

# Cortex™-M1 FPGA Development Kit v1.1

## Installation Guide

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### Release Information

The Change History table list the changes made to this guide.

Date	Issue	Confidentiality	Change
20 November 2007	A	Non-Confidential	First release for v1.0
22 August 2008	B	Non-Confidential	First release for v1.1

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### Product Status

The information in this document is final, that is for a developed product.

### Web Address

<http://www.arm.com>

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# 1 Introduction

The ARM® Cortex-M1 processor is the first ARM processor designed specifically for implementation in FPGAs.

The Cortex-M1 FPGA Development Kit is used with the Altera Cyclone III Starter Board. It enables you to implement, prototype, and test the Cortex-M1 processor in an FPGA system design. It provides an example system design that contains the components, buses, and memory map that you require to run deeply embedded software kernels or *real-time operating systems* (RTOS), such as RTX™ RTOS from Keil™.

The following subsections describe:

- *Contents of the Cortex-M1 FPGA Development Kit*
- *Supported platforms.*

## 1.1 Contents of the Cortex-M1 FPGA Development Kit

The kit contains the following items:

- Cortex-M1 FPGA Development Kit Install CD
- *Cortex-M1 FPGA Development Kit Cortex-M1 User Guide* (ARM DUI 0395)
- Cortex-M1 IP Encryption License Card
- Cortex-M1 RealView® *Microcontroller Development Kit* (MDK) License Card.

If you are using an evaluation version of the kit, information about evaluation licenses is provided when you download the files.

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### Note

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The kit does not include an Altera FPGA development board. ARM recommends that you obtain a suitable development board, such as the Altera Cyclone® III Starter Board (DK-START-3C25N), when using the Cortex-M1 FPGA Development Kit.

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## 1.2 Supported platforms

The Cortex-M1 FPGA Development Kit v1.1 is supported on computers running both:

- Microsoft Windows XP Professional, Service Pack 2 or later
- Altera Quartus II v8.0 or later.

The kit also supports the following additional tools:

- ModelSim-Altera 6.1g for Quartus II v8.0 or later.

## 2 Installing Altera Quartus II and ModelSim-Altera

The following subsections describe the installation:

- *Altera software*
- *Downloading software*
- *Installing software*

### 2.1 Altera software

You must install the following Altera products:

**Quartus® II Software** The design environment and productivity tools for the Altera family of FPGA devices. This software includes the Altera MegaCore® IP Library.

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#### Note

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The Cortex-M1 FPGA Development Kit requires Version 8.0 or higher.

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**ModelSim®-Altera** Software that provides simulation support. The evaluation version of the Cortex-M1 FPGA Development Kit does not support simulation, so this software is not required if you are using an evaluation version of the kit.

### 2.2 Downloading software

Download the software from the Altera website download area at:

<http://www.altera.com/download>

Altera provides the software using the following licenses:

**Web Edition** You can download this edition of a product free of charge, after completing a license agreement.

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#### Note

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A Web Edition license might not give access to some features.

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**Subscription Edition** You must purchase a subscription from Altera to download this edition of a product.

### 2.3 Installing software

Install the software in the following order:

1. Quartus II Software
2. ModelSim-Altera, if applicable.

To install the software, run the supplied installation application and follow the on-screen prompts.

### 3 Installing the Cortex-M1 FPGA Development Kit with RealView MDK

The Cortex-M1 FPGA Development Kit v1.1 contains:

- the Cortex-M1 processor design
- an example system design
- the RealView MDK development environment
- example software for the Cortex-M1 processor
- documentation.

To install the Cortex-M1 FPGA Development Kit v1.1:

1. From CD-ROM:

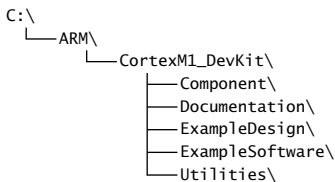
- Insert the installation CD into the CD-ROM drive.
- The product installation wizard starts automatically. If it does not start, run the program `setup.exe` in the top-level directory on the CD.

From an online download:

- Unpack the downloaded file and run the installation program.

2. Follow the instructions that the Wizard provides to install the Cortex-M1 FPGA Development Kit and the RealView MDK software.

Figure 1 shows the directory structure for the Cortex-M1 FPGA Development Kit when the software installation is complete.



**Figure 1 Cortex-M1 FPGA Development Kit installation directory structure**

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**Note**

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Figure 1 shows the directory structure when the Wizard installs the software in the default location. If you select an alternative install location then you must ensure that none of the folder names in the directory path contain any spaces, otherwise the Quartus II Software might not operate correctly with the Cortex-M1 FPGA Development Kit.

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## 4 Connecting the Altera Cyclone III Starter Board

See the *Altera Cyclone III Starter Board Quick Start Guide* for information about:

- connecting the Cyclone® III Starter Board to your computer
- connecting a suitable power supply to the Cyclone III Starter Board
- installing the USB-Blaster driver software.

For more information about the Cyclone III Starter Board refer to the Altera website at:

<http://www.altera.com>

## 5 Licensing the software and Cortex-M1 processor

You must obtain licenses from ARM and Altera before you can use the Cortex-M1 processor in an Altera FPGA design. The following sections describe how to obtain and install the licenses:

- *Obtaining ARM licenses*
- *Obtaining Altera licenses*
- *Installing ARM and Altera licenses*
- *Quartus II license configuration on page 6.*

### 5.1 Obtaining ARM licenses

You require the following ARM licenses:

- Cortex-M1 processor
- RealView MDK.

The Cortex-M1 FPGA Development Kit contains license cards that give your product serial numbers and tell you how to obtain your licenses.

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#### Note

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Do not discard the license cards. Each card contains a unique serial number for the specified product.

Evaluation versions of the development kit include information about obtaining evaluation serial numbers.

### 5.2 Obtaining Altera licenses

You require the following Altera licenses:

- Quartus II Software
- ModelSim-Altera, if applicable.

Obtain these licenses from the support section of the Altera website at:

<http://www.altera.com>

### 5.3 Installing ARM and Altera licenses

After you receive the necessary licenses you must:

- save the licenses to your computer
- create or modify an `LM_LICENSE_FILE` environment variable to define the location of the licenses.

To create or modify an `LM_LICENSE_FILE` environment variable on your computer:

1. On your Desktop, right-click the **My Computer** icon. Select **Properties** from the menu. The System Properties window opens.
2. In the System Properties window, click the **Advanced** tab.
3. In the **Advanced** tab, click **Environment Variables** to open the Environment Variables window.
4. In the Environment Variables window, check the User variables pane, scrolling if necessary, to see if the `LM_LICENSE_FILE` variable is defined.

If the variable exists then:

- a. In the User variables list, double-click on the `LM_LICENSE_FILE` variable to open the Edit User Variable window.
- b. Add the licenses to the `LM_LICENSE_FILE` variable, as described in *Adding the license files to a User Variable or System Variable on page 6.*
- c. Continue from step 8 of these instructions.

If the `LM_LICENSE_FILE` variable does not exist in the User variables pane then continue with the next step.

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#### Note

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If an `LM_LICENSE_FILE` variable is defined in the User variables list, Windows ignores any System variable named `LM_LICENSE_FILE`.

5. In the Environment Variables window, check the System variables pane, scrolling if necessary, to see if the `LM_LICENSE_FILE` variable is defined.

If the variable exists then:

- a. In the System variables list, double-click on the `LM_LICENSE_FILE` variable to open the Edit System Variable window.
- b. Add the licenses to the `LM_LICENSE_FILE` variable, as described in *Adding the license files to a User Variable or System Variable*.
- c. Continue from step 8 of these instructions.

If the `LM_LICENSE_FILE` variable does not exist in the System variables pane then continue with the next step.

6. In the User variables pane, click **New** to open the New User Variable dialog box.
7. In the New User Variable dialog box, edit the fields as follows:

**Variable name** Enter the text `LM_LICENSE_FILE`

**Variable value** Enter the licenses, as described in *Adding the license files to a User Variable or System Variable*.

8. Click **OK** to save the value of the `LM_LICENSE_FILE` variable and close the Edit Variable or New Variable dialog box.
9. In the Environment Variables window, click **OK** to close the window.
10. In the System Properties window, click **OK** to close the window.

#### Adding the license files to a User Variable or System Variable

You add the licenses by defining the full path of each of the license files in the **Variable value** field for an `LM_LICENSE_FILE` variable. Each path must include the file name of the license file:

- if you are defining a new `LM_LICENSE_FILE` variable, enter the paths in the **Variable value** field, using a semicolon to separate the paths
- if you are editing an existing `LM_LICENSE_FILE` variable, add the paths to the existing contents of the **Variable value** field, using semicolons to separate:
  - the new license file paths from the existing contents of the field
  - the license file paths.

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#### Note

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When a Windows variable holds multiple values the values must be separated by semicolons.

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Check that the **Variable value** field for the `LM_LICENSE_FILE` variable lists the paths to all the licenses described in *Obtaining ARM licenses* on page 5 and *Obtaining Altera licenses* on page 5.

## 5.4 Quartus II license configuration

Configure Quartus II to use the `LM_LICENSE_FILE` variable as follows:

1. Start the Quartus II Software application.
2. Select **Tools** → **License Setup** from the Main menu, to open the Licensing window.
3. Select the **Use LM\_LICENSE\_FILE** check box.
4. Click on **OK** to close the Licensing window.

To force the Altera applications to use this new license configuration you must restart the following applications:

- Quartus II Software
- ModelSim-Altera, if it is running.

## 6 Adding the Cortex-M1 processor to the SOPC Builder Library

You must add the Cortex-M1 processor to the Quartus II *System On Programmable Chip* (SOPC) Builder Library, so that SOPC Builder can use the Cortex-M1 processor in *System-on-Chip* (SoC) designs. Add the processor to the library as follows:

1. Start the Quartus II Software application.
2. Select **File** → **Open Project** from the Main menu, to open a project.

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### Note

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It does not matter which project you open. By default, the Cortex-M1 FPGA Development Kit installation process creates an example system project file in the following location:

C:\ARM\CortexM1\_DevKit\ExampleDesign\CortexM1\_ExampleDesign.qpf

If you did not use the default location for the installation, change this path to specify your chosen installation directory.

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Use the file browser window to select a Quartus project file and click **OK** to open the project.

3. Select **Tools** → **SOPC Builder** from the Main menu, to start SOPC Builder.

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### Note

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When SOPC Builder starts it might output error messages because the Cortex-M1 processor is not in the Library.

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4. After SOPC Builder starts you must update the IP search path.  
Select **Tools** → **Options** from the Main menu in SOPC Builder, to open the Options window.
5. In the Options window, select the **IP Search Path** category and click **Add** to open a file browser window.
6. In the file browser window, navigate to the following folder:

C:\ARM\CortexM1\_DevKit\Component\arm\_avalon\_cortexm1

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### Note

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If you did not use the default location for the installation, change this path to specify your chosen installation directory.

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Select this folder and then click **Open** to return to the Options window.

7. In the Options window, click **Finish** to accept the changes and close the window.
8. Close and re-open SOPC Builder to make the changes take effect.

The Cortex-M1 processor now appears in the SOPC Builder Library component list, as Figure 2 on page 8 shows.



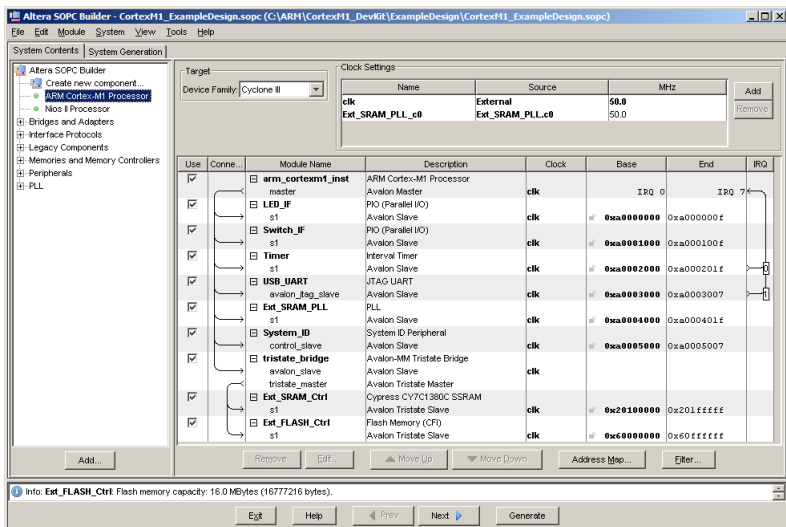


Figure 2 The Cortex-M1 component in the SOPC Builder Library

## 7 Configuring SOPC Builder to use the Altera-ModelSim simulator

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### Note

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You can skip this step if you are using an evaluation version of the Cortex-M1 FPGA Development Kit. The evaluation version of the development kit does not support simulation.

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To run a simulation on your design you must configure SOPC Builder with the location of the simulator application.

When SOPC Builder is running you can configure the location of the Altera-ModelSim application, as follows:

1. Select **Tools** → **Options** from the SOPC Builder Main menu, to open the Options window.
2. In the Options window, click on **HDL Simulator** to open the HDL Simulator Options window.
3. Select **Mentor Graphic's ModelSim-Altera** from the list of simulators.
4. To set the path to this simulator, click on ... to open a file browser window.
5. In the file browser window, navigate to the following folder:

```
C:\altera\80\modelsim_ae\win32aloem
```

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### Note

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- If you did not use the default location when you installed ModelSim-Altera, change this path to specify your chosen installation directory.
  - The path to the win32aloem file depends on the Mentor Graphics ModelSim-Altera release, and might not match the example path given here.
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Select this folder and click **Open** to confirm the directory and close the file browser window.

6. In the Options window, click **Finish** to accept the changes and close the window.

## 8 Using the Example System

The Cortex-M1 FPGA Development Kit provides the Example SOPC System Tutorial documentation that describes how to use the Example System.

Access the Example SOPC System Tutorial as follows:

1. Click the Windows **Start** icon to open the Start menu.
2. In the start menu, select **Programs** → **Cortex-M1 FPGA Development Kit** → **Documentation**
3. Select **Example System Tutorial** to open the document.

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### Note

From the **Programs** → **Cortex-M1 FPGA Development Kit** → **Documentation** menu you can also access the *Cortex-M1 FPGA Development Kit Cortex-M1 User Guide*. This guide describes how to incorporate and program the Cortex-M1 processor in an Altera Cyclone III Starter Board.

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## 9 Additional information

For each of the applications described in this guide, the application **Help** menu gives help on using the application.

The FPGA section on the ARM web site, <http://www.arm.com>, gives more information about ARM FPGA implementations. The most up-to-date documentation for ARM products can be found on the ARM InfoCenter at <http://infocenter.arm.com>.

For technical support, please contact your distributor.

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### **Note**

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The Design Files are provided for use in a compatible release of the Altera Quartus II Tool, or other compatible Altera tool. You will need to obtain a license from Altera Corporation for the relevant tool in order to use the Design Files.

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