VSDSquadron FPGA Mini Board Documentation

Objective:

This document outlines the process of understanding, documenting, and integrating a Verilog code with the VSDSquadron FPGA Mini board. The objective is to review the provided Verilog code, create the necessary PCF file, and successfully program the FPGA board, verifying its functionality through the RGB LED outputs.

Step 1: Understanding the Verilog Code

Purpose of the Module

The Verilog module is designed to control the RGB LED of the VSDSquadron FPGA Mini board. It takes a hardware oscillator clock input and generates a frequency counter that drives the RGB LED.

Description of Internal Logic and Oscillator

The internal oscillator (SB_HFOSC) is instantiated to generate a clock signal. This signal drives the frequency counter, which, in turn, controls the RGB LED outputs (led_red, led_blue, led_green). The module also includes a testwire output for debugging purposes.

Functionality of the RGB LED Driver

The RGB LED driver uses the internal oscillator output to manipulate the LED color. Current parameters are defined for optimal brightness and color intensity.

Step 2: Creating the PCF File

Pin Mapping

The following pin assignments are made based on the PCF file and the FPGA Mini board datasheet:

led_red -> Pin 39

led_blue -> Pin 40

led_green -> Pin 41

hw_clk -> Pin 20

testwire -> Pin 17

Significance

Each pin is chosen according to the board's configuration, ensuring proper signal routing to the RGB LED and clock input.

Step 3: Integration with the VSDSquadron FPGA Mini Board

Board Connection

Connect the VSDSquadron FPGA Mini board to the computer using a USB-C cable. Ensure the FTDI connection as described in the datasheet.

Programming the FPGA

1. Clean previous builds: make clean
2. Build the design: make build
3. Flash the FPGA: sudo make flash

Verification:

Observe the RGB LED on the FPGA board to confirm successful programming. The LED should display colors as per the logic defined in the Verilog code.

Step 4: Challenges and Solutions

During the integration process, the following challenges were encountered:

Incorrect pin assignment leading to no LED response. Fixed by cross-referencing the PCF file with the board datasheet.

Flashing errors resolved by checking USB permissions and installing necessary drivers.

Step 5: Conclusion

The Verilog code was successfully integrated with the VSDSquadron FPGA Mini board. The RGB LED displayed the expected patterns, confirming the correctness of the implementation. The project files and documentation are hosted on GitHub for future reference and improvements.