



# **Cyclone II EP2C35 PCI Development Board**

---

## **Reference Manual**



101 Innovation Drive  
San Jose, CA 95134  
(408) 544-7000  
[www.altera.com](http://www.altera.com)

Development Board Version: 1.0.0  
Document Version: 1.0.0  
Document Date: May 2005

Copyright © 2005 Altera Corporation. All rights reserved. Altera, The Programmable Solutions Company, the stylized Altera logo, specific device designations, and all other words and logos that are identified as trademarks and/or service marks are, unless noted otherwise, the trademarks and service marks of Altera Corporation in the U.S. and other countries. All other product or service names are the property of their respective holders. Altera products are protected under numerous U.S. and foreign patents and pending applications, maskwork rights, and copyrights. Altera warrants performance of its semiconductor products to current specifications in accordance with Altera's standard warranty, but reserves the right to make changes to any products and services at any time without notice. Altera assumes no responsibility or liability arising out of the application or use of any information, product, or service described herein except as expressly agreed to in writing by Altera Corporation. Altera customers are advised to obtain the latest version of device specifications before relying on any published information and before placing orders for products or services.



Part Number MNL-C11021805-1.0

## About This Manual

How to Contact Altera .....	v
Typographic Conventions .....	v

## Chapter 1. Introduction

General Description .....	1-1
Components .....	1-1
Block Diagram .....	1-3
Handling the Board .....	1-4

## Chapter 2. Board Components & Interfaces

Board Overview .....	2-1
Component Operation .....	2-4
Cyclone II Device .....	2-4
PCI & PCI-X Bus Support & Compatibility .....	2-4
Memory .....	2-5
Clocks & Clock Distribution .....	2-6
Power .....	2-7
LEDs .....	2-9
Board DIP Switch Settings .....	2-11
Push-Button Switches .....	2-13
Interface Operation .....	2-14
Altera Daughter Card (PROTO1) Interface .....	2-14
10/100 Ethernet .....	2-14
RS-232 Serial Interface .....	2-15
AS Interface .....	2-15
JTAG .....	2-15
SignalTap II Logic Analyzer .....	2-15
Mictor Probe .....	2-15

## Chapter 3. Using the Board

Introduction .....	3-1
Apply Power to the Board .....	3-1
Configure the Cyclone II Device .....	3-2
Serial Flash Configuration .....	3-2
JTAG Configuration .....	3-3
Program the Serial Flash Memory .....	3-3
Active Serial Programming .....	3-5
In-System Programming via the JTAG & the SFL Solution (User-Programmable EPCS64 Device Only) .....	3-7
Configure the Board for Bench-Top Operation .....	3-8

## Chapter 4. Pin-Outs & Signal Specifications

Introduction .....	4-1
PCI & PCI-X Bus Interfaces .....	4-1
Memory .....	4-5
DDR2 SDRAM Memory .....	4-5
I/O & Serial I/O .....	4-8
10/100 Ethernet .....	4-8
RS-232 Serial Interface .....	4-11
Configuration .....	4-11
JTAG Header .....	4-11
AS Interface Header .....	4-12
EPCS64 Serial Flash Interface .....	4-12
Control & User Settings .....	4-13
User LEDs .....	4-13
DIP Switch Bank Board & User Settings .....	4-13
Push-Button Switches .....	4-14
Altera Daughter Card & Mictor Probe .....	4-15



# About This Manual

This manual provides comprehensive information about the Altera® Cyclone™ II EP2C35 PCI Development Board.

## How to Contact Altera








For the most up-to-date information about Altera products, go to the Altera world-wide web site at [www.altera.com](http://www.altera.com). For technical support on this product, go to [www.altera.com/mysupport](http://www.altera.com/mysupport). For additional information about Altera products, consult the sources shown below.

Information Type	USA & Canada	All Other Locations
Technical support	<a href="http://www.altera.com/mysupport/">www.altera.com/mysupport/</a>	<a href="http://www.altera.com/mysupport/">www.altera.com/mysupport/</a>
	(800) 800-EPLD (3753) (7:00 a.m. to 5:00 p.m. Pacific Time)	+1 408-544-8767 7:00 a.m. to 5:00 p.m. (GMT -8:00) Pacific Time
Product literature	<a href="http://www.altera.com">www.altera.com</a>	<a href="http://www.altera.com">www.altera.com</a>
Altera literature services	<a href="mailto:literature@altera.com">literature@altera.com</a>	<a href="mailto:literature@altera.com">literature@altera.com</a>
Non-technical customer service	(800) 767-3753	+ 1 408-544-7000 7:00 a.m. to 5:00 p.m. (GMT -8:00) Pacific Time
FTP site	<a href="ftp://ftp.altera.com">ftp.altera.com</a>	<a href="ftp://ftp.altera.com">ftp.altera.com</a>

## Typographic Conventions

This document uses the typographic conventions shown below.

Visual Cue	Meaning
<b>Bold Type with Initial Capital Letters</b>	Command names, dialog box titles, check box options, and dialog box options are shown in bold, initial capital letters. Example: <b>Save As</b> dialog box.
<b>bold type</b>	External timing parameters, directory names, project names, disk drive names, filenames, filename extensions, and software utility names are shown in bold type. Examples: <b>f<sub>MAX</sub></b> , <b>lqdesigns</b> directory, <b>d:</b> drive, <b>chiptrip.gdf</b> file.
<i>Italic Type with Initial Capital Letters</i>	Document titles are shown in italic type with initial capital letters. Example: <i>AN 75: High-Speed Board Design</i> .

Visual Cue	Meaning
<i>Italic type</i>	<p>Internal timing parameters and variables are shown in italic type.                      Examples: <math>t_{PIA}</math>, <math>n + 1</math>.</p> <p>Variable names are enclosed in angle brackets (&lt; &gt;) and shown in italic type.                      Example: &lt;file name&gt;, &lt;project name&gt;.pdf file.</p>
Initial Capital Letters	Keyboard keys and menu names are shown with initial capital letters. Examples: Delete key, the Options menu.
"Subheading Title"	References to sections within a document and titles of on-line help topics are shown in quotation marks. Example: "Typographic Conventions."
Courier type	<p>Signal and port names are shown in lowercase Courier type. Examples: data1, tdi, input. Active-low signals are denoted by suffix n, e.g., resetn.</p> <p>Anything that must be typed exactly as it appears is shown in Courier type. For example: c:\qdesigns\tutorial\chiptrip.gdf. Also, sections of an actual file, such as a Report File, references to parts of files (e.g., the AHDL keyword SUBDESIGN), as well as logic function names (e.g., TRI) are shown in Courier.</p>
1., 2., 3., and a., b., c., etc.	Numbered steps are used in a list of items when the sequence of the items is important, such as the steps listed in a procedure.
	Bullets are used in a list of items when the sequence of the items is not important.
	The checkmark indicates a procedure that consists of one step only.
	The hand points to information that requires special attention.
	The caution indicates required information that needs special consideration and understanding and should be read prior to starting or continuing with the procedure or process.
	The warning indicates information that should be read prior to starting or continuing the procedure or processes
	The angled arrow indicates you should press the Enter key.
	The feet direct you to more information on a particular topic.

## General Description

The Cyclone™ II EP2C35 PCI Development Board provides a hardware platform for developing and prototyping high-speed PCI and PCI-X bus interfaces, double data rate 2 (DDR2) SDRAM, and the 10/100 Ethernet interface.

Based on Cyclone II FPGAs and using Altera® MegaCore® functions or Altera Megafunction Partners Program (AMPP<sup>SM</sup>) megafunctions, the Cyclone II EP2C35 PCI Development Board allows users to quickly solve design problems that typically require time-consuming, custom solutions.

The board supports the EP2C35F672 Cyclone II device, which is optimized for high-bandwidth DSP functions. The board also supports the *PCI Local Bus Specification, Revision 3.0* and *PCI-X, Revision 2.0 mode 1*.

Altera provides a DDR2 SDRAM reference design for use as either a design starting point or an experimental platform. The reference design is designed and tested by Altera engineers and distributed with the *PCI Development Kit, Cyclone II Edition* (ordering code: PCI-DEVKIT-2C35).



For more information on the DDR2 SDRAM reference design, refer to *AN 390: PCI-to-DDR2 SDRAM Reference Design*.

## Components

The board provides the following components:

- Short-form universal PCI (3.3 or 5.0 V) card
  - 32 or 64-bit PCI bus operating at 33 or 66 MHz
  - 32 or 64-bit PCI-X bus operating at 66 or 100 MHz
- Memory
  - Two 32-MByte DDR2 SDRAM devices
  - EPCS64 devices
- FPGA device configuration
  - Switch-selectable on power-up, choose one of two serial configuration devices (EPCS64 devices). One device contains the pre-loaded factory default design, and the other device is for user-programming. Configuration data is downloaded via the USB-Blaster™ download cable.
- Flexible clocking options
  - Socketed 100-MHz high-speed clock oscillator
  - SMA connector clock input

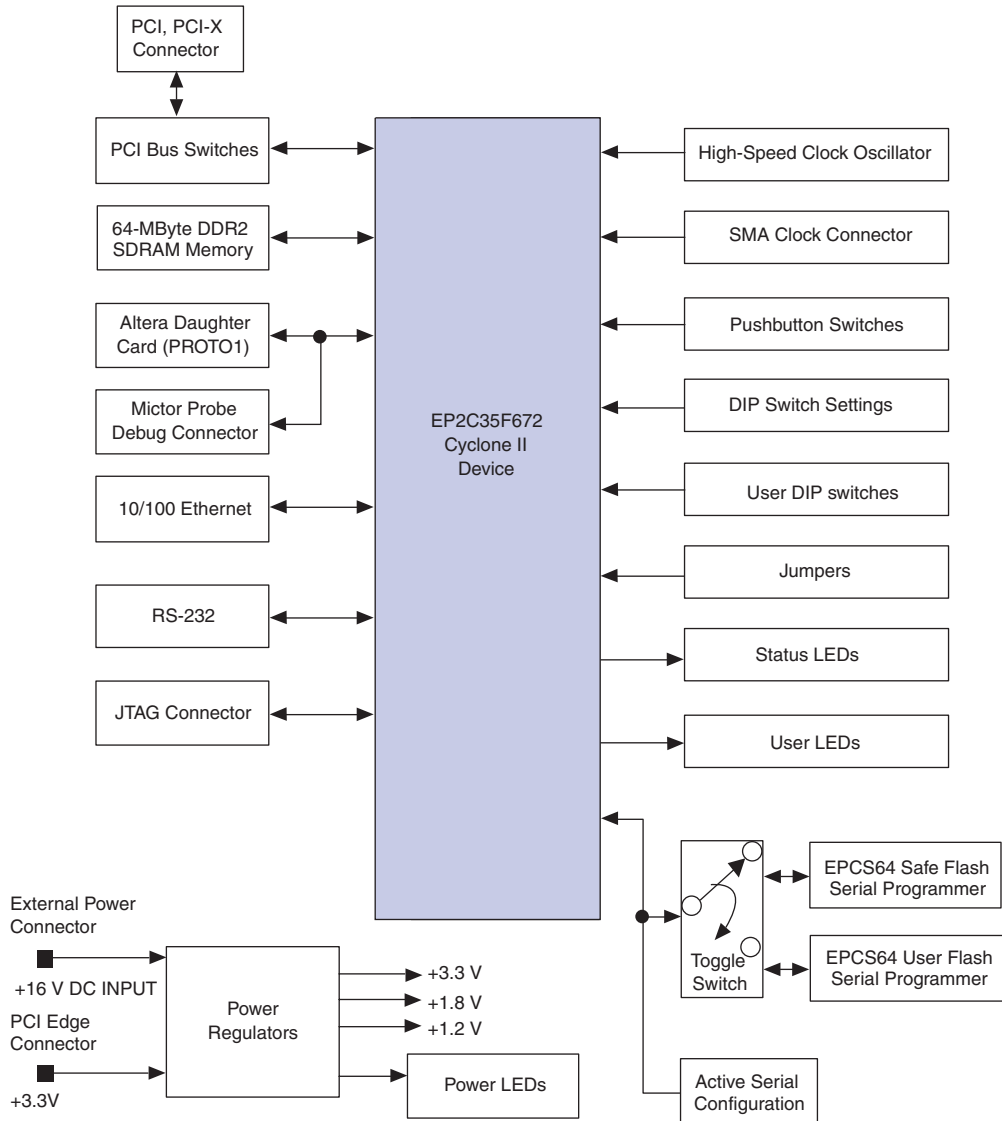
- Switches and indicators
  - Two user-definable push-button switches
  - Five-position, user-definable dual in-line package (DIP) switch bank
  - Eight user-definable LEDs
  - Power and configuration status LEDs
  - Serial port TX/RX activity LEDs
  - Ethernet LEDs (integrated in RJ45 connector)
  - Configuration done and status LEDs
  - Configuration source (local/user) toggle switch
- Flexible power options
  - PCI connector
  - External power supply via laptop power supply cable
- Expansion & Debugging Interfaces
  - Joint Test Action Group (JTAG) interface connector
  - 32-bit Mictor probe connector
  - Altera Daughter Card (PROTO1)
  - 10/100 Ethernet (RJ-45 connector)
  - Serial RS-232 (DB-9 connector)



## Block Diagram

Figure 1-1 shows the board's block diagram.

**Figure 1-1. PCI Development Board, Cyclone II Edition Block Diagram**



## Handling the Board

When handling the board, it is important to observe the following precaution:

*Static discharge precaution*—Without proper anti-static handling the board can be damaged. Therefore, take anti-static precautions while handling the board.

### Board Overview

This chapter provides operational and connectivity detail for the board's major components and interfaces.



For pin-outs and signal specifications, refer to [Chapter 4, Pin-Outs & Signal Specifications](#).

[Figure 2–1](#) shows a top view of the Cyclone™ II EP2C35 PCI Development Board.

**Figure 2–1. Cyclone II EP2C35 PCI Development Board Major Components & Interfaces**

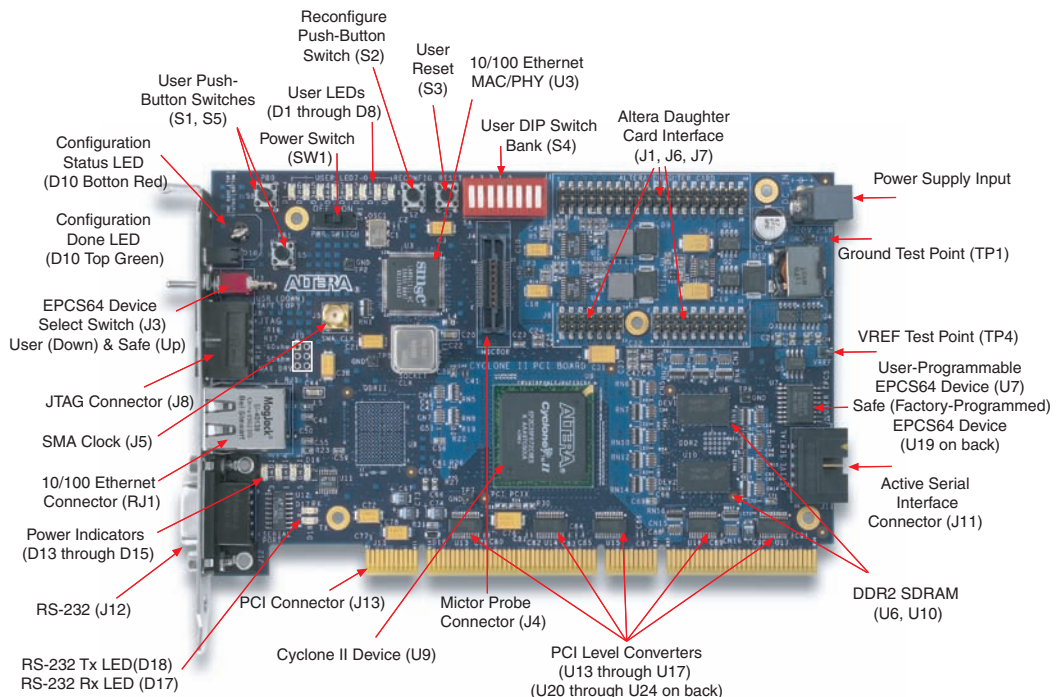


Table 2–1 lists the board’s major components and interfaces.

Type	Component/Interface	Board Reference	Description
FPGA	Cyclone II device	U9	The EP2C35F672 device is installed on the board for the <i>PCI Development Kit, Cyclone II Edition</i> . <i>Note (1)</i>
PCI, PCI-X	PCI connector	J13	Universal PCI and PCI-X bus interfaces. Refer to <a href="#">Table 2–2 on page 2–4</a> .
	PCI level converters	U13 through U17, U20 through U24	Level converters for 5.0-V PCI compatibility. Refer to <a href="#">“PCI Level Converters” on page 2–4</a> .
Memory	DDR2 SDRAM	U6, U10	167 MHz, 32-MByte DDR2 SDRAM
Configuration	User and local-serial FLASH memory	U7, U19	Switch-selectable, factory-programmed (safe) EPCS64 or user-programmable EPCS64 for Cyclone II device configuration.
	JTAG connector	J8	JTAG test and control as well as USB-Blaster configuration interface.
	Active serial (AS) connector	J11	AS configuration interface for EPCS64 device programming ( <i>may not be installed</i> ).
	Configuration status LED	D10 (bottom) (red)	Indicates reconfiguration in progress or configuration error.
	Configuration done LED	D10 (top) (green)	Indicates Cyclone II configuration is complete.
Clock	High-speed clock oscillator	Installed at J9	100-MHz high-speed reference clock.
	SMA clock	J5	Clock input.
	Ethernet clock	OSC1	25-MHz Ethernet clock
Control	User reset push-button switch	S3	User-defined hardware reset.
	Reconfigure push-button switch	S2	Reconfigure Cyclone II device.
	PCI Mode DIP switch	S4, position 1	Enables PCI-X extensions. See <a href="#">Table 2–3 on page 2–5</a> .
	PCI XSPD DIP switch	S4, position 2	If enabled, selects PCI-X operating speed (i.e., 66 or 133 MHz). See <a href="#">Table 2–5 on page 2–5</a> .
	PCI SPD DIP switch	S4, position 3	Selects PCI bus operating speed (66 or 33 MHz). See <a href="#">Table 2–4 on page 2–5</a> .
User settings	User push-button switches	S1, S5	User configurable.
	User DIP switch bank	S4, positions 4-8	User configurable, 5 switches.

**Table 2–1. Cyclone II EP2C35 PCI Development Board Components & Interfaces (Part 2 of 2)**

Type	Component/ Interface	Board Reference	Description
User indicator	User LEDs	D1 through D8	User configurable.
Power	Power connector	J2	External power supply connector.
Power indicators	+5.0-V power OK LED	D15	5.0-V power supply indicator.
	+3.3-V power OK LED	D13	3.3-V power supply indicator.
	+1.8-V power OK LED	D14	1.8-V power supply indicator.
	+1.2-V power OK LED	D16	1.2-V power supply indicator.
Test points	VREF	TP4	VREF test point near VTT/VREF regulator.
	Ground	TP1	Ground test point near power connector.
		TP2	Ground test point near PWR SWITCH.
		TP3	Ground test point near MICTOR.
		TP5	Ground test point near oscillator socket.
		TP6	Ground test point near DDR2 SDRAM.
		TP7	Ground test point near QDRII SRAM.
Expansion interface	Altera® daughter card (PROTO1)	J1, J6, J7	Interface to Altera daughter card (PROTO1).
I/O	10/100 Ethernet	U3, RJ1, OSC1	10/100 Ethernet MAC/PHY, RJ-45 connector, 25-MHz oscillator.
Serial I/O	RS-232	U12, J12	RS-232 serial interface level shifter, DB9 connector.
	RS-232 Tx LED	D18	RS-232 transmitter active indicator.
	RS-232 Rx LED	D17	RS-232 receiver active indicator.
Debug	Mictor probe	J4	Mictor probe interface for Agilent logic analyzers.

**Note to Table 2–1:**

- (1) The Cyclone II EP2C35 PCI Development Board was designed to use either the EP2C35F672, EP2C50F672, or EP2C70F672 device. However, the board ships with—and was only tested with—the EP2C35F672 device.

## Component Operation

This section describes the board's operation, providing detailed component descriptions.

### Cyclone II Device

The Cyclone II device (U9) is connected to all of the board's components through appropriate on-chip interfaces and board circuitry. The device supports PCI and PCI-X bus interfaces, the DDR2 SDRAM, as well as the 10/100 Ethernet. Users can program the Cyclone II device to implement custom designs.



For more information on Cyclone II devices, refer to the *Cyclone II Device Family Data Sheet* section of the *Cyclone II Device Handbook*.

### PCI & PCI-X Bus Support & Compatibility

The board is compatible with Altera® PCI MegaCore® functions (`pci_mt64`, `pci_mt32`, `pci_t64`, `pci_t32`), AMPP<sup>SM</sup> PCI and PCI-X megafunctions, and other third-party vendor megafunctions.

The Cyclone II devices and PCI connector (J13) support *PCI Local Bus Specification, Revision 3.0* and *PCI-X, Revision 2.0 mode 1*. See [Table 2–2](#).

Application	Width (Bits)	Voltage (V)	Speed (MHz)
PCI	32 and 64	3.3 or 5.0 V	33 or 66 MHz
PCI-X	32 and 64	3.3 V	66 or 100 MHz

#### *PCI Level Converters*

Board components U13 - U17 and U20 - U24 are IDT IDTQS3861Q level converters that convert between 5.0-V PCI backplane signals and Cyclone II 3.3-V signals.

### PCI Operating Mode, Speed & DIP Switch Settings

Tables 2-3, 2-4, and 2-5 list the board's PCI operating mode and speed, and the corresponding DIP switch (S4) bank setting.

<b>Table 2-3. PCI Operating Mode Setting</b>	
<b>DIP Switch Position 1 (PCI Mode)</b>	<b>PCI Operating Mode</b>
Off	PCI-X at the speed shown in Table 2-5.
On	PCI at the speed shown in Table 2-4.

<b>Table 2-4. PCI Operating Speed Setting</b>	
<b>DIP Switch Position 3 (PCI SPD)</b>	<b>PCI Operating Speed (MHz)</b>
Off	66 MHz
On	33 MHz

<b>Table 2-5. PCI-X Operating Speed Setting</b>	
<b>DIP Switch Position 2 (PCI XSPD)</b>	<b>PCI-X Operating Speed (MHz)</b>
Off	133 or 100 MHz
On	66 MHz

## Memory

The board has the following memory components:

- Two 32-MByte DDR2 SDRAM devices
- Two EPCS64 serial configuration (flash) devices

### DDR2 SDRAM Memory

The board was tested with the Altera 167-MHz, DDR2 SDRAM Controller MegaCore function version 3.2.0. Two 16M × 16 DDR2 SDRAM devices are connected to banks 3 and 4 of the Cyclone II device as a single 16M × 32 memory block.

### EPCS64 Serial Configuration (Flash) Devices

The board has two EPCS64SI16N serial configuration devices (U7 and U19) that upon power-up programs the Cyclone II device. The board contains one EPCS64SI16N device that is user-programmable, and one preloaded, factory-programmed EPCS64SI16N device.



For more information on serial configuration devices, refer to the *Serial Configuration Devices (EPCS1, EPCS4, EPCS16 & EPCS64) Data Sheet* chapter in volume 2 of the *Configuration Handbook*.

## Clocks & Clock Distribution

The board has two clock sources driven directly to the Cyclone II device. Using the PLLs integrated within the Cyclone II device, the designer has significant flexibility to achieve the appropriate clock configuration.

Table 2–6 shows the board’s clock sources.



Refer to the *PLLs in Cyclone II Devices* chapter in the *Cyclone II Device Handbook* for more information.

**Table 2–6. Cyclone II EP2C35 PCI Development Board Clock Sources**

Signal Name	Source	Destination	Primary PLL (1)
LPCIX_CLK	PCI connector (J13.B16) through level shifter (U13.13 and U13.11) and resistor (R29)	Cyclone II device (U9.P26)	PLL2
OSCA_CLK1	Socketed 100-MHz oscillator (J4.5) through resistor (R61)	Cyclone II device (U9.N1)	PLL1
OSCA_CLK6	Socketed 100-MHz oscillator (J4.5) through resistor (R62)	Cyclone II device (U9.P25)	PLL2
CLK_SMA	SMA clock input connector (J5.1)	Cyclone II device (U9.N2)	PLL1
CLK_FROM_PROTO1	Altera daughter card (PROTO1) (J7.13)	Cyclone II device (U9.P2)	PLL1
DDR2_SYNC_CLK	Cyclone II device (U9.B7)	Cyclone II device (U9.AF14)	PLL4
CLK_25MHZ	On-board 25-MHz 10/100 Ethernet oscillator (OSC1.4)	Ethernet MAC/PHY device (U3.127)	N/A

**Note:**

- (1) A global clock input can directly feed Cyclone II PLLs. Table 2–6 shows the direct connections and does not show the connection via global clock networks.

### SMA Clock Input Requirements

The SMA clock input, CLK\_SMA, can be provided by an external signal source through the J5 connector. Use a 50-Ω signal source and cable with an LVTTTL-type signal (square-wave, with a voltage swing from 0.0 to +3.3 V). The maximum CLK\_SMA input frequency is 464 MHz; the maximum board frequency with the SMA clock is 500 MHz.



## Cyclone II Output Clocks

Table 2–7 lists the Cyclone II output clocks and their destinations.

Signal Name	Source	Cyclone II Device PLL	Destination
DDR2_CK_P0	U9.A22	-	DDR2 SDRAM memory (U10.J8)
DDR2_CK_N0	U9.A23	-	DDR2 SDRAM memory (U10.K8)
DDR2_CK_P1	U9.A9	-	DDR2 SDRAM memory (U6.J8)
DDR2_CK_N1	U9.A8	-	DDR2 SDRAM memory (U6.K8)
PLL_TO_PROTO1	U9.V21	PLL4	Altera daughter card (PROTO1)

## Power

This section describes the on-board switching regulators. The board can be powered from one of the following sources:

- PCI connector J13 supplies +3.3 V and +5.0 V
- Power connector J2 supplies +16 V from external power source (40 W) that is regulated to 3.3 V

### *+3.3-V Regulator*

The board contains a switching regulator (U2) that takes in the external power source of +9 V to +20 V and regulates down to +3.3 V. All power associated with various required voltage levels are regulated either from the PCI 3.3-V power source or from a 3.3-V power source generated from the power connector (stand-alone operation only). Only one power source is required at a time.

### *+1.8-V Regulator*

A switching regulator (U4) generates +1.8 V for the Cyclone II device I/O and DDR2 SDRAM voltages from +3.3 V.

### *+1.2-V Regulator*

A switching regulator (U1) generates +1.2 V for the Cyclone II internal core voltage from +3.3 V.

### External Power Jack

Board header J2 is a power receptacle from a standard laptop power supply. Table 2–8 shows that the external power switch (SW1) enables the external power supply.

<b>External Power Switch (SW1) Position (PWR SWITCH)</b>	<b>Description</b>
Off	Disable external power supply
On	Enable external power supply



If both the external power and the PCI power are supplied at the same time, the board draws power from the external power supply for all power rails except the 5.0-V power rail. Therefore, when the PCI 3.3-V circuit transistors detect external power supply voltage, they disable the power from the PCI connector. The external power switch does not control the power from the PCI connector.

### Test Points

Table 2–9 shows the board's power supply test points.

<b>Signal Name</b>	<b>Reference Designator</b>	<b>Description</b>
VREF	TP4	0.9-V VREF for DDR2 SDRAM
Ground	TP5	Ground test point near oscillator socket.
	TP1	Ground test point near power connector.
	TP2	Ground test point near PWR SWITCH.
	TP3	Ground test point near MICTOR.
	TP6	Ground test point near DDR2 SDRAM.

## LEDs

This section describes the board's LED resources.

### Power LEDs

There are four power indication LEDs on the board, see [Table 2–10](#).

Board Reference	Reference Designator	Color	Description
5.0 V (1)	D15	Green	5.0-V power is on.
3.3 V	D13	Green	3.3-V power is on.
1.8 V	D14	Green	1.8-V power is on.
1.2 V	D16	Green	1.2-V power is on.

*Note:*

- (1) The power indication LED for +5.0 V requires that the board be plugged into a PCI slot.

### Status LEDs

[Table 2–11](#) shows the board's status LEDs.

Board Reference	Reference Designator	Color	Description
CONF_DONE	D10.Anode (Top)	Green	Indicates that the Cyclone II device has been successfully configured.
CONF_STATUS <sub>n</sub>	D10.Cathode (Bottom)	Red	Indicates that the Cyclone II device received an error during device configuration.
TX	D18	Green	Serial cable (RS-232) is transmitting data.
RX	D17	Green	Serial cable (RS-232) is receiving data.

*Ethernet LEDs*

Table 2–12 shows the Ethernet LEDs.

<b>Board Reference</b>	<b>Reference Designator</b>	<b>Color</b>	<b>Description</b>
Ethernet RJ45	RJ1	Green	Indicates Ethernet link
Ethernet RJ45	RJ1	Yellow	Indicates Ethernet link activity

*User LEDs*

Table 2–13 lists the user LEDs, which are identified as components D1-D8. For information on connecting the user LED signals with the Cyclone II pins, refer to “User LEDs” on page 4–13.

<b>Number</b>	<b>Reference Designator</b>	<b>Color</b>	<b>Description</b>
0	D8	Green	User defined
1	D7	Green	User defined
2	D6	Green	User defined
3	D5	Green	User defined
4	D4	Green	User defined
5	D3	Green	User defined
6	D2	Green	User defined
7	D1	Green	User defined

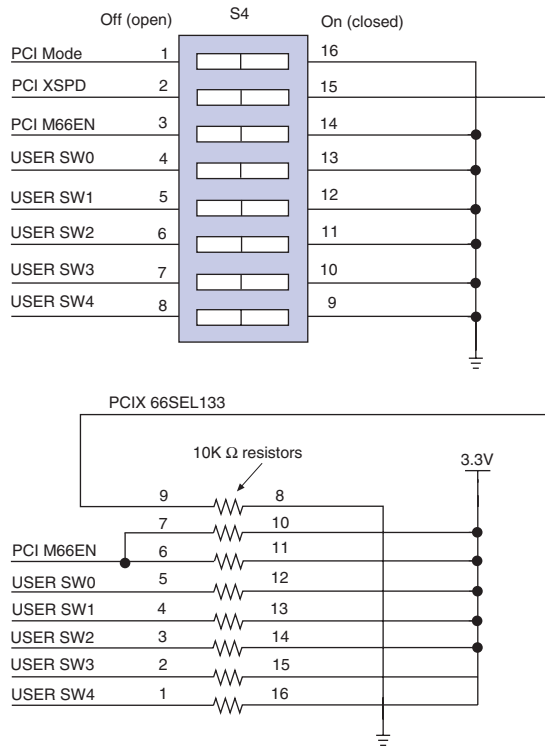
## Board DIP Switch Settings

Table 2–14 describes the board DIP switch bank (S4) settings.

<b>Board Reference</b>	<b>Board DIP Switch Settings</b>	<b>Factory Default Setting</b>	<b>Description</b>
PCI XSPD	Switch S4 Position 2	On	Selects PCI-X bus operating speed. Refer to <a href="#">Table 2–5</a> .
PCI MODE	Switch S4 Position 1	On	Toggles between PCI and PCI-X operating modes. Refer to <a href="#">Table 2–3</a> .
PCI SPD	Switch S4 Position 3	Off	Selects PCI bus operating speed. Refer to <a href="#">Table 2–4</a> .
User SW0	Switch S4 Position 4	Off	User defined. These DIP switches are directly connected to the Cyclone II device. These switches are momentary-contact, push-button switches that provide stimulus to designs in the Cyclone II device. Each switch is connected to a Cyclone II general purpose I/O pin with a pull-up resistor. When a switch is pressed, the Cyclone II device pin will detect a logic 0; when the switch is not pressed, the Cyclone II device pin will detect a logic 1. The push-button switches are tied high with a pull-up resistor.
User SW1	Switch S4 Position 5	Off	
User SW2	Switch S4 Position 6	Off	
User SW3	Switch S4 Position 7	Off	
User SW4	Switch S4 Position 8	Off	

Figure 2–2 shows the board’s DIP switch circuitry.

**Figure 2–2. Board User DIP Switch Settings**



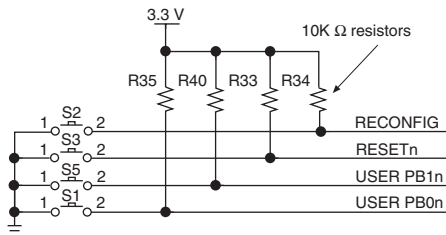
## Push-Button Switches

Table 2–15 describes the board’s push-button switches.

Board Reference	Reference Designator	Description
RECONFIG	S2	Causes Cyclone II device to reload configuration
RESET	S3	User-defined hardware reset.
PB0	S1	User-defined. These switches are momentary-contact, push-button switches that provide stimulus to designs in the Cyclone II device. Each switch is connected to a Cyclone II general purpose I/O pin with a pull-up resistor. When a switch is pressed, the Cyclone II device pin will detect a logic 0; when the switch is not pressed, the Cyclone II device pin will detect a logic 1. The push-button switches are tied high with a pull-up resistor.
PB1	S5	

Figure 2–3 shows the board’s push-button switch circuitry.

**Figure 2–3. Board Push-Button Switches**



## Interface Operation

This section describes the board's expansion and debugging interface operation.

The board includes the following interfaces:

- Altera daughter card (PROTO1)
- 10/100 Ethernet
- RS-232 serial
- AS interface
- JTAG
- SignalTap® II logic analyzer via the JTAG debug interface
- Mictor probe

### Altera Daughter Card (PROTO1) Interface

Board connectors J1, J6, and J7 allow the board to accept optional boards with an Altera daughter card (PROTO1) interface. These connectors can also be used for general purpose debugging, or an expansion interface with 41 pins of LVTTTL signals, which are shared with the Mictor probe connector (J4).

Table 2–16 shows the maximum allowed current draw for the Altera daughter card (PROTO1) interface.

<b>Table 2–16. Maximum Allowed Current Draw for Altera Daughter Card</b>	
<b>Voltage (V)</b>	<b>Maximum Current (A)</b>
3.3	2A



For more information about the following:

- The Altera daughter card interface and to guarantee a longer life for the card, refer to either the Stratix II or Cyclone II Editions of the *Nios Development Board Reference Manuals*.
- Available Altera daughter cards that can be used with the PCI development board, Cyclone II edition, refer to [www.altera.com/devkits](http://www.altera.com/devkits).

### 10/100 Ethernet

Board reference U3 is an SMSC LAN91C111 10/100 Ethernet MAC/PHY, and board reference RJ1 is an RJ-45 connector with integrated magnetics and activity LEDs.



## RS-232 Serial Interface

Board reference J12 is a DB-9 connector wired as an RS-232 serial DTE device. U12 shifts the RS-232 signals to LVTTTL levels for connection to the Cyclone II device.

## AS Interface

Board connector J11 provides active serial programming to the EPCS64 device using an Altera USB-Blaster™ cable.

## JTAG

Board connector J8 provides access to the board's JTAG port using a USB-Blaster cable.

## SignalTap II Logic Analyzer

The JTAG debug interface can also be used for the Altera SignalTap II logic analyzer.



For more information on the SignalTap II logic analyzer, refer to the *Design Debugging Using the SignalTap II Embedded Logic Analyzer* chapter in volume 3 of the *Quartus II Handbook*.

## Mictor Probe

Board connector J4 is a Mictor header that provides probing capability for internal Cyclone II device signals. The Mictor probe is compatible with the Agilent Technologies E5346A Probe Adapter for use with Agilent Technologies Logic Analyzers. The PROTO1 connector signals are shared with the Mictor probe and Altera daughter card interfaces, and the signals on the Mictor header (J4) are shared with the Altera daughter card signals (J1, J6, and J7).

Use the SignalProbe™ incremental routing feature to route internal Cyclone II signals to the J4 connector. You do not need to recompile the Cyclone II device design to use the SignalProbe feature.



For more information on the SignalProbe feature, refer to the *Quick Design Debugging Using Signal Probe* chapter in volume 3 of the *Quartus II Handbook*.



### Introduction

This chapter provides step-by-step instructions for using the board. You can configure the board with either the pre-loaded, factory-programmed (safe) design or with a new design. This chapter discusses both.

To configure the board, there are four main steps:

- Apply power to the board
- Configure the Cyclone™ II device using either:
  - Serial flash configuration
  - JTAG configuration via either:
    - The SRAM object file (.sof)
    - JTAG indirect configuration (.jic) files and the Cyclone II device's Serial FlashLoader (SFL) image
- Program the serial flash memory using either:
  - The conventional active serial programming method
  - The SFL programming scheme for in-system programming via the JTAG interface
- Configure the board for bench-top operation

### Apply Power to the Board

Introduce power in one of the following ways:

- Install the board in a universal PCI slot
- Connect an external power supply to the external power connector (J2)



No damage will occur if the external power supply is connected while the board is installed in the PCI slot. When both power sources are applied, the board is designed to operate from the PCI slot's power supply.

To operate the board with an external power supply, perform the following steps:

1. Insert the connector of a 9 to 20-V laptop power supply into the J2 header.
2. Set the PWR SWITCH (SW1) to the *On* position. Refer to [Table 2-8 on page 2-8](#).

## Configure the Cyclone II Device

The on-board Cyclone II device can be configured in one of two ways:

- Serial flash configuration
- JTAG configuration

### Serial Flash Configuration

Serial flash configuration of the Cyclone II device can be accomplished in two ways:

- Configuration via user-programmable flash memory
- Configuration via factory-programmed design

#### *Configuration via User-Programmable Flash Memory*

The Cyclone II FPGAs use SRAM cells to store configuration data. Because SRAM memory is volatile, configuration data must be downloaded to the Cyclone FPGAs each time power is applied to the board.

The board has a non-volatile configuration scheme that automatically configures the Cyclone II device with either a user-programmable or factory-programmed default design. A switch (J3) is used to select either the user-programmable or the factory-programmed ECPS64 device. In referring to the switch position, the board's bench-top operation perspective is used. Therefore, when the switch is in the *Up* position, it is switched away from the bench and in the same direction as the component side of the board; the *Down* position is in the opposite position.

Upon power-up, the configuration circuit (comprised of the selected EPCS64 device) configures the Cyclone II device. If the switch (J3) is set for user configuration (*Down* position), the circuit attempts to load the user design. If the load is not successful, the CONF\_DONE LED (D10) does not illuminate and the Cyclone II device is not configured. If the load is successful, the CONF\_DONE LED illuminates.

#### *Configuration via Factory-Programmed Design*

When the factory-programmed design is loaded into the Cyclone II device, the user LEDs blink and the CONF\_DONE LED illuminates. To select the factory default design, set the switch (J3) to the *Up* position.



For more information on either the user-programmable or factory-programmed design, refer to the *PCI Development Kit, Cyclone II Edition Getting Started User Guide*.

## JTAG Configuration

The Cyclone II device can be configured after power is applied to the board. The JTAG interface permits the Quartus® II software to load the Cyclone II device with a user design through the Altera® USB-Blaster™ download cable. The user design remains in the Cyclone II device until power is removed from the board.

To configure the Cyclone II device using the Quartus II software and the USB-Blaster cable, perform the following steps:

1. Attach the USB-Blaster cable to the J8 header.
2. Open the Quartus II SRAM Object File (.sof) that you want to load into the device. This step launches the Quartus II Programmer.
3. Select USB-Blaster as the hardware. For instructions, refer to *Changing the Hardware Setup* in Quartus II Help.
4. Set the mode to JTAG.
5. Click **Start**.



If the board is installed into a computer's PCI slot when it is configured by the USB Blaster cable, the computer system could lock up. If this happens, reset the computer. Do not shut down the computer or the configuration will be lost. Restart the computer to re-enumerate the PCI bus.

Upon successful configuration, the CONF\_DONE LED (D10) illuminates.



For information on how to use the USB-Blaster cable, refer to the following:

- *USB-Blaster Download Cable User Guide*
- Quartus II Help

## Program the Serial Flash Memory

The serial flash memory can be programmed in one of two ways:

- Active serial programming
- In-system programming via the JTAG and the SFL solution



The in-system programming method via the SFL solution is only for the user-programmable EPCS64 device. The factory-programmed EPCS64 device's image is not to be replaced.

Figure 3-1 illustrates both the conventional (AS programming) method of programming serial configuration devices as well as the in-system programming method using the SFL solution.

Figure 3-1. Conventional Vs In-System Programming Method

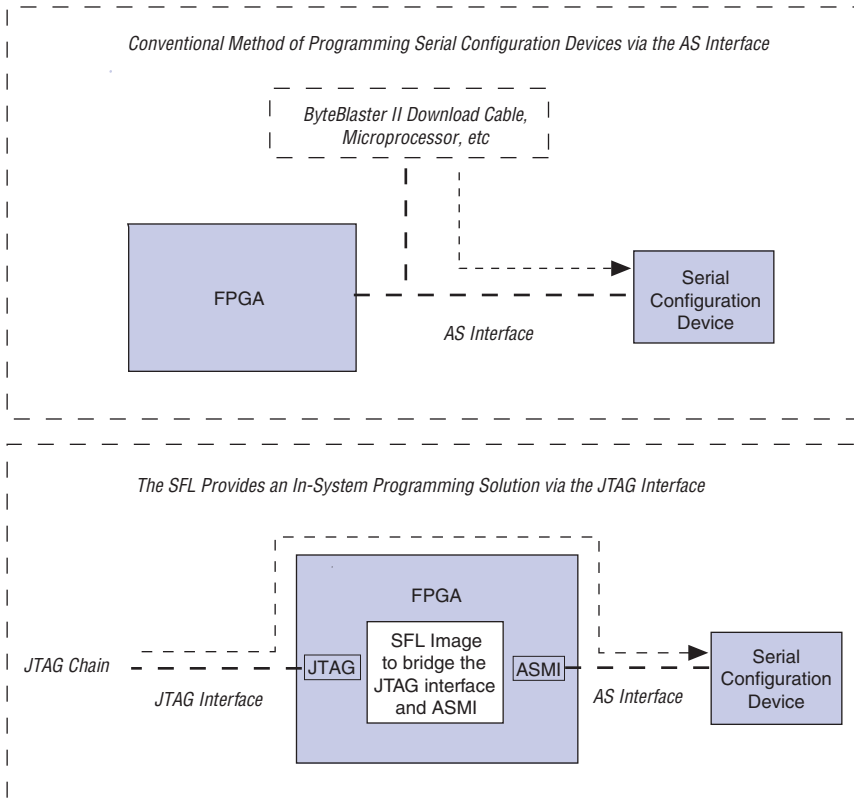


Table 3–1 lists the advantages and disadvantages of both methods.

<i>Table 3–1. Advantages &amp; Disadvantages</i>		
<b>Method</b>	<b>Advantage</b>	<b>Disadvantage</b>
Conventional	Simple and fast	Requires separate programming interface to configure FPGAs and program serial configuration devices.
SFL solution	Able to configure the FPGA and program serial configuration devices using the same JTAG interface	Slow because the SFL solution needs to configure the FPGA before programming serial configuration devices.

## Active Serial Programming

This section provides active serial programming steps for both the user-programmable and preloaded, factory-programmed EPCS64 devices.

### *User-Programmable EPCS64 Device*

This section provides the steps to program the user-programmable EPCS64 device's serial flash memory via the active serial programming method.

To program the user-programmable EPCS64 device's serial flash memory using the Quartus II software, follow these steps:

1. Write your custom programmer object file (**.pof**) into flash memory.



For instructions on either writing a POF to flash memory or creating a POF, refer to Quartus II Help.

2. Choose **Programmer** (Tools menu). The **Chain1.cdf** window displays.
3. Scroll to **Active Serial Programming** in the **Mode** field.
4. To select the user-programmable EPCS64 device, set the switch (J3) to the *Down* position.

If the switch (J3) is in the *Up* position (factory-programmed), the factory-programmed design will be overwritten.

5. Connect the USB-Blaster download cable to the active serial configuration connector, J11.
6. Choose **Add File** and browse to the POF file.
7. Click **Open**.
8. Click **Start**. The user-programmable EPCS64 device is programmed via the active serial header.

To load the program from the user-programmable EPCS64 device to the Cyclone II device, follow these steps:

1. Power-down the board by setting the SW1 switch in the *Off* position.
2. Perform a power-on reset by setting the SW1 switch in the *On* position. This will load the user-programmable flash memory data into the Cyclone II device.

### *Pre-Loaded, Factory-Programmed (Safe) EPCS64 Device*

This section provides the steps to load the factory-created reference design into factory-programmed (safe) EPCS64 device's serial flash memory via the active serial programming method.

To program the pre-loaded, factory-programmed (safe) EPCS64 device's serial flash memory using the Quartus II software, follow these steps:

1. Choose **Programmer** (Tools menu). The **Chain1.cdf** window displays.
2. Scroll to **Active Serial Programming** in the **Mode** field.
3. To select the preloaded, factory-programmed EPCS64 device, set the switch (J3) to the *Up* position.
4. Connect the USB-Blaster download cable to the active serial configuration connector, J11.
5. Choose **Add File** and browse to the factory-programmed POF file.
6. Click **Open**.
7. Click **Start**. The factory-created reference design is loaded into the factory-configuration region of the EPCS64 device via the active serial header.



To load the program from the factory-programmed EPCS64 device to the Cyclone II device, follow these steps:

1. Power-down the board by setting the SW1 switch in the *Off* position.
2. Perform a power-on reset by setting the SW1 switch in the *On* position. This will load the factory-created reference design into the Cyclone II device.

### **In-System Programming via the JTAG & the SFL Solution (User-Programmable EPCS64 Device Only)**

Although serial configuration devices do not directly support the JTAG interface, Cyclone II devices have an IP image that can be used as a bridge between the JTAG interface and active serial interface of the serial configuration device. Therefore, JTAG in-system programming is possible for serial configuration devices.

To program the user-programmable EPCS64 device via the SFL solution, follow these steps:

1. Convert the SOF to a JIC file.
2. Use the Quartus II Programmer to program the JIC file into the EPCS64 device. For step-by-step instructions, refer to *AN 370: Using the Serial FlashLoader with the Quartus II Software*.

The Quartus II software automatically programs the SFL image into the Cyclone II device, erases the EPCS64 device data, and programs the JIC image into the EPCS64 device. This process overwrites the existing image in the Cyclone II device and replaces it with the SFL image.

3. Reconfigure the FPGA with the new configuration data. This can be done by either cycling the power to the board or pressing the Reconfigure switch (S2).

# Configure the Board for Bench-Top Operation

The development board is initially configured for installation in a conventional PCI slot. Five standoffs and five screws are included for bench-top operation.

To configure the board for bench-top operation, follow these steps:

1. Position the board face up with the PCI bracket on the left.
2. Insert a screw in the hole next to PWR SWITCH (SW1) and fasten a standoff to the screw.
3. Insert a screw in the hole next to RS-232 LEDs (D17 and D18) and fasten a standoff to the screw.
4. Insert a screw in between J6 and J7 and fasten a standoff to the screw.
5. Insert a screw in the hole next to external power jack (J2) and fasten a standoff to the screw.
6. Insert a screw in the lower right corner next to J11 and fasten a standoff to the screw.

To configure the board, perform the following steps:

1. Create a POF for your design.
2. Write the POF into flash memory.
3. Select the user-programmable EPCS64 device by setting the switch (J3) to the *Down* position.
4. Force the device to reconfigure by pressing the **RECONFIG** push-button (S2).

## Introduction

This chapter provides the following board pin-out and signal specifications:

- PCI & PCI-X bus interfaces
- Memory
- I/O
- Configuration
- Control & user settings
- Altera® daughter card

## PCI & PCI-X Bus Interfaces

Board header J13 is a 3.3/5.0-V universal PCI connector. Board components U13 - U17 and U20 - U24 are level converters that reduce 5.0-V PCI backplane signals to allowable 3.3-V ranges. [Figure 4-1](#) shows PCI signal flow between the PCI connector and the Cyclone™ II device via the level converters.

**Figure 4-1. PCI Signal Flow Using Level Converters**



[Table 4-1](#) shows the relationship between the PCI signal, PCI connector, Cyclone II device pin, and the local signal. The level converters are not shown.

<b>Table 4-1. PCI Signals &amp; Connections (Part 1 of 4)</b>			
<b>PCI Signal</b>	<b>PCI Connector (J13)</b>	<b>Cyclone II Pin (U9)</b>	<b>Local Signal</b>
PCI_CLK/PCIX_CLK	B16	W26/P26	LPCI_CLK
PCI_RSTn	A15	N25	LPCI_RSTn
PCI_LOCKn	B39	V22	LPCI_LOCKn
PCI_INTAn	A6	M20	LPCI_INTAn
PCI_IDSEL	A26	M25	LPCI_IDSEL

**Table 4–1. PCI Signals & Connections (Part 2 of 4)**

PCI Signal	PCI Connector (J13)	Cyclone II Pin (U9)	Local Signal
PCI_REQn	B18	N20	LPCI_REQn
PCI_REQ64n	A60	V26	LPCI_REQ64n
PCI_GNTn	A17	M24	LPCI_GNTn
PCI_ACK64n	B60	V25	LPCI_ACK64n
PCI_FRAMEn	A34	N24	LPCI_FRAMEn
PCI_DEVSELn	B37	R25	LPCI_DEVSELn
PCI_IRDYn	B35	P23	LPCI_IRDYn
PCI_TRDYn	A36	N23	LPCI_TRDYn
PCI_STOPn	A38	P24	LPCI_STOPn
PCI_PAR	A43	T20	LPCI_PAR
PCI_PAR64	A67	U26	LPCI_PAR64
PCI_PERRn	B40	U24	LPCI_PERRn
PCI_SERRn	B42	U23	LPCI_SERRn
PCI_CBEn0	A52	R20	LPCI_CBEn0
PCI_CBEn1	B44	T22	LPCI_CBEn1
PCI_CBEn2	B33	T24	LPCI_CBEn2
PCI_CBEn3	B26	T25	LPCI_CBEn3
PCI_CBEn4	B66	U20	LPCI_CBEn4
PCI_CBEn5	A65	U21	LPCI_CBEn5
PCI_CBEn6	B65	V24	LPCI_CBEn6
PCI_CBEn7	A64	V23	LPCI_CBEn7
PCI_AD0	A58	L20	LPCI_AD0
PCI_AD1	B58	L21	LPCI_AD1
PCI_AD2	A57	L24	LPCI_AD2
PCI_AD3	B56	L25	LPCI_AD3
PCI_AD4	A55	M19	LPCI_AD4
PCI_AD5	B55	M22	LPCI_AD5
PCI_AD6	A54	M23	LPCI_AD6
PCI_AD7	B53	R24	LPCI_AD7
PCI_AD8	B52	U22	LPCI_AD8
PCI_AD9	A49	U25	LPCI_AD9
PCI_AD10	B48	W21	LPCI_AD10
PCI_AD11	A47	W23	LPCI_AD11

**Table 4–1. PCI Signals & Connections (Part 3 of 4)**

PCI Signal	PCI Connector (J13)	Cyclone II Pin (U9)	Local Signal
PCI_AD12	B47	W24	LPCI_AD12
PCI_AD13	A46	W25	LPCI_AD13
PCI_AD14	B45	Y21	LPCI_AD14
PCI_AD15	A44	Y23	LPCI_AD15
PCI_AD16	A32	Y24	LPCI_AD16
PCI_AD17	B32	Y25	LPCI_AD17
PCI_AD18	B30	Y26	LPCI_AD18
PCI_AD19	B30	AA23	LPCI_AD19
PCI_AD20	A29	AA24	LPCI_AD20
PCI_AD21	B29	AA25	LPCI_AD21
PCI_AD22	A28	AA26	LPCI_AD22
PCI_AD23	B27	AB23	LPCI_AD23
PCI_AD24	A25	AB24	LPCI_AD24
PCI_AD25	B24	AB25	LPCI_AD25
PCI_AD26	A23	AB26	LPCI_AD26
PCI_AD27	B23	AC23	LPCI_AD27
PCI_AD28	A22	AC25	LPCI_AD28
PCI_AD29	B21	AC26	LPCI_AD29
PCI_AD30	A20	AD24	LPCI_AD30
PCI_AD31	B20	AD25	LPCI_AD31
PCI_AD32	A91	B24	LPCI_AD32
PCI_AD33	B90	B25	LPCI_AD33
PCI_AD34	A89	C24	LPCI_AD34
PCI_AD35	B89	C25	LPCI_AD35
PCI_AD36	A88	D23	LPCI_AD36
PCI_AD37	B87	D25	LPCI_AD37
PCI_AD38	A86	D26	LPCI_AD38
PCI_AD39	B86	E22	LPCI_AD39
PCI_AD40	A85	E23	LPCI_AD40
PCI_AD41	B84	E24	LPCI_AD41
PCI_AD42	A83	E25	LPCI_AD42
PCI_AD43	B83	E26	LPCI_AD43
PCI_AD44	A82	F23	LPCI_AD44

**Table 4–1. PCI Signals & Connections (Part 4 of 4)**

PCI Signal	PCI Connector (J13)	Cyclone II Pin (U9)	Local Signal
PCI_AD45	B81	F25	LPCI_AD45
PCI_AD46	A80	F26	LPCI_AD46
PCI_AD47	B80	G21	LPCI_AD47
PCI_AD48	A79	G22	LPCI_AD48
PCI_AD49	B78	G23	LPCI_AD49
PCI_AD50	A77	G26	LPCI_AD50
PCI_AD51	B77	H23	LPCI_AD51
PCI_AD52	A76	H25	LPCI_AD52
PCI_AD53	B75	H26	LPCI_AD53
PCI_AD54	A74	J20	LPCI_AD54
PCI_AD55	B74	J21	LPCI_AD55
PCI_AD56	A73	J23	LPCI_AD56
PCI_AD57	B72	J24	LPCI_AD57
PCI_AD58	A71	J25	LPCI_AD58
PCI_AD59	B71	J26	LPCI_AD59
PCI_AD60	A70	K22	LPCI_AD60
PCI_AD61	B69	K23	LPCI_AD61
PCI_AD62	A68	K25	LPCI_AD62
PCI_AD63	B68	K26	LPCI_AD63

Table 4–2 shows the PCI system configuration signals.

**Table 4–2. PCI System Configuration Signals**

Board Reference	Board Settings DIP Switch Bank Positions (S4)	PCI Signal	PCI Connector (J13)	Attribute
PCI SPD	Switch S4, position 3	PCI_M66EN	B49	Ground
PCI Mode	Switch S4, position 1	PCI_XCAP	B38	Ground
PCI XSPD	Switch S4, position 2			10-K $\Omega$ resistor to ground

## Memory

This section describes the DDR2 memory pin-outs and signal specifications.

### DDR2 SDRAM Memory

The DDR2 SDRAM memory devices installed at U6 and U10 use SSTL-1.8 Class II signaling and termination. A reference voltage of 0.9 V is supplied to banks 3 and 4 for SSTL-1.8 receiver biasing. On-board resistors provide terminations in both 'fly-by' and non 'fly-by' orientations. Figure 4–2 shows the DDR2 SDRAM memory termination connections for the data, data strobe, and data mask pins. The on-board DDR2 SDRAM memory devices share their pins on the Cyclone II device for address and control nets, whereas the data nets are independent.

**Figure 4–2. DDR2 SDRAM Memory Termination Connections**

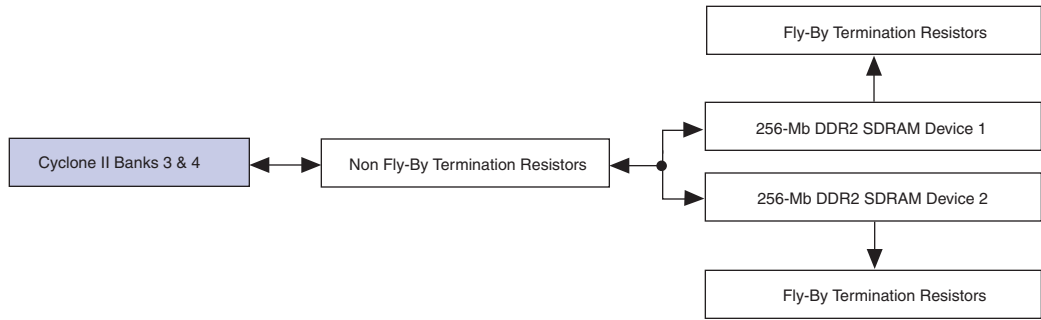


Table 4–3 shows the DDR2 SDRAM memory and termination signal connections.

**Table 4–3. DDR2 SDRAM Memory & Terminator Signal Connections (Part 1 of 3)**

DDR2 SDRAM Signal	DDR2 SDRAM Device 1 (U6)	DDR2 SDRAM Device 2 (U10)	Non Fly-By Terminator	Fly-By Terminator	Cyclone II Pin (U9)
DDR2_CLKEN0	K2	K2	N/A	RN11.2	D21
DDR2_CS <sub>n</sub> 0	L8	L8	N/A	RN11.6	C23
DDR2_RAS <sub>n</sub>	K7	K7	N/A	RN9.1	D7
DDR2_CAS <sub>n</sub>	L7	L7	N/A	RN13.4	F9
DDR2_WEn	K3	K3	N/A	RN9.2	C7
DDR2_ODT	K9	K9	N/A	RN13.3	G9
DDR2_A0	M8	M8	N/A	RN13.2	A19

**Table 4–3. DDR2 SDRAM Memory & Terminator Signal Connections (Part 2 of 3)**

DDR2 SDRAM Signal	DDR2 SDRAM Device 1 (U6)	DDR2 SDRAM Device 2 (U10)	Non Fly-By Terminator	Fly-By Terminator	Cyclone II Pin (U9)
DDR2_A1	M3	M3	N/A	RN13.6	A20
DDR2_A2	M7	M7	N/A	RN11.4	A21
DDR2_A3	N2	N2	N/A	RN13.8	B19
DDR2_A4	N8	N8	N/A	RN11.1	B21
DDR2_A5	N3	N3	N/A	RN11.7	B22
DDR2_A6	N7	N7	N/A	RN13.1	C19
DDR2_A7	P2	P2	N/A	RN13.7	D18
DDR2_A8	P8	P8	N/A	R25	D19
DDR2_A9	P3	P3	N/A	RN13.5	D20
DDR2_A10	M2	M2	N/A	RN9.3	A4
DDR2_A11	P7	P7	N/A	RN9.5	A5
DDR2_A12	R2	R2	N/A	RN9.7	B4
DDR2_A13	R8	R8	N/A	RN9.6	B5
DDR2_A14	R3	R3	N/A	RN9.8	B6
DDR2_A15	R7	R7	N/A	RN9.4	C4
DDR2_BA0	L2	L2	N/A	RN11.8	C22
DDR2_BA1	L3	L3	N/A	RN11.5	C21
DDR2_BA2	L1	L1	N/A	R21	C11
DDR2_DQS0	-	F7	RN14.3	RN17.1	C17
DDR2_DQS1	-	B7	RN10.8	RN16.5	B14
DDR2_DQS2	F7	-	RN7.8	RN3.4	B8
DDR2_DQS3	B7	-	RN6.7	RN2.4	C12
DDR2_DM0	-	F3	RN14.5	RN17.3	C16
DDR2_DM1	-	B3	RN12.6	RN16.4	G12
DDR2_DM2	F3	-	RN7.3	RN3.7	D6
DDR2_DM3	B3	-	RN6.2	RN2.3	B9
DDR2_DQ0	-	G8	RN14.4	RN15.8	A18
DDR2_DQ1	-	G2	RN14.8	RN17.6	G16
DDR2_DQ2	-	H7	RN14.6	RN15.7	F16
DDR2_DQ3	-	H3	RN12.8	RN17.2	F15
DDR2_DQ4	-	H1	RN14.7	RN17.5	G15
DDR2_DQ5	-	H9	RN14.1	RN15.5	B17
DDR2_DQ6	-	F1	RN14.2	RN17.4	A17



**Table 4–3. DDR2 SDRAM Memory & Terminator Signal Connections (Part 3 of 3)**

DDR2 SDRAM Signal	DDR2 SDRAM Device 1 (U6)	DDR2 SDRAM Device 2 (U10)	Non Fly-By Terminator	Fly-By Terminator	Cyclone II Pin (U9)
DDR2_DQ7	-	F9	RN12.7	RN15.6	E15
DDR2_DQ8	-	C8	RN12.3	RN16.6	B16
DDR2_DQ9	-	C2	RN12.2	RN16.1	B15
DDR2_DQ10	-	D7	RN12.4	RN16.3	C15
DDR2_DQ11	-	D3	RN10.6	RN16.2	G13
DDR2_DQ12	-	D1	RN12.1	RN17.7	G14
DDR2_DQ13	-	D9	RN10.7	RN16.7	F14
DDR2_DQ14	-	B1	RN12.5	RN17.8	D14
DDR2_DQ15	-	B9	RN10.5	RN16.8	B11
DDR2_DQ16	G8	-	RN10.4	RN3.6	F11
DDR2_DQ17	G2	-	RN10.2	RN4.3	C9
DDR2_DQ18	H7	-	RN10.3	RN3.8	D9
DDR2_DQ19	H3	-	RN7.4	RN4.1	G10
DDR2_DQ20	H1	-	RN7.5	RN4.4	F10
DDR2_DQ21	H9	-	RN10.1	RN3.5	C8
DDR2_DQ22	F1	-	RN7.6	RN4.2	D8
DDR2_DQ23	F9	-	RN7.7	RN3.3	A7
DDR2_DQ24	C8	-	RN7.2	RN2.7	F12
DDR2_DQ25	C2	-	RN6.8	RN2.5	D12
DDR2_DQ26	D7	-	RN7.1	RN3.1	E12
DDR2_DQ27	D3	-	RN6.1	RN3.2	G11
DDR2_DQ28	D1	-	RN6.5	RN2.2	A10
DDR2_DQ29	D9	-	RN6.4	RN2.8	B10
DDR2_DQ30	B1	-	RN6.6	RN2.1	D10
DDR2_DQ31	B9	-	RN6.3	RN2.6	C10

Table 4-4 shows the DDR2 SDRAM memory clock signal connections.

Clock Signal	DDR2 SDRAM Memory Device 1 (U6)	DDR2 SDRAM Memory Device 1 (U10)	Cyclone II Pin (U9)
DDR2_CK_N0	–	K8	A23
DDR2_CK_P0	–	J8	A22
DDR2_CK_N1	K8	–	A8
DDR2_CK_P1	J8	–	A9
DDR2_SYNC_CLK_IN	–	–	AF14
DDR2_SYNC_CLK_OUT	–	–	B7

## I/O & Serial I/O

This section describes signal specifications for the following interfaces:

- 10/100 Ethernet
- RS-232 serial interface

### 10/100 Ethernet

Table 4-5 shows the 10/100 Ethernet interface signal connections.

Ethernet Signal	Connector Pin (RJ1)	MAC/PHY Pin (U3)	Cyclone II Pin (U9)
LAN_TXDp	RJ1.1	U3.14	–
LAN_TXDn	RJ1.3	U3.15	–
LAN_RXDp	RJ1.4	U3.17 (through resistor R49)	–
LAN_RXDn	RJ1.6	U3.18 (through resistor R53)	–
LAN_LEDA_n	RJ1.10	U3.22	–
LAN_LEDB_n	RJ1.12	U3.23	–
LAN_BEn0	–	U3.94	U5
LAN_BEn1	–	U3.95	U6
LAN_BEn2	–	U3.96	U7
LAN_BEn3	–	U3.97	V1
LAN_AEN	–	U3.41	V4
LAN_A1	–	U3.78	V7

**Table 4–5. 10/100 Ethernet Interface Signal Connections (Part 2 of 3)**

<b>Ethernet Signal</b>	<b>Connector Pin (RJ1)</b>	<b>MAC/PHY Pin (U3)</b>	<b>Cyclone II Pin (U9)</b>
LAN_A2	–	U3.79	W1
LAN_A3	–	U3.80	W3
LAN_A4	–	U3.81	W6
LAN_A5	–	U3.82	Y1
LAN_A6	–	U3.83	Y3
LAN_A7	–	U3.84	Y4
LAN_A8	–	U3.85	Y5
LAN_A9	–	U3.86	P3
LAN_A10	–	U3.87	P4
LAN_A11	–	U3.88	R3
LAN_A12	–	U3.89	B2
LAN_A13	–	U3.90	J7
LAN_A14	–	U3.91	J8
LAN_A15	–	U3.92	L6
LAN_D0	–	U3.107	AA1
LAN_D1	–	U3.106	AA2
LAN_D2	–	U3.105	AA3
LAN_D3	–	U3.104	AA4
LAN_D4	–	U3.102	AA5
LAN_D5	–	U3.101	AB1
LAN_D6	–	U3.100	AB2
LAN_D7	–	U3.99	AB3
LAN_D8	–	U3.76	AB4
LAN_D9	–	U3.75	AC1
LAN_D10	–	U3.74	AC2
LAN_D11	–	U3.73	AC3
LAN_D12	–	U3.71	AD2
LAN_D13	–	U3.70	AD3
LAN_D14	–	U3.69	AE2
LAN_D15	–	U3.68	AE3
LAN_D16	–	U3.66	P6
LAN_D17	–	U3.65	P7
LAN_D18	–	U3.64	R2

**Table 4–5. 10/100 Ethernet Interface Signal Connections (Part 3 of 3)**

<b>Ethernet Signal</b>	<b>Connector Pin (RJ1)</b>	<b>MAC/PHY Pin (U3)</b>	<b>Cyclone II Pin (U9)</b>
LAN_D19	–	U3.63	R4
LAN_D20	–	U3.61	R5
LAN_D21	–	U3.60	R6
LAN_D22	–	U3.59	R7
LAN_D23	–	U3.58	T2
LAN_D24	–	U3.56	T3
LAN_D25	–	U3.55	T4
LAN_D26	–	U3.54	T6
LAN_D27	–	U3.53	T7
LAN_D28	–	U3.51	U1
LAN_D29	–	U3.50	U2
LAN_D30	–	U3.49	U3
LAN_D31	–	U3.48	U4
LAN_RESET	–	U3.30	V2
LAN_ADStn	–	U3.37	W4
LAN_CLK	–	U3.42	AA7
LAN_IOCHRDY	–	U3.38	Y22
LAN_RDYRTNn	–	U3.46	T23
LAN_SRDYn	–	U3.43	N26
LAN_INRTQ0	–	U3.29	V3
LAN_LDEVn	–	U3.45	P1
LAN_IORn	–	U3.31	V5
LAN_IOWn	–	U3.32	V6
LAN_DATAStn	–	U3.34	H24
LAN_CYCLEn	–	U3.35	J5
LAN_W_Rn	–	U3.36	F6
LAN_VLBUSn	–	U3.40	E5
LAN_LOOPBACK	–	U3.21	W2

## RS-232 Serial Interface

Table 4–6 shows the RS-232 serial interface signal and pin connections as well as the level converters.

Connector Signal	Connector Pin	Level Converter A	Level Converter B	Cyclone II Pin (U9)	Cyclone II Signal
DB9_TXD	J12.2	U12.14	U12.11	F24	RS232_TXD
DB9_RXD	J12.3	U12.13	U12.12	G24	RS232_RXD
DB9_RTS	J12.7	U12.8	U12.9	H21	RS232_RTS
DB9_CTS	J12.8	U12.7	U12.10	G25	RS232_CTS

## Configuration

This section describes signal specifications for the following:

- JTAG header
- Active Serial (AS) interface
- EPCS64 serial Flash interface

## JTAG Header

Table 4–7 shows the JTAG header signal and pin connections.

JTAG Signal	JTAG Header (J8)	Cyclone II Pin (U9)
JTAG_TCK	1	M6
JTAG_TDO	3	M7
JTAG_TDI	9	M8
JTAG_TMS	5	L8
GND	2, 10	-
3.3V	4, 6	-

## AS Interface Header

Table 4-8 shows the AS interface header connections.

AS Signal	AS Connector (J8)
CONF_DCLK	1
CONF_DONE	3
CONF_CONFIGn	5
CONF_DATA0	7
CONF_ASD0	9
CONF_CEn	6
CONF_CS0n	8
GND	2, 10
3.3V	4

## EPCS64 Serial Flash Interface

Table 4-9 shows the EPCS64 serial flash interface signal and pin connections for both the user-programmable and preloaded, factory-programmed serial flash devices.

EPCS64 Serial Flash Signal	User-Programmable EPCS64 Device (U7)	Factory-Programmed EPCS64 Device (U19)	Cyclone II Pin (U9)
CONF_DCLK	16	16	N6
CONF_DATA0	8	8	N3
CONF_ASD0	15	15	E3
CONF_CS0n	–	–	D3
CONF_USER_CS0n	7	–	G18
CONF_SAFE_CS0n	–	7	G17

## Control & User Settings

This section describes pin-outs and signal specifications for:

- User LEDs
- DIP switch bank board & user settings
- Push-button switches

### User LEDs

The Cyclone II device directly drives signals USER\_LED0 through USER\_LED7. See [Table 4–10](#). To illuminate the LED, set the control signal to logic 0.

<i>Table 4–10. User LED Connections</i>		
Label	Reference Designator	Cyclone II Pin (U9)
0	D8	J22
1	D7	K19
2	D6	K21
3	D5	M21
4	D4	L23
5	D3	L19
6	D2	K24
7	D1	T21

### DIP Switch Bank Board & User Settings

[Table 4–11](#) lists the DIP switch bank (S4) board settings and the corresponding board references, signal names, and destinations.

<i>Table 4–11. DIP Switch Bank Board Settings</i>			
Board Reference	DIP Switch Bank Board Settings	Signal	Destination
PCI SPD	Switch S4 Position 3	PCI_M66EN	PCI Connector J13.B49
PCI Mode	Switch S4 Position 1	PCI_XCAP	PCI Connector J13.B38
PCI XSPD	Switch S4 Position 2		

Table 4–12 shows the user DIP switch bank (S4) signal names, board references, and pin connections.

Board Reference	User DIP Switch	Signal	Cyclone II Pin (U9)
0	Switch S4 Position 4	USER_SW0	AA12
1	Switch S4 Position 5	USER_SW1	AB8
2	Switch S4 Position 6	USER_SW2	AC6
3	Switch S4 Position 7	USER_SW3	AD12
4	Switch S4 Position 8	USER_SW4	AD8

## Push-Button Switches

Table 4–13 shows the push-button switch signal names and pin connections.

Board Reference	Pin	Signal	Cyclone II Pin (U9)
RESET	S3.2	SYS_RESETh	C5
RECONFIG	S2.2	CONFIG_PBn	R23 (through diode U18)
PB0	S1.2	USER_PB0n	B12
PB1	S5.2	USER_PB1n	D13



## Altera Daughter Card & Mictor Probe

Table 4–14 shows the Altera daughter card (PROTO1) interface and its pin-sharing of the Mictor probe connector.

**Table 4–14. Altera Daughter Card & Mictor Probe Pin Sharing (Part 1 of 2)**

Signal	PROTO1 Pin	Mictor Probe Pin (J4)	Cyclone II Pin (U9)
SYS_RESETh	J1.1	–	C5
PLL_TO_PROTO1	J7.9	–	V21 (through resistor R87)
CLK_TO_PROTO1	J7.11	–	J6
CLK_FROM_PROTO1	J7.13	–	P2
PROTO1_CARDSELn	J1.38	–	G6
PROTO1_IO0	J1.3	J4.37	C2
PROTO1_IO1	J1.4	J4.35	C3
PROTO1_IO2	J1.5	J4.33	D1
PROTO1_IO3	J1.6	J4.31	D2
PROTO1_IO4	J1.7	J4.29	E1
PROTO1_IO5	J1.8	J4.27	E2
PROTO1_IO6	J1.9	J4.25	F1
PROTO1_IO7	J1.10	J4.23	F2
PROTO1_IO8	J1.11	J4.21	F3
PROTO1_IO9	J1.12	J4.19	F4
PROTO1_IO10	J1.13	J4.17	F7
PROTO1_IO11	J1.14	J4.15	G1
PROTO1_IO12	J1.15	J4.13	G2
PROTO1_IO13	J1.16	J4.11	G3
PROTO1_IO14	J1.17	J4.9	G5
PROTO1_IO15	J1.18	J4.7	G4
PROTO1_IO16	J1.21	J4.38	M5
PROTO1_IO17	J1.23	J4.36	M4
PROTO1_IO18	J1.25	J4.34	M3
PROTO1_IO19	J1.27	J4.32	M2
PROTO1_IO20	J1.28	J4.30	L7
PROTO1_IO21	J1.29	J4.28	L4
PROTO1_IO22	J1.31	J4.26	L3
PROTO1_IO23	J1.32	J4.24	L2
PROTO1_IO24	J1.33	J4.22	K4

**Table 4–14. Altera Daughter Card & Mictor Probe Pin Sharing (Part 2 of 2)**

Signal	PROTO1 Pin	Mictor Probe Pin (J4)	Cyclone II Pin (U9)
PROTO1_IO25	J1.35	J4.20	K3
PROTO1_IO26	J1.36	J4.18	K2
PROTO1_IO27	J1.37	J4.16	K1
PROTO1_IO28	J1.39	J4.14	J4
PROTO1_IO29	J6.4	J4.12	J3
PROTO1_IO30	J6.5	J4.10	J2
PROTO1_IO31	J6.6	J4.8	J1
PROTO1_IO32	J6.7	J4.5	H4
PROTO1_IO33	J6.8	J4.6	H3
PROTO1_IO34	J6.9	–	H2
PROTO1_IO35	J6.10	–	H1
PROTO1_IO36	J6.11	–	K8
PROTO1_IO37	J6.12	–	K7
PROTO1_IO38	J6.13	–	K6
PROTO1_IO39	J6.14	–	K5
PROTO1_IO40	J6.3	–	H6