# Video Tutorial

This tutorial provides a method for using the VGA video output from the DE1_SoC. With this tutorial is included a package of code files which implement the video driver. These code files have been adapted from example code developed by Altera.

## Using the Video Driver

The video driver included with this tutorial is designed to offer a very simple interface for common video needs. The driver module contained in video_driver.sv is parameterized with WIDTH and HEIGHT. Any resolution up to the native resolution of the interface, 640 wide by 480 high, may be specified by the user. The driver provides the user with x and y coordinates of the current pixel (origin is the upper left corner), and the user provides the driver with a color to draw at that pixel, which must be valid within two clock cycles of the coordinates changing. Colors are expressed as three 8-bit, unsigned integers, each specifying the light intensity in its respective color channel, red, green, or blue.

- CLOCK_50 – 50MHz clock provided by user
- reset – an active high synchronous reset provided by user
- x – 10-bit unsigned integer x coordinate provided by driver
- y – 9-bit unsigned integer y coordinate provided by driver
- r, g, b – 8-bit unsigned integer color channels provided by user
- All other ports are used to drive the VGA and should be connected to top level pins of the same name

## Details of Video Resolution

The VGA interface implemented only supports 640x480 resolution, so user specified resolutions are emulated by creating large user pixels from several pixels in the native resolution. The driver achieves this by selecting an integer that specifies both the width and height in native resolution pixels of each user pixel. This integer is chosen such that the user pixels are as large as possible without any of the display being cropped out. The region which the user draws in is centered on the display and any margins to the top and bottom or left and right are colored black. This scheme is optimal in that it provides the largest display with uniform pixels sizes and no stretching or non-square pixels.