Mouse Displayer Reference Component

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Overview

This document describes the VHDL implementation of a mouse cursor. The Mouse Displayer Reference Component source file is mouse_displayer.vhd. The mouse controller is used along with the mouse component when the project also involves a VGA display. The cursor is displayed in front of the image on the VGA display.

The Mouse Displayer Reference Component receives the current position of the mouse, the position on screen of the currently displayed pixel, the blank signal, the color channel data to be displayed from the underlying layer (the image layer), and the global clock.
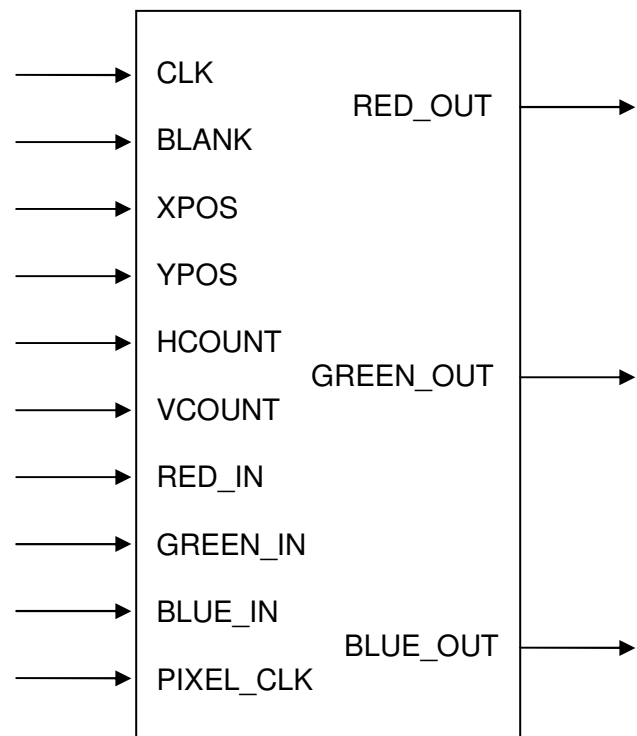
The cursor image is kept in a 256x2 bit ROM. When the horizontal and vertical coordinates are within the region of the mouse cursor, the non-transparent mouse pixels are displayed.

Functional Description

The mouse position is received from the mouse_controller. Horizontal and vertical video counters are received from the vga_module. If the counters are inside the mouse cursor bounds, the cursor image is sent to the screen instead of the received pixels. The mouse cursor is 16x16 pixels and uses three colors: white, black, and transparent.

The cursor image is stored in a 256x2 distributed RAM memory. Two bits are used for color encoding: "00" for black, "01" for white, "10" or "11" for transparent (input colors are output). This way, the mouse cursor will appear as an arrow instead of a 16x16 square.

The RAM memory address is computed based on the difference of the VGA counters and the mouse position. The xdiff is the difference of four bits (because the cursor is 16 pixels wide) between the horizontal VGA counter and the xpos of the mouse. The ydiff is the difference of four bits (because the cursor is 16 pixels tall) between the vertical VGA counter and the ypos of the mouse. The memory address of the current pixel is obtained by linking ydiff and xidff (in this order). Distributed memory is used to store the mouse cursor, to save the block RAM for storing images. If blank input from the vga_module is active, this means that the current pixel is not inside the visible screen and color outputs are set to black.

The Mouse Displayer Component

Port Definitions

clk	global clock signal (100MHz)
pixel_clk	input, from pixel_clock_switcher, the clock used by the vga_controller for the current resolution, generated by a dcm. 25MHz for 640x480 and 40MHz for 800x600. This clock is used to read pixels from memory and output data on color outputs.
xpos	input, 10 bits, from mouse_controller, the mouse x position relative to upper left corner
ypos	input, 10 bits, from mouse_controller, the mouse y position relative to upper left corner
hcount	input, 11 bits, from vga_module, the horizontal counter from the vga_controller (the horizontal position of the current pixel on the screen)
vcount	input, 11 bits, from vga_module, the vertical counter from the vga_controller (the vertical position of the current pixel on the screen)
blank	input, from vga_module, active if current pixel is not in visible area, (color outputs should be 0)
red_in	input, 4 bits, from effects_layer, red channel input of the image to be displayed
green_in	input, 4 bits, from effects_layer, green channel input of the image to be displayed
blue_in	input, 4 bits, from effects_layer, blue channel input of the image to be displayed
red_out	output, 4 bits, to vga hardware module, red output channel
green_out	output, 4 bits, to vga hardware module, green output channel
blue_out	output, 4 bits, to vga hardware module, blue output channel