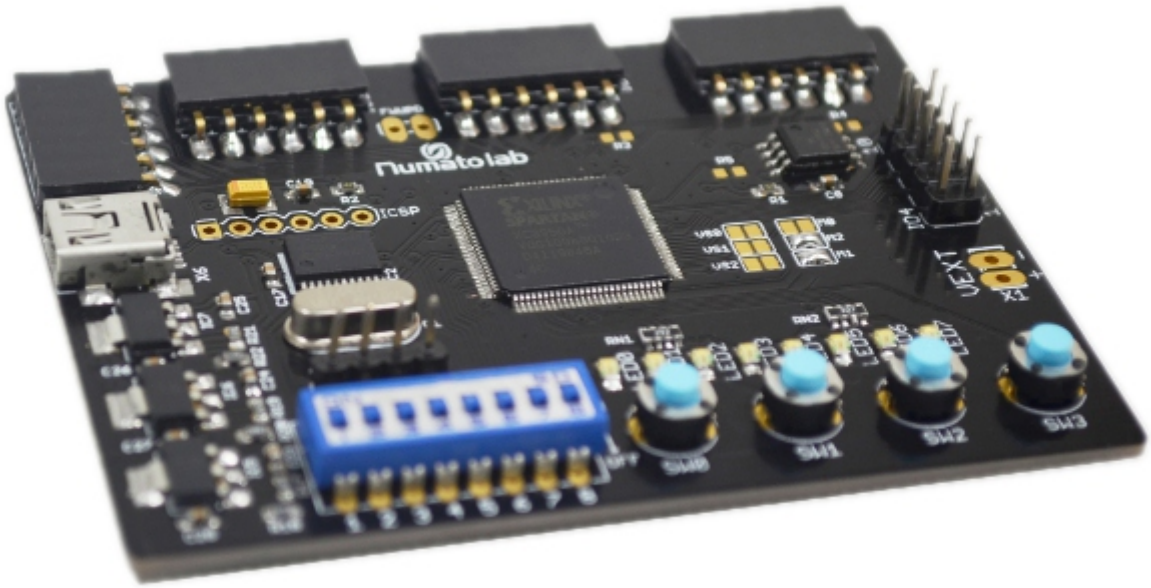
Elbert - Spartan 3A FPGA Development Board User Guide



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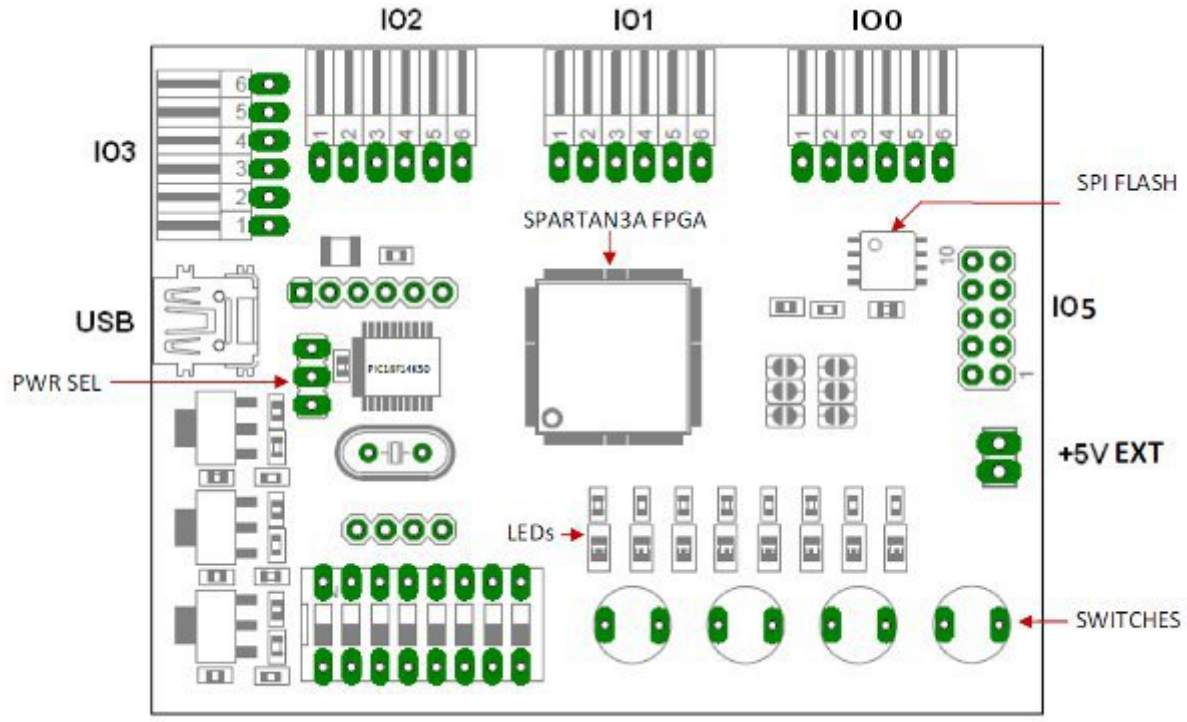
Introduction

ELBERT is a simple but versatile FPGA Learning/Development board featuring Xilinx Spartan 3A FPGA. ELBERT is an excellent choice for beginners and advance learners for experimenting and learning system design with FPGAs. This development board features Xilinx XC3S50A 100 pin FPGA with maximum 68 user IOs (Some are dedicated for system). USB2 interface provides fast and easy configuration download to the on board SPI flash. Yes that's right! You don't need a programmer or special downloader cable to download the bit stream to the board. ELBERT features a stable clock source which is derived from on board configuration controller. ELBERT incorporates LEDs and switches for a curious user to get started with his "Hello World" program in a matter of minutes.

Connection Details



This diagram should be used as a reference only. For detailed information, see ELBERT schematics at the end of this documentation. Details of individual connectors are as below.

1. USB

This USB mini connector is used for host interface and power. The board should be connected to a powered USB Port.

2. IO Expansion (IO5)

Connected to FPGA user IOs. See schematics for individual connection details.

3. Module Expansion (IO1 – IO4)

The module headers can be used to attach optional peripheral modules. Find details about peripheral modules elsewhere in this document.

4. Optional External 5V Input

For standalone operation, ELBERT cat be powered from an external 5V power supply. This power supply input is optional if using USB. The solder jumper SJ7 on the back side for the board needs to changed to "EXT POWER" inorder to use optional external 5V input.

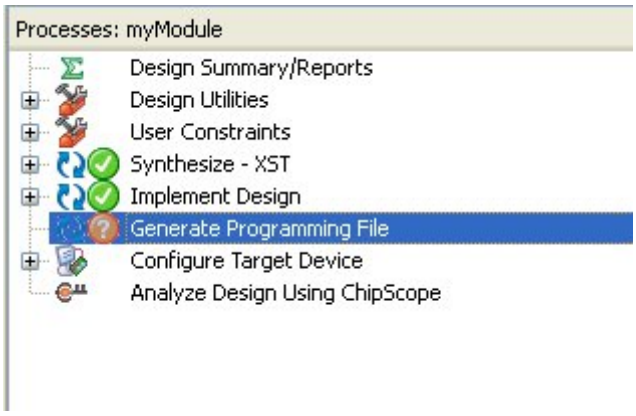
Powering Up ELBERT

ELBERT is powered directly from USB port so make sure you are using a USB port that can power the board properly. It is recommended to connect the board directly to the PC instead a hub. It is practically very difficult to estimate the power consumption of the board as it depends heavily on your design and the clock used. Xilinx ISE has tools to estimate the power consumption. In any case if power from USB is not enough for your application, external 5V can be applied to the board. Jumper PWRSEL should be set up properly to use the board on external power. ELBERT requires three different voltages. Two 3.3V supplies and a 1.3V supply. Onboard regulators derive these voltages from the USB/Ext +5V. The board is shipped with test program already loaded to FPGA and when powering up the board for the first time you can see the test pattern on LEDs and can interact with the board using the switches.

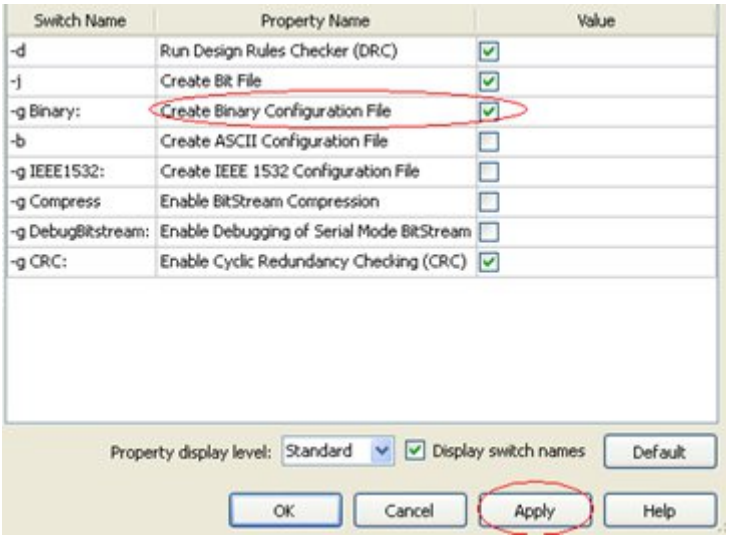
Generating Configuration Bit Stream for ELBERT

HDL design needs to be converted to bit stream before it can be programmed to FPGA. ELBERT at this time accepts only binary (.bin) bit stream created by XILINX ISE (http://www.xilinx.com/tools/webpack.htm [1]). Once the HDL is synthesized, it is easy to create a binary bit stream out of it. Please follow the steps below to generate binary bit stream from your design using ISE WebPack.

1. Right click on the "Generate Programming File" option in "Processes" window.



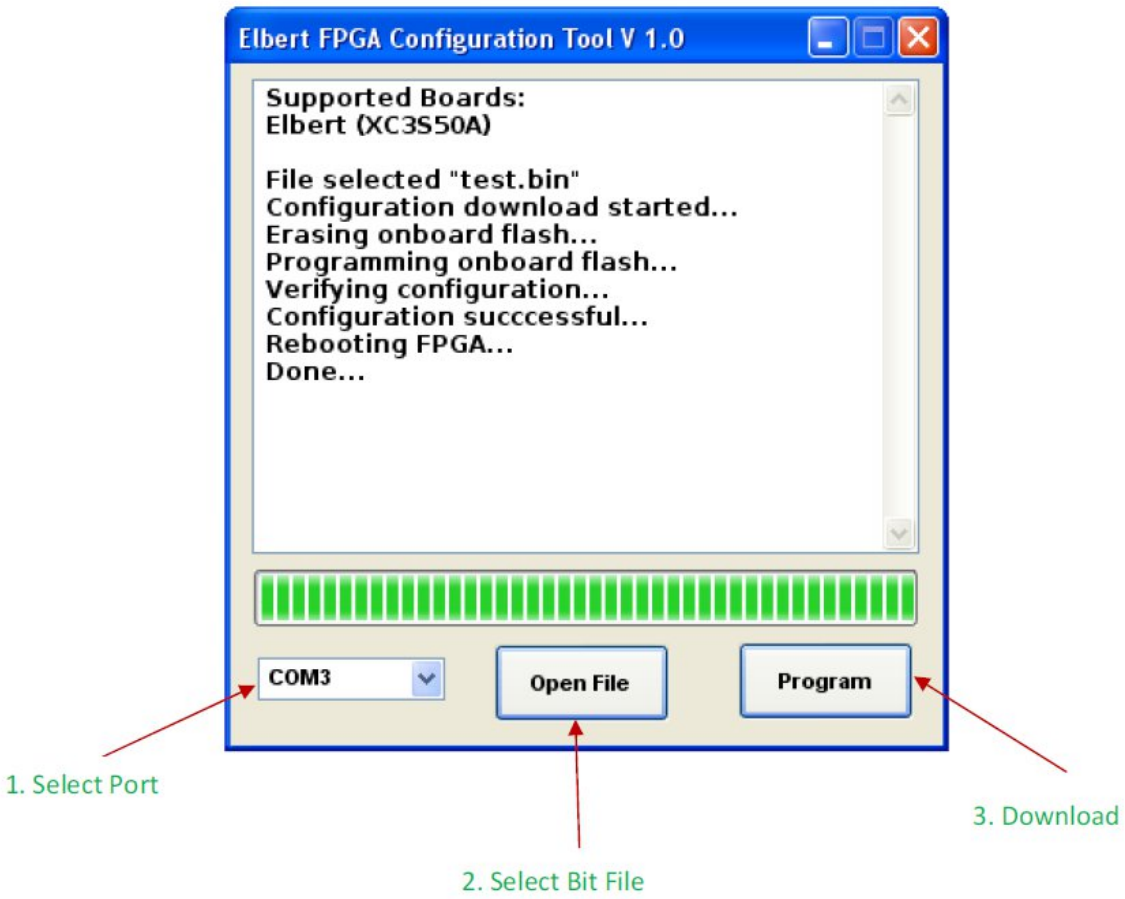
2. Select "Process Properties" from the popup menu. In the dialog box, check "Create Binary Configuration File" Check box and click "Apply".



3. Click “OK” to close the dialog box. Right click on “Generate Programming File” option again and select “Run”. Now you will be able to see a .bin file in the project directory and that file can be directly used for ELBERT configuration.

Programming ELBERT

ELBERT has an on-board microcontroller which facilitates easy reprogramming of on-board SPI flash through USB interface. The microcontroller receives bit stream from the host application and program it in to the SPI Flash and lets the FPGA boot from the flash. The ELBERT configuration application can be downloaded from www.numato.com [2] for free. When ELBERT is connected to PC, it shows up as a COM port in Device Manager. Run configuration application, select proper COM Port before downloading bit stream. Click on “Open File” to select the bit stream file (.bin) and press “Program” button to download the bit stream. Wait till the download process is finished. Once the download process is over, the configuration controller will try to boot the FPGA from the SPI Flash automatically.



On-Board Peripherals

ELBERT is shipped with 1Mbit SPI flash memory on-board which is primarily used for configuration storage. The first 500 kilobytes of SPI Flash memory will be used by configuration storage and rest of the memory space can be used for user defined purposes. Be careful not to write anything to first 500KB while using this memory for data storage.

8 LEDs, four micro switches and one DIP8 switch are provided on-board for user defined purposes. These peripherals are connected to FPGA IOs and can be controlled from user RTL. The switches do not have pull-ups on board so make sure to enable week pull ups on corresponding IOs in your design.

A 12MHz clock derived from the on board microcontroller oscillator circuit is available on FPGA's GCLK14 (Pin No. 40). This clock can be used to drive any user logic implemented inside the FPGA. Other frequencies can be generated using DCMs available on FPGA.

IO Connectors

The IOs that are not used for system purposes are available for user defined applications on headers IO1, IO2, IO 3, IO4 and IO5. IO1, IO2, IO3 and IO4 have four IOs along with 3.3V supply and ground. These headers can be used to connect optional peripheral modules or user defined circuitry. For more information on IO connectors, refer to ELBERT schematics.

Schematics and Files

Please download Schematics, Configuration Downloader tool and User constraints file from the product page. [3]

Links:
[1] http://www.xilinx.com/tools/webpack.htm
[2] http://www.numato.com/
[3] http://numato.com/elbert-spartan-3a-fpga-development-board