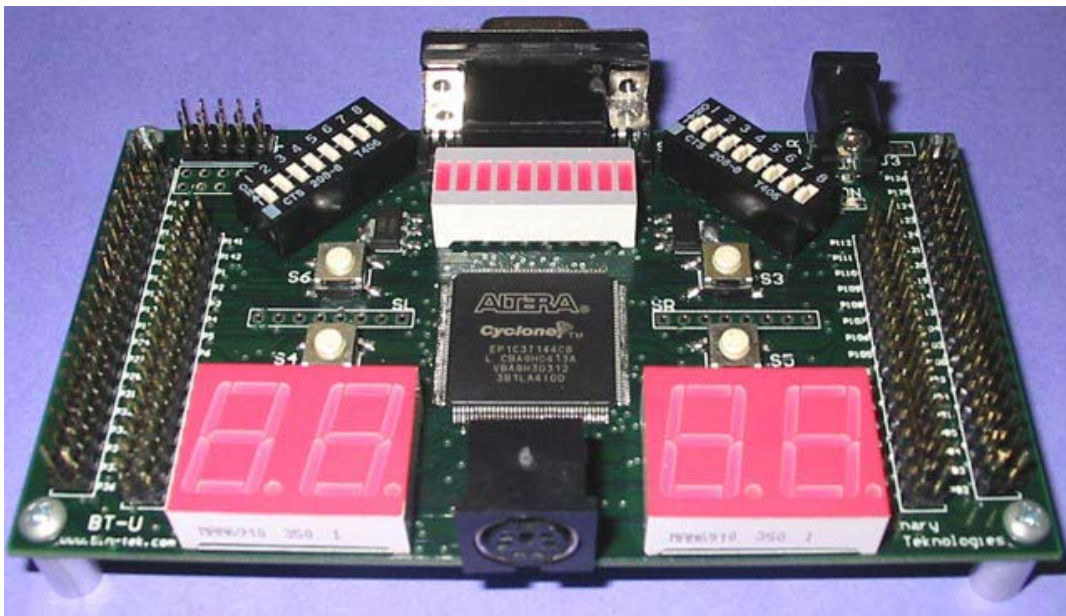


# BT-U User Manual

Presented by Binary Teknologies



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Please just be careful and ask questions to things you do not know.

## INTRODUCTION

At Binary Teknologies, we designed the BT-U board to meet the needs of university students, hobbyists and engineers. As with our entire product line, we strive to offer affordable tools for designing and implementing digital systems. The BT-U board is a great platform to learn about FPGAs and implementing VHDL and VERILOG designs.

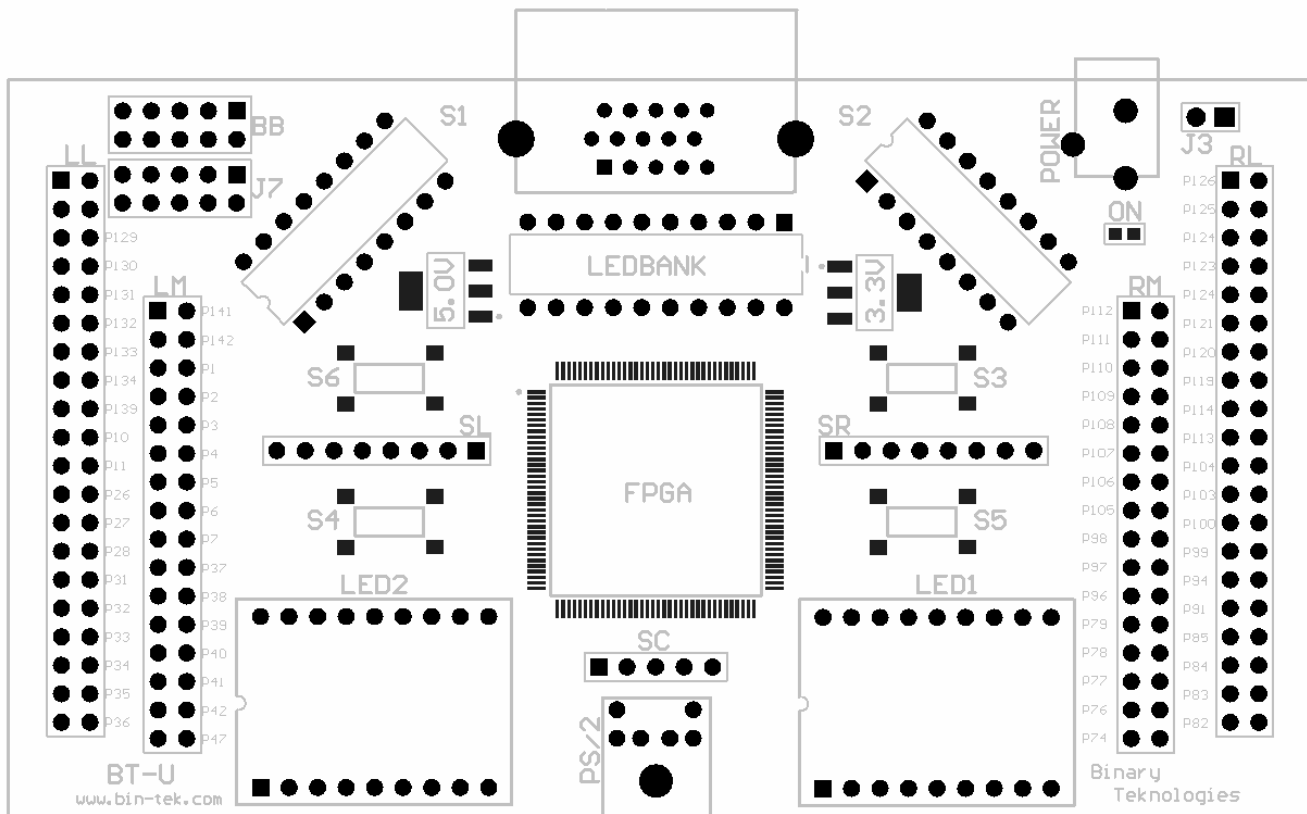
## PACKING LIST

- BT-U Board with box
- 12V 800mA Power Supply
- (2) 80-pin male wire-wrap headers
- (4) mounting bolts and nuts
- BT-Blaster (if purchased)

## FEATURES

- The Cyclone device (**EP1C3T144**) is mounted on the BT-U board with 98 I/Os conveniently available via male headers.
- Two dual-digit 7-segment displays and 8-pin DIP switches are also available via male headers, which you can use a jumper or wire-wrap to connect to the I/O pins.
- Four push buttons, a VGA connector, 10-LED bank array and a PS/2 port are the other peripherals that are accessible via headers (wire-wrap or jumper).
- Power LED to indicate power state of board
- The BT-U board regulates both 5V for peripherals, 3.3V for I/O and 1.5V for the FPGA core from the power jack.
- 3.3V power header is available to power off-board devices
- The four-pin Clock is a 25.1752MHz oscillator and is connected to all clock inputs on the Cyclone device.
- The on-chip PLL can be used to multiply the 25MHz clock up to 275 MHz.
- A JTAG connector is provided to configure the Cyclone device.
- Serial programming socket is available for soldering your own serial device to auto-program the FPGA upon boot up.

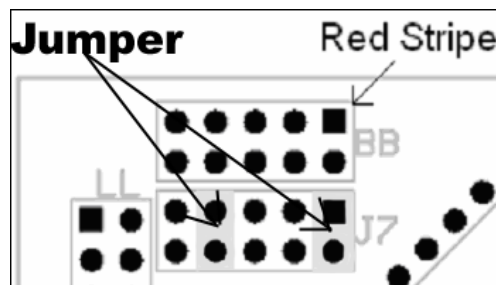
## BT-U BOARD DESCRIPTION



*Figure 1. BT-U Block Diagram*

### BB HEADER

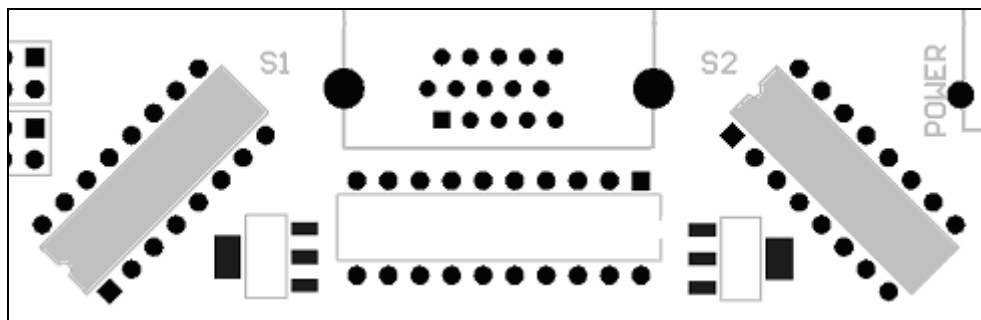
The 10-Pin female plug on Altera's byte blaster or Binary Technologies BT-Blaster cable connects to the BB 10-pin male header on the BT-U board. The board provides power and ground to the programmers. Data is shifted into the devices via the TDI pin and shifted out via the TDO pin. When connecting a programmer, make sure the red-stripe is on the same side as the 'BB' label. ***Please also note*** that two jumpers (or wire-wrap wires) are needed on J7 located below the BB header in order to program your device.



*Figure 2. JTAG Connector for programming*

S1 and S2 8-Pin Dip Switches

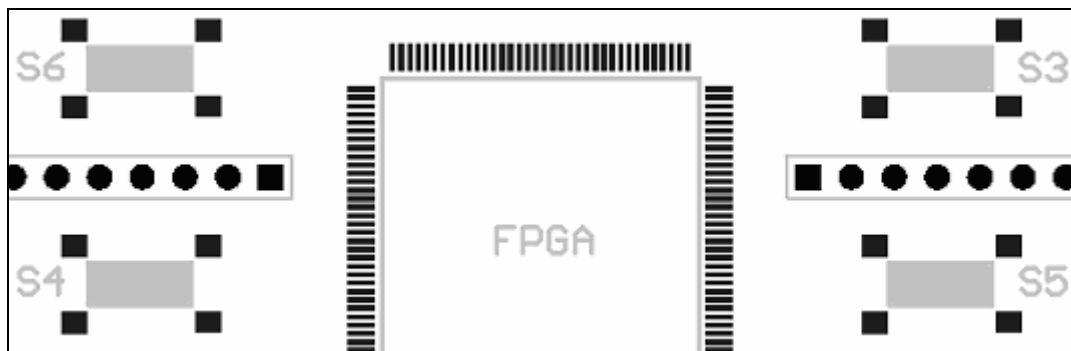
S1 and S2 contain eight switches that provide logic level signals. These switches are pulled-up through 10KΩ resistors. The switch output is set to logic 1 when the switch is open and logic 0 when the switch is closed. Connections to these signals are made with the appropriate pins on the male headers and connecting them to the corresponding pins on the EP1C3 device. Please refer later in the manual or the pin-out quick reference PDF (on website) for the exact pin-outs of the board and the dipswitches.



*Figure 3. 8-Pin Dip Switches (S1 and S2)*

S3, S4, S5 and S6 Push Buttons

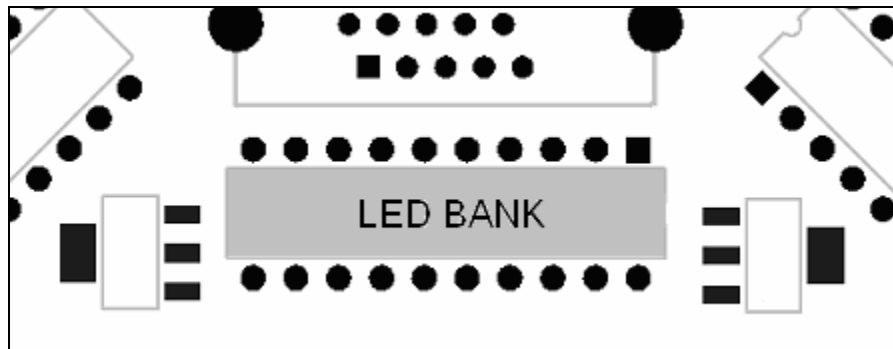
S3, S4, S5 and S6 are push buttons that provide active-low signals and are pulled-up through 10KΩ resistors. Connections to these signals are made with the appropriate pins on the male headers and connecting them to the corresponding pins on the EP1C3 device. Please refer later in the manual or the pin-out quick reference PDF (on website) for the exact pin-outs of the board and the push buttons.



*Figure 4. Push Buttons (S3, S4, S5, and S6)*

10-Segment LED Bank Array

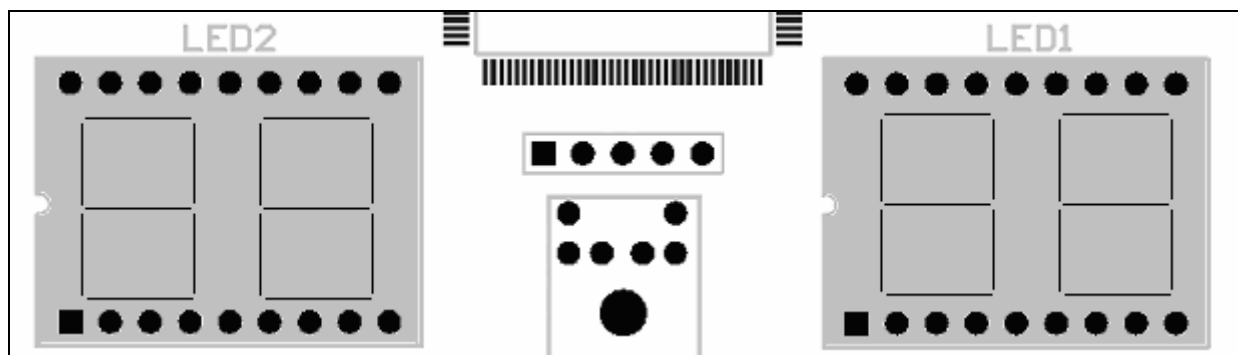
The BT-U board contains 10 LEDs that are pulled-up with a 330-Ω resistor. An LED is illuminated when a logic 0 is applied the male header pin associated with the LED. Connections to these signals are made with the appropriate pins on the male headers and connecting them to the corresponding pins on the EP1C3 device. Please refer later in the manual or the pin-out quick reference PDF (on website) for the exact pin-outs of the board and the push buttons.



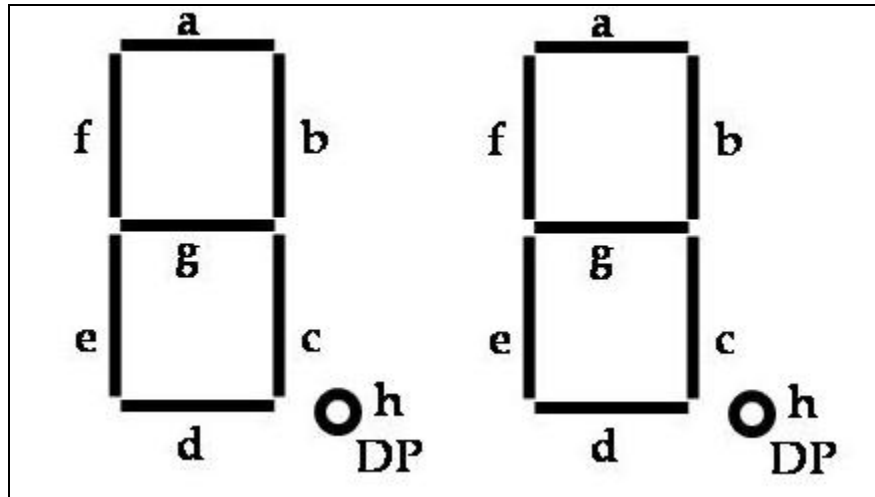
*Figure 5. 10-Segment LED BANK ARRAY*

LED1 and LED2 7-Segment LED Dual-Digit Display

LED1 and LED2 are dual-digit, seven-segment displays that are connected to the male headers. Connections to these signals are made with the appropriate pins on the male headers and connecting them to the corresponding pins on the EP1C3 device. Please refer later in the manual or the pin-out quick reference PDF (on website) for the exact pin-outs of the board and the push buttons.



*Figure 5. Seven-Segment LED Dual-Digit Display*

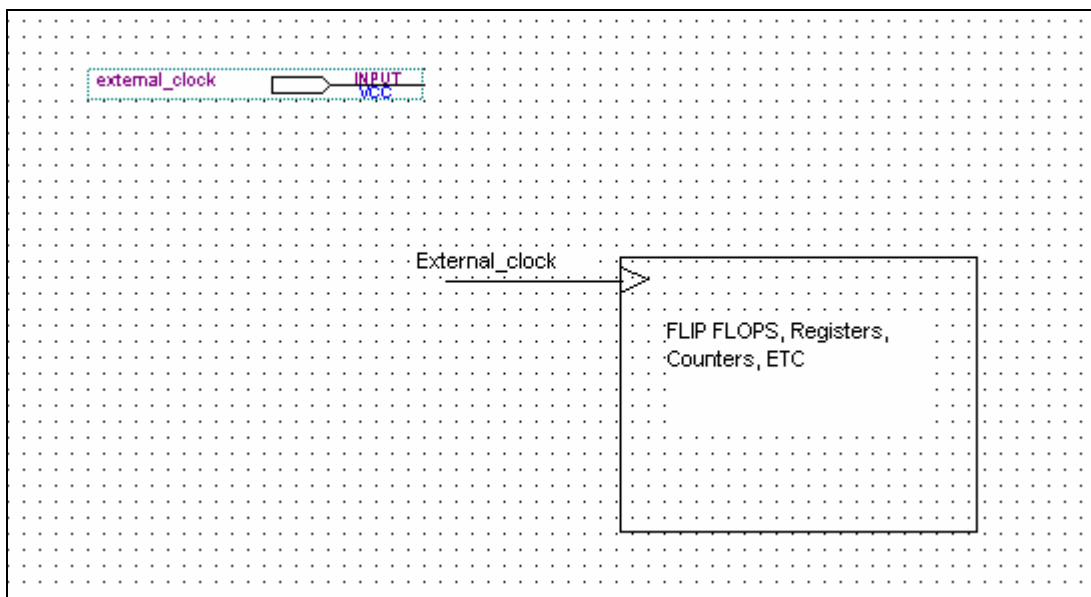


*Figure 6. Pin references for each segment.*

Please remember that A1-G1 are for the right digit and A2-G2 are for the left digit (see reference pin outs).

**Using your own external Clock**

Simply set one of your input pins to accept the new clock. Then connect this pin to all of your desired components that support a clock signal.



*Figure 7. Setting up your external clock to control logic*

## Using the internal Clock

When setting up quartus, please remember to set PIN 16 as the internal 25.157MHZ clock. This is the on board clock that is automatically connected to pin 16. When you want to use this clock for external device, please use a 'wire' symbol and then assign it to an output pin.

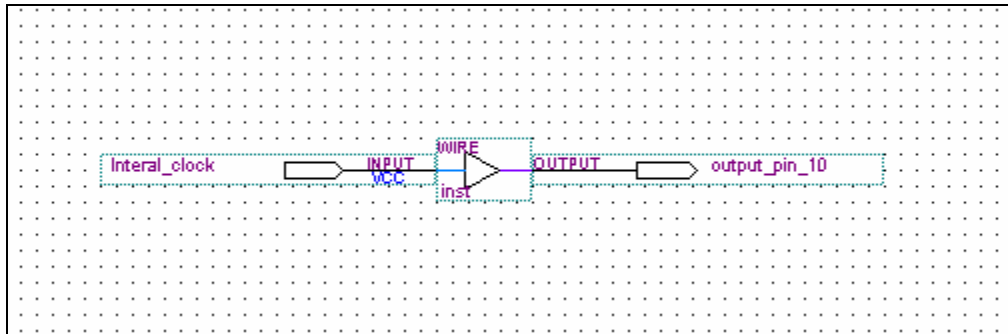


Figure 1. Setting the internal clock to an output pin

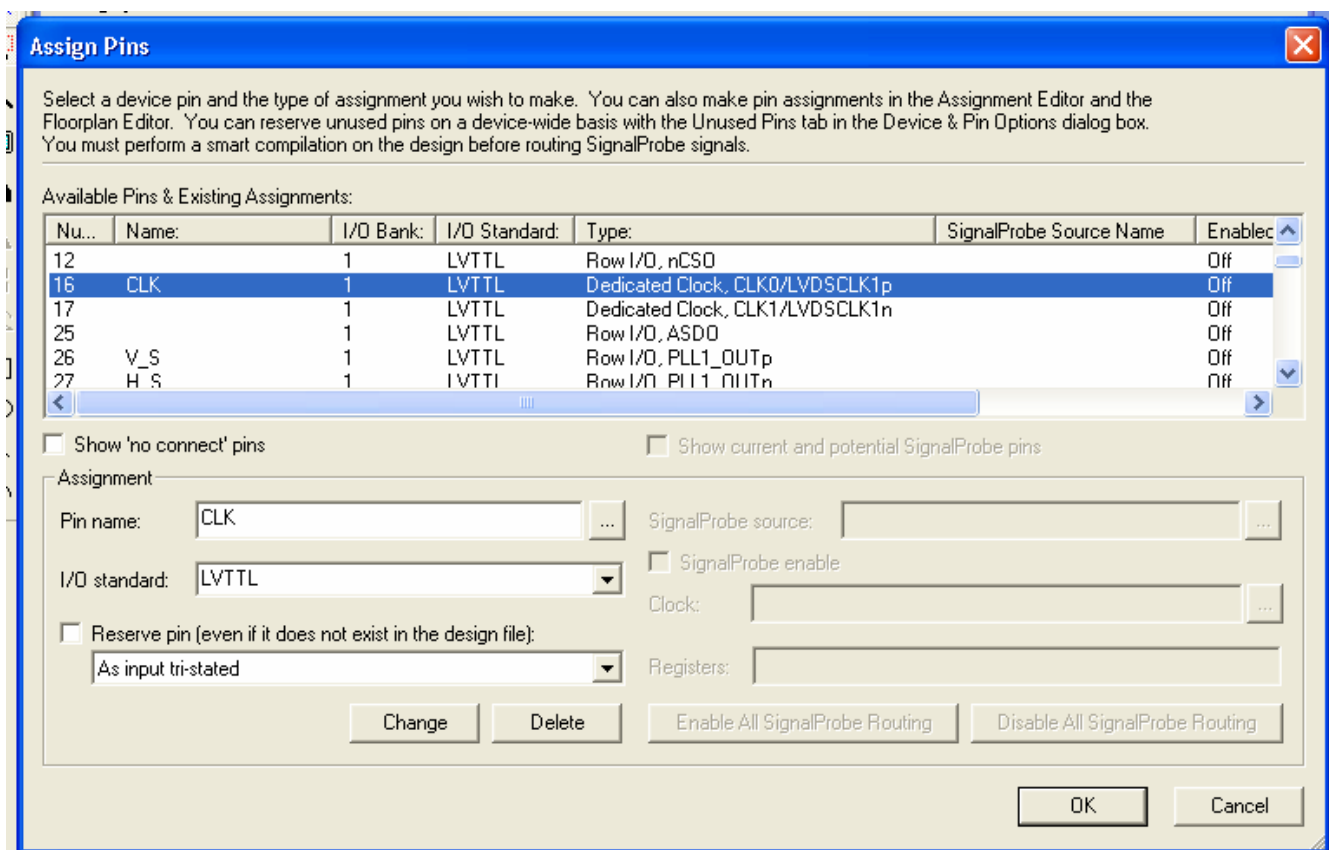
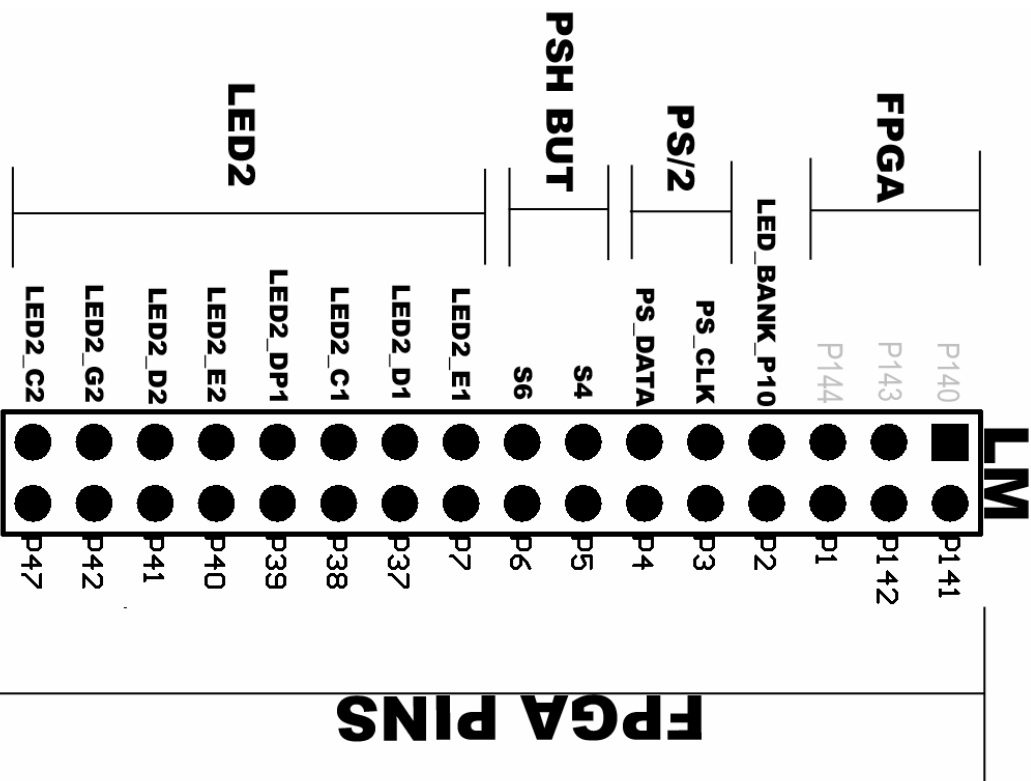
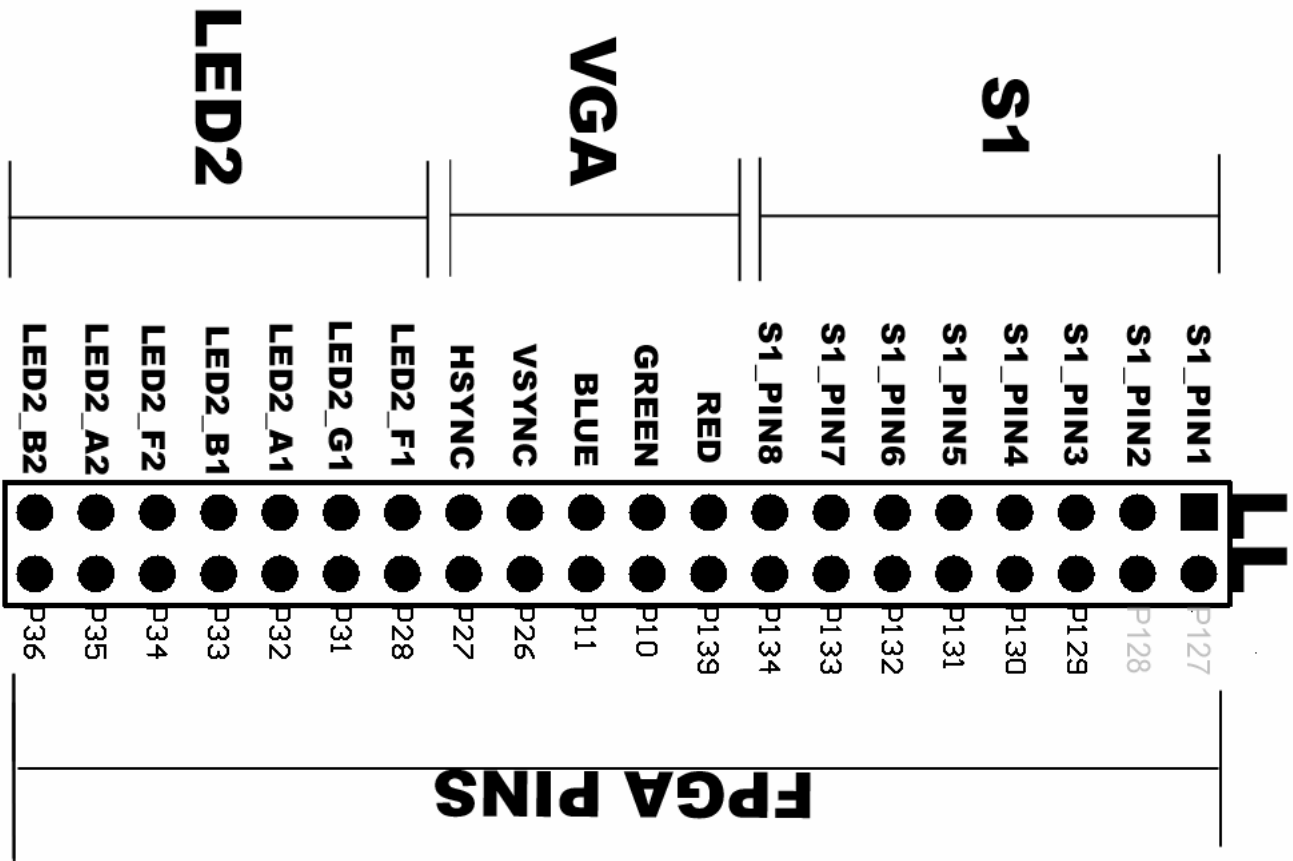
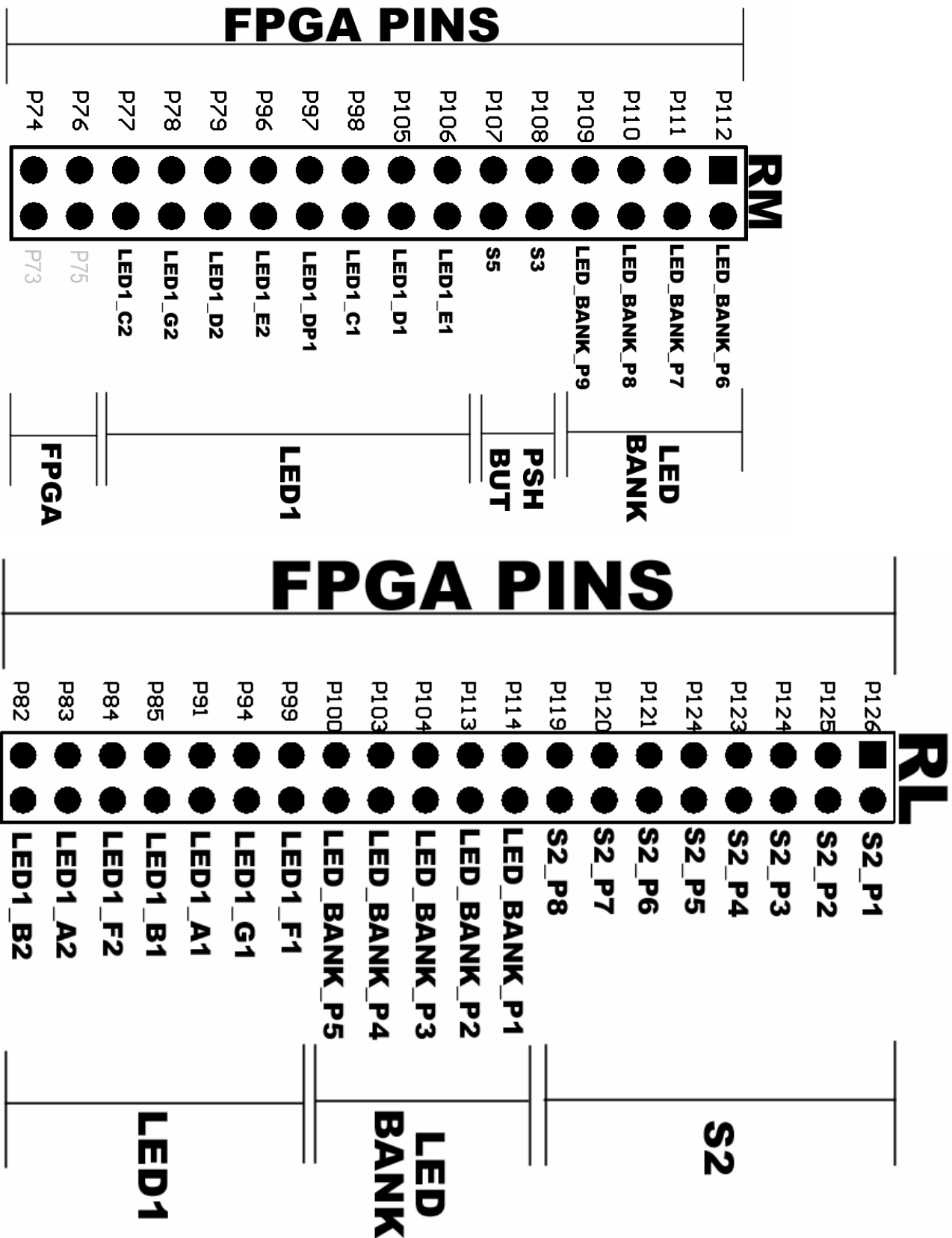


Figure 8. Setting the internal clock to the appropriate pin 16 for the FPGA

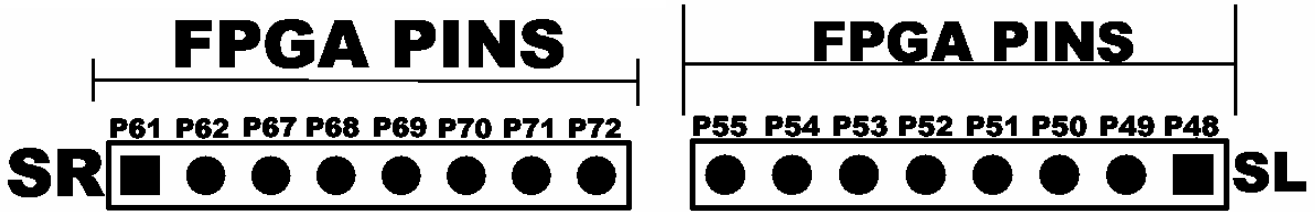
**HEADER PIN OUTS FOR LEFT SIDE**



**HEADER PIN OUTS FOR RIGHT SIDE**



**HEADER PIN OUTS FOR CENTER**



**HEADER PIN OUTS FOR PROGRAMMING AND EXTERN POWER**

