MicroZed™ FPGA Mezzanine Connector (FMC) Carrier Card
Getting Started Guide
Version 1.1
## Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>3/27/2014</td>
<td>Initial Release</td>
</tr>
<tr>
<td>1.1</td>
<td>4/17/2015</td>
<td>Updated URLs</td>
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1 Getting Started with the MicroZed FMC Carrier Card

The Avnet MicroZed FMC Carrier Card (FMC-CC) enables hardware and software developers to expand the capabilities of the MicroZed System-on-Module (SOM). Coupled together, the MicroZed SOM and FMC-CC allow designers to create or evaluate Zynq™-7000 All Programmable SoC designs for both the Processor Subsystem (PS) and the Programmable Logic (PL) fabric.

In addition to all the capabilities that the MicroZed SOM has in standalone mode, the FMC-CC powers and exposes the PL I/Os, while also provided system power through the mezzanine MicroHeaders. The MicroZed PL I/Os are connected on the FMC-CC to a Low-Pin-Count (LPC) FPGA Mezzanine Connector (FMC) based on the Vita 57 standard. Digilent Pmod™ Compatible headers, LEDs, push-buttons, and an Ethernet MAC ID EEPROM are additional features on the board.

![MicroZed FMC Carrier Card Board](image)

This Getting Started Guide will outline the steps to setup the MicroZed SOM and FMC-CC hardware. It documents the procedure to run a simple bare-metal design running on the ARM® dual-core Cortex™-A9 MPCore™ Processing System (PS) that interacts with the LEDs and push-buttons on the FMC-CC tied to Programmable Logic (PL) I/Os.
2 What’s Inside the Box?

![Figure 2 – MicroZed FMC Carrier Card Board and Power Supply](image)

2.1 MicroZed FMC-CC Kit contents

- MicroZed FMC Carrier Card (FMC-CC)
- 12V @ 5A AC/DC adapter
- power adapter plugs for international use
- MicroZed mounting hardware – 4 stand-offs and 8 screws (not shown)
- Documentation (not shown)
  - Quick Start Instruction card
  - WARNING card relative to errata and MicroZed version
3 What’s on the Web?
MicroZed is a community-oriented kit, with all materials being made available through the MicroZed.org community website.

3.1 Official Documentation:
- Getting started guide
- Hardware user guide
- Schematics
- Bill of materials
- Layout
- PCB net lengths
- Mechanical drawing
- 3D Model

3.2 Tutorials and Reference Designs:
- Introductory material for beginners
  - Creating a Zynq hardware platform
  - Developing software in SDK
- Design examples
- Community projects

3.3 Training and Videos:
- Overview of MicroZed
- Introduction to Zynq
- Implementing Linux on the Zynq-7000 SoC
- Software Defined Radio on Zynq
- Using XADC on Zynq for Thermal Analysis
- Embedded System Design Flow
- ZynqGeek Blog
5 MicroZed FMC- CC Key Features

- Expansion connectors
  - Low pin count (LPC) FMC with 72 PL I/Os (36 differential pairs)
  - Five Digilent Pmod™ compatible interfaces
    - Access to 39 user I/O
    - One (8 I/O) connected to PS MIO
    - Two (16 I/O) support the Zed Touch Display Kit
    - Two (15 I/O) connected to Bank 13 (supported with 7Z020 MicroZed only)
- Configuration and Debug
  - Xilinx Platform Cable JTAG connector
- General Purpose I/O
  - 4 user LEDs
  - 2 push buttons
- Memory
  - 2 Kb MAC ID EEPROM
  - (optional) 1 Kb SHA-1 EEPROM (not populated by default)
Figure 3 – MicroZed FMC-CC Block Diagram
6 MicroZed FMC-CC Basic Setup and Operation

The operation of the FMC-CC is determined by the MicroZed module. The functionality of both the MicroZed and the FMC-CC is determined by the application booted from the selected non-volatile memory on the MicroZed itself. Therefore, it is not possible to ship the FMC-CC with any pre-configured design. This must be loaded by the user into the MicroZed.

Of course, the primary purpose of the FMC-CC is to allow both a MicroZed and an FMC module be connected together. In this case, the application is still booted from the MicroZed while the FMC may add enhanced functionality with additional circuitry.

This *Getting Started Guide* offers system developers examples of how to do several things with the MicroZed and FMC-CC together:

1. Interact with GPIOs on the FMC-CC, including the four LEDs and the two push buttons.
2. Control the blink rate of the LEDs using push button input.
3. Boot the example design from MicroZed’s microSD Card

In addition to the items included in the kit, you will also need the following to complete the exercises in this tutorial.

- MicroZed module
- MicroUSB cable
- microSD card reader/adapter

An image of the MicroZed FMC-CC in its expected out-of-box configuration is shown below along with the locations of several key components.
Figure 4 – FMC-CC Topology
6.2 Mounting the MicroZed

The FMC-CC Kit includes mounting hardware that allows you to more permanently secure your MicroZed to the FMC-CC. This can be done now, but it is not required.

1. Insert one of the screws through the top of one of the mounting holes on the MicroZed.
2. Twist a stand-off onto the screw.
3. Repeat for the other three mounting holes.
4. Plug the MicroZed onto the FMC-CC.
5. From the bottom-side of the FMC-CC, use the screws to attach to the standoffs through the FMC-CC mounting holes.

![Figure 5 – Location of Four Mounting Holes](image)

![Figure 6 – Sideview Showing Top Screw, Standoff, and Bottom Screw](image)
6.3 Example Design
The example FMC-CC design is based on the FMC Carrier Card Linux User IO Tutorial which is available at www.microzed.org Reference Design/Tutorials. For more information on how to build this design, please review the tutorial document included with that archive.

The example design interfaces the Zynq processing system (PS) through routing resources inside the programmable logic (PL). A Linux application controls the blink pattern and rate of the four LEDs on the FMC-CC. This is done with the built-in PS GPIO controller. The LEDs are controlled by input through the two push buttons. The LEDs and push buttons of interest are highlighted in the photo below.

Figure 7 – User LEDs and Push Buttons for Example Design
A block diagram for the design is shown below.

Figure 8 – MicroZed/FMC-CC Hardware Design

The example design must be downloaded and unzipped. The hardware design image must then be written to the microSD Card. Download and unzip this design now as follows:

1. Go to www.microzed.org
2. Click Support □□Reference Designs/Tutorials
4. Click on FMC Carrier Card’s View button.
5. Next to the FMC Carrier Card Linux User IO Tutorial, click the Login/Register button and login. Create a new account if necessary.
6. Now click the Download button ➡️
7. Save the file, then unzip it.
The Reference Design archive contains five directories, a zipped solution, and a README.

![Unzipped Archive for FMC Carrier Card Linux User IO Tutorial](image)

Figure 9 – Unzipped Archive for FMC Carrier Card Linux User IO Tutorial

The only directory with any relevance for this Getting Started exercise is the following:

**sd_image**

The **pre-built** sub-directory contains the microSD Card archive that we will use for this exercise.

![Contents of “pre-built” Sub-directory](image)

Figure 10 – Contents of “pre-built” Sub-directory

If you choose to complete the full tutorial to rebuild the design, then refer to the documentation in the **doc** directory.
6.5 Hardware Setup

1. The microSD card must be formatted as FAT32. If this has not been previously done, please do that now. Refer to Appendix A: Format the microSD Card for specific instructions.

2. A terminal program is required. Windows 7 does not come pre-installed with a terminal program. Tera Term was used in this example which can be downloaded from the Tera Term project on the SourceForge Japan page: ttssh2.sourceforge.jp Install Tera Term or another terminal program of your choice.

3. If not previously installed, go to www.microzed.org to download and install the Silicon Labs CP2104 USB-to-UART driver. http://microzed.org/support/documentation/1519
   a. Silicon Labs CP210x USB-to-UART Setup Guide

4. Delete all files from the microSD card so we have an empty starting point. Copy all the files from the sd_image/pre-built directory to the top level of the microSD card.

5. Once the files are copied to the microSD card, eject the microSD card from the PC or SD card reader.

6. Insert the microSD card into the microSD card slot (J6) located on the underside of MicroZed module.

Figure 11 – MicroZed Hardware Reference
7. Set the MicroZed boot mode (JP3-JP1) jumpers to SD card mode as described in the Hardware Users Guide.

SD Card

![SD Card Boot Jumper Settings](image)

Figure 12 – SD Card Boot Jumper Settings

8. Make sure the FMC-CC power switch is in the OFF position.
9. Insert the MicroZed module onto the FMC-CC.
10. Set the VADJ (J6) jumpers to 3V3 (1-2).
11. Insert the appropriate country plug into the 12V AC/DC adapter. Plug it into the CON4 2x3 power connector. (NOTE – this 2x3 connector is NOT compatible with ATX power supplies.)
12. We will be using a micro-USB cable to communicate through a terminal, but this will be plugged in a bit later.
6.7 Running the Example

13. Turn the power switch on the FMC-CC to the ON position. After 1-2 seconds, you will notice four LEDs that are lit:
   - D5 on MicroZed, indicating Power Good
   - LED6 on FMC-CC, indicating Power Good
   - D2 on MicroZed, Zynq PL configuration DONE
   - LED5 on FMC-CC, Zynq PL configuration DONE


15. On the PC, open a serial terminal program. Tera Term is used to show the example output for this lab document. Follow the instructions in the CP210x Setup Guide to set the terminal as shown in Figure 14, using the appropriate COM port that you discover on your own machine.
16. Perform a System Processor Reset by pushing the SYS_RST# button (SW1) on the FMC-CC. The terminal output shows that the Zynq boots to U-boot and then Linux, launching the MicroZed FMC Carrier User IO Example and concluding with the zynq> prompt.
Figure 15 – MicroZed and FMC-CC Example Design
You’ll notice now that the four User LEDs are flashing back and forth rapidly. Using the Push Buttons, you can cause the processor to change the blink pattern and rate.

17. Press BTN1. The LED flash pattern changes to ALL ON then ALL OFF at a rate of 200 milliseconds. Release BTN1.
18. Press BTN2. The pattern is identical to BTN1 push. Release BTN2.
19. Push both BTN1 and BTN2. The blink pattern changes to ALL ON / ALL OFF, but the rate is 4 times slower at 800 milliseconds. Release the buttons.
20. A number of activities can also be performed through the terminal using Linux. If you are unfamiliar with Linux, please refer to the MicroZed Getting Started Guide for some examples.

To further examine this reference design, please refer to the tutorial document included in the FMC Carrier Card Linux User IO Tutorial. To complete this tutorial, you will need to install Xilinx development tools. For instructions on installing the Xilinx software, please refer to Appendix B: Installing and Licensing Xilinx Software.
7 Getting Help and Support

7.1 Avnet Support

MicroZed is a versatile development kit and a SOM ready to be adopted into your next design. All technical support is offered through the MicroZed.org website support forums. MicroZed users are encouraged to participate in the forums and offer help to others when possible.

For questions regarding the MicroZed community website, please direct any questions to:

MicroZed.org Web Master – webmaster@microzed.org

To access the most current collateral for MicroZed please visit the community support page at:

www.microzed.org/content/support

Once on the MicroZed.org support page:

To access the latest MicroZed documentation, click on the Documentation link:

To access the latest reference designs for MicroZed, click on the following link:

To access the MicroZed technical forums, click on the following link:
7.3 **Xilinx Support**

For questions regarding products within the Product Entitlement Account, send an e-mail message to the Customer Service Representative in your region:

Canada, USA and South America - isscs_cases@xilinx.com

Europe, Middle East, and Africa - eucases@xilinx.com

Asia Pacific including Japan - apaccase@xilinx.com

For technical support including the installation and use of the product license file, contact Xilinx Online Technical Support at [www.xilinx.com/support](http://www.xilinx.com/support). The following assistance resources are also available on the website:

- Software, IP and documentation updates
- Access to technical support web tools
- Searchable answer database with over 4,000 solutions
- User forums
Appendix A: Format the microSD Card

The MicroZed Evaluation Kit ships with a blank microSD card. To ensure it is ready to be used in Linux and later as a boot source, it must be properly formatted. To use the microSD card as a boot device, it must be formatted as FAT32.

The following operations were performed on a Windows 7 PC using a built-in SD Card slot. If an SD Card slot is not available on your PC, you will need to purchase an SD Card device or a USB-based microSD adapter.

1. Insert the microSD card into the included SD Adapter.
2. Insert the SD adapter into the SD Card slot and wait for it to enumerate as a Windows drive. If prompted by Windows when inserting the SD card, select the Continue without scanning option.

3. Find the assigned SD Drive in Windows Explorer.
4. Right-click and select Format.
Select the *File System* to be FAT32. The Allocation unit size can be set to **Default**. Click **Start**.

![Format SD (K)](image)

**Figure 17 – Format the microSD Card**

As stated in the warning dialog, formatting will erase all data on the disk. Click **OK**.

![Format SD (K)](image)

**Figure 18 – Formatting Will Erase**
If all goes well, you will get a message stating **Format Complete.** Click **OK.**

![Format Complete](image1)

**Figure 19 – Format Complete**

Click Close in the Format dialog box.
To double-check your card, right-click on the drive in Windows Explorer and select **Properties.** Notice the File system displayed as **FAT32.** Click **OK** to close.

![Properties of the microSD Drive](image2)

**Figure 20 – Properties of the microSD Drive**
Appendix B: Installing and Licensing Xilinx Software

9.1 Install Vivado Design Edition
The MicroZed XC7Z010-CLG400-1 Zynq-7000 AP SoC device development is supported by Vivado WebPACK licensing. The MicroZed Evaluation Kit also comes with an entitlement voucher to a seat of Vivado Design Edition which is device locked to a XC7Z010-CLG400-1 Zynq-7000 AP SoC device. The Design Edition software is an advantage over WebPACK as it adds the Logic Analyzer capability. See http://www.xilinx.com/products/design_tools/vivado/vivado-webpack.htm

This software can be downloaded online at:
www.xilinx.com/support/download/index.htm

You can also request a free DVD from
http://www.xilinx.com/onlinestore/dvd_fulfillment_request-vivado.htm

If a full seat of Vivado System Edition has already been installed, then no further software will be needed. Please check online for any updates at: www.xilinx.com/support/download/index.htm

For detailed instructions on installing and licensing the Xilinx tools, please refer to the Vivado Design Suite User Guide Release Notes, Installation, and Licensing (UG973) available on the Xilinx website: