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CY4609, CY4603, and CY4613

HX3 Kits User Guide

Doc. #: 001-91203 Rev. *D

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

Contents

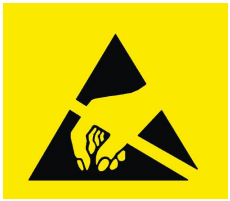
Safety Information

Regulatory Compliance

The 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

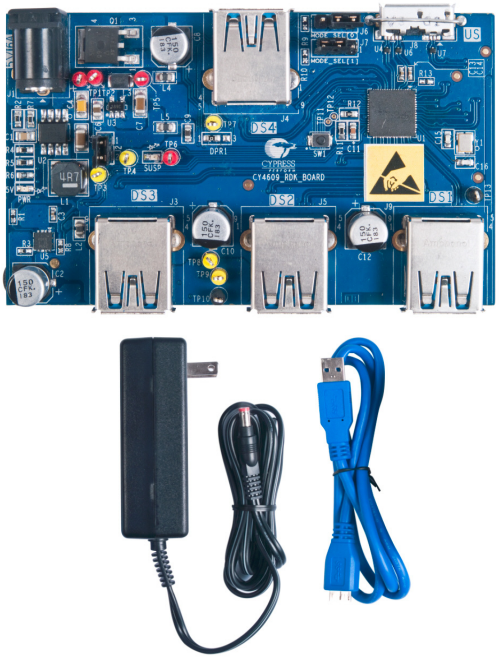
Kit	Kit Contents	List of Kit Contents
CY4609		One each of the following: - CY4609 RDK board - 5-V/4-A AC-DC power adapter - USB 3.0 standard-A to micro-B cable - Quick start guide

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

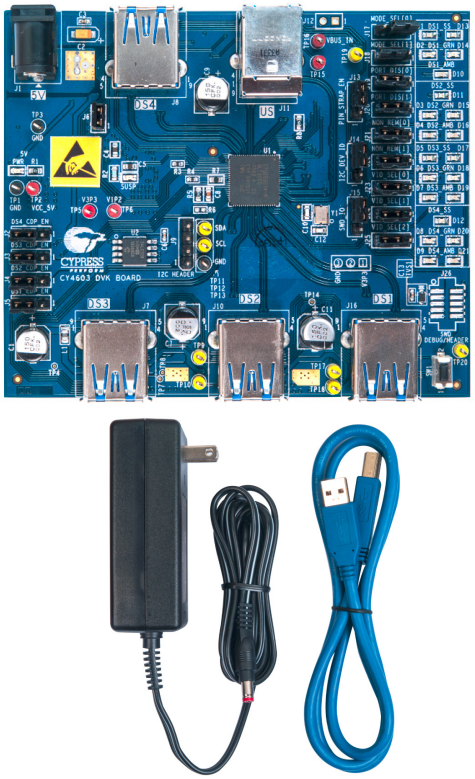
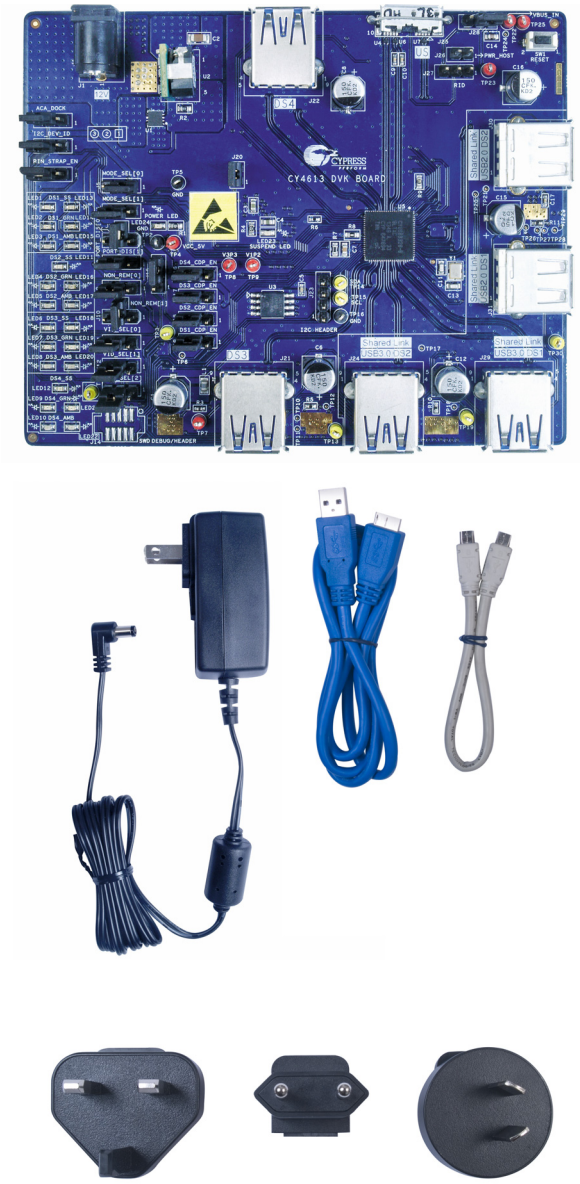
Kit	Kit Contents	List of Kit Contents
CY4603		One each of the following: - CY4603 DVK board - 5-V/4-A AC-DC power adapter - USB 3.0 standard-A to standard-B cable - Quick start guide

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

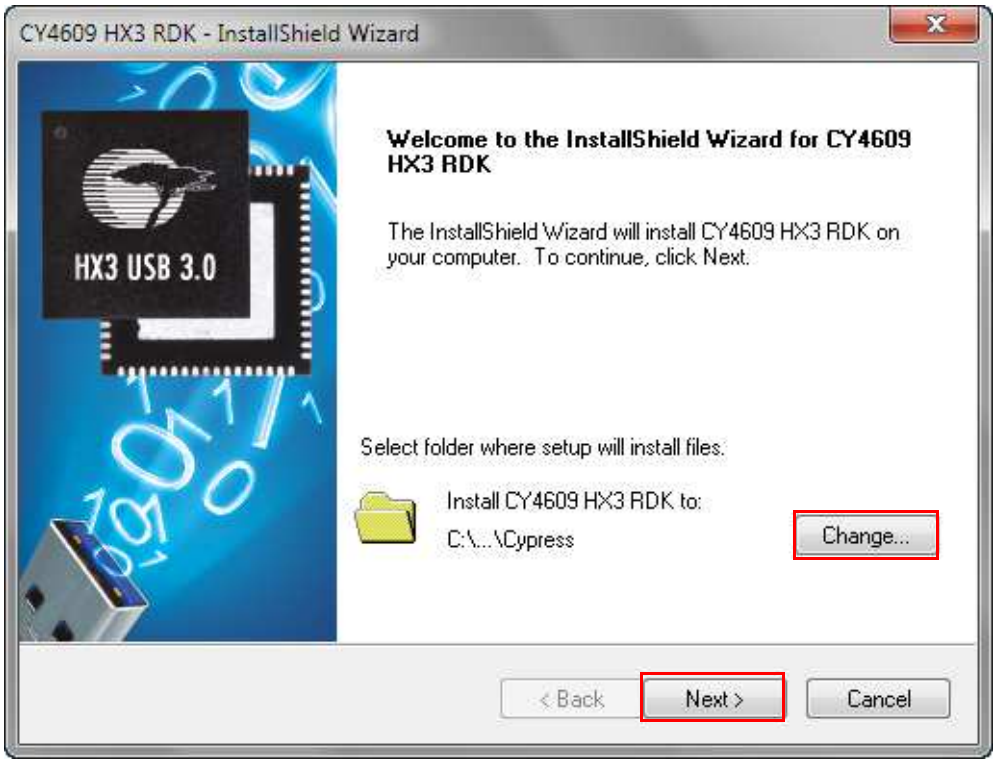
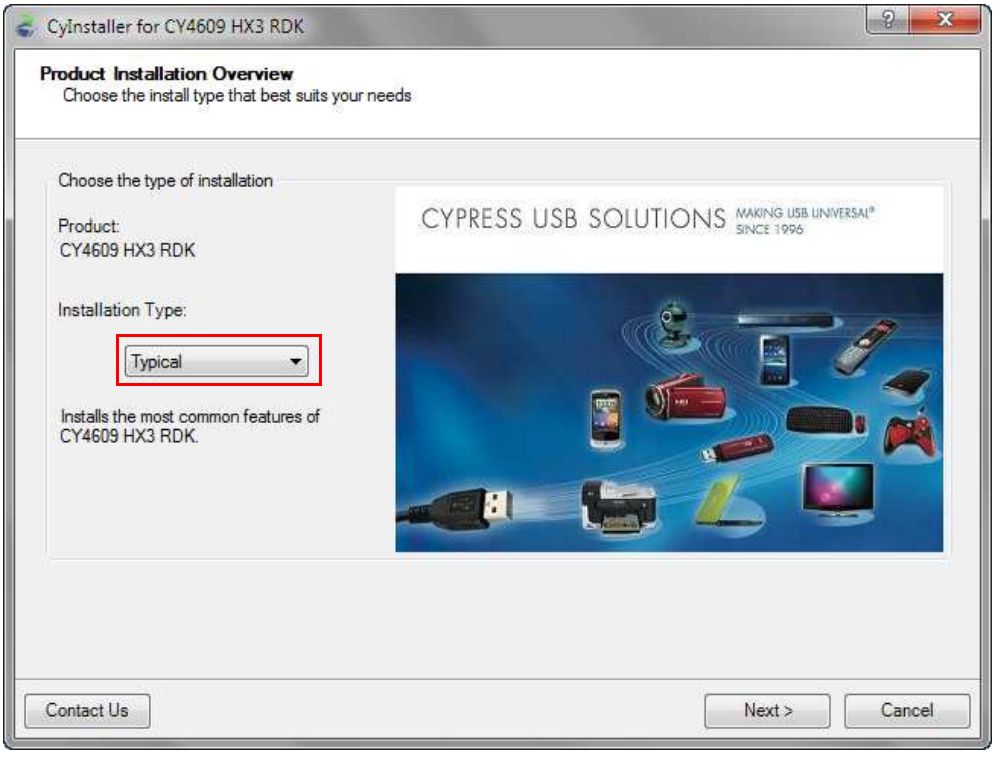
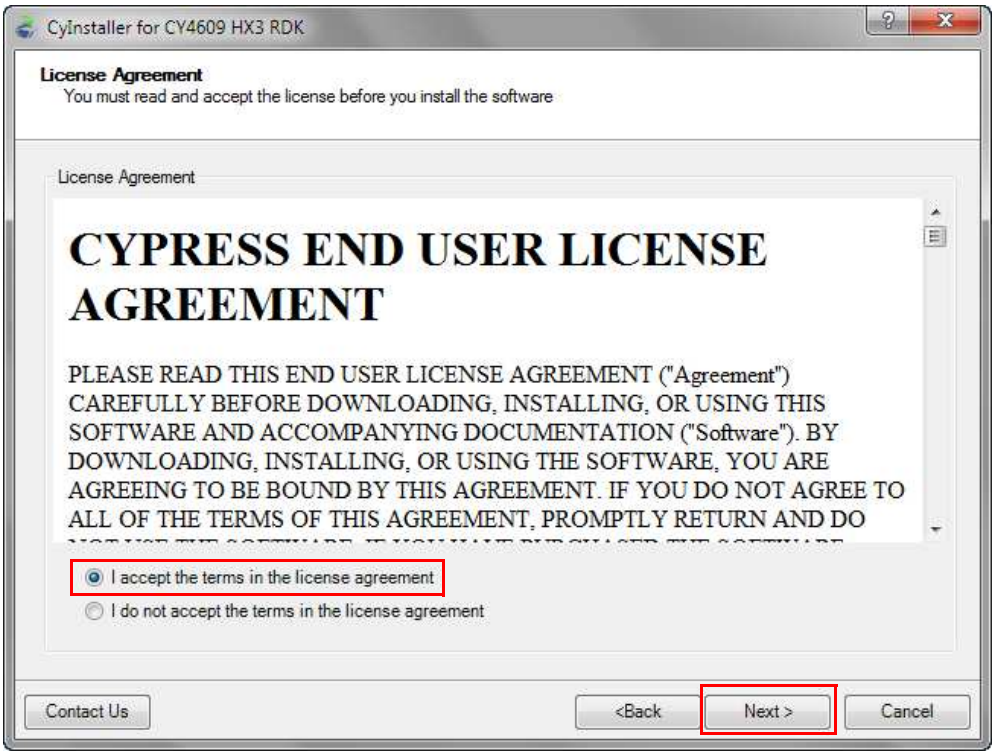


Figure 2-2. Choosing Installation Type



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)

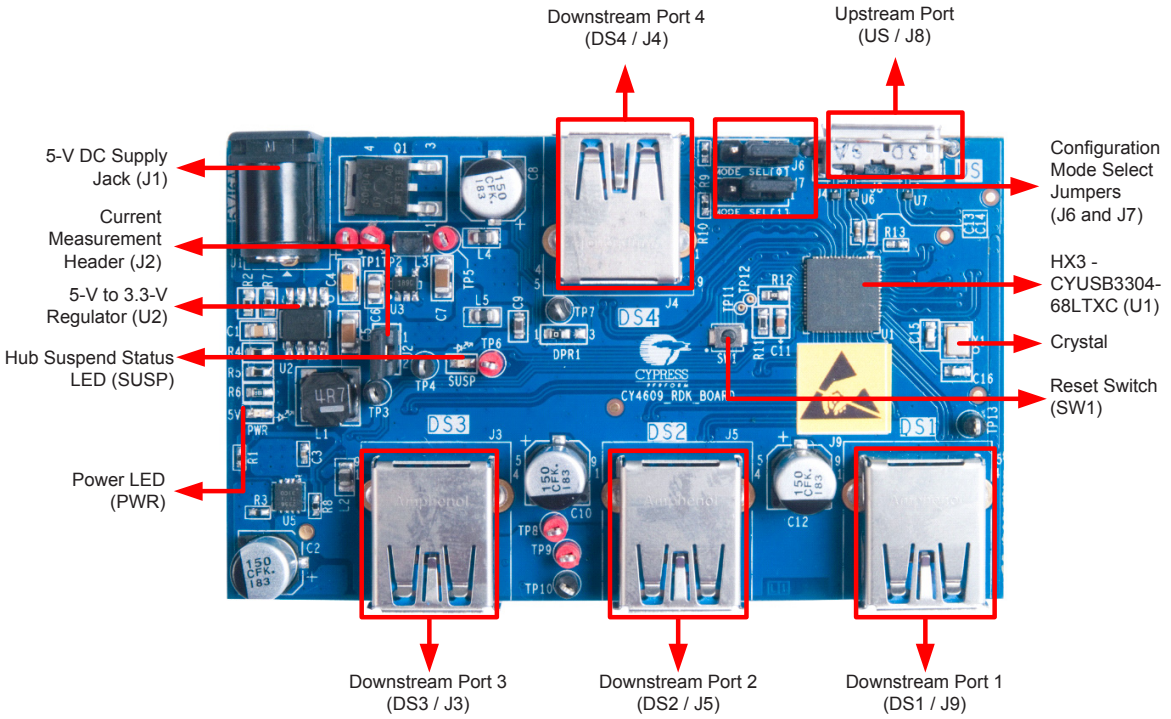
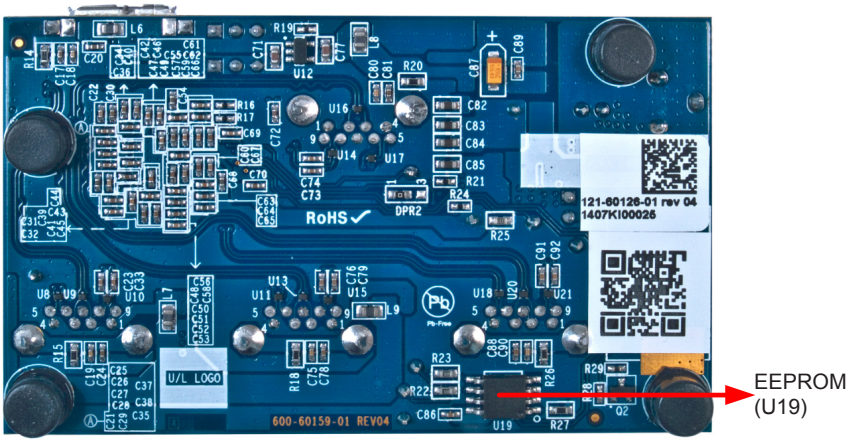


Figure 3-2. CY4609 Board (Bottom Side)



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

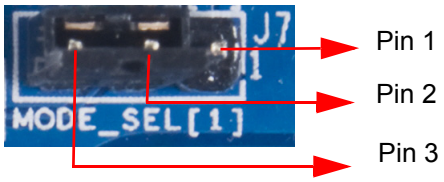
Table 3-1 describes the default jumper settings for CY4609.

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)

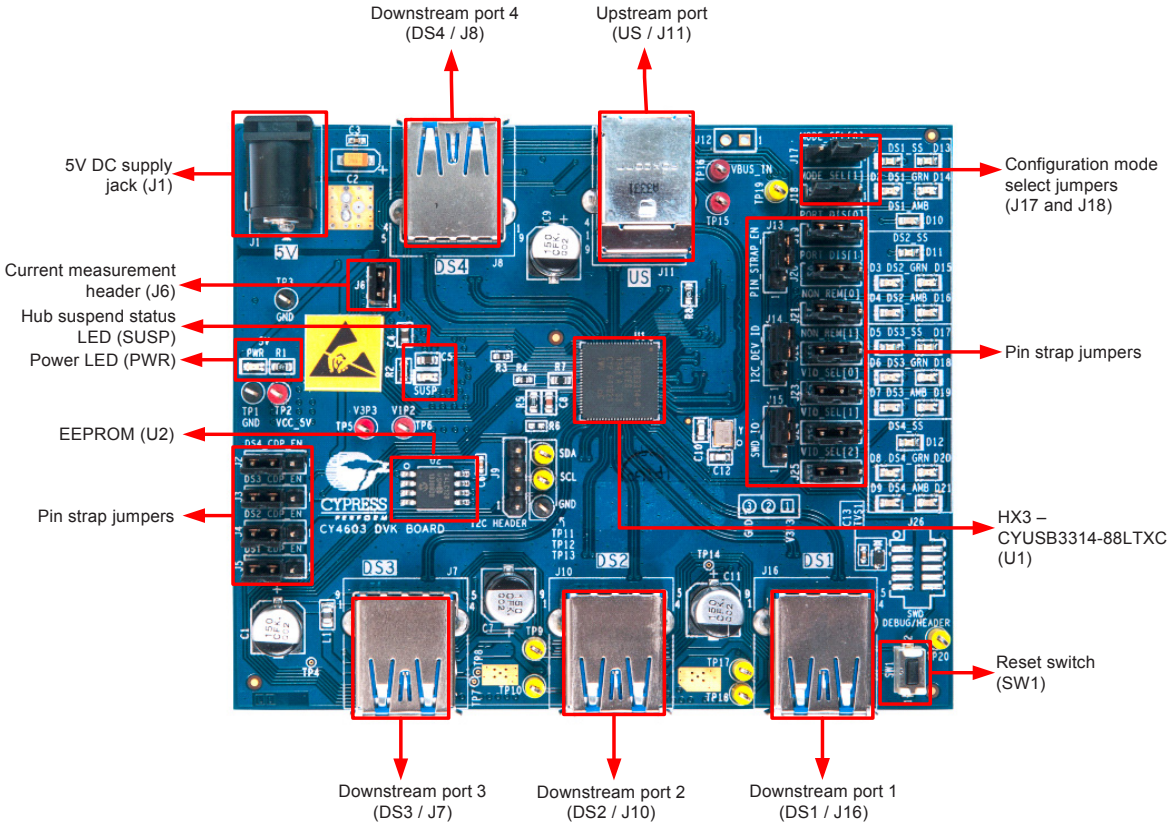
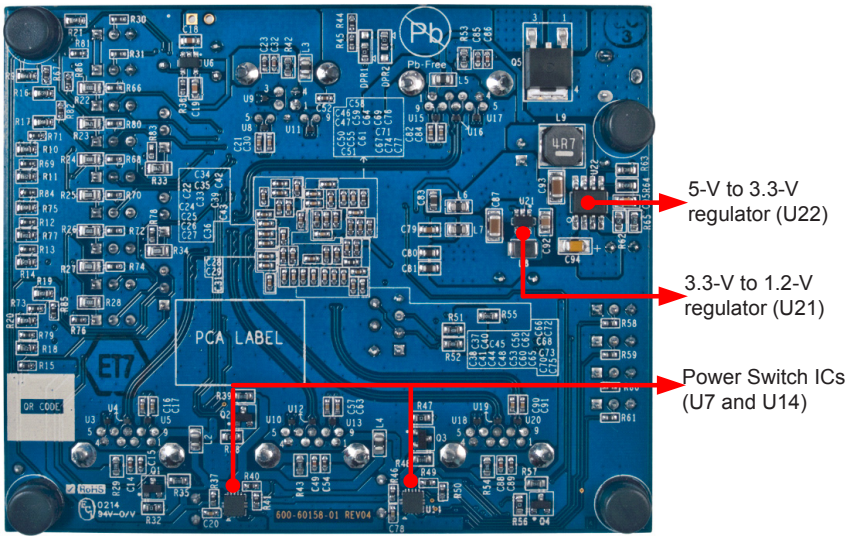


Figure 3-5. CY4603 Board (Bottom Side)



3.2.2 Jumper Settings

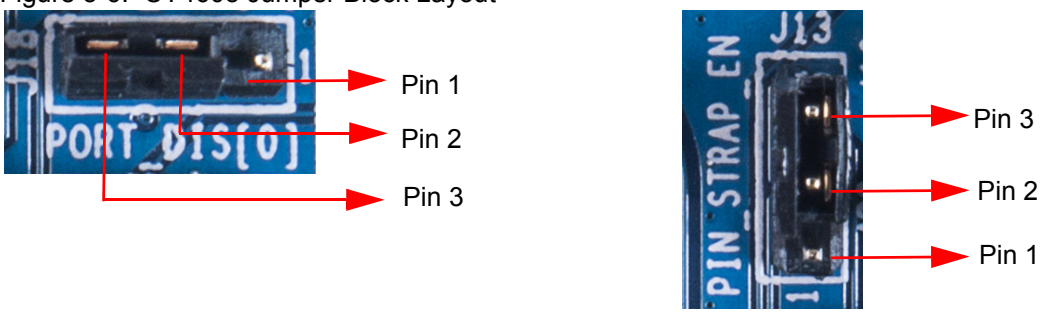
Table 3-2 describes the default jumper settings for CY4603.

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)

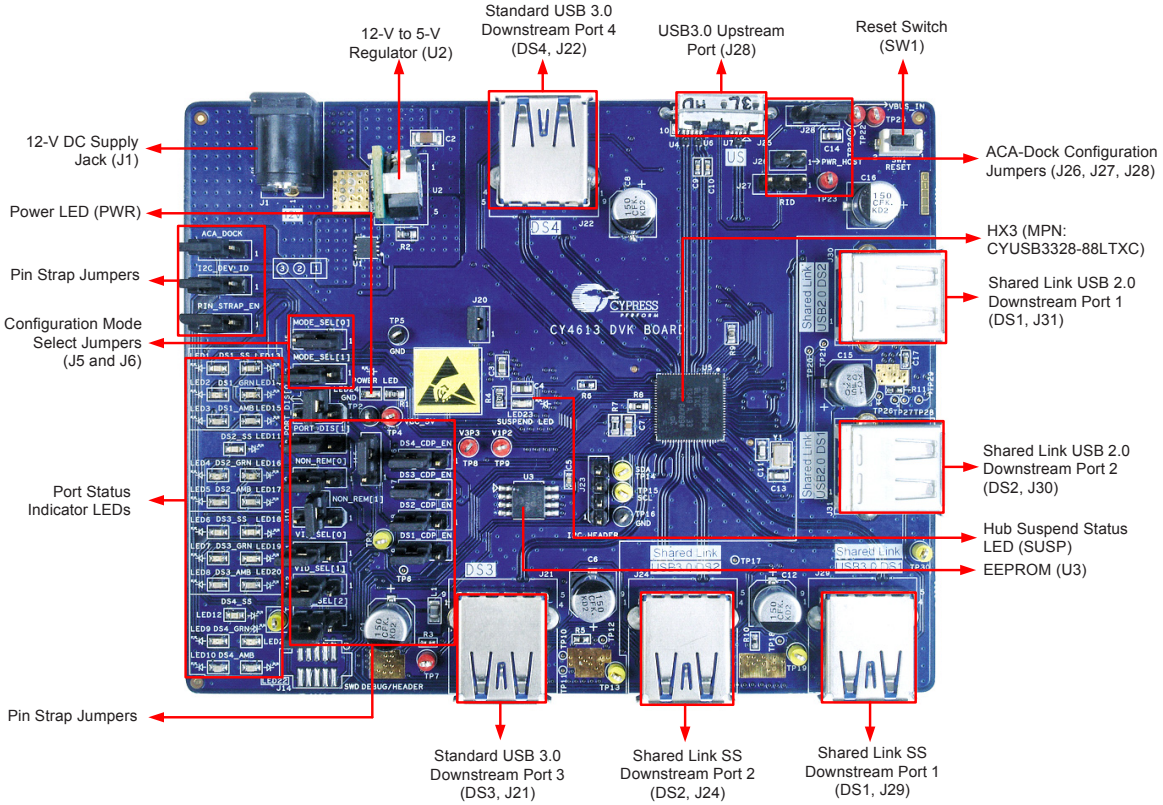
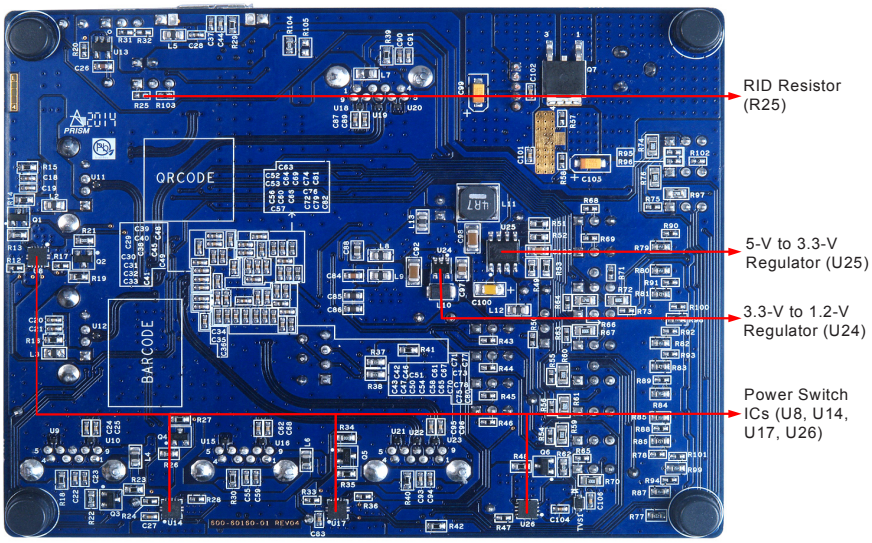


Figure 3-8. CY4613 Board (Bottom Side)



3.3.2 Jumper Settings

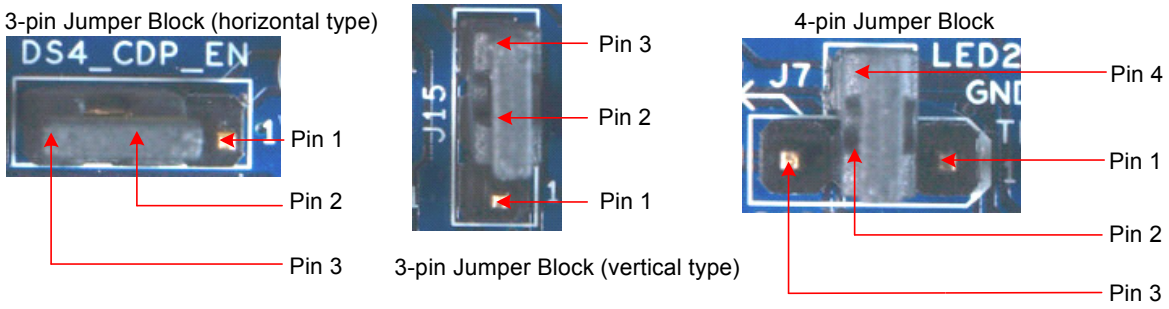
Table 3-3 shows the default jumper settings for CY4613.

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

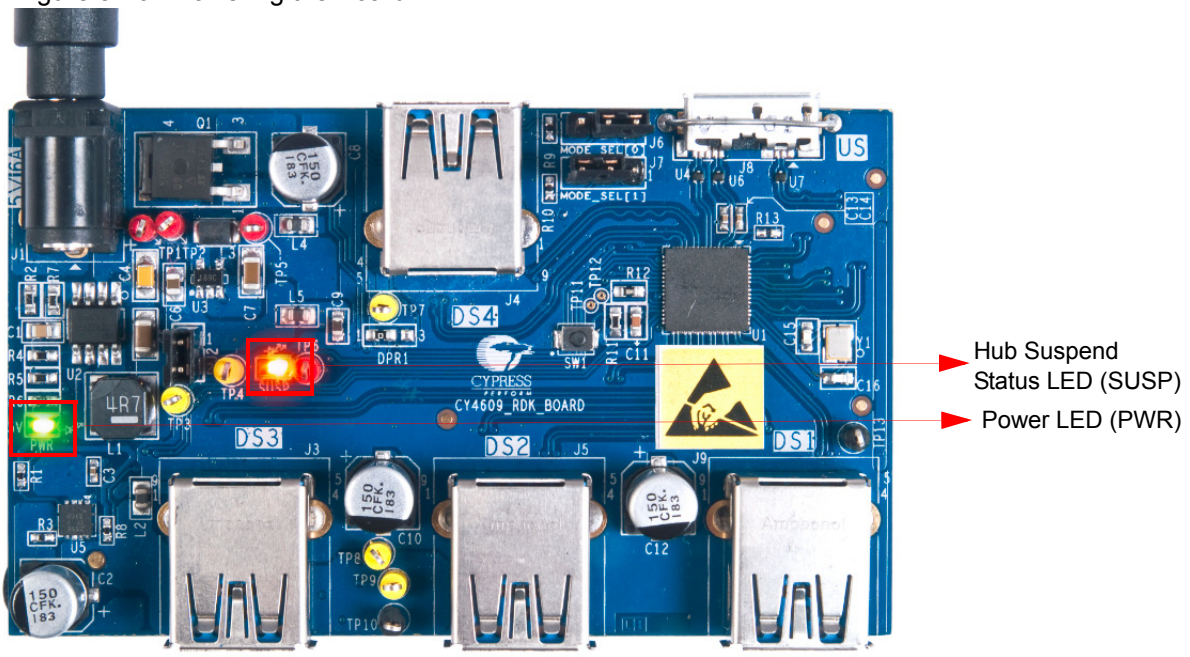
1. Unpack the power adapter, USB 3.0 cable, and HX3 board from the kit package.
2. Ensure that the Configuration Mode Selection jumper blocks for firmware are set to Custom Firmware, as shown in Table 3-4.

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.

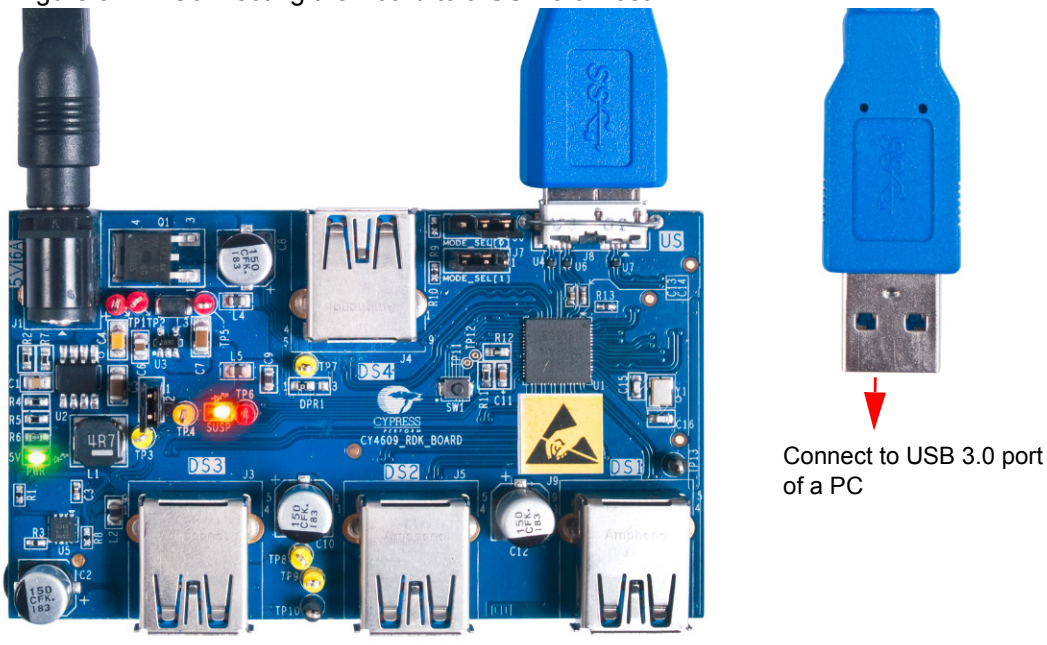
Figure 3-10. Powering the Board



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.

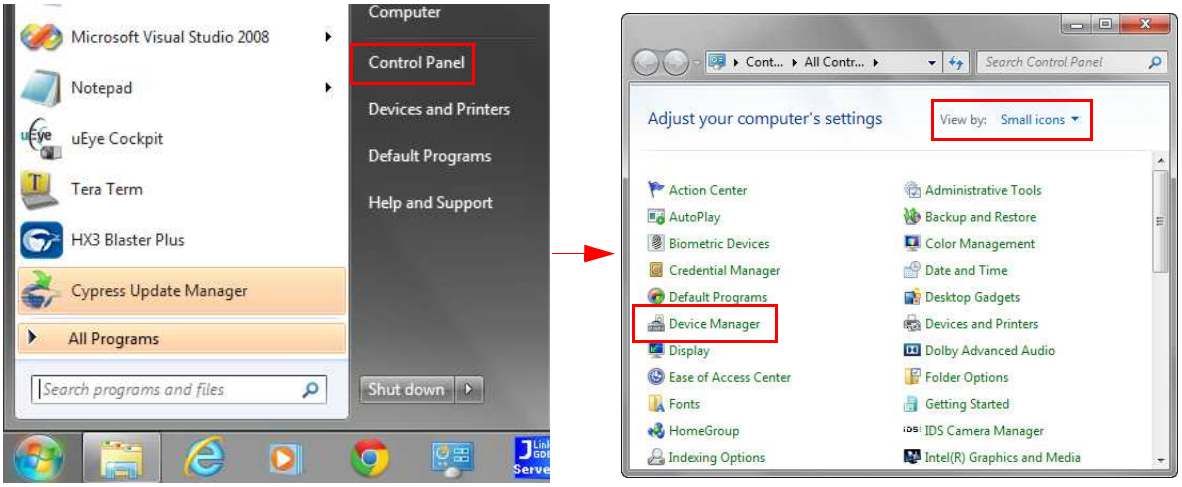
Figure 3-11. Connecting the Board to a USB 3.0 Host



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