



# MicroZed™ I/O Expansion Carrier Card Getting Started Guide

Version 1.0

## Document Control

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# 1 Getting Started with the MicroZed I/O Carrier Card

The Avnet MicroZed I/O Carrier Card (IOCC) enables hardware and software developers to expand the capabilities of the MicroZed System-on-Module (SOM). Coupled together, the MicroZed SOM and IOCC 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, the IOCC 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 IOCC to Digilent Pmod™ Compatible headers, LEDs, push-buttons, switches, a clock, and a Xilinx Agile Mixed Signal (AMS) header.

This Getting Started Guide will outline the steps to setup the MicroZed SOM and IOCC 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 IOCC.

## 2 What's Inside the Box?



### 2.1 MicroZed IOCC Kit contents

- MicroZed I/O Carrier Card
- 5V @ 2A AC/DC adapter
- 4 international adapter plugs
- Documentation
  - 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](http://MicroZed.org) community website.

### 3.1 Official Documentation

- Schematics
- Bill of materials
- Layout
- Hardware manual
- Board definition files

### 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

## 4 MicroZed IOCC Key Features

- Expansion connectors
  - 12 Digilent Pmod™ Compatible headers
    - Five connected to PL Bank 34
    - Four connected to PL Bank 35
    - One connected to PS MIO
    - Two connected to PL Bank 13 (7Z020 only)
  - Xilinx Agile Mixed Signaling (AMS) header
- Clocking
  - 100 MHz clock source for PL
- Configuration and Debug
  - Xilinx Platform Cable JTAG connector
- General Purpose I/O
  - 8 user LEDs
  - 4 push buttons
  - 4 DIP switches
- Memory
  - Optional footprint: 1KB 1-wire SHA Security EEPROM (not populated)

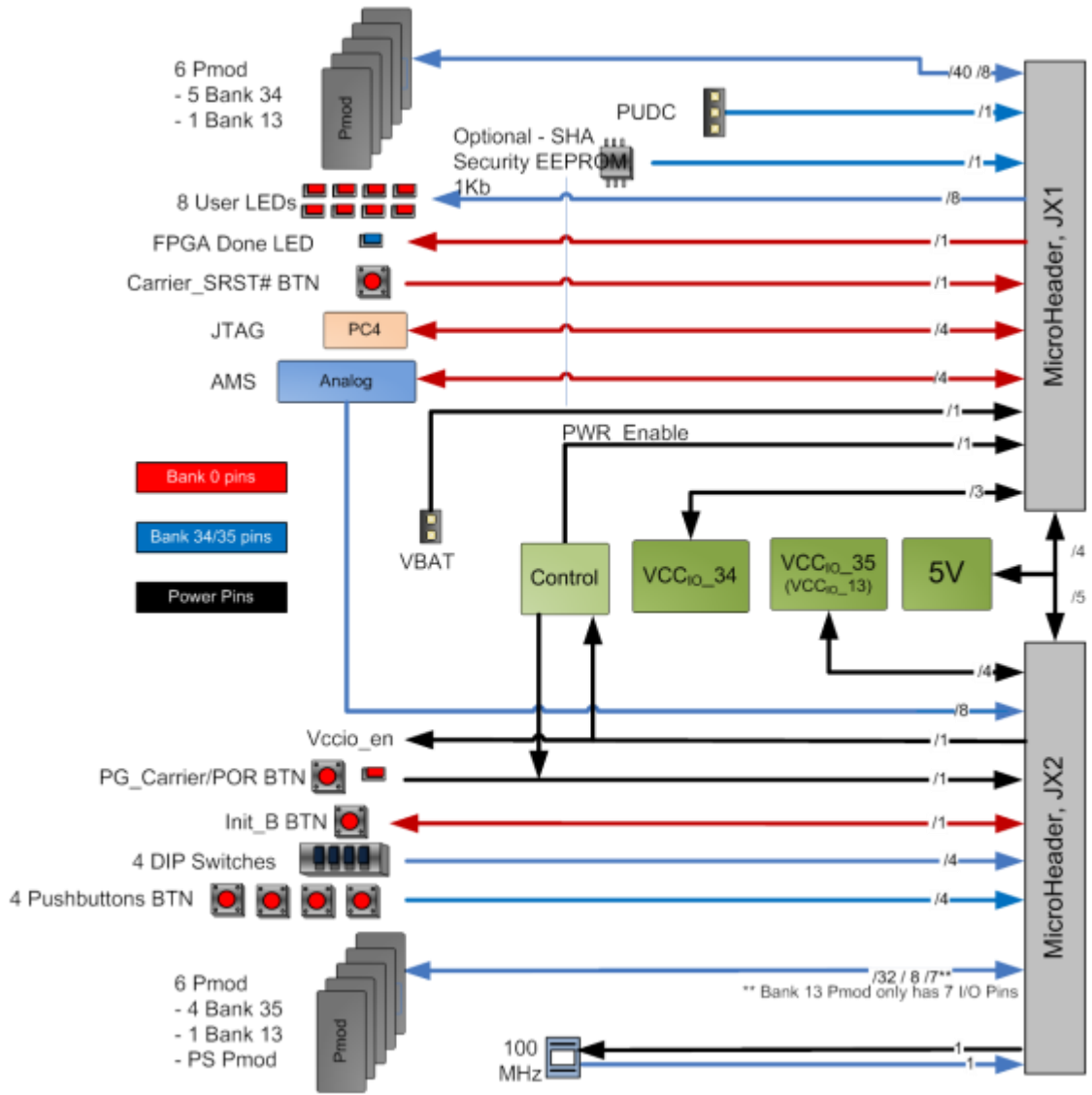


Figure 1 – MicroZed IOCC Block Diagram



## 5 MicroZed IOCC Basic Setup and Operation

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

This Getting Started Guide offers system developers examples of how to do several things the MicroZed and IOCC together:

1. Interact with GPIOs on the IOCC, including the eight LEDs and the four push buttons.
2. Control the brightness of the LEDs using either push button input or terminal input.
3. Boot the example design from SD Card
4. Program the QSPI Flash on the IOCC with the example design

In addition to the items included in the kit, you will also need a **MicroZed module**, a **MicroUSB cable**, and a **microSD card reader/adaptor** to complete the exercises in this tutorial.

An image of the MicroZed IOCC in its expected out-of-box configuration is shown below along with the locations of several key components.

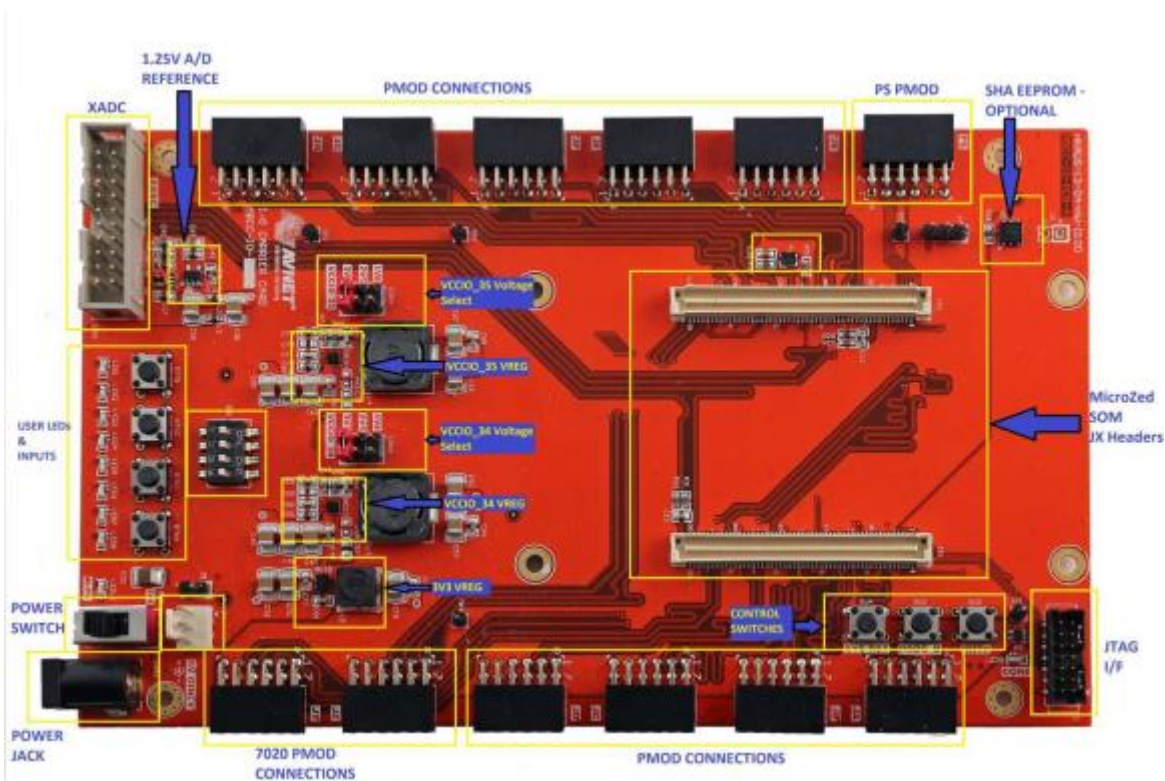


Figure 2 – IOCC Topology

## 5.1 Example Design

The example IOCC design is based on the Zynq Hardware Platform developed as part of the 2013 Speedway course titled *Developing Zynq All-Programmable SoC Hardware with Xilinx Vivado 2013.3*. For more information on how to build this design, please discuss your course options with your Avnet/Silica FAE.

The example design interfaces the Zynq processing system (PS) to simple logic built up in the programmable logic (PL). The purpose of the PL design is to control the brightness of the eight LEDs on the IOCC. This is done with a PWM. The PWM can be controlled from the PS USB-UART, or the PWM can also be controlled by input through the four push buttons, which go through a PL debouncer. A block diagram for the design is shown below.

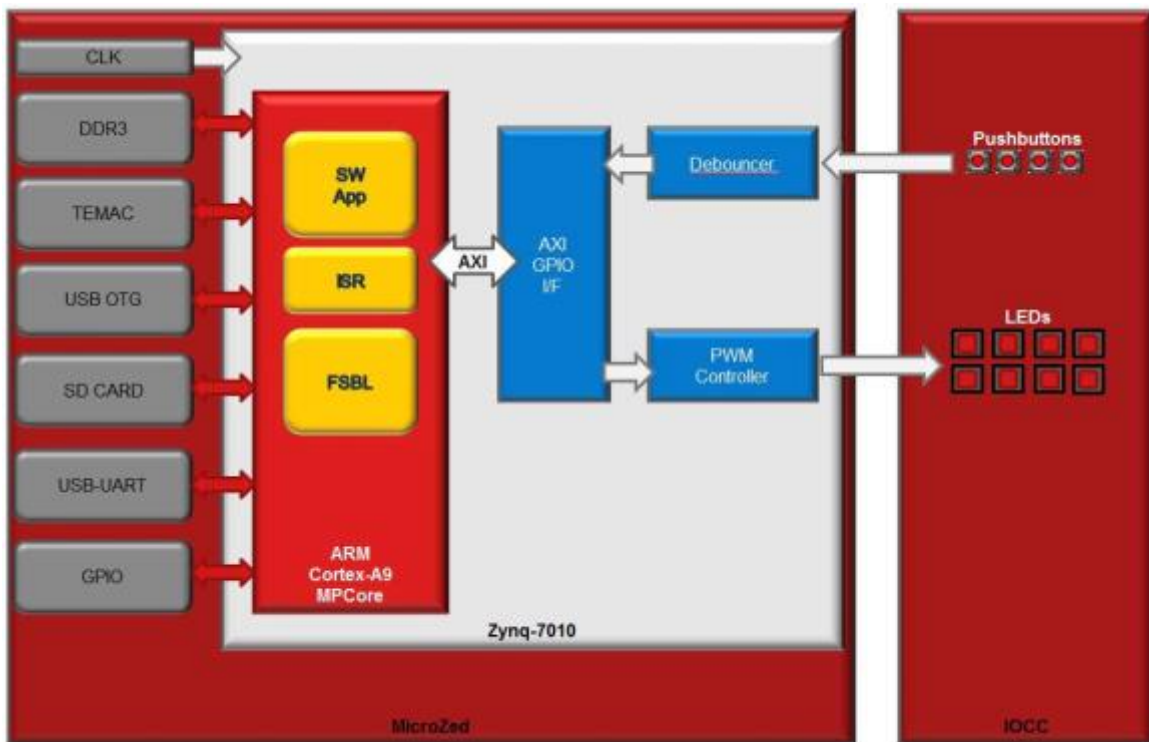


Figure 3 – MicroZed/IOCC C Hardware Design

The example design must be downloaded and then programmed either to the SD Card or the QSPI Flash. Download these designs now as follows:

1. Go to [www.microzed.org](http://www.microzed.org)
2. Click on [Reference Designs/Tutorials](#)
3. Click on I/O Carrier Card's **View All** button.
4. Under the **IO Carrier Card Base Design**, click the **Login/Register** button below, then click on **Download**.
5. Save the file, then unzip it.

The Reference Design archive contains three directories.

### **MicroZed\_IOCC**

This directory contains the Vivado 2013.3 project for the example design. You can view this design in Vivado by opening the MicroZed\_IOCC.xpr project file.

### **sd\_image**

This directory contains the SD Card (boot.bin) and QSPI (output.mcs) images. The ELF files for the FSBL and LED\_Dimmer applications are also included. The LED\_Dimmer.bif file is the boot image format file that describes how the boot images were created.

### **sw**

This directory contains the files that were used in SDK, including the hardware platform, the BSP, the FSBL, and the LED\_Dimmer application. The software environment could be re-created by importing these sources into SDK.

## 5.2 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: [tssh2.sourceforge.jp](http://tssh2.sourceforge.jp) Install Tera Term or another terminal program of your choice.
3. If not previously installed, go to [www.microzed.org](http://www.microzed.org) to download and install the Silicon Labs CP2104 USB-to-UART driver.  
[www.microzed.org/documentation/1519](http://www.microzed.org/documentation/1519)  
Silicon Labs CP210x USB-to-UART Setup Guide
4. Copy the boot.bin file from the **sd\_image** directory to the top level of the microSD card. Delete all other files.
5. Once boot.bin is copied to the microSD card, eject the microSD card from the PC or SD card reader.
6. Insert the 4GB microSD card included with MicroZed into the microSD card slot (J6) located on the underside of MicroZed module.

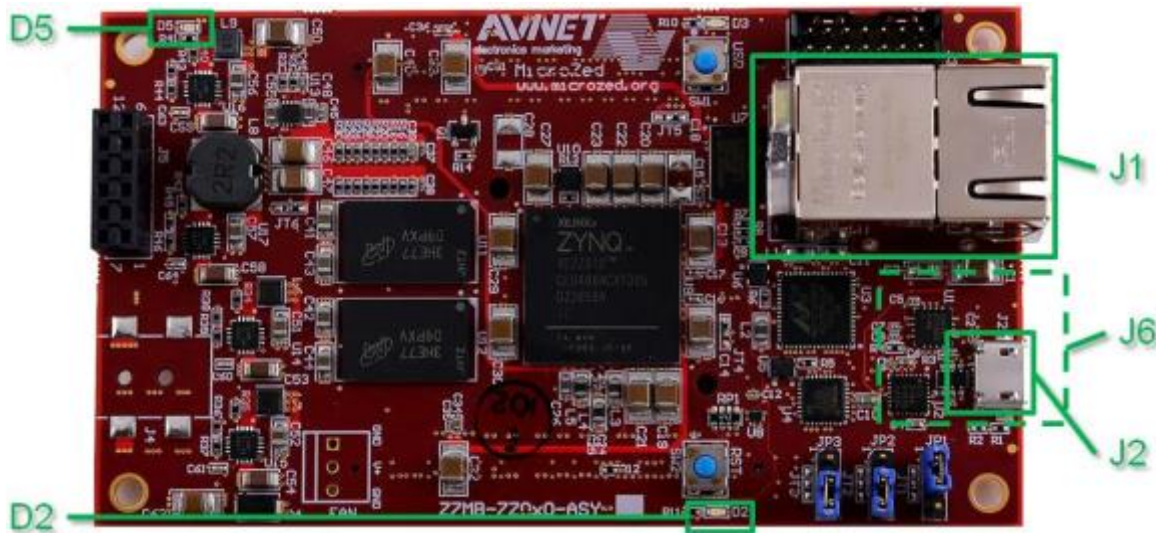


Figure 4 – MicroZed Hardware Reference

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

## SD Card



Figure 5 – SD Card Boot Jumper Settings

8. Insert the MicroZed module onto the IOCC.
9. Set the VCCIO\_34 (CON3) and VCCIO\_35 (CON4) jumpers to 3V3. Make sure the IOCC power switch is in the OFF position.
10. Insert the appropriate country plug into the face of the 5V AC/DC adapter. Plug it into the CON2 barrel jack.
11. We will be using a micro-USB cable to communicate through a terminal, but this will be plugged in a bit later.



### 5.3 Running the Example

12. Turn the power switch on the IOCC to the ON position. After 1-2 seconds, you will notice four LEDs that are lit:
  - D5 on MicroZed, indicating Power Good
  - LED10 on IOCC, indicating Power Good
  - D2 on MicroZed, Zynq PL configuration DONE
  - LED9 on IOCC, Zynq PL configuration DONE



Figure 6 – MicroZed / IOCC Powered On with LEDs

13. Now plug in the microUSB cable between the PC and the J2 USB-UART connector on MicroZed.



Figure 7 – With USB-UART Cable Plugged In

14. 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 8, using the appropriate COM port that you discover on your own machine.

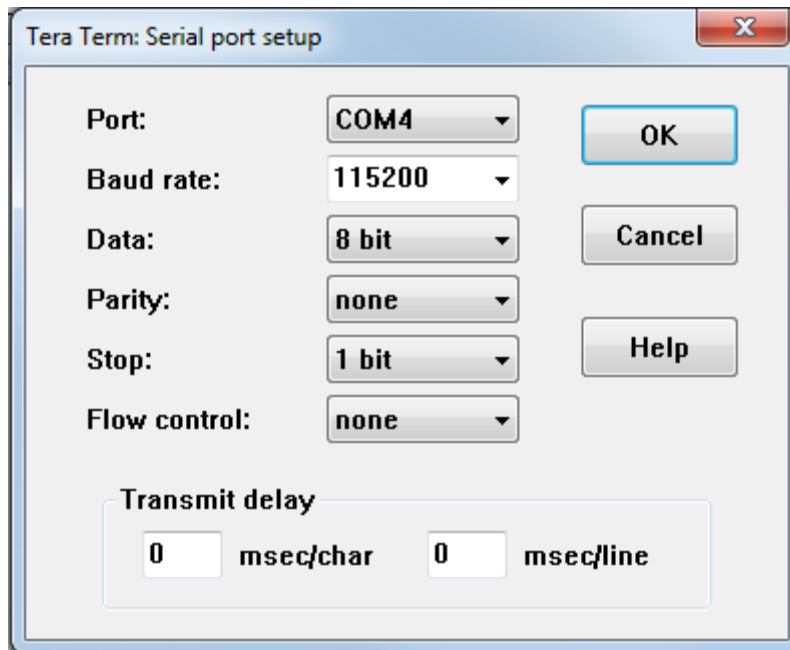


Figure 8 – Connect Tera Term to the proper COMx port

15. Perform a System Processor Reset by pushing the SRST# button (SW4) on the IOCC. The terminal output should display as follows.

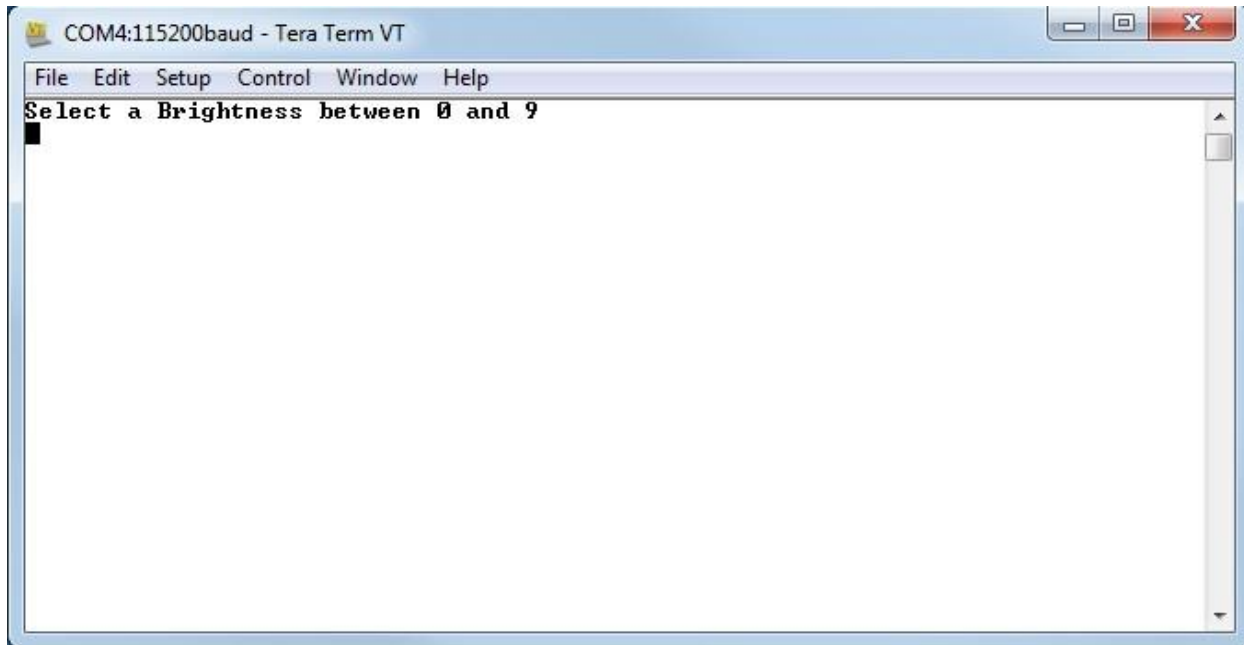


Figure 9 – MicroZed and IOCC Example Design

16. Enter '9' which is full ON. Observe the brightness of the eight red LEDs on the IOCC.
17. Enter '0' which is full OFF.
18. Enter numbers 1 through 8 to see the varying brightnesses.
19. Now the push buttons can be used to accomplish control of the LEDs. To start, press BTN1 to turn OFF the LEDs.
20. Press BTN4 to turn ON the LEDs.
21. Press BTN2 to dim the LEDs one step and BTN3 to brighten the LED one step.
22. When complete, unplug the USB-UART cable first, then turn the IOCC power switch OFF, then unplug the power cable.

The same application can be loaded into the QSPI using the output.mcs file and the Xilinx SDK software. For instructions on installing the Xilinx software, please refer to [Appendix B: Installing and Licensing Xilinx Software](#).



## 6 Getting Help and Support

### 6.1 Avnet Support

MicroZed is a versatile development kit, with all technical support being offered through the [MicroZed.org](http://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:

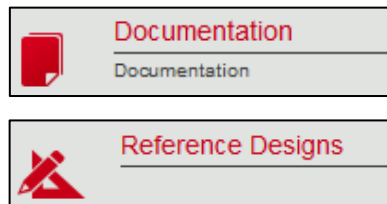
MicroZed.org Web Master – [webmaster@microzed.org](mailto:webmaster@microzed.org)

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

[www.microzed.org/content/support](http://www.microzed.org/content/support)

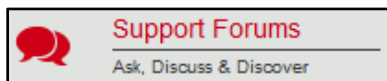
Once on the [MicroZed.org](http://MicroZed.org) support page:

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:



## 6.2 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](mailto:isscs_cases@xilinx.com)

Europe, Middle East, and Africa – [eucases@xilinx.com](mailto:eucases@xilinx.com)

Asia Pacific including Japan – [apaccase@xilinx.com](mailto: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

## 7 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.



Figure 10 – Windows Prompt for Scanning and Fixing an SD Card

3. Find the assigned SD Drive in Windows Explorer.
4. Right-click and select **Format**.

5. Select the *File System* to be FAT32. The *Allocation unit size* can be set to **Default**. Click **Start**.

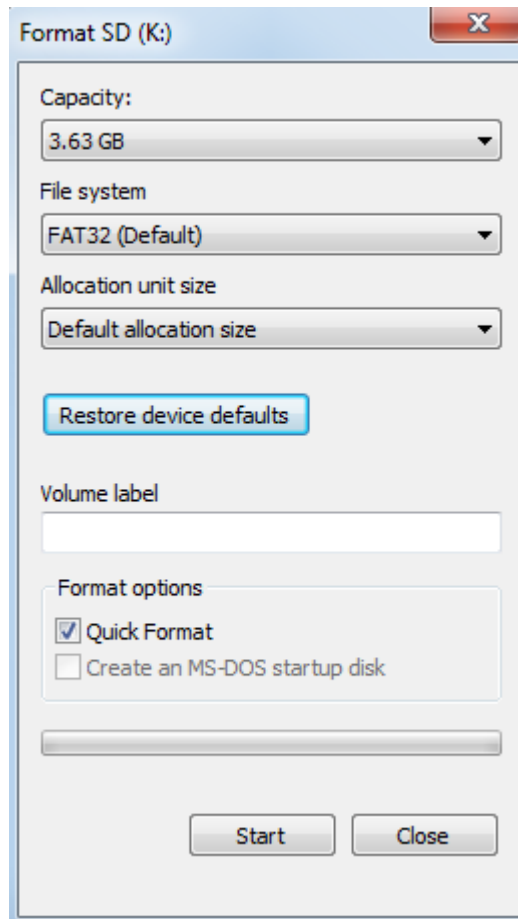


Figure 11 – Format the microSD Card

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

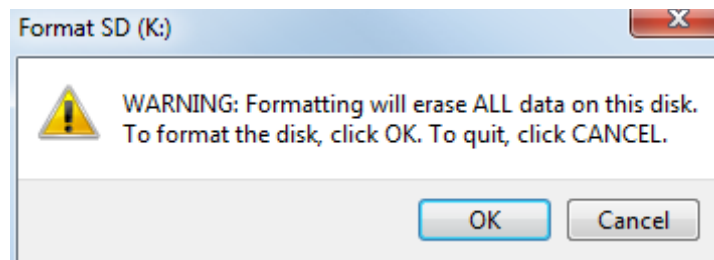


Figure 12 – Formatting Will Erase

7. If all goes well, you will get a message stating **Format Complete**. Click **OK**.

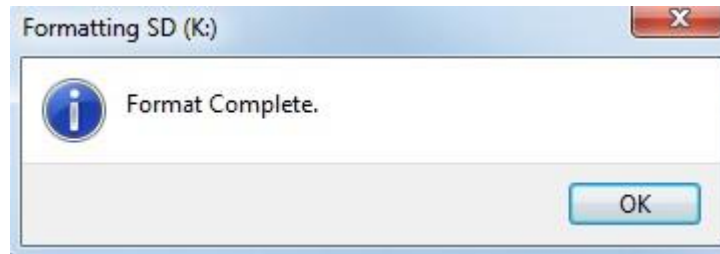


Figure 13 – Format Complete

8. Click **Close** in the Format dialog box.
9. 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.

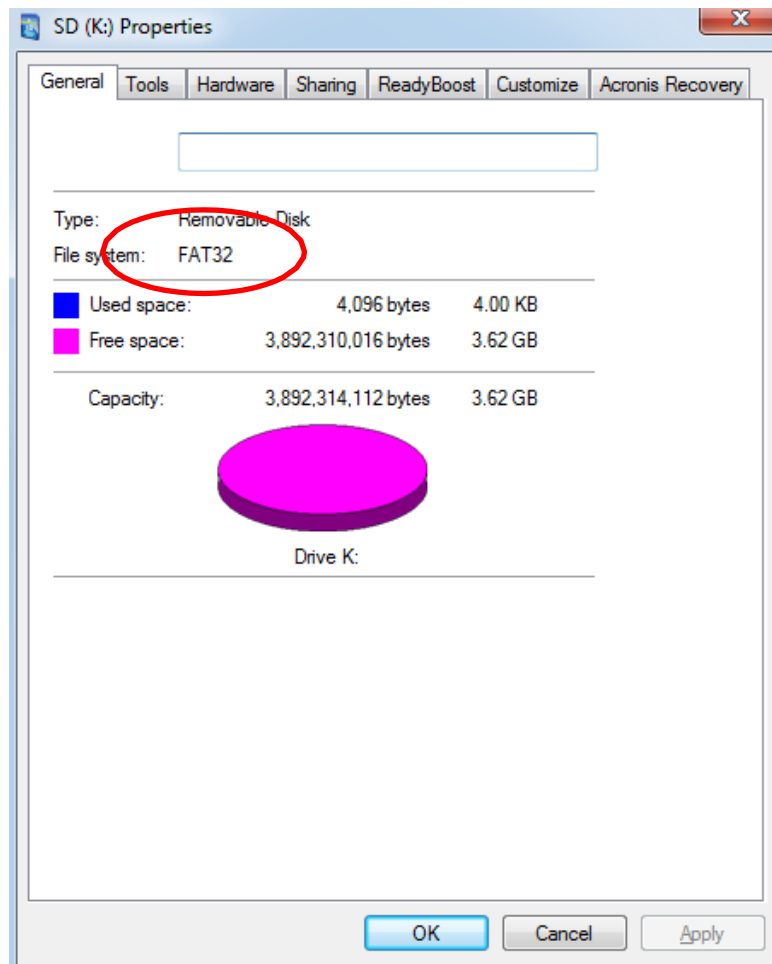


Figure 14 – Properties of the microSD Drive

## 8 Appendix B: Installing and Licensing Xilinx Software

### 8.1 Install Vivado Design Edition

The MicroZed XC7Z010-CLG400-1 Zynq-7000 AP SoC device development is supported by Vivado WebPACK licensing. MicroZed 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](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](http://www.xilinx.com/support/download/index.htm)

You can also request a free DVD from

[www.xilinx.com/onlinestore/dvd\\_fulfillment\\_request.htm](http://www.xilinx.com/onlinestore/dvd_fulfillment_request.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](http://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:

[http://www.xilinx.com/support/documentation/sw\\_manuals/xilinx2013\\_3/ug973-vivado-release-notes-install-license.pdf](http://www.xilinx.com/support/documentation/sw_manuals/xilinx2013_3/ug973-vivado-release-notes-install-license.pdf)