CYUSB3KIT-003

SuperSpeed Explorer Kit User Guide

Doc. # 001-93186 Rev. *A

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Cypress is willing to work with the customer who is concerned about the integrity of their code. Code protection is constantly evolving. We at Cypress are committed to continuously improving the code protection features of our products.

Contents

Safety Information

Regulatory Compliance

The CYUSB3KIT-003 SuperSpeed Explorer kit is intended for use as a development platform for hardware or software in a laboratory environment. The board is an open-system design, which does not include a shielded enclosure. This kit may cause interference to other electrical or electronic devices in close proximity. In a domestic environment, this product may cause radio interference. In such cases, take adequate preventive measures. Also, do not use this board near any medical equipment or RF devices.

Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures must be taken.

The CYUSB3KIT-003 SuperSpeed Explorer contains electrostatic discharge (ESD) sensitive devices. Electrostatic charges readily accumulate on the human body and any equipment, and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Cypress recommends proper ESD precautions to avoid performance degradation or loss of functionality. Store unused CYUSB3KIT-003 SuperSpeed Explorer boards in the protective shipping package.

End-of-Life/Product Recycling

This kit has an end-of-life cycle five years from the year of manufacturing mentioned on the back of the box. Contact your nearest recycler to discard the kit.

General Safety Instructions

ESD Protection

ESD can damage boards and associated components. Cypress recommends that you perform procedures only at an ESD workstation. If an ESD workstation is not available, use appropriate ESD protection by wearing an antistatic wrist strap attached to the chassis ground (any unpainted metal surface) on the board when handling parts.

Handling Boards

CYUSB3KIT-003 boards are sensitive to ESD. Hold the board only by its edges. After removing the board from its box, place it on a grounded, static-free surface. Use a conductive foam pad if available. Do not slide the board over any surface.

1. Introduction

Cypress EZ-USB® FX3™ (FX3) is an ARM-based controller designed to implement USB 3.0 peripherals. USB 3.0 offers the SuperSpeed signaling rate of 5 gigabits per second, which is 10 times greater than the high-speed signaling rate of 480 megabits per second. Because FX3 is USB 3.0 compliant, in addition to operating at the new SuperSpeed data rate, it can also operate at the High-Speed and Full-Speed USB data rates.

FX3 has a fully configurable General Programmable Interface (GPIF™ II) that can interface with any processor, ASIC, image sensor, or field-programmable gate array (FPGA). It provides easy and glueless connectivity to popular industry interfaces such as synchronous slave FIFO, asynchronous SRAM, asynchronous and synchronous address data multiplexed interfaces, image sensor interfaces, and CompactFlash. Additionally, users can define proprietary interfaces using Cypress's GPIF II Designer tool, which is packaged with the FX3 Software Development Kit (SDK).

The SuperSpeed Explorer Kit combines hardware, software, and documentation that enable customers to evaluate the FX3 device. This user guide describes the steps to install the software required by the SuperSpeed Explorer Kit and to operate the development board provided with the kit. The guide also documents different types of firmware download and debug methods with detailed instructions. Two example projects (USBBulkSourceSinkLED and SRAM_FX3) explain the use of various features provided on the SuperSpeed Explorer Kit development board and the host applications provided with the FX3 SDK. This document also explains the hardware interfaces available on the development board.

Interconnect boards are available to interface the SuperSpeed Explorer Kit development board with Aptina image sensor boards, Xilinx FPGA boards, and Altera FPGA boards. See Section 4.4.1 on page 49 for more information on the interconnect boards.

1.1 Kit Contents

The SuperSpeed Explorer Kit contains the following:

- FX3 development board
- USB 3.0 A to B cable
- Quick start guide
- Jumpers

Visit the kit web page (www.cypress.com/go/SuperSpeedExplorerKit) for more information. Inspect the contents of the kit. If any parts are missing, contact your nearest Cypress sales office for further assistance.

1.1.1 Software

FX3 Software Development Kit (FX3 SDK):
The FX3 software development platform is based on the Eclipse integrated development environment (IDE). A prerequisite for using the SuperSpeed Explorer Kit is to download and install the FX3 Software Development Kit (www.cypress.com/go/FX3SDK). This package installs the EZ USB Suite

and ARM GCC toolchain, a firmware library with example projects, and the Cypress USB Suite, including a Windows driver and sample Microsoft Visual Studio applications. After installation, the Cypress Update Manager ensures that all modules are up to date.

SuperSpeed Explorer Kit Installer:
The SuperSpeed Explorer Kit (www.cypress.com/go/SuperSpeedExplorerKit) installer package installs documentation (such as user guide, quick start guide, and release notes), hardware files (such as schematic, PCB layout, and gerber), and firmware examples (USBBulkSourceSinkLED and SRAM_FX3). The SuperSpeed Explorer Kit installer also includes Windows drivers for FX3 and software for JTAG debugging, including an OpenOCD executable and configuration file to use the *CY7C65215 - USB-Serial Dual Channel Bridge with CapSense® and BCD* (www.cypress.com/go/CY7C65215) on the SuperSpeed Explorer Kit development board as an integrated debugger for FX3.

1.1.2 Tools Not Included

- Microsoft Visual C++ or C# software required for editing and building the USB PC application source code. Free Visual Studio Express editions are available on the Microsoft website.
- USB 3.0 capable PC host: The SuperSpeed Explorer Kit firmware examples can operate at either USB 2.0 or USB 3.0 speeds. To achieve maximum performance with the FX3 hardware, use a PC with a USB 3.0 host controller.
- Java Runtime Environment (JRE).

1.1.3 Other Suggested Tools

The following USB protocol analyzers can be used to analyze the traffic between the PC host and the FX3 device:

- Hardware analyzers
  - Ellisys USB Explorer 280
  - Lecroy USB Voyager M3i
  - Beagle USB 5000 SuperSpeed Protocol Analyzer
- Software protocol analyzers
  - SourceQuest SourceUSB
  - SysNucleus USBTrace
  - USBlyzer

1.2 Additional Learning Resources

Visit the EZ-USB FX3 web page (www.cypress.com/fx3/) for additional learning resources in the form of a datasheet, a technical reference manual, application notes, knowledge base articles, and training videos.

1.3 Documentation Conventions

Table 1-1. Document Conventions for Guides

Convention	Usage
`Courier New`	Displays file locations, user entered text, and source code: `C:\ ...cd\icc\`
Italics	Displays file names and reference documentation. For example, *CYUSBS232UART.cyusb.*
[**Bracketed, Bold**]	Displays keyboard commands in procedures: [**Enter**] or [**Ctrl**] [**C**]
File > Open	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: $2 + 2 = 4$
Text in gray boxes	Describes cautions or unique functionality of the product.

1.4 Acronyms

The following table lists the acronyms used in this kit guide.

Acronym	Meaning
AC	Alternating current
ADMUX	Address data multiplexing
API	Application programming interface
ASIC	Application-specific integrated circuit
COM	Communication port
CTS	UART clear to send
DC	Direct current
DSP	Digital signal processor
DVK	Development kit
EEPROM	Electrically erasable programmable read-only memory
EP	Endpoint
ESD	Electrostatic discharge
FMC	FPGA mezzanine c ard
FPGA	Field-programmable gate array
Gbps	Gigabits per second
GCC	GNU compiler collection
GDB	GNU debugger
GPIF	General Programmable Interface
GPIO	General-purpose input/output
HSMC	High-speed mezzanine card
I^2C	Inter-integrated circuit
I^2S	Inter-IC sound
IDE	Integrated development environment

Acronym	Meaning
JTAG	Joint Test Action Group
KB	Kilobyte
LED	Light-emitting diode
MB	Megabyte
Mbps	Megabits per second
OS	Operating system
OTG	On-the-go
PC	Personal computer
PCB	Printed circuit board
PHY	Physical layer
PID	Product ID
RTOS	Real-time operating system
RTS	UART ready to send
SCB	Serial communication block
SCL	I^2C serial clock line
SDA	I^2C serial data line
SDK	Software development kit
SPI	Serial peripheral interface
USB	Universal serial bus
USB-IF	Universal Serial Bus Implementers’ Forum
VID	Vendor ID

1.5 Document History

Revision	PDF Creation Date	Origin of Change	Description of Change
**	07/10/2014	NIKL	Initial version of kit user guide.
*A	08/01/2014	NIKL	Updated links. Minor content edits throughout the document.

2. Software Installation

This chapter guides you through the installation of the FX3 SDK for the Windows and Linux environments and the SuperSpeed Explorer Kit setup for the Windows environment.

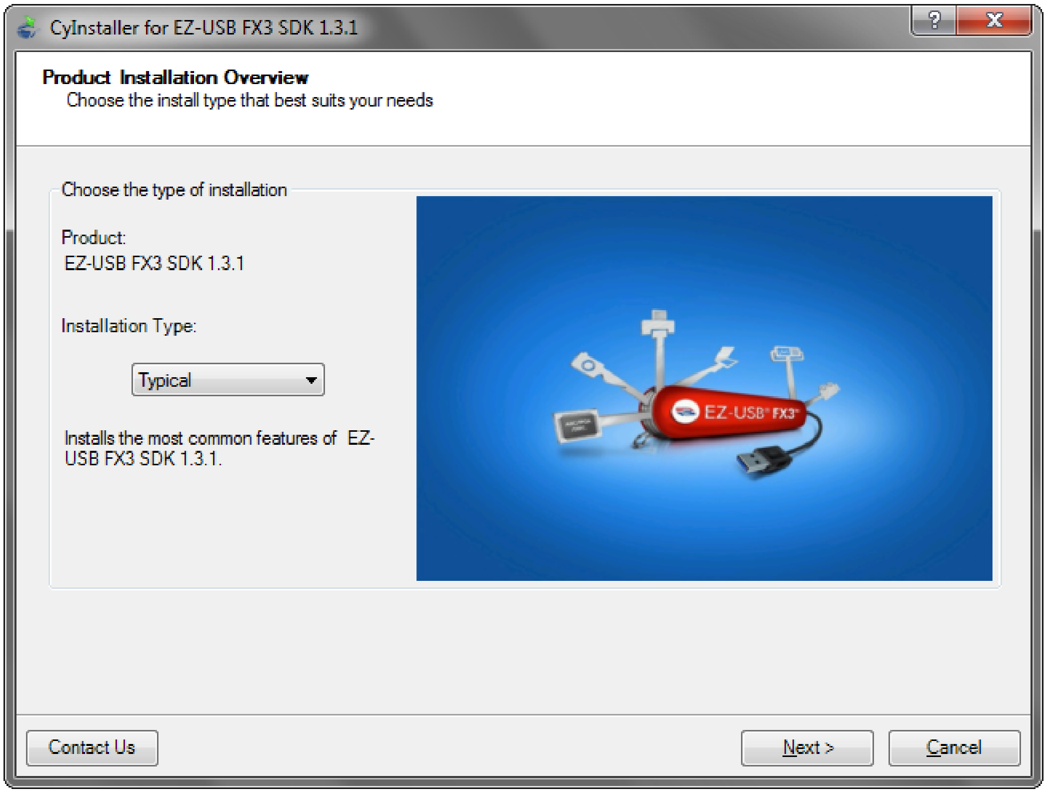
Note The SuperSpeed Explorer Kit Quick Start Guide, packaged with the kit box, specifies to download and install the SuperSpeed Explorer Kit Setup as the first step. If this step was followed, the FX3 SDK and SuperSpeed Explorer Kit Setup are already installed on your machine. You can jump to Section 2.5 on page 15 for steps to launch Cypress Update Manager. Cypress Update Manager helps ensure you have the latest FX3 SDK and the SuperSpeed Explorer Kit Setup installed on your machine.

2.1 FX3 SDK Installation on Windows OS

To install the latest version of the FX3 SDK, follow these steps:

1. Download the latest FX3 SDK from the EZ-USB FX3 Software Development Kit page (www.cypress.com/go/FX3SDK), which includes Windows and Linux downloads. If your browser does not ask to run the downloaded file, locate the *FX3SDKSetup.exe* file in the Downloads folder and double-click it to start the installer (Figure 2-1).

Figure 2-1. FX3 SDK Installer Screen



CyInstaller for EZ-USB FX3 SDK 1.3.1

Product Installation Overview
Choose the install type that best suits your needs

Choose the type of installation

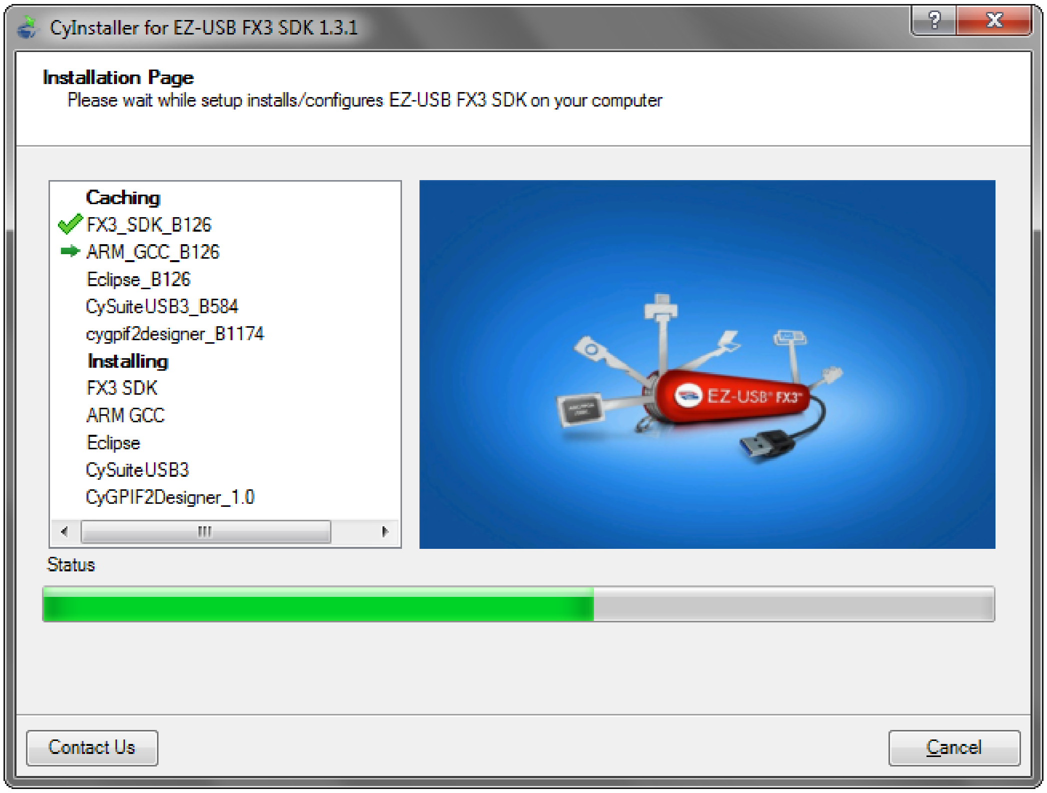
Product:
EZ-USB FX3 SDK 1.3.1

Installation Type:
Typical

Installs the most common features of EZ-USB FX3 SDK 1.3.1.

2. Click **Next** to start the Installation Wizard.
3. Accept the license agreements for the various software components and click **Next**. The installer indicates the completion progress (Figure 2-2).

Figure 2-2. Installation Progress Showing Individual Modules



CyInstaller for EZ-USB FX3 SDK 1.3.1

Installation Page

Please wait while setup installs/configures EZ-USB FX3 SDK on your computer

Caching

✓ FX3_SDK_B126

➜ ARM_GCC_B126

Eclipse_B126

CySuiteUSB3_B584

cygpif2designer_B1174

Installing

FX3 SDK

ARM GCC

Eclipse

CySuiteUSB3

CyGPIF2Designer_1.0

Status

2.2 Rolling Back to a Previous Version of FX3 SDK

Some features or application programming interfaces (APIs) of the SDK may not be supported in the latest version of the FX3 SDK. To use those features, you can roll back to any previous version of the FX3 SDK using the Cypress Update Manager. Follow the steps given in the knowledge base article, *How to Roll Back to a Previous Version of FX3 SDK - KBA89637* (www.cypress.com/go/KBA89637), to install any previous version.

2.3 FX3 SDK Installation on Linux OS

FX3 SDK version 1.2 and later revisions support firmware development with the EZ USB Suite on the Linux platform. The EZ-USB FX3 SDK (www.cypress.com/go/FX3SDK) for Linux is released in the form of a gzipped tar archive called "FX3_SDK.tar.gz”. On extraction, this tar archive contains the following gzipped tar archives:

- FX3_Firmware.tar.gz: FX3 firmware library and examples
- ARM_GCC.tgz: Sourcery ARM GNU toolchain to compile firmware examples
- eclipse_x86.tgz: EZ USB Suite for 32-bit Linux OS
- eclipse_x64.tgz: EZ USB Suite for 64-bit Linux OS
- cyusb_linux_<Build_no>.tar.gz: The CyUSB Suite provides QT-based USB applications to communicate with the FX3 device

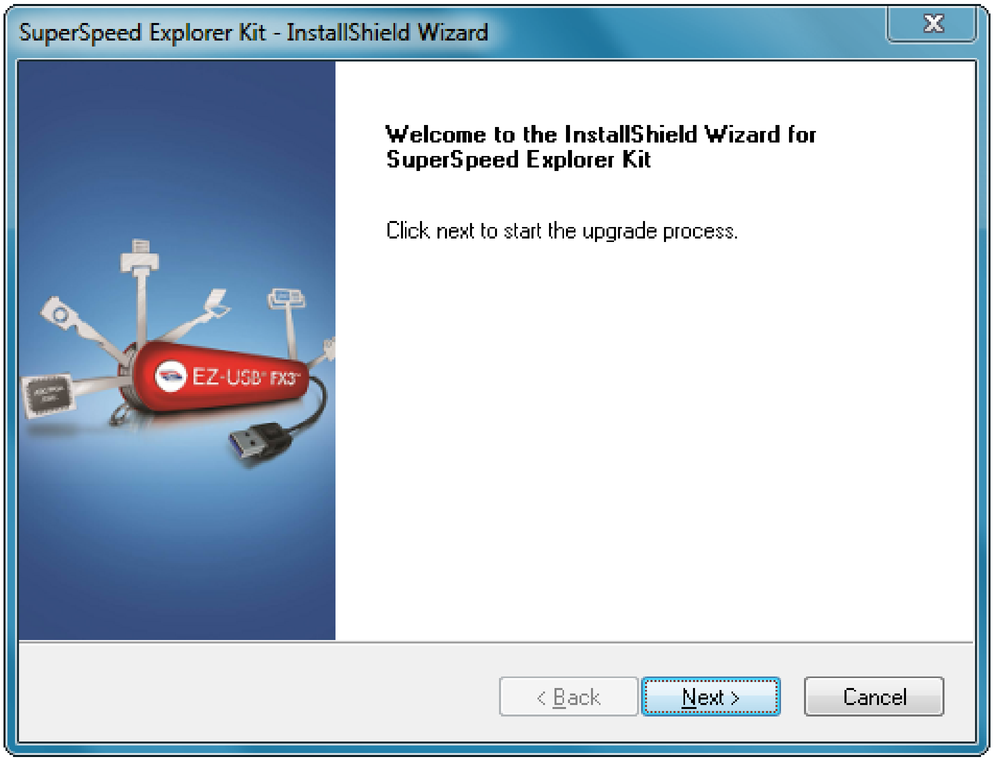
The installation procedure involves extracting these archives and setting environment variables. Refer to the *FX3_SDK_Linux_Support.pdf* file available in the following extracted folder of the FX3 SDK for Linux installation: `fx3_sdk_v1.3_linux\FX3_Firmware\cyfx3sdk\doc`.

2.4 SuperSpeed Explorer Kit Installation

To install the SuperSpeed Explorer Kit software, follow these steps:

1. Download the latest kit installer from www.cypress.com/go/SuperSpeedExplorerKit. Locate the *SuperSpeedExplorerKitSetup.exe* file in the Downloads folder and double-click it to run the Installer (Figure 2-3).

Figure 2-3. SuperSpeed Explorer Kit Installer Screen



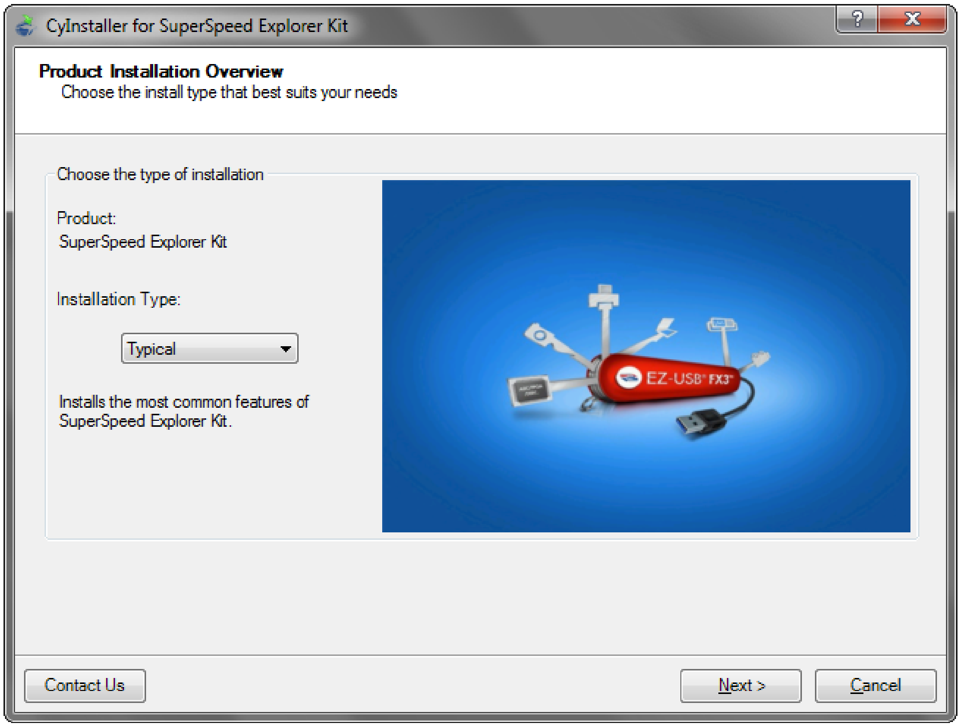
SuperSpeed Explorer Kit - InstallShield Wizard

Welcome to the InstallShield Wizard for SuperSpeed Explorer Kit

Click next to start the upgrade process.

2. Click **Next** and select the required **Installation Type**. When installing for the first time, it is best to select the **Typical** installation type (Figure 2-4).

Figure 2-4. SuperSpeed Explorer Kit Setup Installation Type Selection



CyInstaller for SuperSpeed Explorer Kit

Product Installation Overview
Choose the install type that best suits your needs

Choose the type of installation

Product:
SuperSpeed Explorer Kit

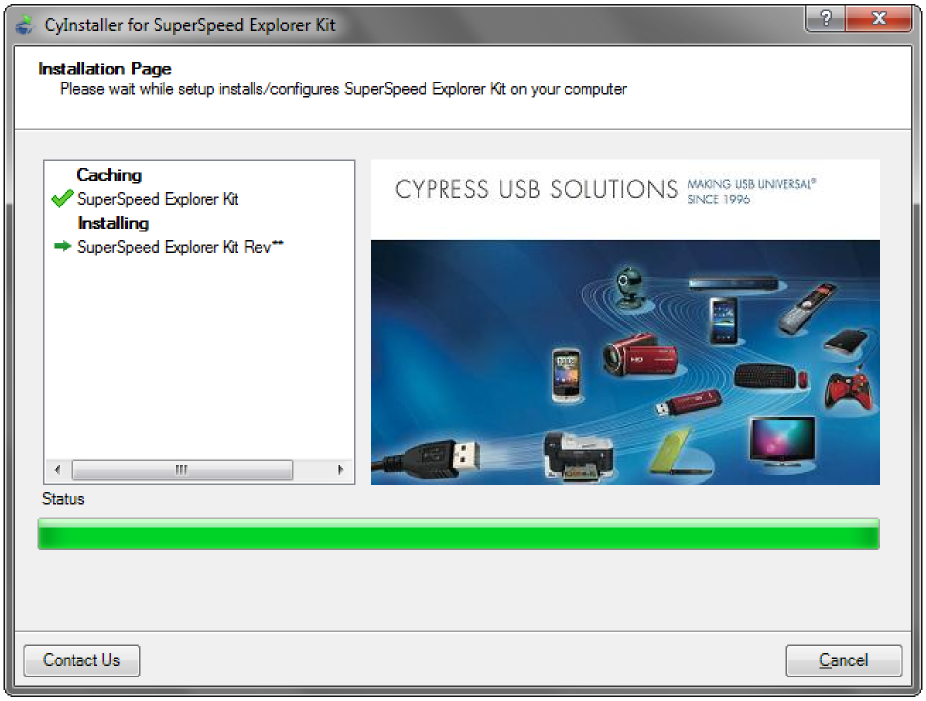
Installation Type:

Typical

Installs the most common features of SuperSpeed Explorer Kit.

3. Click **Next** to start the Installation Wizard.
4. Accept the license agreements for the various software components and click **Next**. Wait until the installation is complete (Figure 2-5).

Figure 2-5. Installation Progress Showing Individual Modules



CyInstaller for SuperSpeed Explorer Kit

Installation Page
Please wait while setup installs/configures SuperSpeed Explorer Kit on your computer

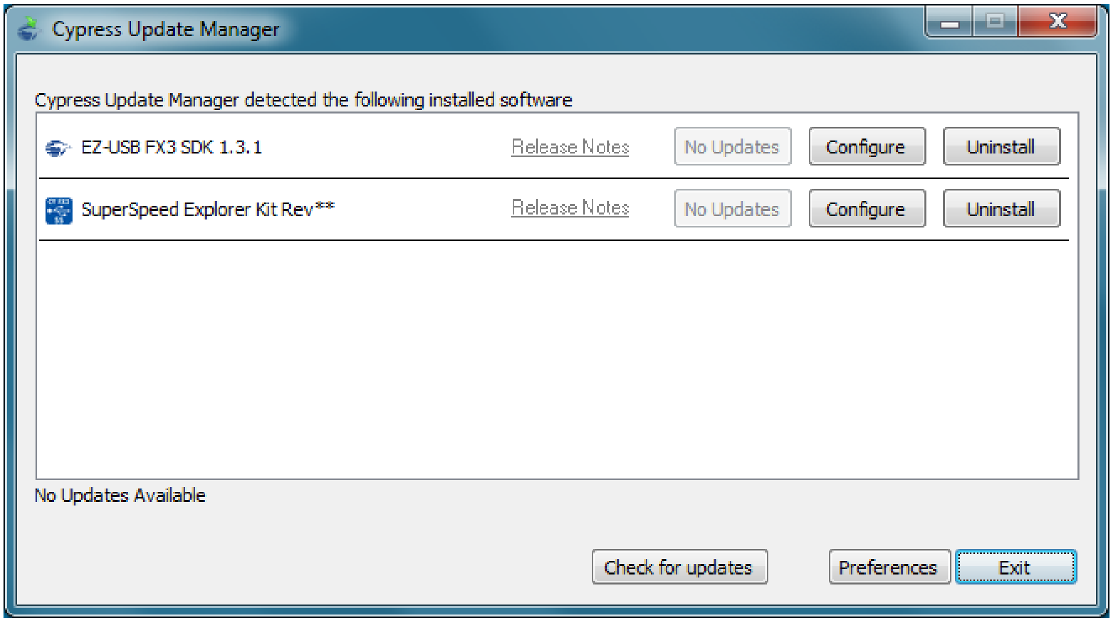
Caching
✓ SuperSpeed Explorer Kit
Installing
➡ SuperSpeed Explorer Kit Rev**

Status

2.5 Cypress Update Manager

1. When the installation is complete, you have the option to run the Cypress Update Manager (Figure 2-6) to ensure you have the latest Explorer Kit revision installed. The Update Manager can be launched in Windows from the **Start** menu by choosing **All Programs > Cypress > Cypress Update Manager**. Click the **Check for updates** button at the bottom of the **Cypress Update Manager** window. If **No Updates** appear next to the FX3 SDK or SuperSpeed Explorer Kit, click the **Exit** button. If there are updates, click the **Update** button to download and install the latest software.

Figure 2-6. Cypress Update Manager



Cypress Update Manager detected the following installed software

EZ-USB FX3 SDK 1.3.1	Release Notes	No Updates	Configure	Uninstall
SuperSpeed Explorer Kit Rev**	Release Notes	No Updates	Configure	Uninstall

No Updates Available

2. The installation creates the SuperSpeed Explorer Kit folder in the path `<Install Directory>\Cypress` (note that for Windows 7 and above, the default install directory is `C:\Program Files (x86)`and for Windows XP, the default install directory is `C:\Program Files`). This folder contains documentation, drivers, hardware files, example firmware, and an OpenOCD executable for using the USB-Serial IC (www.cypress.com/go/CY7C65215) as a USB-JTAG debugger.

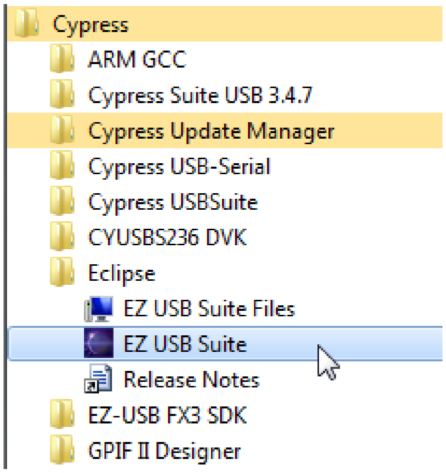
2.6 EZ USB Suite (Eclipse) IDE

2.6.1 Starting the EZ USB Suite

Note The EZ USB Suite is dependent on the Java Runtime Environment (JRE). As the JRE is not packaged with the FX3 SDK 1.3.1, you need to download and install it separately. You can get the current version of Java from the Java website (http://java.com/en/download/index.jsp) if it is not already installed on the system.

Navigate to the Windows **Start** menu and select **All Programs**; click the **Cypress** folder to expand it (Figure 2-7). Click the **Eclipse** entry to expand it and double-click the **EZ USB Suite** entry.

Figure 2-7. Launch the EZ USB Suite

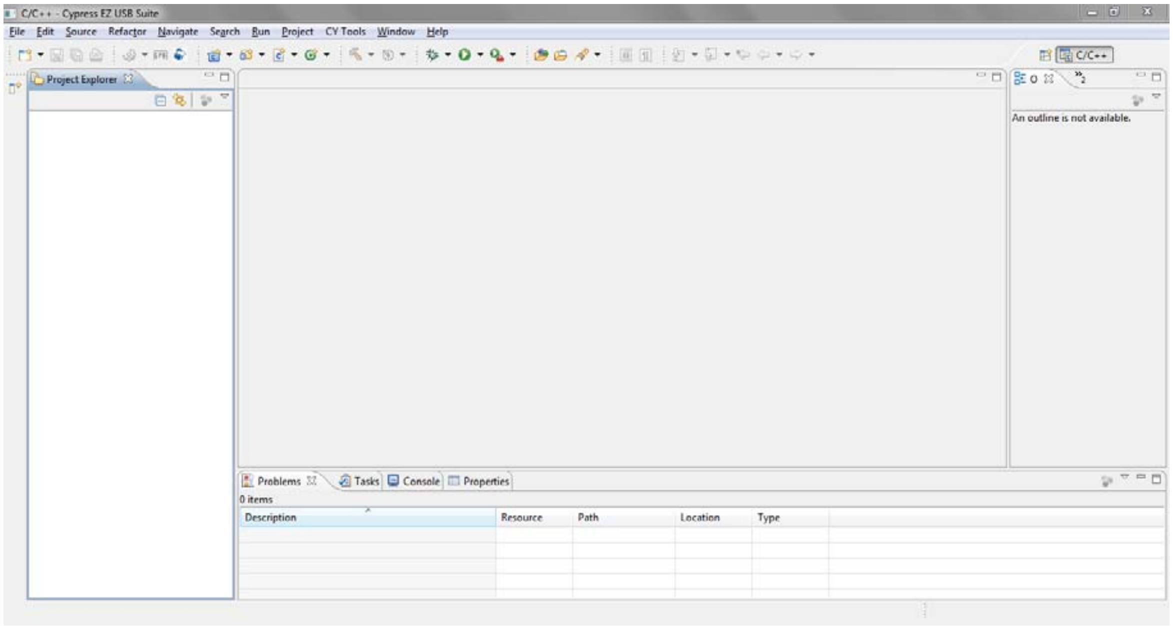


This launches a first-time startup screen that sets up a Workspace folder for all your Cypress Eclipse projects. Accept the default path of `C:\Users\(username)\Cypress\Workspace`. You may want to select **Use this as the default and do not ask again** to skip this message every time you start the EZ USB Suite.

You can create more workspaces by choosing **File > Switch Workspace > Other**. In this way, you can define different workspaces for different projects.

An empty **EZ USB Suite Workbench** appears as shown in Figure 2-8.

Figure 2-8. Empty EZ USB Suite Workbench

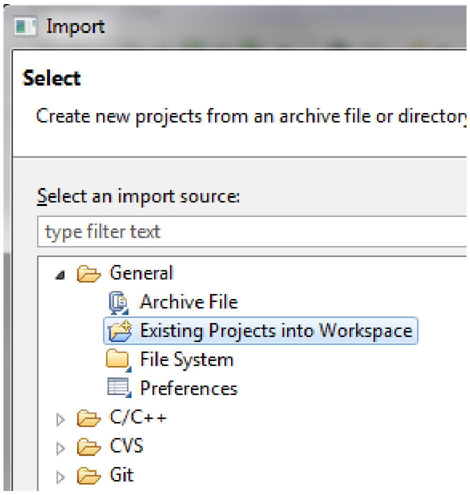


2.6.2 Importing a Project

To import an Eclipse project from any path, follow these steps.

1. In the EZ USB Suite, choose **File > Import > General > Existing Projects into Workspace** (Figure 2-9). Click **Next**.

Figure 2-9. Import an Eclipse Project



Import

Select

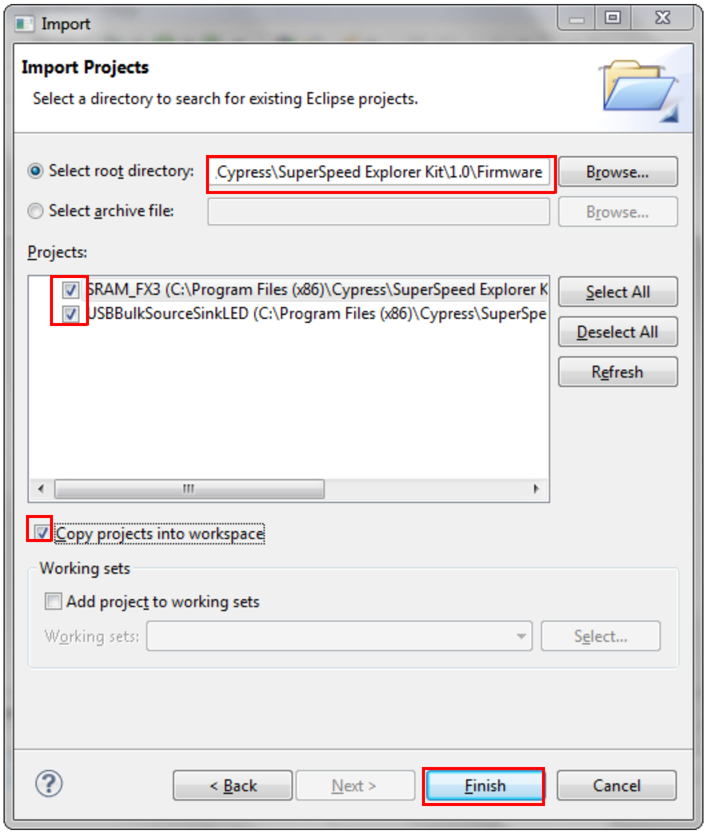
Create new projects from an archive file or director

Select an import source:

type filter text

2. Click the **Browse…** button to **Select root directory**: and browse to the **Firmware** folder of the SuperSpeed Explorer Kit installation, as shown in Figure 2-10. The default path to the firmware folder is `<Install Directory>\Cypress\SuperSpeed Explorer Kit\1.0\Firmware` (for Windows 7 and above, the default install directory is `C:\Program Files (x86)`and for Windows XP, the default install directory is `C:\Program Files`). Select the **Copy projects into workspace** option so that the project folder will be copied to your Workspace folder. Select the firmware application in the **Projects:** box, and click **Finish**.

Figure 2-10. Browse to Project Folder



Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: Cypress\SuperSpeed Explorer Kit\1.0\Firmware

○ Select archive file:

Projects:

☑ SRAM_FX3 (C:\Program Files (x86)\Cypress\SuperSpeed Explorer K

☑ USBBulkSourceSinkLED (C:\Program Files (x86)\Cypress\SuperSpe

☑ Copy projects into workspace

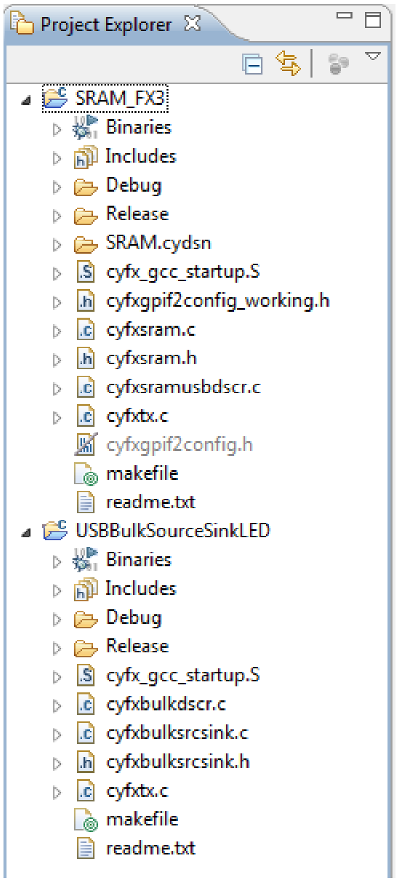
Working sets

☐ Add project to working sets

Working sets:

3. The added projects now appear in the **EZ USB Suite Project Explorer**. Double-click a project name to see the underlying components (Figure 2-11).

Figure 2-11. USBBulkSourceSinkLED and SRAM_FX3 Projects Added to Project Explorer

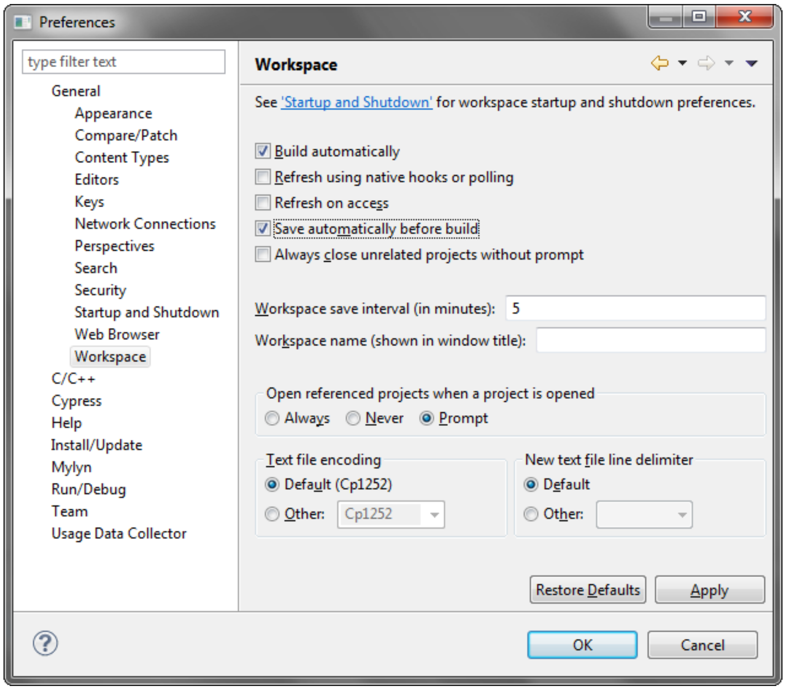


```
Project Explorer
SRAM_FX3
    Binaries
    Includes
    Debug
    Release
    SRAM.cydsn
    cyfx_gcc_startup.S
    cyfxgpif2config_working.h
    cyfxsram.c
    cyfxsram.h
    cyfxsramusbdscr.c
    cyfxtx.c
    cyfxgpif2config.h
    makefile
    readme.txt
USBBulkSourceSinkLED
    Binaries
    Includes
    Debug
    Release
    cyfx_gcc_startup.S
    cyfxbulkdscr.c
    cyfxbulksrcsink.c
    cyfxbulksrcsink.h
    cyfxtx.c
    makefile
    readme.txt
```

2.6.3 Automatically Saving Your Edits

It is recommended that you change one of the Eclipse default settings. To automatically save your edits before building the project, navigate to **Windows > Preferences > General > Workspace** and select **Save automatically before build** (Figure 2-12). Click **OK**.

Figure 2-12. Automatically Saving Edits



Workspace

See 'Startup and Shutdown' for workspace startup and shutdown preferences.

☑ Build automatically
☐ Refresh using native hooks or polling
☐ Refresh on access
☑ Save automatically before build
☐ Always close unrelated projects without prompt

Workspace save interval (in minutes): 5
Workspace name (shown in window title):

Open referenced projects when a project is opened
○ Always ○ Never ● Prompt

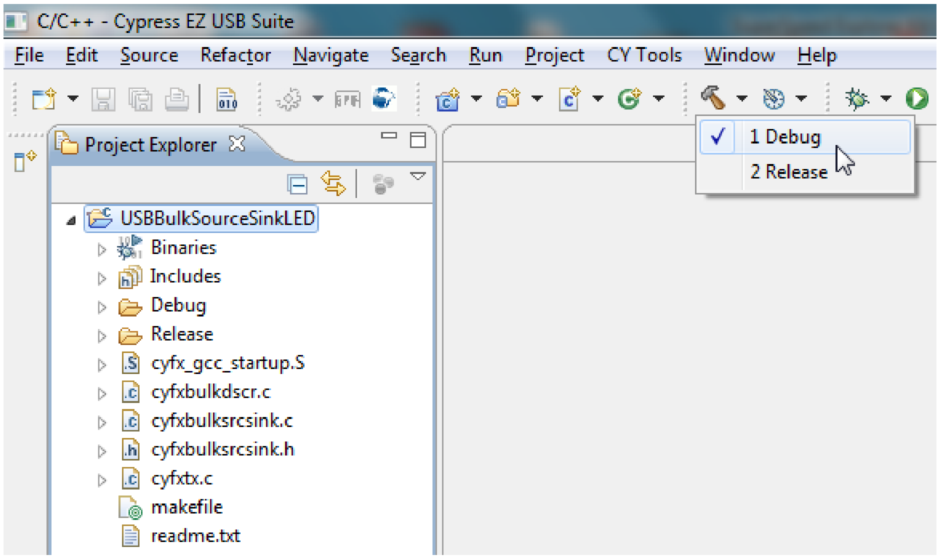
Text file encoding
● Default (Cp1252)
○ Other: Cp1252

New text file line delimiter
● Default
○ Other:

2.6.4 Building the Project

To build an FX3 project, select the project in the Project Explorer window and click the Build icon (hammer) in the EZ USB Suite. You can choose to build a Debug version or a Release version of the firmware (Figure 2-13). The generated image file in the Release version is smaller than in the Debug version. See Section 3.5.2 on page 26 and Section 3.5.3 on page 28 to learn how to download the compiled code image into the SuperSpeed Explorer Kit development board.

Figure 2-13. Build Firmware Icon

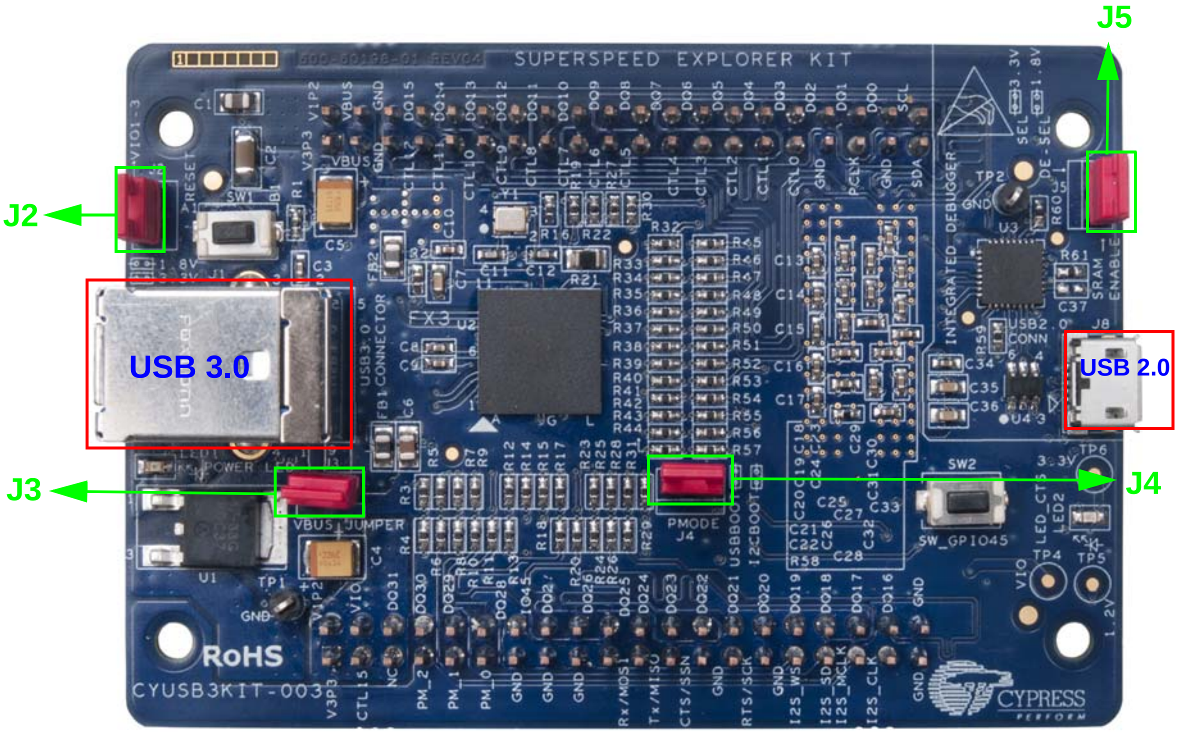


Note You can go to www.cypress.com/go/GettingStartedwithEzUsbSuite for a video course on getting started with the Eclipse IDE for FX3.

3. Kit Operation

The SuperSpeed Explorer Kit includes the development board shown in Figure 3-1.

Figure 3-1. SuperSpeed Explorer Kit Development Board



The development board provides convenient access to FX3 interfaces, such as GPIF II, I^{2}C, SPI, UART, and I^{2}S. The two 40-pin headers (on the reverse PCB side in Figure 3-1) provide FX3 signals to connect to external boards using the GPIF II interface. Note that for convenience, the headers have long pins that extend above the top side of the PCB for use as test points or attachment to mating connectors. All GPIF II signals, which include a 32-bit data bus, 13 control lines, and a 100-MHz clock, are available to connect to external devices such as FPGAs, CPLDs, image sensors, or microcontrollers. The FX3 SDK examples help you program and evaluate these interfaces. The GPIF II interface supports 32-, 24-, 16-, and 8-bit data/modes; unused GPIF II pins can alternatively serve as GPIO pins if the GPIF II interface is not required.

3.1 USB Connectors

The SuperSpeed Explorer Kit development board provides two USB connectors. The USB 3.0 Type B receptacle brings out the FX3 USB signals. This receptacle accepts either a USB 3.0 or USB 2.0 cable; the other end of the cable connects to a USB host PC. A USB 3.0 cable is included in the kit.

Use this port to test FX3 applications that communicate with a host PC at SuperSpeed or High-Speed rates.

The USB 2.0 Micro-B receptacle connects to an onboard Cypress CY7C65215 USB-Serial Dual Channel (UART/I2C/SPI) Bridge (www.cypress.com/go/CY7C65215), which is configured as an integrated debugger operating at the USB Full-Speed rate. This chip provides a bridge between the FX3 debug interface and a PC's USB port, enabling two debug methods: serial terminal messages and JTAG debug. These debug methods are explained in Section 3.7 on page 33.

3.2 Jumpers

The SuperSpeed Explorer Kit development board contains four jumpers, labeled J2–J5. The jumper settings are as follows.

Jumper J2: This jumper sets the voltage levels of the FX3 power domains VIO1, VIO2, and VIO3. Inserting the jumper selects 3.3 V while removing the jumper selects 1.8 V. These domains set the operating voltage of the FX3 interface pins. The default is to have the J2 jumper in place, selecting the 3.3-V interface. This makes the interface compatible with the 3.3-V SRAM connected to the GPIF II interface.

Jumper J3: This jumper is connected in series with the VBUS signal of the USB 3.0 connector. This jumper must be inserted to power the development board. The J3 jumper is provided to measure the development board's power consumption by removing the J3 jumper and connecting an ammeter between the J3 pin headers.

Jumper J4: This jumper selects the FX3 boot method. Similar to all Cypress EZ-USB parts, the code is loaded ("booted") into high-speed internal RAM for execution. The SuperSpeed Explorer Kit supports USB boot and I^{2}C boot. FX3 contains an internal ROM, where the boot code resides, and an internal RAM, where application firmware and data are stored. At power-on, depending on this jumper setting, FX3 boots from the internal ROM and then does one of the following:

- If J4 is removed, then FX3 copies the application firmware from the onboard 2-Mbit I^{2}C EEPROM to FX3's internal RAM and then enumerates with the functionality defined in the application firmware. If there is no valid firmware in EEPROM or if the EEPROM is disabled or not present, then FX3 enumerates as a bootloader device and enables firmware download to internal RAM through USB. This method of booting is referred to as I^{2}C boot, with fallback to USB. The USBBulk-SourceSinkLED firmware is stored in the onboard EEPROM when the SuperSpeed Explorer Kit development board leaves the Cypress factory. The steps to store new firmware in EEPROM and then boot from it are explained in Section 3.5.3 on page 28.
- If J4 is inserted, then FX3 enumerates as a bootloader device and allows the application firmware to be loaded to internal RAM through USB. This boot method is referred to as USB boot. In this boot method, you can download the application firmware to FX3's RAM using a host application. The steps to load firmware to FX3's RAM using this boot method are explained in a later section.

The J4 jumper is labeled "PMODE" to correspond to the FX3 PMODE0 pin.

Jumper J5: This jumper is connected in series with the CTL0 pin of the FX3. The CTL0 pin is used as a chip select signal for the onboard SRAM external to FX3. J5 must be inserted for applications that use the SRAM. It is recommended that you deselect the SRAM by removing J5 when the SRAM is not used. Note that the SRAM operates at 3.3 V and does not support 1.8-V signaling. Therefore, the SRAM must be deselected if the 1.8-V interface is selected (if J2 is removed, then J5 should also be removed). Table 3-1 summarizes the default jumper settings.

Table 3-1. Default Jumper Settings

Jumper	Jumper State	Function

Table 3-1. Default Jumper Settings

J2	Short	Power domain VIO1, VIO2, and VOI3 voltages set to 3.3 V to support external 3.3-V interfaces and the onboard SRAM.
J3	Short	Development board is powered from USB 3.0 VBUS. This jumper must be in place for normal operation.
J4	Open	Boot from I^{2}C EEPROM on the development board, if a valid firmware image is present in EEPROM; otherwise, fall back to USB boot. **Note** By default, USBBulkSourceSink with LED Blink firmware is stored by EEPROM.
J5	Open	Deselect external SRAM.

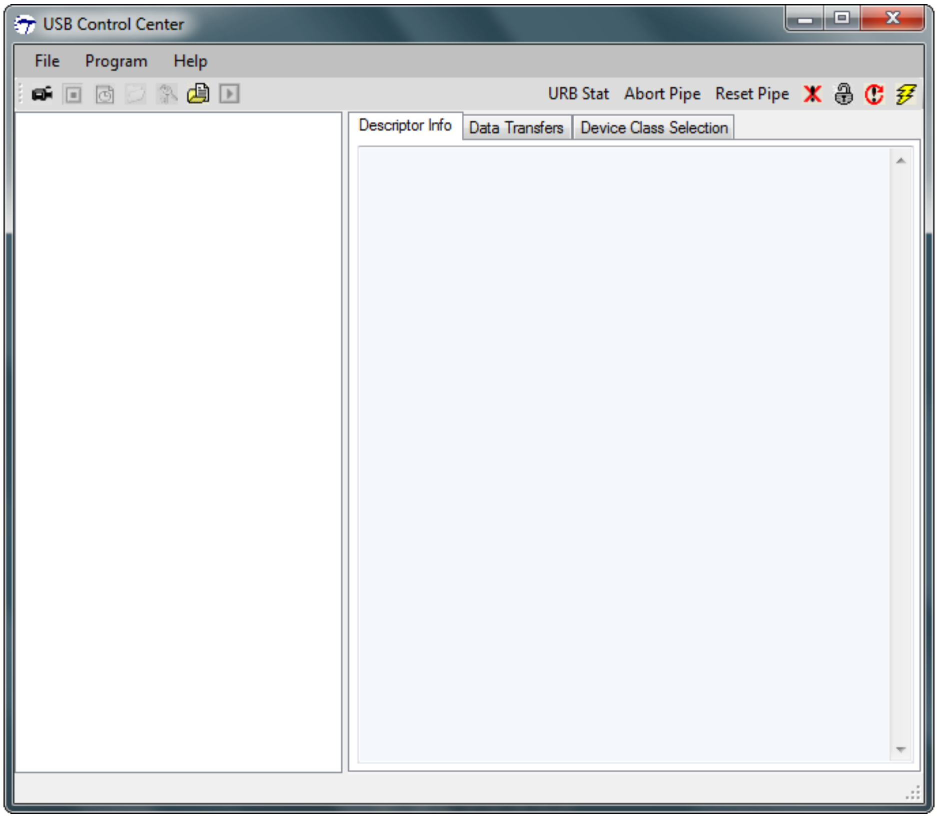
3.3 Power Mode

The development board operates only in USB bus-powered mode. Note that an FX3 design can also be self-powered but this feature is not supported in this kit.

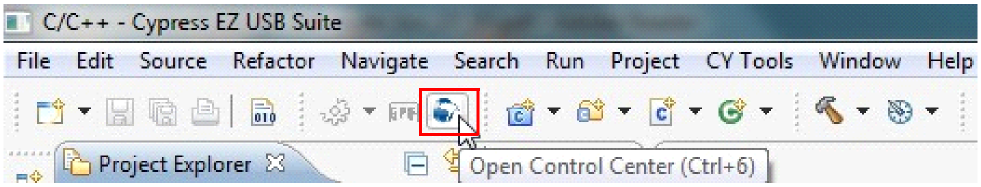
3.4 USB Control Center

To explore various FX3 boot options, open Cypress's USB Control Center application by choosing **Start** menu **All Programs > Cypress > Cypress USBSuite > Control Center** (see Figure 3-2).

Figure 3-2. USB Control Center Opening Screen



Alternatively, the USB Control Center application can be launched by clicking the icon (shown in the following figure) in the EZ USB Suite application.



Note If you see various non-Cypress devices in the left panel of the USB Control Center application, select the **Device Class Selection** tab and deselect all check boxes except the one that says **Devices served by the CyUSB3.sys driver** (or a derivative).

The following sections demonstrate how to use the USB Control Center to identify connected USB devices, download FX3 code, and test firmware by conducting USB transfers.

3.5 Boot Options

As described in Section 3.2 on page 21, the SuperSpeed Explorer Kit development board supports the USB and I^{2}C boot options, When the J4 jumper is removed, FX3 boots from the onboard I^{2}C EEPROM if a valid firmware image is available in the EEPROM; otherwise, FX3 falls back to USB boot. When the J4 jumper is inserted, FX3 allows firmware download through USB.

This section discusses how to execute three FX3 boot options:

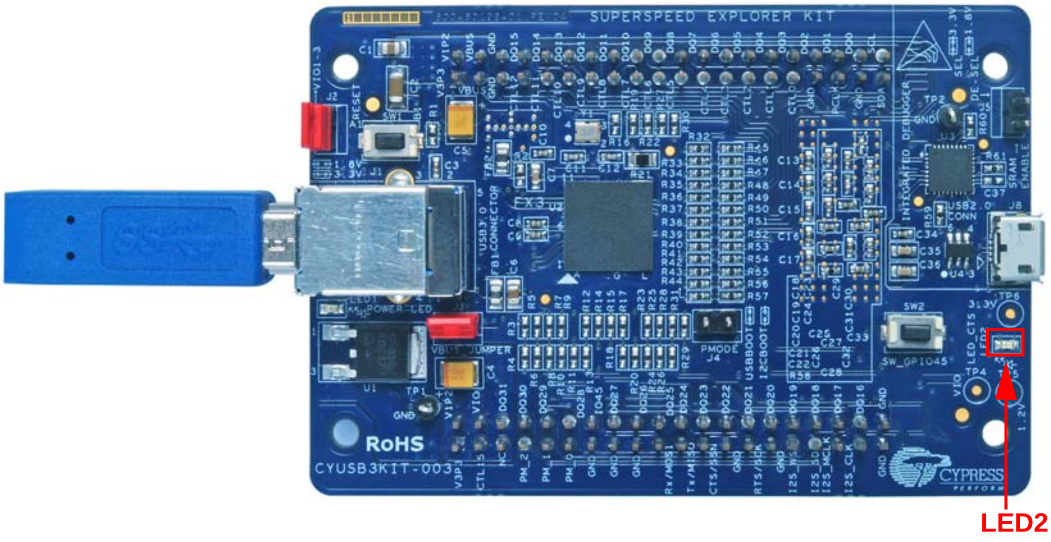
- Boot from the onboard I^{2}C EEPROM and run its code.
- Boot as a USB loader to load and run code from the PC.
- Program the onboard EEPROM with your own code and boot from it after a reset.

3.5.1 Boot From Onboard I^{2}C EEPROM

Confirm that the J4 jumper is not inserted. This enables FX3 to boot from the onboard I^{2}C EEPROM, which is loaded in the factory with the USBBulkSourceSinkLED example code.

1. Connect the development board to your computer using the USB 3.0 cable provided with the kit, as shown in Figure 3-3.

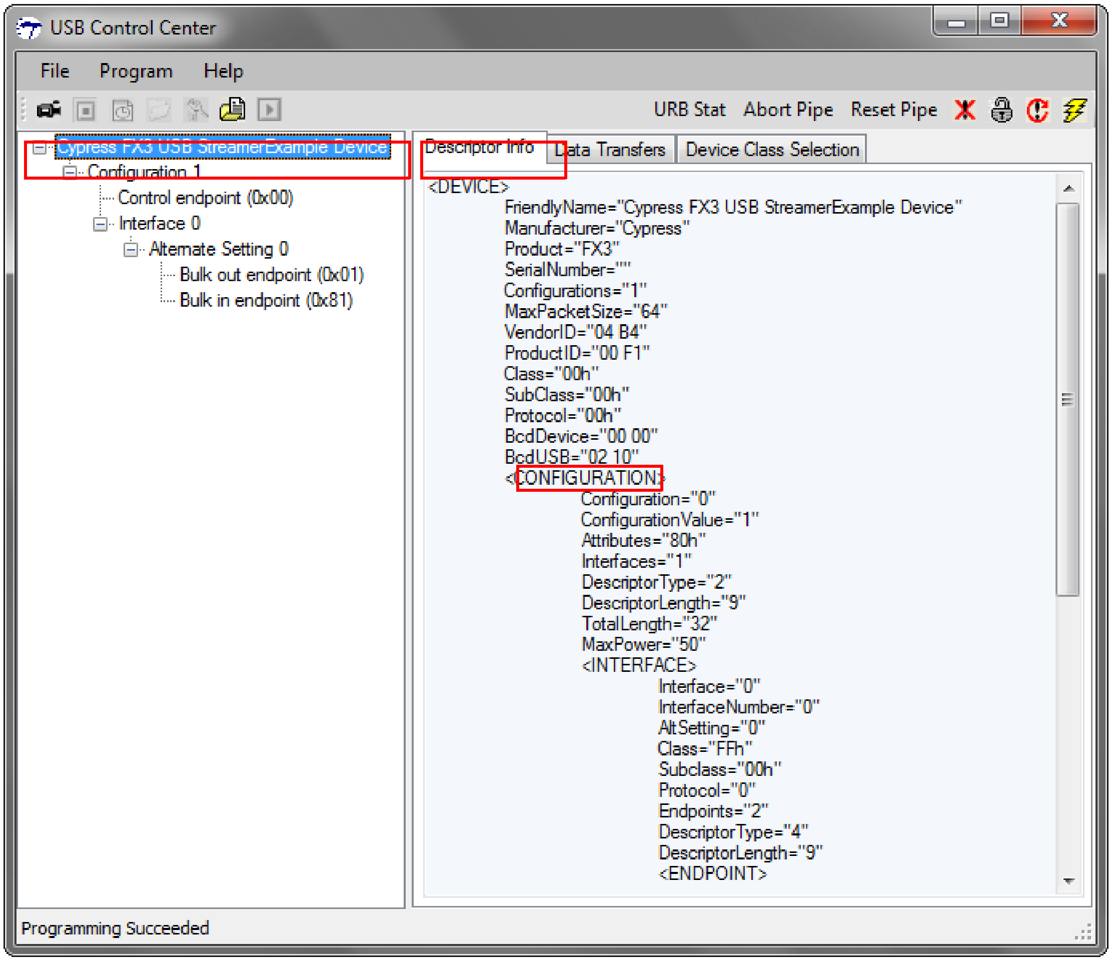
Figure 3-3. USB Connection



2. After connecting the development board to the host, wait for the Windows drivers to install. If the drivers do not install automatically, follow the steps in the “Appendix” on page 52 to manually install the drivers.
3. After the driver installation is complete, observe the blue LED (LED2). If the development board is connected to a USB 3.0 port, the blue LED (LED2) blinks. If the development board is connected to a USB 2.0 port, the blue LED (LED2) stays ON. If the development board is connected to a USB 1.1 port, the blue LED (LED2) stays OFF.

   Note This is a useful way to speed-test USB ports on a PC, where the USB operating speed is not always obvious. For example, some desktop PCs have the telltale blue plastic inserts (which are supposed to indicate USB 3.0) in both front and rear USB receptacles. Nevertheless, the front-panel receptacles often operate only at a USB 2.0 rate (480 Mbps).
4. Take a look at the **USB Control Center**. It should appear as shown in Figure 3-4. The **USB Control Center** detects the development board, which is named Cypress FX3 USB StreamerExample Device. This appears as the heading in a device tree in the left panel.

Figure 3-4. FX3 Board Connected to a USB 2.0 Port



```
<DEVICE>
          FriendlyName="Cypress FX3 USB StreamerExample Device"
          Manufacturer="Cypress"
          Product="FX3"
          SerialNumber=""
          Configurations="1"
          MaxPacketSize="64"
          VendorID="04 B4"
          ProductID="00 F1"
          Class="00h"
          SubClass="00h"
          Protocol="00h"
          BcdDevice="00 00"
          BcdUSB="02 10"
          <CONFIGURATION>
                    Configuration="0"
                    ConfigurationValue="1"
                    Attributes="80h"
                    Interfaces="1"
                    DescriptorType="2"
                    DescriptorLength="9"
                    TotalLength="32"
                    MaxPower="50"
                    <INTERFACE>
                              Interface="0"
                              InterfaceNumber="0"
                              AltSetting="0"
                              Class="FFh"
                              Subclass="00h"
                              Protocol="0"
                              Endpoints="2"
                              DescriptorType="4"
                              DescriptorLength="9"
                              <ENDPOINT>
```

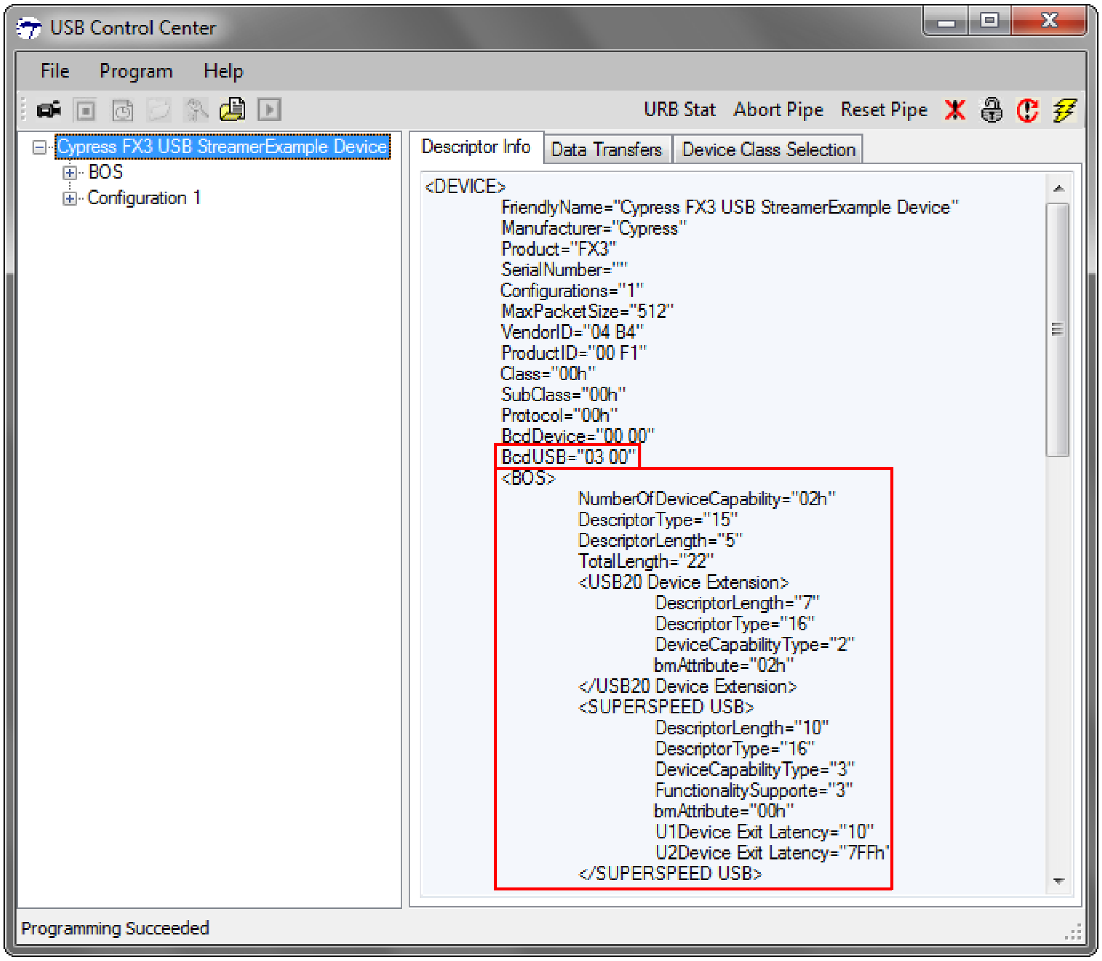
With the **Descriptor Info** tab selected, expand the device tree nodes and click on the various components – Device, Configuration, Interface, and so on. Notice that the descriptor information changes according to what is highlighted in the device tree. This illustrates the context-sensitive nature of the USB Control Center – you should select an item in the device tree before conducting a particular USB operation.

In Figure 3-4, the development board is connected to a USB 2.0 receptacle. One way to determine this is to look at the **BcdUSB** entry "02 10", which indicates the USB specification version under which the device enumerated (USB 2.1). With this connection, the blue LED (LED2) on the board stays ON to indicate the USB 2.0 High-Speed connection.

Compare Figure 3-4 with Figure 3-5, where the same development board was unplugged from the front-panel USB 2.0 receptacle and plugged into a rear-panel USB 3.0 receptacle on the same PC. The blue LED now blinks and the **BcdUSB Descriptor Info** entry now reads "03 00", indicating a USB 3.0 device. SuperSpeed devices also uniquely contain **Binary Device Object Store (BOS)** descriptors, as shown in Figure 3-5.

The same development board is now operating with SuperSpeed capability. This demonstrates an important USB 3.0/FX3 feature: Firmware can be written to automatically detect and support SuperSpeed or legacy USB attachments. The example Cypress code shows how this can be done.

Figure 3-5. Same Device, Different Port, Now Operating as a USB 3.0 Device



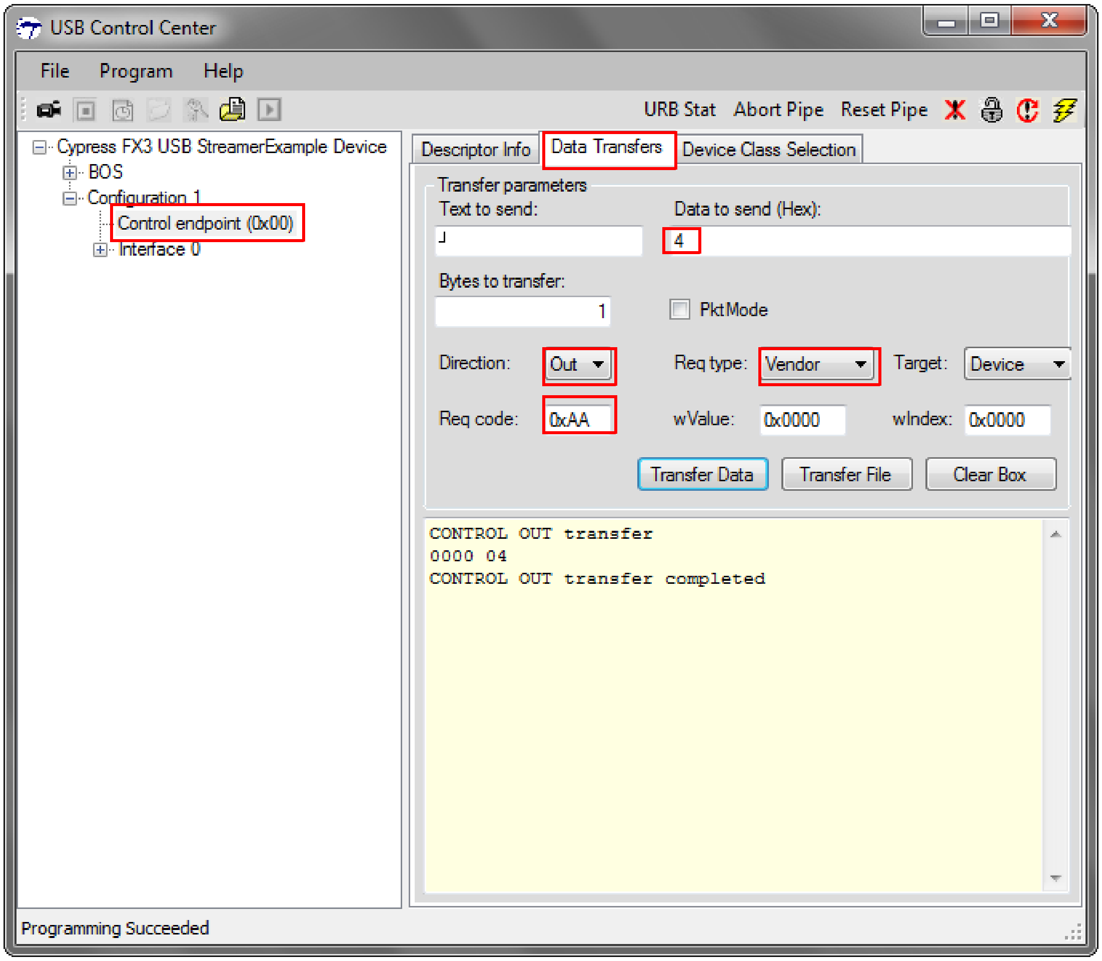
```
<DEVICE>
          FriendlyName="Cypress FX3 USB StreamerExample Device"
          Manufacturer="Cypress"
          Product="FX3"
          SerialNumber=""
          Configurations="1"
          MaxPacketSize="512"
          VendorID="04 B4"
          ProductID="00 F1"
          Class="00h"
          SubClass="00h"
          Protocol="00h"
          BcdDevice="00 00"
          BcdUSB="03 00"
          <BOS>
                    NumberOfDeviceCapability="02h"
                    DescriptorType="15"
                    DescriptorLength="5"
                    TotalLength="22"
                    <USB20 Device Extension>
                              DescriptorLength="7"
                              DescriptorType="16"
                              DeviceCapabilityType="2"
                              bmAttribute="02h"
                    </USB20 Device Extension>
                    <SUPERSPEED USB>
                              DescriptorLength="10"
                              DescriptorType="16"
                              DeviceCapabilityType="3"
                              FunctionalitySupporte="3"
                              bmAttribute="00h"
                              U1Device Exit Latency="10"
                              U2Device Exit Latency="7FFh"
                    </SUPERSPEED USB>
```

Another USB Control Center option is to conduct USB transfers to and from the FX3 board. The example firmware booted from the EEPROM contains code to respond to a custom USB request type called a ‘vendor request’. To exercise this option, select the **Control endpoint (0x00)** item in the device tree and click the **Data Transfers** tab, as shown in Figure 3-6. Then select ‘Vendor’ from the **Req type** (USB request type) drop-down list. The example firmware responds to a vendor request code of 0xAA, which you enter in the **Req code** box. Your panel values should look similar to those in Figure 3-6. Enter a number between 0 and 9 in the **Data to send (Hex)** box and click the

Transfer Data button. The LED blinks with a 1-second period and the ON time corresponding to the data you enter times 100 milliseconds. Entries greater than nine (LED ON for 900 ms) blink at a fixed 500-ms ON time.

Note Make sure there are no spaces before the number you type into the **Data to send (Hex)** text box.

Figure 3-6. Using the USB Control Center to Set the FX3 LED Blink Rate



Text to send:

Data to send (Hex): 4

Bytes to transfer: 1

□ PktMode

Direction: Out

Req type: Vendor

Target: Device

Req code: 0xAA

wValue: 0x0000

wIndex: 0x0000

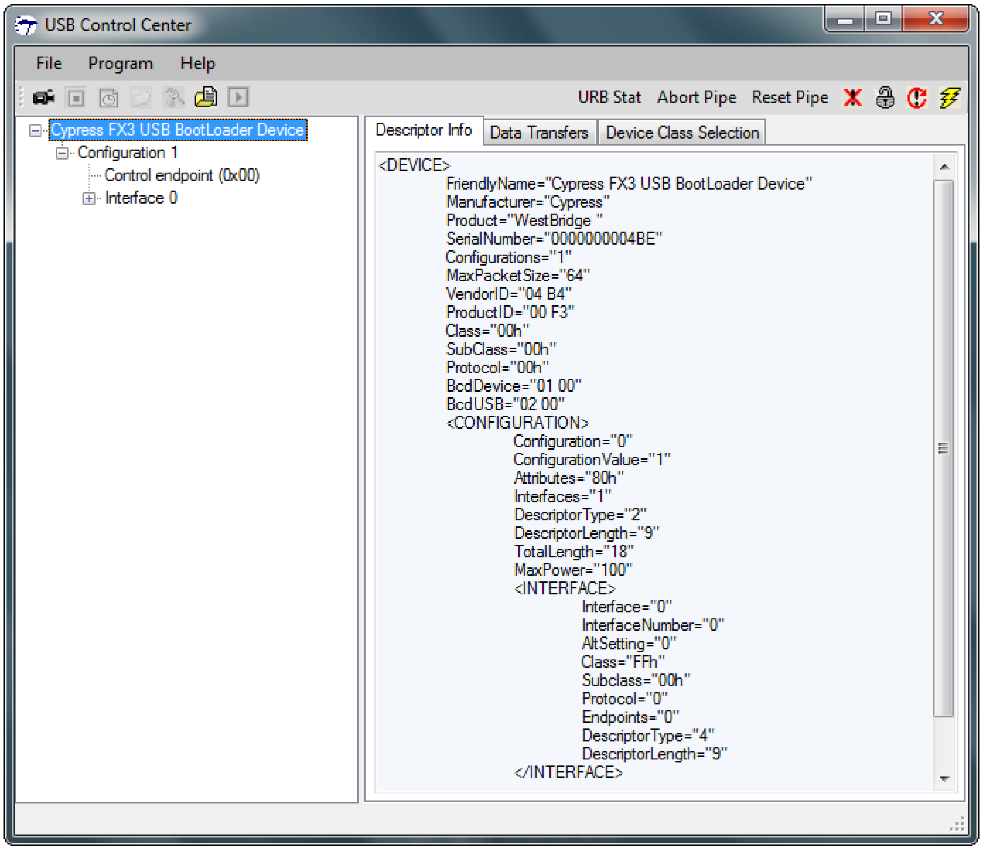
```
CONTROL OUT transfer
0000 04
CONTROL OUT transfer completed
```

3.5.2 Boot as a USB Loader

To demonstrate the FX3 operation as a USB bootloader, follow these instructions:

1. Unplug the development board, insert the J4 jumper, and reattach the development board to the PC. In USB boot mode, FX3 enumerates as a high-speed bootloader using Vendor ID VID=04B4 and Product ID PID=0x00F3. FX3 identifies itself in the USB Control Center as the Cypress FX3 Bootloader Device, as shown in Figure 3-7. It may take several seconds for this device entry to appear.

Figure 3-7. FX3 as a USB Bootloader

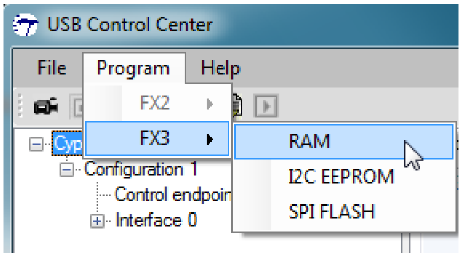


```
<DEVICE>
          FriendlyName="Cypress FX3 USB BootLoader Device"
          Manufacturer="Cypress"
          Product="WestBridge "
          SerialNumber="0000000004BE"
          Configurations="1"
          MaxPacketSize="64"
          VendorID="04 B4"
          ProductID="00 F3"
          Class="00h"
          SubClass="00h"
          Protocol="00h"
          BcdDevice="01 00"
          BcdUSB="02 00"
          <CONFIGURATION>
                    Configuration="0"
                    ConfigurationValue="1"
                    Attributes="80h"
                    Interfaces="1"
                    DescriptorType="2"
                    DescriptorLength="9"
                    TotalLength="18"
                    MaxPower="100"
                    <INTERFACE>
                              Interface="0"
                              InterfaceNumber="0"
                              AltSetting="0"
                              Class="FFh"
                              Subclass="00h"
                              Protocol="0"
                              Endpoints="0"
                              DescriptorType="4"
                              DescriptorLength="9"
                    </INTERFACE>
```

Note The FX3 bootloader operates at high speed (USB 2.0) even if connected to a USB 3.0 port. Therefore, it appears as a USB 2.0 device, seen by BcdSUB = "02 00" and no BOS (SuperSpeed) descriptor.

2. When the FX3 enumerates as a bootloader device, it can be used to download code into internal RAM or to program the onboard EEPROM with custom code. To download and execute code from the FX3 internal RAM, choose **Program > FX3 > RAM**, as shown in Figure 3-8.

Figure 3-8. Programming FX3 RAM



3. A pop-up window asks for a file to download. Navigate to the same example firmware application available in the path (this is the same firmware stored in the EEPROM when the SuperSpeed Explorer Kit development board leaves the Cypress factory) at:

   `<Install Directory>\Cypress\SuperSpeed Explorer Kit\1.0\Firmware\USBBulk SourceSinkLED\Debug`

Note For Windows 7 and above, the default install directory is `C:\Program Files (x86)`. For Windows XP, the default install directory is `C:\Program Files.`

Notice that after loading the firmware from the PC, the FX3 automatically disconnects from USB and immediately reappears in the USB Control Center as the device created by the code it loaded, namely, the Cypress FX3 USB StreamerExample Device, as described previously. You can confirm operation of the code using the same steps as those used to change the blink rate. The only difference is that this code is loaded into the FX3 RAM from the PC instead of the EEPROM.

This method can be used to download and test any code you develop using the FX3 SDK. Because loading into RAM is extremely fast, the load-and-test cycles can be very short.

3.5.3 Program the EEPROM

You may want to have the FX3 boot from the onboard EEPROM using the code you put into it.

1. To program your own code into the EEPROM and boot directly to it at power-on, start the FX3 bootloader by inserting the J4 jumper and then connecting the development board to the PC. Note that pressing the RESET button has the same effect as disconnecting-then-reconnecting to the USB. As long as the J4 jumper is in place, pressing the RESET button always brings the SuperSpeed Explorer Kit development board back as a code loader. This allows you to load new code builds during development without disconnecting the USB cable. This time, select **I^{2}C EEPROM** as the target device instead of RAM in the USB Control Center application (Figure 3.6). This causes FX3 to invoke a secondary loader called Cypress FX3 USB BootProgrammer Device (Figure 3.6), as opposed to the "BootLoader" device used to program the FX3 RAM in the previous section.

   Note The BootProgrammer has different VID/PID values than the BootLoader, which may trigger driver installation the first time it is used. If the driver does not install automatically, follow the steps in Section A.1.1 on page 52 to manually install the driver.

Figure 3-9. I^{2}C EEPROM Download Option

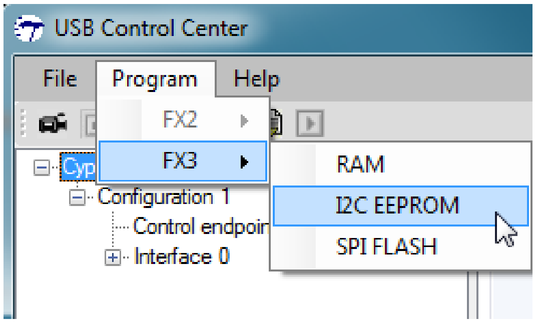
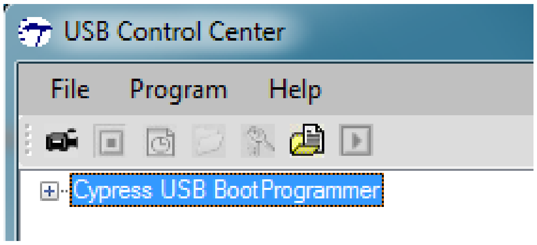


Figure 3-10. FX3 Re-Enumerates as a Cypress FX3 USB BootProgrammer Device



2. After selecting **I^{2}C EEPROM** as the programming target, navigate to the *.img* file to be loaded and click **Open**. After the BootProgrammer code erases and reprograms the EEPROM, a success message appears in the lower left corner of the USB Control Center. Note that erasing and programming EEPROM takes much longer than programming internal RAM, on the order of 20-30 seconds.

3. Disconnect the USB cable, remove the J4 jumper, reattach the cable, and the FX3 boots with the code from EEPROM.

3.6 Firmware Examples

Two firmware examples are provided with the SuperSpeed Explorer Kit installation in addition to those provided with the SDK. The SDK examples are available in the Firmware folder of the FX3 SDK. To import an SDK example, refer to the steps in Section 2.6.2 on page 16. For Windows 7 and above, the default location of the firmware folder is `C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\firmware`. For Windows XP, the default install directory is `C:\Program Files\Cypress\EZ-USB FX3 SDK\1.3\firmware`.

Note The SuperSpeed Explorer Kit development board does not support FX3 USB HS-OTG functionality. Therefore, the OTG/host-based example firmware projects provided with the FX3 SDK do not apply to this kit. In addition, SDK example firmware projects that are meant for FX3S and CX3 are not applicable to this development board.

3.6.1 USBBulkSourceSink with LED Blink

This is the default firmware stored in the kit's onboard EEPROM. As described in the previous section, this firmware supports the following features:

- It implements endless data sources and sinks over a pair of USB bulk endpoints.
- The blue LED (LED2) blinks at connection, depending on the USB host controller capability. If the development board is connected to a USB 3.0 port, the blue LED (LED2) blinks and if it is connected to a USB 2.0 port, the blue LED (LED2) stays ON. If the development board is connected to a USB 1.1 port, the blue LED (LED2) stays OFF.
- The LED blink rate can be modified through a vendor command.

The firmware source (USBBulkSourceSinkLED) is located in the Firmware folder of the SuperSpeed Explorer Kit installation. To study and modify this example, import this project into the EZ USB Suite and build the firmware image (see Section 2.6 on page 15). The firmware will be copied to the EZ USB Suite Workspace folder and a newly built firmware image will be available in the same path after building the project.

In Section 3.5.1 on page 23, the Cypress USB Control Center was used to exercise the LED functionality of this example. A second Windows application, *streamer.exe*, can be used to exercise the data source and sink capabilities. This application is available at:

```
<Install Directory>\Cypress\EZ-USB FX3SDK\1.3\application\cpp\streamer\x86\Release
```

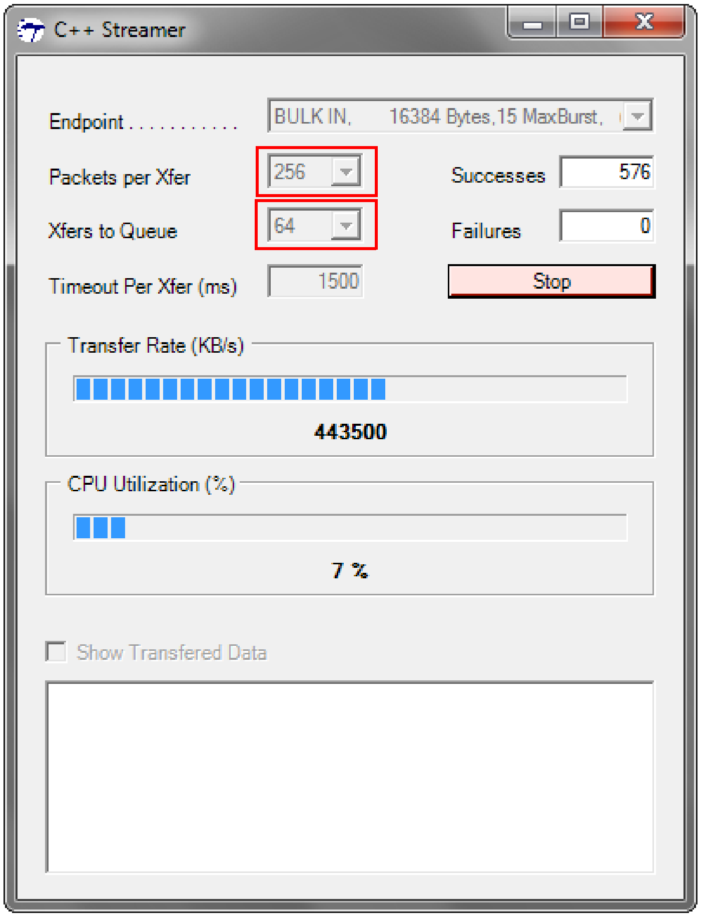
Note For Windows 7 and above, the default install directory is `C:\Program Files (x86)`. For Windows XP, the default install directory is `C:\Program Files.`

Before running *streamer.exe*, make sure the Cypress FX3 USB StreamerExample Device is loaded into FX3, as detailed in Section 3.5.1 on page 23.

As Figure 3-11 shows, select 256 as **Packets per Xfer** and 64 as **Xfers to Queue** from the drop-down list available in the Streamer application.

- **Packets per Xfer**: A transfer is a collection of packets for one data set. A greater number of packets for each transfer reduces the USB overhead and achieves higher data throughput.
- **Xfers to Queue**: This setting initiates multiple transfers and adds them to a task queue, which reduces the latency between successive transfers on the host application side. Therefore, queuing more transfers results in a higher data rate.

Figure 3-11. Streamer.exe



C++ Streamer

Endpoint . . . . BULK IN, 16384 Bytes,15 MaxBurst,

Packets per Xfer 256

Successes 576

Xfers to Queue 64

Failures 0

Timeout Per Xfer (ms) 1500

Transfer Rate (KB/s)

443500

CPU Utilization (%)

7 %

□ Show Transfered Data

The SuperSpeed bulk throughput depends on the burst size, buffer size, and the number of buffers. This firmware is already optimized to achieve maximum throughput. Refer to *AN86947 - Optimizing USB 3.0 Throughput with EZ-USB® FX3™* (www.cypress.com/go/AN86947) for more details about the parameters that affect the throughput in the bulk source/sink firmware.

AN86947 (www.cypress.com/go/AN86947) lists the USB 3.0 throughput numbers using internally provided FX3 data. The USB 3.0 throughput numbers will be slightly lower when the data originates from an external device into FX3 through GPIF II. Refer to *AN65974 - Designing with the EZ-USB® FX3™ Slave FIFO Interface* (www.cypress.com/go/AN65974) for the throughput numbers when an FPGA supplies data to FX3 via the GPIF II interface.

3.6.2 SRAM Example

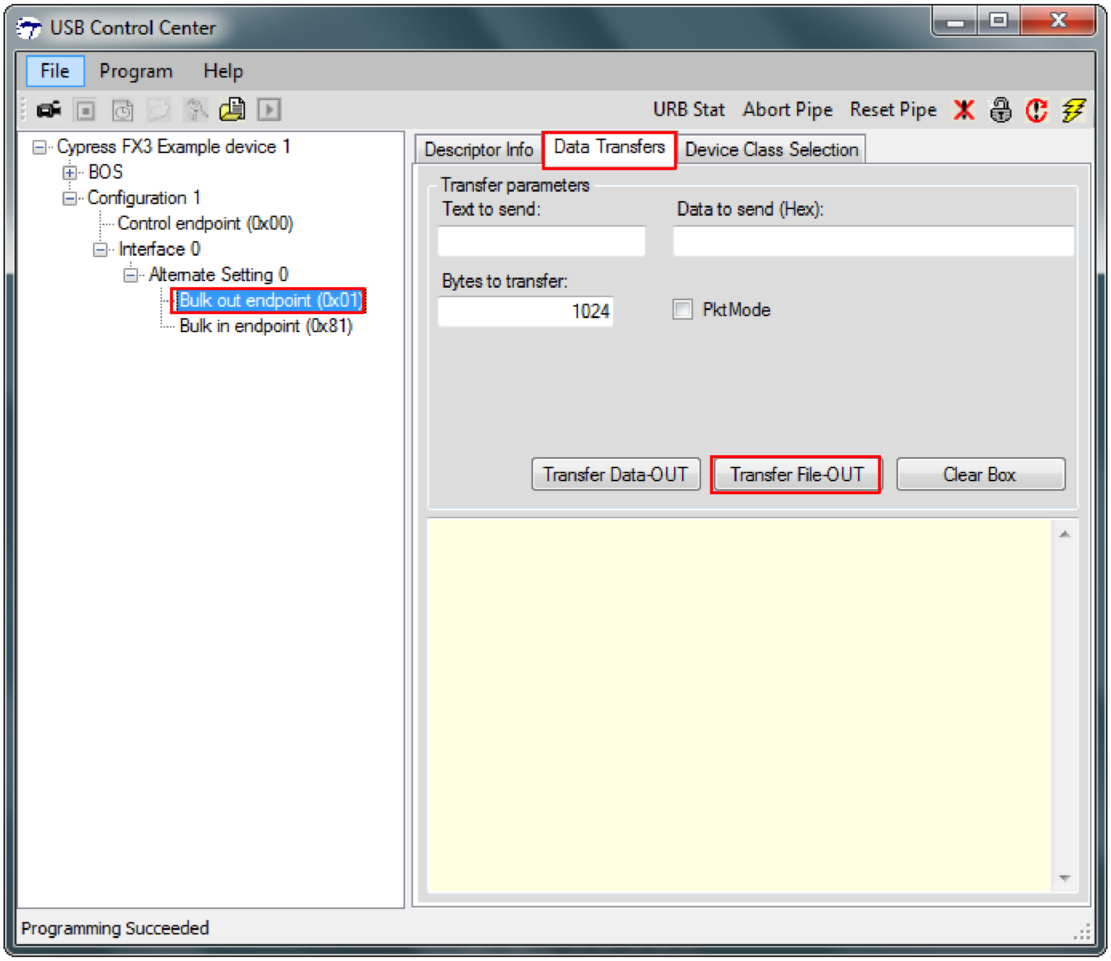
This firmware supports reading and writing to the onboard SRAM. The LED blinking activity is maintained in this firmware as well. You can find the firmware source (SRAM_FX3) in the Firmware folder of the SuperSpeed Explorer Kit installation. Be sure to import this project into the EZ USB Suite and build the firmware image, if not already done. The firmware will be copied to the **EZ USB Suite Workspace** folder, and a newly built firmware image will be available in the same path.

To test the functionality of this firmware, follow these steps.

1. Disconnect the development board from the computer if it is already connected.
2. Insert the J5 jumper to enable SRAM.

3. Make sure that the J2 jumper is inserted so that 3.3 V is provided to the SRAM interface. The SRAM works only at 3.3 V.
4. Insert the J4 jumper to boot from USB.
5. Connect the development board to your computer using the USB 3.0 cable.
6. Open the USB Control Center application and load the newly built firmware image, *SRAM_FX3.img* (from the project folder in the workspace), to FX3 RAM, as described in Section 3.5.2 on page 26.
7. FX3 re-enumerates as **Cypress FX3 Example device 1**. Wait for the drivers to be installed automatically. If the drivers are not installed automatically, follow the steps listed in Section A.1.1 on page 52 to install the drivers manually.
8. In the USB Control Center application, expand the **Cypress FX3 Example device 1** (in the left panel) and select the **Bulk out endpoint**; and in the **Data Transfers** tab (in the right panel), click **Transfer File-OUT**, as shown in Figure 3-12.

Figure 3-12. Sending Data Through Control Center to Write to SRAM



Bytes to transfer: 1024

□ PktMode

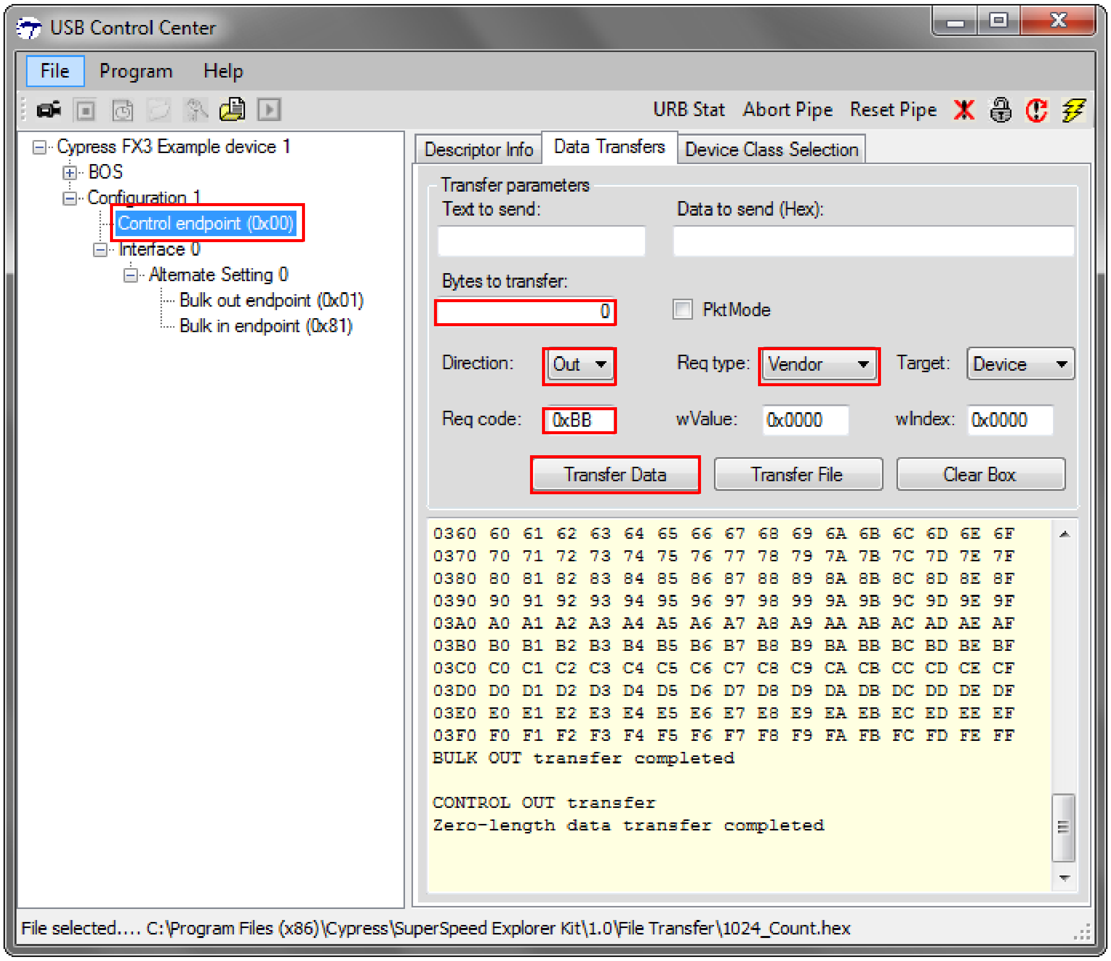
Programming Succeeded

A dialog box opens, prompting you to select a file. A sample 1-KB file, *1024_Count.hex*, is provided in the **File Transfer** folder of the SuperSpeed Explorer Kit installation. Browse to the path `<Install Directory>\Cypress\SuperSpeed Explorer Kit\1.0\File Transfer` to select the file. This writes the 1-KB data available in the file to the SRAM starting from the address 0x00.

Note For Windows 7 and above, the default install directory is `C:\Program Files (x86)`. For Windows XP, the default install directory is `C:\Program Files.`

9. Send a vendor command with the **Req code** 0xBB to the control endpoint, as shown in Figure 3-13. This step is necessary to switch the GPIF state machine from the SRAM Write cycle to SRAM read cycle.

Figure 3-13. Sending Vendor Request to Read From SRAM



Bytes to transfer: 0

Direction: Out

Req type: Vendor

Target: Device

Req code: 0xBB

wValue: 0x0000

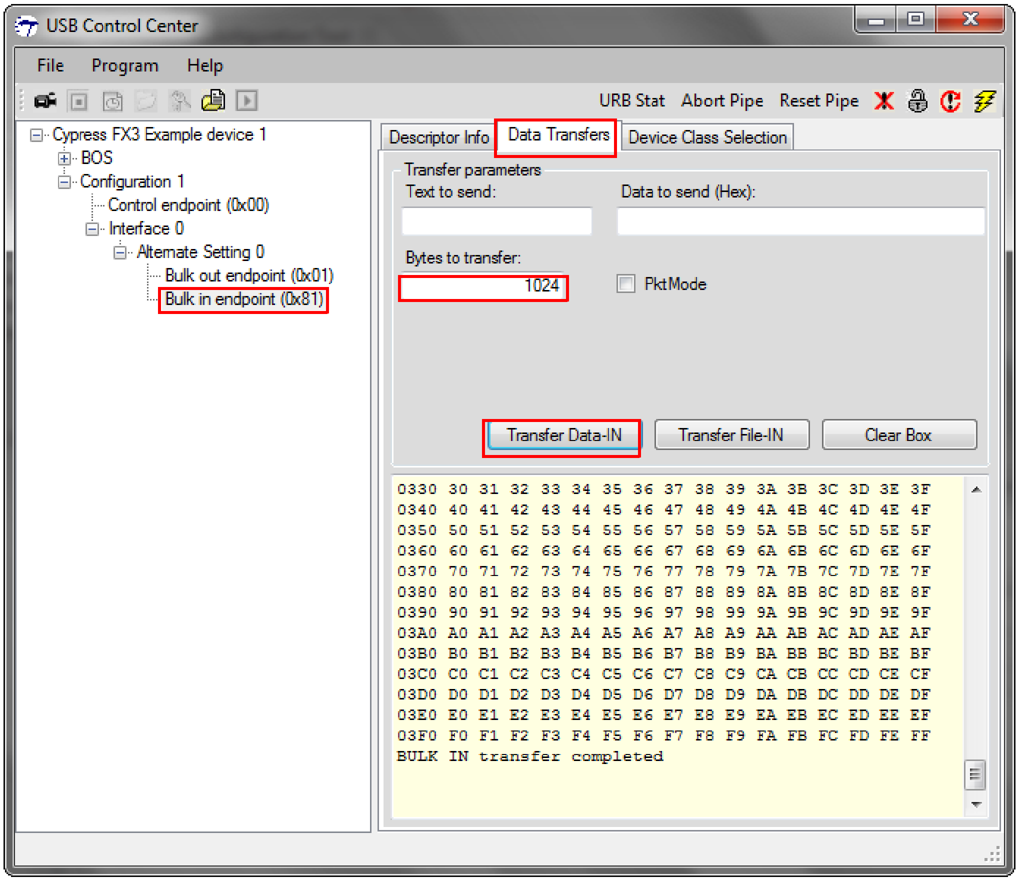
wIndex: 0x0000

```
0360 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
0370 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
0380 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
0390 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
03A0 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
03B0 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
03C0 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
03D0 D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
03E0 E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
03F0 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
BULK OUT transfer completed

CONTROL OUT transfer
Zero-length data transfer completed
```

File selected.... C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\File Transfer\1024_Count.hex

10. Select the **Bulk in endpoint(0x81)** in the left panel. In the **Data Transfers** tab (in the right panel), enter ‘1024’ in the **Bytes to transfer** field and click **Transfer Data-IN** to read the 1024 bytes written to SRAM in the previous step. (See Figure 3-14).

Figure 3-14. Reading 1024 Bytes From SRAM



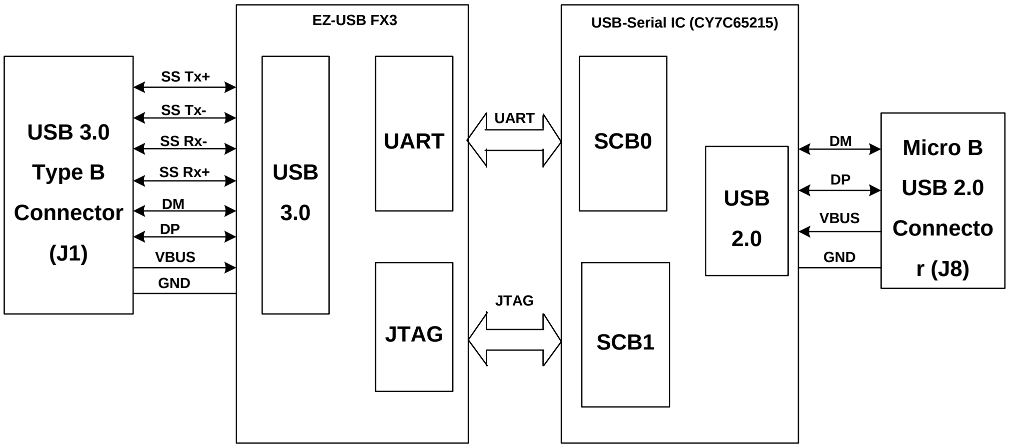
Bytes to transfer: 1024

```
0330 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
0340 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
0350 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
0360 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
0370 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
0380 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
0390 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
03A0 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
03B0 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
03C0 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
03D0 D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
03E0 E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
03F0 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
BULK IN transfer completed
```

3.7 Integrated Debugger

The CY7C65215 USB-Serial IC (www.cypress.com/go/CY7C65215) is a full-speed USB-Serial bridge controller that offers two configurable serial communications blocks (SCBs). The development board uses the first serial channel of the CY7C65215 as a UART and the second serial channel as a JTAG interface. Figure 3-15 shows the block diagram.

Figure 3-15. Block Diagram of CY7C65215

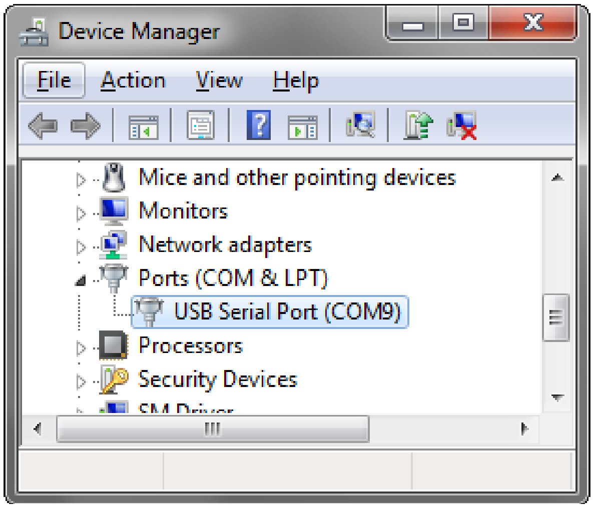


3.7.1 UART

To use the UART functionality on the SuperSpeed Explorer Kit, follow these instructions:

1. Use J1 to connect the development board to your computer. This powers the board and provides the USB 3.0 conduit to FX3. Then, use a micro USB 2.0 cable to connect J8 to your computer. This connection makes the integrated debugger enumerate with three interfaces. One of the interfaces will be COM port. You can verify the entry in the Device Manager (Figure 3-16).

Figure 3-16. USB Serial IC Enumerating as COM Port



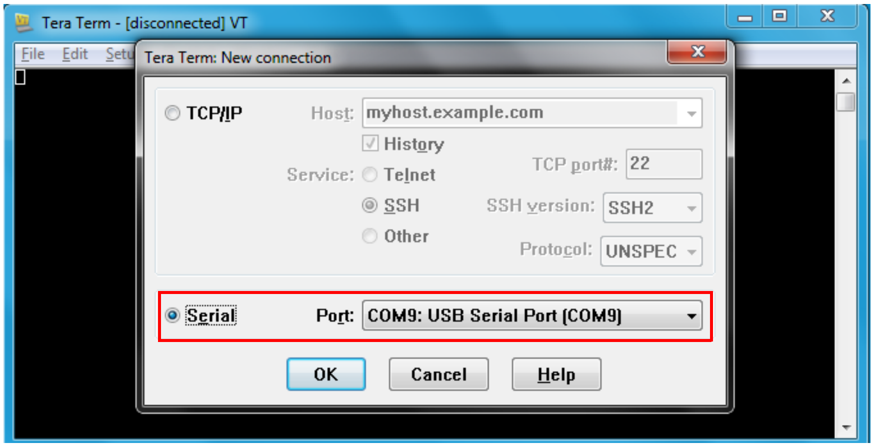
You can use any standard UART communication terminal, such as Tera Term, to display the messages transmitted over the UART.

Note Some PC terminal applications put an upper limit on COM port choices, for example offering support only up to COM7. If your USB serial port has a COM number that is too high for your PC terminal app, see Section A.2 on page 54, for a method to remove inactive COM port assignments to free up the lower-numbered COM ports.

2. When the COM port entry is verified in the Windows Device Manager, open Tera Term (or any other standard UART communication terminal), select the USB Serial Port (COM#), and click **OK**, as shown in Figure 3-18.

   Note The Tera Term application is known to have problems of data loss at very low baud rates (1200 and below) with the integrated debugger, when larger blocks of data are received or transmitted over UART. You can use other standard COM port terminals, such as HyperTerminal or TestView, if you encounter such data loss issue with the Tera Term application.

Figure 3-17. Selecting USB-Serial COM Port in Tera Term



○ TCP/IP Host: myhost.example.com

☑ History

Service: ○ Telnet TCP port#: 22

● SSH SSH version: SSH2

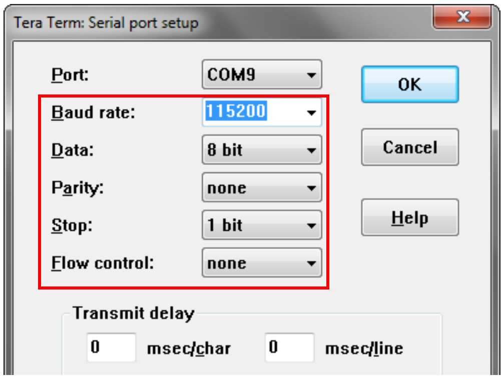
○ Other Protocol: UNSPEC

● Serial Port: COM9: USB Serial Port (COM9)

3. In the Tera Term application, choose **Setup > Serial Port** to change the COM port settings, as shown in Figure 3-18 and click **OK**.

   Note In all the SDK firmware projects and the firmware projects provided with the SuperSpeed Explorer Kit, the UART block of the FX3 device is initialized to work at 115200 baud rate. Therefore, in the Tera Term application, you should select the 115200 baud rate while setting up the COM port, unless you have changed the baud rate setting for the UART block in the FX3 firmware project.

Figure 3-18. Setting Up the COM Port in Tera Term



Port: COM9

Baud rate: 115200

Data: 8 bit

Parity: none

Stop: 1 bit

Flow control: none

Transmit delay

0 msec/char 0 msec/line

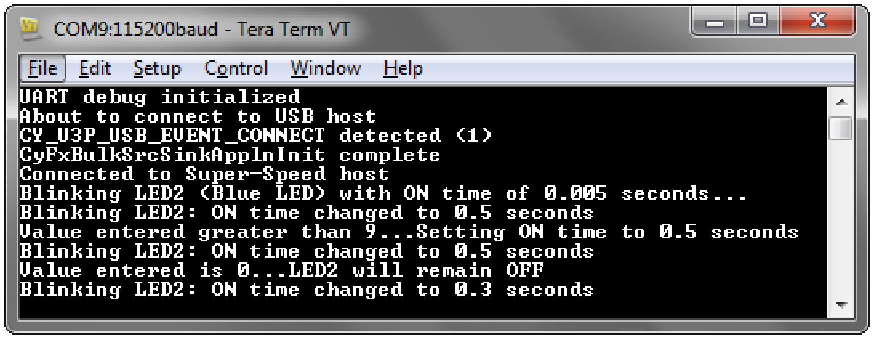
   Note Though the UART hardware flow control is supported by the FX3 SDK, it is not supported by the SuperSpeed Explorer Kit. Therefore, the **Flow Control** field should be set to “none” in the UART communication terminal. When the UART interface is used while debugging through JTAG, the UART baud rate should not be more than 115200.

4. The debug prints in Figure 3-19 can be observed when running the USBBulkSourceSinkLED firmware on the FX3 device. To obtain the debug prints available in the USBBulkSourceSinkLED project over UART, follow the steps mentioned above and then perform one of the following actions:

   a. The USBBulkSourceSinkLED firmware is stored in the onboard EEPROM by default. If the EEPROM still has the same firmware, then remove the J4 jumper and press the FX3 reset button so the USBBulkSourceSinkLED firmware from EEPROM is loaded to the FX3 RAM.

   b. Insert the J4 jumper and follow the steps in Section 3.5.2 on page 26 to load the USBBulkSourceSinkLED firmware to the FX3 RAM using the USB boot option.

Figure 3-19. UART Debug Prints When Running USBBulkSourceSinkLED Firmware Project


COM9:115200baud - Tera Term VT
File Edit Setup Control Window Help

```
UART debug initialized
About to connect to USB host
CY_U3P_USB_EVENT_CONNECT detected (1)
CyFxBulkSrcSinkApplnInit complete
Connected to Super-Speed host
Blinking LED2 (Blue LED) with ON time of 0.005 seconds...
Blinking LED2: ON time changed to 0.5 seconds
Value entered greater than 9...Setting ON time to 0.5 seconds
Blinking LED2: ON time changed to 0.5 seconds
Value entered is 0...LED2 will remain OFF
Blinking LED2: ON time changed to 0.3 seconds
```

3.7.2 JTAG

The JTAG interface provided by the integrated debugger supports the OpenJTAG protocol and uses the OpenOCD demon tool on the host to conduct a debugging session. All the required files for JTAG debugging are provided with the SuperSpeed Explorer Kit installation and are available in the following default path after installation: `<Install Directory>\Cypress\SuperSpeed Explorer Kit\1.0\USBSerialOpenOCD`.

Note For Windows 7 and above, the default install directory is `C:\Program Files (x86)`. For Windows XP, the default install directory is `C:\Program Files`.

The OpenOCD demon tool is tailored to work with the integrated debugger. The OpenOCD executable provided with the SuperSpeed Explorer Kit setup is generated by patching OpenOCD 0.7.0 (http://openocd.sourceforge.net/) and then compiling to make it work with the integrated debugger provided on the development board. The configuration file, *arm926ejs_FX3.cfg,* is also provided as required by OpenOCD to identify the USB-Serial IC as a JTAG debugger and FX3 as a target.

Follow these steps to debug the FX3 firmware using the onboard USB-Serial IC as a JTAG debugger.

Hardware Setup

1. Insert the J4 jumper and connect the development board (USB 3.0 connector J1) to your computer using the USB 3.0 cable.
2. Connect the development board to your computer using a micro USB cable through the USB 2.0 microconnector J8. Here, the USB-Serial IC (CY7C65215) acts as a USB-JTAG device.
3. Wait for the USB-Serial IC to enumerate and install the Cypress driver automatically. If the driver does not install automatically, follow the steps in Section A.1.1 on page 52 to manually install the driver.

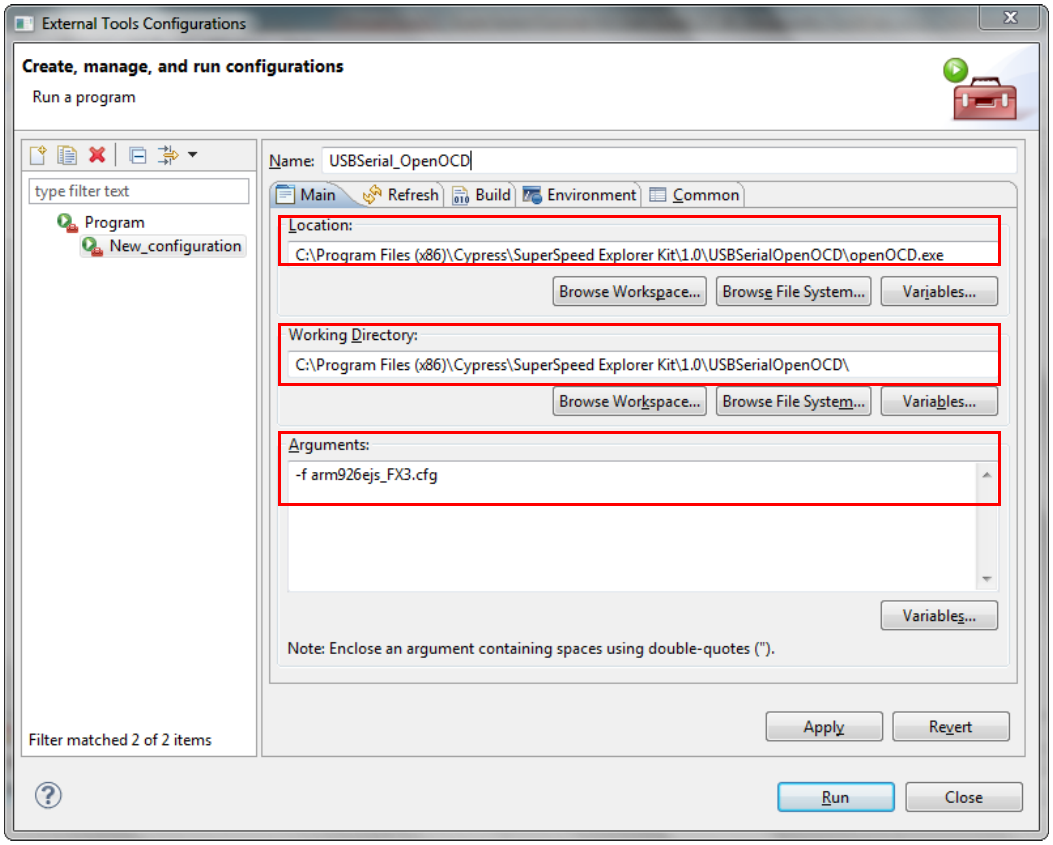
   After driver installation, the USB-Serial interfaces can be identified as:

- USB Serial Port (COMx): This interface acts as an UART interface.
- USB-Serial (Dual Channel) Vendor MFG: This interface is used to configure the USB-Serial IC.
- USB-Serial (Dual Channel) Vendor 1: This interface acts as a JTAG interface.

Software Setup:

1. Open the EZ USB Suite, and highlight the USBBulkSourceSinkLED project you loaded and compiled in Section 3.6.1 on page 29.
2. Create an external tool configuration for the debugger. In the EZ USB Suite, choose **Run > External Tools > External Tools Configurations**. Double-click **Program**. A new run configuration opens. Give the configuration a name, and fill in the fields as follows and as shown in Figure 3-20.

Figure 3-20. External Tool Configuration in EZ USB Suite



External Tools Configurations

Create, manage, and run configurations

Run a program

type filter text

Program

New_configuration

Filter matched 2 of 2 items

Name: USBSerial_OpenOCD

Location: C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\USBSerialOpenOCD\openOCD.exe

Working Directory: C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\USBSerialOpenOCD\

Arguments: -f arm926ejs_FX3.cfg

Note: Enclose an argument containing spaces using double-quotes (").

Location:

This field specifies the location for the OpenOCD executable (*openOCD.exe*), available in the USBSerialOpenOCD folder of the SuperSpeed Explorer Kit installation. For a SuperSpeed Explorer Kit installation using the default installation path, copy and paste the following path in this field:

```
C:\Program Files (x86)\Cypress\SuperSpeed Explorer
Kit\1.0\USBSerialOpenOCD\openOCD.exe
```

Working Directory:

This field specifies the OpenOCD working directory. Use the same directory that contains the executable. For a SuperSpeed Explorer Kit installation using the default installation path, copy and paste the following path in this field:

```
C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\USBSerialOpenOCD\
```

Arguments:

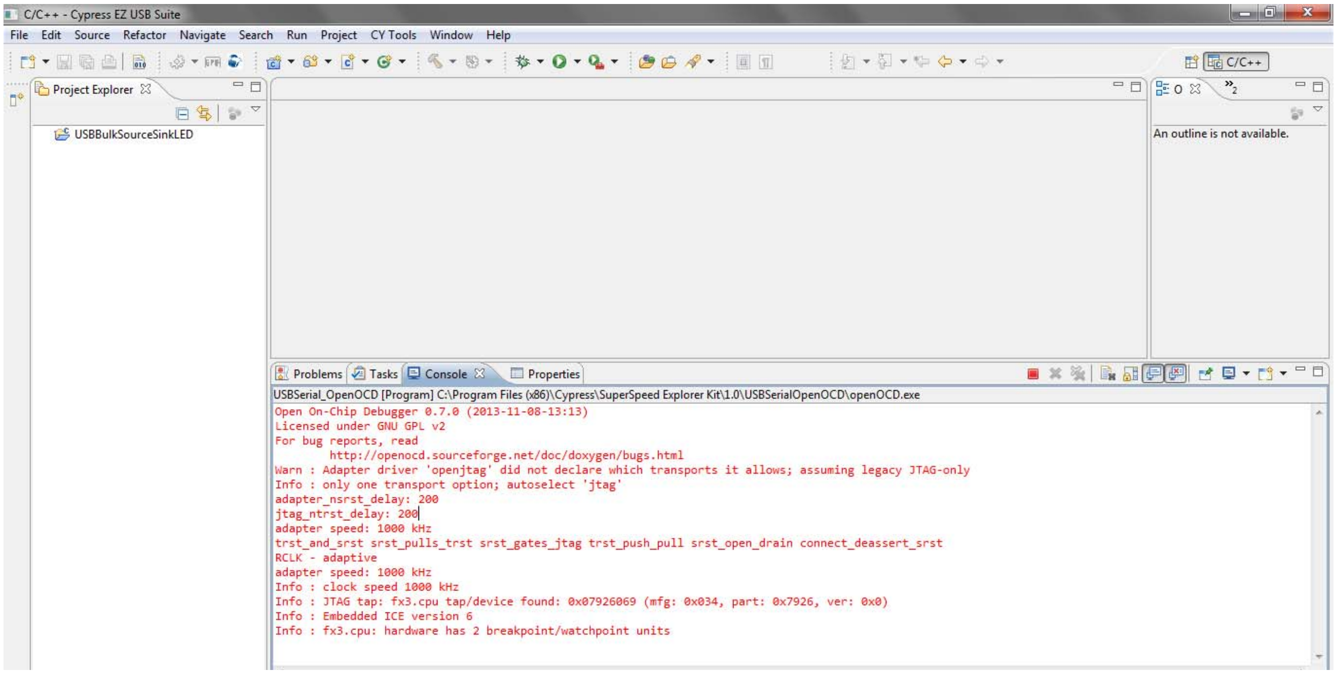
This field specifies the arguments supplied to the OpenOCD executable. The file, *arm926ejs_FX3.cfg,* provided in the USBSerialOpenOCD folder of the SuperSpeed Explorer Kit installation contains the JTAG debugger and the target (FX3) details as required by OpenOCD. Copy and paste the following argument:
-f arm926ejs_FX3.cfg

Note When you click **Run**, the EZ USB Suite will build the entire workspace before launching the External Tool configuration. To eliminate this step, you can uncheck the **Build before launch** option in the **Build** tab.

When you click **Run**, OpenOCD is invoked and the messages shown in Figure 3-21 appear in the EZ USB Suite **Console** window, indicating that OpenOCD has accepted the integrated debugger as a JTAG adapter, has recognized FX3 as a target device, and is now running in the background as a debug server.

Note You need to create the external tool configuration only once for each JTAG debugger per Workspace. The configuration you just entered is saved in the EZ USB Suite.

Figure 3-21. Console Window in EZ USB Suite


C/C++ - Cypress EZ USB Suite
File Edit Source Refactor Navigate Search Run Project CY Tools Window Help
C/C++
Project Explorer
USBBulkSourceSinkLED
An outline is not available.
Problems
Tasks
Console
Properties

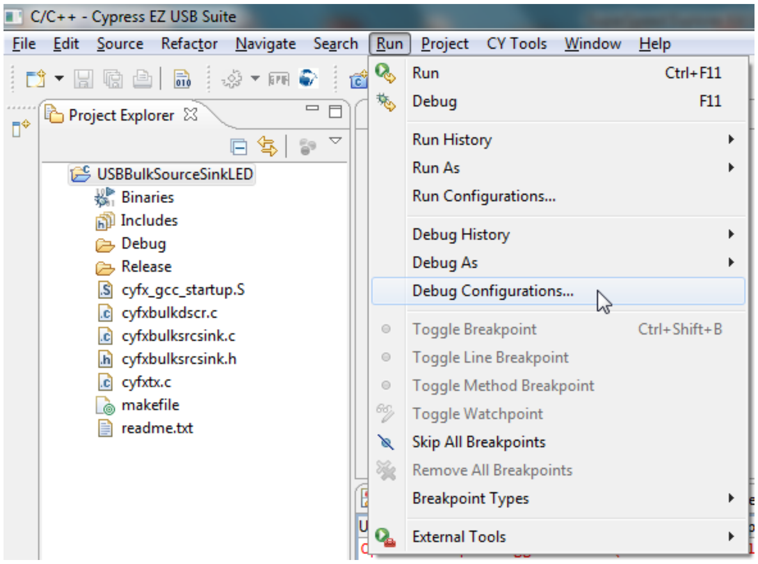
USBSerial_OpenOCD [Program] C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\USBSerialOpenOCD\openOCD.exe

```
Open On-Chip Debugger 0.7.0 (2013-11-08-13:13)
Licensed under GNU GPL v2
For bug reports, read
        http://openocd.sourceforge.net/doc/doxygen/bugs.html
Warn : Adapter driver 'openjtag' did not declare which transports it allows; assuming legacy JTAG-only
Info : only one transport option; autoselect 'jtag'
adapter_nsrst_delay: 200
jtag_ntrst_delay: 200
adapter speed: 1000 kHz
trst_and_srst srst_pulls_trst srst_gates_jtag trst_push_pull srst_open_drain connect_deassert_srst
RCLK - adaptive
adapter speed: 1000 kHz
Info : clock speed 1000 kHz
Info : JTAG tap: fx3.cpu tap/device found: 0x07926069 (mfg: 0x034, part: 0x7926, ver: 0x0)
Info : Embedded ICE version 6
Info : fx3.cpu: hardware has 2 breakpoint/watchpoint units
```

Follow these steps to create a debug configuration for the project. Because individual projects require individual debug configurations, this procedure must be done once for every project. To create a debug configuration for a project, make sure to import the firmware project into the workspace and build the project, if not already done. Then, follow these steps:

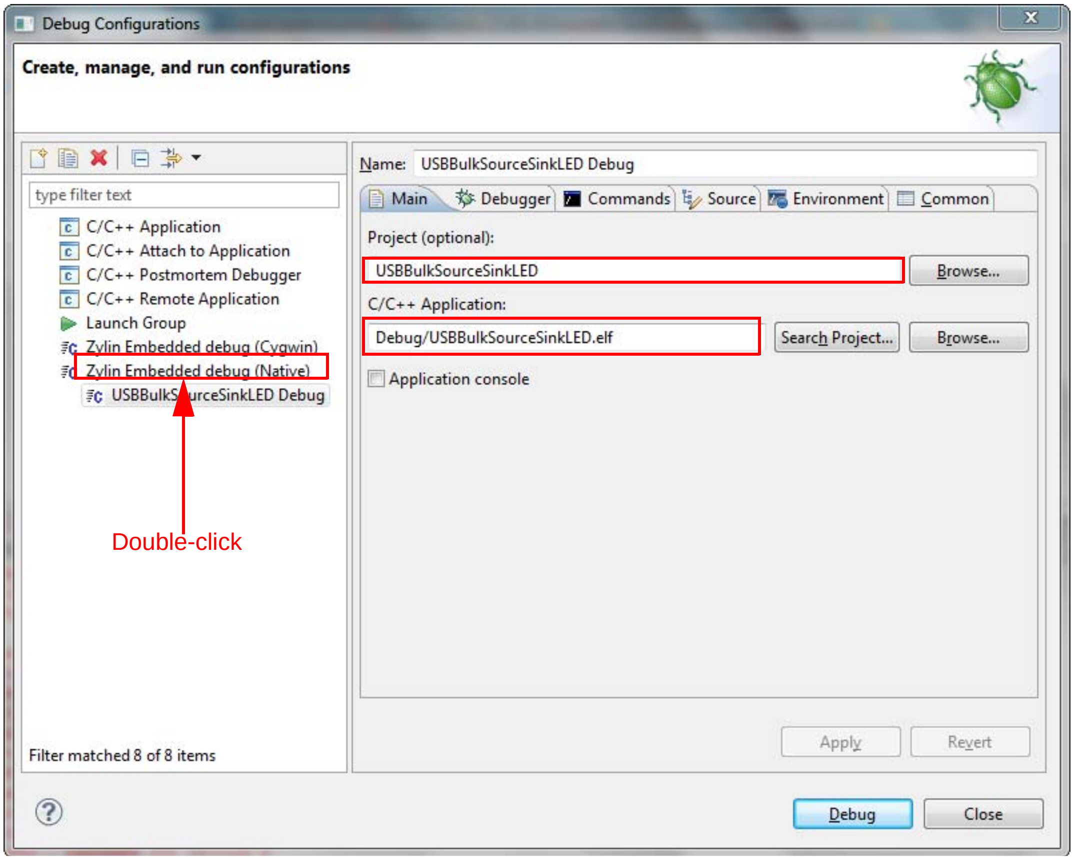
1. Select the desired project in the Project Explorer; then, go to **Run > Debug Configurations**, as shown in Figure 3-22.

Figure 3-22. Generating Debug Configuration in EZ USB Suite



2. Double-click **Zylin Embedded debug (Native)**. A new debug configuration opens with the firmware name as the **Project** name. Confirm that EZ USB Suite has filled in the fields as shown in Figure 3-23. If the **C/C++ Application** field is empty, click **Search Project** and select the Debug or Release build of the *.elf* file, which was built previously.

Figure 3-23. Debug Configuration in EZ USB Suite


Name: USBBulkSourceSinkLED Debug

Project (optional): USBBulkSourceSinkLED

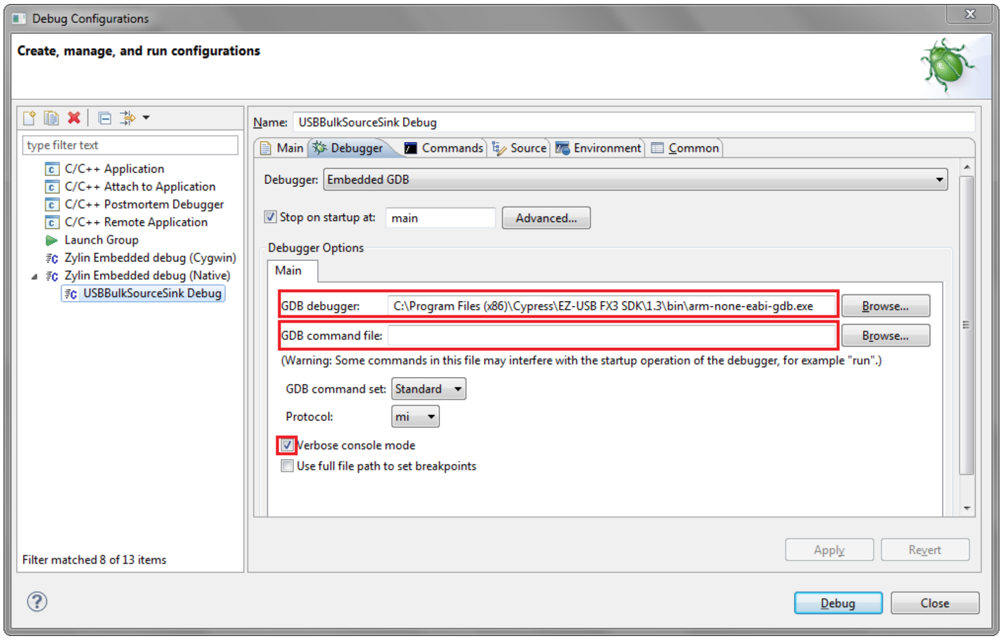
C/C++ Application: Debug/USBBulkSourceSinkLED.elf

□ Application console

Debug Configurations
Create, manage, and run configurations
type filter text
C/C++ Application
C/C++ Attach to Application
C/C++ Postmortem Debugger
C/C++ Remote Application
Launch Group
Zylin Embedded debug (Cygwin)
Zylin Embedded debug (Native)
USBBulkSourceSinkLED Debug
Double-click
Filter matched 8 of 8 items
Main
Debugger
Commands
Source
Environment
Common
Browse...
Search Project...
Browse...
Apply
Revert
Debug
Close

3. In the **Debugger** tab, browse to the path shown in Figure 3-24 for the GDB debugger. Leave the GDB command file field blank.

Figure 3-24. Debugger Tab of Debug Configurations Window in EZ USB Suite



Debug Configurations

Create, manage, and run configurations

type filter text

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- Launch Group
- Zylin Embedded debug (Cygwin)
- Zylin Embedded debug (Native)
  - USBBulkSourceSink Debug

Filter matched 8 of 13 items

Name: USBBulkSourceSink Debug

Main | Debugger | Commands | Source | Environment | Common

Debugger: Embedded GDB

☑ Stop on startup at: main [Advanced...]

Debugger Options

Main

GDB debugger: C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe [Browse...]

GDB command file: [Browse...]

(Warning: Some commands in this file may interfere with the startup operation of the debugger, for example "run".)

GDB command set: Standard

Protocol: mi

☑ Verbose console mode

☐ Use full file path to set breakpoints

4. In the **Commands** tab (Figure 3-25), copy and paste the following text into the 'Initialize' commands section:

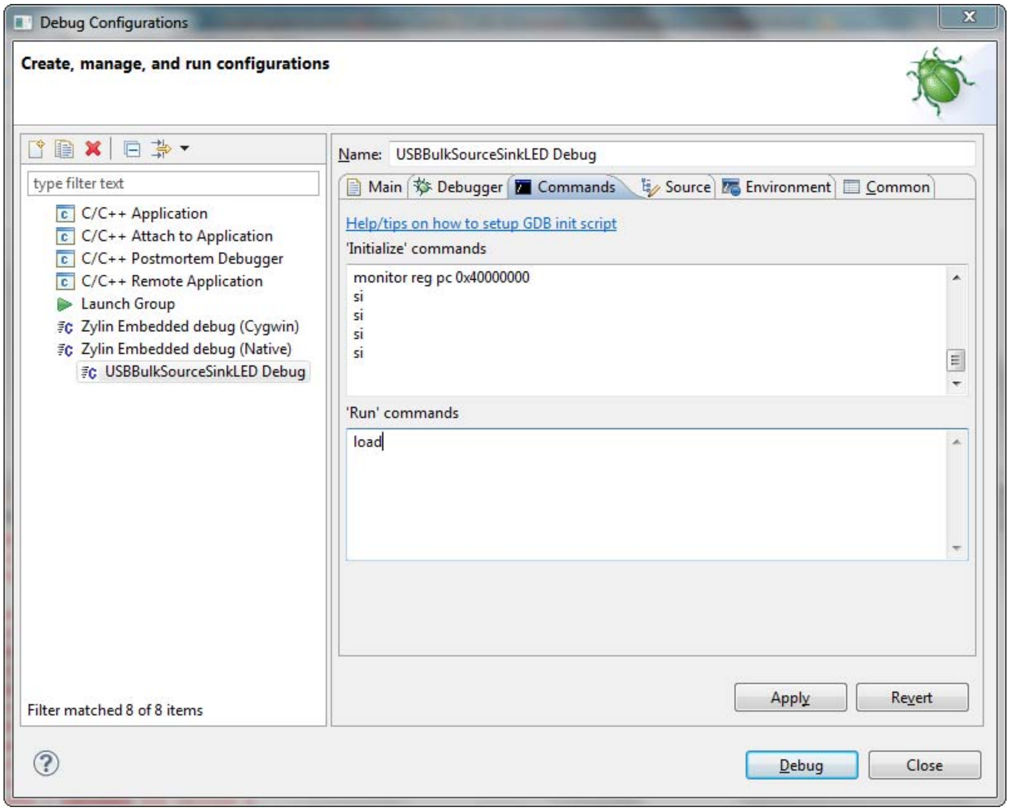
```
set prompt (arm-gdb)
# This connects to a target via netsiliconLibRemote
# listening for commands on this PC's tcp port 3333
target remote localhost:3333
monitor reset halt
# Set the processor to SVC mode monitor reg cpsr 0xd3
# Disable all interrupts
monitor mww 0xFFFFF014 0xFFFFFFFF
# Enable the TCMs
monitor mww 0x40000000 0xE3A00015
monitor mww 0x40000004 0xEE090F31
monitor mww 0x40000008 0xE240024F
monitor mww 0x4000000C 0xEE090F11
# Set the PC to 0x40000000
monitor reg pc 0x40000000
si
si
si
si
```

In the **'Run' commands** section, enter:

```
load
```

The 'Initialize' and 'Run' commands are the GDB commands to initialize and run the JTAG target device, in this case, FX3.

Figure 3-25. Commands Tab of Debug Configurations Window in EZ USB Suite


Debug Configurations
Create, manage, and run configurations
type filter text
C/C++ Application
C/C++ Attach to Application
C/C++ Postmortem Debugger
C/C++ Remote Application
Launch Group
Zylin Embedded debug (Cygwin)
Zylin Embedded debug (Native)
USBBulkSourceSinkLED Debug
Filter matched 8 of 8 items
Main
Debugger
Commands
Source
Environment
Common
Help/tips on how to setup GDB init script
Apply
Revert
Debug
Close

Name: USBBulkSourceSinkLED Debug

'Initialize' commands

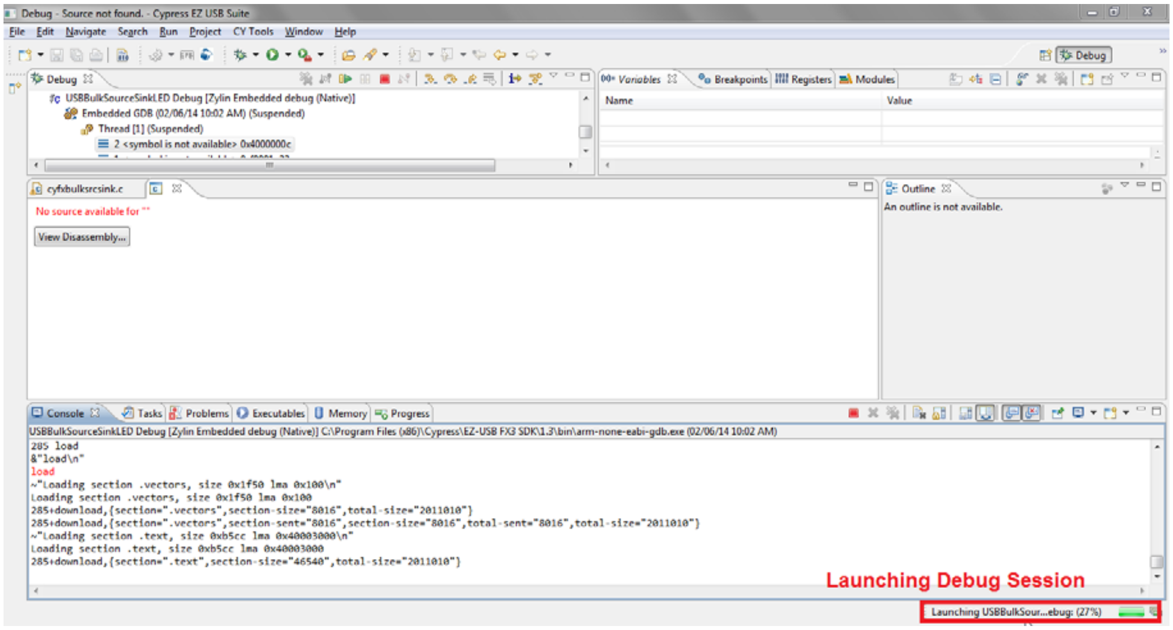
```
monitor reg pc 0x40000000
si
si
si
si
```

'Run' commands

```
load
```

5. Click **Debug**. Accept the option to switch to the "Debug Perspective". An Eclipse perspective is a screen layout optimized for various activities. In the upper right corner of the Eclipse screen, you can select **Debug** for debugging or **C/C++** for code development. The executable firmware launches, and the debug perspective (view) opens, as shown in Figure 3-26.

Figure 3-26. Launching Debug Session



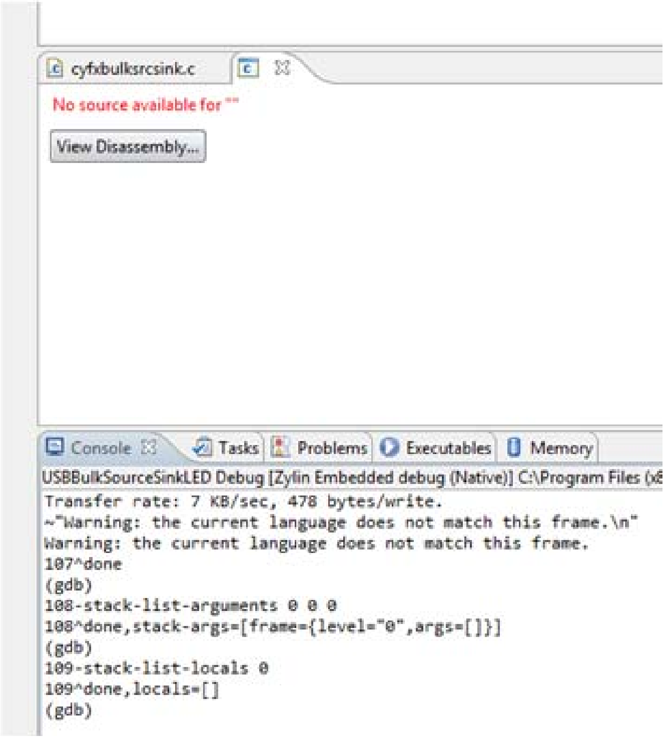
```
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)]
    Embedded GDB (02/06/14 10:02 AM) (Suspended)
        Thread [1] (Suspended)
            2 <symbol is not available> 0x4000000c
```

No source available for ""

```
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)] C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 10:02 AM)
285 load
&"load\n"
load
~"Loading section .vectors, size 0x1f50 lma 0x100\n"
Loading section .vectors, size 0x1f50 lma 0x100
285+download,{section=".vectors",section-size="8016",total-size="2011010"}
285+download,{section=".vectors",section-sent="8016",section-size="8016",total-sent="8016",total-size="2011010"}
~"Loading section .text, size 0xb5cc lma 0x40003000\n"
Loading section .text, size 0xb5cc lma 0x40003000
285+download,{section=".text",section-size="46540",total-size="2011010"}
```

The firmware launch status is shown in the bottom right corner of the EZ USB Suite debug perspective. After the firmware is launched completely, a second window opens with the message **No source available for ""**, as shown in Figure 3-27.

Figure 3-27. Launching Debug Session Complete



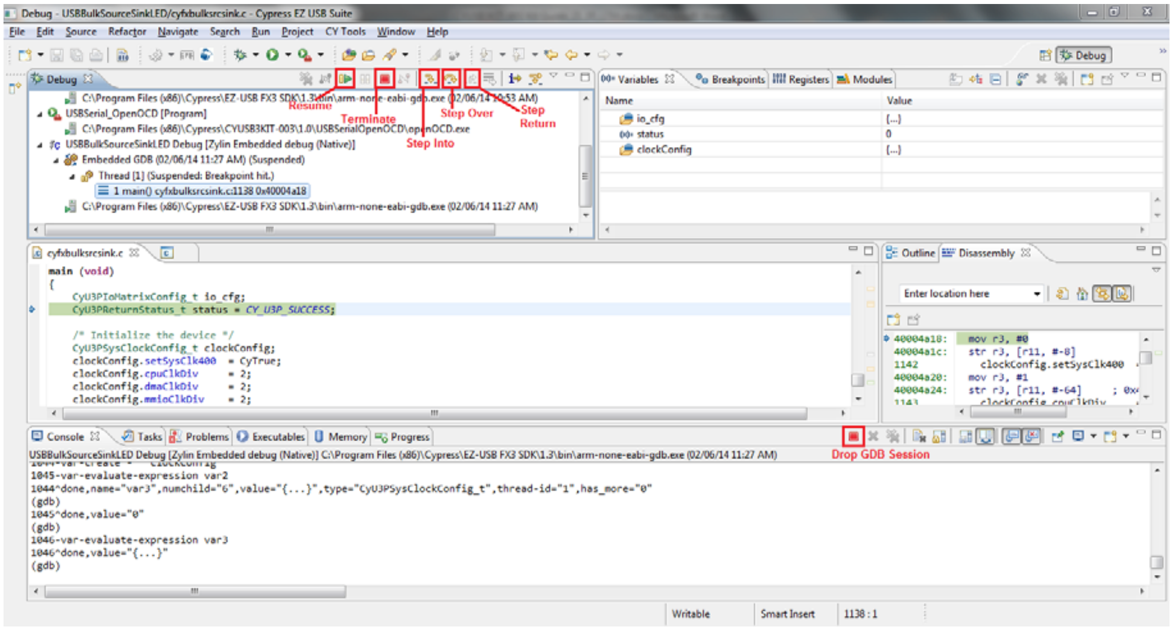
No source available for ""

USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)] C:\Program Files (x8

```
Transfer rate: 7 KB/sec, 478 bytes/write.
~"Warning: the current language does not match this frame.\n"
Warning: the current language does not match this frame.
107^done
(gdb)
108-stack-list-arguments 0 0 0
108^done,stack-args=[frame={level="0",args=[]}]
(gdb)
109-stack-list-locals 0
109^done,locals=[]
(gdb)
```

6. Ignore this message and click **Resume**. The debug point stops at "main" as shown in Figure 3-28.

Figure 3-28. Debugger Stops at Main



```
C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 10:53 AM)
USBSerial_OpenOCD [Program]
  C:\Program Files (x86)\Cypress\CYUSB3KIT-003\1.0\USBSerialOpenOCD\openOCD.exe
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)]
  Embedded GDB (02/06/14 11:27 AM) (Suspended)
    Thread [1] (Suspended: Breakpoint hit.)
      1 main() cyfxbulksrcsink.c:1138 0x40004a18
  C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 11:27 AM)
```

Name	Value
io_cfg	{...}
status	0
clockConfig	{...}

```
main (void)
{
    CyU3PIoMatrixConfig_t io_cfg;
    CyU3PReturnStatus_t status = CY_U3P_SUCCESS;

    /* Initialize the device */
    CyU3PSysClockConfig_t clockConfig;
    clockConfig.setSysClk400  = CyTrue;
    clockConfig.cpuClkDiv     = 2;
    clockConfig.dmaClkDiv     = 2;
    clockConfig.mmioClkDiv    = 2;
```

```
40004a18:   mov r3, #0
40004a1c:   str r3, [r11, #-8]
1142          clockConfig.setSysClk400
40004a20:   mov r3, #1
40004a24:   str r3, [r11, #-64]      ; 0x
1143          clockConfig.cpuClkDiv
```

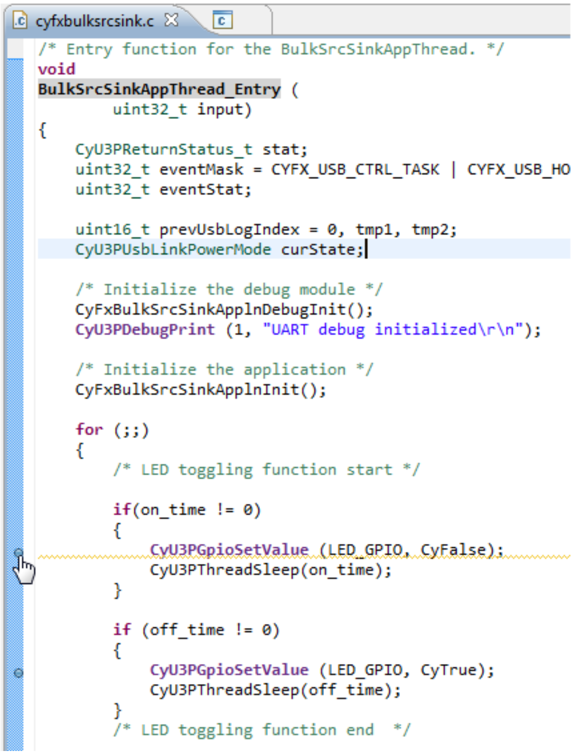
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)] C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 11:27 AM)

```
1044-var-create - clockConfig
1045-var-evaluate-expression var2
1044^done,name="var3",numchild="6",value="{...}",type="CyU3PSysClockConfig_t",thread-id="1",has_more="0"
(gdb)
1045^done,value="0"
(gdb)
1046-var-evaluate-expression var3
1046^done,value="{...}"
(gdb)
```

7. Apply breakpoints wherever necessary and click **Resume**. For example, apply breakpoints in the function BulkSrcSinkAppThread_Entry, as shown in Figure 3-29. To apply a breakpoint, double-click on the blue bar to the left of the line. This part of the firmware toggles the GPIO to which the blue LED (LED2) is connected.

   Note Do not add breakpoints in the sections of code where USB requests are handled (CyFxBulkSrcSinkApplnUSBSetupCB, CyFxBulkSrcSinkApplnUSBEventCB functions in the USBBulkSourceSinkLED firmware project), because they affect the USB enumeration process or any other control request handling. Similarly, avoid placing breakpoints in the GPIF callback or DMA callback sections of the firmware project, as these functions are called inside the FX3 SDK libraries. Applying a breakpoint inside these functions may affect how the firmware works in applications where FX3 is receiving continuous data over GPIF II and is streaming that data to the host.

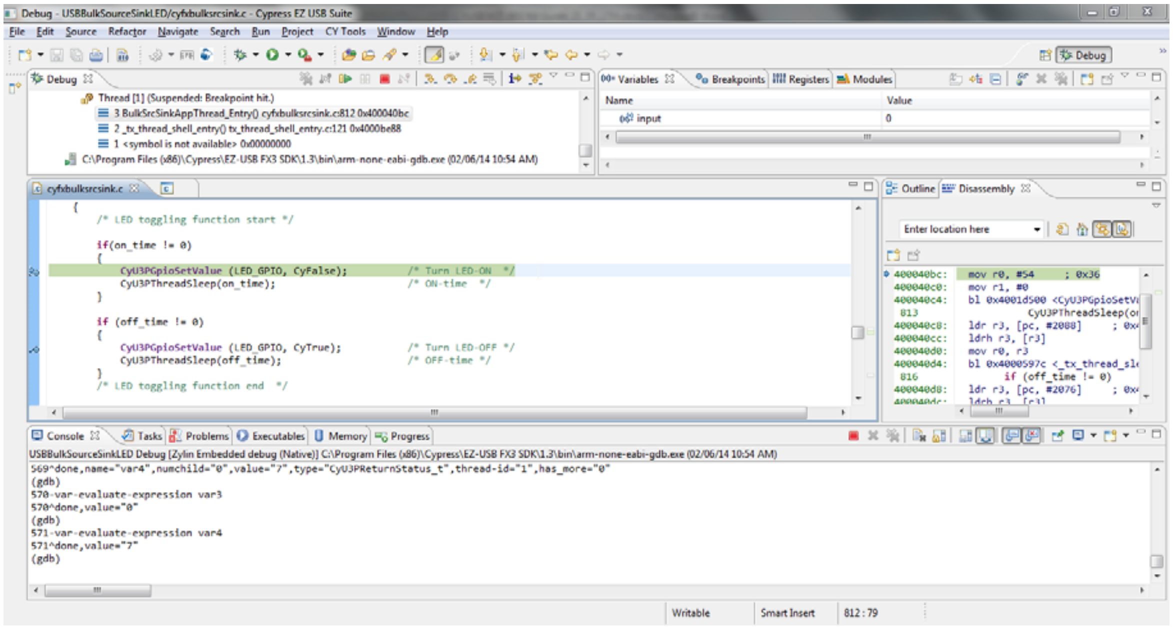
Figure 3-29. Applying Breakpoints in the Firmware



```
/* Entry function for the BulkSrcSinkAppThread. */
void
BulkSrcSinkAppThread_Entry (
        uint32_t input)
{
    CyU3PReturnStatus_t stat;
    uint32_t eventMask = CYFX_USB_CTRL_TASK | CYFX_USB_HO
    uint32_t eventStat;

    uint16_t prevUsbLogIndex = 0, tmp1, tmp2;
    CyU3PUsbLinkPowerMode curState;

    /* Initialize the debug module */
    CyFxBulkSrcSinkApplnDebugInit();
    CyU3PDebugPrint (1, "UART debug initialized\r\n");

    /* Initialize the application */
    CyFxBulkSrcSinkApplnInit();

    for (;;)
    {
        /* LED toggling function start */

        if(on_time != 0)
        {
            CyU3PGpioSetValue (LED_GPIO, CyFalse);
            CyU3PThreadSleep(on_time);
        }

        if (off_time != 0)
        {
            CyU3PGpioSetValue (LED_GPIO, CyTrue);
            CyU3PThreadSleep(off_time);
        }
        /* LED toggling function end  */
```

8. After the debugger stops at "main", click **Resume**. The debugger stops at the first breakpoint, as shown in Figure 3-30. This line of the firmware switches the blue LED (LED2) ON. The second breakpoint is applied at the line of firmware that switches the blue LED (LED2) OFF.

Figure 3-30. Debugger Stops at First Breakpoint



```
Thread [1] (Suspended: Breakpoint hit.)
    3 BulkSrcSinkAppThread_Entry() cyfxbulksrcsink.c:812 0x400040bc
    2 _tx_thread_shell_entry() tx_thread_shell_entry.c:121 0x4000be88
    1 <symbol is not available> 0x00000000
C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 10:54 AM)
```

Name	Value
input	0

```
    {
        /* LED toggling function start */

        if(on_time != 0)
        {
            CyU3PGpioSetValue (LED_GPIO, CyFalse);          /* Turn LED-ON  */
            CyU3PThreadSleep(on_time);                      /* ON-time  */
        }

        if (off_time != 0)
        {
            CyU3PGpioSetValue (LED_GPIO, CyTrue);           /* Turn LED-OFF */
            CyU3PThreadSleep(off_time);                     /* OFF-time */
        }
        /* LED toggling function end  */
```

```
400040bc:   mov r0, #54      ; 0x36
400040c0:   mov r1, #0
400040c4:   bl 0x4001d500 <CyU3PGpioSetVa
 813                  CyU3PThreadSleep(o
400040c8:   ldr r3, [pc, #2088]      ; 0x
400040cc:   ldrh r3, [r3]
400040d0:   mov r0, r3
400040d4:   bl 0x4000597c <_tx_thread_sl
 816              if (off_time != 0)
400040d8:   ldr r3, [pc, #2076]      ; 0x
400040dc:   ldrh r3, [r3]
```

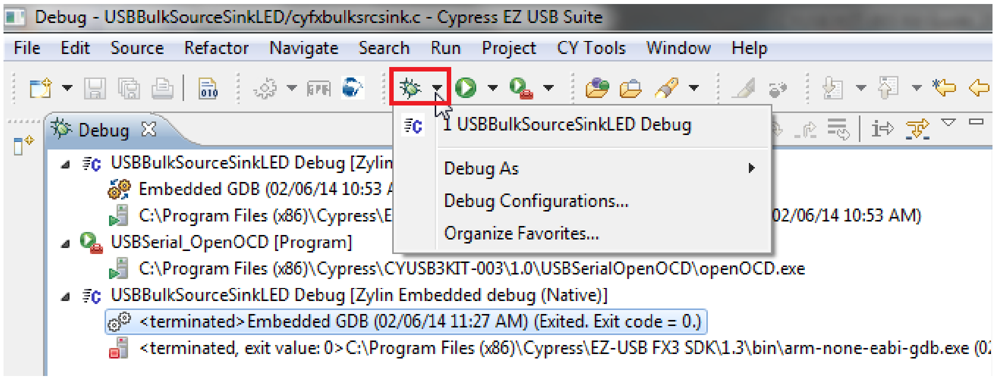
```
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)] C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (02/06/14 10:54 AM)
569^done,name="var4",numchild="0",value="7",type="CyU3PReturnStatus_t",thread-id="1",has_more="0"
(gdb)
570-var-evaluate-expression var3
570^done,value="0"
(gdb)
571-var-evaluate-expression var4
571^done,value="7"
(gdb)
```

9. Click the **Step Over** icon until you reach the second breakpoint. Note that if the development board is connected to the SuperSpeed host, the debugger will reach the second breakpoint. If the development board is connected to the high-speed host, the debugger will not reach the second breakpoint, because the initial state of the blue LED (LED2) is that it will stay on. This part of the code is in an infinite loop and clicking **Resume** will make the debugger stop at the first and second breakpoints one after the other. Use the **Step Into** or **Step Over** icons when required.

   Note All FX3 SDK APIs should be "stepped over". "Stepping into" FX3 SDK APIs (APIs are the function calls that start with "CyU3P" in the firmware) will result in a warning message of "source not available at…". If you encounter this message, click the **Step Return** icon.

10. To stop the debug session, click the **Terminate** icon (see Figure 3-28). When the debug session is terminated, it can be launched again with the Debug Configurations icon shown in Figure 3-31. Be sure to reset FX3 before loading the debug configuration again. Clicking the drop-down arrow of the **Debug Configurations** icon will display all the debug configurations available. You can select the desired debug configuration from the drop-down list.

Figure 3-31. Debug Configurations Icon


Debug - USBBulkSourceSinkLED/cyfxbulksrcsink.c - Cypress EZ USB Suite
File Edit Source Refactor Navigate Search Run Project CY Tools Window Help
Debug
1 USBBulkSourceSinkLED Debug
Debug As
Debug Configurations...
Organize Favorites...

```
USBBulkSourceSinkLED Debug [Zylin
    Embedded GDB (02/06/14 10:53 A
    C:\Program Files (x86)\Cypress\E                                    02/06/14 10:53 AM)
USBSerial_OpenOCD [Program]
    C:\Program Files (x86)\Cypress\CYUSB3KIT-003\1.0\USBSerialOpenOCD\openOCD.exe
USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)]
    <terminated>Embedded GDB (02/06/14 11:27 AM) (Exited. Exit code = 0.)
    <terminated, exit value: 0>C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (0
```

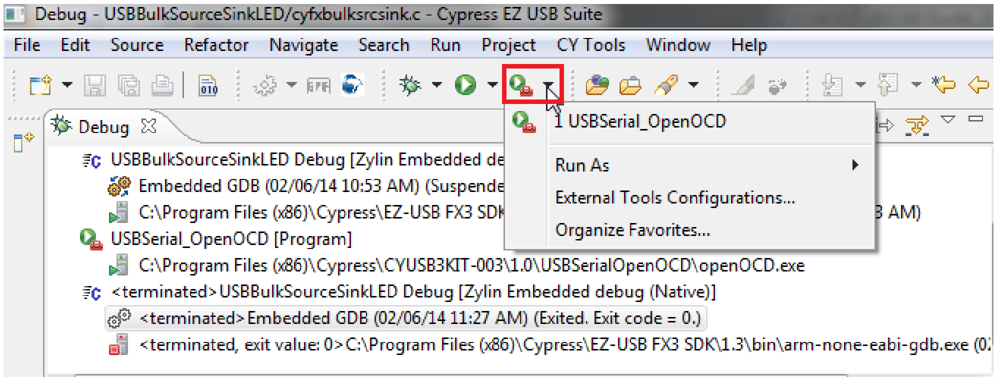
11. To completely stop the debug session, drop the GDB connection, and terminate the OpenOCD tool (running in the background), click the **Drop GDB Session** icon twice, instead of clicking the

Terminate icon as explained in the previous step. Clicking the **Drop GDP** Session icon the first time stops the GDB session, and then clicking it again terminates the OpenOCD application.

Note It is recommended that you drop the GDB session and terminate the OpenOCD application before unplugging the USB cable of the integrated debugger, because the OpenOCD tool keeps polling for the availability of the integrated debugger. If the integrated debugger is unplugged without dropping the GDB session, continuous "CyJTAGRead failed" and "CyJTAGWrite failed" messages will be flashed in the Console window of the EZ USB Suite. Terminating the OpenOCD application will stop this activity.

If the GDB session is dropped and the OpenOCD application is terminated, then you should run the external tool configuration before starting the debug session again. Figure 3-32 shows the icon for **External Tools Configurations**. The drop-down list associated with this icon identifies all the external tools configurations saved with the EZ USB Suite. When the external tool configuration is run, you can launch the debug session to debug the firmware.

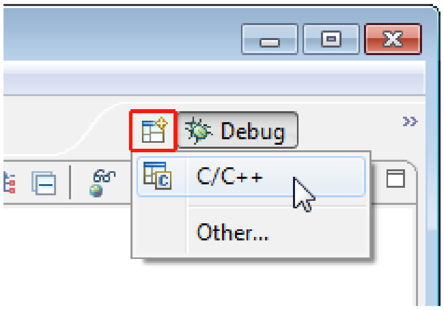
Figure 3-32. External Tools Configurations Icon


Debug - USBBulkSourceSinkLED/cyfxbulksrcsink.c - Cypress EZ USB Suite
File Edit Source Refactor Navigate Search Run Project CY Tools Window Help
Debug
1 USBSerial_OpenOCD
Run As
External Tools Configurations...
Organize Favorites...

USBBulkSourceSinkLED Debug [Zylin Embedded de
Embedded GDB (02/06/14 10:53 AM) (Suspende
C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK ... 3 AM)
USBSerial_OpenOCD [Program]
C:\Program Files (x86)\Cypress\CYUSB3KIT-003\1.0\USBSerialOpenOCD\openOCD.exe
<terminated>USBBulkSourceSinkLED Debug [Zylin Embedded debug (Native)]
<terminated>Embedded GDB (02/06/14 11:27 AM) (Exited. Exit code = 0.)
<terminated, exit value: 0>C:\Program Files (x86)\Cypress\EZ-USB FX3 SDK\1.3\bin\arm-none-eabi-gdb.exe (0.

The **Debug** perspective (view) is the best one to use for debug sessions. To return to the code development perspective, click the **Open Perspective** icon and select **C/C++**, as shown in Figure 3-33.

Figure 3-33. Icon to Switch to C/C++ Perspective



4. Hardware

This chapter describes the hardware interfaces and circuits available on the SuperSpeed Explorer Kit development board. It covers the following topics:

- Power supply
- USB 3.0 receptacle connector
- FX3 clocking mechanism using onboard crystal
- User push button
- User LED
- GPIF II connector
- Reset circuit
- Serial interfaces: I^{2}S, I^{2}C, SPI, UART, and JTAG

4.1 Power Supply

The SuperSpeed Explorer Kit development board is powered from the USB 3.0 connector J1. This development board does not support self-powered mode, although the FX3 device does support it.

Select voltage levels for FX3 I/O power domains through the J2 jumper, as shown in Table 4-1.

Table 4-1. Power Supply Domain

Power Domains	Jumper	Position	Voltage Level
VIO1, VIO2, VIO3	J2	Short (default)	3.3 V
VIO1, VIO2, VIO3	J2	Open	1.8 V

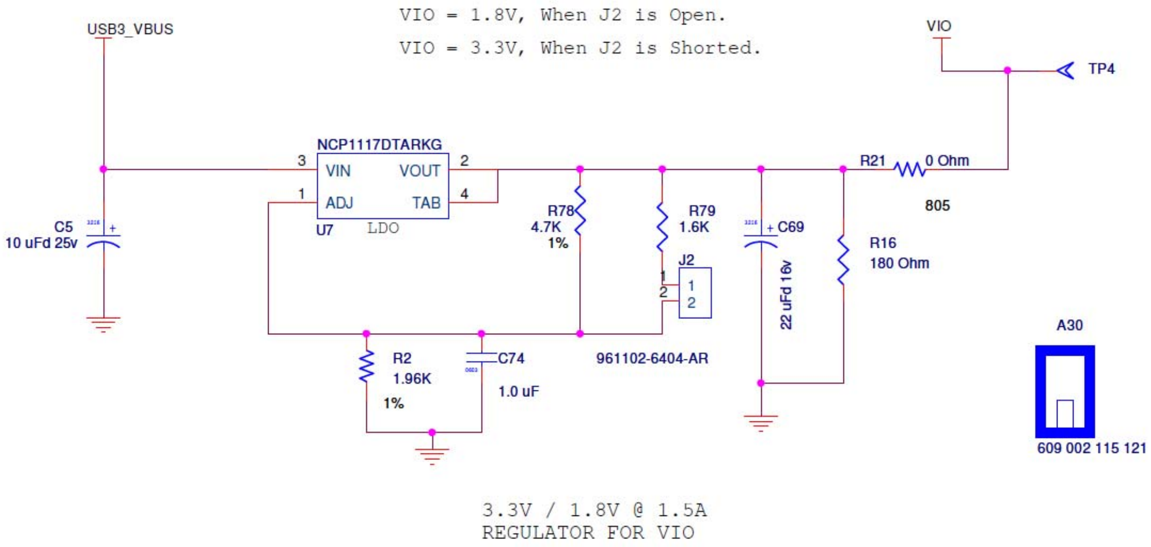
FX3 I/O voltage domains VIO4 and VIO5 are fixed to 3.3 V. If you are using the onboard SRAM, you must select the 3.3 V option.

The FX3 device has additional power domains (U3TXVDDQ, U3RXVDDQ, AVDD, and VDD), which are fixed at 1.2 V on the development board.

Refer to the "Pin Description" section of the *EZ-USB FX3: SuperSpeed USB Controller datasheet* (www.cypress.com/go/CYUSB301X) for details on configuring the I/O in each power domain.

Figure 4-1 shows the circuit used to switch the voltage level using the J2 jumper.

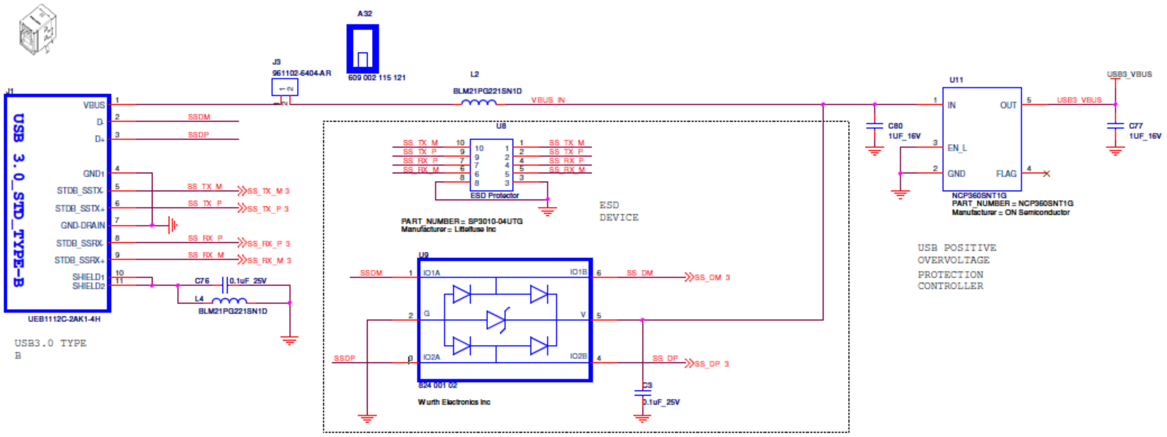
Figure 4-1. Circuit to Switch Voltage Level for FX3 VIO Domain



4.2 USB 3.0 Receptacle Connector

A standard B-type USB 3.0 connector is on the development board. Figure 4-2 shows the USB 3.0 pins (SS_TX_M, SS_TX_P, SS_RX_P, and SS_RX_M) and USB 2.0 pins (D+ and D–) that are available on the J1 USB connector. The USB 3.0 and USB 2.0 lines go through an ESD protection device. This connector accepts either the newer USB 3.0 plug or an older USB 1.1/2.0 plug.

Figure 4-2. USB 3.0 Type B Connector and ESD Device



4.3 FX3 Clock

On the development board, the clock for the FX3 is provided by an onboard 19.2-MHz crystal connected to the FX3 XTALIN and XTALOUT pins, as shown in Figure 4-3. The FSLC[0:2] lines of FX3 are tied to ground to select the 19.2-MHz crystal for clocking, as shown in Figure 4-4.

Figure 4-3. Crystal Circuit

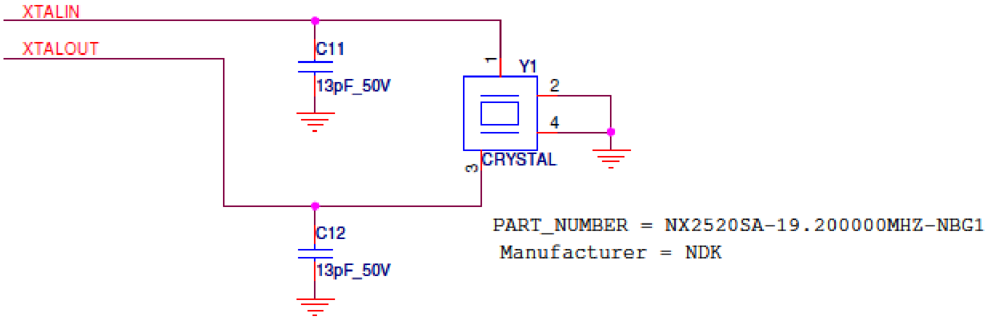
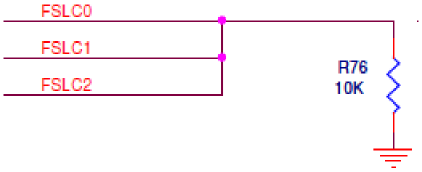


Figure 4-4. FSLC[0:2] Lines Pulled to Ground

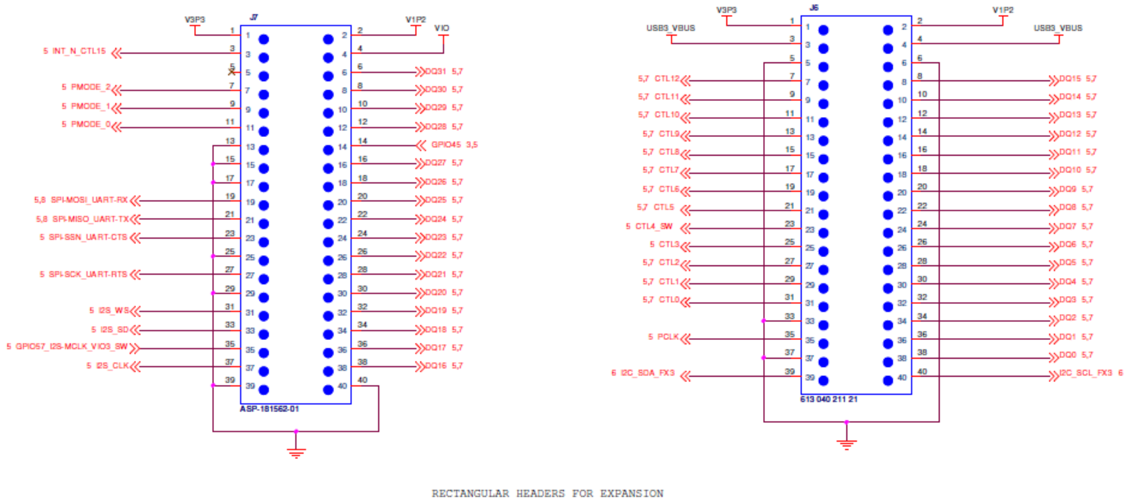


4.4 GPIF II Connector

The General Programmable Interface, Gen 2 (GPIF II) enables functionality similar to, but more advanced than that of the FX2LP™ GPIF. It is a programmable state machine that enables a flexible interface, functioning either as a master or a slave using industry-standard or proprietary interfaces. You can implement both parallel and serial interfaces with GPIF II. The development board provides two rectangular connectors to interface with external processors, ASICs, DSPs, or FPGAs, as Figure 4-5 shows.

If the GPIF II is not used as the FX3 firmware, these pins become the FX3 GPIO pins.

Figure 4-5. GPIF II Lines on Rectangular Connectors



4.4.1 SuperSpeed Explorer Kit Interconnect Boards

Two popular applications of FX3 are the following:

- Use FX3 as a USB controller for an image sensor to stream uncompressed data
- Implement the synchronous slave FIFO configuration of FX3 to interface to an FPGA

The application note, *AN75779 - How to Implement an Image Sensor Interface with EZ-USB® FX3™ in a USB Video Class (UVC) Framework* (www.cypress.com/go/AN75779) explains how to implement an image sensor interface with FX3 in a USB video class (UVC) framework. The project provided with this application note interfaces FX3 with an Aptina MT9M114 Image Sensor (www.aptina.com/products/soc/mt9m114/).

The application note, *AN65974 - Designing with the EZ-USB® FX3™ Slave FIFO Interface* (www.cypress.com/go/AN65974), explains how to use FX3 in a slave FIFO configuration to interface to both Xilinx and Altera FPGAs. This application note uses the Xilinx Spartan 6 SP601 Evaluation Kit (www.xilinx.com/products/boards-and-kits/EK-S6-SP601-G.htm) and the Altera Cyclone III Starter Board (www.altera.com/products/devkits/altera/kit-cyc3-starter.html) to explain the application. FPGA codes and an FX3 firmware project are available with the application note.

Table 4-2 shows the interconnect boards that are available for the SuperSpeed Explorer Kit to interface with Aptina image sensors and Xilinx and Altera FPGA boards.

Table 4-2. Interconnect Boards Available for SuperSpeed Explorer Kit

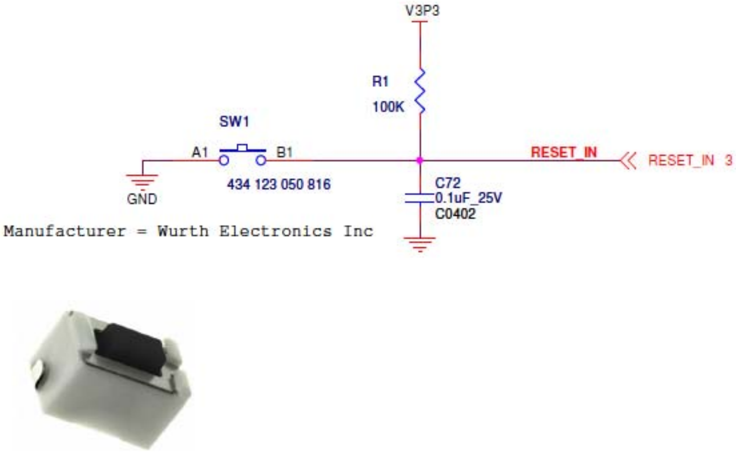
Part No.	Name	Interface for	Link
CYUSB3ACC-004	Aptina Interconnect	Aptina image sensor	www.cypress.com/go/CYUSB3ACC-004
CYUSB3ACC-005	FMC Interconnect	Xilinx FPGA board	www.cypress.com/go/CYUSB3ACC-005
CYUSB3ACC-006	HSMC Interconnect	Altera FPGA board	www.cypress.com/go/CYUSB3ACC-006

For more information on the interconnect boards, visit the web pages provided in the table.

4.5 Reset Circuit

You can reset the FX3 device from an onboard push button, SW1. The reset circuit used for FX3 on the SuperSpeed Explorer Kit is shown in Figure 4-6.

Figure 4-6. Reset Circuit

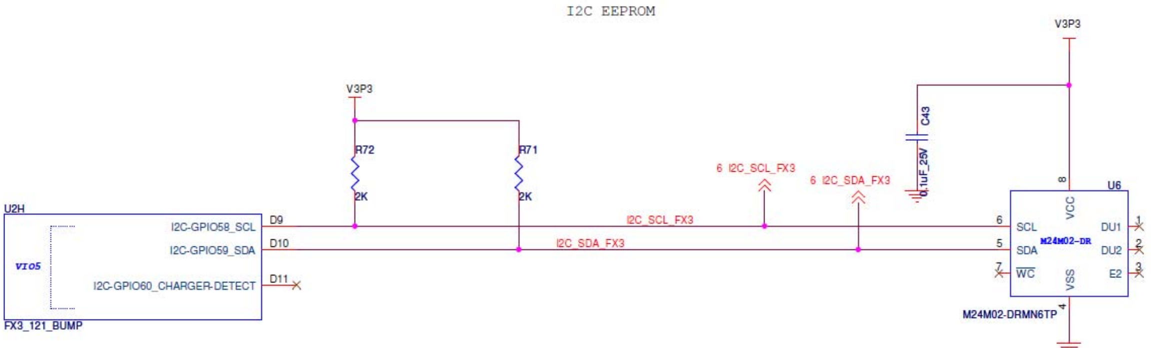


4.6 Serial Interfaces

4.6.1 I^{2}C

The I^{2}C interface lines on the FX3 device are available on the rectangular connector, J6, for probing and expansion. These lines also connect to the onboard EEPROM device and USB-Serial IC as shown in Figure 4-7 and Figure 4-8. Figure 4-7 shows the SuperSpeed Explorer Kit EEPROM circuit. To avoid contention with the EEPROM, anything you connect to the I2C bus should avoid I2C addresses that start with 1010 or 1011.

Figure 4-7. EEPROM and Circuit



For more details on I^{2}C EEPROM boot, including I^{2}C boot image format, refer to the application note, *AN76405 - EZ-USB FX3 Boot Options* (www.cypress.com/go/AN76405).

4.6.2 I^{2}S

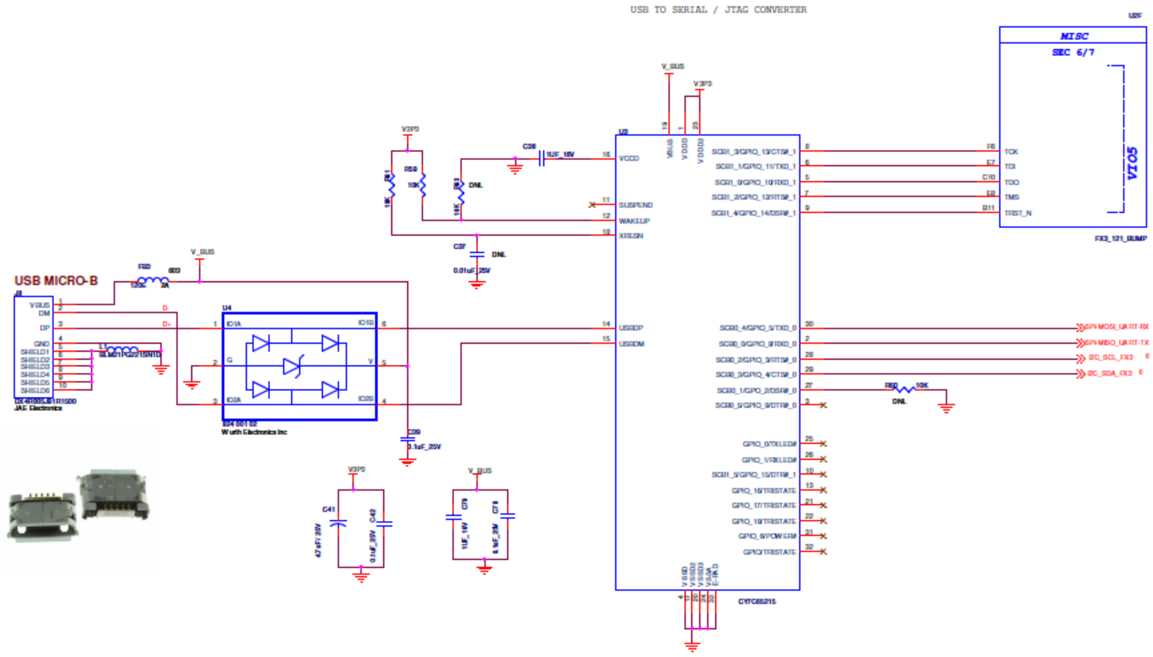
FX3 includes an I^{2}S port to support external audio codec devices. FX3 functions as an I^{2}S master (transmitter only). The I^{2}S interface comprises four signals: clock (I2S_CLK), serial data (I2S_SD), word select (I2S_WS), and master system clock (I2S_MCLK). FX3 can generate the system clock as an output on the I2S_MCLK line or accept an external system clock input on the same line. All four I^{2}S lines come out on the rectangular connector J7.

4.6.3 SPI and UART

FX3 supports an SPI master interface on the serial peripheral port. The SPI I/O lines are shared with the UART I/O lines on the FX3 device.

The FX3 SPI/UART lines are brought out to the pins of a rectangular connector. The same lines are also connected to the USB-Serial IC (Figure 4-8) on the SuperSpeed Explorer Kit. The USB-Serial IC enumerates with one interface as a virtual COM port.

Figure 4-8. USB-Serial IC



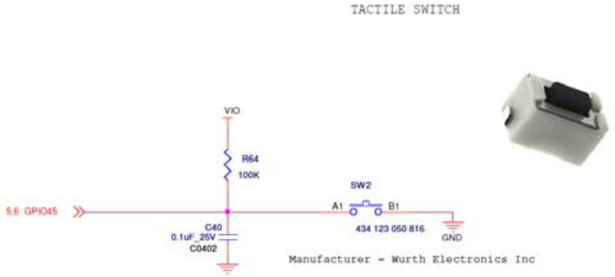
4.6.4 JTAG

FX3 debug is available using the FX3 JTAG port and the Cypress USB-Serial IC as a dedicated JTAG master. The USB-Serial IC implements a JTAG TAP controller so no additional hardware is required for JTAG operation. The Eclipse development software includes an OpenOCD driver for this JTAG port. Figure 4-8 shows the circuit for the JTAG interface using the USB-Serial IC.

4.6.5 User Push Button (SW2)

As shown in Figure 4-9, a push button is connected to GPIO45 of the FX3, which can be used by the user application.

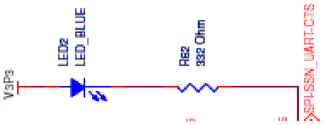
Figure 4-9. User Push Button - SW2



4.6.6 User LED (LED2)

As shown in Figure 4-10, the blue LED (LED2) is connected to GPIO54(SPI-SSN) of FX3. The LED glows when GPIO is driven low.

Figure 4-10. User LED- LED2



A. Appendix

A.1 Troubleshooting

A.1.1 Manual Installation of a Cypress Driver

1. In Windows, invoke **Start**; right-click **Computer** and choose **Properties** > **Select Device Manager**.

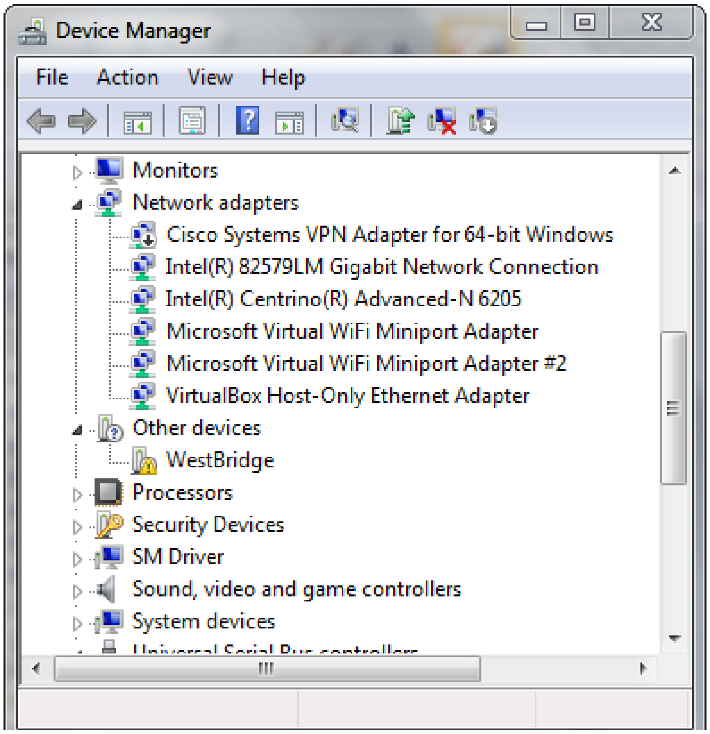
   Note In Windows XP, invoke **Start**; right-click **My Computer** and choose **Properties** > **Hardware tab** > **Select Device Manager**.

2. Locate the FX3 or USB-Serial device entry with a yellow symbol in the **Other devices** list.

   Note FX3 enumerates as **WestBridge**® (see Figure A-1) when the J4 jumper is inserted before connecting the board to the computer. The FX3 device belongs to the WestBridge family of Cypress's USB 3.0 controllers. Therefore, when there are no drivers installed and there is no valid firmware running, the FX3 device displays the entry **WestBridge** in the Device Manager. When the J4 jumper is not inserted, that is, when FX3 boots from I^{2}C and there is a valid firmware running in FX3's RAM, FX3 enumerates with the string descriptors provided in the firmware. In the USBBulkSourceSinkLED firmware, which is provided in the EEPROM by default, FX3 enumerates with the string descriptor **FX3** when no drivers are installed.

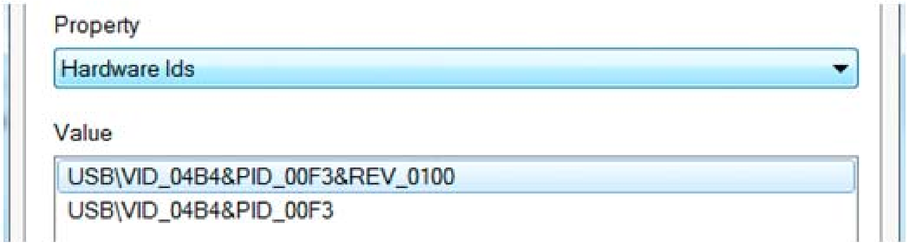
   The USB-Serial device enumerates with the entry **USB-Serial (Dual Channel)**.

Figure A-1. FX3 Device Entry in Windows Device Manager


Device Manager
File
Action
View
Help
Monitors
Network adapters
Cisco Systems VPN Adapter for 64-bit Windows
Intel(R) 82579LM Gigabit Network Connection
Intel(R) Centrino(R) Advanced-N 6205
Microsoft Virtual WiFi Miniport Adapter
Microsoft Virtual WiFi Miniport Adapter #2
VirtualBox Host-Only Ethernet Adapter
Other devices
WestBridge
Processors
Security Devices
SM Driver
Sound, video and game controllers
System devices
Universal Serial Bus controllers

3. Right-click on the FX3 or USB-Serial device entry to verify the VID/PID of the device. Choose **Properties** > **Details**. Select **Hardware Ids** and observe if the VID/PID for the **WestBridge** entry is 0x04B4/0x00F3, as shown in Figure A-2.

Figure A-2. Default FX3 Bootloader VID/PID



Property

Hardware Ids

Value

USB\VID_04B4&PID_00F3&REV_0100
USB\VID_04B4&PID_00F3

4. Right-click on the FX3 or USB-Serial device entry and select **Browse my computer for driver software**. Provide the location of drivers in the field **Search for driver software in the location**.

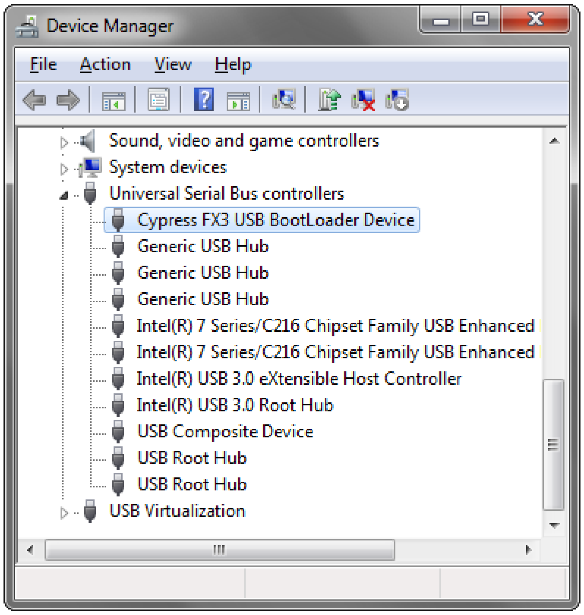
   Note The drivers are located in the path `<Install Directory>\Cypress\SuperSpeed Explorer Kit\1.0\Driver\bin`. Provide the complete path, depending on the version of Windows OS. For Windows 7 and above, the default install directory is `C:\Program Files (x86)`. For Windows XP, the default install directory is `C:\Program Files`. For example, on a 64-bit Windows 7 machine, the default location of driver is `C:\Program Files (x86)\Cypress\SuperSpeed Explorer Kit\1.0\Driver\bin\Win7\x64`.

5. The **Device Manager** window should remove the device entry and identify the same entry with the friendly name provided in the *.inf* file for the particular VID/PID combination. For example, when the J4 jumper is inserted, the SuperSpeed Explorer Kit development board enumerates with the string **WestBridge** and VID/ PID 0x04B4/0x00F3 and after driver installation, this entry appears as **Cypress FX3 USB BootLoader Device**, as shown in Figure A-3.

   Note After driver installation, the USB-Serial interfaces can be identified as:

   - USB Serial Port (COM#): Acts as a UART interface
   - USB-Serial (Dual Channel) Vendor MFG: Used to configure the USB-Serial IC
   - USB-Serial (Dual Channel) Vendor 1: Acts as a JTAG interface

Figure A-3. FX3 Entry in Device Manager After Driver Binding



Sound, video and game controllers
System devices
Universal Serial Bus controllers
Cypress FX3 USB BootLoader Device
Generic USB Hub
Generic USB Hub
Generic USB Hub
Intel(R) 7 Series/C216 Chipset Family USB Enhanced
Intel(R) 7 Series/C216 Chipset Family USB Enhanced
Intel(R) USB 3.0 eXtensible Host Controller
Intel(R) USB 3.0 Root Hub
USB Composite Device
USB Root Hub
USB Root Hub
USB Virtualization

A.2 If You Have "Too Many" COM Ports

Some terminal programs do not allow high COM port numbers, for example COM17. The reason Windows assigns such high numbers is that many applications that create COM ports do not remove the port when the application is no longer running. To clear these unused COM ports, follow these steps:

1. Select **Start > All Programs > Accessories** and right-click **Command Prompt** to start a Command Prompt window.
2. Choose **Run As Administrator**.
3. In the DOS window, type (without quotes) ‘set devmgr_show_nonpresent_devices=1?’.
4. In the DOS window, type (without quotes) ‘start devmgmt.msc’. This brings up the Device Manager window.
5. In the **View** menu, select **Show hidden devices**.

Notice that the **Ports (COM & LPT)** entry may have many old COM ports; those that are not actually present are greyed out. To eliminate the ports you are no longer using, right-click it and select **Uninstall**. This will give Windows a chance to select lower COM numbers for the application.