

Lab 6 Preliminary Report

Labwork 6
VGA Controller with VHDL
30.11.2018
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21601793 EE 102-2

- **Objective**

In this lab experiment, I will design a simulation with VHDL and I will display it on a screen using Basys3 and it's VGA port. 5 buttons are going to assigned for specific colors, so whenever user press color of the displayed screen will be changed. 1280x1024 resolution monitor and clock of the Basys3(100Mhz) will be used. Clock divider method will be used to obtain wanted clock/s.

- **Design Specification Plan**

In order to see the wanted view on the display, we need to implement some fundamental modules. In first module, we are going to count every pixel on the screen one by one. This counting event will be happening in the order of most significant (left) to least significant (right), after counting of the is done next row (downwards) will be counted and so on. To perform neatly we need to know the resolution specs of the monitor we are going to use, so we can determine right values to horizontal and vertical porches and sync pulses. In the second module, we will have simple paint module to change the color of the view. In VGA there are three primary colors red, green and blue and they all get 4-bit inputs, so we can obtain $2^4 \times 2^4 \times 2^4 = 4096$ different tone of colors. We are going to assign 12 switches for 12 bits (4-bit for red, 4-bit for blue and 4-bit for green), so user can change the color of the view manually.

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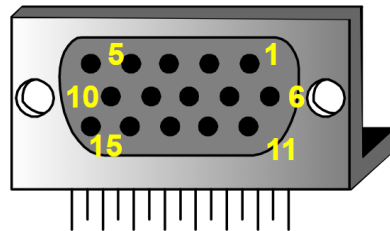
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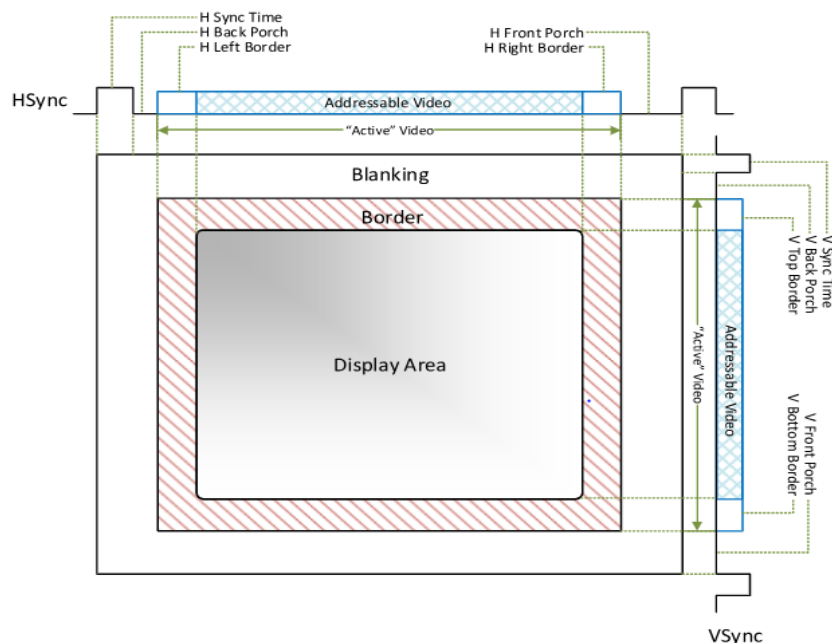
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• Proposed Design Methodology



Pin 1: Red	Pin 5: GND
Pin 2: Grn	Pin 6: Red GND
Pin 3: Blue	Pin 7: Grn GND
Pin 13: HS	Pin 8: Blu GND
Pin 14: VS	Pin 10: Sync GND

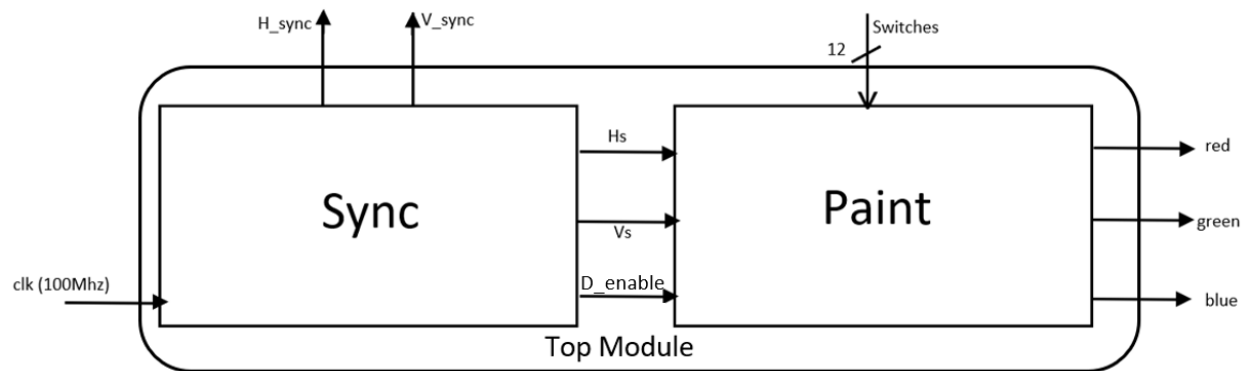
In VGA port, there are 15 pins. 2 of pins are Hs (horizontal sync) and Vs (vertical sync). Rest 12 pins are rgb pins (4 pin per each). H_sync and V_sync are changing in every clock pulse by increasing one. Hs and Vs are the coordinate variables (like x, y) and we are going to use these to paint. We have the coordinate map of the screen (pixels). But not all pixels are displayed from screen such as front, back porches and sync pulses. User will be changing the color of the active (displayed) area by changing the switches manually on Basys3.



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• VHDL Model



Sync module:

In this model, we are going to scan the screen and we will create coordinate map. We will be determining to create wanted pixel by looking at the Hs, Vs, H_sync and V_sync, if it is in the displayed area we will, if not we will not create.

Paint module:

In this model, we will set the initial values of rgb as all '1' s (all 4 bits will be 1, like "1111") so we will have a white screen at initial time. As user changes the switches, in every clock pulse we will display the new color of the view.

Top Module:

In this top module, we will be connecting the other two modules.