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MAX® II Micro Kit

User Manual

CONTENTS

Chapter 1

MAX II Micro Package

The MAX II Micro package contains all components needed to use the MAX II Micro board in conjunction with a computer that runs the Microsoft Windows software.

1.1   Package Contents

Figure 1.1 shows a photograph of the MAX II Micro package.

Figure 1.1 MAX II Micro package contents.

The MAX II Micro package includes:

- MAX II Micro board
- USB Cable (Type-A-Male to Type-A-Female) for FPGA programming, control, and power source
- CD-ROM containing Altera's Quartus® II 7.0 Web Edition software.

1.2 Assemble the MAX II Micro

Connect the MAX II Micro to PC either:

- Plug-in directly, as shown in Figure 1.2
- Via the USB cable provided in the package, as shown in Figure 1.3

Figure 1.2. Connect to PC directly.

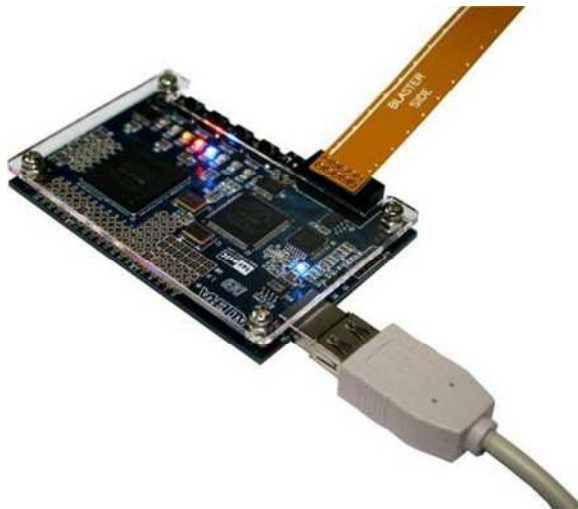Figure 1.3. Connect to PC through USB cable.

1.3 Getting Help

Here are the addresses where you can get help if you encounter problems:

- Altera Corporation
  101 Innovation Drive
  San Jose, California, 95134 USA
  Email: university@altera.com

- Terasic Technologies
  No. 356, Sec. 1, Fusing E. Rd.
  Jhubei City, HsinChu County, Taiwan, 302
  Email: support@terasic.com
  Web: www.terasic.com

Chapter 2

Altera MAX II Micro Board

This chapter presents the features and design characteristics of the MAX II Micro board.

2.1   Layout and Components

A photograph of the MAX II Micro board is shown in Figure 2.1. It depicts the layout of the board and indicates the location of the connectors and key components.
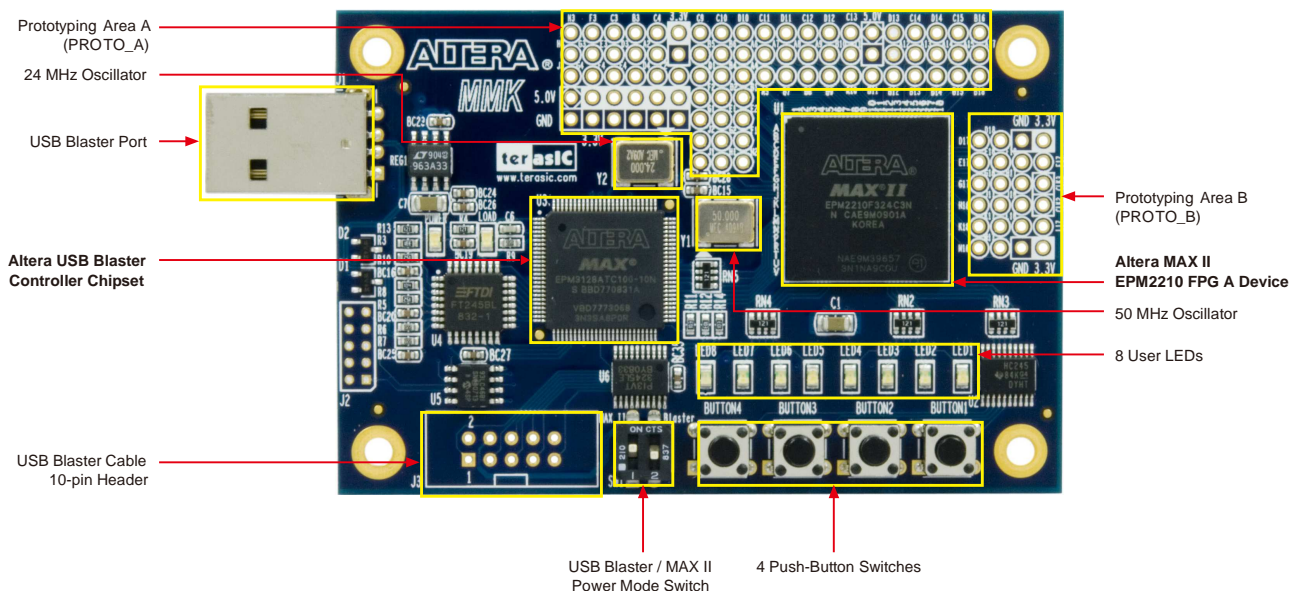

Figure 2.1.   The MAX II Micro board.

The following hardware is provided on the MAX II Micro board:

- Altera MAX$^®$ II EPM2210F324 FPGA device
- USB Blaster (on board) for programming; MAX II Micro can be used as a USB Blaster, and programming mode supported depends on the configuration device of Altera board connected to MAX II Micro. Only JTAG programming mode is supported to configure MAX II Micro.
- 4 pushbutton switches
- 1 DIP switch
- 2 red user LEDs
- 2 yellow user LEDs
- 2 green user LEDs

- 2 blue user LEDs
- 50-MHz oscillator for clock sources
- Powered by a USB cable (Type-A-Male to Type-A-Female)

2.2   Block Diagram of the MAX II Micro Board

Figure 2.2 gives the block diagram of the MAX II Micro board.
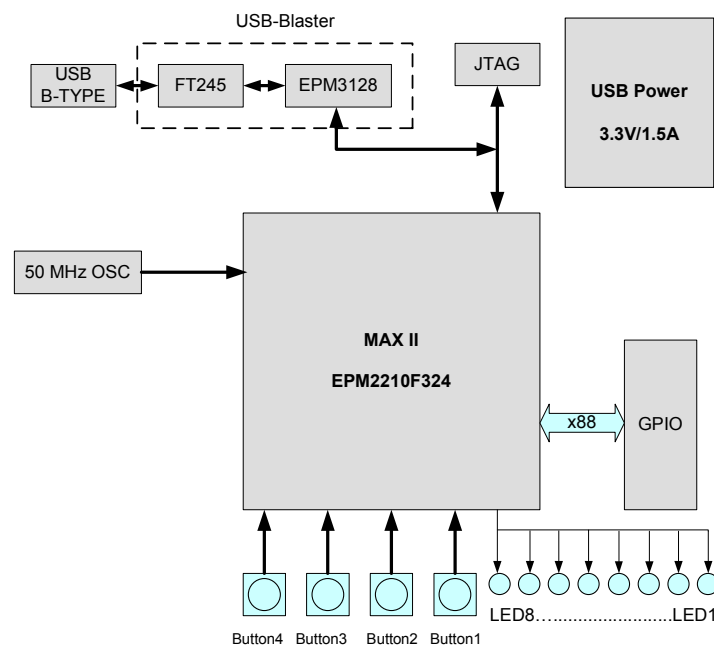

Figure 2.2. Block diagram of the MAX II Micro board.

Following is more detailed information about the blocks in Figure 2.2:

MAX II 2210 FPGA
- 2,210 LEs
- 272 user I/O pins
- FineLine BGA 324-pin package

USB Blaster circuit
- On-board USB Blaster for programming
- Only JTAG programming mode is supported to configure MAX II Micro or when MAX II Micro is used as a USB Blaster cable.

Pushbutton switches

- 4 pushbutton switches
- Debounced by a Schmitt trigger circuit
- Normally high; generates one active-low pulse when the switch is pressed

Clock inputs

- 50-MHz oscillator

Prototyping Areas

- A 40-pin expansion port area compatible with Altera DE2/DE1 expansion ports.
- Prototyping Area A with **68** *GPIO*, **6** *3.3V*, **2** *5V* and **8** *GND* pins
- Prototyping Area B with **20** *GPIO*, **2** *3.3V*, and **2** *GND* pins

2.3   Schematic of the MAX II Micro Board

The complete schematic can be found in the Schematic folder of MAX II Micro System CD-ROM. The following sections describe the major parts of the schematic in detail.

2.3.1   LEDs, Switches, and Clock Inputs

The MAX II Micro board provides four pushbutton switches. Each of these switches is debounced using a Schmitt Trigger circuit, as indicated in Figure 2.3. The four outputs called *KEY0*, …, *KEY3* of the Schmitt Trigger device are connected directly to the MAX II CPLD. Each switch provides a high logic level (3.3 volts) when it is not pressed, and provides a low logic level (0 volts) when depressed. Since the pushbutton switches are debounced, they are appropriate for use as clock or reset inputs in a circuit.
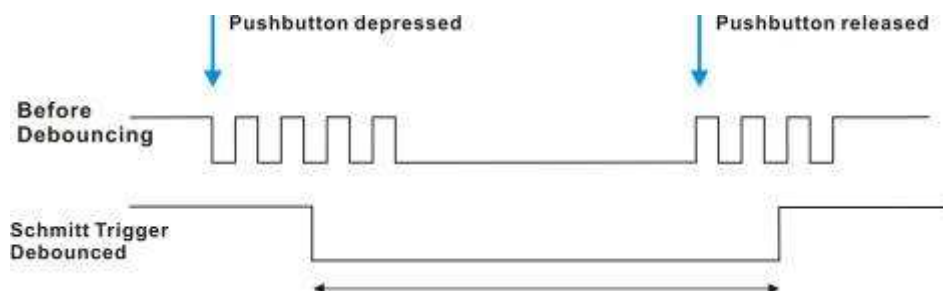

Figure 2.3. Switch debouncing.

There are 8 user-controllable LEDs on the MAX II Micro board. Each LED is driven directly by a pin on the MAX II CPLD; driving its associated pin to a high logic level turns the LED on, and driving the pin low turns it off.

A list of the pin names on the MAX II CPLD that are connected to the LEDs, pushbuttons, and clock inputs is given in Table 2.1.

Signal Name	FPGA Pin No.	Description
LED[0]	PIN_U13	Blue LED
LED[1]	PIN_V13	Green LED
LED[2]	PIN_U12	Yellow LED
LED[3]	PIN_V12	Red LED
LED[4]	PIN_V5	Blue LED
LED[5]	PIN_U5	Green LED
LED[6]	PIN_V4	Yellow LED
LED[7]	PIN_U4	Red LED
KEY[0]	PIN_U15	Button1
KEY[1]	PIN_V15	Button2
KEY[2]	PIN_U14	Button3
KEY[3]	PIN_V14	Button4
CLOCK_50	PIN_J6	50 MHz clock input

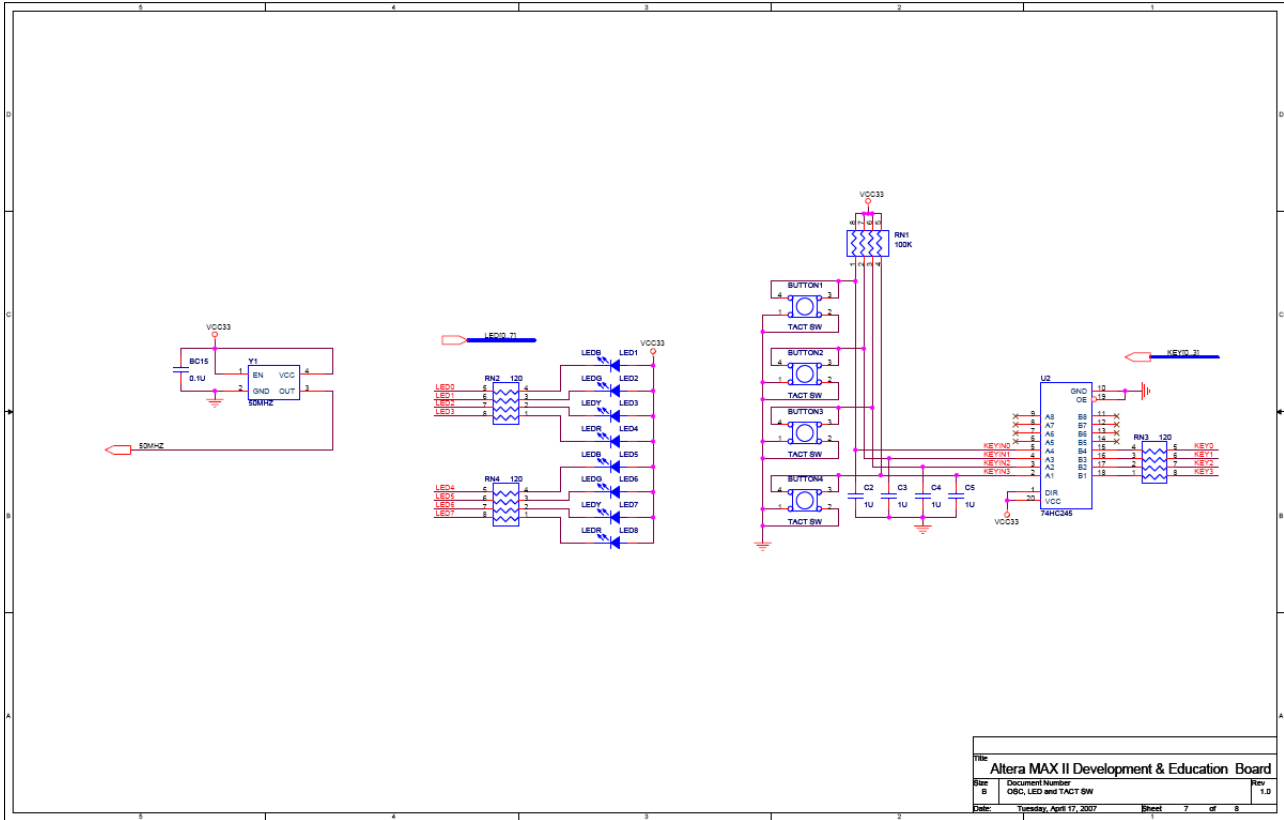Table 2.1.   Pin assignments for the LEDs, Buttons, and Clock inputs.

Figure 2.4. Schematic diagram of the LEDs, pushbuttons, and clock circuit.

2.3.2 Expansion Port and Prototyping Area

The MAX II Micro board provides users two prototyping area: PROTO_A and PROTO_B, as shown in Figure 2.1. The schematics are shown in Figure 2.5 and Figure 2.6.To help users locate the corresponding GPIOs, we provide a detailed I/O map shown in Figure 2.7.
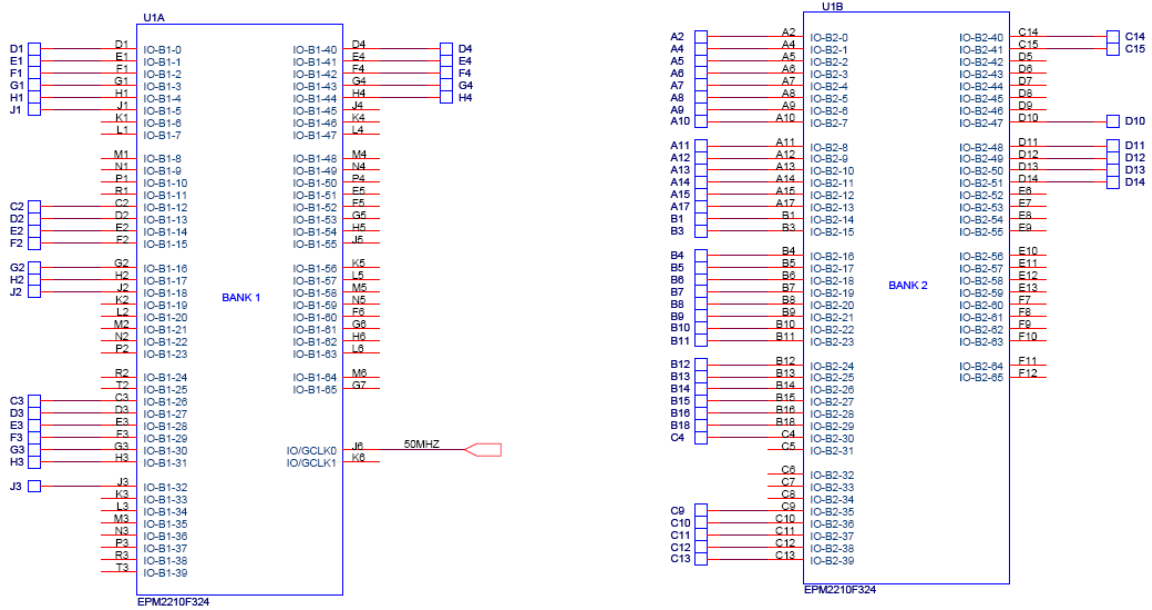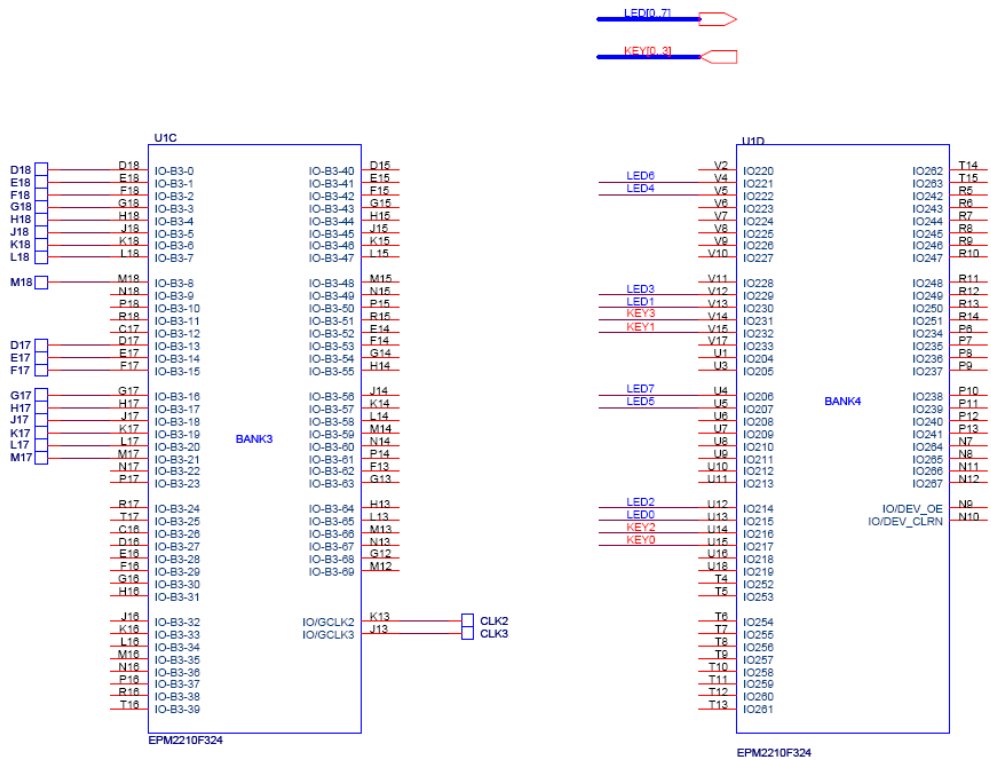
Figure 2.5.   Schematic of the prototyping area.

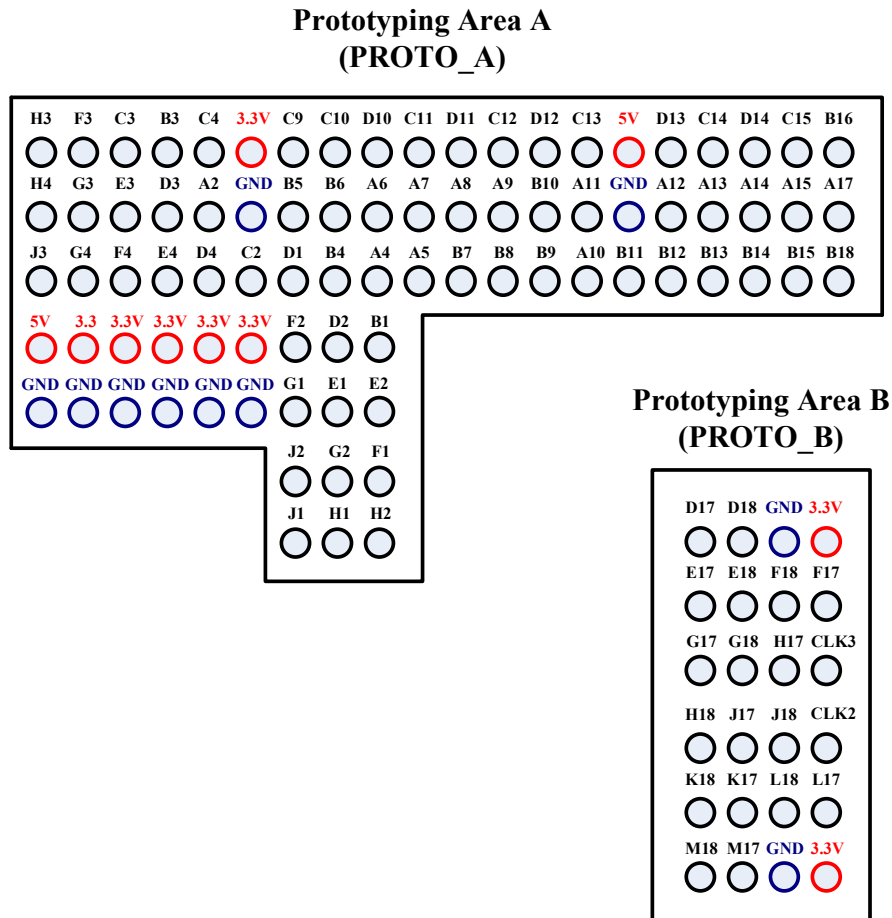Figure 2.6.   Schematic of the prototyping area.

Prototyping Area A
(PROTO_A)

Prototyping Area B
(PROTO_B)

Figure 2.7.   The detailed I/O map of prototyping area A and B.

2.4   Power-up the MAX II Micro Board

The MAX II Micro board comes with a pre-loaded configuration bit stream to demonstrate various LED modes. This bit stream also allows users to see quickly if the board is working properly. For communication between the host and the MAX II Micro board, it is necessary to install the Altera USB Blaster driver software. The driver only supports Windows OS, and if it is not already installed on the host computer, it can be installed as explained in the Altera website :

For XP: http://www.altera.com/support/software/drivers/usb-blaster/dri-usb-blaster-xp.html .

For 2000: http://www.altera.com/support/software/drivers/usb-blaster/dri-usb-blaster-2000.html

At this point you should observe LEDs turn ON/OFF in sequence There are 2 different modes pre-loaded and it can be changed by pressing Button1. Each mode can be reset by pressing corresponding Button3 and Button4.

2.5 Methods to Configure the MAX II Micro Board

The MAX II Micro board provides two modes, *JTAG Mode* and *USB Blaster Mode*, which allows users to use the MAX II Micro board as a CPLD development board or as a USB Blaster cable, respectively.

2.5.1 Configure the MAX II Micro board in JTAG Mode

Users should use JTAG mode in normal operation. Set **Swtich1** to **UP** position and set **Switch2** to **DOWN** position as shown in Figure 2.8.
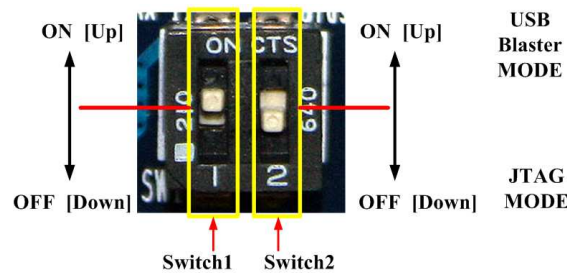

Figure 2.8.   Set Switch1 to UP position and Switch2 to DOWN position in normal operation (JTAG mode)

2.5.2 Use MAX II Micro as a USB Blaster Cable

This section describes how to use MAX II Micro as a USB Blaster Cable. Simply follow the instructions below to finish the setting. Before using MAX II Micro board as a USB Blaster, you need to solder a 10-pin header onto the board as show in Figure 2.9.

Note: The USB blaster cable function only supports **JTAG** programming mode.

Figure 2.9. Solder a 10-pin header onto the MAX II Micro board

1. Connect the USB cable to the USB port on your PC and to the USB-Blaster port of MAX II Micro board.

2. Set the both dip switches on the Max II Micro board to **UP** location, as shown in Figure 2.10.

3. Connect the USB-Blaster download cable to the 10-pin header (J3) on the device board and MAX II Micro board. Figure 2.11 shows how to use the MAX II Micro Board to configure an Altera NIOS II Kit.
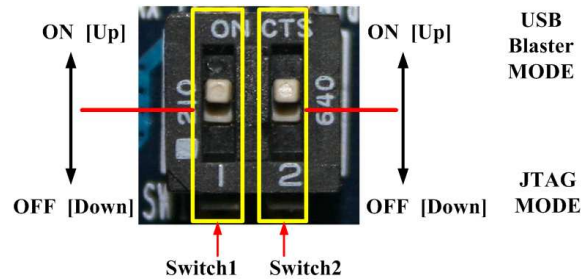

Figure 2.10. Set both switches to UP position to set up the MAX II Micro board as a USB Blaster.

Figure 2.11. Use MAX II Micro as a USB Blaster cable and connect to another Altera board (NIOS II Kit in this case).

2.5.3 MAX II CPLD Power OFF Mode

The MAX II Micro board provides a Power OFF switch mode to completely shutdown the MAX II CPLD by setting Switch1 to **DOWN** position as show in Figure 2.12.
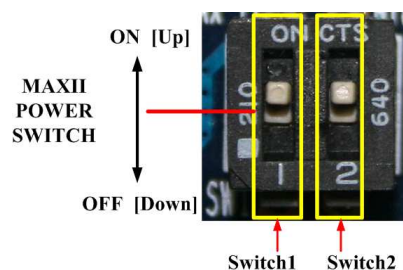

Figure 2.12. Set Switch1 to DOWN position to turn off the power supply to MAX II CPLD

Chapter 3

MAX II Micro Board Control Panel

The MAX II Micro board comes with a Control Panel facility that allows users to access various components on the board through a USB connection from a host computer. This chapter first presents how to setting up the Control Panel, then describes its structure in block diagram form, and finally describes its capabilities.

3.1 Control Panel Setup

To run the Control Panel application, it is first necessary to configure a corresponding circuit in the MAX II CPLD. This is done by downloading the configuration file DEN_Control_Panel.pof into the CPLD. The downloading procedure is described as followed.

In addition to the *DEN_Control_Panel.pof* file, it is necessary to execute on the host computer the program *DEN_Control_Panel.exe*. Both of these files are available under the directory DEN_control_panel of the MAX II Micro system CD-ROM included..

To activate the Control Panel, perform the following steps:

1. Configure the dip switch on the MAX II Micro board as shown in Figure 2.8.
2. Connect the USB cable to the USB port on your PC and to the USB-Blaster port of MAX II Micro board.
3. Start the Quartus II software.
4. Select **Tools** > **Programmer** to reach the window in Figure 3.1. Click on **Add File** and in the pop-up window that appears select the *DEN_Control_Panel.pof* file. Next, click on the three check boxes in the **Program/Configure** columns. Now, click **Start** to download the configuration file into the CPLD.
5. Once the download is finished, Plug out the USB cable from the MAX II Micro board and re-plug it in to power up and reset the MAX II CPLD device.
6. Start the executable *DEN_Control_Panel.exe* on the host computer. The Control Panel user interface shown in Figure 3.2 will appear.
7. The Control Panel also can download the configuration file *DEN_Control_Panel.pof* into the CPLD by clicking the icon of **Download . POF** as shown in Figure 3.2.
8. The Control Panel is now ready for use.

The Control Panel will occupy the USB port , you cannot use Quartus II to download a configuration file into the CPLD until you close the Control Panel.
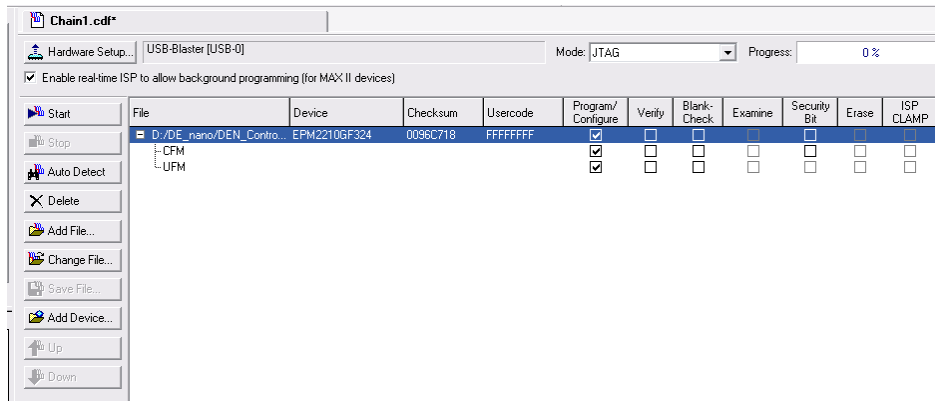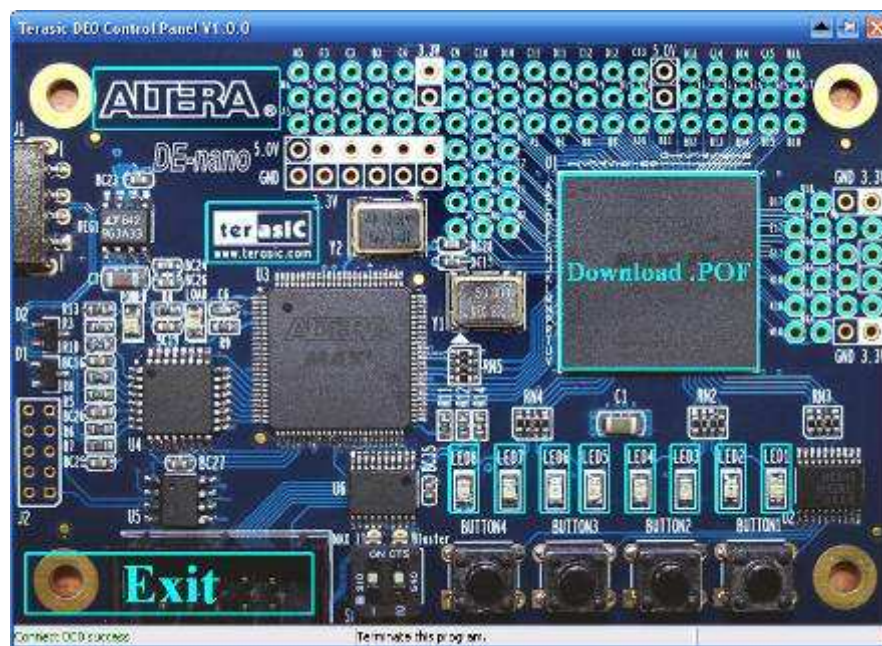
Figure 3.1. Quartus II Programmer window

Figure 3.2. The MAX II Micro Board Control Panel window.

The concept of the MAX II Micro Control Panel is illustrated in Figure 3.3. The IP that performs the control functions is implemented in the CPLD device. It communicates with the Control Panel window, which is active on the host computer, via the USB Blaster link. The graphical interface is used to issue commands to the control circuitry. The provided IP handles all requests and performs data transfers between the computer and the MAX II Micro board.
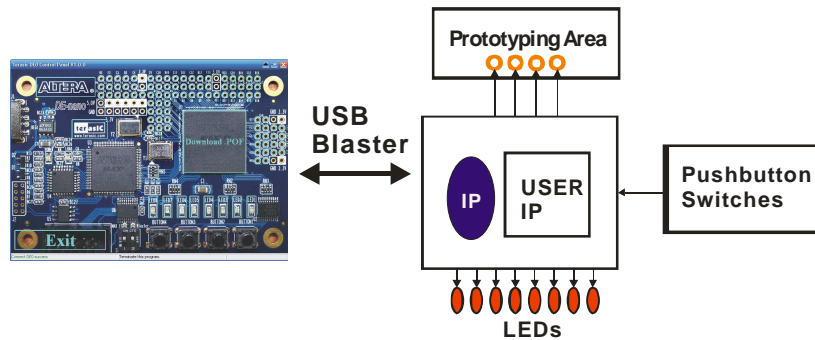
Figure 3.3. The MAX II Micro Control Panel concept.

3.2 Using the Control Panel

The interface of the MAX II Micro control panel window matches the real MAX II Micro board. Users can select the components they want to control directly. All configurable components are marked with blue frame in the window.

The MAX II Micro Control Panel can be used to light up LEDs, detect the pressed action of pushbutton switches and configure the I/O logic level of prototyping area on the MAX II Micro board. The following sections describe how to perform these actions with the control panel already open on the host computer

Typical design activities do not require the ability to set arbitrary values for simple display devices. However, for troubleshooting purposes, setting arbitrary values enables you to verify that the devices are operating correctly.

- **Light up the LEDs**

    To light up the LEDs on the MAX II Micro board, you can turn the individual LEDs on by clicking the LED icon on the control panel window as show in the Figure 3.4. The icon of the chosen LED will be marked with yellow color.
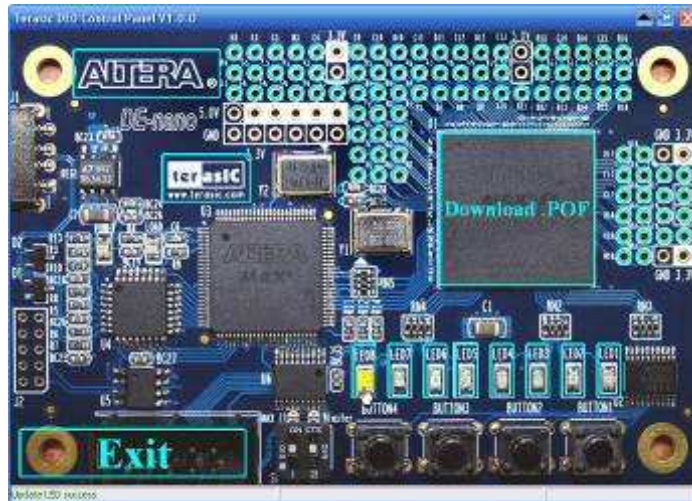
Figure 3.4 Control panel window for LED controlling.

- **Detection of the action of the pushbuttons**

When users press the pushbutton switches on the MAX II Micro board, the MAX II Micro control panel window will indicate which pushbutton switches are pressed with an arrow icon as show in Figure 3.5.
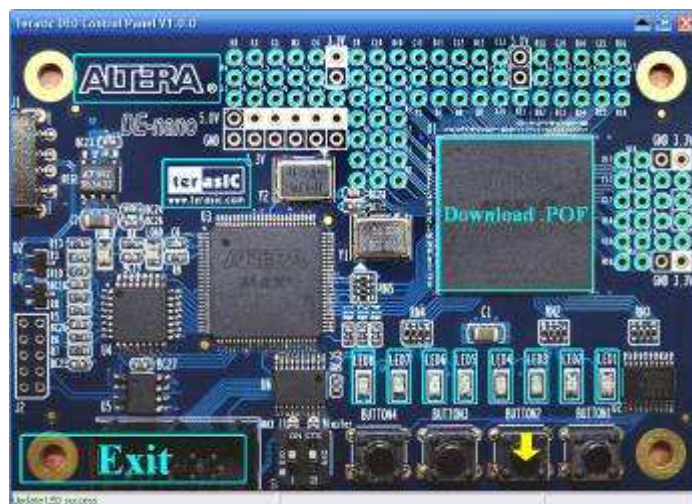

Figure 3.5 Control panel can detect if any pushbutton is pressed by users.

- **Configure the GPIOs in the prototyping area**

The I/O logic level of the GPIOs in the prototyping area is low (0 volts), you can change the logic level of the GPIOs to high (3.3 volts) by clicking the corresponding GPIO holes on the control panel window as show in Figure 3.6. The icon of the chosen GPIO holes will be marked with yellow color. With this function you can control the other circuit easily by using the control
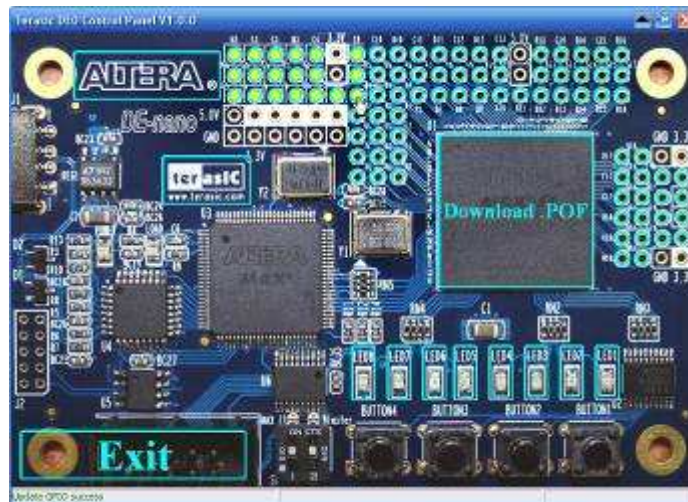
panel and prototyping area I/Os.

Figure 3.6 Users can configure the GPIOs in the prototyping areas by clicking on the corresponding holes shown in the Control Panel window section. The GPIOs' color will be marked by yellow to indicate their voltage level is HIGH (3.3V).

Chapter 4

MAX II Micro Board Design Demonstrations

This chapter demonstrates several reference designs to help users to understand how to implement their own designs using the MAX II Micro board.

4.1   Demonstration Setup

As mentioned in section 1.2, the MAX II Micro board can be connected to the PC either through the USB cable provided in the package or through the USB slots directly.

4.2   Configuring the MAX II CPLD on MAX II Micro Board

The MAX II Micro board stores configuration data in the MAX II CPLD. User can reprogram the CPLD any time using Quartus II software via the USB connection.

Configuring the CPLD in JTAG Mode

Figure 4.1 shows the switch configuration for JTAG mode. Set the Switch1 to UP position and Switch 2 to DOWN position. To download a configuration bit stream into the CPLD, perform the following steps:

- Ensure that power is supplied to the MAX II Micro board by connecting it to a USB port, as shown in Figure 1.2 or Figure 1.3.
- The CPLD can now be programmed by using the Quartus II Programmer module. Select a configuration bit stream file with the *.pof* filename extension.
- Once the download is finished, you should power off and on the MAX II Micro board to activate the bitstream by disconnecting the board from you PC.
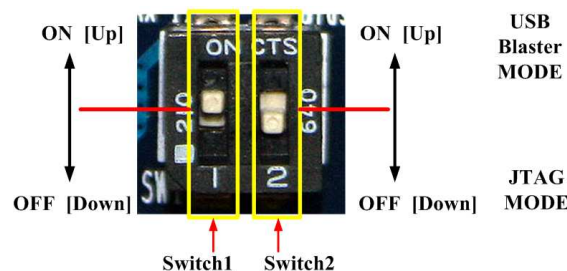
Figure 4.1.   Set Switch1 to UP position and Switch2 to DOWN position in normal operation (JTAG mode)

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4.3   Exercise 1: Traffic Light Experiment.

The purpose of the exercise is to let users get familiar with logic design, starting from the basics. The experiment simulates the behavior of two traffic lights at the intersection. The traffic light will flash a few times before it turns from green to yellow. The loop will continue according to the state flow chart (driven by a timer), as shown in Figure 4.2. Each state represents a unique combination of two traffic lights, as shown in Figure 4.3. The circuit can be reset to state S1 if Button1 is pressed.
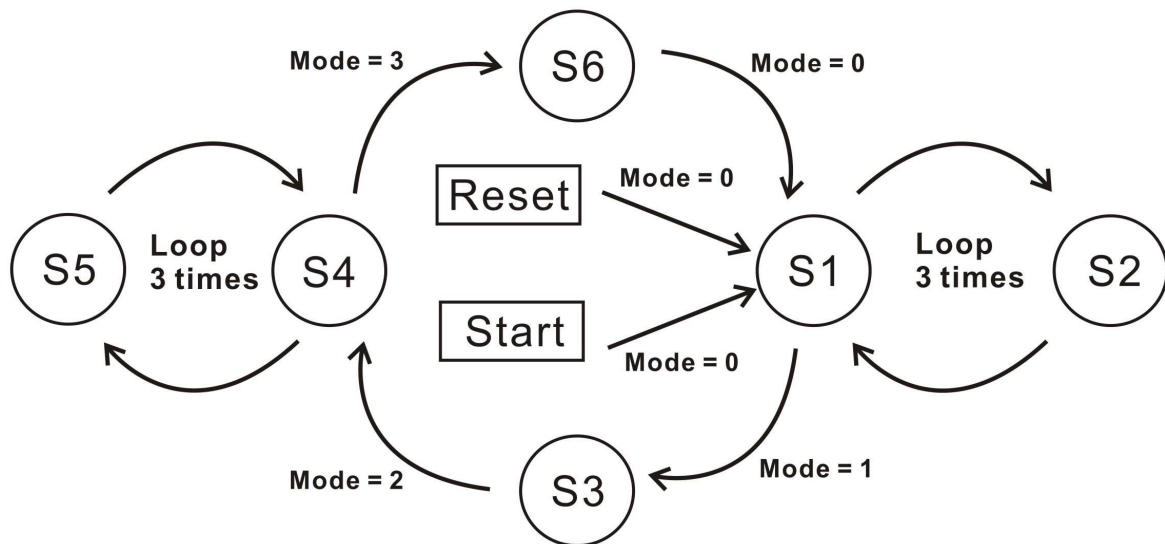

Figure 4.2 State flow chart of traffic light.

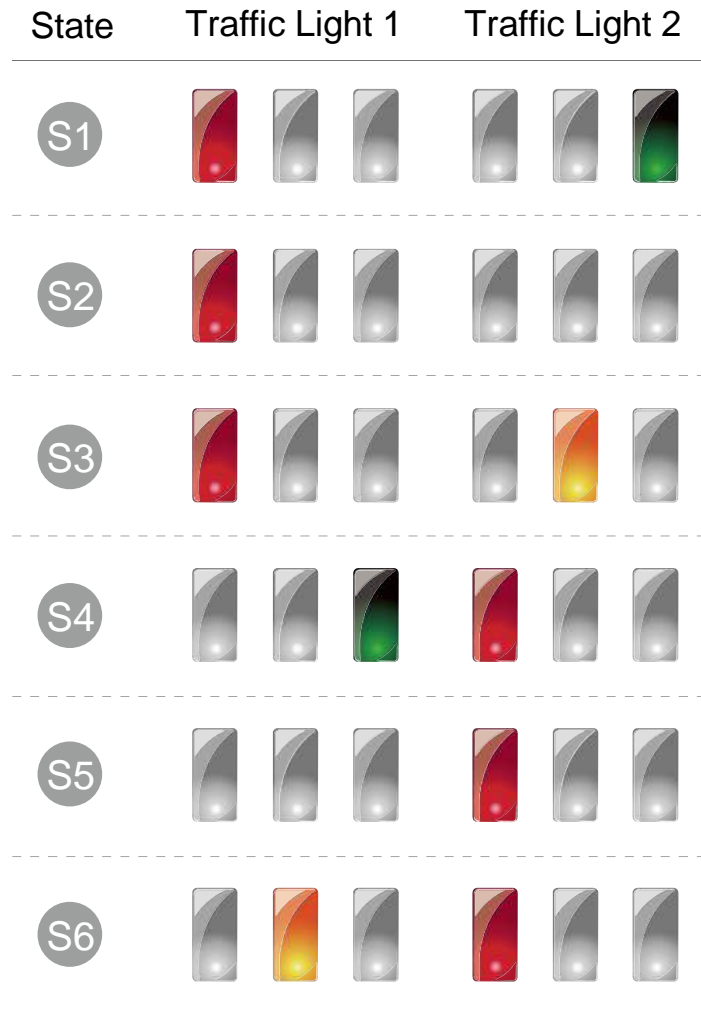| State	Traffic Light 1	Traffic Light 2
S1		
S2		
S3		
S4		
S5		
S6		

Figure 4.3 Behavior of two traffic lights at each state.

Simply follow the instructions below to repeat the exercise.

1. Ensure LEDs are flashing after demonstration setup is completed. Please check connection to PC and/or the configuration of the switch if nothing happened.
2. Open Quartus II and locate DEnano.pof under the directory DEN_demonstrations\DEN_Traffic_Light\ of the CD-ROM included.
3. Download the bitstream (*DEnano.pof*) to the MAX II Micro board.
4. Once the download is finished, Plug out the USB cable from the MAX II Micro board and re-plug it in to power up and reset the MAX II CPLD device.
5. you should observe the LEDs are displaying in "Traffic Light" mode.
6. Press Button2 of the MAX II Micro board to reset the circuit.

4.4   Exercise 2:   A Color Pattern Generator Using 4.3" LCD Panel

Users can follow the instructions below to implement a color pattern generator using a 4.3" touch panel with the MAX II Micro board. We are using a Terasic 4.3" Ultra-high resolution LCD Touch Panel module for this demonstration.

To connect the 4.3" LCD Touch Panel to the MAX II Micro board, you need to solder a DIP 40-pin male connector onto PROT_A, as shown in Figure 4.4.
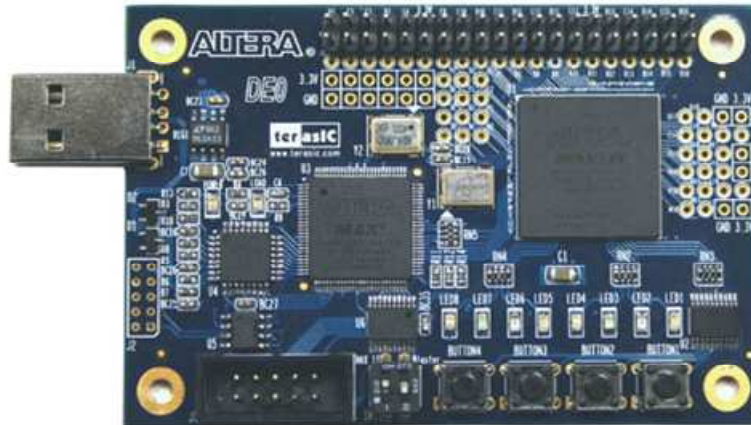

Figure 4.4. Solder a 40-pin male DIP connector to the upper most rows in the PROT_A prototyping area (H3 to A17)

1.   Ensure the connection is made correctly, as shown in Figure 4.5.
2.   Please NOTE the orientation of the 40-pin cable when connecting the DIP 40-pin male connector on the PROT_A, as shown in Figure 4.6.
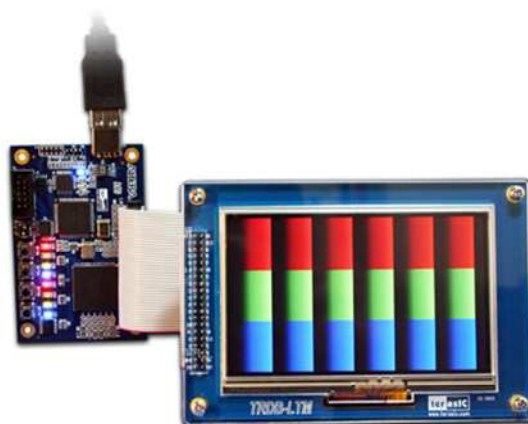

Figure 4.5. The connection setup for the pattern generator demo with MAX II Micro board.
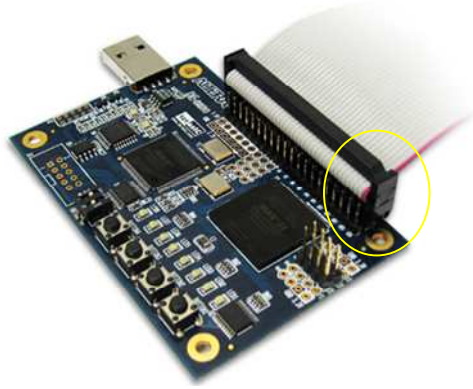
Figure 4.6. The connection setup for the 40-pin cable with MAX II Micro board.

3.   Open Quartus II and locate DEN_LTM_TEST.pof under the directory \ DEN_demonstrations \ DEN_LTM_TEST \ of the CD-ROM included.

4.   Download the bitstream (*DEN_LTM_TEST.pof*) to the MAX II Micro board.

5.   Once the download is finished, Plug out the USB cable from the MAX II Micro board and re-plug it in to power up and reset the MAX II CPLD device.

6.   Press BUTTON1 on the MMK board to reset the circuit.

7.   You can touch the LTM screen to switch to the other pattern.

8.   The following table summarizes the pattern types of this exercise.

Pattern
Gray bar.
Color bar.
50% gray level pattern.
White pattern.

4.5   Exercise 3:   A Color Pattern Generator Using 3.6" LCD module

Users can follow the instructions below to implement a color pattern generator using a 3.6" LCD module with the MAX II Micro board. We are using a Terasic 3.6" LCD module for this demonstration.

To connect the 3.6" LCD module to the MAX II Micro board, you need to solder a DIP 40-pin male connector onto PROT_A (refer to Figure 4.4).

1.   Ensure the connection is made correctly, as shown in Figure 4.7.

2. Please NOTE the orientation of the 40-pin cable when connecting the DIP 40-pin male connector on the PROT_A, as shown in Figure 4.6.
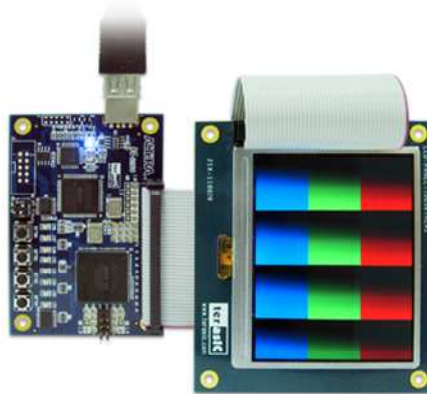

Figure 4.7. The connection setup for the pattern generator demo with MAX II Micro board.

3. Open Quartus II and locate DEN_LCM_TEST.pof under the directory \ DEN_demonstrations \ DEN_LCM_TEST \ of the CD-ROM included.
4. Download the bitstream (*DEN_LCM_TEST.pof*) to the MAX II Micro board.
5. Once the download is finished, Plug out the USB cable from the MAX II Micro board and re-plug it in to power up and reset the MAX II CPLD device.
6. Press BUTTON1 on the MAX II Micro board to reset the circuit.
7. Press BUTTON2 on the MAX II Micro board to switch to the other pattern
8. The following table summarizes the pattern types of this exercise.

Pattern
Color bar.
50% gray level pattern.
White pattern.
Gray pattern