Getting Started

Mpression Nitro Board

Revision 1.0

2014 / 8

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Contents

1. Read This First

1.1 Important Information

READ FIRST:

- ***READ*** this Reference Manual before using this product.
- ***KEEP*** the Reference Manual handy for future reference.
- ***Do not attempt*** to use the product until you fully understand its mechanism.

Purpose of the Product:

- The purpose of this product is to support the evaluation of a system that uses the Cyclone® V GX FPGA, manufactured by Altera® Corporation. It provides support for system development in both software and hardware.

For Users of This Product:

- This product can only be used by operators who have carefully read the "Getting Started" and "Reference Manual" manuals and understand how to use it. Use of this product requires a basic knowledge of electric circuits, logic circuits, and FPGAs.

Precautions to be taken when using This Product:

- This product is to be used for evaluation of a program, and the evaluation stage. You cannot install this Board in your product and cannot use this Board for mass-production. When mass-producing a program you have finished developing, be sure to decide at your own responsibility whether it can be put to practical use by performing integration test, evaluation, or some other experiment.
- In no event shall Macnica Inc. be liable for any consequence arising from the use of this product.
- Macnica Inc. cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this reference manual and on the product are therefore not all-inclusive. The user is therefore responsible for the safe use of the product at the user's own responsibility.
- The operation of any specific USB memories or SD cards cannot be guaranteed.
- Connection with the apparatus of any specific LAN interfaces cannot be guaranteed.
- This product does not guarantee device functionality.
- Remodeling by the customer is not guaranteed.
- This product is a lead-free mounting product.
- Generally, the brand names carried in this reference manual each constitute a maker's trademark or registered trademark.

Improvement Policy:

- Macnica Inc. pursues a policy of continuous improvement in design, performance, and safety of the product. Macnica Inc. reserves the right to change, wholly or partially, specifications, design, reference manual, and other documentation at any time without notice.

Warranty:

- Macnica Inc. offers exchange of this product free of charge only in a set range of cases of initial trouble for this product, and within 30 days from when the customer received delivery of the Board.

Macnica Inc. cannot exchange products in cases where breakdown is caused for the following reasons:
(1) Misuse, abuse of the product or use under abnormal conditions
(2) Remodeling or repair
(3) A fire, earthquake, fall or other accidents

Figures:

- Some figures in this reference manual may differ from your system as purchased.

1.2 Developer Information

The Developer of this product is:
Macnica Inc.
1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

1.3 Inquires

In case you have any inquiries about the use this product, please contact your local Macnica company or make inquiries through the contact form in the following web site:
http://www.m-pression.com/contact

Macnica companies:

• China & HK:	Cytech Technology	http://www.cytech.com/
• ASEAN & India:	Cytech Global	http://www.cytechglobal.com/
• Taiwan:	Galaxy Far East Corp.	http://www.gfec.com.tw/
• North America:	Macnica Americas	http://www.macnica-na.com/
• Brazil:	Macnica DHW	http://www.macnicadhw.com.br/en/
• Japan:	Altima	http://www.altima.co.jp
	Elsena	http://www.elsena.co.jp

2. For Ensuring Safe Use

Be sure to follow the instructions given in this Manual which are intended to prevent harm to the user and others as well as material damage.

2.1 Legend

Danger	Indicates an imminent hazardous situation which if not avoided will result in death or serious injury.
Warning	Indicates a potentially hazardous situation which if not avoided could result in death or serious injury.
Caution	Indicates a potentially hazardous situation which if not avoided may result in minor or moderate injury or in property damage.

2.2 Cautions

Danger	If an AC adapter is required, make sure to use one that meets the specification described in this manual, or one that is included in the package. Using an AC adapter not meeting the specifications described in this Manual may cause the kit to emit heat, explode, or ignite.
Warning	Do not apply strong impacts or blows to the kit. Doing so may cause the kit to emit heat, explode, or ignite, or the equipment in the kit to fail or malfunction. This may also cause fire.
	Do not put the main unit or the AC adapter in cooking appliances such as microwave ovens, or high-pressure containers. Doing so might cause the main unit or AC adapter to emit heat, explode, ignite, or emit smoke, or its parts to break or warp.
	Do not wrap the main unit that is in use with cloth or other materials that are likely to allow heat to build up inside the wrapping. This will cause heat to build up inside the wrapping which may cause the main unit to ignite or malfunction.
	When disposing of the main unit, do not dispose of it along with general household waste. Throwing the main unit into fire may cause it to explode. Dispose of the main unit following the laws, regulations, and ordinances governing waste disposal.
	Do not pull the power supply cable with excessive force or place heavy items on it. Do not damage, break, bundle, or tamper with the power supply cable. Damaged parts of the power supply cable might cause a short circuit resulting in fire or accidents involving electrical shock.
	Do not plug or unplug the power plug with wet or moist hands. This might cause injuries or equipment malfunctions or failures due to electrical shock.

 **Warning** (Continued from previous page)	Plug the power plug securely into the outlet. If the power plug is not securely plugged into the outlet, it may cause accidents involving electrical shock or fire due to heat emitted.
	Do not connect many electrical cords to a single socket or connect an AC adapter to an outlet that is not rated for the specified voltage. Doing so may cause the equipment to malfunction or fail, or lead to accidents involving electrical shock or fire due to heat emitted.
	Periodically remove any dust accumulated on the power plug and around the outlet (socket). Do not use a power plug with dust accumulated on it because doing so will lead to insulation failure due to moisture which may lead to fire. Remove any dust on the power plug and around the outlet with dried cloth.
	Do not place any containers such as cups or vases filled with water or other liquid on this Board. If this Board is exposed to water or other liquids it may cause the Board to malfunction or lead to accidents involving electrical shock. If you spilled water or other liquid on this Board, immediately stop using the Board, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact the local Macnica company or Mpression inquiry URL.
	Keep this board and accessories out of reach of children. Failure to do so may lead to injuries.
 **Caution**	Do not place the kit on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this Board to malfunction if the Board should fall.
	Do not attempt to use or leave the kit in places subject to strong direct sunlight or other places subject to high temperatures such as in cars in hot weather. Doing so might cause the kit to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat causing burn injuries.
	Do not use the kit in places subject to extremely high or low temperatures or severe temperature changes. Doing so may cause the kit to fail or to malfunction. Always be sure to use the kit within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%.
	Unplug the power supply cable when carrying out maintenance of devices in which the main unit is embedded. Failure to do so may lead to accidents involving electrical shock.
	Do not place this Board in locations where excessive force is applied to the Board. Doing so may cause the PC board to warp, leading to breakage of the PC board, missing parts or malfunctioning parts.
	When using the kit together with expansion boards or other peripheral devices, be sure to carefully read each of their manuals and to use them correctly. Developer does not guarantee the operation of specific expansion boards or peripheral devices when used in conjunction with this Board unless they are specifically mentioned in this Manual or their successful operation with this Board has been confirmed in separate documents.

Caution (Continued from previous page)	Be sure to turn off the power switch when moving this Board to connect to other devices. Failure to do so may cause this Board to fail or lead to accidents involving electrical shock.
	Do not clean this Board by using a rag containing chemicals such as benzine or thinner. Failure to do so will likely to cause this Board to deteriorate. When using a chemical cloth be sure to comply with any directions or warnings.
	Do not immediately turn on the power if you find that water or moisture had condensed onto the main unit after removing the board from the package. Condensation might occur on this Board when taking it out of the box, if the board is cool yet the room temperature is warm. Do not apply power to the Board while water or moisture has condensed on it because the moisture may cause the Board to break or may shorten the service life of the parts. When you first take this Board out of the box be sure to leave it at room temperature for a while before using it. If condensation or moisture has occurred on this Board, first wait for the moisture to fully evaporate before installing or connecting the Board to other devices.
	Do not disassemble, dismantle, modify, alter, or recycle parts unless they are clearly described as customizable in this Manual. Although this kit is customizable, if parts not specified in this Manual as customizable are modified in any way, then the overall product operation cannot be guaranteed. Please contact the local Macnica company or Mpression inquiry URL beforehand if you wish to customize or modify any parts that are not described in this Manual as customizable.

3. Preparations

3.1 About This Manual

This manual describes how to set up this Board, how to use the sample design, and the development flow of a software project. After reading this manual, you will learn:

- The basic specifications of this Board
- How to install the software required for FPGA development
- How to set up this Board
- How to use the sample design
- Flow of building and debugging a software project

3.2 Preparations

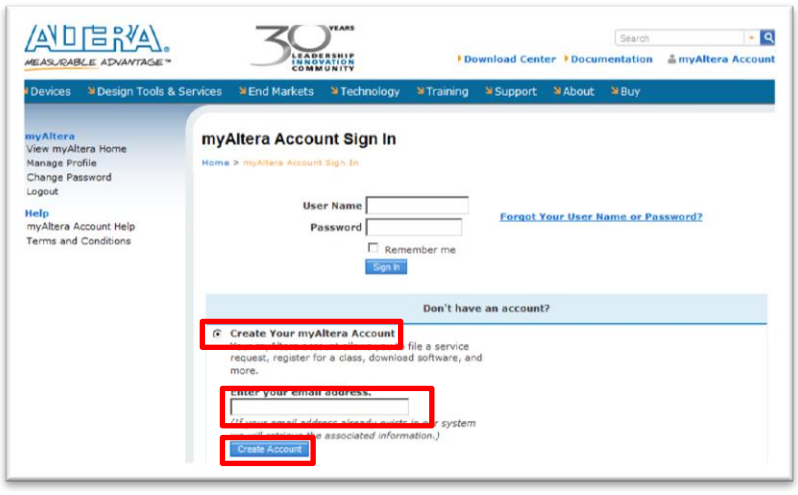
Before using this Board, download the software described below, which is required for FPGA development. To download Altera software, you must create a myAltera account beforehand. Complete registration of your myAltera account before you begin downloading the software.

A. How to Create a MyAltera Account

Open the following URL and enter the required information to create a MyAltera account.

- URL for MyAltera account registration
  https://www.altera.com/myaltera/mal-signin.jsp

- If you are creating a myAltera account for the first time, check **Create Your myAltera Account** on the lower part of the page, enter your email address below the message **Enter your email address**, and then click **Create Account**.



B. Quartus® II Web Edition

Quartus II Web Edition is a license-free software program provided by Altera. Some limitations apply to the functions compared to the Subscription Edition. Quartus II Web Edition can be downloaded from the Quartus II Web Edition Software page. See the following page for details on the difference between the Web and Subscription Editions of Quartus II.

- Quartus II Web Edition Software page
  http://dl.altera.com/?edition=web

- Comparison between Subscription Edition and Web Edition of Quartus II
  http://www.altera.com/literature/po/ss_quartussevswe.pdf

C. Installing the USB-Blaster™ Driver

USB-Blaster (sold separately) is required for writing the FPGA programming file to the FPGA/configuration ROM of this Board. To install the USB-Blaster driver, download it from the Altera Programming Cable Driver Information page.

- Altera Programming Cable Driver Information page
  http://www.altera.com/download/drivers/dri-index.html

4. Setting Up the Board and Executing the Design

4.1 Board Specification

This section describes the layout of components on this Board and their specifications.
Figure 1 shows the layout of components on this Board.

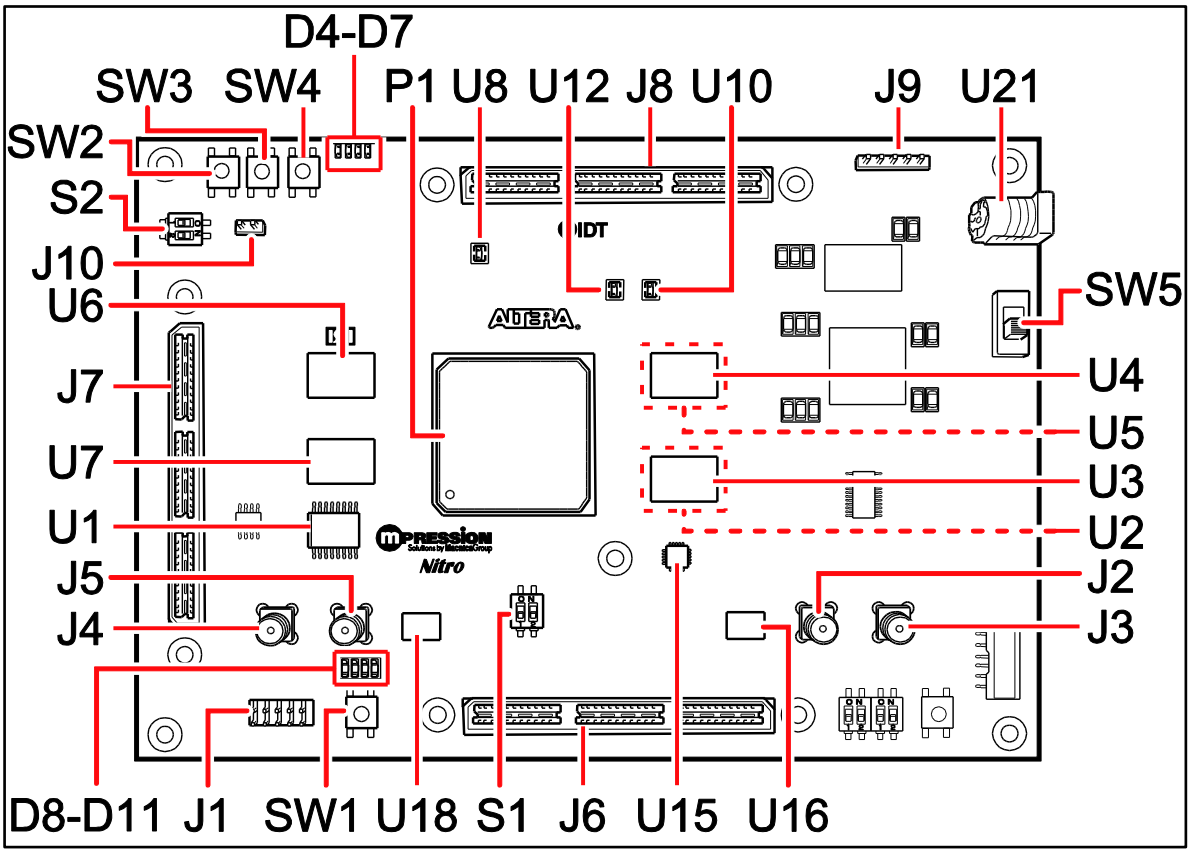


Figure 1 Layout of Components on this Board

Table 1 Main Components of this Board

Reference No.	Type	Details
Main Devices		
P1	FPGA	Cyclone V GX:5CGXFC9E6F31C7N 896-pin FPGA
U1	Configuration ROM	EPCQ256
Configuration/Status LED		
J1	JTAG 10-pin Header	Access port to the JTAG chain. Use a USB-Blaster cable for connection.
SW1	FPGA_Reconfig	Configuration Reset. Drives the nCONFIG port of the FPGA.

Continued from the previous page

Reference No.	Type	Details
D8	nCONFIG	When unlit, there is abnormality in the configuration status of the FPGA. When lit, there is no abnormality.
D9	nSTATUS	When lit, FPGA configuration has been completed. When unlit, FPGA configuration has not been completed.
D10	CONF_DONE	When lit, configuration can be done. When unlit, the FPGA configuration has been reset.
D11	INIT_DONE	When lit, configuration has been completed and the Board can operate in user mode.
Clock Circuit		
U15	Clock Generator • 148.5 MHz • 125 MHz • 74.25 MHz • 27 MHz	Generates 4 frequencies described on the left.
U16	Clock Generator • 100 MHz	Generates the frequency described on the left.
U18	Clock Generator • 100 MHz	Generates the frequency described on the left.
U8	Clock Generator • 50 MHz	Generates the frequency described on the left.
U10	Clock Generator • 50 MHz	Generates the frequency described on the left.
U12	Clock Generator • 100 MHz	Generates the frequency described on the left.
J2/J3	External clock input connector	Supplies the clock to the transceiver block via SMA.
J4/J5	External clock input connector	Supplies the clock to the transceiver block via SMA.
S1	Reference clock selector switch	DIP switch used for switching between On-board clock and clock supplied via SMA.
General-purpose user input/output		
D4, D5, D6, D7	User LED	4 low-active user LEDs.
SW2, SW3, SW4	User push-buttons	3 user push buttons. Inputs Low to the FPGA when pushed.
S2	User DIP switches	2 user DIP switches. Inputs Low to the FPGA when set to On.
J6	HSMC	HSMC Port-A
J7	HSMC	HSMC Port-B
J8	HSMC	HSMC Port-C
J9	GPIO	GPIO Pin-Header
Memory		
U2, U3, U4, U5	DDR3 SDRAM	DDR3 SDRAM 64-bit(16x4) Bottom
U6, U7	DDR3 SDRAM	DDR3 SDRAM 32-bit(16x2) Top
Power Connector and Switch		
U21	DC jack	12 V DC power can be supplied.
SW5	Power Switch	Switches on/off the power supply from the DC jack.

Continued from the previous page		
Reference No.	**Type**	**Details**
Power Connector for the Cooling Fan		
J10	2-pin Header	Power supply for the Cooling Fan

4.2 Executing the FPGA Example Design

This section describes how to write the Nitro_Sample_Design onto this Board and test the DDR3-SDRAM. Nitro_Sample_Design has Avalon-MM Traffic Generator and BIST Engine integrated into the design. It checks if the reading and writing of each DDR3-SDRAM is executed normally and shows the results by the lighting of the LEDs.

4.2.1 Block Diagram of the Example Design

Figure 2 shows the block diagram of the example design and the hardware configuration.

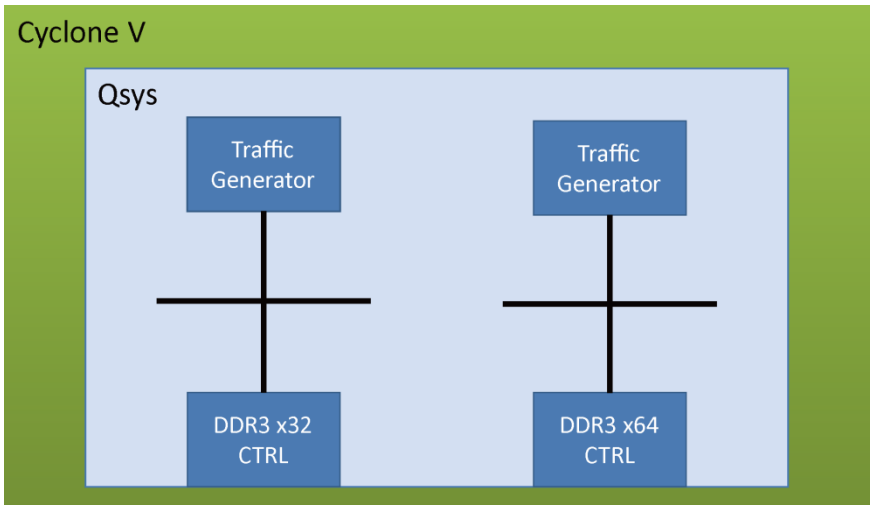


Figure 2 Block Diagram of the Example Design

Name in the Diagram	Function
Traffic Generator	Avalon-MM Traffic Generator and BIST Engine
DDR3 x32 CTRL	DDR3 SDRAM Controller with UniPHY
DDR3 x64 CTRL	DDR3 SDRAM Controller with UniPHY

4.2.2 Executing the Design

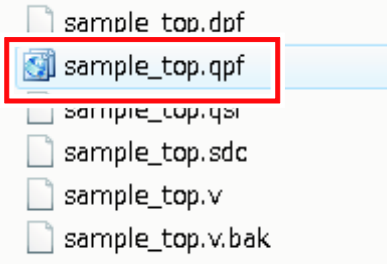
Execute the example design by following the steps below.

A. Save the example design onto a PC.

Copy the project folder "Nitro_Samlpe_Design" to a work folder. In this manual we use "D:\work" as an example.

B. Open the Quartus II project file.

Double-click the "sample_top.qpf" file in the "D:\work\Nitro_Samlpe_Design" folder to open the Quartus II project.

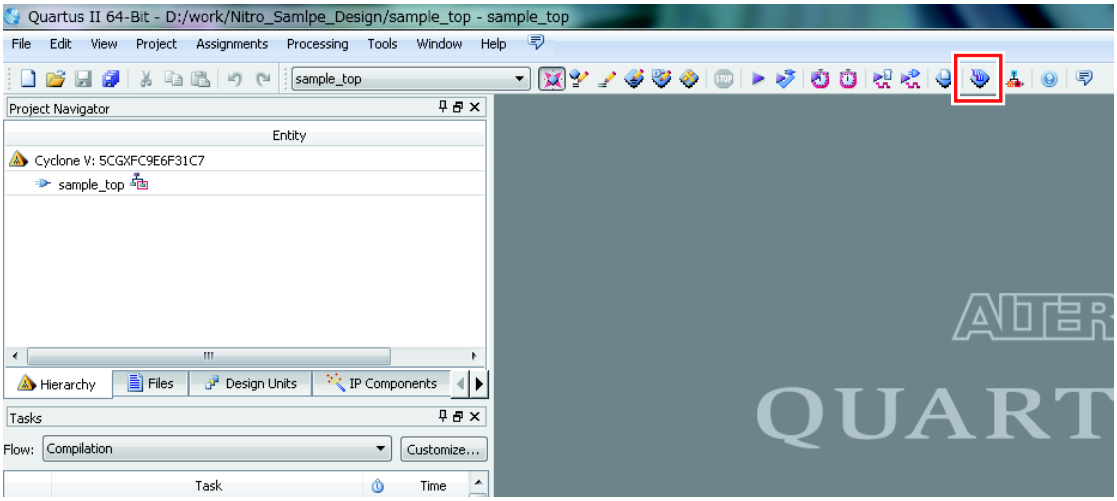


C. Download the program file to the FPGA.

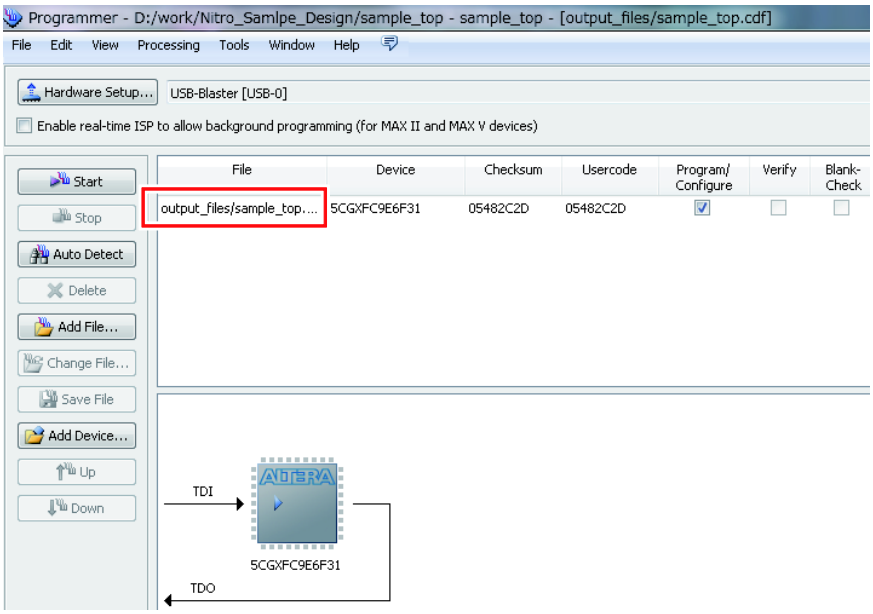
Use an Altera USB-Blaster cable to download the "sample_top.sof" file to the FPGA.

1) With the power of this board turned off, connect a USB-Blaster cable between the PC and the JTAG pins on this board.

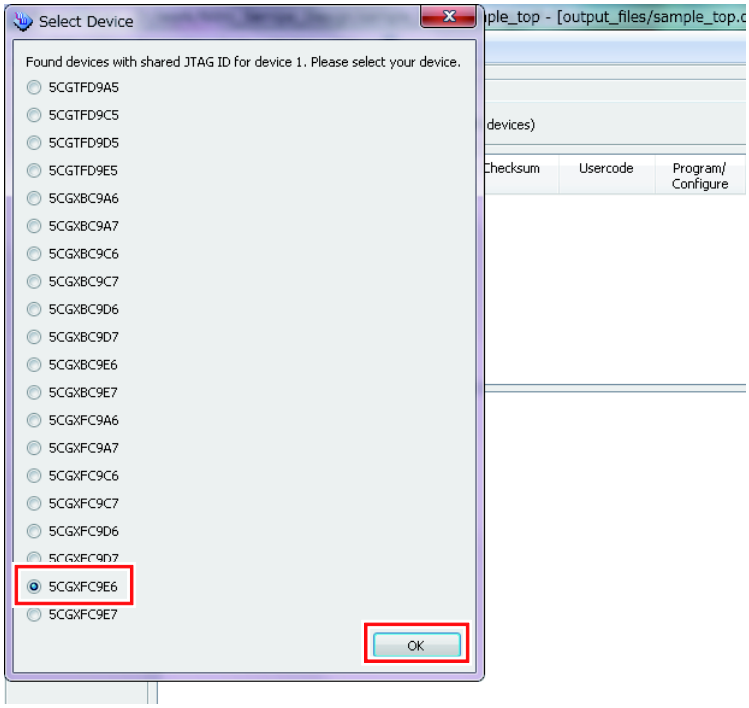
2) Start Quartus II Programmer.



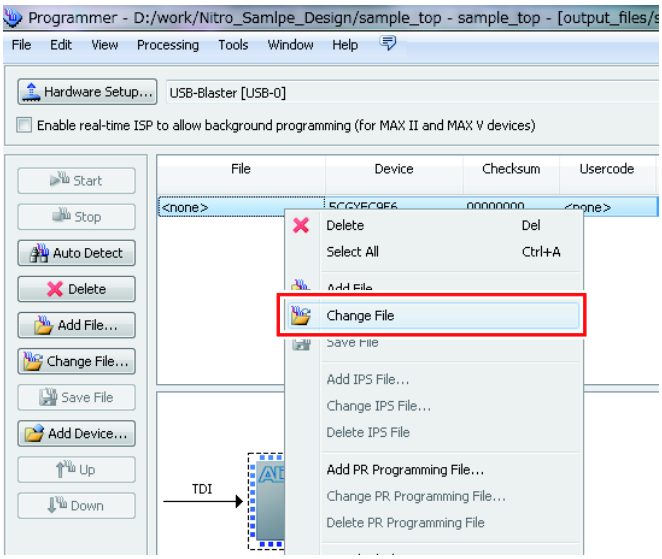
After Quartus II Programmer starts, check if “sample_top.sof” is selected. If it is selected, move on to step 4.



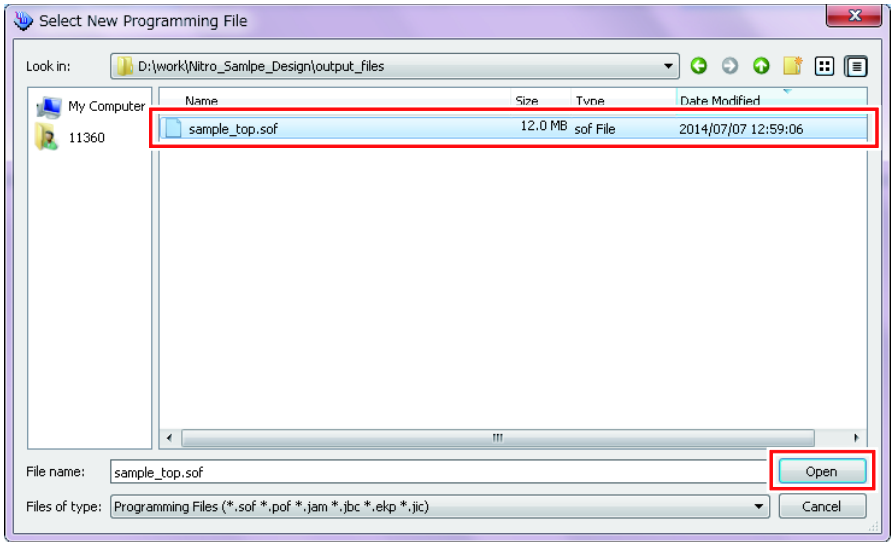
3) If it is not selected, click the **Auto Detect** button, select "5CGXFC9E6" on the "Select Device" window that appears, and then click **OK**.



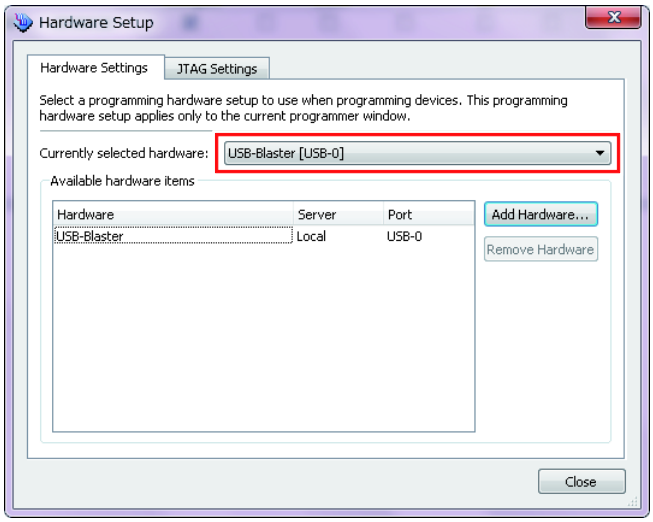
Right-click the detected FPGA, and then select **Change File**.



On the file selection window, select sample_top.sof in the "output_files" folder, and then click **Open**.



4) At the same time, check that **USB-Blaster** is selected for **Hardware Setup** and the **Program/Configure** checkbox is checked.



5) Click the **Start** button to start programming. Programming is completed when the **Progress** indicator in the upper right area becomes "100%".

If FPGA_LED0 to FPGA_LED3 light after programming is completed, the devices have passed the test. If the LEDs do not light, the devices have failed the test.

LED	Status
FPGA_LED0	DDR3 x64 CTRL test passed
FPGA_LED1	DDR3 x64 CTRL test completed
FPGA_LED2	DDR3 x32 CTRL test passed
FPGA_LED3	DDR3 x32 CTRL test completed

The circuit is working correctly if the tests above have been completed successfully.

5. Document Revision History

Date	Revision	Changes
August, 2014	1	• Document created
		•
		•