Basys Demo Reference Project

Revision: July 14, 2008

This document was produced by Digilent Romania. For questions, contact support@digilent.ro.

Overview

This document describes the project used to compile the Basys Demo configuration file. This configuration is loaded on the Basys platform flash after manufacturing test. The configuration file remains in the platform flash on the Basys boards (until erased/replaced by user) and serves as a Demo and self test for final users.

Functional Description

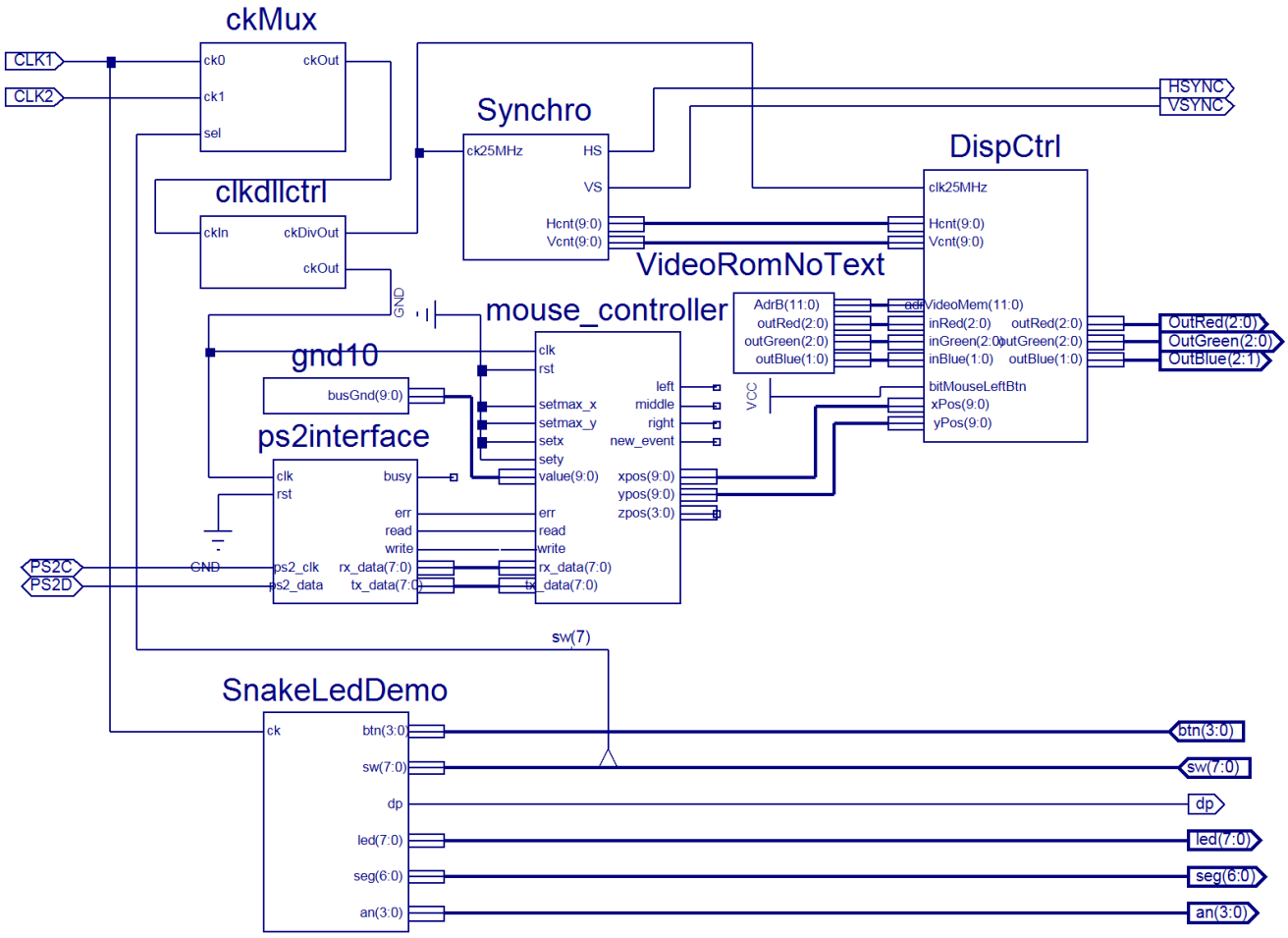

Figure 1 ***The Basys Demo Project***

Figure 1 shows the Basys Demo project block diagram. The behavior is explained below, with each block.

Copyright Digilent, Inc. All rights reserved. Other product and company names mentioned may be trademarks of their respective owners.

Port Definitions

Clock Signals

clk1	in, system clock (100MHz) from the RC oscillator IC6 (LTC6905)
clk2	in, system clock (50MHz) from the quartz oscillator (IC7 socket)

PS/2 Signals

PS2D	inout, PS/2 data
RS2C	inout, PS/2 clock

VGA Signals

HSYNC	out, horizontal sync
VSYNC	out, vertical sync
vgaRed	out 3-bit, red
vgaGreen	out 3-bit, green
vgaBlue	out 2-bit, blue

Seven-Segment Display Signals

seg	out 7-bit, cathode
an	out 4-bit, anode
dp	out, decimal point cathode

LED, Switch, Button Signals

led	out 7-bit, cathode
sw	in 8-bit, switch input
btn	in 4-bit, button input

VGA PS/2 Demo

The Basys Demo project contains the design for a VGA image generator. A moving colored pattern is shown on the VGA display (640X480, 60Hz mode). Red bars slide from the lower-right corner toward the upper-left one, green ones from left to right, and blue double-sided bars fall from the upper edge. For each color, the intensity decreases in steps from brightest to black. There are eight intensity bars for red and green (the VGA interface handles three bits for each) and just four levels for blue (only two bits in the VGA simplified “analog to digital converter”). While the fundamental colors move, all the combinations could be observed, generating all the colors that can be generated on the 8-bit VGA interface.

A Digilent logo is also shown on the VGA screen with black lines and white surfaces, except the ones in shadow, which degrade in five grey levels. A mouse is initialized for the first time when connected after the project is launched. It controls the position on screen of the Digilent logo, which acts as a mouse cursor. The anchor point (upper left corner) of the Digilent logo cannot leave the active VGA screen.

When sw7 is in the LOW position, the image generated by the Basys Demo project is poor quality. The reason for that is the unstable frequency generated by the RC oscillator IC6. This clock signal

Copyright Digilent, Inc. All rights reserved. Other product and company names mentioned may be trademarks of their respective owners.

(CLK1) is good for applications which do not require a very precise and stable frequency, but is not appropriate for more advanced projects (video, asynchronous serial transmissions, etc.).

When sw7 is in the HIGH position, CLK2 is used instead of CLK1. If a quartz oscillator (50MHz) is loaded in the IC7 socket, a much better quality image will be generated on the VGA display. (If no quartz oscillator is loaded in the IC7 socket or if the quartz oscillator does not generate a 50MHz clock signal, then the VGA PS/2 will not work at all).

All components in Figure 1, except SnakeLedDemo, are involved in the VGA PS/2 Demo.

ckMux

ckMux instantiates a BufGMux Xilinx Primitive. Based on the signal sel, ckOut is assigned CLK1/2 or CLK2. CLK1 is divided by two, to have the same frequency for ckOut, regardless of the value of sel. This way, the frequency stability can be compared between an RC oscillator (CLK1) and a quartz one (CLK2, if available).

ClkDllCtrl

The ClkDllCtrl component instantiates a CLKDLL Xilinx Primitive. The input signal ckIn (50MHz) is used to generate two output clock signals: ckOut (100MHz) and ckDivOut (25MHz).

Synchro

The Synchro component uses the 25MHz clock signal ck25MHz to generate the HS and VS VGA synchro signals and two counters: Hcnt (pixel counter) and Vcnt (line counter). The VGA mode implemented is 640x480, 60Hz frame frequency.

ps2interface, mouse_controller and gnd10

These files implement a mouse component, as described in the *Mouse Reference Component*. Since value input is not used, a 10-bit GND component is used to connect it to “0000000000”. The ps2interface was slightly modified in this project, adding the demoEnable input. When demoEnable is ‘0’, the ps2interface drives PS2C and PS2D, otherwise they are driven HighZ.

VideoRom

This file implements a ROM memory which encodes the Digilent logo for VGA representation. Each line in constant ROM defines a line in the logo. There are 64 lines, each with 64 pixels. A 3-bit palette is used to encode eight grey levels and green.

The colors are encoded:

- 0 = white
- 1...5 = decreasing intensity grey levels
- 6 = black
- 7 = green background (green = 50%, blue = 25%)

Output outData encodes the colors on 8-bit: outData(8 downto 0) = red(2 downto 0) & green(2 downto 0) & blue(1 downto 0).

Copyright Digilent, Inc. All rights reserved. Other product and company names mentioned may be trademarks of their respective owners.

DispCtrl

This file generates red, green, and blue color bars (decreasing intensity) which move on the screen in three directions. It also overlaps the Digilent logo at the position shown by the mouse_controller.

SnakeLedDemo

The SnakeLedDemo file contains the demo for the seven-segment display and the LEDs on the Basys board. Each switch controls the state of an LED (SW0 ->LED0, etc.). When the switch is ’1’ (UPPER position), the corresponding LED is ON, and vice-versa. A “fade” effect is added: when changing the switch position to ’1’, the corresponding LED increases intensity gradually from OFF to ON. This is done by supplying the LED with a pulse width modulated signal (PWM) which starts at ‘0’ duty factor (LED OFF), then increases the duty factor (increasing the LED light intensity) until reaching the duty factor ‘1’ (LED full ON). When turning the switch to ’0’, the duty factor (and the LED intensity) decreases.

The Snake is the demo on the seven-segment display. A curled up snake is represented on one of the seven-segment display digits. The segment light intensity is maximal for the snake head, but decreases towards the tail (again, PWM is used to control the light intensity). The snake likes to rest on the digit where the decimal dot is lit (target digit). Pressing a button moves the target to the corresponding digit (BTN0 -> Digit 0, etc.). Immediately, the snake begins to crawl towards the new target. It uncurls, slides through the midline of the display (the G segments of the intermediate digits), and curls back on the target digit.

Copyright Digilent, Inc. All rights reserved. Other product and company names mentioned may be trademarks of their respective owners.