$.

Since the pointer need to change one pixel per vga_clock, the number of vga_clk per second is 3×10^7 . In other word, the frequency of vga_clk is around 3×10^7 Hz, which is 30 MHz.

In this design, I test two different frequencies: 25.175MHz, 30MHz, 10MHz

The case with 25.175MHz and 30 MHz can show functional results on the monitor, as shown in the last section. The case with 10 MHz cannot show any pixel on the monitor.

RTL Schematic of the top module



VGA Display

I shift the displayed color between red and blue at an adjustable speed. The `vga_clock` and the `vcount` are used to generate a flag bit, which is used to decide the number of frames between each shift.

