CY4609, CY4603, and CY4613

HX3 Kits User Guide

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Safety Information

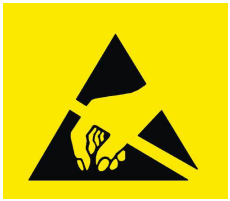
Regulatory Compliance

The CY4603, CY4609, and CY4613 kits are intended for use as a development platform for hardware or software in a laboratory environment. The board is designed as an open system, which does not include a shielded enclosure. This may cause interference to other electrical or electronic devices in close proximity. In a domestic environment, these products may cause radio interference. In such cases, you may be required to take adequate preventive measures. In addition, these boards should not be used near any medical equipment or RF devices.

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

The CY4603, CY4609, and CY4613 kits as shipped from the factory have been verified to meet with the requirements of CE as a Class A product.





The CY4603, CY4609, and CY4613 kits contain 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. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused boards in the protective shipping package.



End-of-Life/Product Recycling

These kits have an end-of life five years from the date of manufacture mentioned on the back of the box. Contact your nearest recycler for discarding 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 such a workstation is not available, use appropriate ESD protection by wearing an antistatic wrist strap attached to the chassis ground (any unpainted metal surface) on your board when handling parts.

Handling Boards

CY4603, CY4609, and CY4613 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 board over any surface.

1. Introduction

Thank you for your interest in the CY4609, CY4603, and CY4613 HX3 kits. HX3 is a family of USB 3.0 hub controller parts compliant to USB 3.0 specification revision 1.0. These parts support Low-Speed (LS), Full-Speed (FS), Hi-Speed (HS), and SuperSpeed (SS) peripherals.

The CY4609 Reference Design Kit (RDK) is a small form-factor, ready-to-use hub reference design. The CY4603 Development Kit (DVK) provides the flexibility to configure and evaluate all HX3 features. The CY4613 DVK implements advanced features, such as Shared Link™ and ACA-Dock. This document is the common user guide for the three HX3 kits, which are based on three different HX3 USB 3.0 hub controller parts. Table 1-1 compares the features of these kits.

Table 1-1. Feature Comparison of HX3 Kits

Feature	CY4609	CY4603	CY4613
Kit type	RDK	DVK	DVK
HX3 USB 3.0 hub controller marketing part number	CYUSB3304-68LTXC	CYUSB3314-88LTXC	CYUSB3328-88LTXC
Board size	3.3 × 2.0 inches	3.7 × 3.115 inches	4.5 x 3.6 inches
Downstream port capabilities			
Number of downstream ports	4 (4 USB 3.0 ports)	4 (4 USB 3.0 ports)	6 (2 USB 3.0, 2 Shared Link[a] SS and 2 Shared Link USB 2.0 ports)
Support for LS, FS, HS, and SS peripherals	Yes	Yes	Yes
Support for USB-IF Battery Charging (BC) specification v1.2	Yes	Yes	Yes[b]
Emulation of Apple charging	Yes	Yes	Yes
Ghost Charging™ support[c]	Yes	Yes	Yes
Power control for downstream ports			
Single ganged power control for all four ports	Yes	No	No
Independent power control for each port	No	Yes	Yes
Configuration features			
Selection of firmware boot mode	Yes	Yes	Yes
Configuration using pin strap GPIOs	No	Yes	No
Power supply			
AC-DC power adapter type	5 V/4 A	5 V/4 A	12 V/3 A

Table 1-1. Feature Comparison of HX3 Kits

Feature	CY4609	CY4603	CY4613
Status LEDs			
Power	Yes	Yes	Yes
Hub Suspend Status	Yes	Yes	Yes
Downstream Port Status Indicators	No	Yes	Yes
Shared Link™	No	No	Yes
ACA-Dock[d]	No	No	Yes

a. Shared Link is a Cypress-proprietary feature that enables a USB 3.0 port to be split into an embedded SS port and a standard USB 2.0 port.
b. Battery Charging is supported on standard USB 3.0 and Shared Link USB 2.0 ports only.
c. Ghost Charging is a unique feature with which a downstream port emulates a dedicated charging port (DCP) to support charging even when the upstream port is not connected to a USB host.
d. In traditional USB topologies, the host DS port provides VBUS to enable and charge the connected devices. With OTG devices, however, the ACA-Dock provides VBUS and a method to charge the host. HX3 supports the ACA-Dock standard (see section 6 of the BC v1.2 specification for more details) by integrating the functions of the adaptor controller.

1.1 Kit Contents

Table 1-2. CY4603, CY4609, and CY4613 Kit Contents

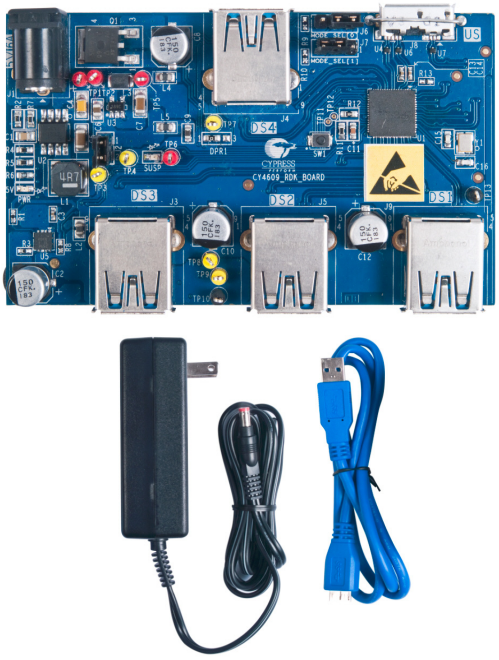
Kit	Kit Contents	List of Kit Contents
CY4609		One each of the following: - CY4609 RDK board - 5-V/4-A AC-DC power adapter - USB 3.0 standard-A to micro-B cable - Quick start guide

Table 1-2. CY4603, CY4609, and CY4613 Kit Contents *(continued)*

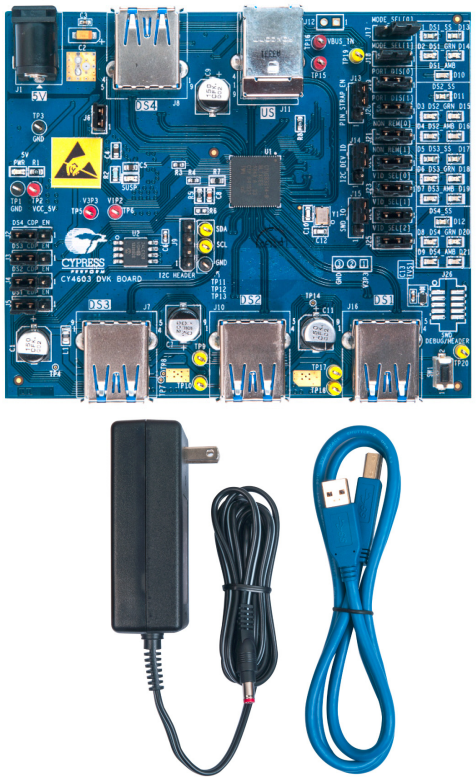
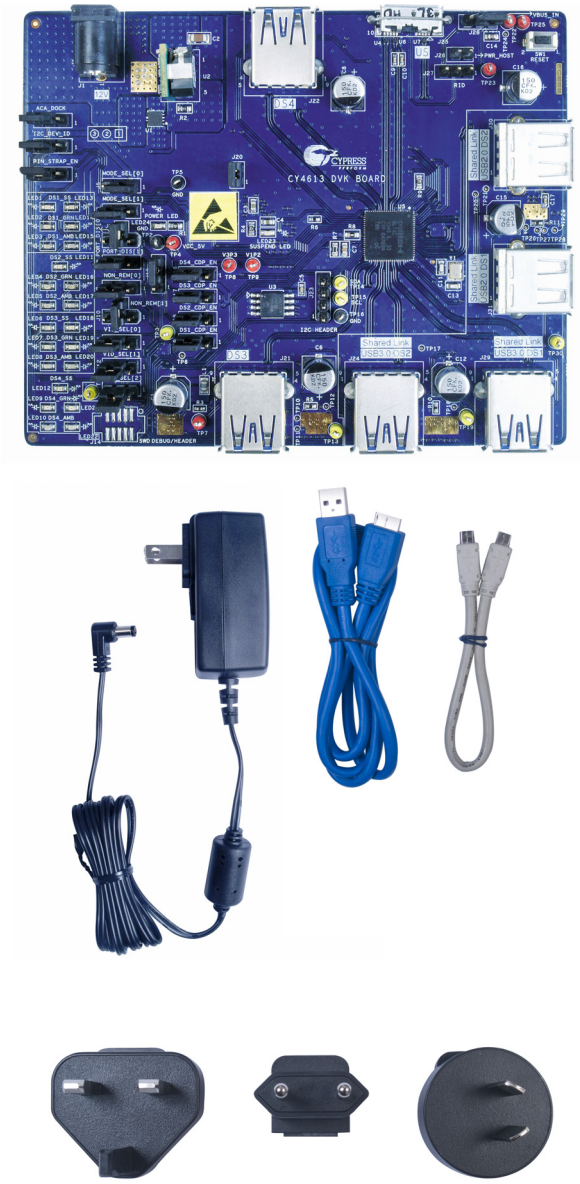
Kit	Kit Contents	List of Kit Contents
CY4603		One each of the following: - CY4603 DVK board - 5-V/4-A AC-DC power adapter - USB 3.0 standard-A to standard-B cable - Quick start guide

Table 1-2. CY4603, CY4609, and CY4613 Kit Contents *(continued)*

Kit	Kit Contents	List of Kit Contents
CY4613		One each of the following items: - CY4613 DVK board - 12-V/3-A AC-DC power adapter with four types of plugs - USB 3.0 standard-A to micro-B cable - USB 2.0 micro-B to micro-B connector with ID pin support - 5 jumpers - Quick start guide

1.2 HX3 Firmware Boot Modes

HX3 supports the following boot modes:

- **Custom firmware:** In this mode, HX3 boots from the firmware stored in an onboard I^2C EEPROM. This is the default factory setting for all three kits.
- **ROM firmware:** In this mode, HX3 boots from the internal ROM.

Refer to Table 3-4 to understand the jumper setting for these two modes.

1.3 Getting Started

This user guide helps to familiarize you with the CY4609 RDK, CY4603 DVK, and CY4613 DVK. The Software Installation chapter on page 13 describes step-by-step instructions to install the kit software for these kits. The Kit Operation chapter on page 17 describes how to configure the kits and evaluate the HX3 features. The HX3 Blaster Plus Tool chapter on page 41 describes the features of the tool and how to use it. The Hardware chapter on page 59 provides design details for both the kits. The Appendix on page 77 lists the troubleshooting procedure and hardware design details for these kits.

1.4 Additional Learning Resources

Visit the HX3 web page at www.cypress.com/hx3 for additional learning resources including datasheets and application notes. The web page also includes videos explaining the Shared Link and ACA-Dock features of HX3.

1.5 Technical Support

For assistance, go to www.cypress.com/go/support or contact our customer support at +1 (800) 858-1810 (in the U.S.) or +1 (408) 943-2600 (international) and follow the voice prompt.

1.6 Document Conventions

Table 1-3. 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: The Configuration Options section of the *HX3 datasheet* gives more details about the use of pin straps.
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.

1.7 Abbreviations

Table 1-4. List of Abbreviations

Abbreviation	Meaning
ACA	Accessory Charging Adapter
BC	Battery charging
CDP	Charging downstream port
DCP	Dedicated charging port
DSX_AMB LED	Downstream port X amber LED, where X can be from 1 to 4
DSX_GRN LED	Downstream port X green LED, where X can be from 1 to 4
DSX_SS LED	Downstream port X SuperSpeed LED, where X can be from 1 to 4
DVK	Development Kit
ESD	Electrostatic discharge
GUI	Graphical user interface
HS	Hi-Speed
I^2C	Inter-integrated circuit
I2C_DEV_ID	I^2C device identifier
KB	Kilobyte
LED	Light-emitting diode
LS	Low-Speed
NON_REM[X]	Nonremovable downstream port X, where X can be from 1 to 4; denotes an embedded port that is not exposed for connecting or disconnecting any USB device
OTG	On The Go
PC	Personal computer
PHY	Physical layer
PID	Product ID
PIN_STRAP_EN	Pin strap enable
PORT_DIS[X]	Port disable X, where X can be from 1 to 4
RDK	Reference Design Kit
ROM	Read-only memory
SWD_IO	Serial wire debug input/output interface
US	Upstream
USB	Universal Serial Bus
USB-IF	Universal Serial Bus Implementers Forum
VID	Vendor ID

2. Software Installation

2.1 Install Software

Follow these steps to install the kit software on a Windows-based PC or laptop:

1. Download the respective kit package from www.cypress.com/go/CY4609 or www.cypress.com/go/CY4603 or www.cypress.com/go/CY4613 based on the kit you have and start the installation. The kit package is available for download in two different installer formats:
   a. **Kit Setup** (*CY4609HX3RDKSetup.exe* for CY4609 RDK, *CY4603HX3DVKSetup.exe* for CY4603 DVK, or *CY4613HX3DVKSetup.exe* for CY4613 DVK): This installation package contains the HX3 Blaster Plus tool, Quick Start Guide, HX3 Kits User Guide, and hardware design files. It does not include the Windows installer and Microsoft .NET framework packages. If these packages are not on your computer, the installer provides links to download and install them from the Internet.
   b. **Kit ISO** (*CY4609HX3RDK_RevSS.iso* for CY4609 RDK, *CY4603HX3DVK_RevSS.iso* for CY4603 DVK, or *CY4613HX3DVK_RevSS.iso* for CY4613 DVK): This file is a complete package, stored in a CD-ROM image format that can be used to create a CD or extract using ISO extraction programs, such as WinZip or WinRAR. This file includes the HX3 Blaster Plus tool, Quick Start Guide, HX3 Kits User Guide, and hardware design files.
2. Click **Next** on the first screen to start the installation, as shown in Figure 2-1; select **Typical** on the second screen and click **Next**, as shown in Figure 2-2.

   Note: The remaining steps in this section explain the installation procedure for CY4609. The same procedure can be used to install CY4603 or CY4613.

Figure 2-1. Initiating CY4609 Software Installation

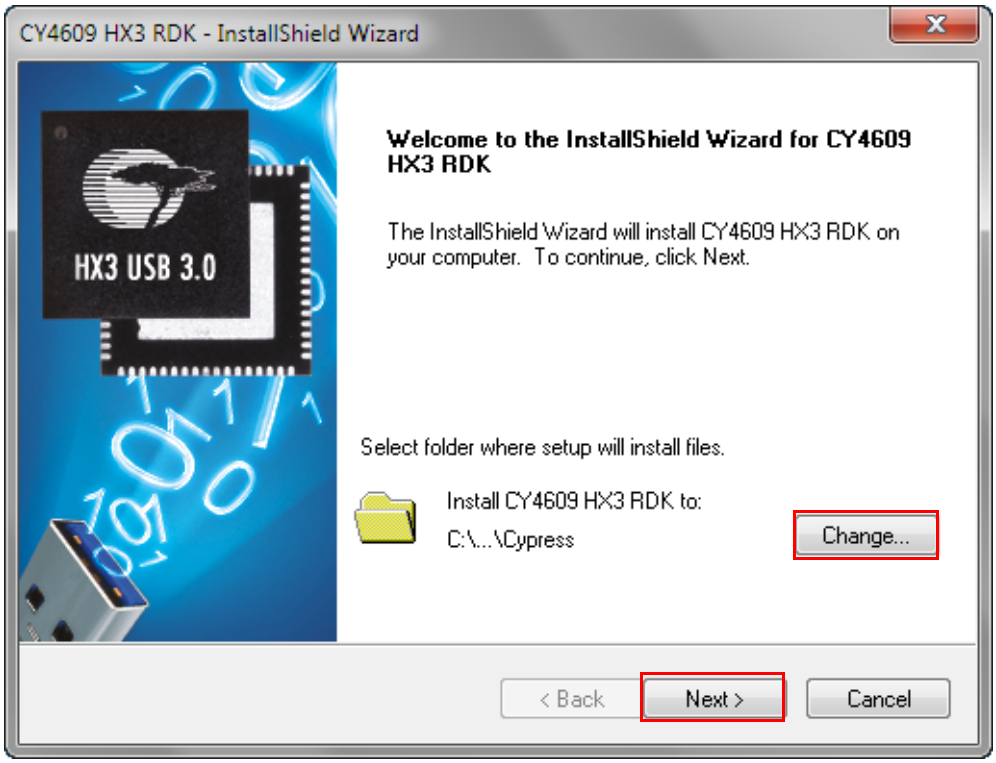
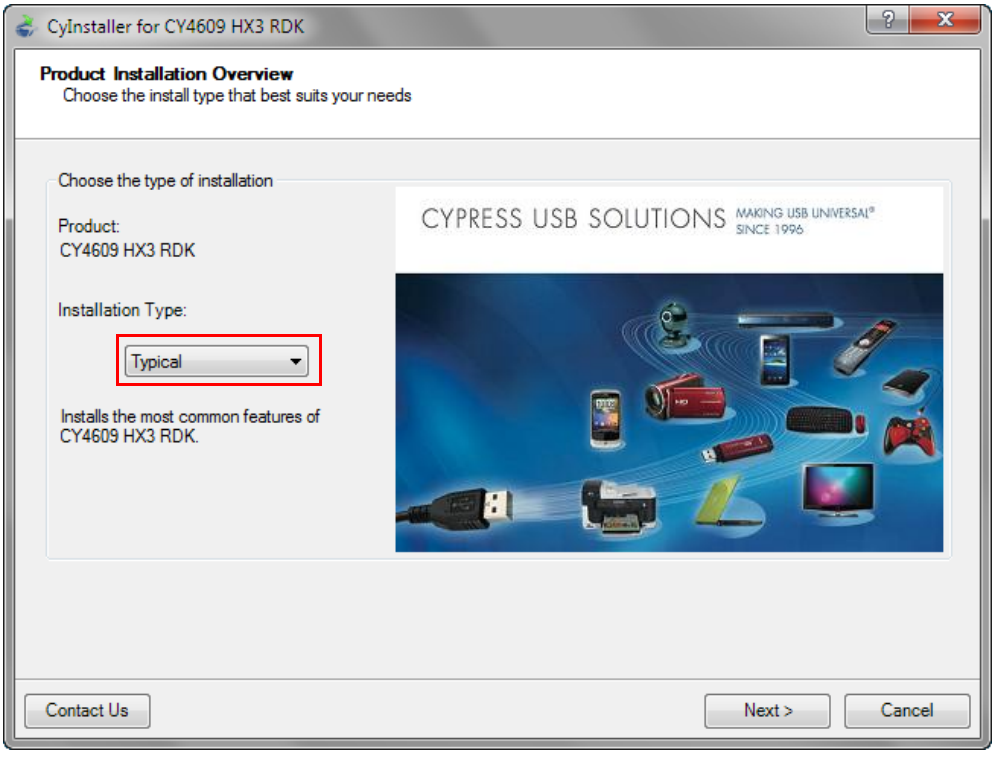
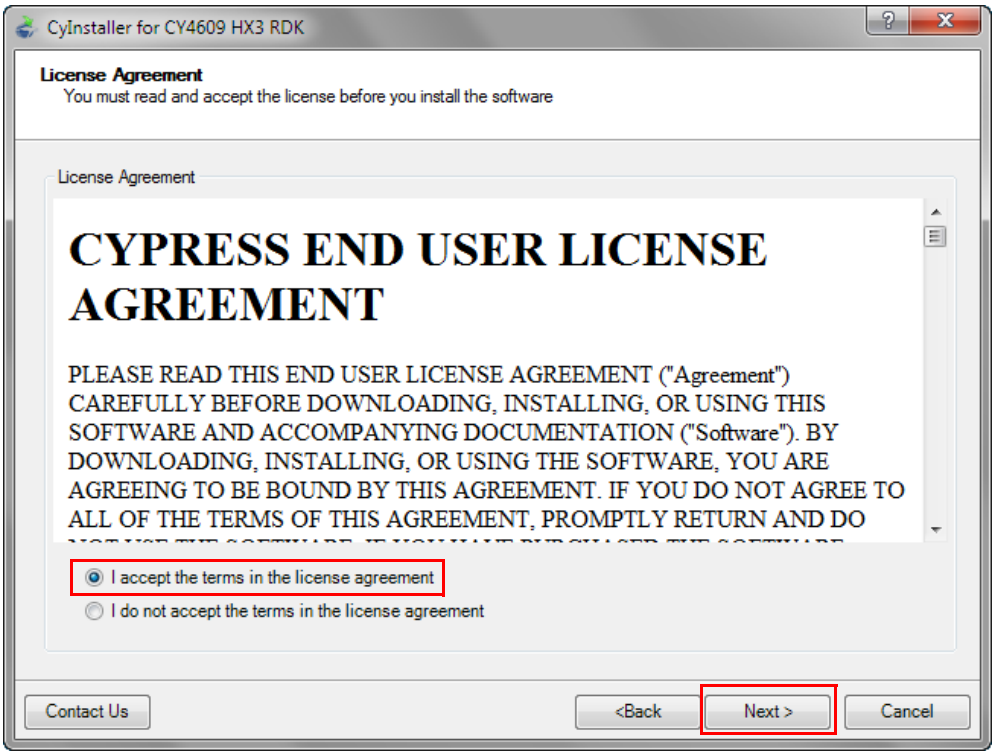


Figure 2-2. Choosing Installation Type



3. Read and accept the Cypress End-User License Agreement and click **Next** to continue, as shown in Figure 2-3.

Figure 2-3. CY4609 End User License Agreement



4. Wait for the installation to complete.
5. After the installation is complete, the contents are available at the following location:

   CY46xx: `<Install Directory>\CY46XX HX3 <RDK/DVK>\1.0`

   HX3 Blaster Plus: `<Install Directory>\HX3 Blaster Plus`

   Note 1: On the Windows 32-bit platform, the default `<Install Directory>` is `C:\Program Files\Cypress`; on the Windows 64-bit platform, it is `C:\Program Files(x86)\Cypress`.

   Note 2: HX3 Blaster Plus is a tool to configure HX3. The HX3 Blaster Plus Tool chapter on page 41 explains the procedure to run the tool.

2.2 Install Hardware

The kits do not require any hardware installation.

2.3 Uninstall Software

You can uninstall the kit software using one of the following methods:

- Go to **Start > All Programs > Cypress > Cypress Update Manager**; click the **Uninstall** button associated with the **Cypress CY46XX HX3 <RDK/DVK> Rev **** entry in the Cypress Update Manager table.
- Go to **Start > Control Panel > Programs and Features**; select the **Cypress CY46XX HX3 <RDK/DVK> Rev **** program from the list and click the **Uninstall/Change** button.

3. Kit Operation

This chapter provides details about the board interfaces, jumper settings, and the procedure to operate the HX3 kits.

3.1 Overview of CY4609 RDK

The CY4609 RDK (Figure 3-1 and Figure 3-2) enables you to evaluate the features of Cypress's CYUSB330X-68LTXC USB 3.0 hub controller parts. The RDK is powered using an external 5-V/4-A AC-DC power adapter.

3.1.1 CY4609 Board Interfaces

Figure 3-1. CY4609 Board (Top Side)

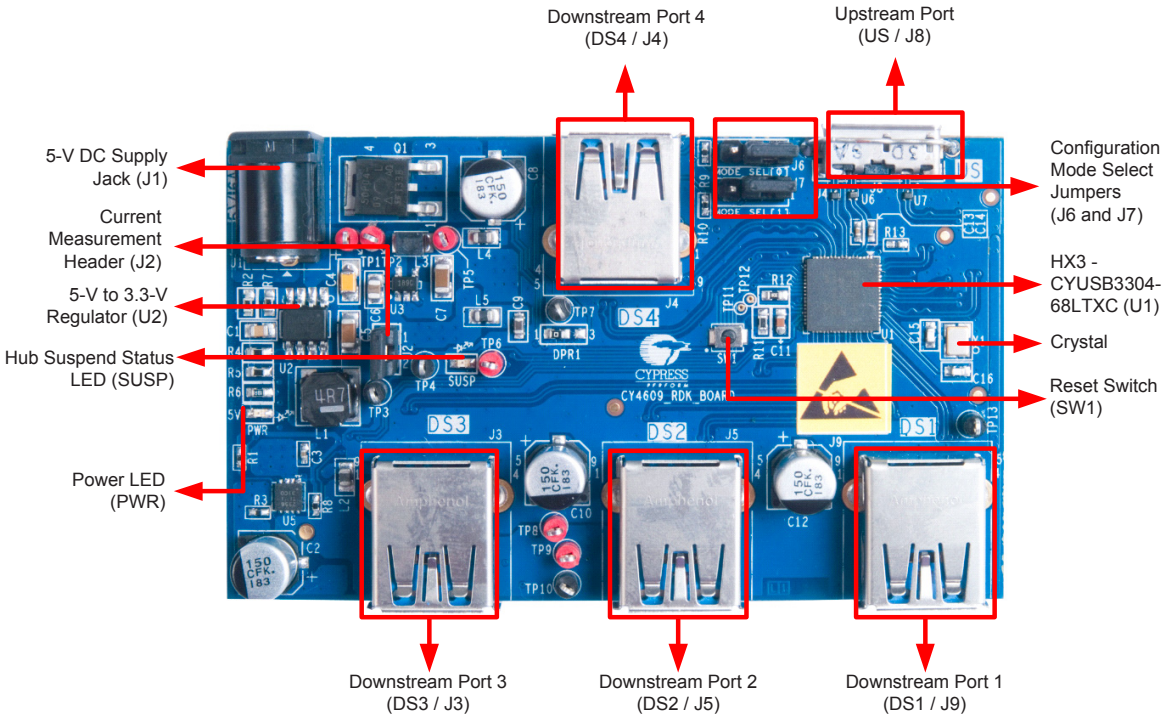
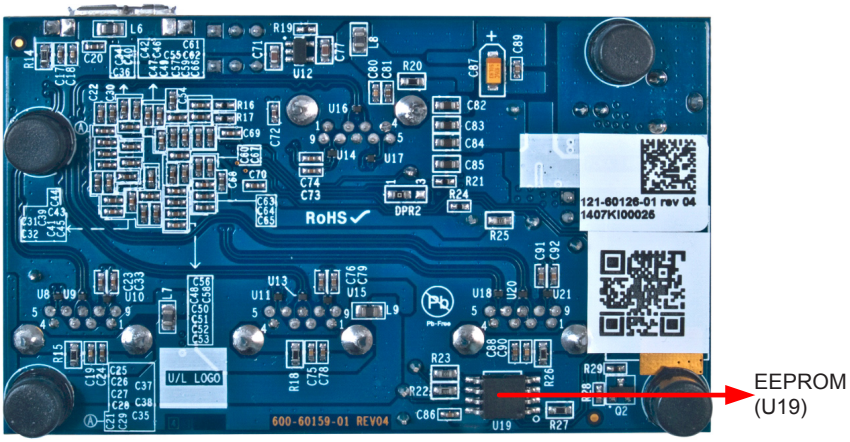


Figure 3-2. CY4609 Board (Bottom Side)



Following is the list of recommended hardware to evaluate the CY4609 RDK:

- A PC with USB 3.0 host controller
- USB 3.0 certified devices such as a USB 3.0 flash drive or a USB 3.0 hard disk drive
- Devices supporting the USB-IF Battery Charging specification v1.2, such as Samsung Galaxy and Apple iPhone

3.1.2 Jumper Settings

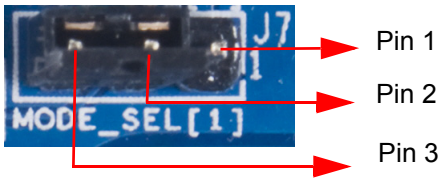
Table 3-1 describes the default jumper settings for CY4609.

Table 3-1. CY4609 Board Jumper Settings

Function	Jumper Blocks	Default Setting	Purpose
Current measurement	2-pin jumper block (J2)	Pins 1 and 2 shorted	To measure current, open the jumper and connect a multimeter's terminals (set in the current measurement mode) between pins 1 and 2. The measured current includes the current consumed by HX3, a 1.2-V regulator, and the hub suspend status (SUSP) LED.
Configuration mode selection	3-pin jumper blocks (J6, J7)	J6: Pins 1 and 2 shorted J7: Pins 2 and 3 shorted	In this setting, HX3 boots from the custom firmware stored in the onboard I^2C EEPROM. This is the default factory setting.

Figure 3-3 shows the location of pins 1, 2, and 3 on the CY4609 jumper blocks. Pin 1 is marked on the board.

Figure 3-3. CY4609 Jumper Block Layout



3.2 Overview of CY4603 DVK

3.2.1 CY4603 Board Interfaces

The CY4603 DVK (Figure 3-4) enables you to evaluate the features of Cypress's CYUSB331X-88LTXC USB 3.0 hub controller parts. The board is powered using an external 5-V/4-A AC-DC power adapter.

Figure 3-4. CY4603 Board (Top Side)

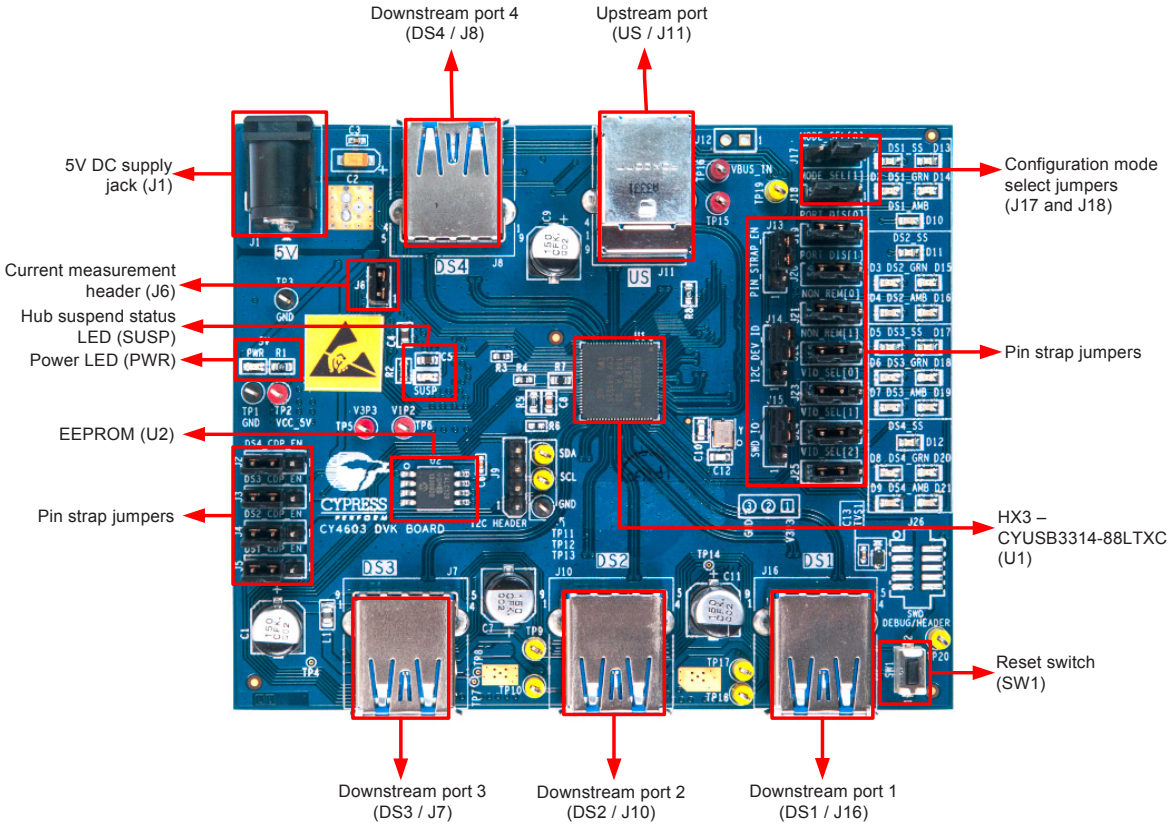
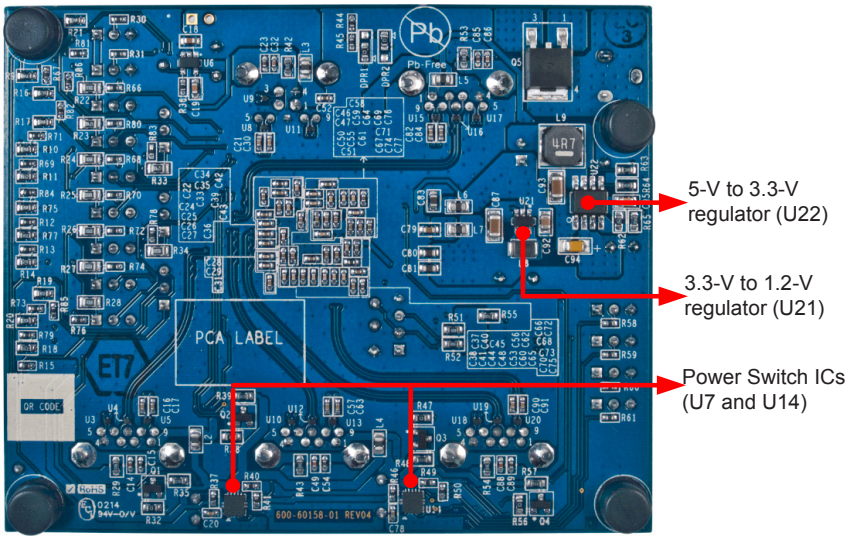


Figure 3-5. CY4603 Board (Bottom Side)



3.2.2 Jumper Settings

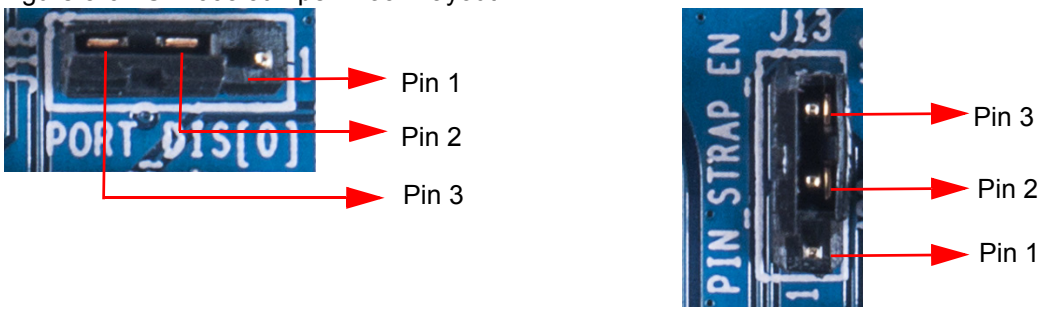
Table 3-2 describes the default jumper settings for CY4603.

Table 3-2. CY4603 Default Jumper Settings

Function	Jumper Blocks	Default Setting	Purpose
Pin strap	3-pin jumper blocks (J2, J3, J4, J5, J13, J14, J19, J20, J21, J22, J23, J24, J25)	Pins 2 and 3 shorted on all the jumper blocks	Pin strap jumpers can be used to configure the hub controller. For more details about these jumpers, see Configuring HX3 Using Pin Straps on CY4603 on page 34.
Current measurement	2-pin jumper block (J6)	Pins 1 and 2 shorted	To measure current, open the jumper and connect a multimeter's terminals (set in the current measurement mode) between pins 1 and 2. The measured current includes the current consumed by HX3, a 1.2-V regulator, and the SUSP LED.
Configuration mode selection	3-pin jumper blocks (J17, J18)	J17: Pins 1 and 2 shorted J18: Pins 2 and 3 shorted	In this setting, HX3 boots from the custom firmware stored in the onboard I^2C EEPROM. This is the default factory setting.

Figure 3-6 shows the location of jumper pins 1, 2, and 3 for the horizontal and vertical jumper blocks on the CY4603 board. Pin 1 is marked on the board.

Figure 3-6. CY4603 Jumper Block Layout



3.3 Overview of CY4613 DVK

3.3.1 CY4613 Board Details

The CY4613 DVK (Figure 3-8 and Figure 3-8) enables you to evaluate the features of Cypress's CYUSB332X-88LTXC USB 3.0 hub controller parts. The board is powered using an external 12-V / 3-A AC-DC power adapter.

Figure 3-7. CY4613 Board (Top Side)

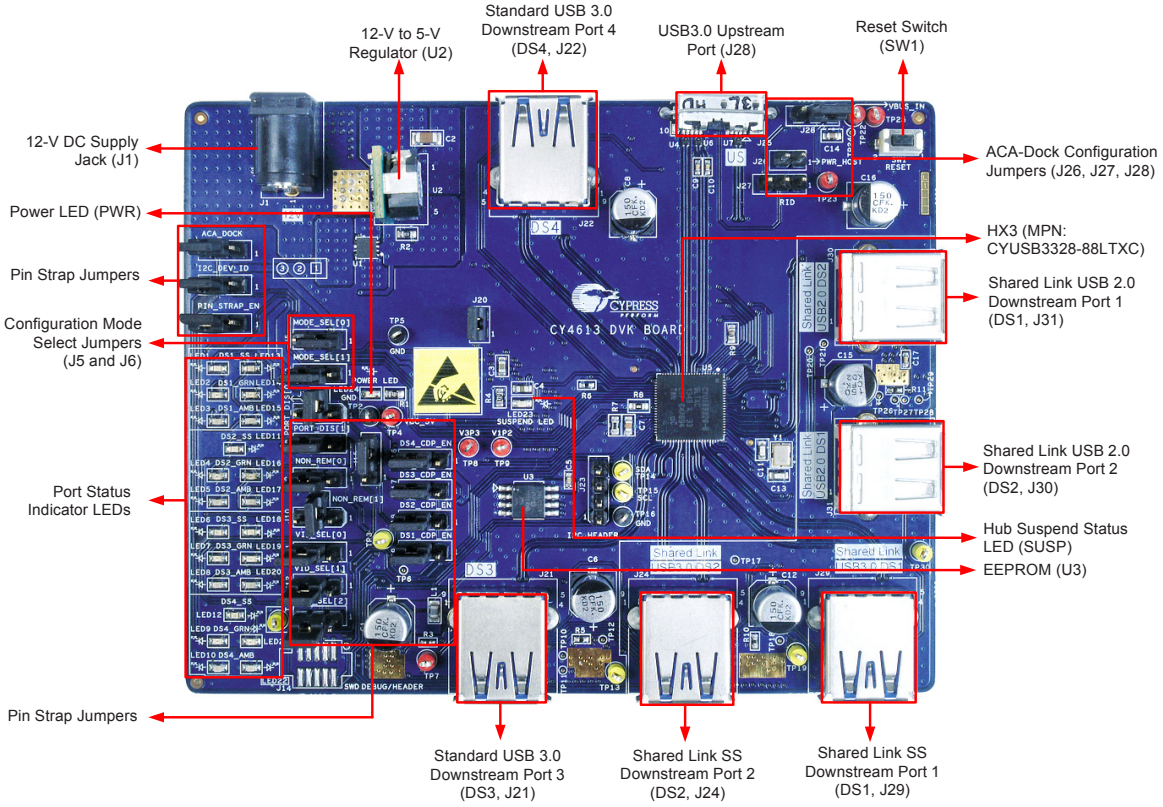
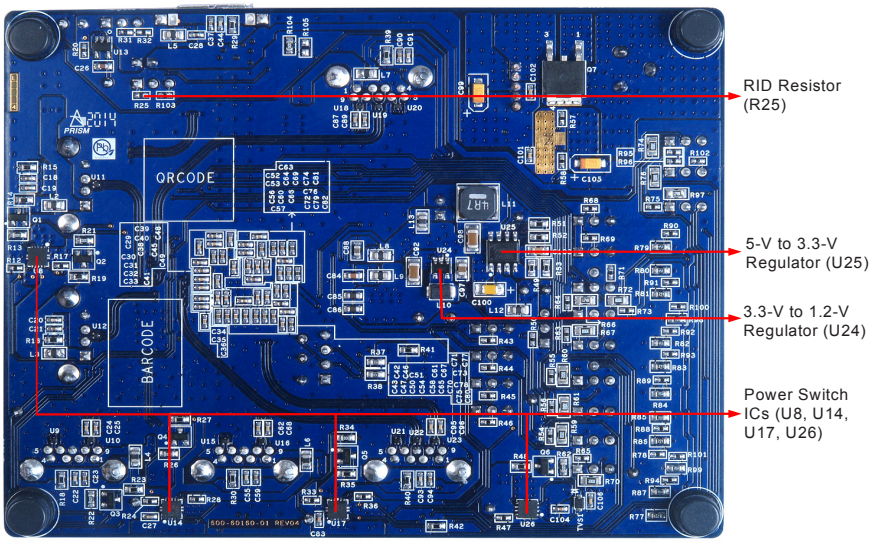


Figure 3-8. CY4613 Board (Bottom Side)



3.3.2 Jumper Settings

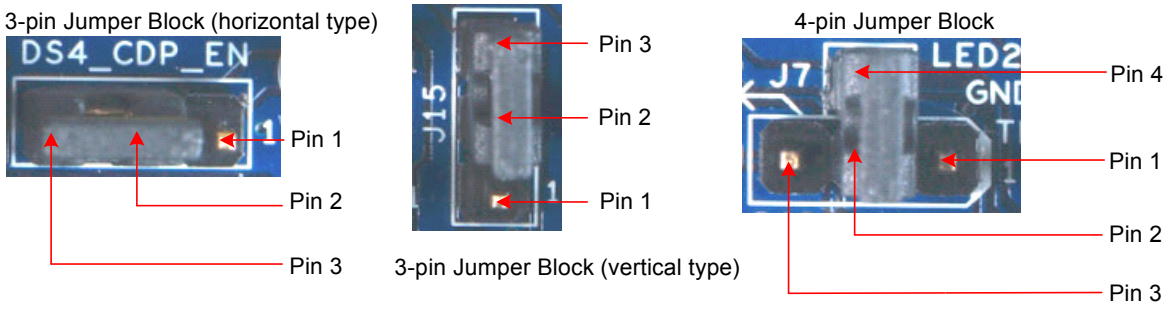
Table 3-3 shows the default jumper settings for CY4613.

Table 3-3. CY4613 Default Jumper Settings

Function	Jumper Block	Default Setting	Purpose
Pin strap	**3-pin jumper blocks** (J2, J3, J4, J8, J9, J11, J12, J13, J15, J16, J17, J18, J19) **4-pin jumper blocks** (J7, J10)	**3-pin jumper blocks:** Pins 2 and 3 shorted **4-pin jumper blocks:** Pins 2 and 4 shorted	Note that pin strap features are not supported in the current CY4613 board.
Current measurement	**2-pin jumper block** (J20)	Pins 1 and 2 shorted	For current measurement, open the jumper and connect a multimeter's terminals (set in current measurement mode) between pins 1 and 2. The measured current includes the current consumed by HX3, 3.3-V to 1.2-V regulator, and the SUSP LED.
Configuration mode selection	**3-pin jumper blocks** (J5 J6)	J5: Pins 1 and 2 shorted J6: Pins 2 and 3 shorted	In this setting, HX3 boots from the custom firmware stored in the onboard I^2C EEPROM. This is the default factory setting.
ACA-Dock	**3-pin jumper block** (J28) **2-pin jumper blocks** (J26 J27)	J28: Pins 1 and 2 shorted J26, J27: Open	The default jumper settings disable the ACA-Dock feature. To enable this feature on this kit, see 3.4.7 ACA-Dock Feature on CY4613 on page 36.
I^2C header	**4-pin jumper block** (J23)	Open	The I^2C header can be used to connect the HX3 to external I^2C based master/slave devices.

Figure 3-9 shows the location of jumper pins 1, 2, and 3 for the horizontal and vertical jumper blocks on the CY4613 board. Pin 1 is marked on the board.

Figure 3-9. CY4613 Jumper Block Layout



3.4 Operating the Kits

The following sections explain the procedure to operate the kits. These steps are based on CY4609 and they are applicable to CY4603 and CY4613 as well. Unique steps for each kit are specified in the corresponding sections.

3.4.1 Powering the Kit

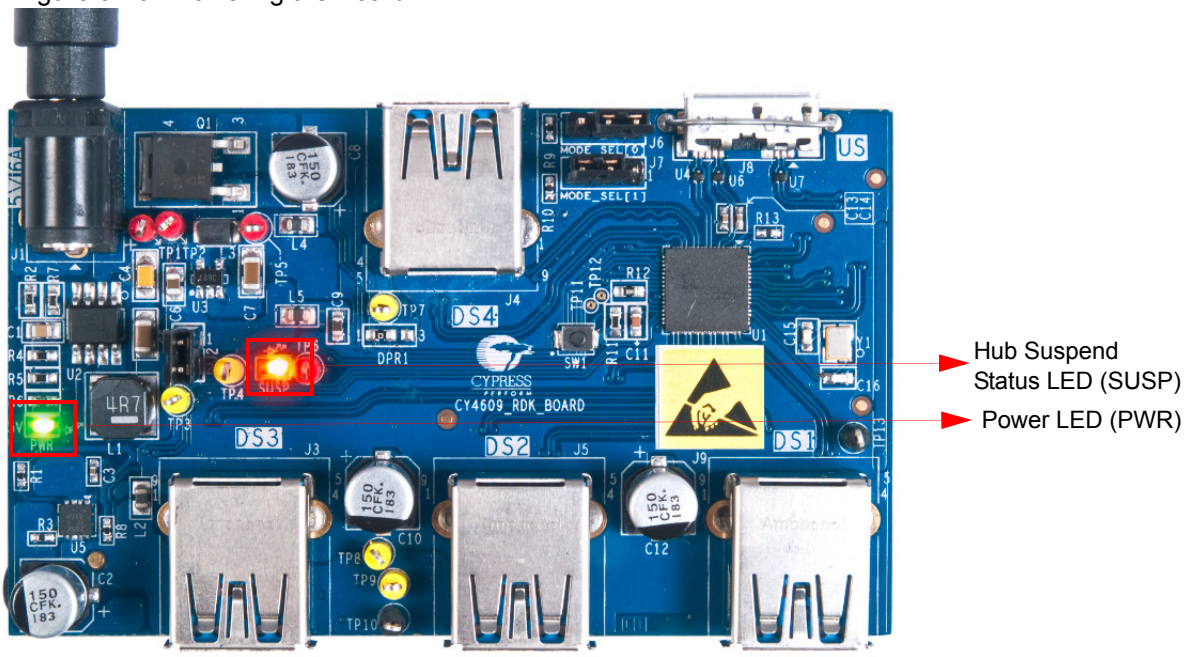
1. Unpack the power adapter, USB 3.0 cable, and HX3 board from the kit package.
2. Ensure that the Configuration Mode Selection jumper blocks for firmware are set to Custom Firmware, as shown in Table 3-4.

Table 3-4. Configuration Mode Selection Settings

Kit	Custom Firmware (Default Factory Setting)	ROM Firmware
CY4609	J6: Short pins 1 and 2 J7: Short pins 2 and 3	J6: Short pins 1 and 2 J7: Short pins 1 and 2
CY4603	J17: Short pins 1 and 2 J18: Short pins 2 and 3	J17: Short pins 1 and 2 J18: Short pins 1 and 2
CY4613	J5: Short pins 1 and 2 J6: Short pins 2 and 3	J5: Short pins 1 and 2 J6: Short pins 1 and 2

3. Plug the power adapter into an AC wall power receptacle. Connect the power supply plug to the board's DC supply jack. The power (PWR) LED glows green to indicate that the board is powered. The SUSP LED glows amber to indicate that HX3 is in Suspend mode because it is not connected to a PC on the upstream port, as shown in Figure 3-10.

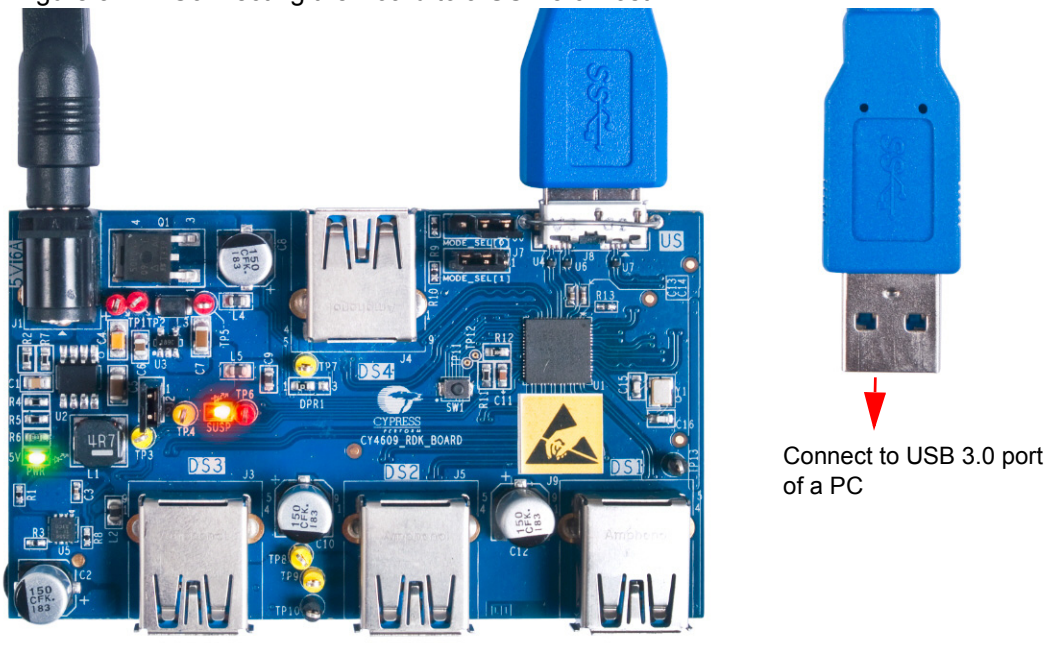
Figure 3-10. Powering the Board



3.4.2 Connecting the Board to a USB 3.0 PC

1. Connect the micro-B end of the USB cable to the board's upstream port; connect the other end of the cable to the USB 3.0 port on a PC, as shown in Figure 3-11. The SUSP LED turns off if the connected PC is running the Windows 7 operating system. The behavior of the SUSP LED varies with respect to the operating system. For example, in Windows 8, the SUSP LED turns off momentarily and turns on again when there is no further USB activity on the board.

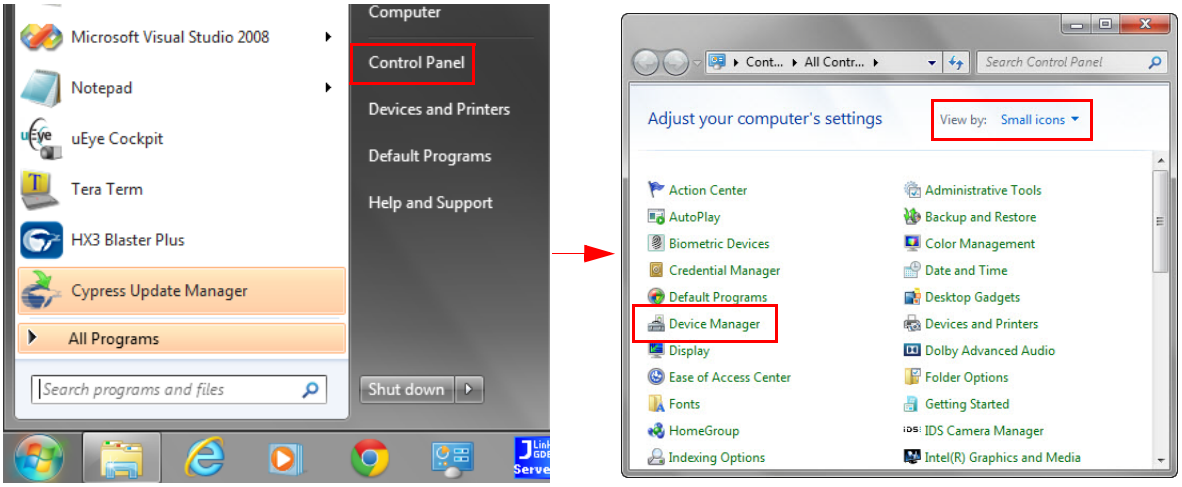
Figure 3-11. Connecting the Board to a USB 3.0 Host



The board enumerates as a USB 3.0 hub. To check whether the hub has enumerated successfully, follow steps 2 to 4.

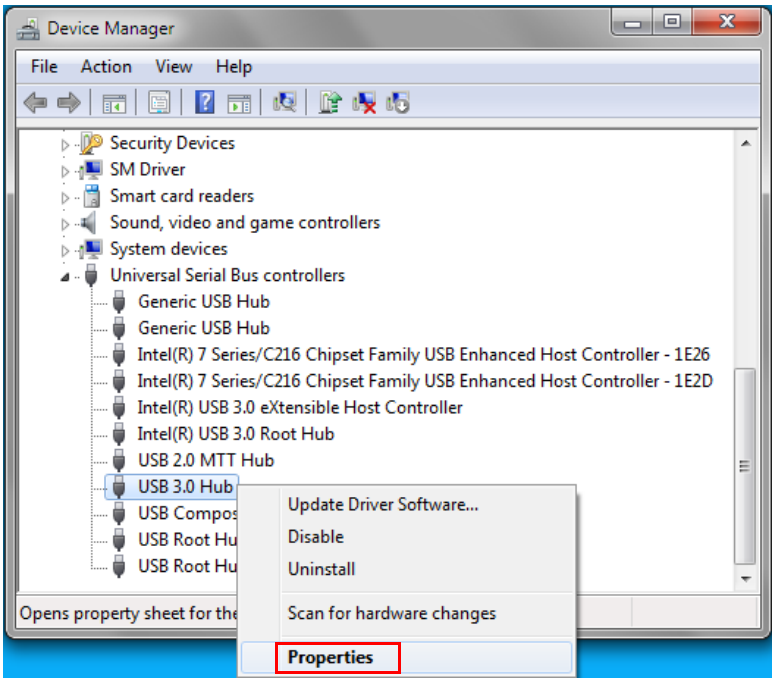
2. Click **Start > Control Panel**. On the Control Panel window, select **Small Icons** for the **View by:** parameter and click **Device Manager**. Note that the screenshots are captured on PCs running Windows 7. If you are running another OS, the screenshots may differ.

Figure 3-12. Invoking Device Manager



3. Click **Universal Serial Bus controllers** to list all the USB devices attached to the PC. The CY4609, CY4603, and CY4613 boards are installed as two hubs: a USB 3.0 Hub and a USB 2.0 MTT Hub. To locate the new hub entries in the Device Manager, detach and attach the USB cable from the upstream port of the CY4609, CY4603, or CY4613 board. The device list under **Universal Serial Bus controllers** is refreshed and the two entries—USB 2.0 MTT Hub and USB 3.0 Hub—appear again, as shown in Figure 3-13. Click **USB 3.0 Hub** and select **Properties**.
Note: The name used for the USB 3.0 Hub and USB 2.0 MTT Hub may vary based on the USB Host Controller implementation on the PC or Laptop.

Figure 3-13. List of Installed USB Hardware



Note: The Device Manager listing for the USB 3.0 and USB 2.0 MTT hubs can vary based on the host or OS implementation.

4. In the **USB 3.0 Hub Properties** window, select the **Details** tab and choose **Hardware Ids** from the drop-down list. The Cypress VID and PID are displayed, as shown in Figure 3-14.

Figure 3-14. VID and PID for CY4609

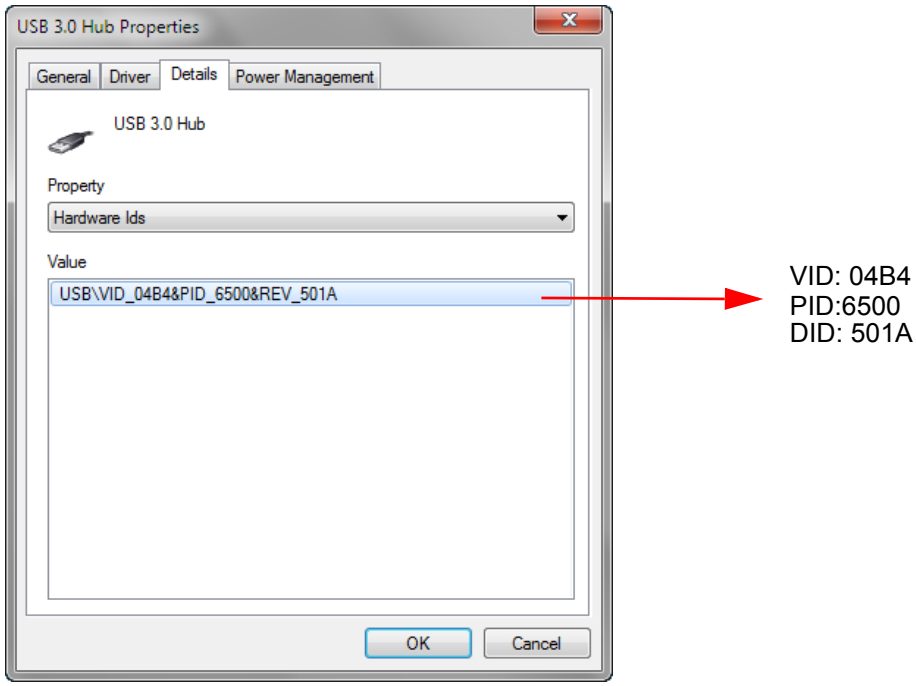


Table 3-5 describes the VID and PID values for USB 2.0 and USB 3.0 hubs.

Table 3-5. VID and PID Values of HX3 Kits

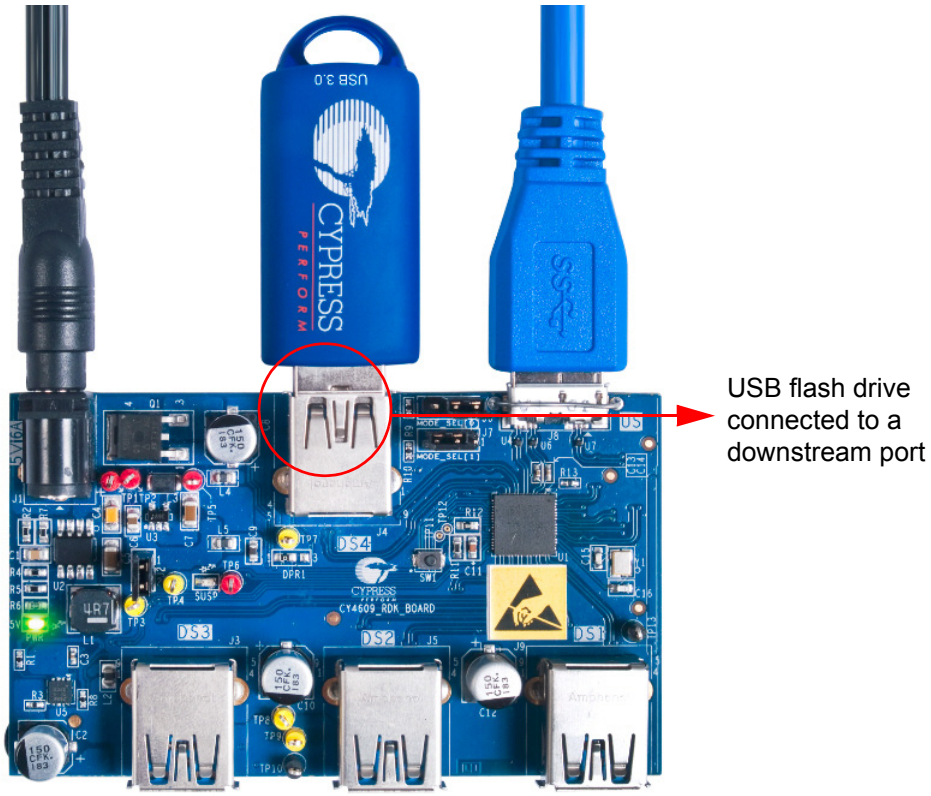
Kit	Hub Type	VID (hex)	PID (hex)
CY4609	USB 3.0	04B4	6500
	USB 2.0 MTT		6502
CY4603	USB 3.0		6504
	USB 2.0 MTT		6506
CY4613	USB 3.0		6508
	USB 2.0 MTT		650A

Note: The DID value displayed in Figure 3-14 may vary depending up on the HX3 firmware version.

3.4.3 USB 3.0 Data Transfer

1. Get a USB 3.0-certified flash drive and store a 2-GB file. Connect the flash drive to one of the downstream ports, as shown in Figure 3-15. For the CY4613 board, connect the flash drive to a standard USB 3.0 downstream port or to a Shared Link SS downstream port.
2. Copy the 2-GB file from the flash drive to the PC to transfer data in the USB 3.0 SuperSpeed mode.

Figure 3-15. USB 3.0 SuperSpeed Data Transfer



Note: CY4603 and CY4613 have three port status indicator LEDs for each downstream port; Table 3-6 describes their functions.

Table 3-6. Port Status Indicator LEDs on CY4603 and CY4613

No.	LEDs	Color	Behavior
1	DS1_SS, DS2_SS, DS3_SS, DS4_SS	Blue	Turns on when a USB 3.0 device is connected to a downstream port in SuperSpeed mode
2	DS1_GRN, DS2_GRN, DS3_GRN, DS4_GRN	Green	Turns on when a USB 2.0 device is connected to a downstream port **Note:** DS1_GRN and DS2_GRN are disabled on the CY4613 board
3	DS1_AMB, DS2_AMB, DS3_AMB, DS4_AMB	Amber	Turns on when any error condition (such as over current) occurs on a downstream port

The port status indicator LEDs (DSX_SS, DSX_GRN, DSX_AMB) are grouped according to downstream port; Figure 3-16 and Figure 3-17 illustrate this for the CY4603 and CY4613 boards, respectively.

Figure 3-16. Port Status Indicator LEDs on CY4603

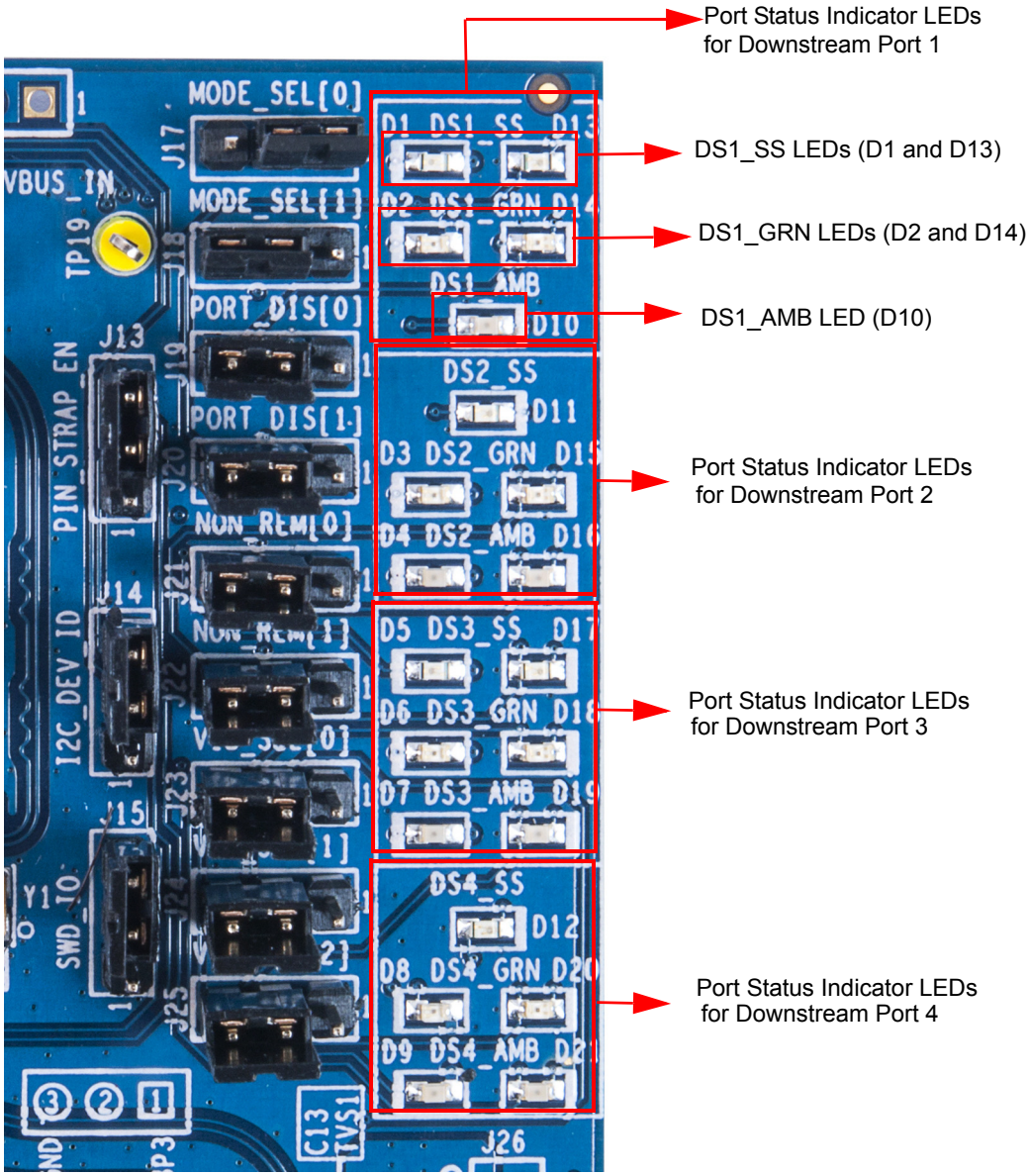
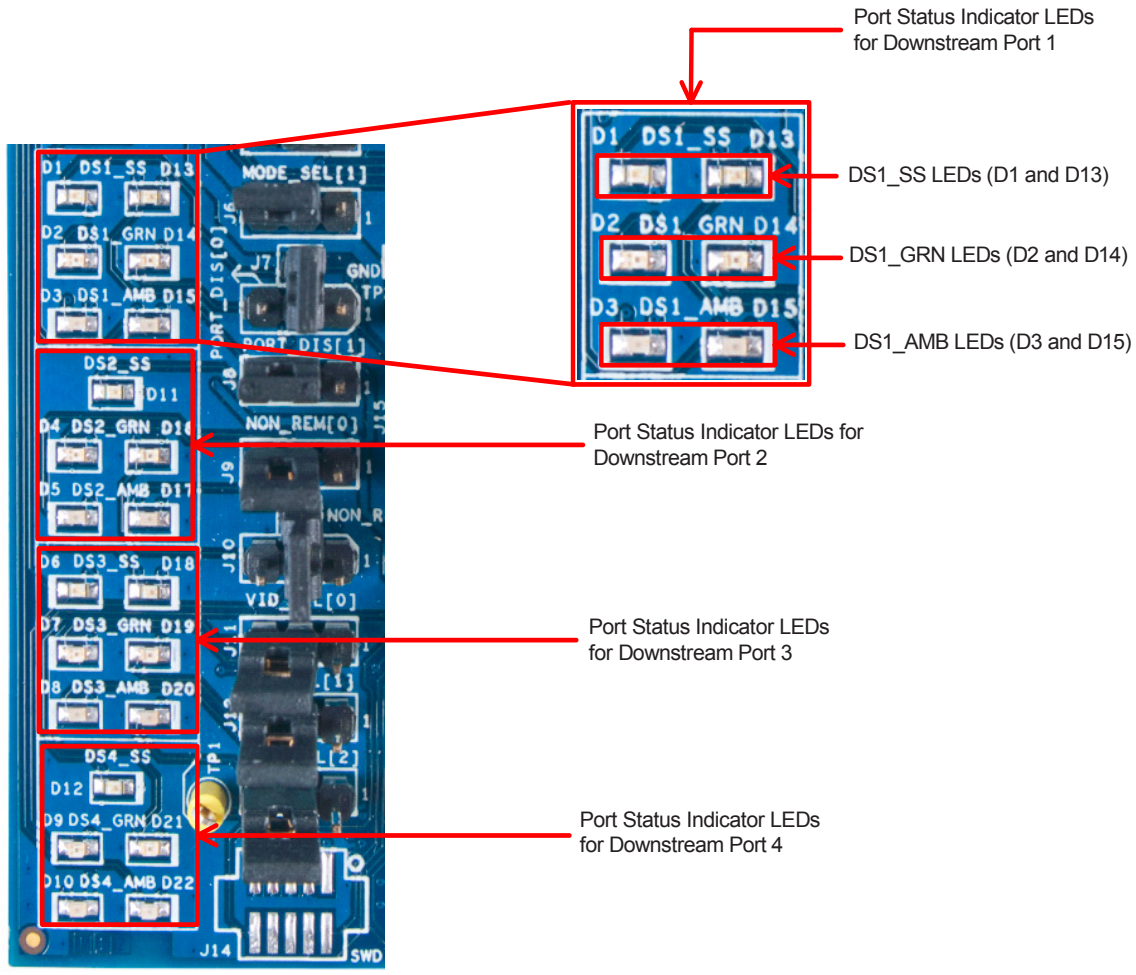


Figure 3-17. Port Status Indicator LEDs on CY4613



The GPIOs used to implement the port status indicator LEDs (except D10, D11, and D12) are also used for implementing the pin strap feature. For example, the DS1_GRN port status indicator LED on the CY4603 board is shared with the PORT_DIS[0] pin strap feature, as shown in Figure 3-18. The PORT_DIS[0] pin strap feature is implemented using a three-pin jumper. When the jumper is placed between pin 1 and 2, the shared GPIO used for the PORT_DIS[0] feature is pulled HIGH. When the jumper is placed between pins 2 and 3, it is pulled LOW. To support the port status indicator LED functionality in both the pull-up and pull-down settings, one LED is used for each setting.

Figure 3-18. Port Status Indicator LEDs Using Shared GPIOs

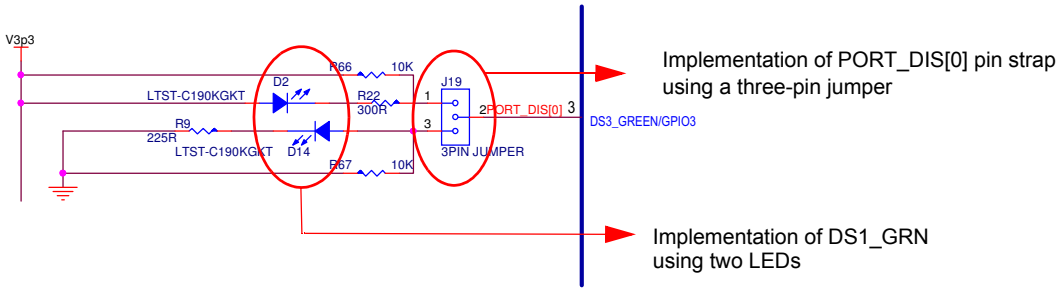


Table 3-7. Shared GPIOs for Port Status Indicator LED and Pin Strap Feature

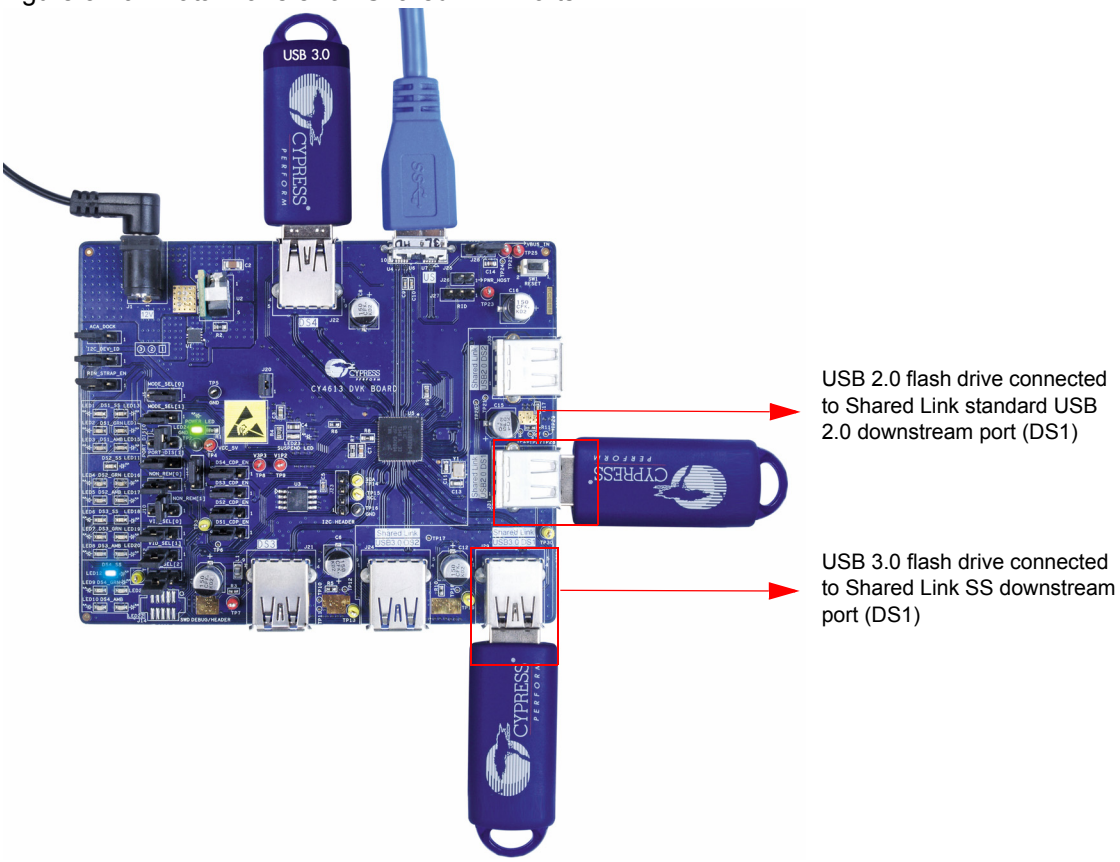
Shared GPIO	Port Status Indicator LED[a]	Pin Strap Feature[a.]	Active Port Status Indicator LED on CY4603		Active Port Status Indicator LED on CY4613	
			Shared GPIO in Pull-Up Setting	Shared GPIO in Pull-Down Setting	Shared GPIO in Pull-up Setting	Shared GPIO in Pull-Down Setting
GPIO2	DS1_AMB	ACA_DOCK	NA	D10	D3	D15
GPIO 3	DS1_GRN	PORT_DIS[0]	D2	D14	D2[b]	D14[b.]
GPIO 4	DS1_SS	PORT_DIS[1]	D1	D13	D1	D13
GPIO 5	DS2_AMB	NON_REM[0]	D4	D16	D5	D17
GPIO 6	DS2_GRN	NON_REM[1]	D3	D15	D4[b.]	D16[b.]
GPIO 8	DS3_AMB	VID_SEL[2]	D7	D19	D8	D20
GPIO 12	DS3_GRN	VID_SEL[1]	D6	D18	D7	D19
GPIO 13	DS3_SS	PIN_STRAP_EN	D5	D17	D6	D18
GPIO 14	DS4_AMB	I2C_DEV_ID	D9	D21	D10	D22
GPIO 19	DS4_GRN	VID_SEL[0]	D8	D20	D9	D21

a. Refer to Table 1-4 on page 12 for more details about the abbreviations listed in this table.
b. Green status LEDs (DS1_GRN and DS2_GRN) on the Shared Link ports DS1 and DS2 are disabled as the two GPIOs used for these LEDs are reassigned to enable power to DS1 SS and DS2 SS ports. Therefore, these LEDs will not turn on when the USB 2.0 devices are connected to the DS1 or DS2 USB 2.0 downstream port.

Note that pin strap features are not supported on the current CY4613 board configuration. This is due to settings related to Shared Link, which are stored in the CY4613 board's EEPROM by default for the CYUSB3328 part. The settings in the EEPROM enable configuring the CYUSBS3328 to support Shared Link on DS1 and DS2 ports to match with the CY4613 board design. When the settings are stored in the EEPROM, they take precedence over the pin strap features.

On the CY4613 board, a USB 3.0 data transfer and USB 2.0 data transfer can be simultaneously done on Shared Link ports as shown in Figure 3-19 on page 31.

Figure 3-19. Data Transfer on Shared Link Ports



Power off the board by disconnecting the AC-DC adapter. Connect a USB 3.0-certified flash drive to a Shared Link SS downstream port (DS1). Power on the board by connecting the AC-DC adapter. Connect a USB 2.0-certified flash drive to a standard USB 2.0 downstream port (DS1).

Note: The board must be in the powered-off state while connecting a device on any Shared Link SS downstream port. This is because the Shared Link SS ports are configured as embedded ports (non-removable device); the devices are expected to be permanently connected to the DS ports even before being powered on.

Copy a 2-GB file from the PC to both the flash drives. SS and USB 2.0 data transfers happen simultaneously on the Shared Link downstream ports.

3.4.4 Battery Charging

Connect an Apple device or a device that is compliant with the USB-IF Battery Charging specification v1.2 to one of the downstream ports. The connected device is charged by the board (see Figure 3-20).

Figure 3-20. Battery Charging



Note: For the CY4613 kit, battery charging is supported only on standard USB 3.0 ports and Shared Link USB 2.0 ports. Battery charging is not supported on Shared Link SS ports because the SS ports are expected to be embedded ports and not exposed.

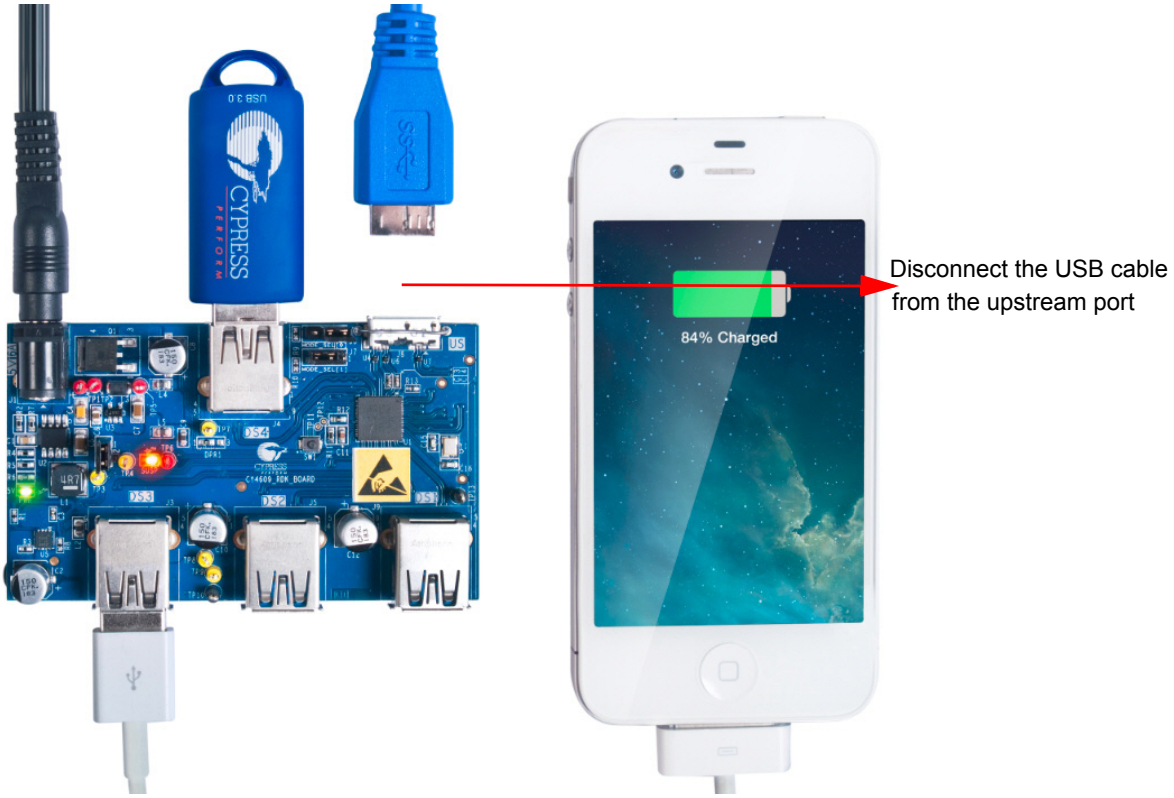
3.4.5 Ghost Charging

Disconnect the USB cable from the upstream port to detach the board from the PC, as shown in Figure 3-21. The board continues to charge the device connected to the downstream port using the Ghost Charging feature.

Notes:

- While the board is switching to the Ghost Charging mode, it stops charging the device connected to the downstream port momentarily and resumes charging within 1 to 2 seconds.
- The current drawn by the device in Ghost Charging mode may vary compared to the current drawn in normal Battery Charging mode.

Figure 3-21. Ghost Charging



According to the USB-IF Battery Charging specification v1.2, charging downstream ports (CDPs) are expected to provide 1.5-A current (typical) per port. The power adapter shipped with CY4609 and CY4603 supports up to 4 A of load current. After calculating the power consumed by HX3 and other parts of the board, 3.6 A is available to support charging on the downstream ports. When the board is used with the 5-V/4-A power adapter, ensure that no more than two downstream ports are used as CDP. If the current consumed by the downstream ports exceeds 3.6 A, the CY4609 board detects an overcurrent condition and interrupts HX3, which disables power to all the downstream ports until the overcurrent condition is removed and the board is reset.

3.4.6 Configuring HX3 Using Pin Straps on CY4603

You can configure HX3 using pin strap GPIOs. The “Configuration Options” section of the HX3 datasheet gives more details about the use of pin strap GPIOs. A pin strap GPIO can be strapped to logic '1' by shorting pins 1 and 2 using a jumper. It can be strapped to logic '0' by shorting pins 2 and 3. Figure 3-22 illustrates the pin strap jumpers on the CY4603 board.

Figure 3-22. Pin Strap Jumpers on CY4603 Board

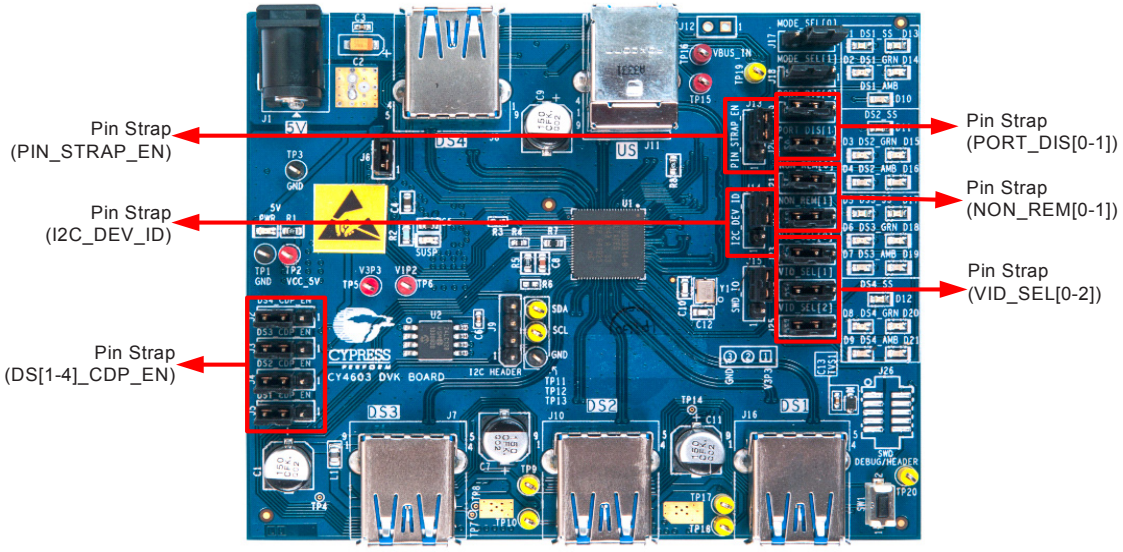


Table 3-8 describes the list of pin straps that can be configured on the CY4603 board. For the pin strap configuration feature to work, the PIN_STRAP_EN GPIO must be strapped to logic '1'. Note that this GPIO is strapped to logic '0' by default.

Table 3-8. Implementation of Pin Straps on CY4603 Hardware

Pin Strap Name	Description	Strapped to Logic '1' (Jumper on Pin 1 and 2)	Strapped to Logic '0' (Jumper on Pin 2 and 3)
DS1_CDP_EN	Enables the battery charging feature on a given downstream port.	DS1 CDP disabled	DS1 CDP enabled
DS2_CDP_EN		DS2 CDP disabled	DS2 CDP enabled
DS3_CDP_EN		DS3 CDP disabled	DS3 CDP enabled
DS4_CDP_EN		DS4 CDP disabled	DS4 CDP enabled
PORT_DIS[0]	Enables or disables the downstream ports.	PORT_DISABLE[1:0] = b'00: DS1, DS2, DS3, DS4 enabled b'01: DS1, DS2, DS3 enabled b'10: DS1, DS2 enabled b'11: DS1 enabled	
PORT_DIS[1]			
NON_REM[0]	Configures the downstream ports as removable or nonremovable. A nonremovable port is an embedded port that is not exposed for connecting or disconnecting any USB device.	NON_REMOVABLE[1:0] = 00: DS1, DS2, DS3, DS4 removable 01: DS1, DS2, DS3 removable 10: DS1, DS2 removable 11: DS1 removable	
NON_REM[1]			

Table 3-8. Implementation of Pin Straps on CY4603 Hardware *(continued)*

Pin Strap Name	Description	Strapped to Logic '1' (Jumper on Pin 1 and 2)	Strapped to Logic '0' (Jumper on Pin 2 and 3)
VID_SEL[0]	Selects the vendor ID.	Reserved	
VID_SEL[1]			
VID_SEL[2]			
I2C_DEV_ID	Sets the I^2C slave address for the HX3 hub controller when it is connected to an external processor.	0xB0	0xC0

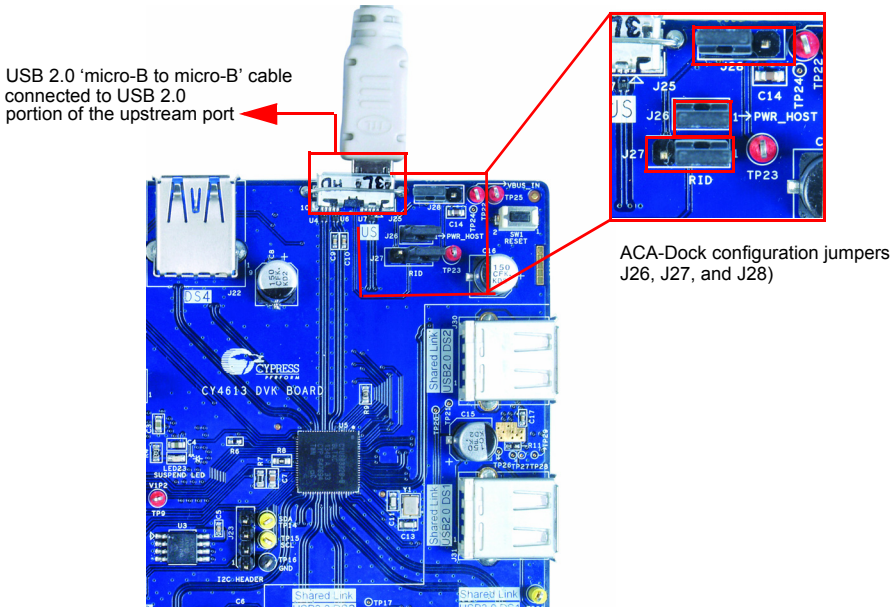
You can configure HX3 on the CY4603 board using the following procedure:

1. Power off the CY4603 board by disconnecting the AC-DC power adapter from the DC jack.
2. Enable configuration using pin straps by installing a jumper on pins 1 and 2 of PIN_STRAP_EN (J13 on CY4603).
3. Remove the jumper on VID_SEL[0] to retain the Cypress VID. Note that the DS4_GRN LED functionality will be void in this configuration.
4. Configure the required pin straps by installing the jumpers as required. Refer to Table 3-8 for more details.
5. Power the CY4603 board.
6. Verify the configuration implemented using the pin straps.

3.4.7 ACA-Dock Feature on CY4613

The ACA-Dock feature helps to demonstrate the USB host functionality while charging. Normally when a host-capable handheld device such as a phone is connected to a device on the DS port, the VBUS is provided by the USB host. When the battery is drained and the host-capable phone needs to be charged, the host functionality cannot be exercised until the phone is charged. To enable the USB host functionality while charging, USB-IF has implemented the ACA-Dock feature (BC v1.2 specification). This allows the host-capable battery devices to be charged and at the same time exhibit the host functionality. Refer to ACA- Dock Implementation on page 75 for more details. This section describes the procedure to set up and use the ACA-Dock feature on the CY4613 board.

Figure 3-23. Configuring CY4613 Board for ACA-Dock

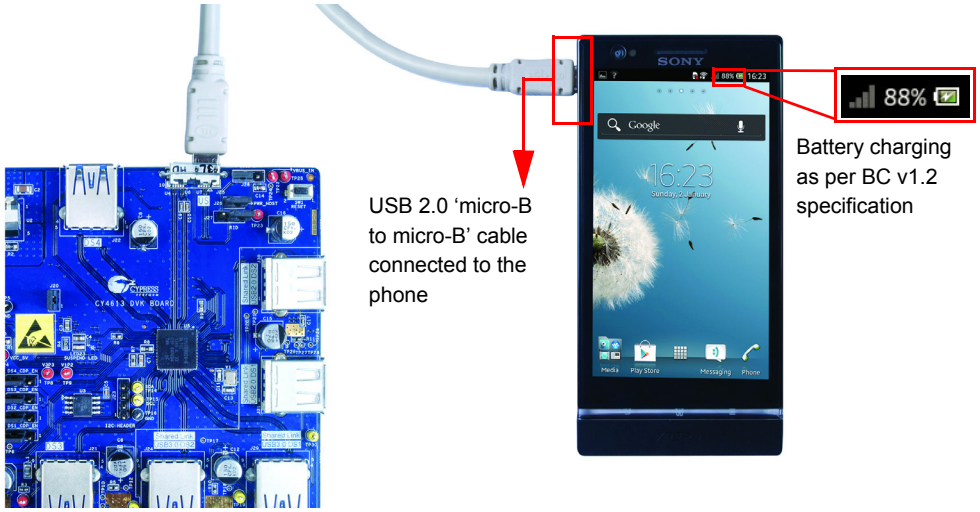


Note that the ACA-Dock feature is disabled by default on the CY4613 board. Following is the procedure to enable and use the ACA-Dock feature.

1. Power off the HX3 board by disconnecting the AC-DC power adapter from the DC jack and remove the USB 3.0 standard-A to micro-B cable. Remove the devices on the downstream ports.
2. Install a jumper between pins 2 and 3 of J28. Install jumpers on pin 1 and 2 of J26 (PWR_HOST) and J27(RID). Installing a jumper on J26 enables 5-V VBUS on the US connector. Installing a jumper on J27 enables the ID termination resistor required for the ACA-Dock feature according to the BC v1.2 specification.
   Note: To use ACA-Dock feature with Samsung Galaxy Note 3, S3 and S4 devices, install jumper on pins 2 and 3 of J27.
3. Get a BC v1.2-compliant phone with the OTG host capability such as Sony Xperia (S / P / neo V). Connect one end of the micro-B to micro-B cable to the USB 2.0 portion of the HX3 board's upstream port as shown in Figure 3-24. Connect the other end of the cable to the phone.

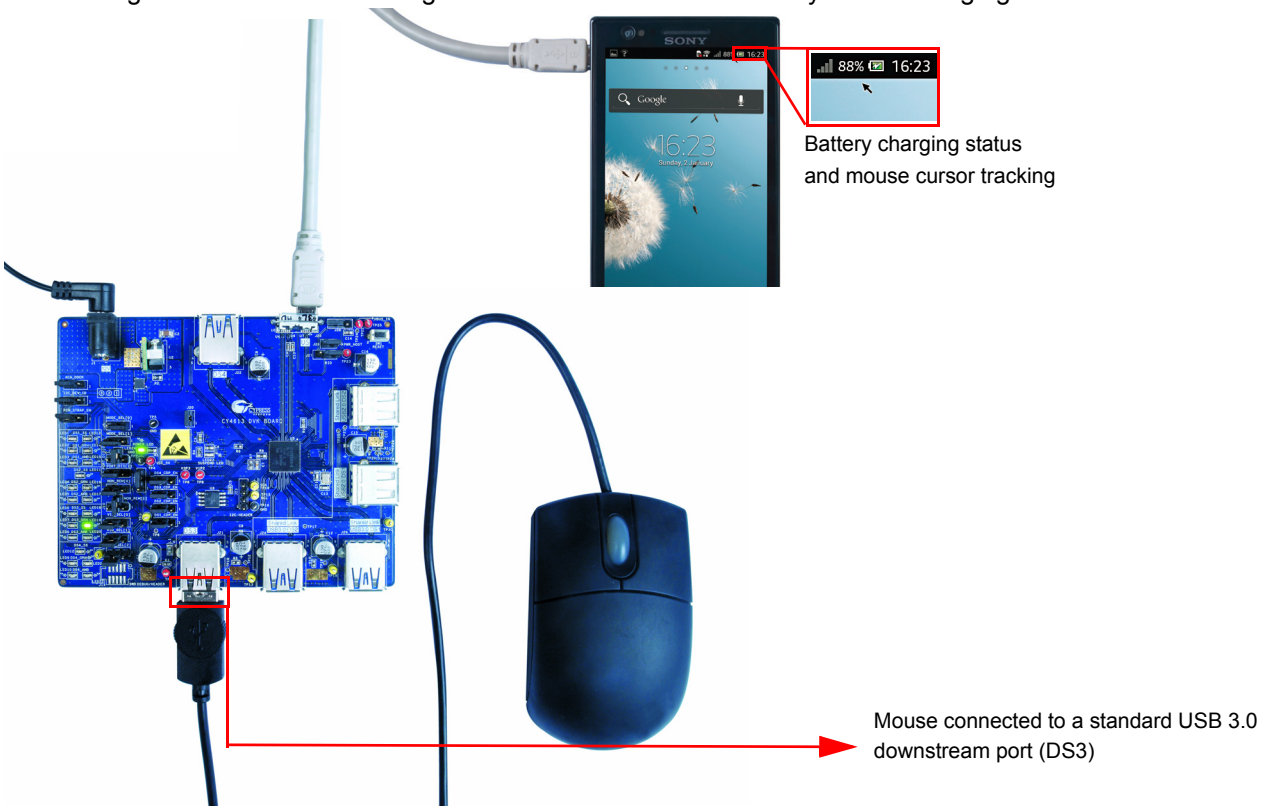
   CAUTION: Make sure the phone is compliant with the BC v1.2 specification before using with the HX3 board. Using the board with a non-BC v 1.2-compliant host can damage or affect the phone functionality.

Figure 3-24. Demonstrating Battery Charging on Upstream Port



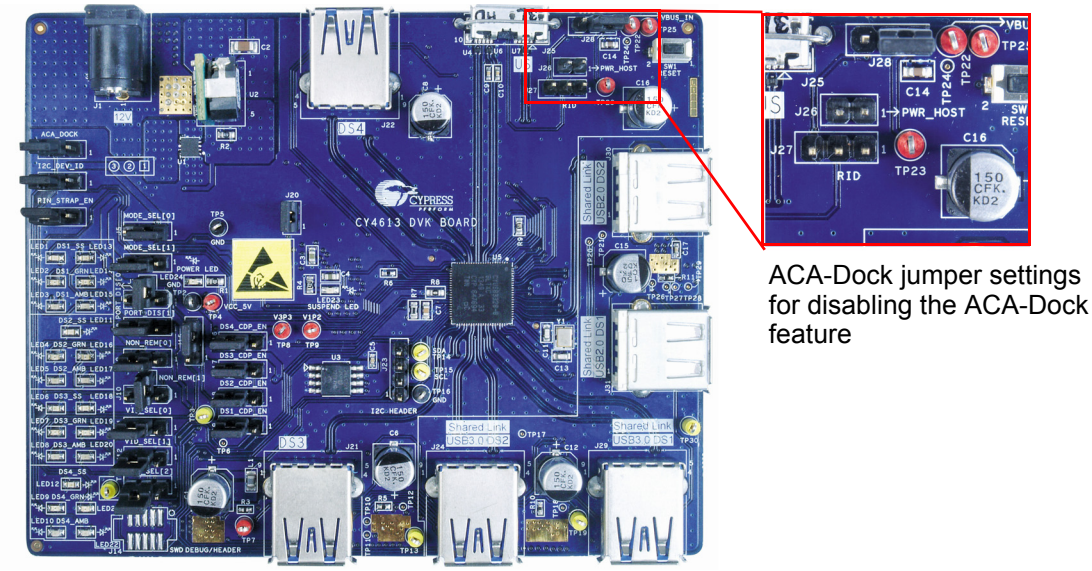
4. Power the HX3 board by connecting the power supply plug to the board's DC supply jack.
5. The phone is charged using HX3's ACA-Dock feature from the CY4613 board.

Figure 3-25. Demonstrating Phone's USB Host Functionality While Charging



6. Connect a mouse to a Shared Link USB 2.0 downstream port (DS1 or DS2) or to a standard USB 3.0 downstream port (DS3 or DS4).
7. The mouse is enumerated on the phone and the on-screen cursor can be tracked using the mouse. Note that the phone is charged at the same time from the CY4613 board.

Figure 3-26. Disabling ACA-Dock Feature in CY4613 Board



ACA-Dock jumper settings for disabling the ACA-Dock feature

8. Power off the HX3 board by disconnecting the AC-DC power adapter from the DC jack. Disconnect the phone by detaching the micro-B to micro-B cable from the CY4613 board.
9. To disable the ACA-Dock feature in the CY4613 board and restore factory default setting, install a jumper between pins 1 and 2 on J28 and remove the jumpers on J26 (PWR_HOST) and J27 (RID).

3.4.8 I²C Slave Mode Operation

The CY4603 and CY4613 DVKs support I²C slave mode operation which enables configuration of HX3 from an external I²C master. Following is the procedure to use the HX3 DVKs in I²C slave mode:

1. Generate the 'HX3 I²C Slave Mode file' using the required configuration parameters together with the firmware by following the instructions specified in Generating 'HX3 I2C Slave Mode file' for CY4603 and CY4613 DVKs on page 55.
2. Configure the HX3 DVK for I2C slave mode operation by setting the configuration mode selection jumpers as mentioned in Table 3-9.

Table 3-9. Configuration Mode selection

DVK	Configuration Mode Jumper Setting
CY4603	J17: Short pins 2 and 3 J18: Short pins 1 and 2
CY4613	J5: Short pins 2 and 3 J6: Short pins 1 and 2

3. Connect the HX3 DVK to I²C master device by connecting wires to GND, SCL and SDA pins of I²C header.

Figure 3-27. I²C header on CY4603 DVK

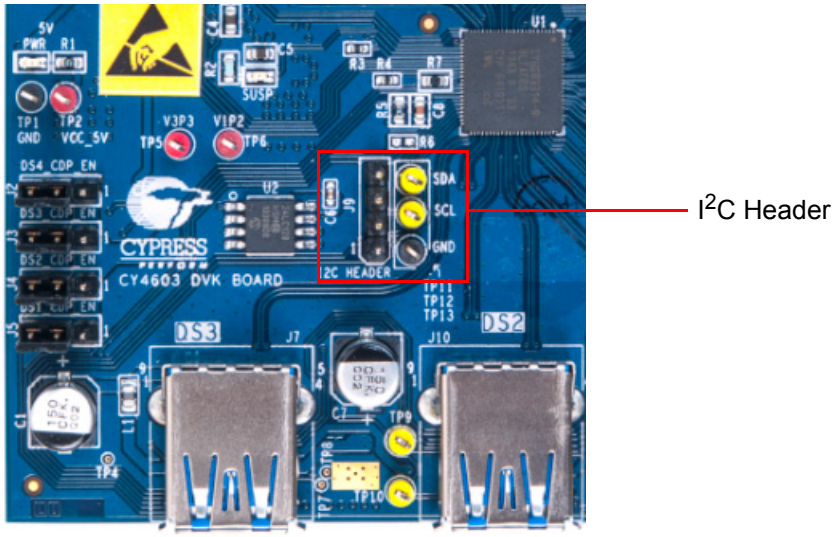
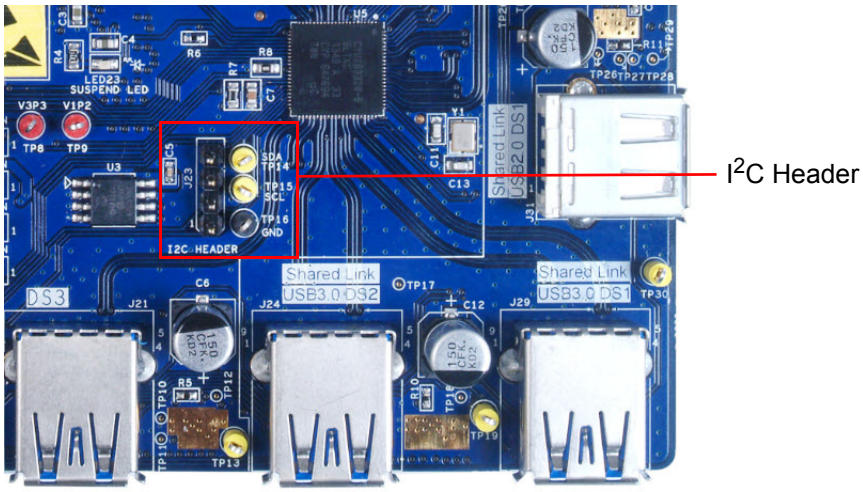


Figure 3-28. I²C header on CY4613 DVK



4. Power on HX3 DVK and the I²C master device. Connect HX3 to a PC / laptop. Send the 'HX3 I²C Slave Mode file' content from the I²C master device. HX3 kit enumerates on the PC / laptop using the firmware and configuration settings sent from the I²C master.
   Note: The HX3 kit will not enumerate until it receives the firmware and configuration settings from the I²C master device.
5. Once the I²C slave mode usage is completed, detach the I²C master device and restore the kits to custom firmware state by setting the configuration mode selection jumpers as mentioned in Table 3-9.
   Note: The firmware and configuration settings sent from the I²C master are stored in HX3's RAM memory. Hence the I²C master needs to send the firmware and configuration settings every time HX3 is reset or powered on.

4. HX3 Blaster Plus Tool

This chapter provides details about the HX3 Blaster Plus tool and the operating procedure with the CY4609, CY4603, and CY4613 kits.

4.1 Overview

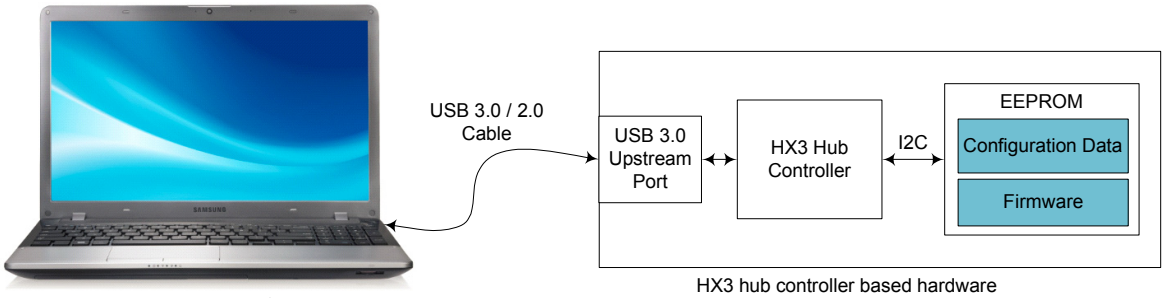
HX3 Blaster Plus is a GUI-based tool to configure the HX3 hub controller. It can be used to configure any HX3-based hardware with a compatible EEPROM connected to HX3 over I^2C. This tool allows you to do the following:

- Read configuration data from EEPROM and display the values.
- Download custom firmware from a PC via HX3 and store it on the EEPROM.
- Download custom firmware and configuration data together and store it on the EEPROM.
- Configure HX3 and download only the configuration data to the EEPROM.
- Erase the firmware and configuration data from the EEPROM.
- Generate HX3 configuration data to be sent over I^2C bus when HX3 is configured as an I^2C slave.

4.2 Setup

Figure 4-1 displays the setup to run the HX3 Blaster Plus tool with the HX3-based hardware.

Figure 4-1. HX3 Blaster Plus Tool Setup

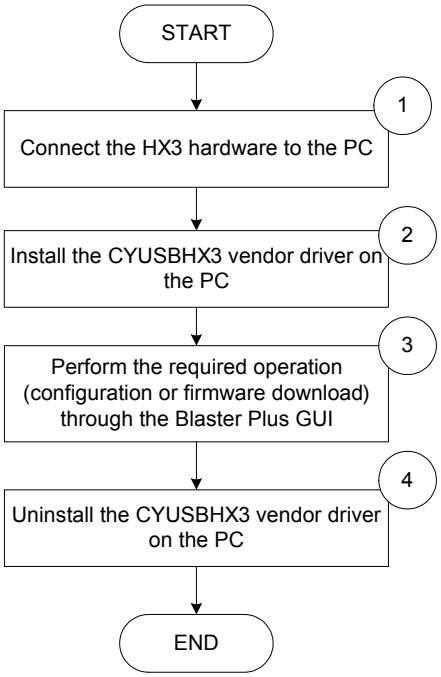


The HX3 Blaster Plus tool needs to be installed on a Windows-based PC. The Windows OS can be Windows XP, 7, 8, or 8.1. The PC must have a USB 3.0 or USB 2.0 port. It needs to be connected to the HX3-based hardware using a USB 2.0- or 3.0-certified cable. The hardware needs to have an external EEPROM connected to the HX3 over the I^2C interface.

4.3 Procedure to run the HX3 Blaster Plus Tool

Figure 4-2 provides the steps to run the HX3 Blaster Plus tool with CY4609 or CY4603 boards.

Figure 4-2. Steps to Run HX3 Blaster Plus Tool



4.3.1 Connect HX3 Board to PC

Follow these steps to connect the HX3 board to a PC:

1. Set the configuration mode selection jumpers for the custom firmware as listed in Table 4-1.

Table 4-1. Configuration Mode Selection Settings

Kit	Custom Firmware (Default Factory Setting)	ROM Firmware
CY4609	J6: Short pins 1 and 2 J7: Short pins 2 and 3	J6: Short pins 1 and 2 J7: Short pins 1 and 2
CY4603	J17: Short pins 1 and 2 J18: Short pins 2 and 3	J17: Short pins 1 and 2 J18: Short pins 1 and 2
CY4613	J5: Short pins 1 and 2 J6: Short pins 2 and 3	J5: Short pins 1 and 2 J6: Short pins 1 and 2

2. Power on the HX3 board.
3. Connect the HX3 board to a USB 3.0 or USB 2.0 port on the PC.

4.3.2 Bind CYUSBHX3 Vendor Driver on the PC

To run the HX3 Blaster Plus tool, the default Windows hub class driver, which is automatically bound to the USB 2.0 interface of the HX3-based hardware, needs to be unbound and the CYUSBHX3 vendor driver needs to be bound.

To install the device driver on Windows 7, do the following:

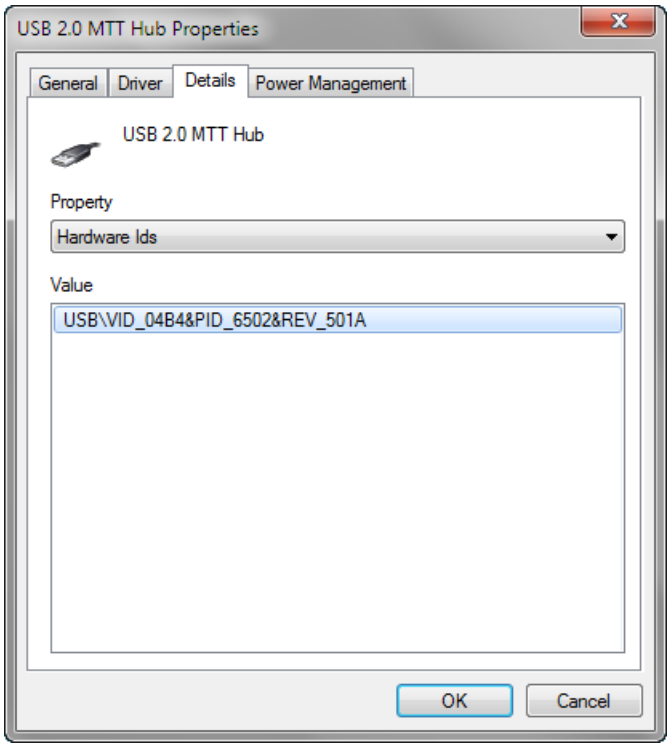
1. Connect the HX3 board to one of the USB ports.
   a. Invoke **Device Manager** and search for a USB 2.0 hub device with the following properties:

Table 4-2. Identifying USB 2.0 Hub

Hardware	VID (hex)	PID (hex)
CY4609	04B4	6502
CY4603	04B4	6506
CY4613	04B4	650A

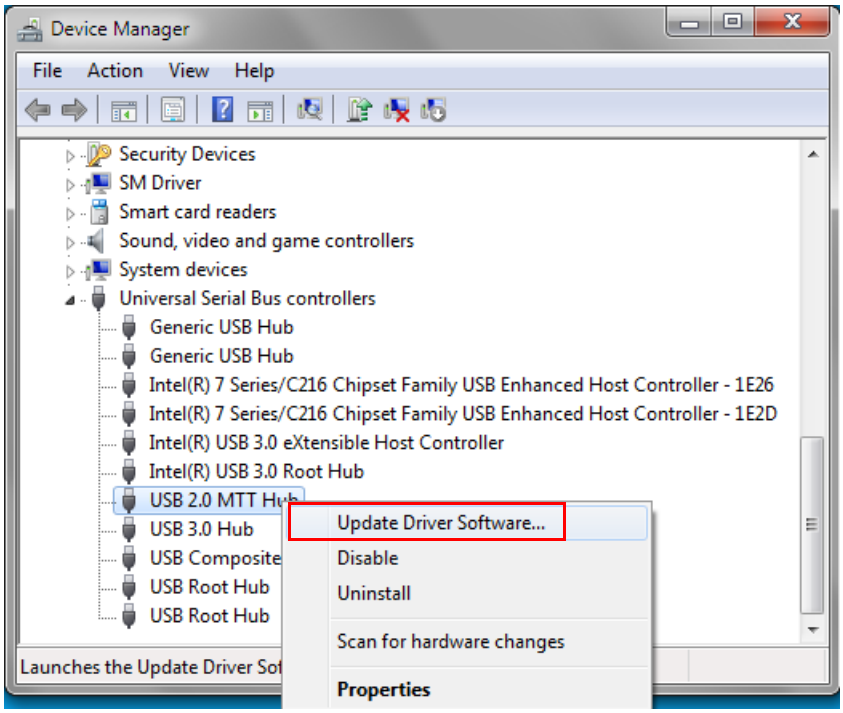
   b. Check the VID and PID details in **Properties > Details > Hardware Ids**; see Figure 4-3.

Figure 4-3. Identifying VID and PID



2. After the device is identified, right-click and select **Update Driver Software**; see Figure 4-4.

Figure 4-4. Updating Driver Software



Note: When the HX3-based hardware is connected to a PC over a USB 3.0 port, the Device Manager will list one hub with USB 2.0 capability and another hub with USB 3.0 capability. Make sure to invoke **Update Driver Software** only on the hub with USB 2.0 capability because HX3 Blaster Plus can only work with a hub with USB 2.0 capability. If the hardware is connected to a PC over a USB 2.0 port, the Device Manager will list only one hub. Make sure to invoke **Update Driver Software** on that hub.

3. In the **Update Driver Software** window, click **Browse my computer for driver software**, as shown in Figure 4-5. On the next screen, click **Let me pick from a list of device drivers on my computer** and click **Next**, as shown in Figure 4-6.

Figure 4-5. Searching CYUSBHX3 Driver

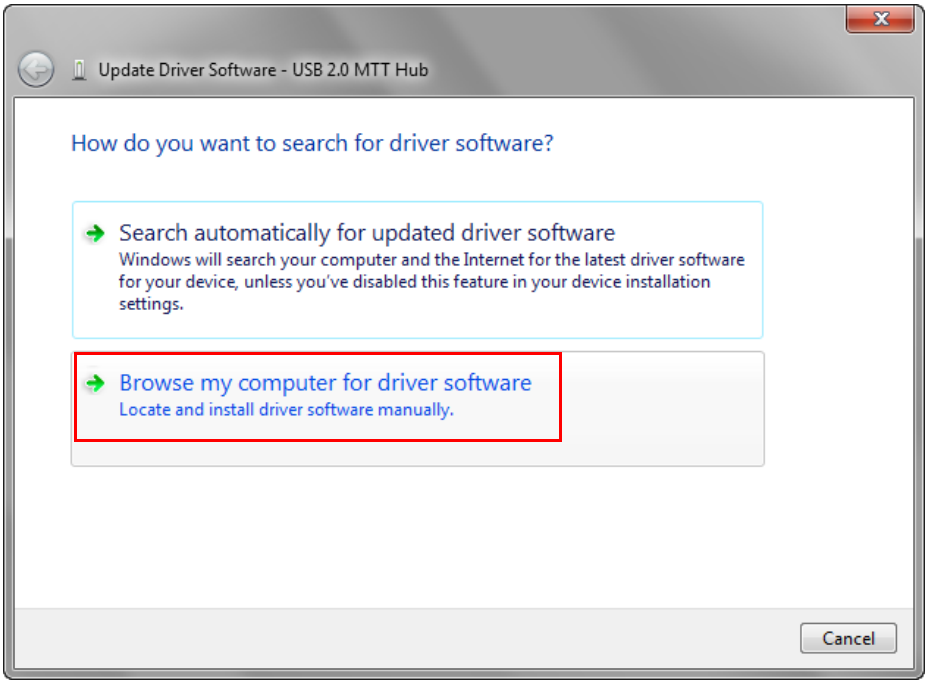
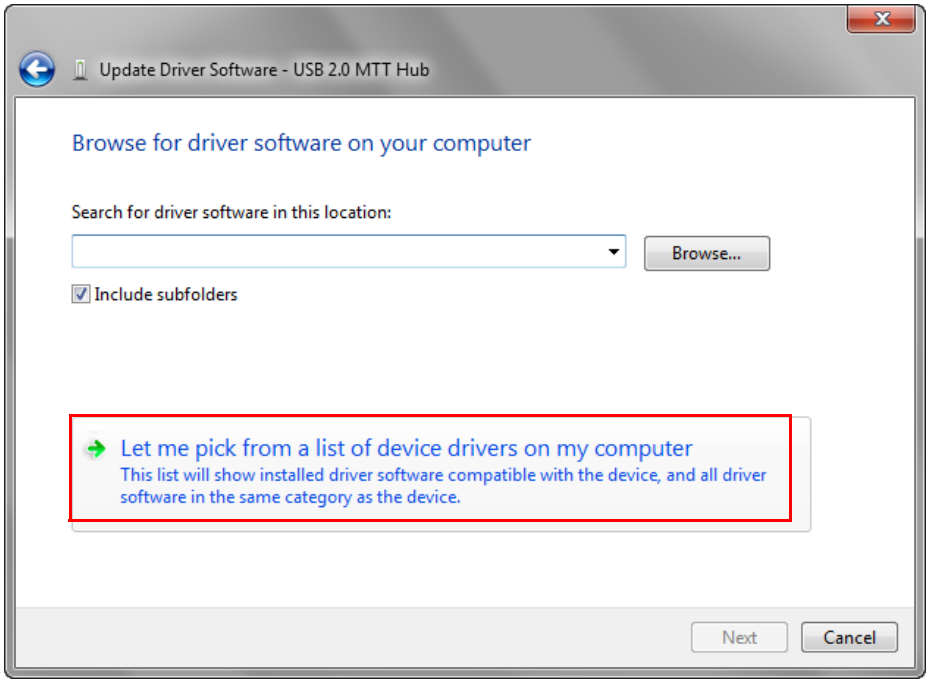
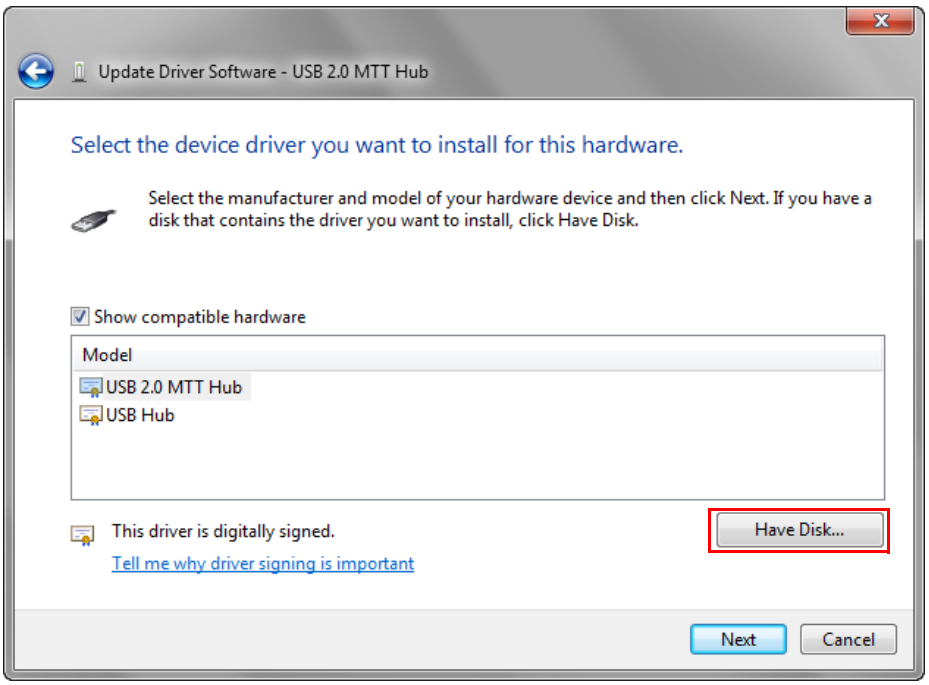


Figure 4-6. Locating CYUSBHX3 Driver



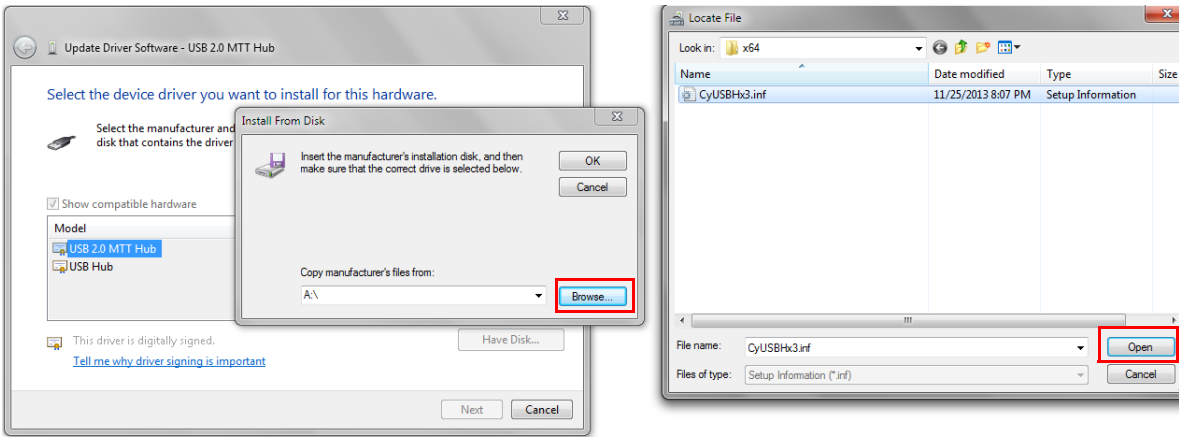
4. Click **Have Disk**, as shown in Figure 4-7.

Figure 4-7. Loading CYUSBHX3 Driver Path



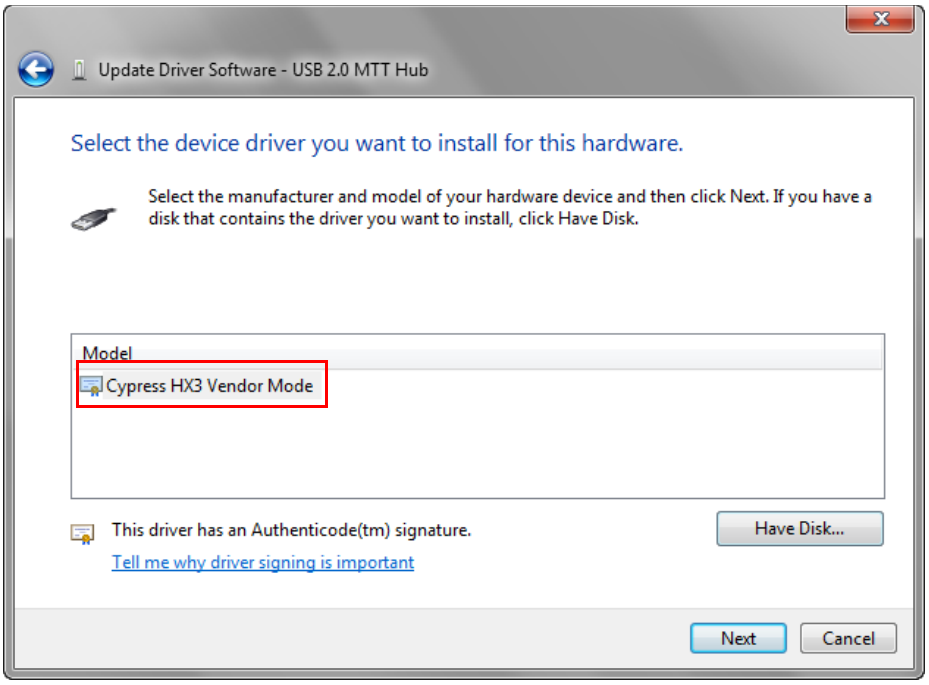
5. Click **Browse** and select the driver file (*CyUSBHx3.inf*) by navigating to `<Install Directory>\HX3 Blaster Plus\drivers\<operating system>\<x64/x86>`; click **Open**, as shown in Figure 4-8.

Figure 4-8. Loading CYUSBHX3 Driver



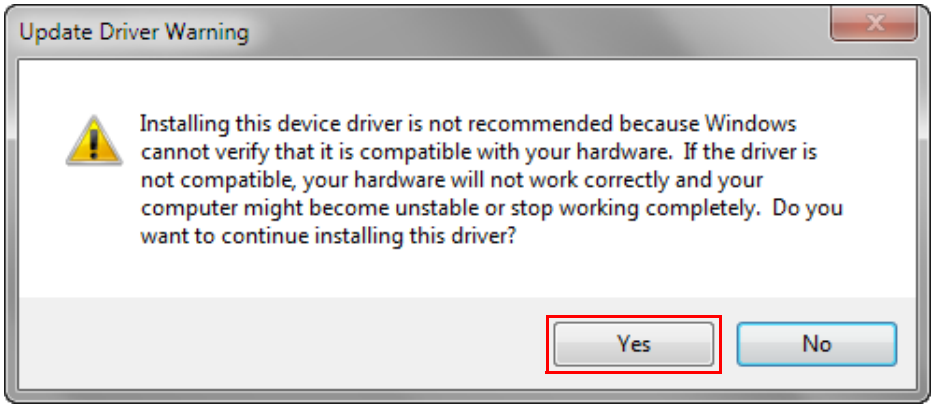
6. Select **Cypress HX3 Vendor Mode**, as shown in Figure 4-9.

Figure 4-9. Selecting Driver Type



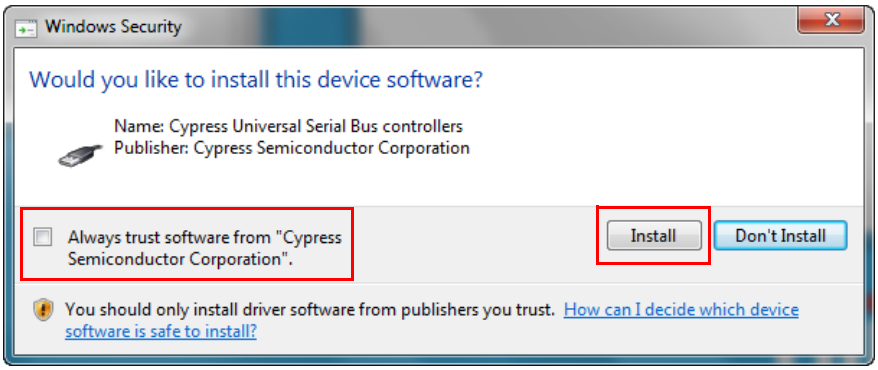
7. Click **Yes** in the **Update Driver Warning** window, as shown in Figure 4-10.

Figure 4-10. Confirming Installation of Driver



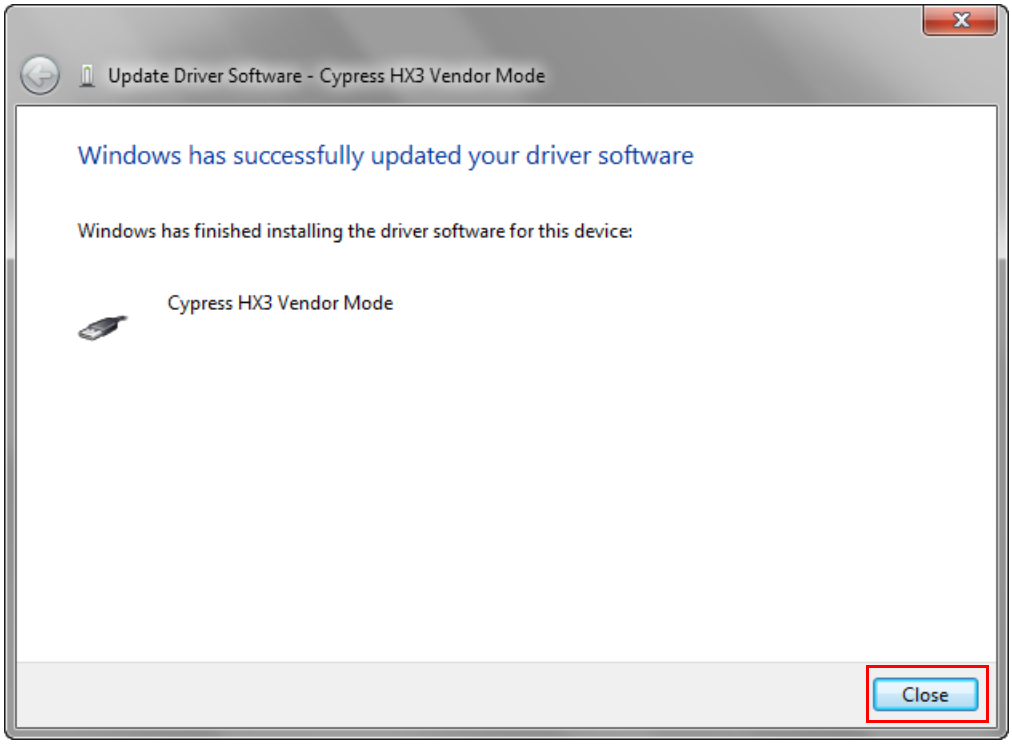
8. Accept the driver signature by selecting the **Always trust software from "Cypress Semiconductor Corporation"** check box and click **Install**; see Figure 4-11.

Figure 4-11. Enabling Installation of the Driver



9. When the installation is successful, click **Close**.

Figure 4-12. Successful Installation of CYUSBHX3 Driver



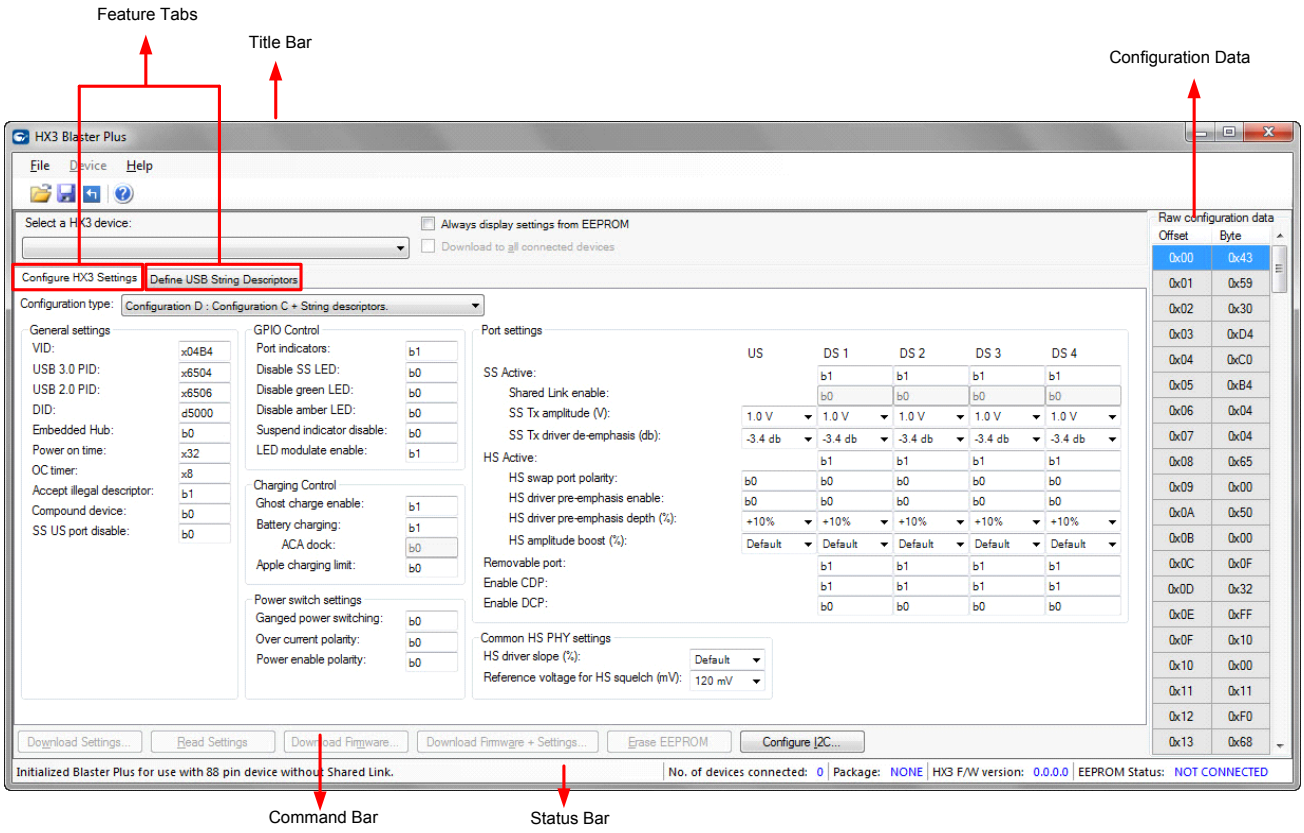
10. Restart the PC if required.

Note: When the CYUSBHX3 driver is installed successfully, the standard hub functionality including battery charging will not be supported until the driver is uninstalled. Refer to Uninstall the CYUSBHX3 Vendor Driver on page 57.

4.3.3 Configure HX3 Board Using the HX3 Blaster Plus Tool

1. Invoke the HX3 Blaster Plus tool from **Start** > **All Programs** > **Cypress** > **HX3 Blaster Plus** > **HX3 Blaster Plus**. The HX3 Blaster Plus GUI is displayed as shown in Figure 4-13.

Figure 4-13. GUI Layout of HX3 Blaster Plus Tool



HX3 Blaster Plus includes two feature tabs: **Configure HX3 Settings** and **Define USB String Descriptors**. The title bar of the application shows the currently selected device. The status bar displays the following information:

- Error, warning, and status messages
- HX3 package type used on the hardware or kit
- Firmware version used on the board
- EEPROM status, which displays five status values: NOT CONNECTED, BLANK, F/W, F/W + SETTINGS, and SETTINGS

The Configuration Data section of the GUI displays the flat view of the current configuration data displayed in the feature tabs.

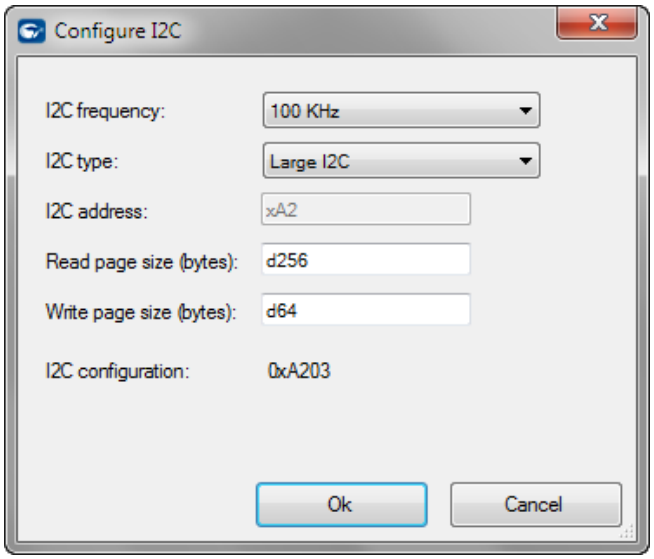
Table 4-3 provides an overview of the seven groups of configuration settings supported by the HX3 Blaster Plus tool.

Table 4-3. Configuration Setting Groups

Configuration Setting Group	Description
General settings	This group of parameters is related to the hub descriptor that will be sent to the host; these controls are according to the USB-IF hub specification and will change the enumeration details of HX3.
GPIO control	This group is applicable only to the 88-pin version of HX3. They control the default behavior of GPIO pins and port status indicator LED pins. The HX3 Blaster Plus tool gives you an option to drop the port status indicator LEDs to free up GPIOs.
Charging control	This group consists of configurable parameters related to USB Battery Charging, proprietary charging, and Ghost Charging.
Power switch settings	This group consists of configurable parameters related to HX3 power management controls such as power enable polarity, overcurrent polarity, and ganged power switching.
Port settings	This group consists of configurable parameters related to port-specific features such as Shared Link, DCP, CDP, and port polarity swapping. Also the physical layer (PHY) parameters for each port can be tuned according to the hardware design.
Common HS PHY settings	This group consists of configurable parameters related to advanced, high-speed PHY settings common to all the downstream and upstream ports.
USB string descriptors	This group consists of three configurable string descriptors, including the manufacturer string descriptor, product string descriptor, and serial number string descriptor.

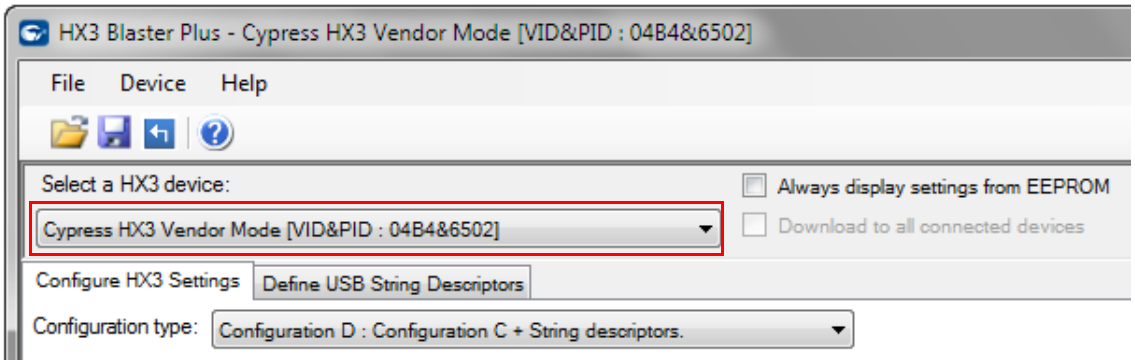
1. Click the **Configure I2C** button. Confirm that values for **I2C frequency**, **I2C type**, **Read page size**, and **Write page size** parameters are set as shown in Figure 4-14.

Figure 4-14. Setting I2C Parameters



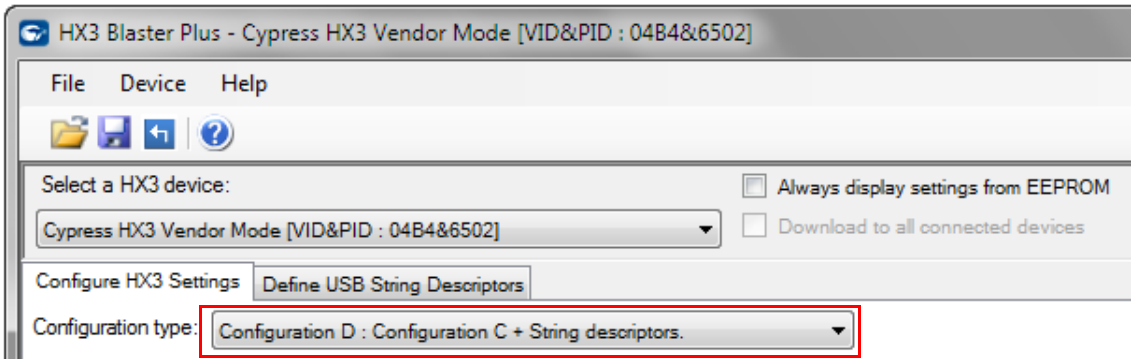
2. Select the HX3 device from the **Select a HX3 device** drop-down list, as shown in Figure 4-15.

Figure 4-15. Selecting HX3 Device



3. Select the **Configuration** type.

Figure 4-16. Selecting Configuration Type



Configuration type (Configuration A to Configuration D) determines the number of parameters that can be configured using the HX3 Blaster Plus tool GUI. Configuration A enables a minimum number of parameters and Configuration D enables a maximum number of parameters. Table 4-4 lists the configurable parameters for each configuration type.

Table 4-4. Configurable Parameters for Each Configuration Type

Configuration Setting Group	Configurable Parameters[a]	Configuration Type			
		A[b]	B[b]	C	D
General settings	VID	X	X	X	X
	USB 3.0 PID	X	X	X	X
	USB 2.0 PID			X	X
	DID	X	X	X	X
	Embedded hub		X	X	X
	Controller power		X	X	X
	Power on time		X	X	X
	OC timer		X	X	X
	Accept illegal descriptor		X	X	X
	Compound device		X	X	X
	Legacy host driver support		X	X	X
	SS US port disable		X	X	X

Table 4-4. Configurable Parameters for Each Configuration Type *(continued)*

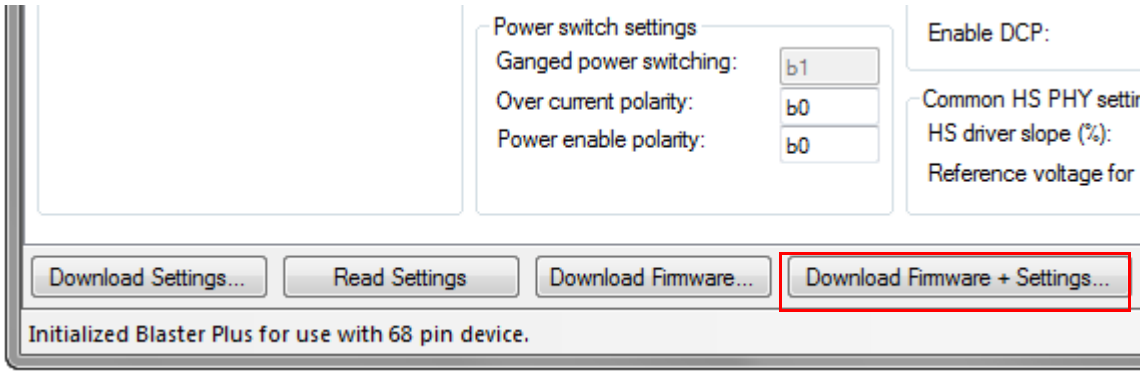
Configuration Setting Group	Configurable Parameters[a]	Configuration Type			
		A[b]	B[b]	C	D
GPIO control	Port Indicators		X	X	X
	Disable SS LED		X	X	X
	Disable green LED		X	X	X
	Disable amber LED		X	X	X
	Suspend indicator disable		X	X	X
	LED modulate enable		X	X	X
Charging control	Ghost charge enable		X	X	X
	Battery charging		X	X	X
	ACA-Dock		X	X	X
	Apple charging limit		X	X	X
Power switch settings	Ganged power switching		X	X	X
	Overcurrent polarity		X	X	X
	Power enable polarity		X	X	X
Port settings	SS active		X	X	X
	Shared Link enable		X	X	X
	SS Tx amplitude (V)			X	X
	SS Tx driver de-emphasis (db)			X	X
	HS active		X	X	X
	HS swap port polarity		X	X	X
	HS driver pre-emphasis enable			X	X
	HS driver pre-emphasis depth (%)			X	X
	HS amplitude boost (%)			X	X
	Removable port		X	X	X
	Enable CDP		X	X	X
	Enable DCP		X	X	X
Common HS PHY settings	HS driver slope (%)			X	X
	Reference voltage for HS squelch (mV)			X	X
USB string descriptors	Manufacturer string descriptor				X
	Product string descriptor				X
	Serial number string descriptor				X

a. Refer to the EEPROM Map table in the HX3 datasheet for more details about these configuration parameters. The EEPROM Map table describes the location and the default value for the configuration parameters.
b. When Configuration Type A and B are selected, the firmware assigns USB 2.0 PID by incrementing the value assigned to USB 3.0 PID by 2. For example, if you enter 6550 for USB 3.0 PID the firmware assigns 6552 for USB 2.0 PID.

4. Now, you can perform the following operations:
   a. Edit and download configuration settings to the EEPROM
   b. Download a custom firmware to the EEPROM
   c. Download a custom firmware and configuration settings together to the EEPROM
   d. Erase the contents of the EEPROM
   e. Read the configuration settings from the EEPROM

5. The following example illustrates the procedure to change the PID for the USB 3.0 hub interface and verify the updated PID.
   a. Click **Always display settings from EEPROM** check box located near the menu bar to read the current settings stored on the EEPROM.
   b. Modify the value of **USB 3.0 PID** listed in the **General Settings** group to 'x7500'.
   c. Click the **Download Firmware + Settings…** button to write the modified settings to EEPROM along with custom firmware, as shown in Figure 4-17.

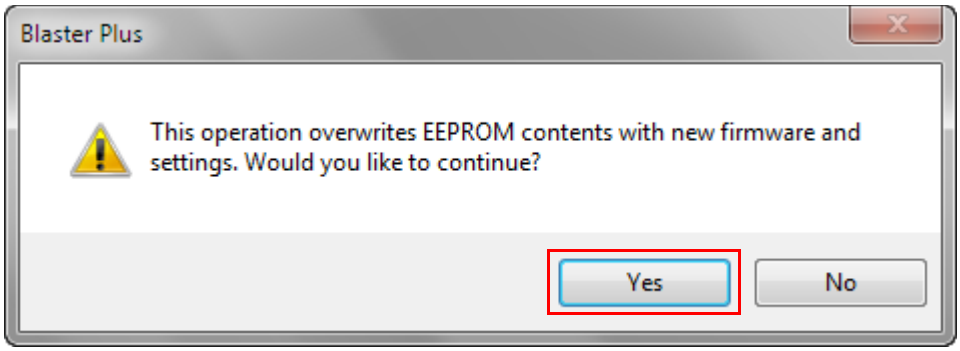
Figure 4-17. Downloading Custom Firmware and Configuration Settings



Notes:
1. Since the HX3 hardware is configured for custom firmware mode by default, always make sure to download the firmware along with the configuration settings.
2. In case you want to change the PID value for USB 3.0 or USB 2.0 hubs, make sure not to assign any of the other standard PID values allocated for HX3 kits as listed in Table 3-5 on page 26.

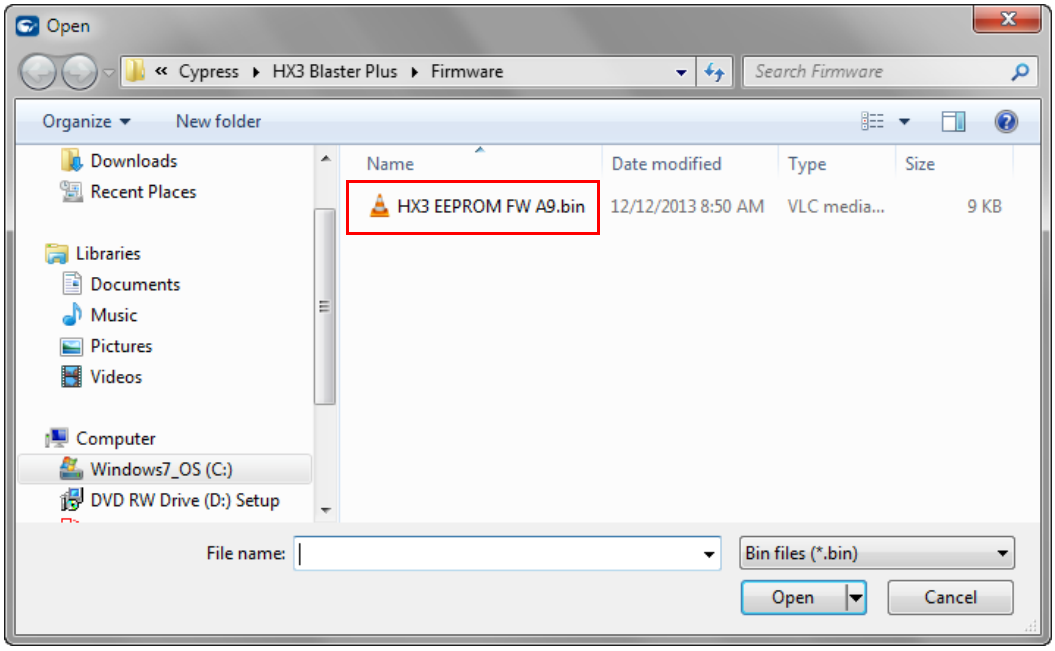
   d. Click **Yes** to confirm the download operation.

Figure 4-18. Confirming Firmware and Configuration Setting Download



e. Provide the path to the HX3 firmware (*HX3 EEPROM FW.bin*) in the dialog box and click **Open** (see Figure 4-19). The HX3 firmware is available under `<Install Directory>\HX3 Blaster Plus\Firmware`

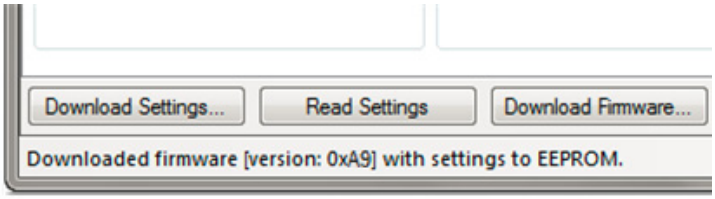
Figure 4-19. Selecting the Firmware File



Note: The "version" number shown in Figure 4-19 may vary depending upon the latest HX3 firmware version. Contact Cypress Technical Support at cypress.com/go/support for HX3 firmware-related queries.

f. Wait for the status bar to be updated as shown in Figure 4-20, denoting the successful download of the configuration parameters and firmware to the EEPROM.

Figure 4-20. EEPROM Download Confirmation



g. Reset the HX3 hardware by pressing the reset switch (SW1 on CY4603 and CY4609).

h. Identify the USB 3.0 hub entry in **Device Manager** for the HX3 hardware and check the PID.

Notes:

- When the HX3 Blaster Plus tool is invoked, it identifies the configuration parameters that can be modified for the HX3 part used on the given hardware and disables editing of all other parameters.
- Some configuration parameters include subparameters. When a configuration parameter is disabled, all the subparameters are also disabled. For example, disabling “SS Active” for “DS 1” disables all its subparameters. The subparameters are displayed in the GUI under the configuration parameter.

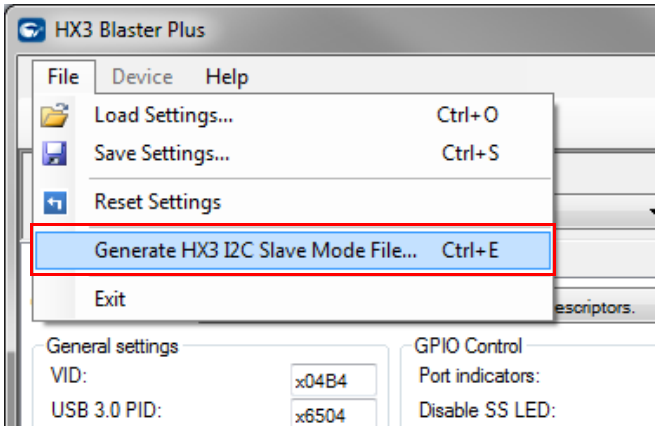
- While specifying value for the configuration parameters, make sure that the HX3 board design can support the values wherever applicable. For e.g., if the HX3 board design uses 'active low' signal to indicate 'over current' state on downstream port, only 0 can be assigned as the value for 'Over current polarity' parameter in Blaster Plus.
- After the configuration data along with the firmware is written to the EEPROM, the pin strap feature is disabled. This is because the configuration data stored in the EEPROM overrides all other settings. To enable the pin strap feature again, download only the custom firmware to the EEPROM using the HX3 Blaster Plus tool and power cycle the HX3 hardware.
- When configuration data is downloaded to multiple HX3 devices by enabling **Download to all connected devices**, the same serial number shall be used for all the devices.

4.3.4 Generating 'HX3 I2C Slave Mode file' for CY4603 and CY4613 DVKs

Note that the CY4603 and CY4613 DVKs support I2C slave mode operation which enables configuration of HX3 from an external I2C master.

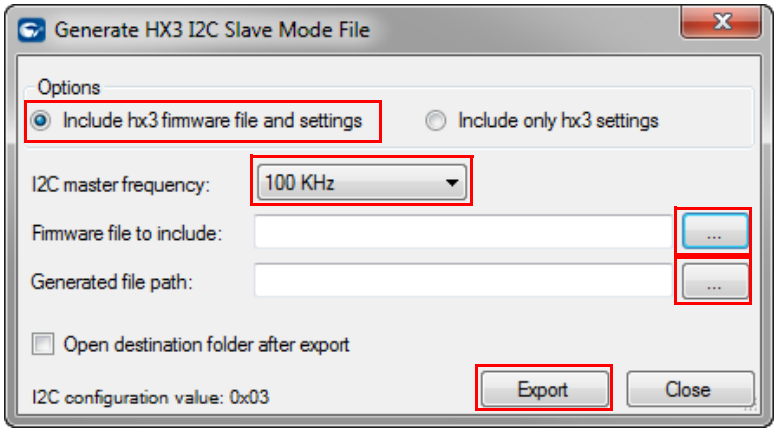
1. Specify the required configuration settings on the Blaster Plus GUI
2. Invoke 'Generate HX3 I2C Slave Mode File…' menu item from the 'File' menu as show in Figure 4-21.

Figure 4-21. Invoking menu item to generate I^{2}C slave mode file



3. On the **Generate HX3 I2C Slave Mode File** dialog box select **Include hx3 firmware file and settings** option as shown in Figure 4-22. Select the **I^{2}C master frequency** based on the frequency to be used by the I2C master device which shall be connected to the HX3 DVK. Provide the path to the HX3 firmware (HX3 EEPROM FW.bin) in **Firmware file to include** field. The HX3 firmware is available under <Install Directory>\HX3 Blaster Plus\Firmware. Also provide the path to store the output file in **Generated file path** field and click **Export**.
Note: Since the HX3 hardware is configured for custom firmware mode by default, always make sure to select **Include HX3 firmware file and settings** in the **Generate HX3 I2C Slave Mode File dialog box**.

Figure 4-22. Generate HX3 I²C Slave Mode File dialog box



4.3.5 Restoring CY4613 DVK to factory default firmware

The CY4613 DVK can be restored to factory default firmware using the below mentioned procedure:

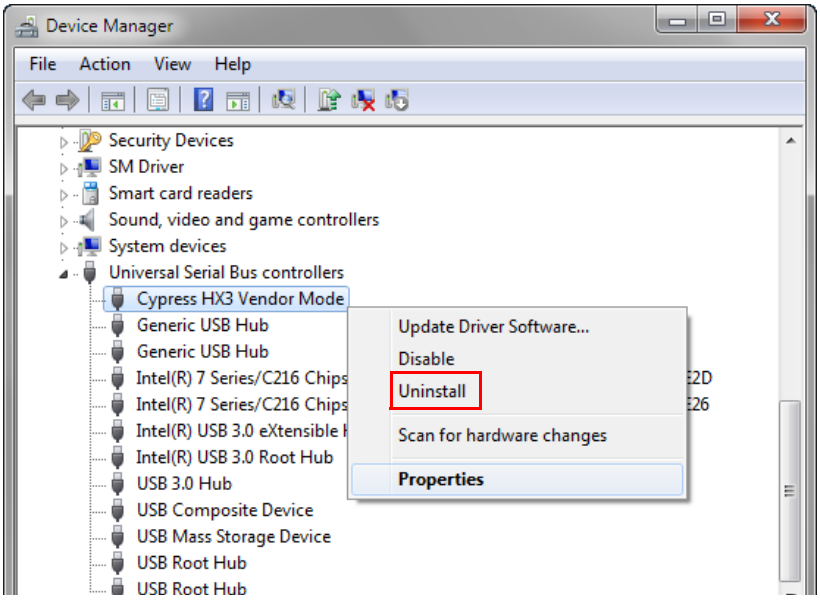
1. Power off the CY4613 board and configure it for the ROM firmware mode. Refer to Table 3-4 on page 23 for jumper details. Install a jumper on pins 1 and 2 of the PIN_STRAP_EN (J4) jumper block. Also, install a jumper on pins 2 and 3 of the ACA_DOCK (J2) jumper block.
2. Power on the CY4613 board and invoke the Blaster Plus tool.
3. Select Configuration type as **Configuration C** and set **Shared Link Enable** to '0' for DS3 and DS4.
4. Click the **Download Firmware + Settings…** button to write the modified settings to the EEPROM along with the custom firmware provided with the Blaster Plus tool as shown in Figure 4-17 on page 53.
5. Power off the CY4613 board and configure it for the Custom firmware mode. Refer to Table 3-4 on page 23 for jumper details. On the PIN_STRAP_EN (J4) jumper block, install a jumper on pins 2 and 3. The jumper on the ACA_DOCK (J2) jumper block need not be changed.

4.3.6 Uninstall the CYUSBHX3 Vendor Driver

When the CYUSBHX3 driver is installed, the board ceases to function as the HX3 hub and it can be used with the HX3 Blaster Plus tool only. To restore the hub functionality, you need to uninstall the CYUSBHX3 driver associated with the board using the following procedure:

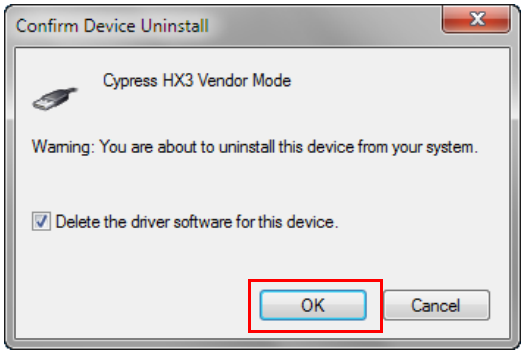
1. Open the **Device Manager** and locate the **Cypress HX3 Vendor Mode** device. Right-click the device and select **Uninstall**, as shown in Figure 4-23.

Figure 4-23. Uninstalling CYUSBHX3 Driver



2. Select **Delete the driver software for this device** and click **OK**; see Figure 4-24.

Figure 4-24. Initiating Uninstall of CYUSBHX3 Driver



3. Restart the PC if required.

This restores the hub driver, so the attached board can be used as the normal USB 3.0 hub.

5. Hardware

This chapter explains the theory of operation and design details for the CY4609, CY4603, and CY4613 hardware.

5.1 CY4609 RDK Hardware Design

5.1.1 Board Details

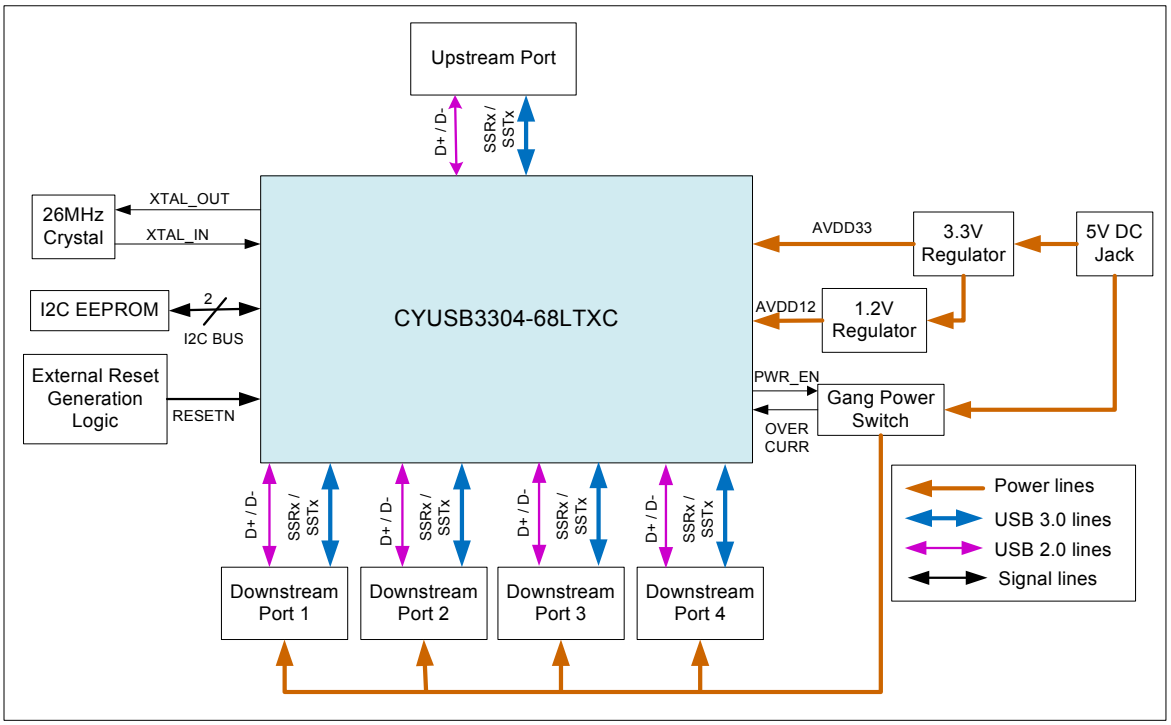
The CY4609 RDK hardware consists of the following components:

- CYUSB3304-68LTXC hub controller
- 5-V DC supply jack to connect the 5-V/4-A power adapter provided as part of the kit
- Two DC-DC power regulators to provide 3.3-V and 1.2-V power supply
- Four USB 3.0 downstream ports and a USB 3.0 upstream port
- Configuration mode select jumpers (J7 and J8)
- Onboard 16-KB I^2C EEPROM to store configuration data and hub controller firmware
- Power LED (PWR) and Hub Suspend Status LED (SUSP)
- Current measurement jumper (J2)

5.1.2 Theory of Operation

This section provides a block-level description of the CY4609 hardware illustrated in Figure 5-1.

Figure 5-1. CY4609 Hardware Block Diagram



The CY4609 RDK is based on the CYUSB3304-68LTXC hub controller. It is a small form-factor hardware supporting four USB 3.0 downstream ports that conform to USB 3.0 and BC v1.2 specifications. The ports also support Ghost Charging and emulate Apple charging. The upstream port is implemented using a USB 3.0 micro-B connector.

The RDK is shipped with a 5-V AC-DC adapter with a current rating of 4 A. However, the hardware is designed to support operation with an AC-DC adapter with up to a 6-A current rating.

The CYUSB3304-68LTXC hub controller is clocked using a 26-MHz crystal on the board.

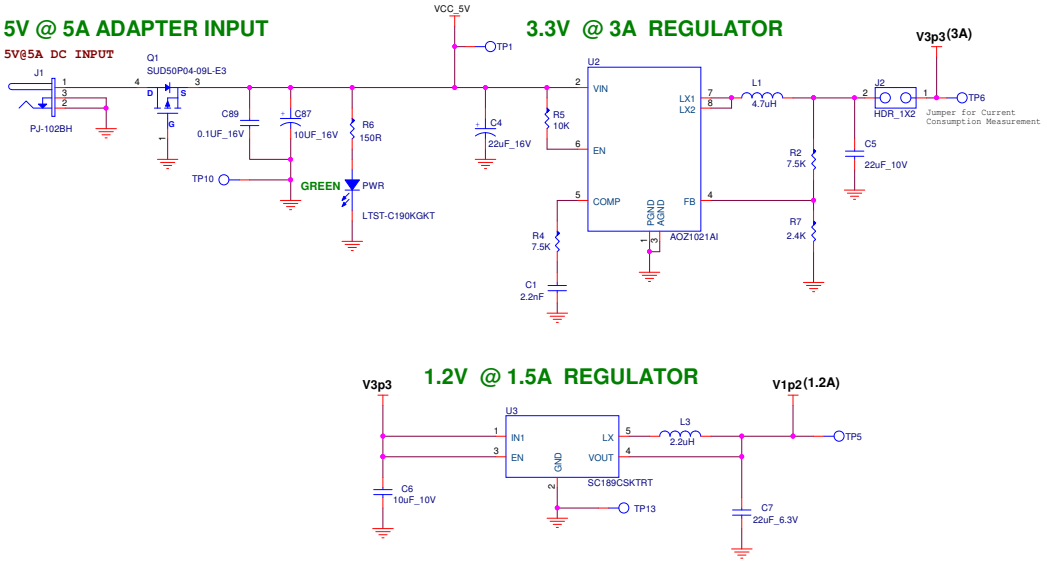
The HX3 hub controller supports an I^2C communication interface; it can support both slave and master modes. On the RDK, an EEPROM is connected to the hub controller on this interface to store the configuration data and firmware.

5.1.3 Functional Description

5.1.3.1 Power Supply

This section describes the hardware circuit implemented on the CY4609 RDK hardware to supply the required 5-V, 3.3-V, and 1.2-V power supplies, as shown in Figure 5-2. It also describes the circuit implemented to monitor and control overcurrent conditions on downstream ports.

Figure 5-2. Power Regulators for 3.3-V and 1.2-V Power Domains



HX3 (CYUSB3304-68LTXC) requires four power domains, as detailed in Table 5-1.

Table 5-1. HX3 Power Domains

Parameter	Description	Min	Typical	Max	Unit
AVDD12	1.2-V Analog supply	1.14	1.2	1.26	V
DVDD12	1.2-V Core supply	1.14	1.2	1.26	V
AVDD33	3.3-V Analog supply	3	3.3	3.6	V
VDDIO	3.3-V I/O supply	3	3.3	3.6	V

These power domains can be served using two power supplies (3.3 V and 1.2 V). The CY4609 RDK is designed to support these power supplies using two independent DC-DC regulators. The 5-V supply from the AC-DC adapter is fed to a 5-V-to-3.3-V DC-DC regulator (AOZ1021AI) to create a 3.3-V supply. The output from this regulator is fed to a 3.3-V-to-1.2-V DC-DC regulator (SC189CSKTRT) to create a 1.2-V supply.

The DC jack used on the RDK supports the AC-DC adapter with a center-positive configuration. If an AC-DC adapter with a center-negative configuration is connected to the RDK, the blocking diode of the MOSFET (Q1) provides reverse-polarity protection and avoids damage to the hardware.

The power LED (PWR) is connected on the input 5-V line and glows continuously when a 5-V supply is provided to the hardware.

The power (5-V VBUS) to downstream ports is controlled using a power switch (U5, TPS2556DRBT) as shown in Figure 5-3. This switch gets input from the 5-V AC-DC adapter connected to the hardware. The output of the power switch can be enabled and disabled by the HX3 using the Power Enable (PWR_EN_DS) GPIO.

After the output of the power switch is enabled, it monitors the current consumed by all the devices attached to the downstream ports in ganged mode. When the total current consumed exceeds 4.85 A, the power switch interrupts the HX3. The HX3 in turn immediately disables the output of the power switch by pulling the Power Enable (PWR_EN_DS) GPIO HIGH. This disables the power (5-V VBUS) to all four downstream ports; the hub controller notifies the PC that all the downstream ports are shut down.

Figure 5-3. Overcurrent Monitoring and Controlling of Downstream Ports Using Power Switch

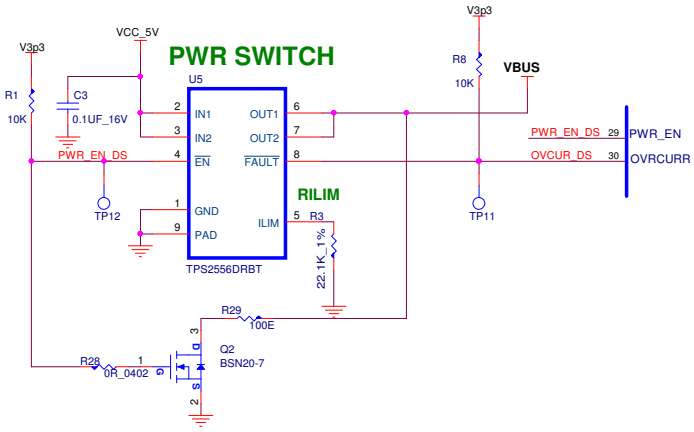


Table 5-2 lists the decoupling and bulk capacitors used on CY4609.

Table 5-2. Decoupling and Bulk Capacitors on CY4609

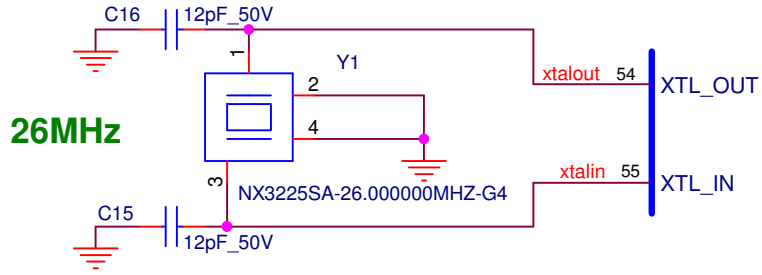
Power Domain (Pin Numbers)	Description	Bulk Capacitor for the Group	Decoupling Capacitor Per Pin
AVDD12 (10,16,34,46,52)	1.2 V for SS PHY RX	0.1 µF, 1 µF, and 22 µF	0.01 µF and 0.001 µF
AVDD12 (53)	1.2 V for clock domain	1 µF	0.1 µF and 0.01 µF
DVDD12 (1,3,19,27)	1.2 V for core	22 µF and 1 µF	0.1 µF and 0.01 µF
DVDD12 (7,13,37,43,49)	1.2 V for SS PHY TX	0.1 µF, 1 µF, and 22 µF	0.001 µF and 0.01 µF
AVDD33 (56,61,66)	3.3 V for internal PLL	1 µF and 22 µF	0.1 µF and 0.01 µF
AVDD33 (4)	3.3 V for USB 3.0 PHY	22 µF and 1 µF	0.1 µF and 0.01 µF
VDDIO (28)	3.3 V for I/Os	–	0.1 µF and 0.01 µF

Note: Visit www.cypress.com/hx3 for schematics with a reduced BOM.

5.1.3.2 Clock and Reset

This section describes the hardware circuit implemented for clock and reset aspects as shown in Figure 5-4.

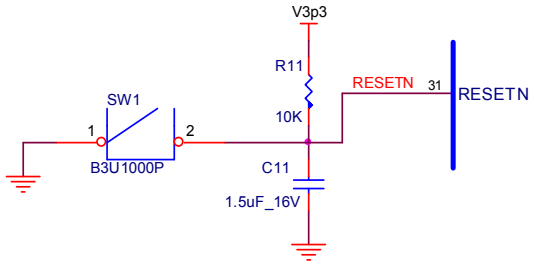
Figure 5-4. Clock Design



HX3 requires an external crystal with a frequency of 26 MHz and an accuracy of ±150 ppm in parallel resonant, fundamental mode. The crystal drive circuit is capable of a low-drive level (<200 µW). The crystal circuit implemented using the NX3225SA-26.000000MHZ-G4 part meets these requirements.

HX3 undergoes a hardware reset when the RESETN pin is pulled LOW. The RESETN pin is tied to the power supply (V3p3) through an external resistor and to ground (GND) through an external capacitor as shown in Figure 5-5. This RC circuit implements a 15-ms reset timing at power on, which guarantees the stable operation for HX3. There is also an external reset button to reset the HX3 hub controller manually whenever needed.

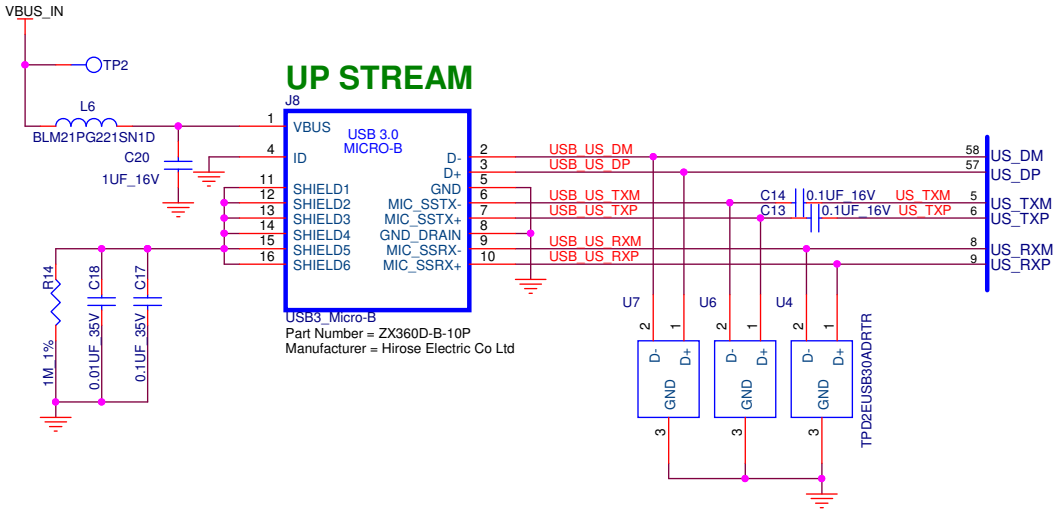
Figure 5-5. Reset Design



5.1.3.3 USB 3.0 Ports

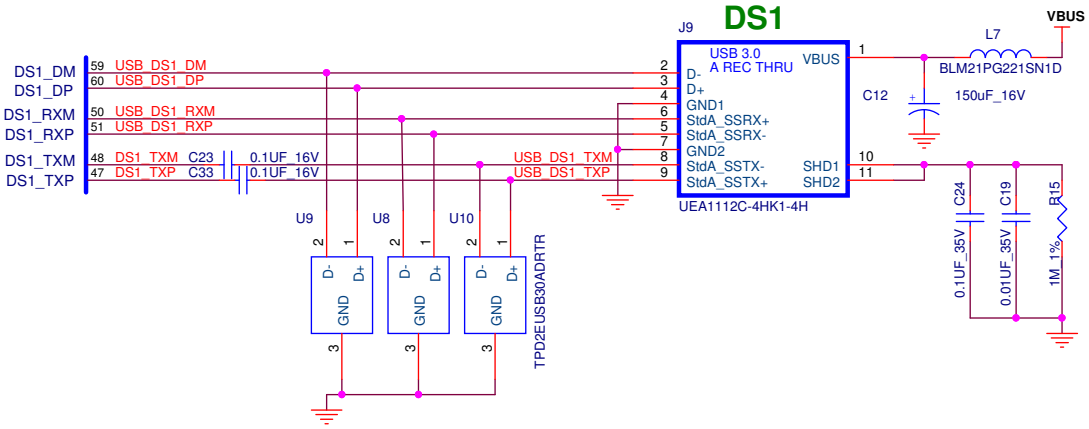
This section describes the hardware circuit for the upstream port (Figure 5-6) and four downstream ports (Figure 5-7). CY4609 uses a micro-B connector for the upstream port and a standard-A connector for downstream ports. ESD protection diode ICs are included on all these connectors to support the IEC 610004-5 (level 4) ESD standard.

Figure 5-6. Implementation of Upstream Port



The upstream interface is implemented using a USB 3.0-certified micro-B connector (ZX360D-B-10P). Three pairs of differential data lines (D±, SSTX±, SSRX±) are connected from the HX3 hub controller to the micro-B connector. A reinforcement wire is fastened around the micro-B connector to provide mechanical support to the connector.

Figure 5-7. Implementation of Downstream (DS) Port



The downstream interface is implemented using a USB 3.0-certified standard-A connector (UEA1112C-4HK1-4H). Three pairs of differential data lines (D±, SSTX±, SSRX±) are connected from the HX3 hub controller to the type-A connector.

5.1.3.4 LEDs and Jumpers

This section describes the hardware circuit for the two LEDs (see Figure 5-8 and Table 5-3) and the jumpers (see Figure 5-9) implemented on the CY4609 hardware.

Figure 5-8. LEDs

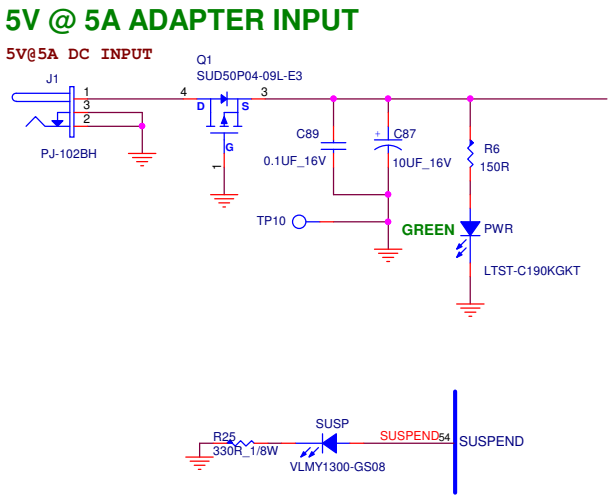
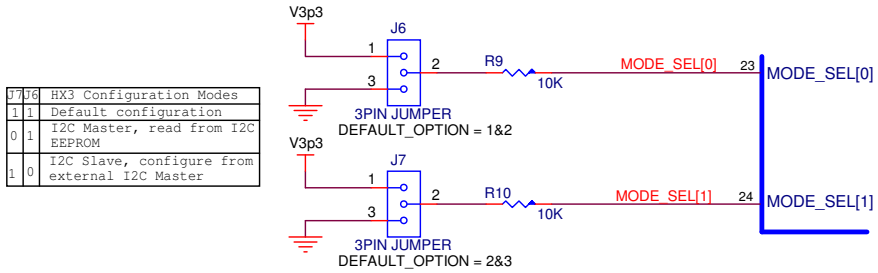


Table 5-3. LEDs on CY4609 Hardware

LED Name	Color	Purpose	Implementation
Power LED	Green	Indicates that the CY4609 hardware is powered	The LED is implemented as part of the power circuit and it remains turned on as long as the 5-V power is available at the 5-V DC jack input.
Suspend Status LED	Amber	Indicates whether the hub is in a suspend state	This LED is controlled by the HX3 firmware, which turns on this LED whenever HX3 goes into a suspend state. It is turned off when HX3 exits the suspend state.

Figure 5-9. Jumpers

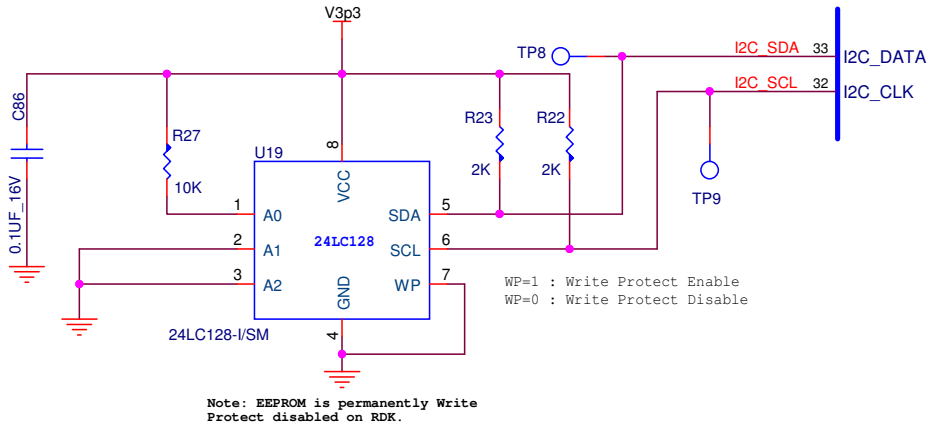


The CY4609 RDK hardware implements two jumpers (J6 and J7). These jumpers are used to specify the boot mode for HX3. Refer to the *System Interfaces* section of the HX3 datasheet to learn more about how the configuration mode select jumpers work.

5.1.3.5 EEPROM Over I^2C Interface

This section describes the hardware circuit used to attach an external EEPROM to the HX3 hub controller, as shown in Figure 5-10.

Figure 5-10. I²C EEPROM on CY4609 Hardware



HX3 supports the I²C communication interface, which can be configured in the master or slave mode. On the CY4609 RDK, an onboard I²C-based EEPROM (24LC128-I/SM) with an address of 10100010b is connected, with HX3 acting as the I²C master. The storage capacity of this EEPROM is 16 KB. Test points are provided on the I²C data (I2C_SDA) and clock (I2C_SCL) lines to connect any external device over the I²C interface.

Note that the current CY4609 hardware design provides the flexibility to enable or disable Write Protect (WP) for the I²C EEPROM during assembly time. WP can be disabled by assembling a 0-Ω resistor between WP and GND; it can be enabled by assembling a 0-Ω resistor between WP and V3p3. WP is disabled by default on the CY4609 hardware to enable configuration data to be stored on the EEPROM using the HX3 Blaster Plus tool.

5.1.3.6 *Test Points*

Table 5-4 lists the test points available on the CY4609 hardware and the associated signal names.

Table 5-4. Test Points on CY4609 Hardware

Test Point	Signal Name
TP1	VCC_5V
TP2	VBUS input from the PC
TP3	GPIO
TP4	SWDDIO
TP5	V1P2
TP6	V3P3
TP7	SWDCLK
TP8	I2C_SDA
TP9	I2C_SCL
TP10	Ground
TP11	Ganged overcurrent input
TP12	Power enable output for DS ports

Take the following precautions while using the test points:

- Do not apply overvoltage or reverse voltage on the 5-V, 3.3-V, and 1.2-V test points.
- Do not short the power test points with ground.

5.2 CY4603 DVK Hardware Design

5.2.1 Board Details

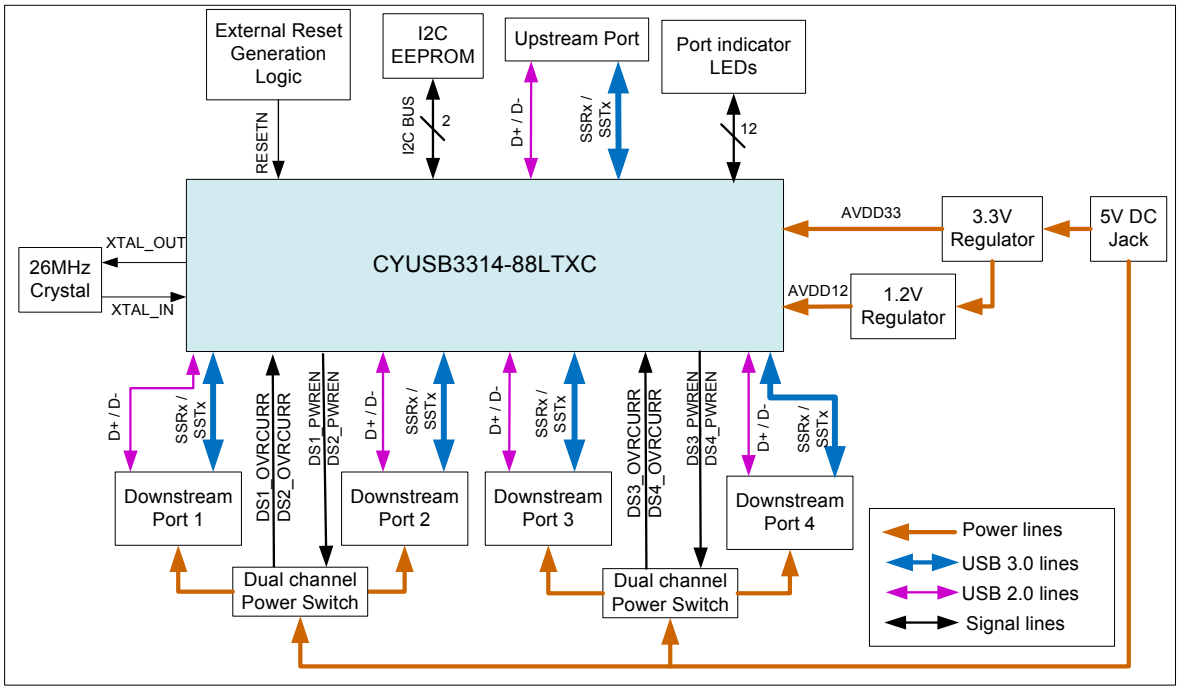
The CY4603 DVK hardware consists of the following components:

- CYUSB3314-88LTXC hub controller
- Power supply block to provide 5-V, 3.3-V, and 1.2-V outputs
- Four USB 3.0 downstream ports and one USB 3.0 upstream port
- Configuration-mode selection jumpers (J17 and J18)
- Onboard 16-KB EEPROM to store configuration data and HX3 firmware
- Power LED (PWR) and Hub Suspend Status LED (SUSP)
- Port Status Indicator LEDs
- Current-measurement jumper (J6)

5.2.2 Theory of Operation

This section provides a block-level description of the CY4603 hardware shown in Figure 5-11.

Figure 5-11. CY4603 Hardware Block Diagram



The CY4603 DVK supports four downstream ports, which are terminated as USB 3.0 type-A connectors. All these downstream ports conform to the USB 3.0 and BC v1.2 specifications. They also support Ghost Charging and emulate Apple charging. Each downstream port is controlled using a power switch, which allows monitoring an overcurrent situation on each downstream port and the shutdown of the ports with an overcurrent condition selectively.

The CYUSB3314-88LTXC hub controller is clocked using a 26-MHz crystal. More details about the crystal specification are available in the HX3 datasheet. The DVK is powered using a 5-V AC-DC adapter. The DVK is shipped with a 5-V AC-DC adapter with a current rating of 4 A. However, the power supply tracks on the DVK hardware are designed to support up to 8 A of input current. The

DVK contains two onboard DC-DC regulators to provide 3.3-V and 1.2-V power supplies to the HX3 hub controller. A 5-V input from the AC-DC adapter is directly passed to the downstream ports via power switches.

The HX3 hub controller supports the I^2C communication interface; it can support both slave and master modes. On the DVK, an I^2C EEPROM is interfaced to the hub controller to store the configuration data and firmware, with the hub controller acting as the I^2C master.

5.2.3 Functional Description

5.2.3.1 Power Supply

CY4603 uses the same power supply circuit as CY4609 to generate 3.3-V and 1.2-V power supplies. The design of CY4603 differs from that of CY4609 with respect to the implementation of power control. CY4603 implementation supports monitoring an overcurrent condition at each downstream port using a power switch. To reduce the number of power switches, CY4603 uses two dual-channel power switches (TPS2560DRC) as shown in Figure 5-12. Each switch can control two downstream ports.

These power switches are configured to interrupt the HX3 hub controller when the current drawn by the connected downstream device exceeds 2.1 A. In response, HX3 immediately shuts down the power supply (VBUS) to that downstream port by disabling power enable on the corresponding channel (for example, DS1_PWREN) of the power switch.

Figure 5-12. Power Switch Implementation

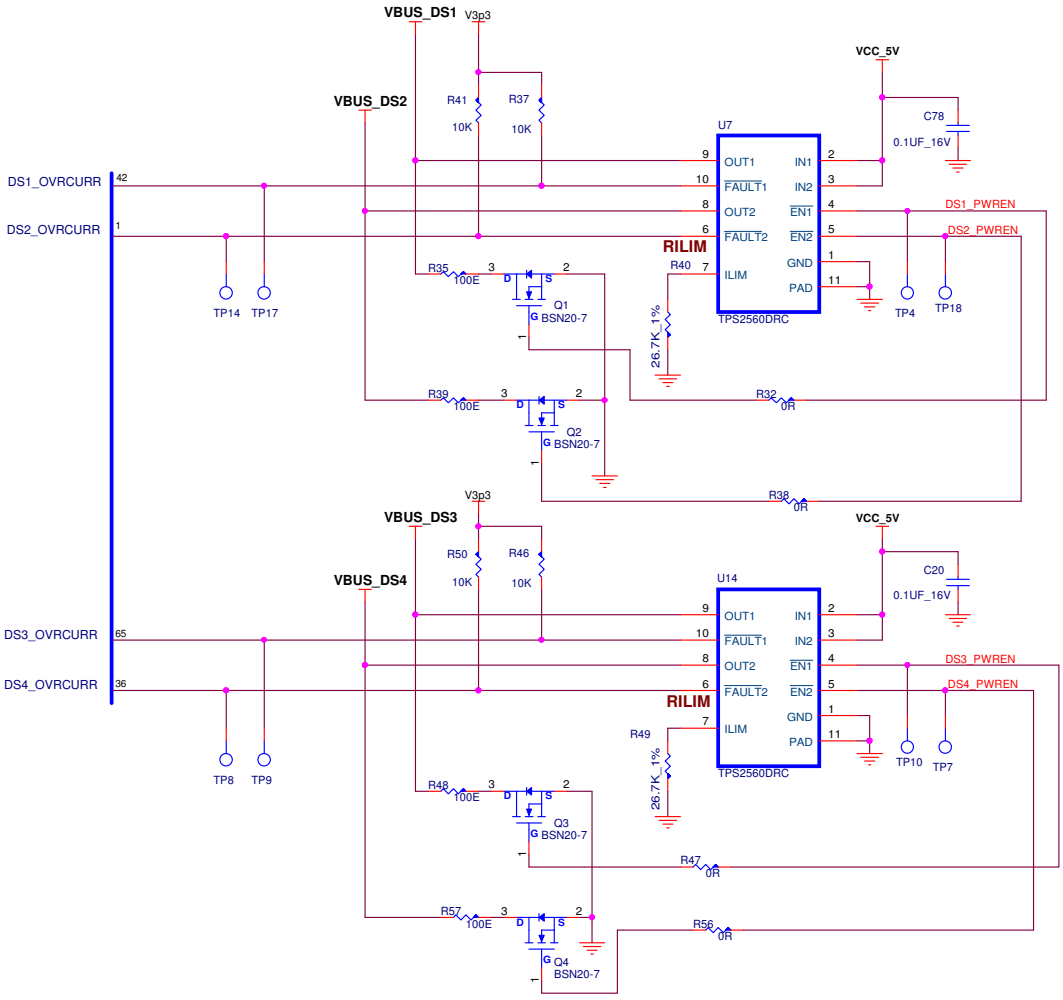


Table 5-5 lists the decoupling and bulk capacitors used on CY4603.

Table 5-5. Decoupling and Bulk Capacitors on CY4603

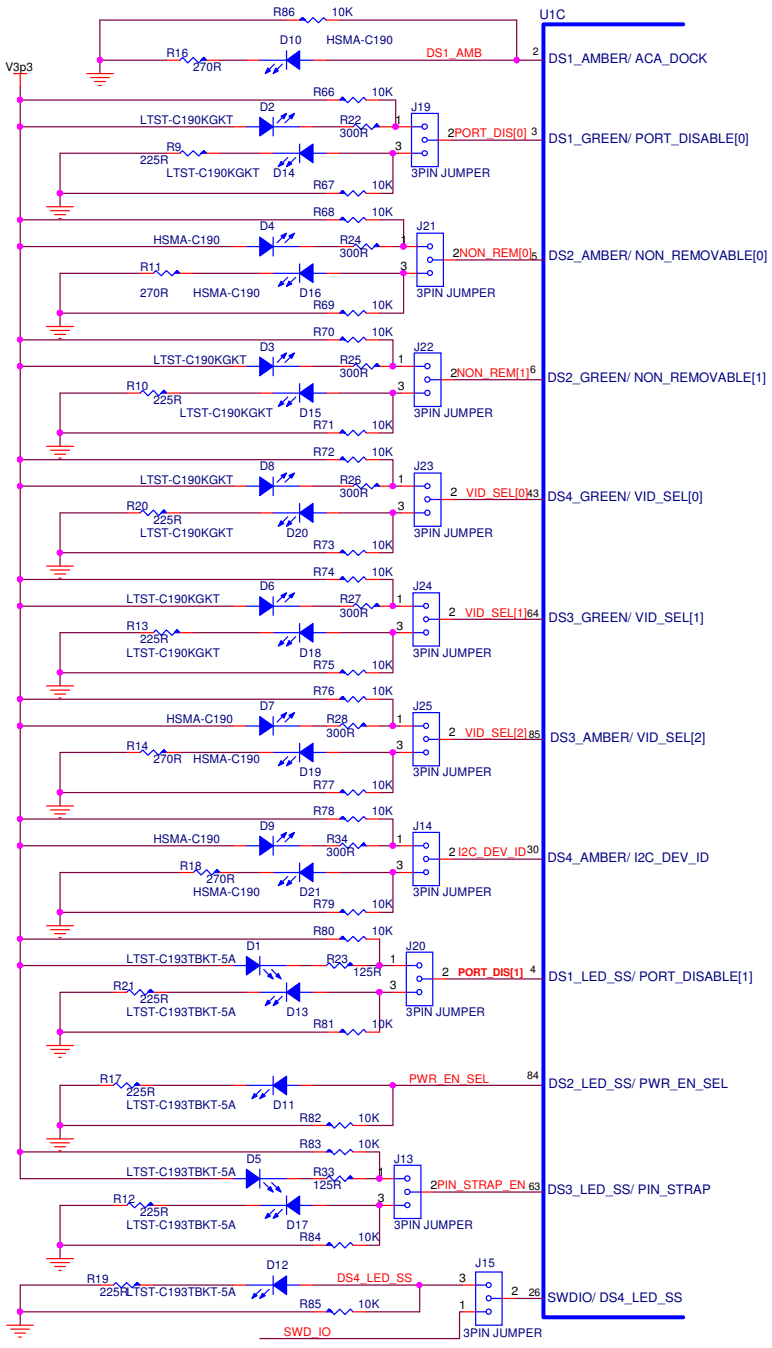
Power Domain (Pin Numbers)	Description	Bulk Capacitor for the Group	Decoupling Capacitor Per Pin
AVDD12 (15,21,44,56,62)	1.2 V for SS PHY RX	0.1 µF, 1 µF, and 22 µF	0.01 µF and 0.001 µF
AVDD12 (67)	1.2 V for clock domain	1 µF	0.1 µF and 0.01 µF
DVDD12 (8,24,33,83)	1.2 V for core	10 µF and 1 µF	0.1 µF and 0.01 µF
DVDD12 (12,18,47,53,59)	1.2 V for SS TX	0.1 µF, 1 µF, and 22 µF	0.001 µF and 0.01 µF
AVDD33 (70,75,80)	3.3 V for internal PLL	10 µF and 1 µF	0.1 µF and 0.01 µF
AVDD33 (9)	3.3 V for USB 3.0 PHY	10 µF and 1 µF	0.1 µF and 0.01 µF
VDDIO (34,66,88)	3.3 V for I/Os	10 µF	0.1 µF and 0.01 µF

Note: Visit www.cypress.com/hx3 for schematics with a reduced BOM.

5.2.3.2 *LEDs and Jumpers*

CY4603 uses the same circuit as CY4609 for the boot mode selection jumper and for the Power (PWR) and Suspend (SUSP) LEDs. However, CY4603 implements three LEDs per downstream port to indicate SuperSpeed (blue), USB 2.0 (green), and exception (amber) status. Figure 5-13 illustrates the circuit implementing this functionality. This diagram also captures the pin strap configuration circuit that is implemented by sharing GPIOs used for status LEDs.

Figure 5-13. Status LEDs for Downstream Ports



5.2.3.3 EEPROM over I²C Interface

CY4603 uses the same circuit as CY4609 to interface with the EEPROM.

5.2.3.4 Clock and Reset

CY4603 uses the same clock and reset circuit as CY4609.

5.2.3.5 USB Ports

CY4603 implements an upstream connector interface using a standard-B connector instead of a micro-B connector as in CY4609, but CY4603 uses the same downstream port circuit as CY4609.

5.2.3.6 Test Points

Table 5-6 lists the test points available on the CY4603 hardware and the associated signal names.

Table 5-6. Test Points on CY4603 Hardware

Test Point	Signal Name
TP1	Ground
TP2	VCC_5V
TP3	Ground
TP4	Power enable output for DS1 port
TP5	V3P3
TP6	V1P2
TP7	Power enable output for DS4 port
TP8	Overcurrent input for DS4 port
TP9	Overcurrent input for DS3 port
TP10	Power enable output for DS3 port
TP11	Serial data of I²C
TP12	Serial clock of I²C
TP13	Ground
TP14	Overcurrent input for DS2 port
TP15	VBUS input from the PC or laptop
TP16	Regulated output of VBUS from US
TP17	Overcurrent input for DS1 port
TP18	Power enable output for DS2 port
TP19	Overcurrent for VBUS protection IC
TP20	Overcurrent input for US port

Take the following precautions while using the test points:

- Do not apply overvoltage or reverse voltage on the TP2 (5-V), TP5 (3.3-V), and TP6 (1.2-V) test points.
- Do not short the power test points with ground.

5.3 CY4613 DVK Hardware Design

5.3.1 Board Details

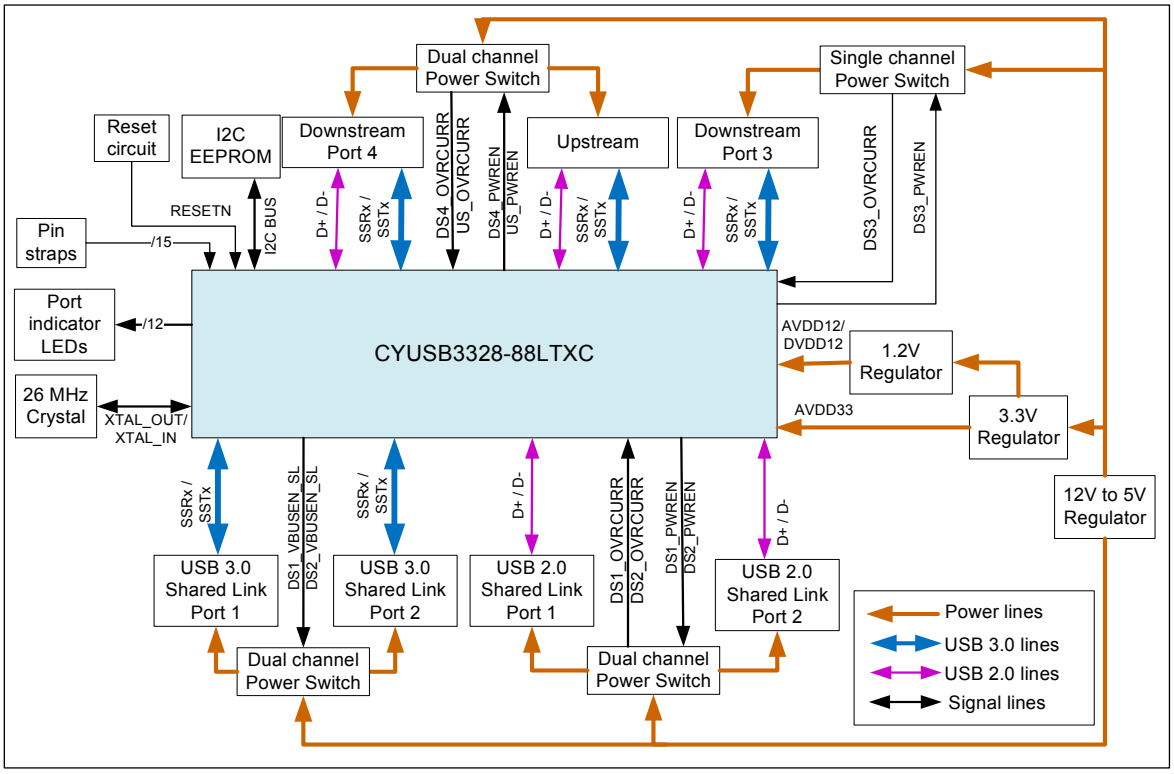
The CY4613 DVK hardware consists of the following components:

- CYUSB3328-88LTXC hub controller. It is an 8-port Shared Link part, which is configured using the Blaster Plus tool for six-port operation on the CY4613 board
- Power supply block to provide 5-V, 3.3-V, and 1.2-V outputs
- Two standard USB 3.0 downstream ports, two Shared Link USB 2.0 ports, two Shared Link SS ports, and one USB 3.0 upstream port
- Configuration-mode selection jumpers (J5 and J6)
- Onboard 16-KB EEPROM to store the configuration data and HX3 firmware
- Power (PWR) LED and Hub Suspend Status (SUSP) LED
- Port Status Indicator LEDs for each downstream port
- Current-measurement jumper (J20)

5.3.2 Theory of Operation

This section provides a block-level description of the CY4613 hardware shown in Figure 5-14.

Figure 5-14. CY4613 Hardware Block Diagram



The CY4613 DVK supports six downstream ports, which are terminated as four USB 3.0 ports and two USB 2.0 ports. The DVK is powered using a 12-V AC-DC adaptor with a current rating of 3 A.

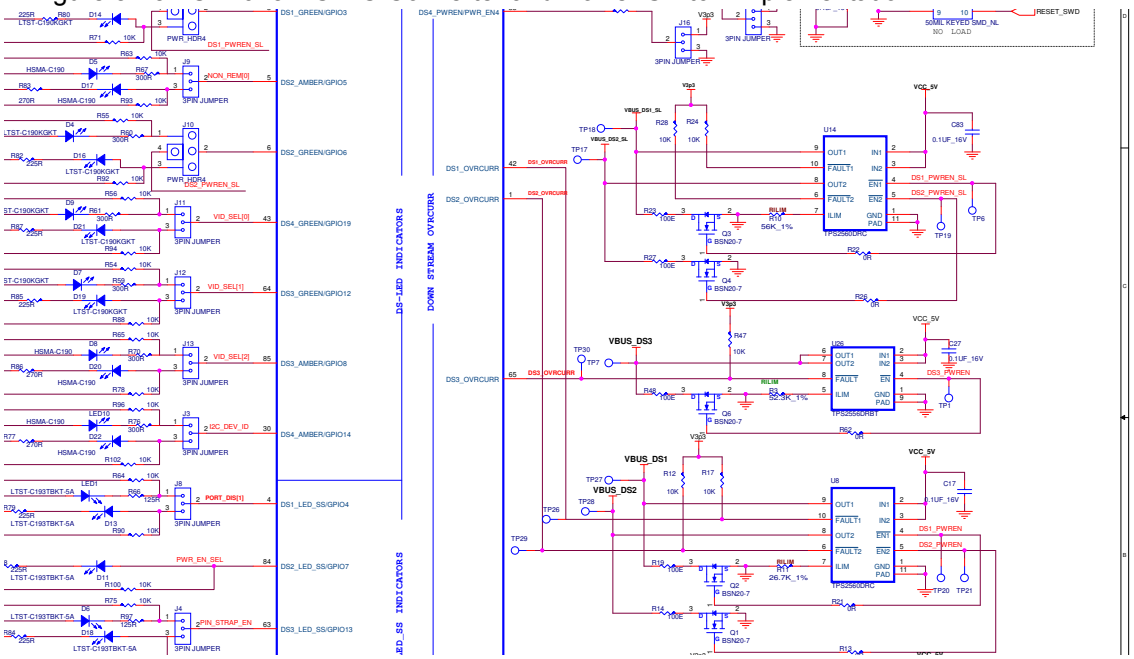
5.3.3 Functional Description

5.3.3.1 Power Supply

This section describes the hardware circuit implemented on the CY4613 DVK hardware to provide the required 5-V, 3.3-V, and 1.2-V supplies. A 12-V DC-DC regulator is used to generate the 5-V supply. The output of the 12-V to 5-V regulator is fed to a power switch, which limits the maximum current to 5 A to prevent excess heating of the 12-V to 5-V DC-DC regulator.

CY4613 uses the same power circuit as the CY4609 to generate the 3.3-V and 1.2-V supplies. A Ferrite Bead (L12) is used at the input of the 3.3-V regulator to remove excess ripple from the 12-V to 5-V DC-DC regulator.

Figure 5-15. CY4613 DC-DC Converter and Power Switch Implementation



The power switches are configured to interrupt the HX3 hub controller when the current drawn by the connected devices exceeds 2.1 A on the Shared Link USB 2.0 downstream port and standard USB 3.0 ports. The power switch used for the USB 3.0 Shared Link downstream ports interrupts the HX3 hub controller when the current drawn by the connected devices exceeds 1 A.

5.3.3.2 LEDs and Jumpers

CY4613 uses the same circuit as CY4603 for the configuration-mode selection jumper, power LED (PWR), hub suspend status LED (SUSP), and port status indicator LEDs.

5.3.3.3 EEPROM Over I²C Interface

CY4613 uses the same circuit as CY4603 to interface with the EEPROM.

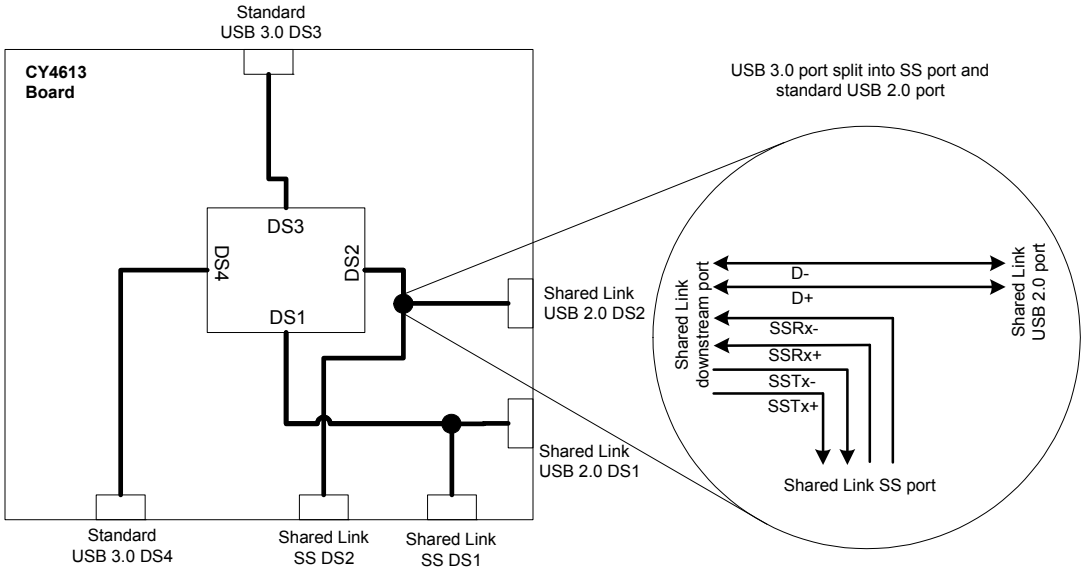
5.3.3.4 Clock and Reset

CY4613 uses the same clock and reset circuit as CY4603.

5.3.3.5 *Shared Link Implementation*

Shared Link is a Cypress-proprietary feature that enables a USB 3.0 port to be split into an embedded SS port and a standard USB 2.0 port. For example, if one of the DS ports is connected to an embedded SS device, HX3 enables the system designer to reuse the USB 2.0 signals of that specific port to connect to a standard USB 2.0 device. Figure 5-16 shows how Shared Link is implemented on the CY4613 board.

Figure 5-16. CY4613 Shared Link Implementation



On CY4613, DS1 and DS2 are implemented as Shared Link ports. Thus, a total of six USB ports are available on the CY4613 board as listed in Table 5-7.

Table 5-7. CY4613 Downstream Port Types

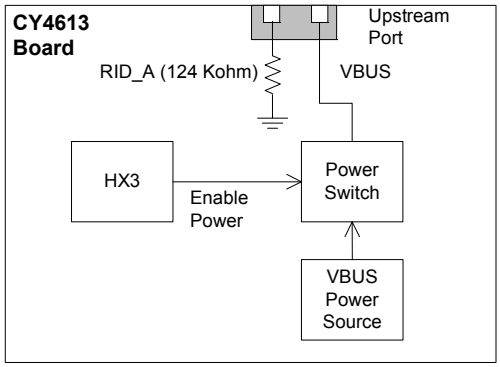
Downstream Port Type	Quantity	Designator
Standard USB 3.0 port	2	DS3 and DS4
Shared Link SS port	2	DS1 and DS2
Shared Link USB 2.0 port	2	DS1 and DS2

5.3.3.6 *ACA- Dock Implementation*

In traditional USB topologies, the host DS port provides VBUS to enable and charge the connected devices. With OTG devices, however, the ACA-Dock provides VBUS and a method to charge the host. HX3 supports the ACA-Dock standard by integrating the functions of the adaptor controller.

Figure 5-17 shows the ACA-Dock system. If ACA-Dock is enabled, HX3 turns on the external power switch to drive VBUS on the US port. To inform the device connected on the US port that it should act as a host and draw current, the ID pin is connected to ground using RID_A as shown in Figure 5-17.

Figure 5-17. ACA- Dock Implementation



Note: The RID resistor value may require change for docking applications targeted for some specific hosts, which are not compliant to the BC v1.2 specification. Contact Cypress Technical Support at cypress.com/go/support to get more details.

CY4613 supports the ACA-Dock feature (BC v1.2 compliant). The following three jumpers are used to set up the ACA-Dock feature.

Table 5-8. CY4613 ACA-Dock Configuration Jumpers

Jumper	Purpose
J26	To drive VBUS on the US port
J27	To indicate to the device connected on the US port to act as a host and draw current from the VBUS provided by the CY4613 board
J28	To enable VBUS sensing to the HX3 hub controller from an onboard DC-DC regulator

5.3.3.7 *Test Points*

Table 5-9 lists the test points available on the CY4613 hardware and the associated signal names.

Table 5-9. CY4613 Test Points

Test Point	Signal Name
TP1	Power Enable for DS3 port
TP2	GND
TP3	Overcurrent signal for DS4 port
TP4	VCC_5V
TP5	GND
TP6	Power Enable for Shared Link DS1 port
TP7	VBUS Power for DS3 port

Table 5-9. CY4613 Test Points *(continued)*

Test Point	Signal Name
TP8	V3P3
TP9	V1P2
TP10	Overcurrent for US port
TP11	Power Enable for US port
TP12	VBUS Power for DS4 port
TP13	Power Enable for DS4 port
TP14	Serial Data for I^2C
TP15	Serial Clock for I^2C
TP16	GND
TP17	VBUS Power for Shared Link DS2 port
TP18	VBUS Power for Shared Link DS1 port
TP19	Power Enable for shared link DS2 port
TP20	Power Enable for DS1 port
TP21	Power Enable for DS2 port
TP22	VBUS_IN from the PC
TP23	VBUS_PROTECT
TP24	VBUS_IN from the PC
TP25	Overcurrent for VBUS Protect IC
TP26	Overcurrent for DS1 port
TP27	VBUS Power for DS1 port
TP28	VBUS Power for DS2 port
TP29	Overcurrent for DS2 port
TP30	Overcurrent for DS3 port

Take the following precautions while using the test points:

- Do not apply overvoltage or reverse voltage on the TP4 (5 V), TP8 (3.3 V), and TP9 (1.2 V) test points.
- Do not short the power test points with ground.

A. Appendix

A.1 Troubleshooting Guide

Table A-1. Troubleshooting the CY4609, CY4603, and CY4613 Kits

Problem	Applicable Kits	Possible Cause	Possible Solution
The HX3 board does not power on.	CY4609, CY4603, and CY4613	The jumper on the current measurement header may not have been installed.	Ensure that the jumper on the current measurement header (J2 on CY4609, J6 on CY4603, and J20 on CY4613) is connected correctly.
		If you are holding the HX3 board, you may be touching the crystal area on the board.	Remove the contact on the crystal and power on the board. See Figure 3-4 on page 19 for the crystal location.
Only the USB 2.0 hub entry appears in the Device Manager (on Windows operating systems) when the HX3 board is connected to the PC.	CY4609, CY4603, and CY4613	The PC USB port may not support USB 3.0 capability.	Ensure that the PC has USB 3.0 specification-compliant ports.
		The USB cable used to connect the HX3 hardware may not support USB 3.0 capability.	Ensure that the USB cable provided with the Cypress kits or cables supporting USB 3.0 capability are used.
		The USB device driver installed on the PC may not support USB 3.0 capability.	Check whether the device driver installed on the PC supports USB 3.0 capability. Fix the device driver if required.
Port status indicator LEDs do not work.	CY4603 and CY4613	If the port status indicator LED is shared with the pin strap feature, a jumper associated with that pin strap may have been installed.	See Table 3-7 on page 30 to check if the port status indicator LED is shared with a pin strap. If it is shared, ensure that the pin strap is strapped to logic '0' or '1' as described in "Configuring HX3 Using Pin Straps on CY4603" on page 34. The pin strap jumper needs to be installed tightly even though the pin strap feature is not enabled using PIN_STRAP_EN (J13).
When a USB 3.0 device is connected on a downstream port, the green port status indicator LED glows instead of the blue LED.	CY4603 and CY4613	The hardware might be operating in the USB 2.0 mode because the USB port on the PC may not support USB 3.0 capability.	Ensure that the USB port on the PC supports USB 3.0 capability. Otherwise, the CY4603 hardware will operate in the USB 2.0 mode only.

Table A-1. Troubleshooting the CY4609, CY4603, and CY4613 Kits *(continued)*

Problem	Applicable Kits	Possible Cause	Possible Solution
Pin strap feature does not work.	CY4603	The pin strap feature may not have been enabled.	Ensure that the pin strap feature is enabled by shorting pins 1 and 2 of the PIN_STRAP_EN (J13) jumper.
		The CY4603 board may not have been restarted after configuring the pin strap jumper.	Restart the CY4603 board either by power cycling the hardware or by pressing the reset switch (SW1).
A task started on the PC (such as copying a file from a flash drive connected to the hub's downstream port) is aborted.	CY4609, CY4603, and CY4613	An external event (such as accidental unplugging of the flash drive from the hub's downstream port) may have caused an error condition, which may have resulted in the task getting aborted.	Fix the error condition (for example, plug in the flash driver on the hub's downstream port) and restart the operation on the PC.
The HX3 Blaster Plus tool does not list the HX3 board that is connected to the PC on the tool's title bar.	CY4609, CY4603, and CY4613	The CYUSBHX3 vendor driver may not be bound on the USB port to which the HX3 board is connected.	Ensure that the CYUSBHX3 vendor driver is bound using the procedure described in "Bind CYUSBHX3 Vendor Driver on the PC" on page 43 before invoking the HX3 Blaster Plus tool.
The HX3 Blaster Plus tool does not list the HX3 board any longer after modifying the configuration settings.	CY4609, CY4603 and CY4613	The change in configuration settings might have caused the CYUSBHX3 vendor driver binding to be lost.	Rebind the CYUSBHX3 vendor driver using the procedure described in "Bind CYUSBHX3 Vendor Driver on the PC" on page 43.
Configurations set using the HX3 Blaster Plus tool are not enabled after running the tool.	CY4609, CY4603, and CY4613	The configuration mode selection jumpers may not have been set correctly.	Ensure that the hardware is configured for the custom firmware mode using the configuration-mode selection jumpers. See Table 3-4 on page 23. Ensure that the configuration-mode selection jumpers are connected tightly. Restart the hardware either by power cycling the hardware or by pressing the reset switch (SW1) after setting the configuration-mode selection jumpers.
All devices connected to a downstream port stop working.	CY4609	The total current consumed by all devices connected to the downstream port may have exceeded 3.6 A. When this happens, the power switch detects an overcurrent condition and interrupts HX3, which disables power to all the downstream ports.	Reduce the current consumed by the devices attached to the downstream ports.
The device connected to a particular downstream port stops working.	CY4603	The current consumption by the device connected on that port may have exceeded 2.1 A.	Remove the overcurrent condition on the downstream port. Power cycle the board if the dialog box displayed on the PC instructs you to reset the hardware.

Table A-1. Troubleshooting the CY4609, CY4603, and CY4613 Kits *(continued)*

Problem	Applicable Kits	Possible Cause	Possible Solution
When the pin strap feature is enabled, the hardware does not enumerate with Cypress VID.	CY4603	Cypress VID is not supported if jumpers are installed on VID_SEL[0-2] after enabling the pin strap feature	Remove the jumper from one of the three VID_SEL[0-2] jumper blocks to restore Cypress VID. Note that the port status indicator LED, which is shared with the VID_SEL on which the jumper is removed will not be functional. See Table 3-7 on page 30 for the list of port status indicator LEDs shared with VID_SEL[0-2]
The device connected to a downstream port gets charged but is not recognized on the PC, although the hardware's upstream port is connected to the PC.	CY4609, CY4603, and CY4613	The downstream port may have been configured as DCP using the HX3 Blaster Plus tool.	Disable the DCP feature for the given downstream port using the HX3 Blaster Plus tool. Refer to the HX3 Blaster Plus Tool chapter on page 41 for the procedure to run the tool.
Installation of the CYHX3 driver, required to run the HX3 Blaster Plus tool, fails with 'code 10' error.	CY4609, CY4603, and CY4613	The USB 3.0 host controller on the PC may not be compatible with the CYUSBHX3 driver (for example, ASMedia USB 3.0 host controller-based PC).	Try installing the CYHX3 driver on another PC with a different USB 3.0 host controller (such as Intel and Renesas)
After configuring the hardware using the HX3 Blaster Plus tool, the enumeration of the kit fails.	CY4609, CY4603, and CY4613	During configuration using the HX3 Blaster Plus tool, the DCP feature may have been enabled on all the downstream ports. When the DCP feature is enabled, a downstream port only works as a charging port	Configure the hardware to use the ROM firmware. Invoke the HX3 Blaster Plus tool and disable the DCP feature on the required downstream ports using the HX3 Blaster Plus tool. Configure the hardware to use the custom firmware
		During configuration using the HX3 Blaster Plus tool, an incompatible setting with respect to the hardware might have been enabled.	Configure the hardware to use the ROM firmware. Invoke the HX3 Blaster Plus tool, erase EEPROM, and configure new settings. Configure the hardware to use the custom firmware
Unable to install the CYUSBHX3 driver on Windows XP after changing the USB 2.0 PID using the HX3 Blaster Plus tool.	CY4609, CY4603, and CY4613	The new USB 2.0 PID value set may not be supported by the CYUSBHX3 driver on Windows XP.	Configure the hardware to use the ROM firmware. Invoke the HX3 Blaster Plus tool and restore the USB 2.0 PID to the default value.
Devices connected on Shared Link SS ports are not listed on the PC.	CY4613	The HX3 board's USB 3.0 upstream port may be connected to the PC's USB 2.0 port.	Connect the HX3 board's USB 3.0 upstream port to a USB 3.0 port of the PC.

Table A-1. Troubleshooting the CY4609, CY4603, and CY4613 Kits *(continued)*

Problem	Applicable Kits	Possible Cause	Possible Solution
DS19 and DS21 LEDs glow after restoring the kit to factory default firmware though there are no devices connected on the DS3 and DS4 downstream ports.	CY4613	Shared Link feature may not have been disabled on DS3 and DS4 ports while restoring the kit to factory default state.	Repeat the procedure to put the kit in factory default state as mentioned in "Restoring CY4613 DVK to factory default firmware" on page 56 and make sure to disable the Shared Link capability on DS3 and DS4 ports.
HX3 Blaster Plus tool does not list the HX3 board when the board is connected on a Win 7 PC / laptop.	All	String descriptor may have been stored on the EEPROM attached to HX3 board. When string descriptors are stored, the board may not get recognized on Blaster Plus due to a Cypress driver compatibility issue on Win 7.	Run the procedure to put the kit in factory default state as mentioned in "Restoring CY4613 DVK to factory default firmware" on page 56. From there onwards HX3 Blaster Plus tool will continue to list the board even after the String Descriptors are stored in the EEPROM using HX3 Blaster Plus tool.

A.2 Hardware Design Details

A.2.1 CY4609 RDK Schematics

Figure A-1. Voltage Regulators

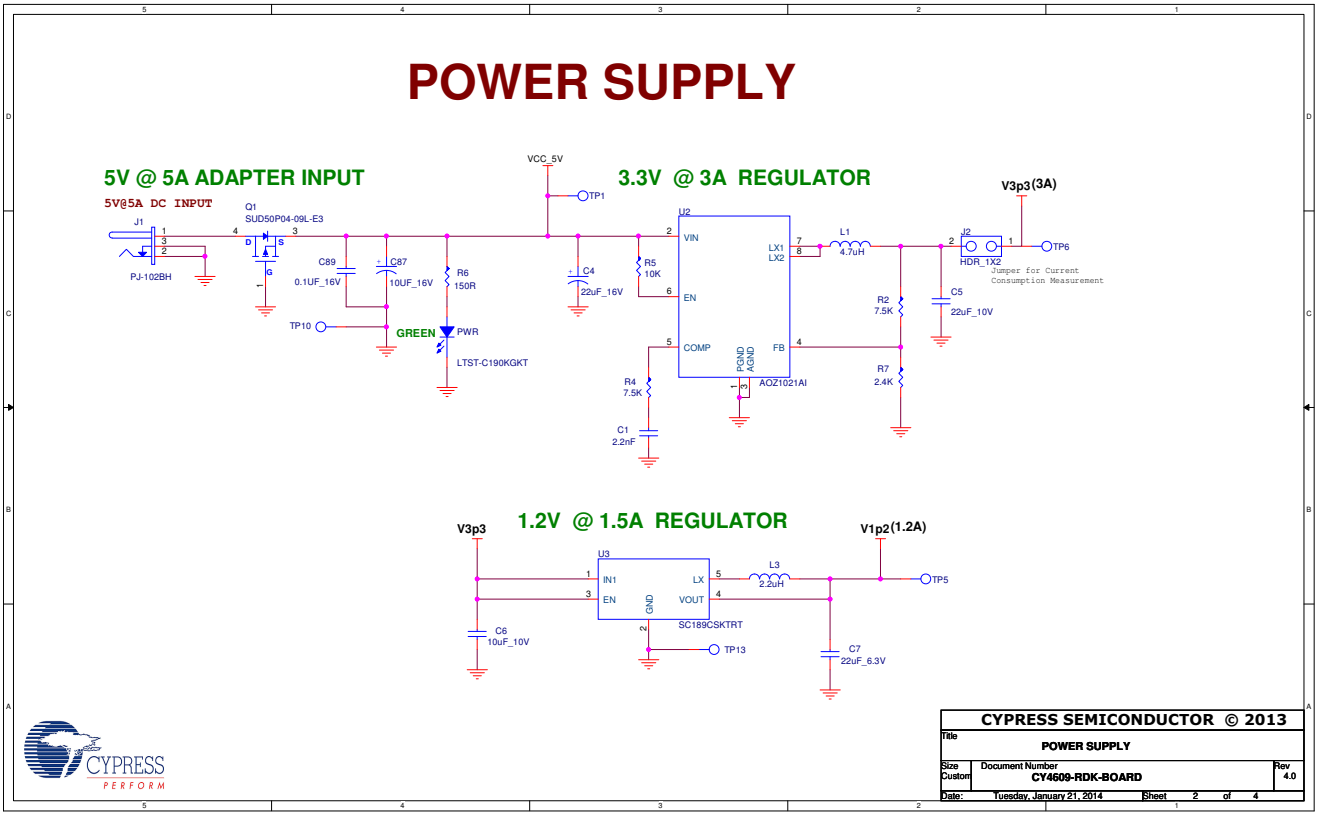


Figure A-2. Overvoltage, Overcurrent Protection, and Decoupling Capacitors

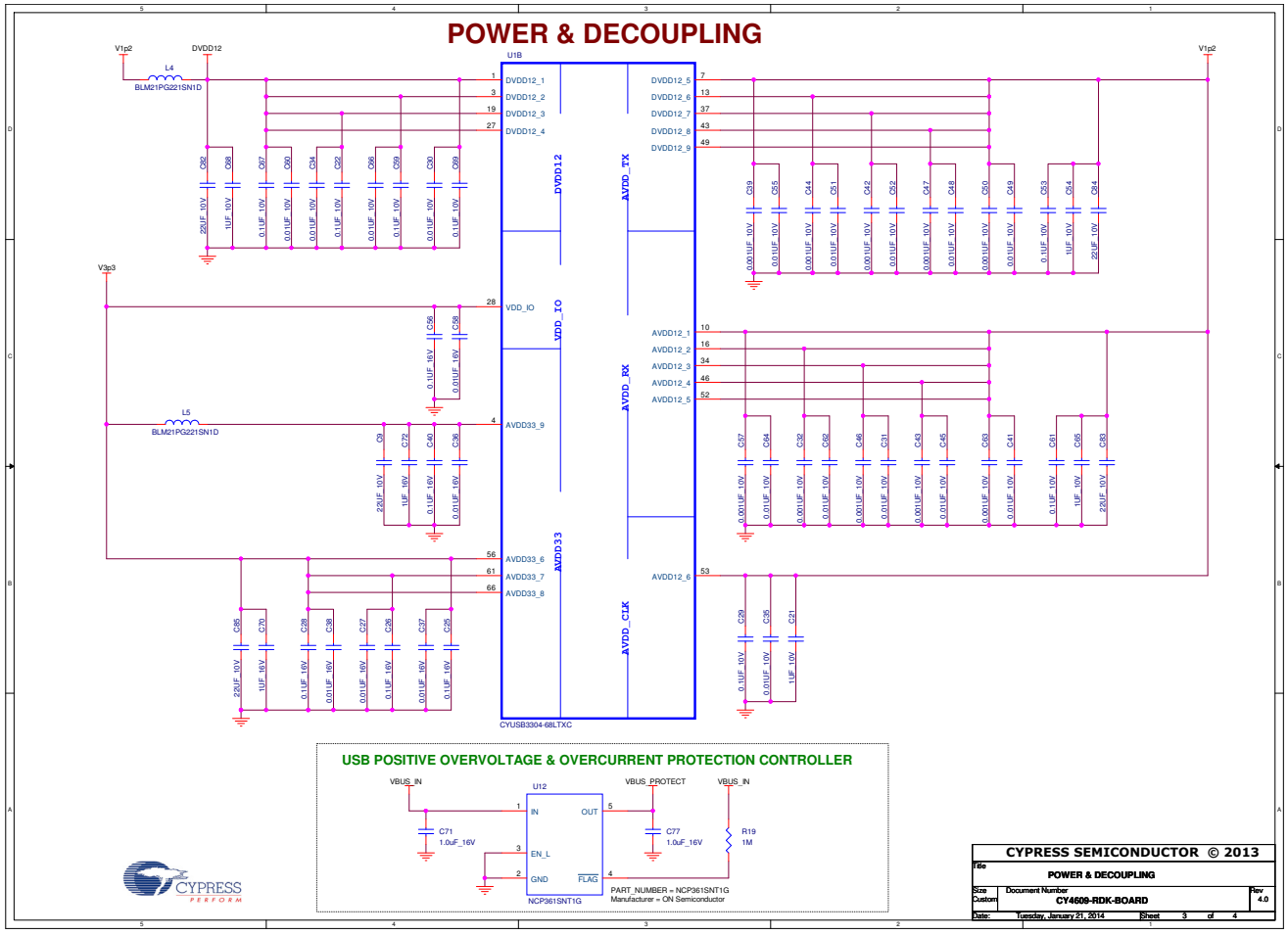
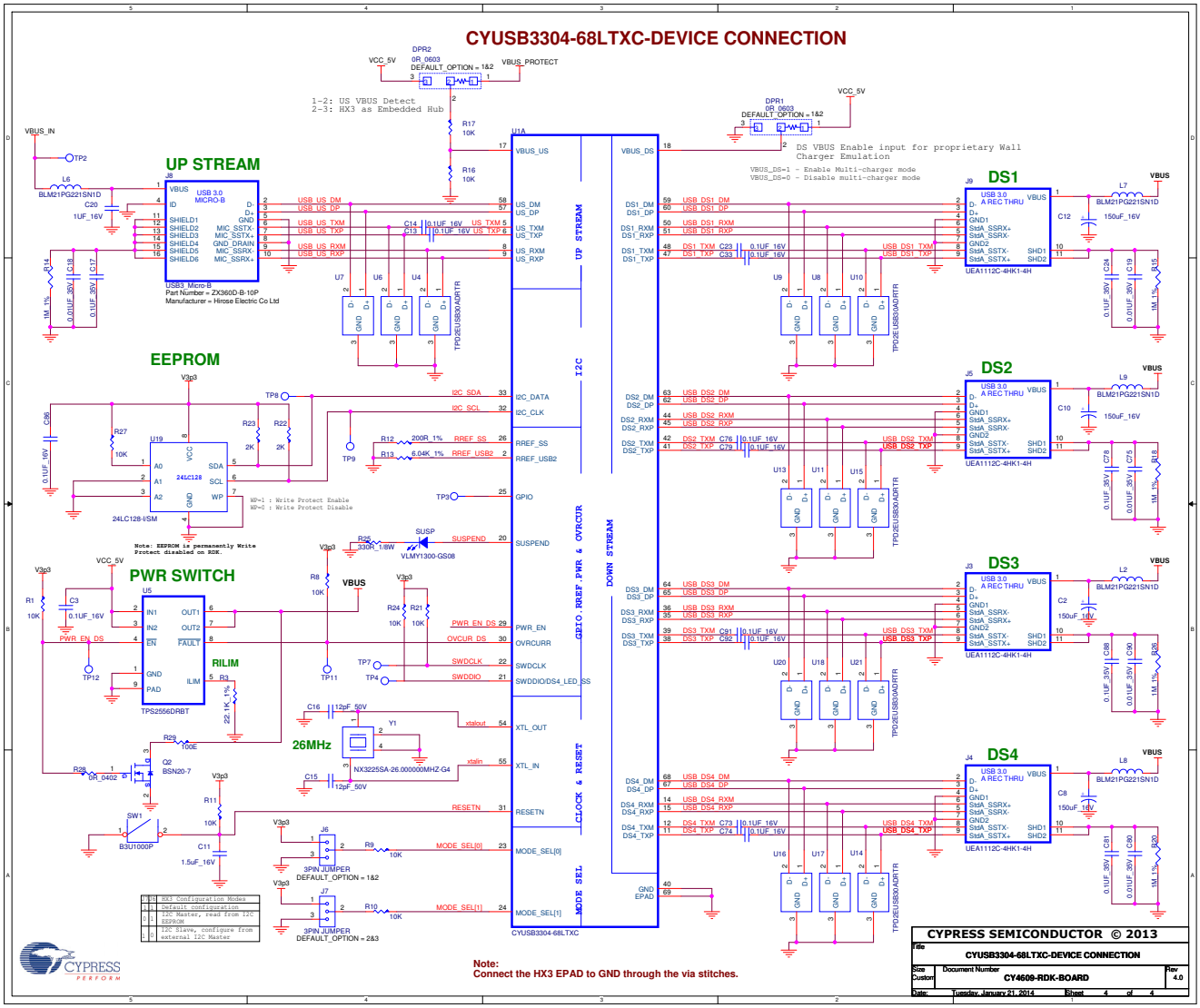


Figure A-3. EEPROM, Upstream, and Downstream Connections



Note: Visit www.cypress.com/hx3 for schematics with reduced BOM.

A.2.2 CY4603 DVK Schematics

Figure A-4. Voltage Regulators

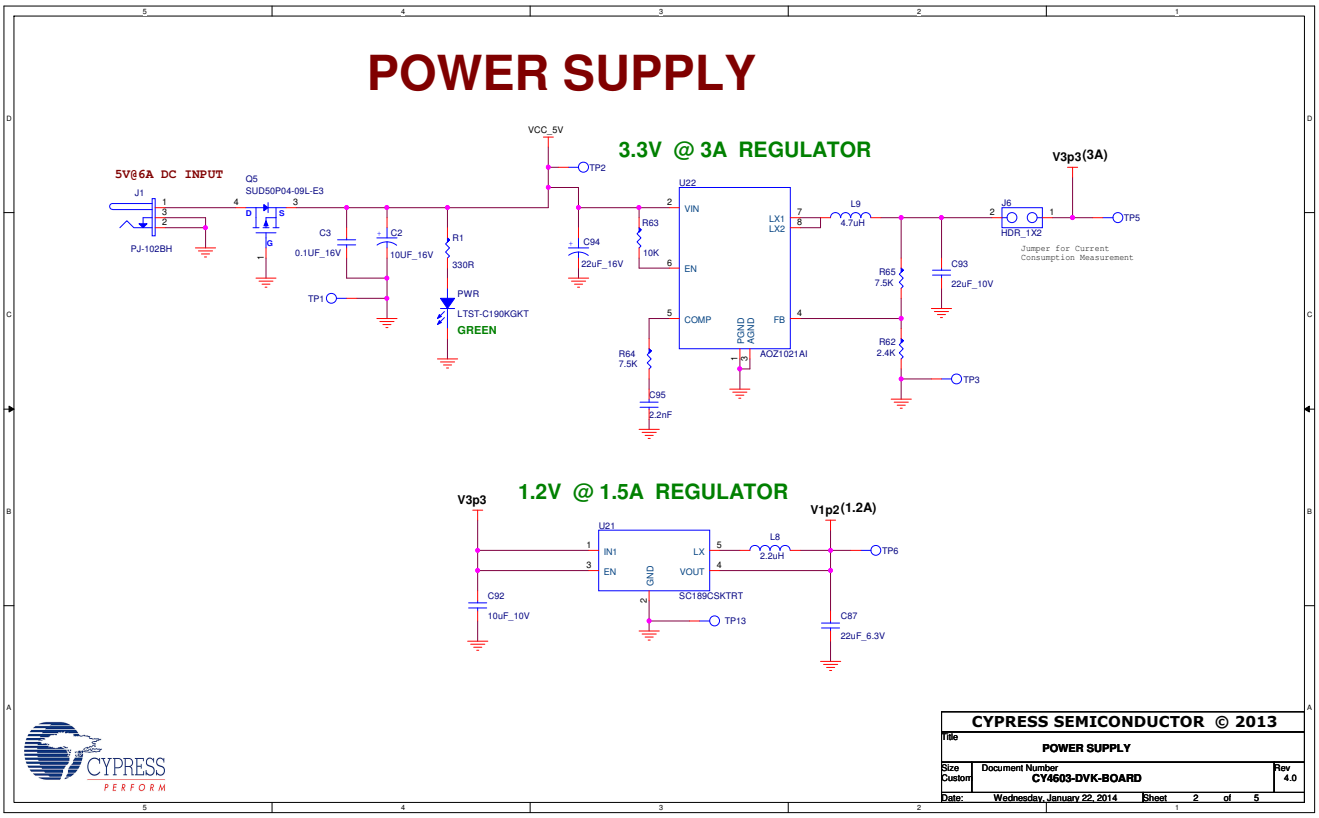


Figure A-5. Overvoltage, Overcurrent Protection, and Decoupling Capacitors

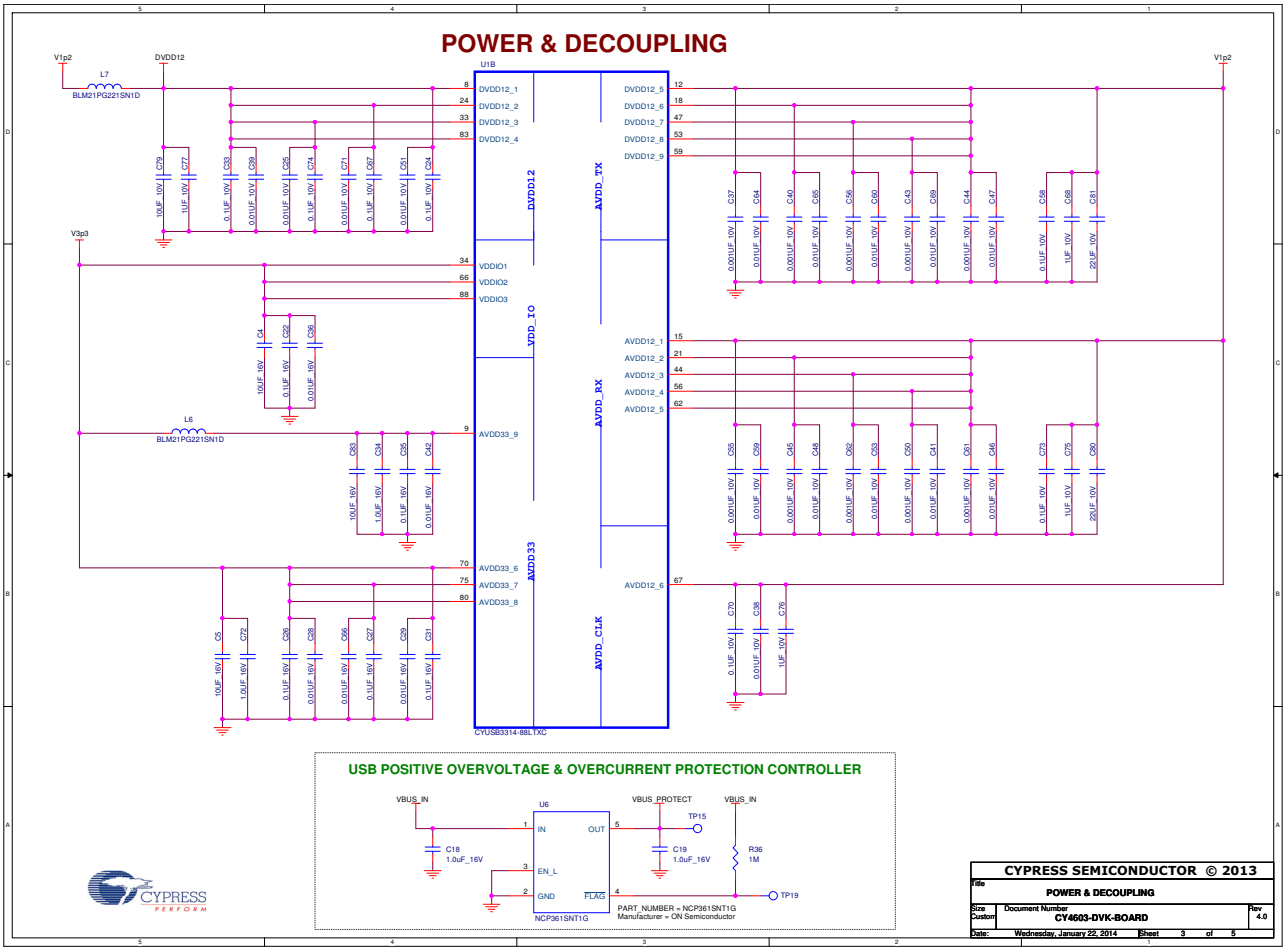
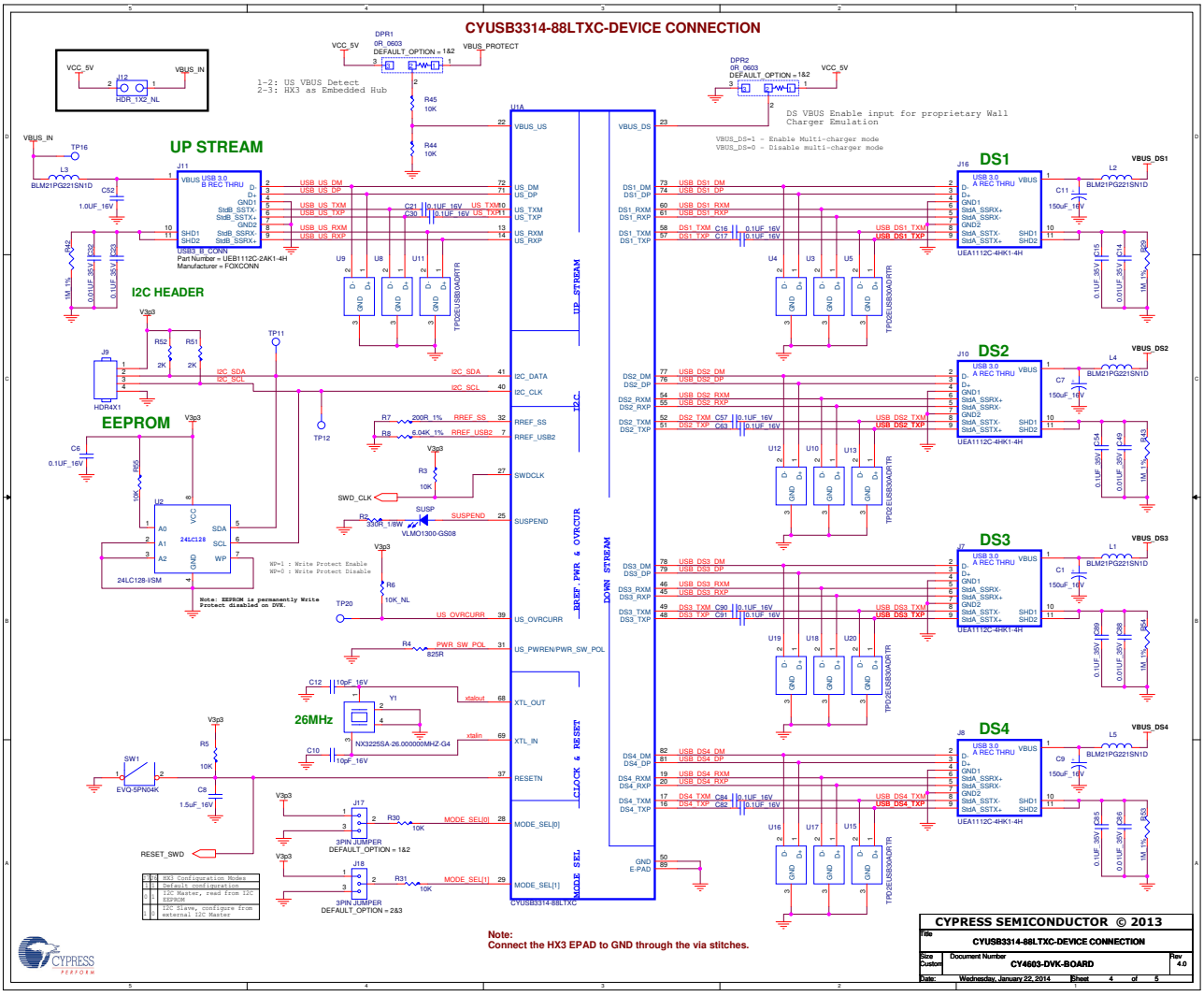
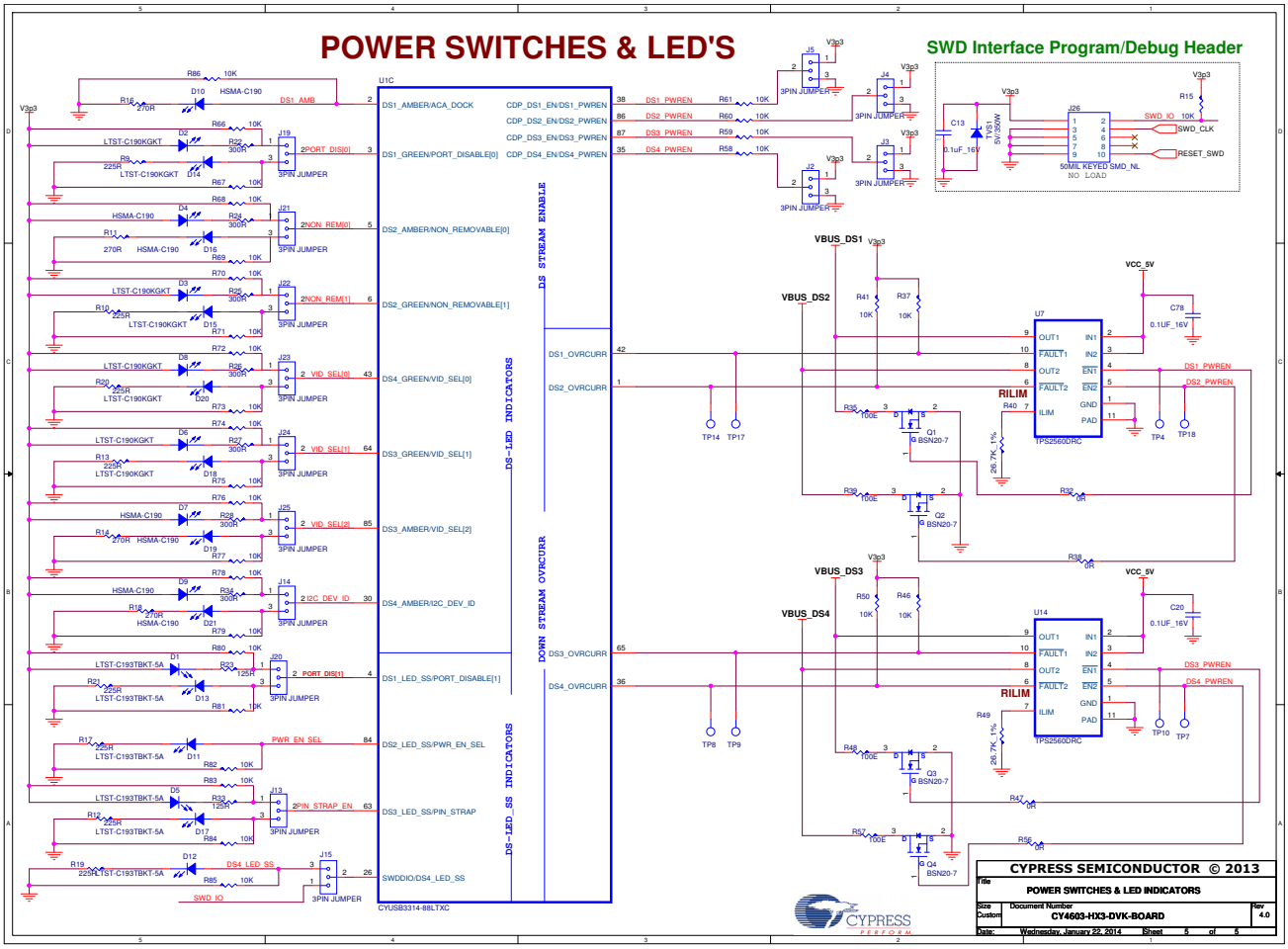


Figure A-6. EEPROM, Upstream, and Downstream Connections



Note: Visit www.cypress.com/hx3 for schematics with reduced BOM.

Figure A-7. LEDs



A.2.3 CY4613 DVK Schematics

Figure A-8. CY4613 Schematics for Voltage Regulators

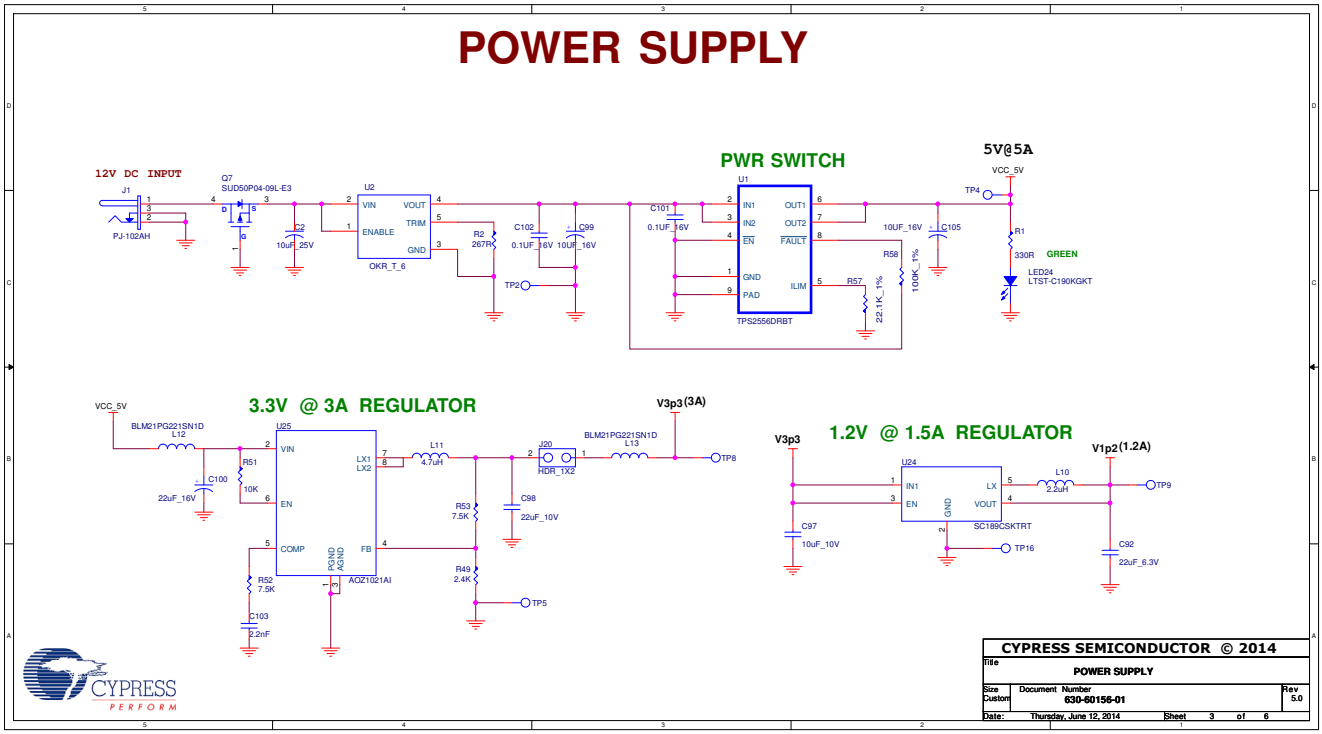


Figure A-9. CY4613 Schematics for Overvoltage, Overcurrent Protection, and Decoupling Capacitors

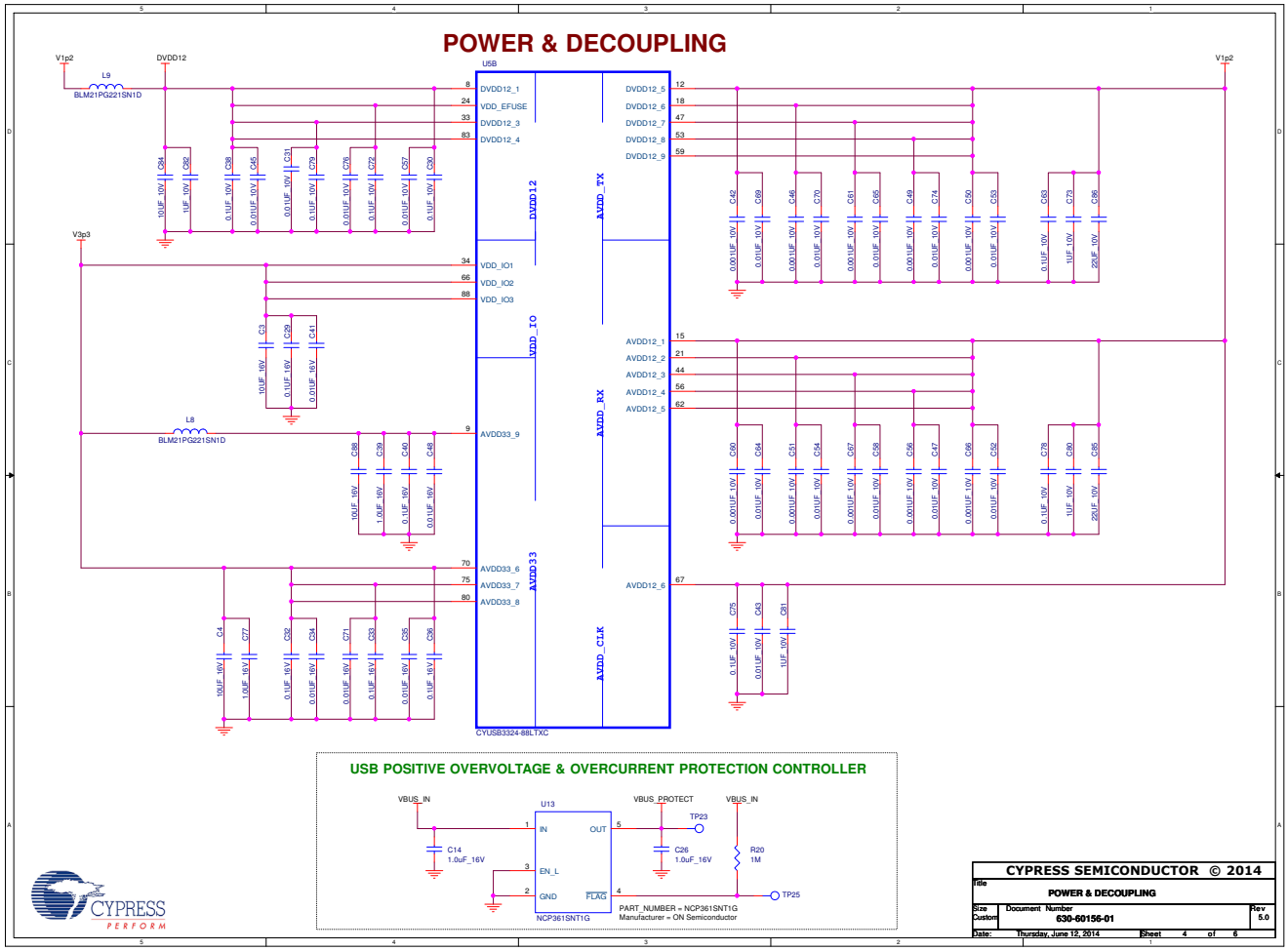
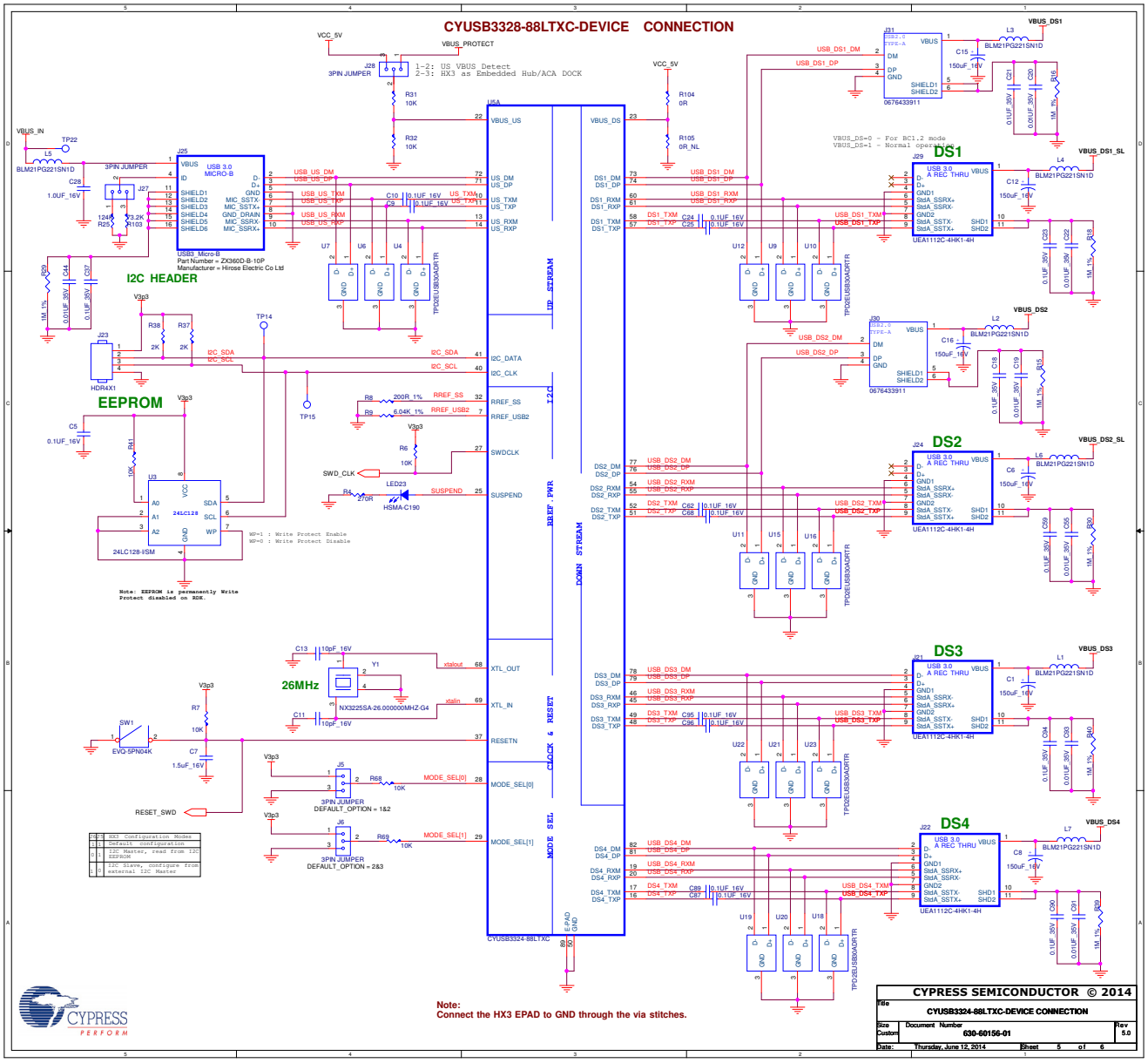
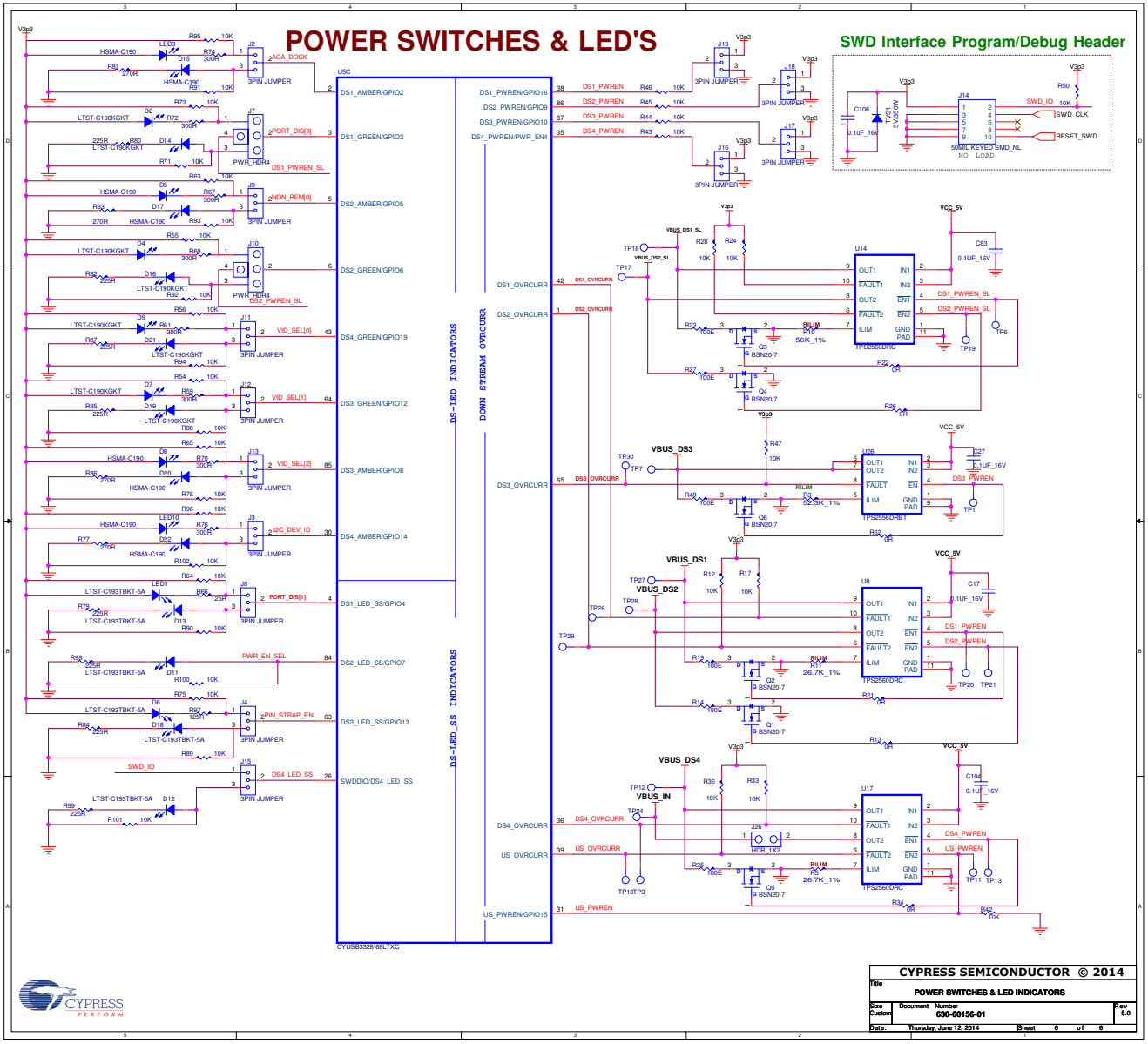


Figure A-10. CY4613 Schematics for EEPROM, Upstream, and Downstream Connections



Note: Visit www.cypress.com/hx3 for schematics with reduced BOM.

Figure A-11. CY4613 Schematics for Power Switches and LEDs



Revision History

Document Revision History

Document Title: CY4609, CY4603, and CY4613 HX3 Kits User Guide Document Number: 001-91203			
Revision	**Issue Date**	**Origin of Change**	**Description of Change**
**	02/25/2014	SELV	New kit guide.
*A	04/11/2014	SHEA	Corrected the document number in the Revision History table.
*B	04/29/2014	SELV	Updated document title. Updated with details of CY4613 kit.
*C	07/01/2014	SELV	Updated CY4613 kit images. Added details about ACA-Dock support for Samsung phones in CY4613 kit.
*D	07/10/2014	SELV	Updated Kit Operation chapter on page 17: Updated "Operating the Kits" on page 23: Added "I2C Slave Mode Operation" on page 38. Updated HX3 Blaster Plus Tool chapter on page 41: Updated "Procedure to run the HX3 Blaster Plus Tool" on page 42: Added "Generating 'HX3 I2C Slave Mode file' for CY4603 and CY4613 DVKs" on page 55.