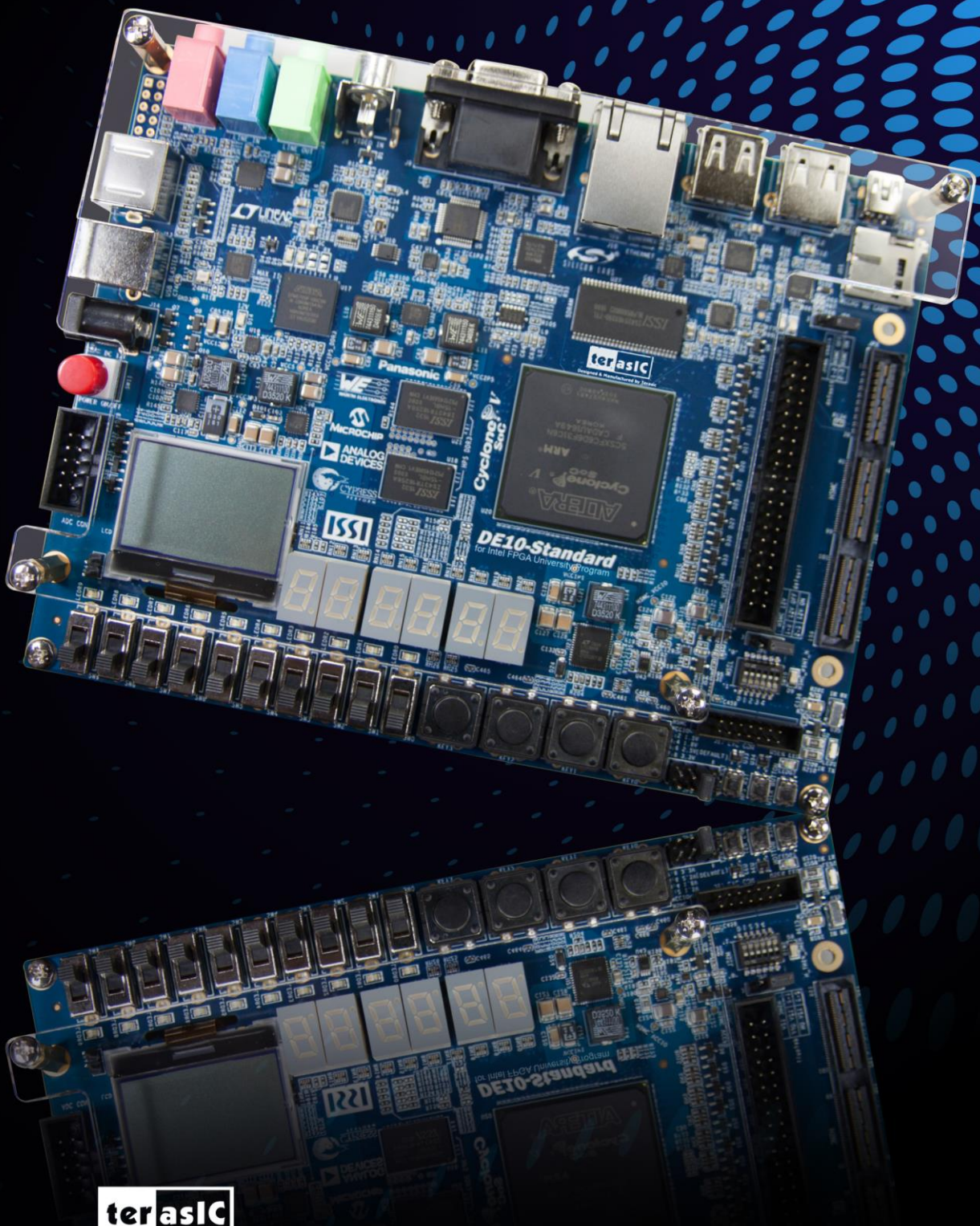
DE10-Standard

Getting Started Guide



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Chapter 1

About this Guide

The DE10-Standard Getting Started Guide contains a quick overview of the hardware and software setup including step-by-step procedures from installing the necessary software tools to using the DE10-Standard board. The main topics that this guide covers are listed below:

- Software Installation: Installing Quartus II and SoC EDS
- Development Board Setup: Powering on the DE10-Standard
- Perform FPGA System Test: Downloading a FPGA SRAM Object File (.sof)
- Running Linux on DE10-Standard Board

Chapter 2

Software Installation

2.1 Introduction

This section explains how to install the following software:

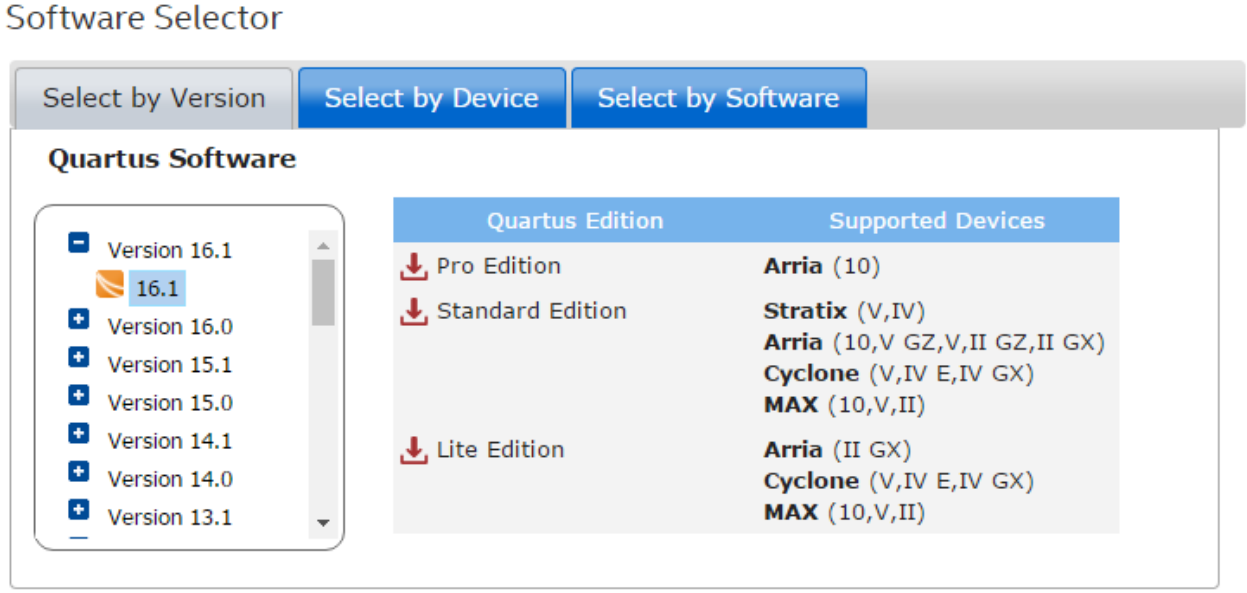
- Altera Quartus II software
- Altera SoC Embedded Design Suite

Note: 64-bit OS required

2.2 Installing Quartus II software

The Altera Complete Design Suite provides the necessary tools used for developing hardware and software solutions for Altera FPGAs. The Quartus II software is the primary FPGA development tool used to create reference designs along with the NIOS II soft-core embedded processor integrated development environment

User can download the latest software from:
https://www.altera.com/downloads/download-center.html



- If you choose to install the Standard Edition, please note that a purchased license will be required. Please go to the following link for more information on the Standard Edition: https://www.altera.com/support/support-resources/download/licensing.html

- Download files from **Standard** or **Lite** edition page. You must download the Quartus II Software (includes NIOS II EDS) and Cyclone V device support (includes all variations).

Quartus Prime Standard Edition

Release date: November, 2016
Latest Release: v16.1

Quartus Prime Design Suite

Select release: 16.1

Operating System Windows Linux

Download Method Akamai DLM3 Download Manager Direct Download

The Quartus Prime software version 16.1 supports the following device families: Stratix IV, Stratix V, Arria II, Arria V, Arria V GZ, Arria 10, Cyclone IV, Cyclone V, MAX II, MAX V, and MAX 10 FPGA. More

Combined Files | **Individual Files** | **Additional Software** | **Updates**

Download and install instructions: More

Read Intel FPGA Software v16.1 Installation FAQ
Quick Start Guide

Updates Available

- **Select All**
  - **Quartus Prime Standard Edition**
    - **Quartus Prime (includes Nios II EDS)**
      Size: 2.2 GB **MD5:** B0B6DE19632452B3D7757EE0E2A5C028
    - **ModelSim-Intel FPGA Edition (includes Starter Edition)**
      Size: 1.1 GB **MD5:** 81EAE2F2D55ABECD4F1265FCDFE74760
  - **Devices**
    You must install device support for at least one device family to use the Quartus Prime software
    - **Arria II device support**
      Size: 669.7 MB **MD5:** C3B3AB6ECA98C260F4EB31E778B4E51F
    - **Arria 10 device support**
      - **Arria 10 device support Part 1**
        Size: 3.0 GB **MD5:** 9310F05926BAA61B31D687D8B7B7E669
      - **Arria 10 device support Part 2**
        Size: 3.6 GB **MD5:** CF548FB5A5CF098FBDE6892E3D92950F
      - **Arria 10 device support Part 3**
        Size: 3.0 GB **MD5:** 8247BAA0EB689C24C8D681675F44918A
    - **Arria V device support**
      Size: 1.3 GB **MD5:** E0CCEE4BE7C7C926670AAFA9E9FE58A4
    - **Arria V GZ device support**
      Size: 2.0 GB **MD5:** B82B74B58BCE65CF6D9AFF1AAFDD76BB
    - **Cyclone IV device support**
      Size: 466.7 MB **MD5:** 70A27B31D439D6271650C832A9785F2C
    - **Cyclone V device support**
      Size: 1.1 GB **MD5:** 8386E6891D17DC1FAF29067C46953FC7
    - **MAX II, MAX V device support**
      Size: 11.4 MB **MD5:** AFC8FF969FBA63E84D5D40AE812F83A2
    - **MAX 10 FPGA device support**
      Size: 331.3 MB **MD5:** 013AACB391EAD32FF8E094D9D14987C3
    - **Stratix IV device support**
      Size: 544.5 MB **MD5:** 01084D9F216530499664839C51EE129C
    - **Stratix V device support**
      Size: 2.9 GB **MD5:** C3E7C3569214D412B4E19BE58C89A194

Download Selected Files

Note: The Quartus Prime software is a full-featured EDA product. Depending on your download speed, download times may be lengthy.

- After the file is downloaded on the computer, select the *.exe file, and install the software. All of the defaults are to be used.

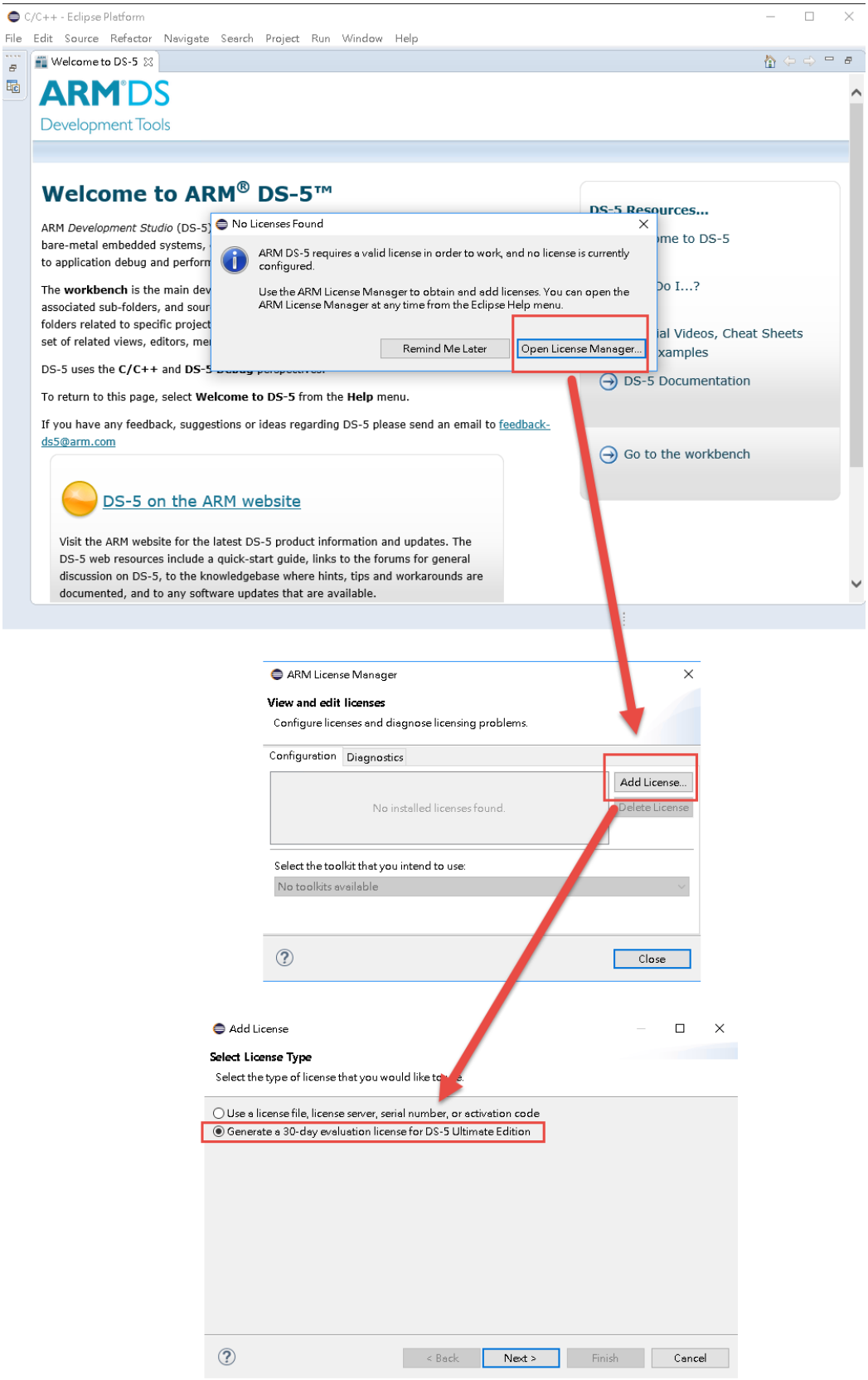
2.3 Installing Altera SoC Embedded Design Suite

The Altera SoC Embedded Design Suite (EDS) contains development tools, utility programs, run-time software, and application examples to enable embedded development on the Altera SoC hardware platform. User can use the Altera SoC EDS to develop firmware and application software. Users can download the software from the Altera webpage: http://dl.altera.com/soceds/

After you have installed the SoC Embedded Design Suite (EDS), you can start the ARM® Development Studio 5 (DS-5™) Altera Edition software. If this is your first time using the DS-5, a popup dialog will automatically ask if you wish to open the license manager.

For the free SoC EDS **Lite Edition**, you will be able to use DS-5 perpetually to debug Linux applications over an Ethernet conn. If you have purchased the SoC EDS **Standard Edition**, you would have received an ARM license serial number. This is a 15-character alphanumeric string with two dashes in between. Please enter this serial number into the input field to get full capabilities for the DS-5 Altera Edition software. This license includes one-year Support & Maintenance from ARM starting at the date of purchase or renewal.

After success installing the DS-5, user can select the “Generate a 30-day evaluation license for DS-5 Ultimate Edition” as below image and follow the procedure.


C/C++ - Eclipse Platform
File Edit Source Refactor Navigate Search Project Run Window Help
Welcome to DS-5
ARM DS
Development Tools
Welcome to ARM® DS-5™
No Licenses Found
ARM DS-5 requires a valid license in order to work, and no license is currently configured.
Use the ARM License Manager to obtain and add licenses. You can open the ARM License Manager at any time from the Eclipse Help menu.
Remind Me Later
Open License Manager...
DS-5 Documentation
Go to the workbench
To return to this page, select Welcome to DS-5 from the Help menu.
If you have any feedback, suggestions or ideas regarding DS-5 please send an email to feedback-ds5@arm.com
DS-5 on the ARM website
Visit the ARM website for the latest DS-5 product information and updates. The DS-5 web resources include a quick-start guide, links to the forums for general discussion on DS-5, to the knowledgebase where hints, tips and workarounds are documented, and to any software updates that are available.
ARM License Manager
View and edit licenses
Configure licenses and diagnose licensing problems.
Configuration
Diagnostics
Add License...
Delete License
No installed licenses found.
Select the toolkit that you intend to use:
No toolkits available
Close
Add License
Select License Type
Use a license file, license server, serial number, or activation code
Generate a 30-day evaluation license for DS-5 Ultimate Edition
< Back
Next >
Finish
Cancel

Chapter 3

Development Board Setup

3.1 Introduction

The instructions in this section explain how to set up the DE10-Standard development board. The following pictures show the board overview of DE10-Standard board.

3.2 MSEL Settings

■ FPPx32 Mode(Default)

The FPGA Configuration Mode Switch (MSEL) shown in **Figure 3-1** is by default set to **01010** (MSEL[4:0] = 01010). The setting corresponds to FPGA configured from HPS software (in the SD Card) in FPPx32 mode. **If users want to boot with Linux LXDE desktop, please setting MSEL switch in this mode**.

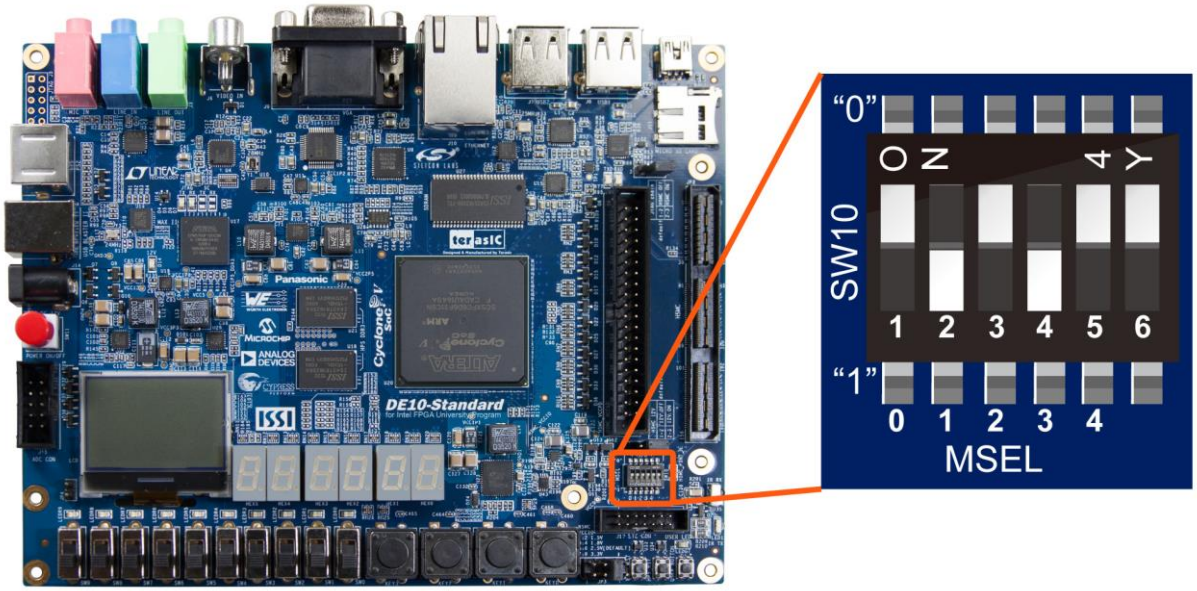


Figure 3-1 FPGA Configuration Mode Switch set in FPPx32 Mode

■ AS Mode

When the board is powered on and MSEL[4:0] set to "10010" (See **Figure 3-2)**, the FPGA is configured from EPCS.

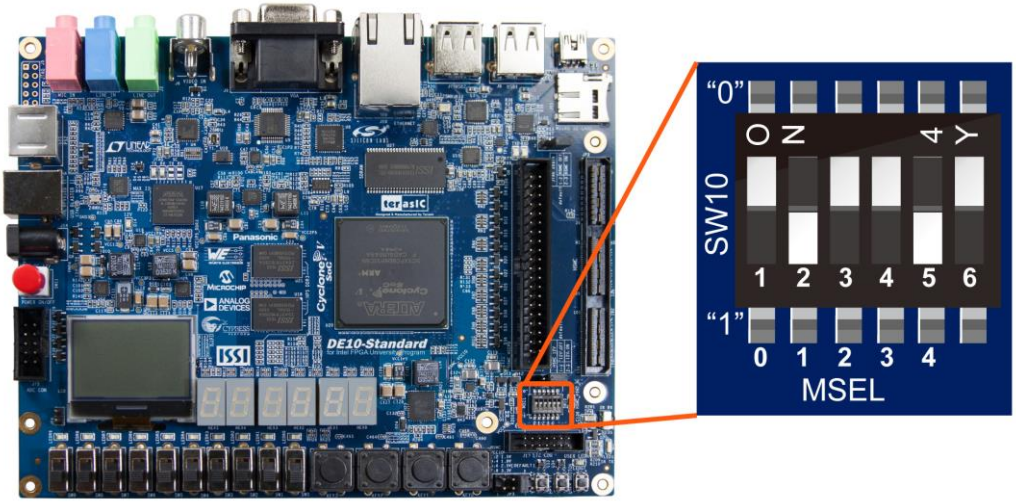


Figure 3-2 FPGA Configuration Mode Switch set in AS Mode

3.3 USB , VGA Output and Power Cables

Cable connections are shown in **Figure 3-3** as below:

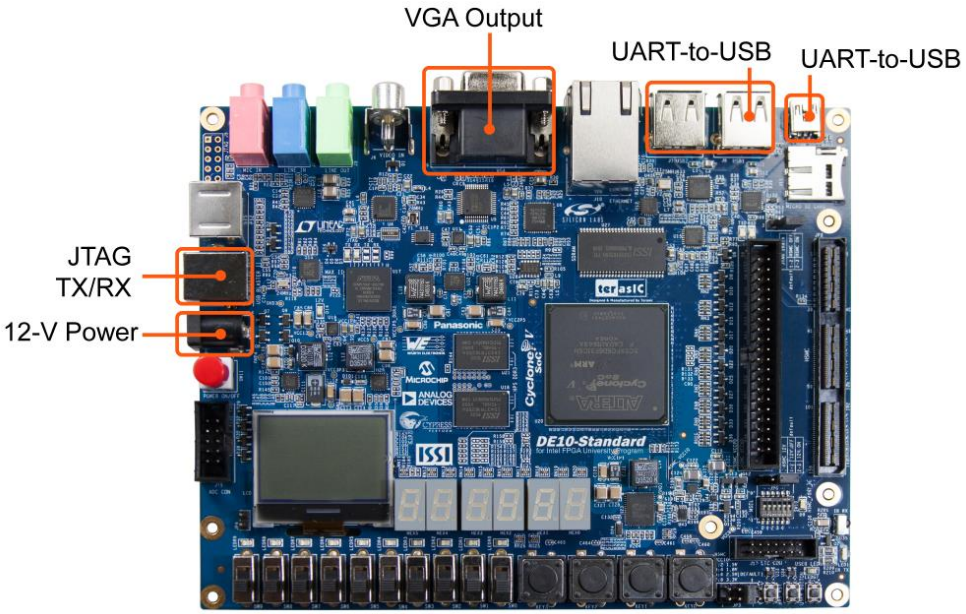


Figure 3-3 USB, HDMI Output and Power Cables

3.4 Powering up the DE10-Standard Board with LXDE Linux Desktop

To power-up the board and run the LXDE desktop, perform the following steps below:

1. Connect the provided power cord to the power supply and plug the cord into a power outlet (verify the voltage supplied is the same as the specification on the power supply).
2. Connect the VGA port of DE10-Standard to a VGA monitor.
3. Connect a Mouse/Keyboard to the USB host port (J7/J8).
4. Make sure the Factory SD Card is inserted in the SD Card socket.
5. Connect the supplied DE10-Standard power adapter to the power connector (J14) on the DE10-Standard board. At this point, you should see the 12V indicator LED (D14) turned on.
6. It will take about 35 seconds to boot Linux. Finally, the screen will enter LXDE desktop on the monitor. Now, user can use mouse/keyboard on the LEXD desktop.

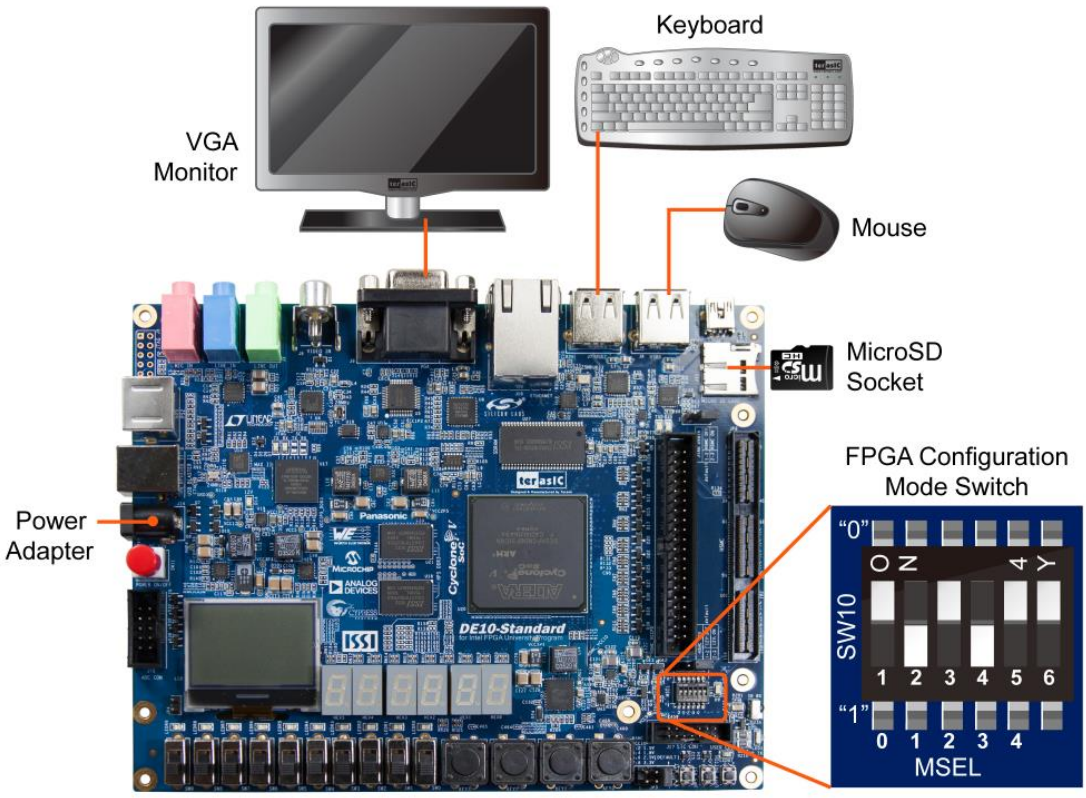


Figure 3-4 Setup for LXDE Desktop

Chapter 4

Performing a FPGA System Test

4.1 Introduction

This chapter shows how to install the USB-Blaster II driver and download a FPGA SRAM Object (.sof) file to your FPGA board.

4.2 Installing the USB-Blaster II Driver

The steps below outline how to install the USB-Blaster II driver.

1. Connect your computer to the development board by plugging the USB cable into the USB connector (J13) of DE10-Standard (connection shown in **Figure 3-3**)
2. Power up the board and open the device manager in Windows. You will find an unknown device.

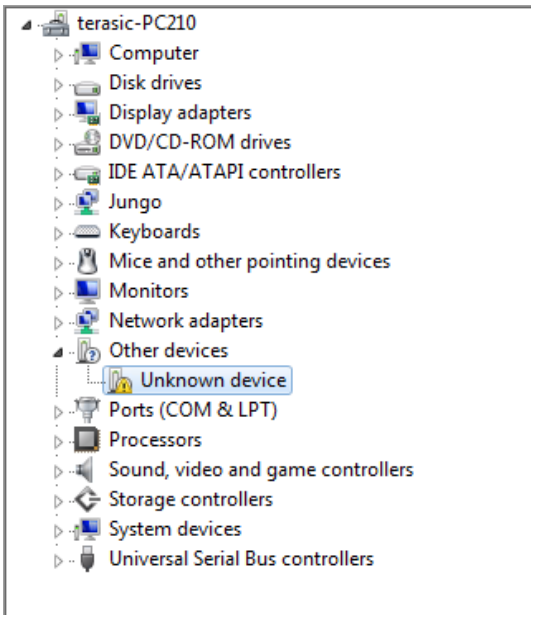


Figure 4-1 Unknown device on device manager

3. Select the unknown device to update the driver software. The driver file is in the \<Quartus II installation directory>\drivers\ usb-blaster-ii directory.

4. After the driver is installed correctly, the device is recognized as Altera USB-Blaster II as shown in following picture.

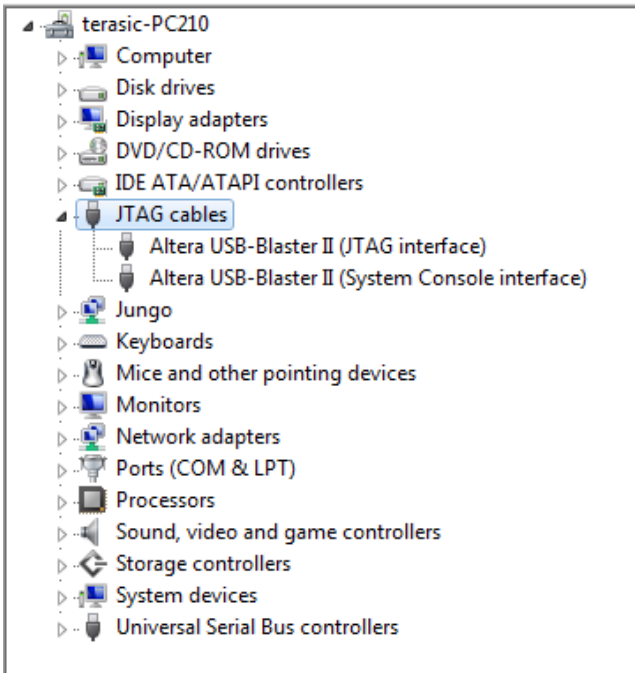


Figure 4-2 USB-Blaster II driver is installed correctly

4.3 Downloading a FPGA SRAM Object File

The Quartus II Programmer is used to configure the FPGA with a specific .sof file. Before configuring the FPGA, ensure that the Quartus II software and the USB-Blaster II driver are installed on the host computer.

If users would like to program their SRAM Object File (.sof) into the Cyclone V SOC FPGA device on the DE10-Standard board, There are two devices (FPGA and HPS) on the JTAG Chain, the configure flow is different from the one used with DE0-Nano. The following shows the programming flow with JTAG mode step by step.

1. Connect your computer to the DE10-Standard board by plugging the USB cable into the USB connector (J13) of DE10-Standard and power up the board (details shown in **Chapter 3**)

2. Open the Quartus II software and select Tools > Programmer. The Programmer window will appear.

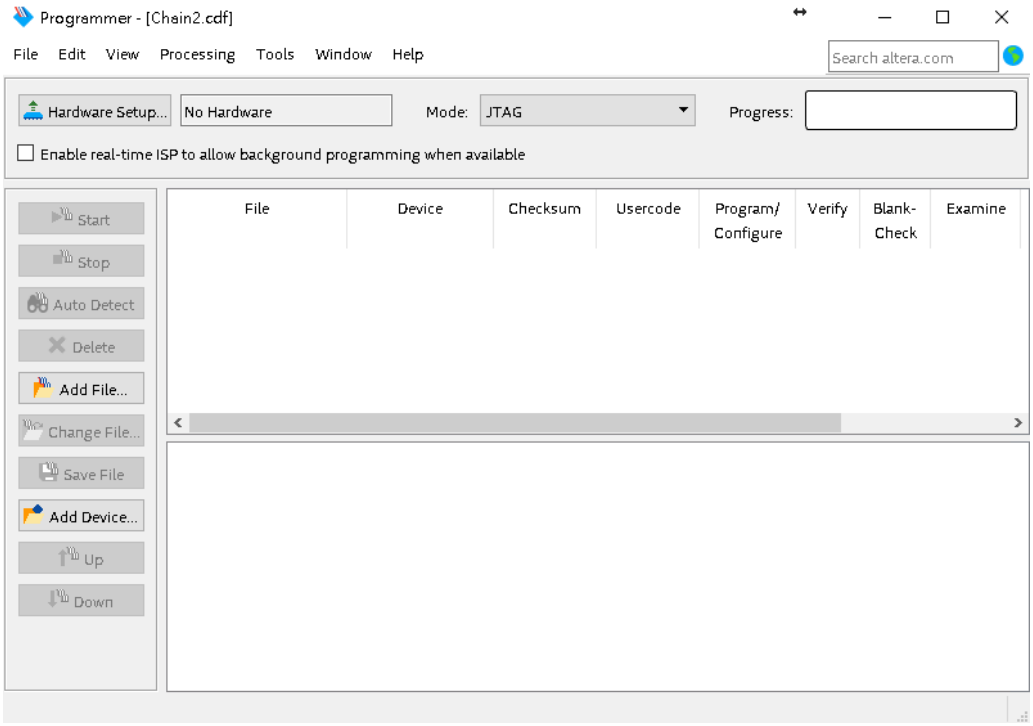


Figure 4-3 Quartus Programer

3. Click **Hardware Setup**.
4. If **DE-SoC [USB-1]** does not appear under **Currently Selected Hardware**, select that option and click **Close** as shown below.

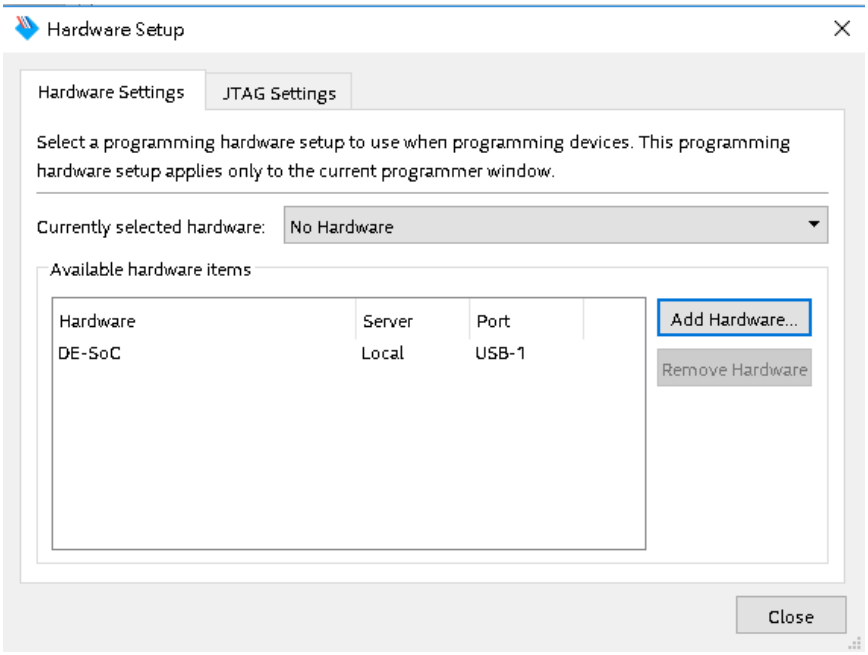


Figure 4-4 Hardware Setup

If the USB-Blaster II does not appear under hardware options list, please confirm if the USB-Blaster II driver has been correctly installed, and the USB cable has been properly connected between the DE10-Standard board and host computer.

5. Click "Auto Detect".

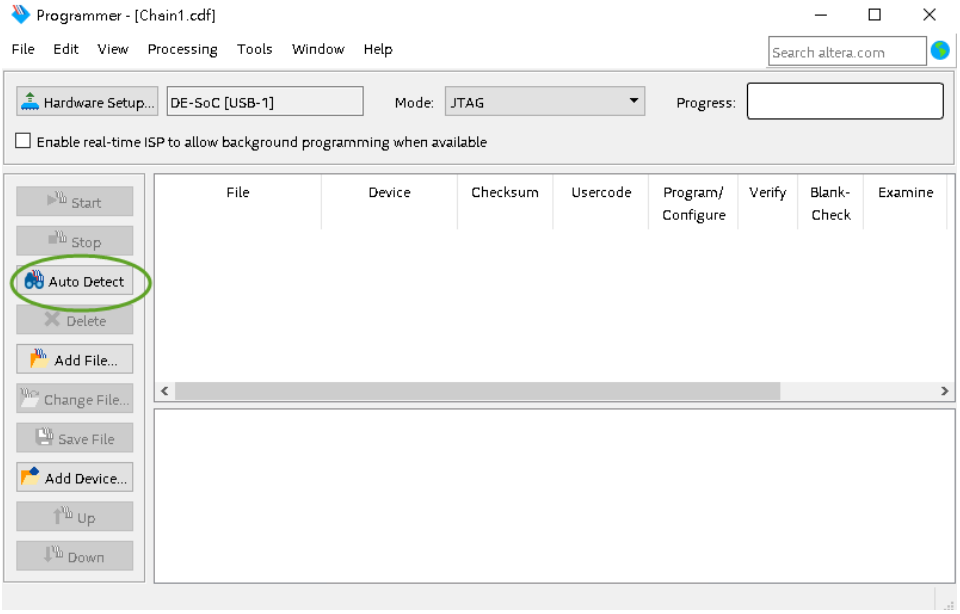


Figure 4-5 Auto detect FPGA device

6. Select the device associated with the board

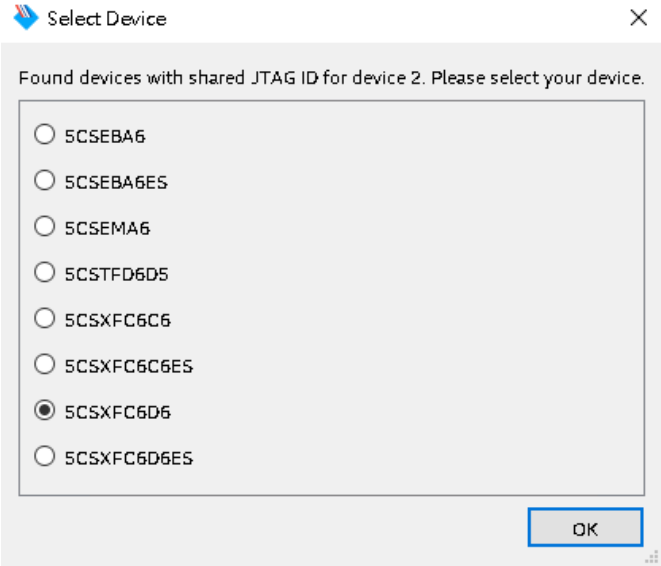


Figure 4-6 Select FPGA device

7. FPGA and HPS devices are all show in the JTAG chain.

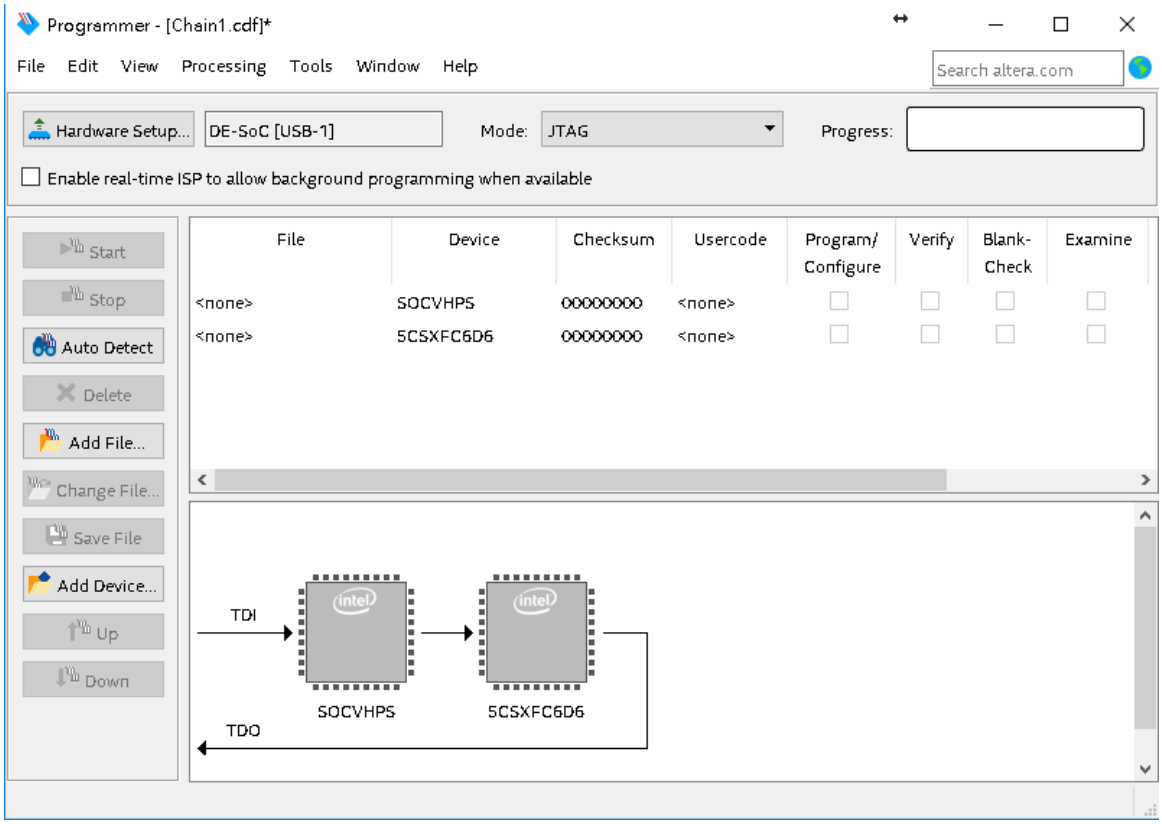


Figure 4-7 JTAG Chain on DE10-Standard board

8. Click the FPGA device, click “Change File..”, and then select .sof file for FPGA

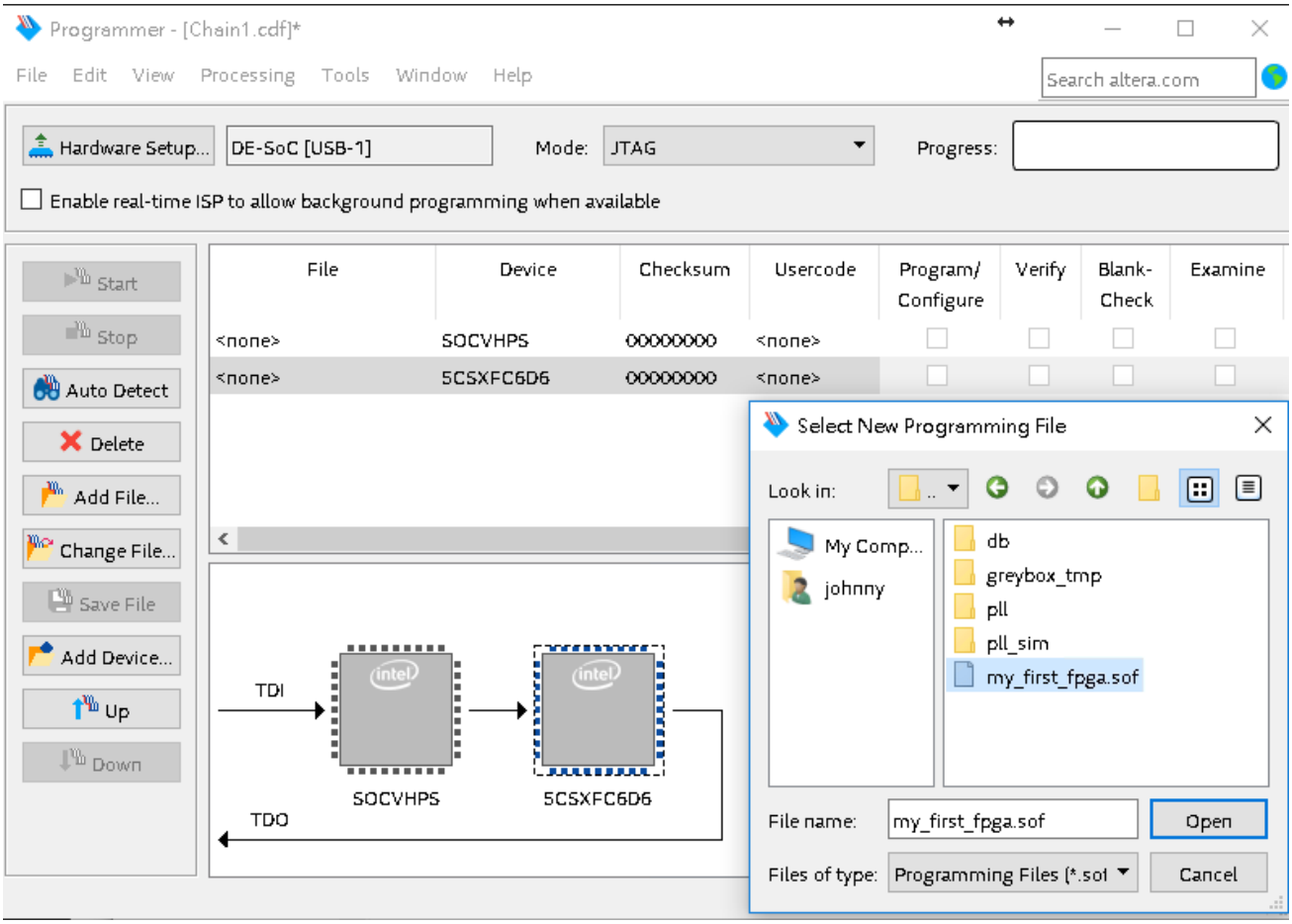


Figure 4-8 Add .sof file

9. Select \<CD directory>\Demonstration\FPGA\my_first_fpga\my_first_fpga.sof.

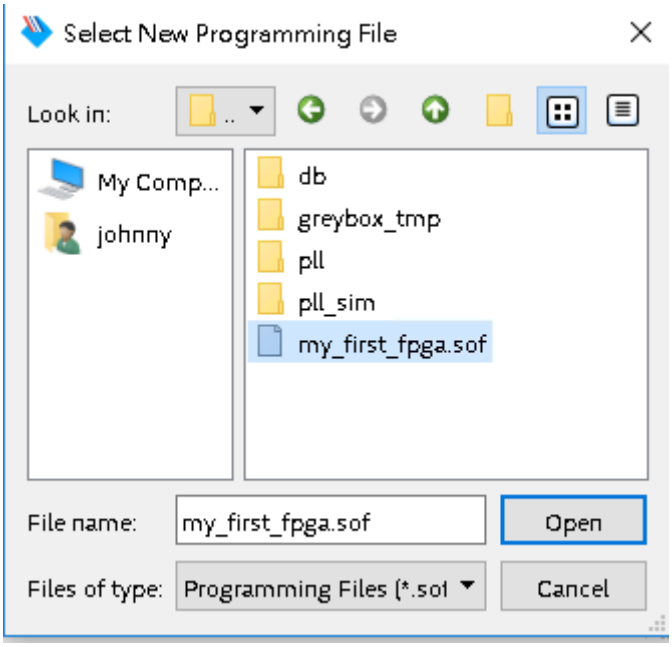


Figure 4-9 Select .sof file

10. Click “Program/Configure” check box, and then click “Start” button to download .sof file into FPGA

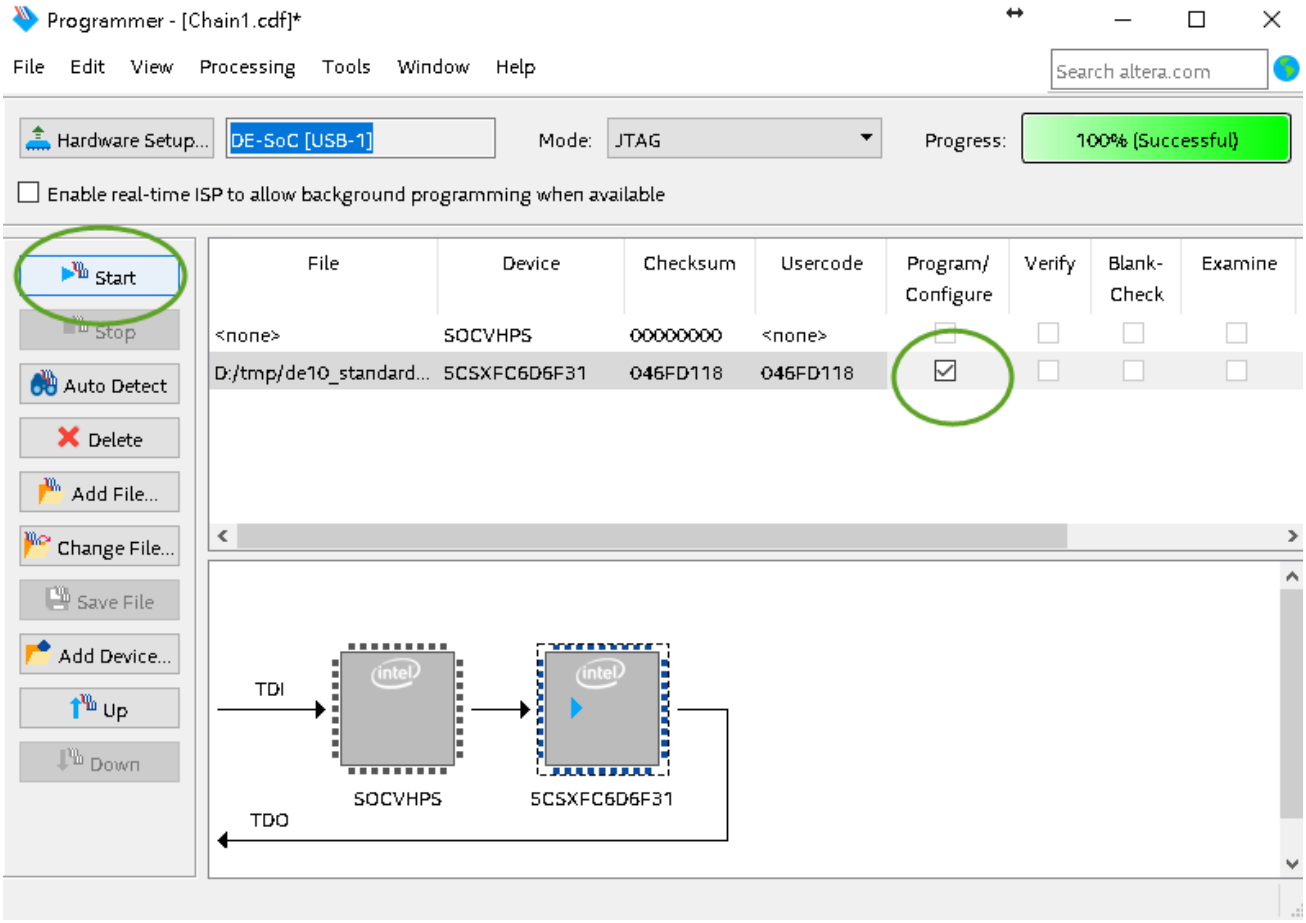


Figure 4-10 Downaload .sof file

Chapter 5

Running Linux on the DE10-Standard board via UART Terminal

5.1 Introduction

This chapter demonstrates how to set up a UART Terminal, and connect to DE10-Standard Board running Linux. Also, we will show how to create a Micro SD card image for using another board support image (BSP) such us **Linux Console.** User can download the latest SD Card image file from Terasic's website: http://de10-standard.terasic.com/cd.

5.2 Setting Up UART Terminal

This section presents how to install the drivers for the USB to UART chip on the DE10-Standard board and set up the UART terminal on your host PC. The DE10-Standard board communicates with the PC through the micro USB connector J4.You should install the USB to UART driver and configure the UART terminal before you run Linux on the board.

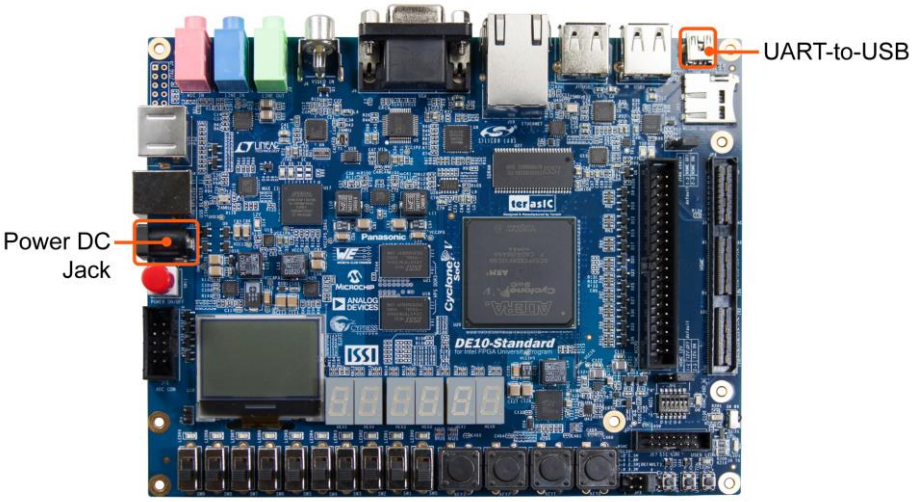


Figure 5-1 Hardware Setup for UART Terminal

■ Installing the Driver

This section presents how to install the drivers for USB to UART communication. The necessary steps on Windows 7 are:

1. Connect your computer to the development board by plugging the USB cable into the **Mini USB connector** (J4) of DE10-Standard (connection shown in **Figure 3-3**)
2. Power on the board then open the computer device manager in Windows. You will find an unrecognized FT232R USB UART.

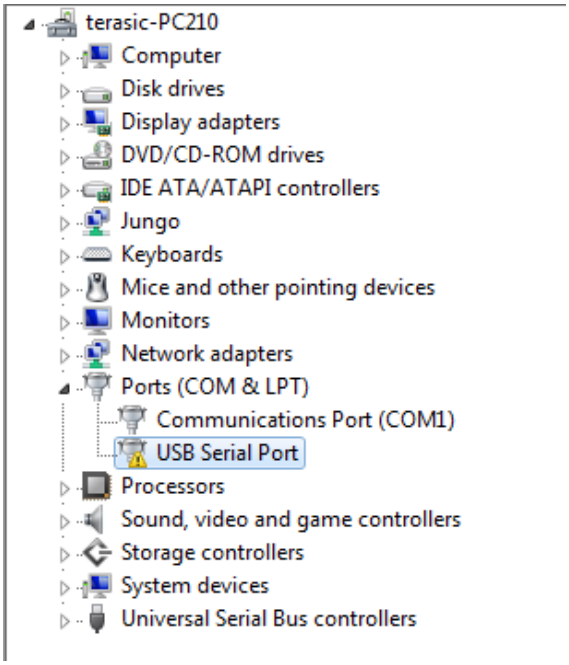


Figure 5-2 Unknown device on device manager

Select the FT232R USB UART to update the driver software. The driver can be downloaded from http://www.ftdichip.com/Drivers/VCP.htm.

3. After the driver has been installed correctly, the USB Serial Port is recognized as a port such as ***COM5*** *(Open the device manager to know which COM port assigned in your computer)*

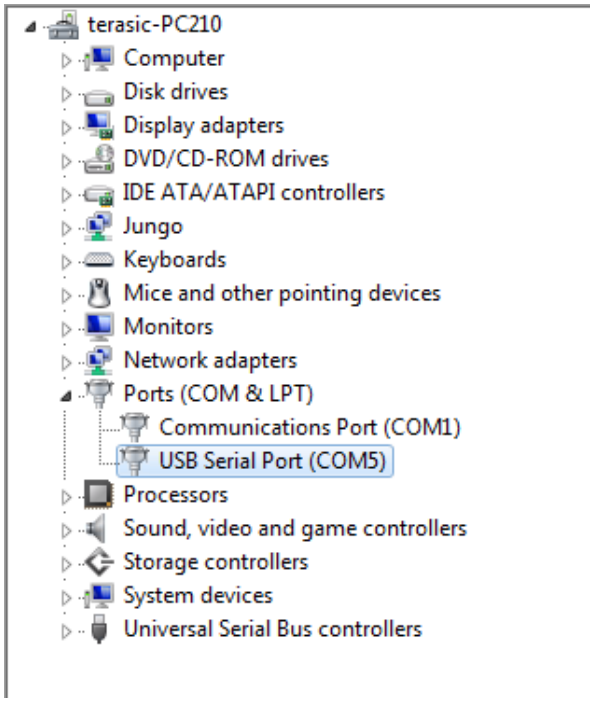


Figure 5-3 USB Serial Poet driver is installed correctly

4. Now you can power off the DE10-Standard board

■ Configure UART terminal UART terminal spec:

- 115200 baud rate
- no parity
- 1 stop bit
- no flow control settings

The following steps present how to configure a PuTTY terminal window (can be downloaded from the link: http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe)

1. Open putty.exe, click ***Serial*** go to a serial configure interface.

2. Configure the window like the flowing picture and click save button to save the configuration.

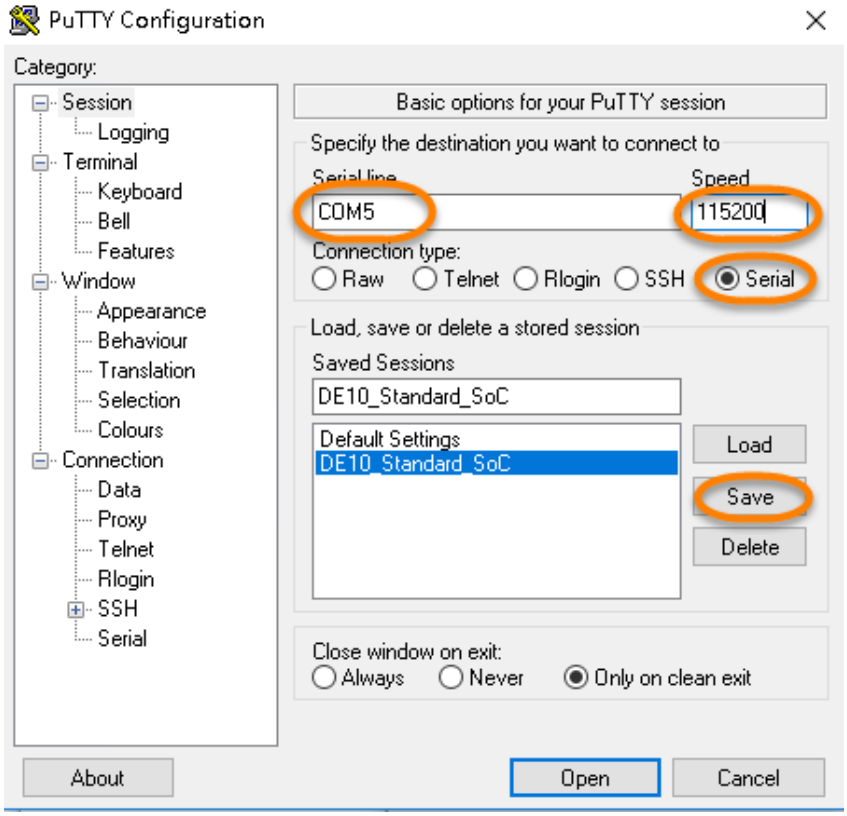


Figure 5-4 Putty Window

5.3 Running Linux on DE10-Standard board

This section presents how to run the pre-built Linux images on the DE10-Standard board. You can run the Linux by following the steps below:

1. Insert the factory microSD card with the pre-built image into the board (See Section 5.4 to prepare a microSD card)
2. Make sure the MSEL switch is set to “MSEL[4:0] = 01010”
3. Power up the board (See **Chapter 3** for details)
4. Open putty.exe, select the saved configuration **DE10_Standard_SoC** and click open button.
5. After a successful boot, the Linux will ask for the login name. Type "**root**" with the password “**terasic**” to login LXDE Linux..

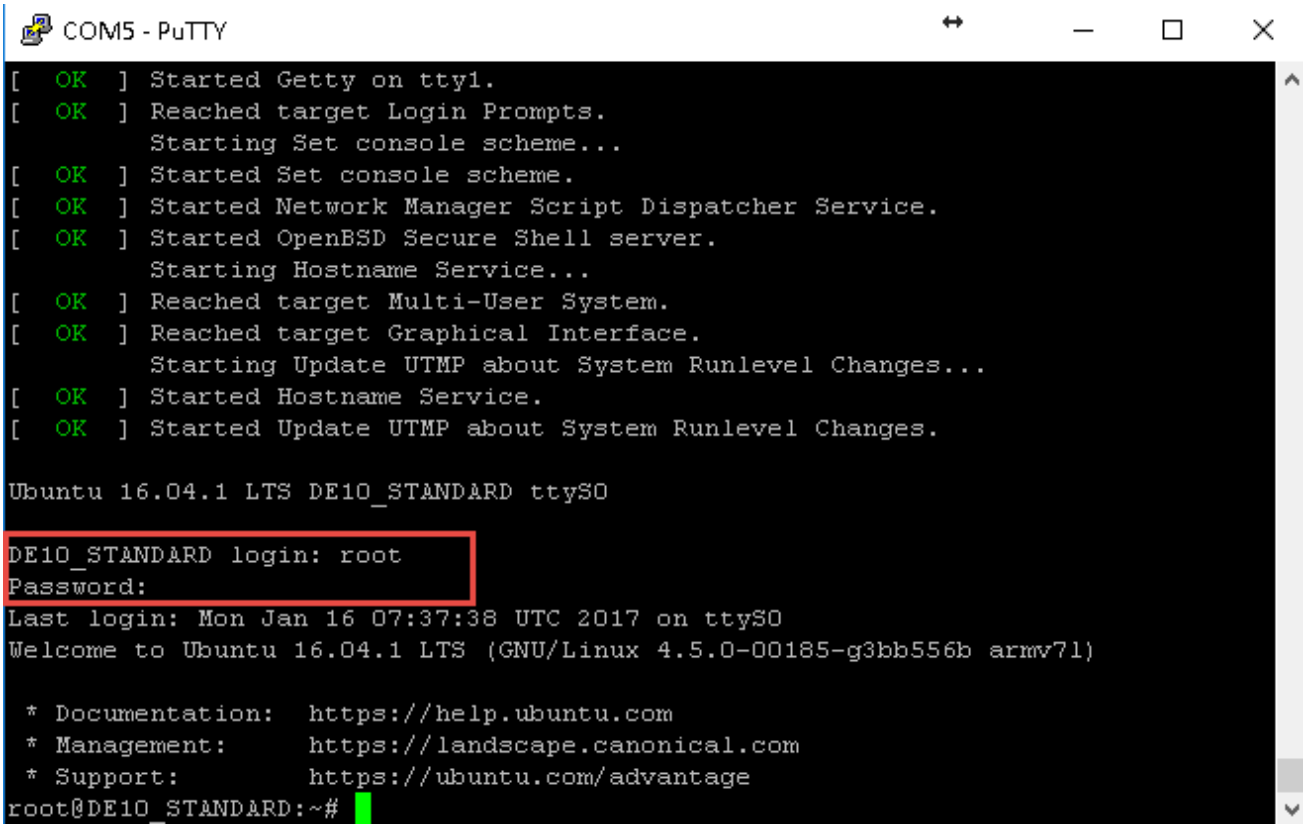


Figure 5-5 Putty Window

5.4 Creating a microSD Card Image

To program a microSD card Linux image you can use a free tool called **Win32DiskImager.exe** from http://sourceforge.net/projects/win32diskimager/ on a Windows machine.

■ MicroSD Specification

- Capacity: 8GB minimum
- Speed: Class 4 (at least)

■ Pre-built SD Card Image

The pre-built binaries are delivered as an archive named DE10-Standard_LXDE.img. This SD card image file contains all the items that are needed to run Linux on DE10-Standard board. (You can download the compressed file from the link: http://www.terasic.com/downloads/cd-rom/de10-standard/Linux/DE10-Standard_LXDE.zip. And

extract file to get the image file after downloading)

- SPL Pre-loader
- U-boot
- Device Tree Blob
- Linux Kernel
- Linux Root File system

The SD card image file needs to be programmed to a microSD card before it can be used. The steps below present how to create microSD card on a windows machine using Win32DiskImager.exe.

1. Connect the microSD card to a Windows PC
2. Execute Win32DiskImager.exe
3. Select the image file for microSD card
4. Select the microSD card device

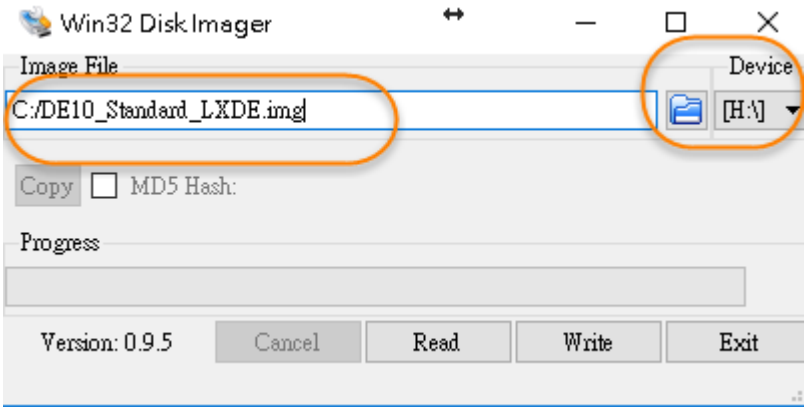


Figure 5-6 Win32 Disk Imager

5. Click “write” to start writing the image file to the microSD card. Wait until the image is written successfully.
6. There is also a Linux console image file which don’t have desktop feature can be download on the link below: http://www.terasic.com/downloads/cd-rom/de10-standard/Linux/DE10-Standard_Linux_Console.zip . Type “root” can enter the system.

Additional Information

Getting Help

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

- Terasic Inc.
  9F., No.176, Sec.2, Gongdao 5th Rd, East Dist, Hsinchu City, 30070. Taiwan, 30070
  Email: support@terasic.com
  Web: www.terasic.com

Revision History

Date	Version	Changes
2017.01	V1.0	First Version