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CYUSB330x/CYUSB331x
CYUSB332x/CYUSB230x
HX3 USB 3.0 Hub

General Description

HX3 is a family of USB 3.0 hub controllers compliant with the USB 3.0 specification revision 1.0. HX3 supports SuperSpeed (SS), Hi-Speed (HS), Full-Speed (FS), and Low-Speed (LS) on all the ports. It has integrated termination, pull-up, and pull-down resistors, and supports configuration options through pin-straps to reduce the overall BOM of the system.

HX3 includes the following Cypress-proprietary features:

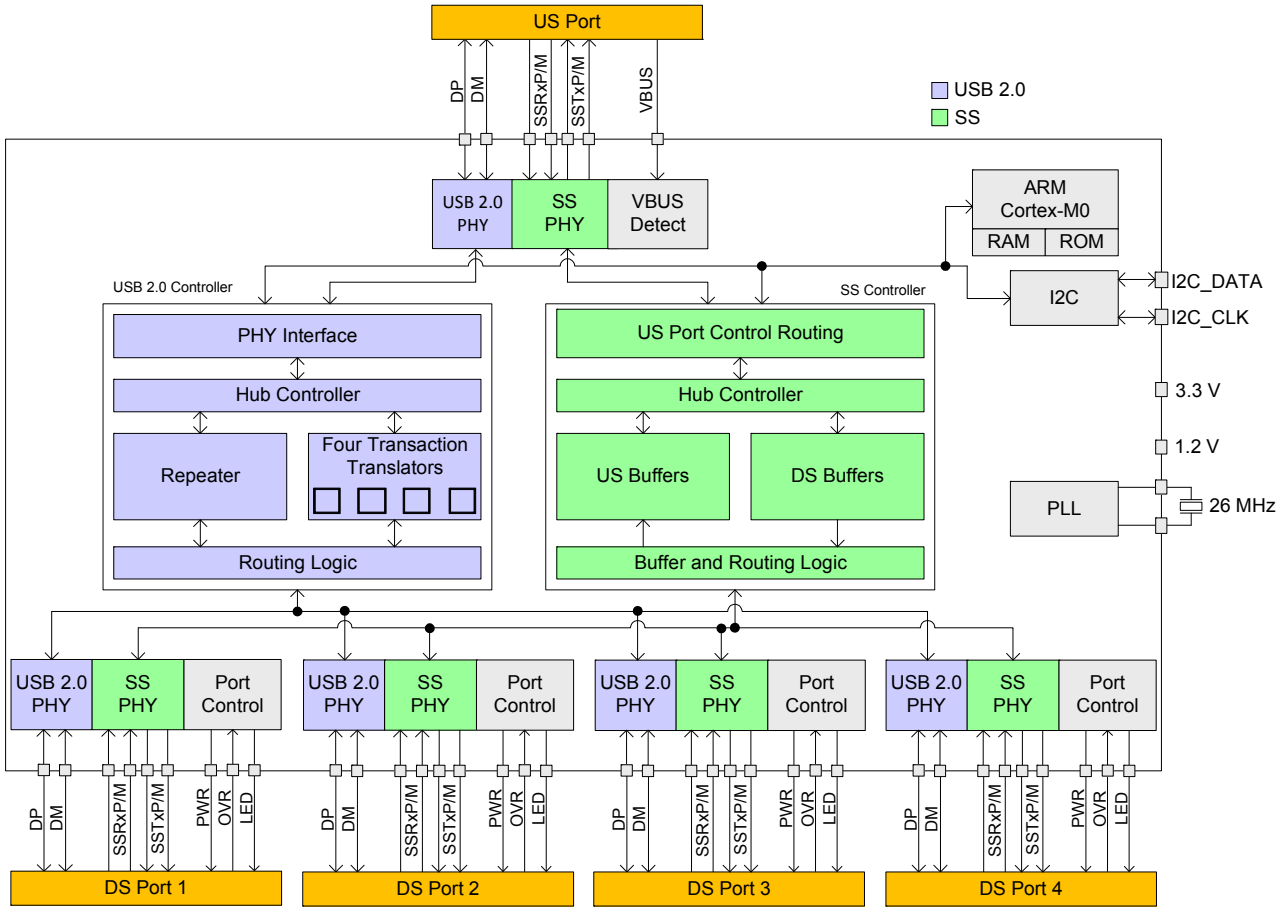
Shared Link™: Enables extra downstream (DS) ports for on-board connections in embedded applications

Ghost Charge™: Enables charging of devices connected to the DS ports when no host is connected on the upstream (US) port

Features

- USB-IF Certified Hub, TID# 330000060, 30000074
- Supports up to Four USB 3.0-Compliant DS ports
  - All ports support SS (5 Gbps), and are backward-compatible with HS (480 Mbps), FS (12 Mbps), and LS (1.5 Mbps)
  - SS and USB 2.0 Link Power Management (LPM)
  - Dedicated Hi-Speed Transaction Translators (Multi-TT)
  - LED status indicators – suspend, SS, and USB 2.0 operation
- Shared Link™ for Embedded Applications
  - Each DS port can simultaneously connect to an embedded SS device and a removable USB 2.0 device
  - Enables up to eight device connections
- Enhanced Battery Charging
  - Each DS port complies with the USB Battery Charging v1.2 (BC v1.2) specification
  - Ghost Charge™: Each DS port can emulate a Dedicated Charging Port (DCP) when the host is not connected to the US port
  - Accessory Charger Adapter Dock (ACA-Dock): Enables charging and simultaneous data transfer for a smart phone or a tablet acting as a host compliant to BC v1.2
  - Apple charging supported on all DS ports
- Integrated ARM® Cortex™-M0 CPU
  - 16 KB RAM, 32 KB ROM
  - Configure GPIOs for overcurrent protection, power enable, and LEDs
  - Upgrade firmware using (a) I^2C EEPROM or (b) an external I^2C master
- Vendor-Command Support to Implement a USB-to-I^2C Bridge
  - Firmware upgrade of an external ASSP connected to HX3 through USB
  - In-System Programming (ISP) of the EEPROM connected to HX3 through USB
- Extensive Configuration Support
  - Pin-strap configuration for the following functions:
    - Vendor ID (VID)
    - Charging support for each DS port
    - Number of active ports
    - Number of non-removable devices
    - Ganged or individual power switch enables for DS ports
    - Power switch polarity selection
  - Custom configuration modes supported with eFuse, I^2C EEPROM, or I^2C slave
    - SS and USB 2.0 PHY parameters
    - Product ID (PID)/VID, manufacturer, and product string descriptors
    - Swap DP/DM signals for flexible PCB routing
- Software Features
  - Microsoft WHQL-certified for Windows XP/Vista/7/8/8.1
  - Compatible with Mac OS 10.9 and Linux kernel version 3.11
  - Customize configuration parameters with the easy-to-use Cypress's "Blaster Plus" software tool
- Flexible Packaging Options
  - 68-pin QFN (8 × 8 × 1.0 mm)
  - 88-pin QFN (10 × 10 × 1.0 mm)
  - 100-ball BGA (6 × 6 × 1.0 mm)
  - Industrial temperature range (–40 °C to +85 °C)

Block Diagram



Contents

Architecture Overview

The Block Diagram on page 2 shows the HX3 architecture. HX3 consists of two independent hub controllers (SS and USB 2.0), the Cortex-M0 CPU subsystem, an I^2C interface, and port controller blocks.

SS Hub Controller

This block supports the SS hub functionality based on the USB 3.0 specification. The SS hub controller supports the following:

- SS link power management (U0, U1, U2, U3 states)
- Full-duplex data transmission

USB 2.0 Hub Controller

This block supports the LS, FS, and HS hub functionalities. It includes the repeater, frame timer, and four transaction translators.

The USB 2.0 hub controller block supports the following:

- USB 2.0 link power management (L0, L1, L2, L3 states)
- Suspend, resume, and remote wake-up signaling
- Multi-TT (one TT for each DS port)

CPU

The ARM Cortex-M0 CPU subsystem is used for the following functions:

- System configuration and initialization
- Battery charging control
- Vendor-specific commands for the USB-to-I^2C bridge
- String-descriptor support
- Suspend status indicator
- Shared Link support in embedded systems

I^2C Interface

The I^2C interface in HX3 supports the following:

- I^2C Slave, Master, and Multi-master configurations
  - Configure HX3 by an external I^2C master in I^2C slave mode
  - Configure HX3 from an I^2C EEPROM
  - Multi-master mode to share EEPROM with other I^2C masters
- In-System Programming of the I^2C EEPROM from HX3's US port

Port Controller

The port controller block controls DS port power to comply with the BC v1.2 and USB 3.0 specifications. This block also controls the US port power in the ACA-Dock mode. Control signals for external power switches are implemented within the chip. HX3 controls the external power switches at power-on to reduce in-rush current.

The port controller block supports the following:

- Overcurrent detection
- SS and USB 2.0 port indicators for each DS port
- Ganged and individual power control modes
- Automatic port numbering based on active ports

Applications

- Standalone hubs
- PC and tablet motherboards
- Docking station
- Hand-held cradles
- Monitors
- Digital TVs
- Set-top boxes
- Printers

HX3 Product Options

Table 1. HX3 Product Options

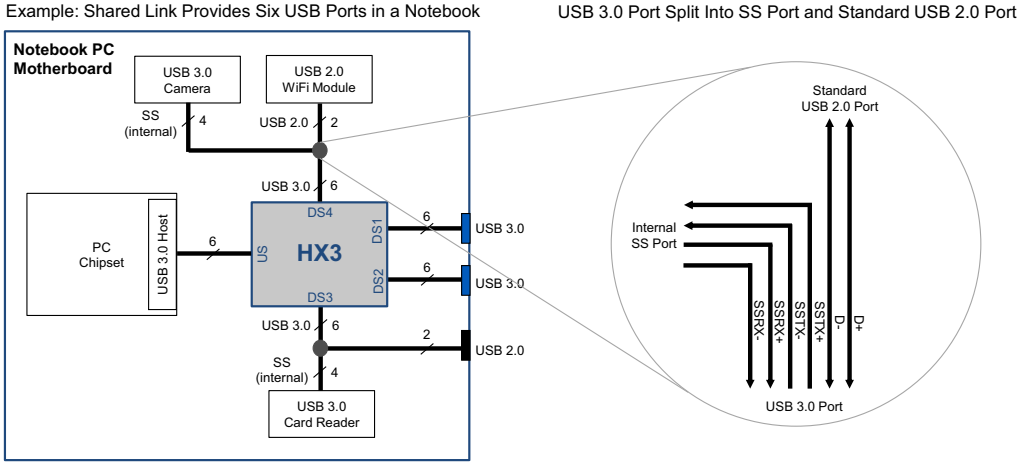
Features	CYUSB3302	CYUSB3304	CYUSB3312	CYUSB3314	CYUSB3324	CYUSB3326	CYUSB3328	CYUSB2302-68LTXI	CYUSB2304-68LTXI
Number of DS ports	2 (USB 3.0)	4 (USB 3.0)	2 (USB 3.0)	4 (USB 3.0)	4 (USB 3.0)	6 (2 USB 3.0, 2 SS, 2 USB 2.0)	8 (4 SS, 4 USB 2.0)	2 (USB 2.0)	4 (USB 2.0)
Number of Shared Link ports	0	0	0	0	0	2[1]	4	0	0
BC v1.2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ACA-Dock	No	No	No	No	Yes	No	Yes	No	No
External Power Switch Control	Ganged	Ganged	Individual and Ganged	Individual and Ganged	Individual and Ganged	Individual	Individual	Ganged	Ganged
Pin-Strap support	No	No	Yes	Yes	Yes	Yes	Yes	No	No
I^2C	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vendor command	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Port indicators	No	No	Yes	Yes	Yes	No	No	No	No
Packages[2]	68-QFN, 100-ball BGA	68-QFN, 100-ball BGA	88-QFN, 100-ball BGA	88-QFN, 100-ball BGA	88-QFN, 100-ball BGA	88-QFN, 100-ball BGA	88-QFN, 100-ball BGA	68-QFN, 100-ball BGA	68-QFN, 100-ball BGA
Temperature range	Industrial and Commercial	Industrial and Commercial	Industrial and Commercial	Industrial and Commercial	Industrial and Commercial	Industrial and Commercial	Industrial (88-QFN only) and Commercial	Industrial and Commercial	Industrial and Commercial

Notes
1. DS1 and DS2 are Shared link Ports.
2. BGA Industrial Grade packages are limited to 1 W of active power. For power calculations refer to Table 10 on page 33.

Product Features

Shared Link

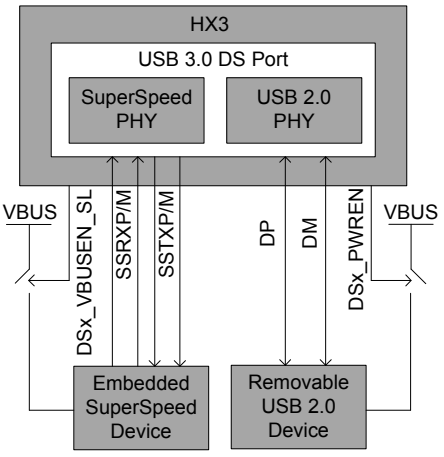
Figure 1. Application of Shared Link in a Notebook



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. Shared Link enables a maximum of eight DS ports from a four-port USB 3.0 hub.

For example, if one of the DS ports is connected to an embedded SS device, such as a USB 3.0 camera, HX3 enables the system designer to reuse the USB 2.0 signals of that specific port to connect to a standard USB 2.0 port. Figure 1 shows how Shared Link can be used in an application.

Figure 2. DS Port VBUS Control in Shared Link



The Shared Link mode requires a separate VBUS control for the removable USB 2.0 device and the embedded SS device. Figure 2 shows the VBUS control implementation.

To ensure that the embedded SS device does not fall back to USB 2.0 operation, an external power switch is required. This switch is controlled by HX3, which generates an output signal called DSx_VBUSEN_SL. This signal controls the VBUS for the embedded device.

DSx_PWREN is another output signal generated by HX3 and controls VBUS for the removable USB 2.0 device. For example, when an overcurrent condition occurs, DSx_PWREN turns off the port power.

Ghost Charge

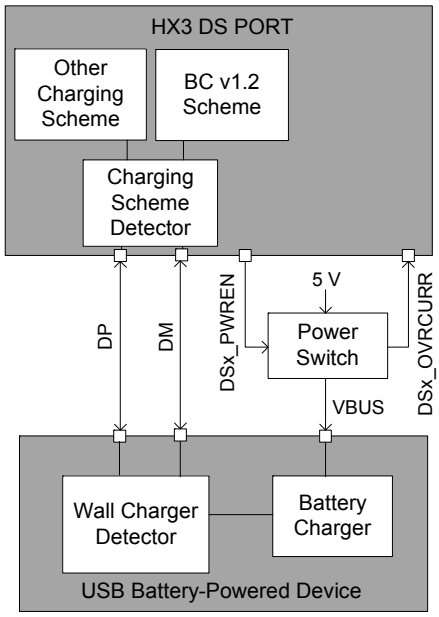
Ghost Charge is a Cypress-proprietary feature for charging USB devices on the DS port when the US port is not connected to a host. For example, in a docking station with HX3 as shown in Figure 3, when the laptop is undocked, HX3 will emulate a dedicated charging port (DCP) to provide charge to a phone connected on a DS port.

Figure 3. Ghost Charge

Charge a smartphone without docking the notebook

When the US port is disconnected from the host, HX3 detects if any of the DS ports are connected to a device requesting charging. It determines the charging method and then switches to the appropriate signaling based on the detected charging specification as shown in Figure 4. The hub either emulates a USB-compliant dedicated charging port by connecting DP and DM (see the BC v1.2 specification) or other supported proprietary charging schemes.

Figure 4. Ghost Charge Implementation in HX3



Ghost Charge is enabled by default and can be disabled through configuration. Refer to Configuration Options on page 24.

Vendor-Command Support

HX3 supports vendor-specific requests and can also enumerate as a vendor-specific device. The vendor-specific request can be used to (a) bridge USB and I^2C and (b) configure HX3. This feature can be used for the following applications:

- Firmware upgrade of an external ASSP connected to HX3 through USB
- In-System programming (ISP) of an EEPROM connected to HX3 through USB

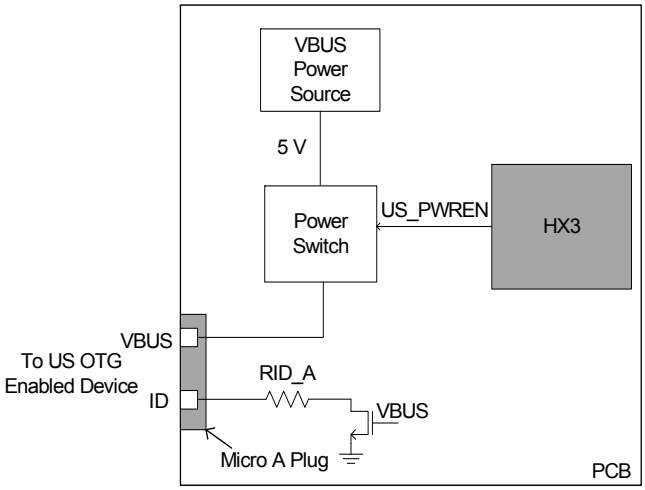
ACA-Dock Support

In traditional USB topologies, the host provides VBUS to enable and charge the connected devices. For OTG hosts, however, an ACA-Dock provides VBUS and a method to charge the host. HX3 supports the ACA-Dock standard (see BC v1.2 specification) by integrating the functions of the adapter controller.

Figure 5 shows the ACA-Dock system. If the ACA-Dock feature is enabled, HX3 turns on the external power switch to drive VBUS on the US port. To inform the OTG host that it is connected to an ACA-Dock, the ID pin is tied to ground using a resistor RID_A,[3] as shown in Figure 5. The ACA-Dock feature can be disabled using the Configuration Options on page 24.

For example, a BC v1.2 compliant phone such as a Sony Xperia (neo V) can be docked to a HX3-based ACA-Dock system. The phone acts as an OTG host and the ACA-Dock charges the phone connected to the US port while also powering the four DS ports.

Figure 5. ACA-Dock Support



Note
3. 124 kΩ is the recommended RID_A value as per BC v1.2 specification, but some portable devices use custom RID_A values.

Pin Information

Figure 6. HX3 68-Pin QFN 2-Port Pinout

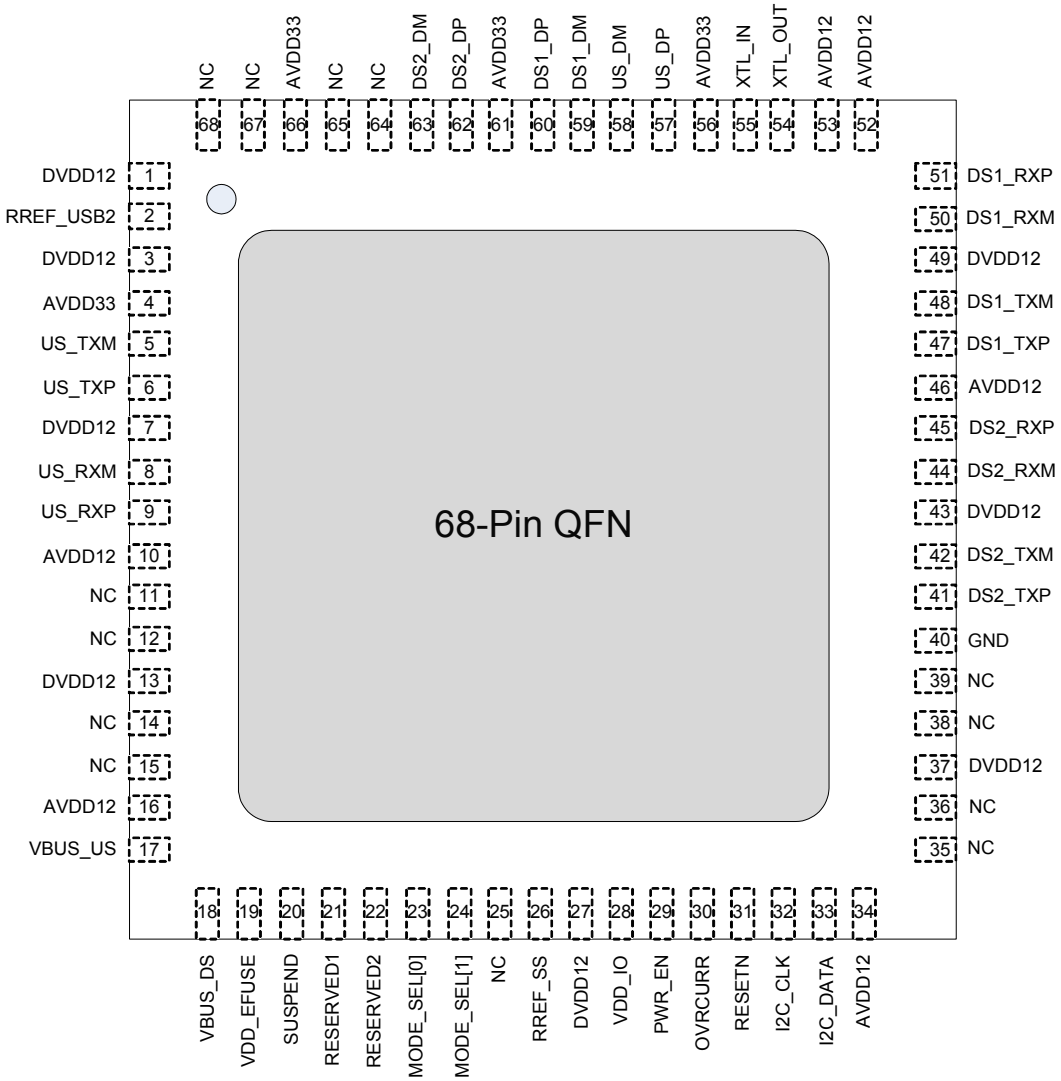


Figure 7. HX3 68-Pin QFN 4-Port Pinout

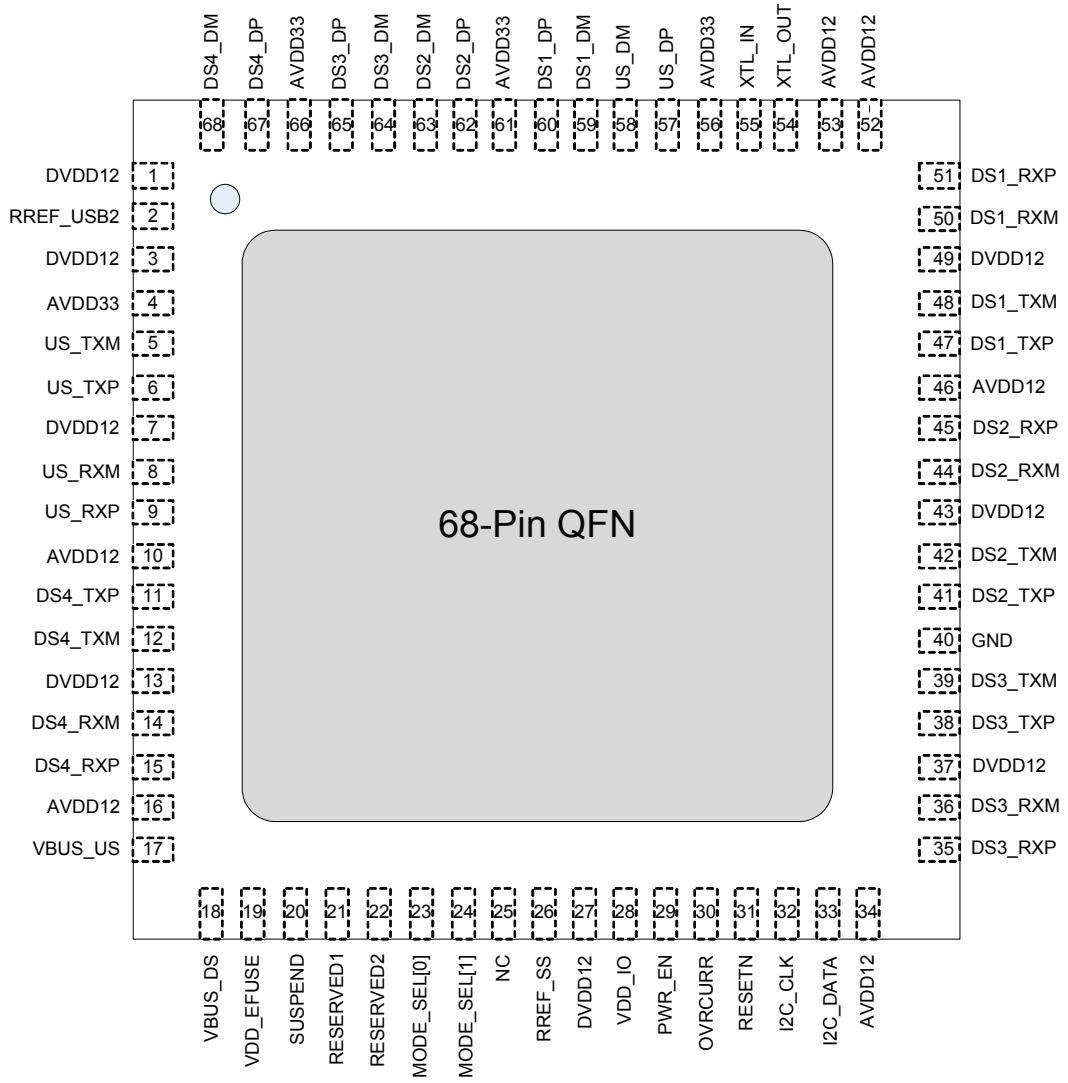


Figure 8. HX3 100-Ball BGA Pinout for CYUSB3302

A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
NC	NC	NC	AVDD33	DS2_DM	DS2_DP	AVDD33	US_DM	US_DP	AVDD12
B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
NC	NC	NC	VDD_IO	VSS	AVDD33	NC	NC	NC	DVDD12
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
US_TXM	NC	NC	NC	NC	VSS	DS1_DP	DS1_DM	AVDD12	DS1_RXM
D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**
US_TXP	NC	NC	DVDD12	VSS	DVDD12	VSS	DVDD12	VSS	DS1_RXP
E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**E10**
DVDD12	RREF_USB2	NC	NC	XTL_IN	XTL_OUT	VDD_IO	DS1_TXM	VSS	DVDD12
F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
US_RXM	VSS	AVDD33	MODE_SEL[1]	DVDD12	OVRCURR	RESETN	DS1_TXP	AVDD12	DS2_RXP
G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**
US_RXP	VBUS_DS	SUSPEND	RESERVED1	MODE_SEL[0]	VDD_IO	PWR_EN	I2C_DATA	VSS	DS2_RXM
H1	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
AVDD12	VBUS_US	VDD_EFUSE	RESERVED2	RREF_SS	VSS	DS2_TXM	DS2_TXP	NC	AVDD12
J1	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**	**J8**	**J9**	**J10**
VSS	AVDD12	VSS	GPIO	NC	I2C_CLK	NC	NC	VSS	NC
K1	**K2**	**K3**	**K4**	**K5**	**K6**	**K7**	**K8**	**K9**	**K10**
NC	NC	DVDD12	NC	NC	NC	NC	NC	DVDD12	NC

Figure 9. HX3 100-Ball BGA Pinout for CYUSB3304

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
NC	DS4_DM	DS4_DP	AVDD33	DS2_DM	DS2_DP	AVDD33	US_DM	US_DP	AVDD12
B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
NC	NC	NC	VDD_IO	VSS	AVDD33	NC	NC	NC	DVDD12
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**10**
US_TXM	NC	NC	DS3_DP	DS3_DM	VSS	DS1_DP	DS1_DM	AVDD12	DS1_RXM
D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**
US_TXP	NC	NC	DVDD12	VSS	DVDD12	VSS	DVDD12	VSS	DS1_RXP
E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**E10**
DVDD12	RREF_USB2	NC	NC	XTL_IN	XTL_OUT	VDD_IO	DS1_TXM	VSS	DVDD12
F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
US_RXM	VSS	AVDD33	MODE_SEL[1]	DVDD12	OVRCURR	RESETN	DS1_TXP	AVDD12	DS2_RXP
G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**
US_RXP	VBUS_DS	SUSPEND	RESERVED1	MODE_SEL[0]	VDD_IO	PWR_EN	I2C_DATA	VSS	DS2_RXM
H1	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
AVDD12	VBUS_US	VDD_EFUSE	RESERVED2	RREF_SS	VSS	DS2_TXM	DS2_TXP	NC	AVDD12
J1	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**	**J8**	**J9**	**J10**
VSS	AVDD12	VSS	GPIO	NC	I2C_CLK	NC	NC	VSS	DS3_RXM
K1	**K2**	**K3**	**K4**	**K5**	**K6**	**K7**	**K8**	**K9**	**K10**
DS4_TXP	DS4_TXM	DVDD12	DS4_RXP	DS4_RXM	NC	DS3_TXP	DS3_TXM	DVDD12	DS3_RXP

Table 2. 68-Pin QFN, 100-Ball BGA Pinout for CYUSB3302 and CYUSB3304

Pin Name		Type	68-QFN Pin#	100-BGA Ball #	Description
CYUSB3302	CYUSB3304				
US Port					
US_RXP		I	9	G1	SuperSpeed receive plus
US_RXM		I	8	F1	SuperSpeed receive minus
US_TXP		O	6	D1	SuperSpeed transmit plus
US_TXM		O	5	C1	SuperSpeed transmit minus
US_DP		I/O	57	A9	USB 2.0 data plus
US_DM		I/O	58	A8	USB 2.0 data minus
DS1 Port					
DS1_RXP		I	51	D10	SuperSpeed receive plus
DS1_RXM		I	50	C10	SuperSpeed receive minus
DS1_TXP		O	47	F8	SuperSpeed transmit plus
DS1_TXM		O	48	E8	SuperSpeed transmit minus
DS1_DP		I/O	60	C7	USB 2.0 data plus
DS1_DM		I/O	59	C8	USB 2.0 data minus
DS2 Port					
DS2_RXP		I	45	F10	SuperSpeed receive plus
DS2_RXM		I	44	G10	SuperSpeed receive minus
DS2_TXP		O	41	H8	SuperSpeed transmit plus
DS2_TXM		O	42	H7	SuperSpeed transmit minus
DS2_DP		I/O	62	A6	USB 2.0 data plus
DS2_DM		I/O	63	A5	USB 2.0 data minus
DS3 Port					
NC	DS3_RXP	I	35	K10	SuperSpeed receive plus
NC	DS3_RXM	I	36	J10	SuperSpeed receive minus
NC	DS3_TXP	O	38	K7	SuperSpeed transmit plus
NC	DS3_TXM	O	39	K8	SuperSpeed transmit minus
NC	DS3_DP	I/O	65	C4	USB 2.0 data plus
NC	DS3_DM	I/O	64	C5	USB 2.0 data minus
DS4 Port					
NC	DS4_RXP	I	15	K4	SuperSpeed receive plus
NC	DS4_RXM	I	14	K5	SuperSpeed receive minus
NC	DS4_TXP	O	11	K1	SuperSpeed transmit plus
NC	DS4_TXM	O	12	K2	SuperSpeed transmit minus
NC	DS4_DP	I/O	67	A3	USB 2.0 data plus
NC	DS4_DM	I/O	68	A2	USB 2.0 data minus
OVRCURR		I	30	F6	Ganged overcurrent input
PWR_EN		I/O	29	G7	Ganged power enable output
NC		I/O	25	NA	NC

Table 2. 68-Pin QFN, 100-Ball BGA Pinout for CYUSB3302 and CYUSB3304 *(continued)*

Pin Name		Type	68-QFN Pin#	100-BGA Ball #	Description
CYUSB3302	CYUSB3304				
RESERVED1		I/O	21	G4	This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
RESERVED2		I	22	H4	This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
Mode Select, Clock, and Reset					
MODE_SEL[0]		I	23	G5	Device operation mode select bit 0; refer to Table 5 on page 24
MODE_SEL[1]		I	24	F4	Device operation mode select bit 1; refer to Table 5 on page 24
XTL_OUT		A	54	E6	Crystal out
XTL_IN		A	55	E5	Crystal in
RESETN		I	31	F7	Active LOW reset input
I2C_CLK		I/O	32	J6	I^2C clock
I2C_DATA		I/O	33	G8	I^2C data
SUSPEND		I/O	20	G3	Hub suspend status indicator. This pin is asserted if both the SS and USB 2.0 hubs are in the suspend state and is de-asserted when either of the hubs comes out of the suspend state.
Power and Ground					
VDD_EFUSE		PWR	19	H3	1.2 V normal operation, 2.5 V for programming. Customers should connect to 1.2 V.
AVDD12		PWR	10, 16, 34, 46, 52, 53	A10, C9, F9, H1, H10, J2	1.2 V analog supply
GND		PWR	40	B5, C6, D5, D7, D9, E9, F2, G9, H6, J1, J3, J9	GND pin
DVDD12		PWR	1, 3, 7, 13, 27, 37, 43, 49,	B10, D4, D6, D8, E1, E10, F5, K3, K9	1.2 V core supply
VBUS _US		PWR	17	H2	This pin must be connected to VBUS from US port
VBUS_DS		PWR	18	G2	This pin is used to power the Apple-charging circuit in HX3. For BC v1.2 compliance testing, connect pin to GND. For normal operation, connect pin to local 5 V supply.
AVDD33		PWR	4, 56, 61, 66	A4, A7, B6, F3	3.3 V analog supply
VDD_IO		PWR	28	B4, E7, G6	3.3 V I/O supply
USB Precision Resistors					
RREF_USB2		A	2	E2	Connect pin to a precision resistor (6.04 kΩ ±1%) to generate a current reference for USB 2.0 PHY.
RREF_SS		A	26	H5	Connect pin to a precision resistor (200 Ω ±1%) for SS PHY termination impedance calibration.

Note
4. These pins are Do Not Use (DNU); they must be left floating.

Table 3. 68-Pin QFN, 100-Ball BGA Pinout for CYUSB2302 and CYUSB2304

Pin Name		Type	68-QFN Pin#	100-BGA Ball #	Description
CYUSB2302	CYUSB2304				
US Port					
NC		I	9	G1	SuperSpeed receive plus
NC		I	8	F1	SuperSpeed receive minus
NC		O	6	D1	SuperSpeed transmit plus
NC		O	5	C1	SuperSpeed transmit minus
US_DP		I/O	57	A9	USB 2.0 data plus
US_DM		I/O	58	A8	USB 2.0 data minus
DS1 Port					
NC		I	51	D10	SuperSpeed receive plus
NC		I	50	C10	SuperSpeed receive minus
NC		O	47	F8	SuperSpeed transmit plus
NC		O	48	E8	SuperSpeed transmit minus
DS1_DP		I/O	60	C7	USB 2.0 data plus
DS1_DM		I/O	59	C8	USB 2.0 data minus
DS2 Port					
NC		I	45	F10	SuperSpeed receive plus
NC		I	44	G10	SuperSpeed receive minus
NC		O	41	H8	SuperSpeed transmit plus
NC		O	42	H7	SuperSpeed transmit minus
DS2_DP		I/O	62	A6	USB 2.0 data plus
DS2_DM		I/O	63	A5	USB 2.0 data minus
DS3 Port					
NC	NC	I	35	K10	SuperSpeed receive plus
NC	NC	I	36	J10	SuperSpeed receive minus
NC	NC	O	38	K7	SuperSpeed transmit plus
NC	NC	O	39	K8	SuperSpeed transmit minus
NC	DS3_DP	I/O	65	C4	USB 2.0 data plus
NC	DS3_DM	I/O	64	C5	USB 2.0 data minus
DS4 Port					
NC	NC	I	15	K4	SuperSpeed receive plus
NC	NC	I	14	K5	SuperSpeed receive minus
NC	NC	O	11	K1	SuperSpeed transmit plus
NC	NC	O	12	K2	SuperSpeed transmit minus
NC	DS4_DP	I/O	67	A3	USB 2.0 data plus
NC	DS4_DM	I/O	68	A2	USB 2.0 data minus
OVRCURR		I	30	F6	Ganged overcurrent input
PWR_EN		I/O	29	G7	Ganged power enable output
NC		I/O	25	NA	NC

Table 3. 68-Pin QFN, 100-Ball BGA Pinout for CYUSB2302 and CYUSB2304 *(continued)*

Pin Name		Type	68-QFN Pin#	100-BGA Ball #	Description
CYUSB2302	CYUSB2304				
RESERVED1		I/O	21	G4	This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
RESERVED2		I	22	H4	This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
Mode Select, Clock, and Reset					
MODE_SEL[0]		I	23	G5	Device operation mode select bit 0; refer to Table 5 on page 24
MODE_SEL[1]		I	24	F4	Device operation mode select bit 1; refer to Table 5 on page 24
XTL_OUT		A	54	E6	Crystal out
XTL_IN		A	55	E5	Crystal in
RESETN		I	31	F7	Active LOW reset input
I2C_CLK		I/O	32	J6	I^2C clock
I2C_DATA		I/O	33	G8	I^2C data
SUSPEND		I/O	20	G3	Hub suspend status indicator. This pin is asserted if both the SS and USB 2.0 hubs are in the suspend state and is de-asserted when either of the hubs comes out of the suspend state.
Power and Ground					
VDD_EFUSE		PWR	19	H3	1.2 V normal operation, 2.5 V for programming. Customers should connect to 1.2 V.
AVDD12		PWR	10, 16, 34, 46, 52, 53	A10, C9, F9, H1, H10, J2	1.2 V analog supply
GND		PWR	40	B5, C6, D5, D7, D9, E9, F2, G9, H6, J1, J3, J9	GND pin
DVDD12		PWR	1, 3, 7, 13, 27, 37, 43, 49,	B10, D4, D6, D8, E1, E10, F5, K3, K9	1.2 V core supply
VBUS _US		PWR	17	H2	This pin must be connected to VBUS from US port
VBUS_DS		PWR	18	G2	This pin is used to power the Apple-charging circuit in HX3. For BC v1.2 compliance testing, connect pin to GND. For normal operation, connect pin to local 5 V supply.
AVDD33		PWR	4, 56, 61, 66	A4, A7, B6, F3	3.3 V analog supply
VDD_IO		PWR	28	B4, E7, G6	3.3 V I/O supply
USB Precision Resistors					
RREF_USB2		A	2	E2	Connect pin to a precision resistor (6.04 kΩ ±1%) to generate a current reference for USB 2.0 PHY.
RREF_SS		A	26	H5	Connect pin to a precision resistor (200 Ω ±1%) for SS PHY termination impedance calibration.

Figure 10. HX3 88-Pin QFN 2-Port Pinout

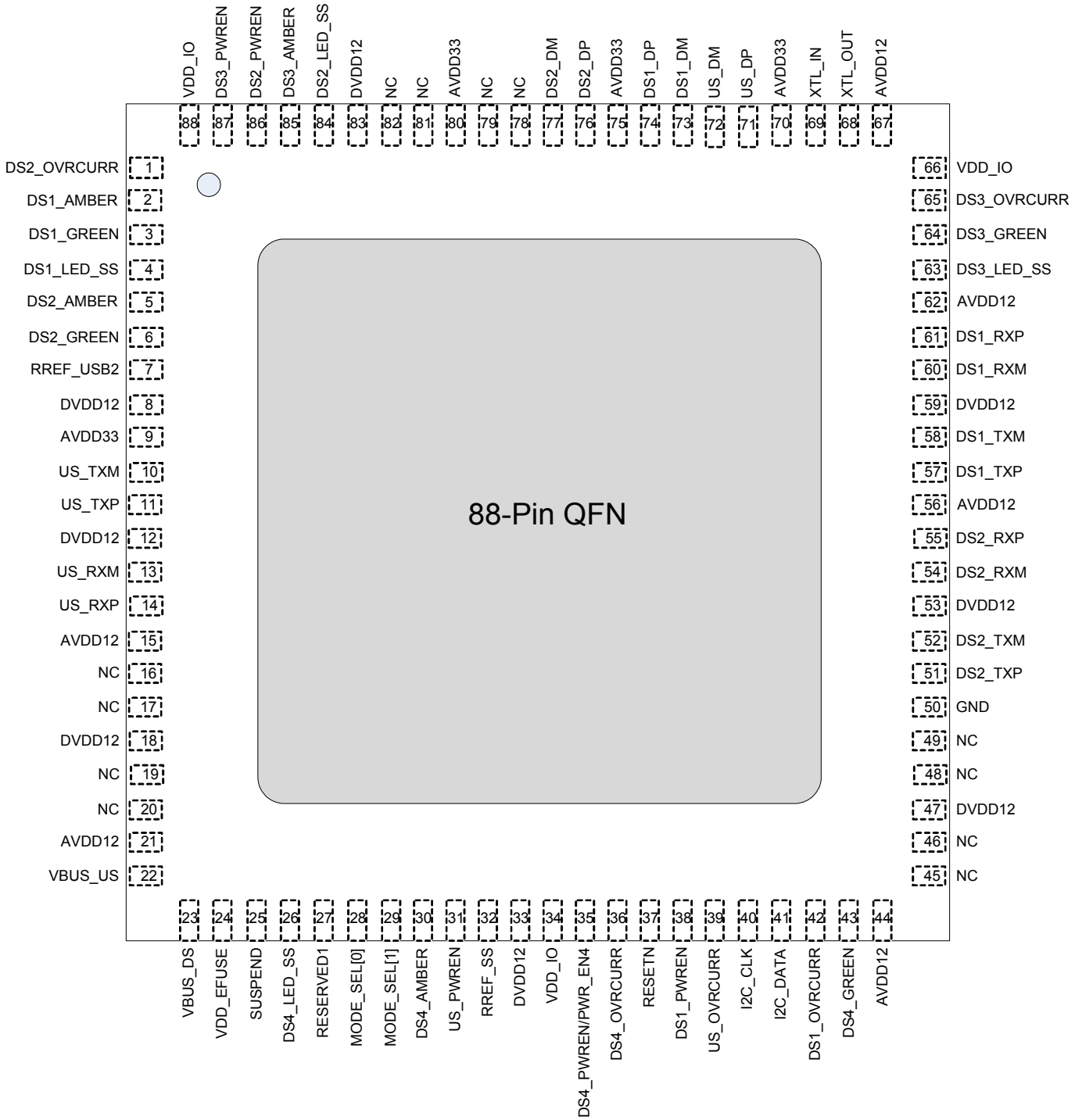


Figure 11. HX3 88-Pin QFN 4-Port Pinout

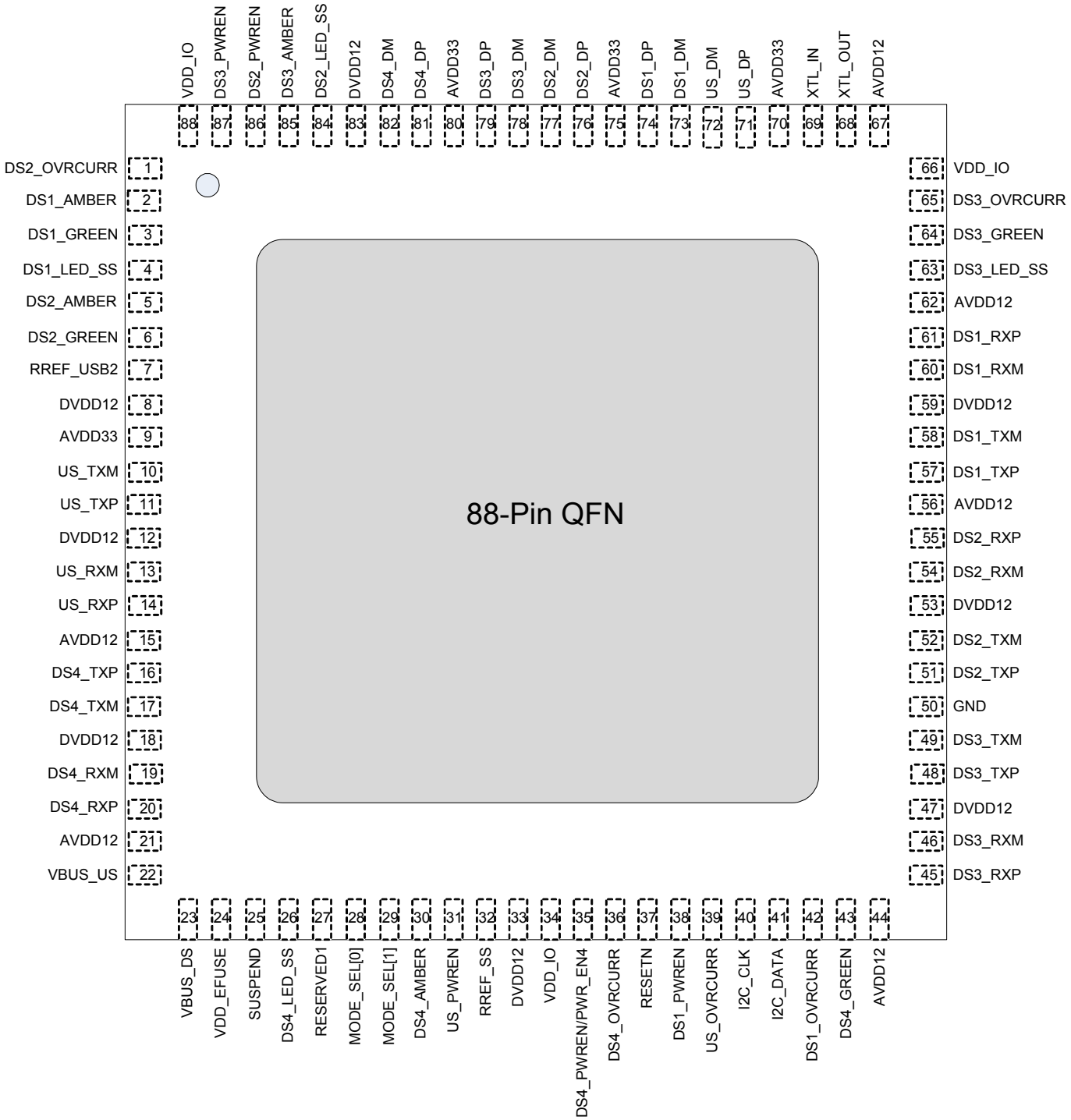


Figure 12. HX3 100-Ball BGA Pinout for CYUSB3312

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
DS3_PWREN	NC	NC	AVDD33	DS2_DM	DS2_DP	AVDD33	US_DM	US_DP	AVDD12
B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
DS2_OVRCURR	DS2_PWREN	DS3_AMBER	VDD_IO	VSS	AVDD33	DS3_OVRCURR	DS3_GREEN	DS3_LED_SS	DVDD12
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
US_TXM	DS1_AMBER	DS2_LED_SS	NC	NC	VSS	DS1_DP	DS1_DM	AVDD12	DS1_RXM
D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**
US_TXP	DS1_LED_SS	DS1_GREEN	DVDD12	VSS	DVDD12	VSS	DVDD12	VSS	DS1_RXP
E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**E10**
DVDD12	RREF_USB2	DS2_GREEN	DS2_AMBER	XTL_IN	XTL_OUT	VDD_IO	DS1_TXM	VSS	DVDD12
F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
US_RXM	VSS	AVDD33	MODE_SEL[1]	DVDD12	DS4_OVRCURR	RESETN	DS1_TXP	AVDD12	DS2_RXP
G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**
US_RXP	VBUS_DS	SUSPEND	RESERVED1	MODE_SEL[0]	VDD_IO	DS4_PWREN	I2C_DATA	VSS	DS2_RXM
H1	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
AVDD12	VBUS_US	VDD_EFUSE	DS4_LED_SS	RREF_SS	VSS	DS2_TXM	DS2_TXP	DS4_GREEN	AVDD12
J1	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**	**J8**	**J9**	**J10**
VSS	AVDD12	VSS	DS4_AMBER	US_PWREN	I2C_CLK	DS1_PWREN	DS1_OVRCURR	VSS	NC
K1	**K2**	**K3**	**K4**	**K5**	**K6**	**K7**	**K8**	**K9**	**K10**
NC	NC	DVDD12	NC	NC	US_OVRCURR	NC	NC	DVDD12	NC

Figure 13. HX3 100-Ball BGA Pinout for CYUSB3314, CYUSB332x

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
DS3_PWREN	DS4_DM	DS4_DP	AVDD33	DS2_DM	DS2_DP	AVDD33	US_DM	US_DP	AVDD12
B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
DS2_OVRCURR	DS2_PWREN	DS3_AMBER	VDD_IO	VSS	AVDD33	DS3_OVRCURR	DS3_GREEN	DS3_LED_SS	DVDD12
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
US_TXM	DS1_AMBER	DS2_LED_SS	DS3_DP	DS3_DM	VSS	DS1_DP	DS1_DM	AVDD12	DS1_RXM
D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**
US_TXP	DS1_LED_SS	DS1_GREEN	DVDD12	VSS	DVDD12	VSS	DVDD12	VSS	DS1_RXP
E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**E10**
DVDD12	RREF_USB2	DS2_GREEN	DS2_AMBER	XTL_IN	XTL_OUT	VDD_IO	DS1_TXM	VSS	DVDD12
F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
US_RXM	VSS	AVDD33	MODE_SEL[1]	DVDD12	DS4_OVRCURR	RESETN	DS1_TXP	AVDD12	DS2_RXP
G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**
US_RXP	VBUS_DS	SUSPEND	RESERVED1	MODE_SEL[0]	VDD_IO	DS4_PWREN	I2C_DATA	VSS	DS2_RXM
H1	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
AVDD12	VBUS_US	VDD_EFUSE	DS4_LED_SS	RREF_SS	VSS	DS2_TXM	DS2_TXP	DS4_GREEN	AVDD12
J1	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**	**J8**	**J9**	**J10**
VSS	AVDD12	VSS	DS4_AMBER	US_PWREN	I2C_CLK	DS1_PWREN	DS1_OVRCURR	VSS	DS3_RXM
K1	**K2**	**K3**	**K4**	**K5**	**K6**	**K7**	**K8**	**K9**	**K10**
DS4_TXP	DS4_TXM	DVDD12	DS4_RXP	DS4_RXM	US_OVRCURR	DS3_TXP	DS3_TXM	DVDD12	DS3_RXP

Table 4. 88-Pin QFN, 100-Ball BGA Pinout for CYUSB331X and CYUSB332X

Pin Name		Type	Pin#	Ball#	Description
CYUSB3312	CYUSB3314 CYUSB3324 CYUSB3326 CYUSB3328				
US Port					
US_RXP		I	14	G1	SuperSpeed receive plus
US_RXM		I	13	F1	SuperSpeed receive minus
US_TXP		O	11	D1	SuperSpeed transmit plus
US_TXM		O	10	C1	SuperSpeed transmit minus
US_DP		I/O	71	A9	USB 2.0 data plus
US_DM		I/O	72	A8	USB 2.0 data minus
US_OVRCURR		I	39	K6	CYUSB3324/3328: Overcurrent detect input for US port in ACA-Dock mode. If ACA-Dock mode is disabled using Configuration Options on page 24, this pin must be pulled HIGH using a 10 kΩ to VDD_IO. Other part numbers: This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
US_PWREN[5]		I/O	31	J5	CYUSB3324/3328: VBUS power enable output for US port in ACA-Dock mode. If ACA-Dock mode is disabled using Configuration Options on page 24, this pin can be left floating if Pin-Strap is not enabled. Other part numbers: This pin can be left floating if Pin-Strap (Pin# 63) is not enabled.
PWR_SW_POL[6]					This pin is called PWR_SW_POL in pin-strap configuration mode.
DS1 Port					
DS1_RXP		I	61	D10	SuperSpeed receive plus
DS1_RXM		I	60	C10	SuperSpeed receive minus
DS1_TXP		O	57	F8	SuperSpeed transmit plus
DS1_TXM		O	58	E8	SuperSpeed transmit minus
DS1_DP		I/O	74	C7	USB 2.0 data plus
DS1_DM		I/O	73	C8	USB 2.0 data minus
DS1_OVRCURR		I	42	J8	Overcurrent detect input for DS1 port
DS1_PWREN[5]		I/O	38	J7	VBUS power enable output for DS1 port. When the port is disabled, this pin is in tristate.
DS1_CDP_EN[6]					This pin is called DS1_CDP_EN in pin-strap configuration mode.
DS1_AMBER[5]		I/O	2	C2	LED_AMBER output for DS1 port
ACA_DOCK[6]					This pin is called ACA-DOCK in pin-strap configuration mode.
DS1_GREEN[5]		I/O	3	D3	CYUSB3312/3314/3324: LED_GREEN output for DS1 port
DS1_VBUSEN_SL[5]					CYUSB3326/3328: VBUS power enable output for SS port 1
PORT_DISABLE[0][6]					This pin is called PORT_DISABLE[0] in pin-strap configuration mode.
DS1_LED_SS[5]		I/O	4	D2	LED_SS output for DS1 port
PORT_DISABLE[1][6]					This pin is called PORT_DISABLE[1] in pin-strap configuration mode.

Notes
5. This pin can be configured as a GPIO using custom firmware. For information contact www.cypress.com/support.
6. For pin-strap configuration details, refer to Table 6 on page 25.

Table 4. 88-Pin QFN, 100-Ball BGA Pinout for CYUSB331X and CYUSB332X *(continued)*

Pin Name		Type	Pin#	Ball#	Description
CYUSB3312	CYUSB3314 CYUSB3324 CYUSB3326 CYUSB3328				
DS2 Port					
DS2_RXP		I	55	F10	SuperSpeed receive plus
DS2_RXM		I	54	G10	SuperSpeed receive minus
DS2_TXP		O	51	H8	SuperSpeed transmit plus
DS2_TXM		O	52	H7	SuperSpeed transmit minus
DS2_DP		I/O	76	A6	USB 2.0 data plus
DS2_DM		I/O	77	A5	USB 2.0 data minus
DS2_OVRCURR		I	1	B1	Overcurrent detect input for DS2 port
DS2_PWREN[7]		I/O	86	B2	VBUS power enable output for DS2 port. When the port is disabled, this pin is in tristate.
DS2_CDP_EN[8]					This pin is called DS2_CDP_EN in the pin-strap configuration mode.
DS2_AMBER[7]		I/O	5	E4	LED_AMBER output for DS2 port
NON_REMOVABLE[0][8]					This pin is called NON_REMOVABLE[0] in the pin-strap configuration mode.
DS2_GREEN[7]		I/O	6	E3	CYUSB3312/3314/3324: LED_GREEN output for DS2 port
DS2_VBUSEN_SL[7]					CYUSB3326/3328: VBUS power enable output for SS port 2
NON_REMOVABLE[1][8]					This pin is called NON_REMOVABLE[1] in the pin-strap configuration mode.
DS2_LED_SS[7]		I/O	84	C3	LED_SS output for DS2 port
PWR_EN_SEL[8]					This pin is called PWR_EN_SEL in the pin-strap configuration mode.
DS3 Port					
NC	DS3_RXP	I	45	K10	SuperSpeed receive plus
NC	DS3_RXM	I	46	J10	SuperSpeed receive minus
NC	DS3_TXP	O	48	K7	SuperSpeed transmit plus
NC	DS3_TXM	O	49	K8	SuperSpeed transmit minus
NC	DS3_DP	I/O	79	C4	USB 2.0 data plus
NC	DS3_DM	I/O	78	C5	USB 2.0 data minus
DS3_OVRCURR		I	65	B7	CYUSB3314/3324/3326/3328: Overcurrent detect input for DS3 port CYUSB3312: This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
DS3_PWREN[7]		I/O	87	A1	VBUS power enable output for DS3 port. When the port is disabled, this pin is in tristate.
DS3_CDP_EN[8]					This pin is called DS3_CDP_EN in the pin-strap configuration mode.
DS3_AMBER[7]		I/O	85	B3	LED_AMBER output for DS3 port
VID_SEL[2][8]					This pin is called VID_SEL[2] in the pin-strap configuration mode.

Notes
7. This pin can be configured as a GPIO using custom firmware. For information contact www.cypress.com/support.
8. For pin-strap configuration details, refer to Table 6 on page 25.

Table 4. 88-Pin QFN, 100-Ball BGA Pinout for CYUSB331X and CYUSB332X *(continued)*

Pin Name		Type	Pin#	Ball#	Description
CYUSB3312 / CYUSB3314 / CYUSB3324 / CYUSB3326 / CYUSB3328					
DS3_GREEN[9]		I/O	64	B8	CYUSB3312/3314/3324: LED_GREEN output for DS3 port
DS3_VBUSEN_SL[9]					CYUSB3328: VBUS power enable output for SS port 3
VID_SEL[1][10]					This pin is called VID_SEL[1] in the pin-strap configuration mode. For pin-strap configuration details, refer to Table 6 on page 25.
DS3_LED_SS[9]		I/O	63	B9	LED_SS output for DS3 port
PIN_STRAP[10]					This pin is called PIN_STRAP in pin-strap configuration mode. When connected to VDD_IO through a 10-kΩ resistor, this pin enables pin-strap configuration mode for HX3.
DS4 Port					
NC	DS4_RXP	I	20	K4	SuperSpeed receive plus
NC	DS4_RXM	I	19	K5	SuperSpeed receive minus
NC	DS4_TXP	O	16	K1	SuperSpeed transmit plus
NC	DS4_TXM	O	17	K2	SuperSpeed transmit minus
NC	DS4_DP	I/O	81	A3	USB 2.0 data plus
NC	DS4_DM	I/O	82	A2	USB 2.0 data minus
DS4_OVRCURR		I	36	F6	CYUSB3314/3324/3326/3328: Overcurrent detect input for DS4 port. CYUSB3312: This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
DS4_PWREN/PWR_EN4		I/O	35	G7	VBUS power enable output for DS4 port. This pin is also used as power enable output when configured in ganged power mode using the Blaster Plus tool. When the port is disabled, this pin is in tristate.
DS4_CDP_EN[10]					This pin is called DS4_CDP_EN in the pin-strap configuration mode.
DS4_AMBER[9]		I/O	30	J4	LED_AMBER output for DS4 port
I2C_DEV_ID[10]					This pin is called I2C_DEV_ID in the pin-strap configuration mode.
DS4_GREEN[9]		I/O	43	H9	CYUSB3312/3314/3324: LED_GREEN output for DS4 port
DS4_VBUSEN_SL					CYUSB3328: VBUS power enable output for SS port 4
VID_SEL[0][10]					This pin is called VID_SEL[0] in the pin-strap configuration mode.
DS4_LED_SS		I/O	26	H4	LED_SS output for DS4 port. The LED must be connected to GND as shown in Figure 16 on page 25. If LED is not used, this pin must be pulled HIGH using a 10 kΩ to VDD_IO.
RESERVED1		I	27	G4	This pin must be pulled HIGH using a 10 kΩ to VDD_IO.
Mode Select, Clock, and Reset					
MODE_SEL[0]		I	28	G5	Device operation mode select bit 0; refer to Table 5 on page 24
MODE_SEL[1]		I	29	F4	Device operation mode select bit 1; refer to Table 5 on page 24
XTL_OUT		A	68	E6	Crystal out
XTL_IN		A	69	E5	Crystal in
RESETN		I	37	F7	Active LOW reset input
I2C_CLK		I/O	40	J6	I^2C clock
I2C_DATA		I/O	41	G8	I^2C data

Notes
9. This pin can be configured as a GPIO using custom firmware. For information contact www.cypress.com/support.
10. For pin-strap configuration details, refer to Table 6 on page 25.

Table 4. 88-Pin QFN, 100-Ball BGA Pinout for CYUSB331X and CYUSB332X *(continued)*

Pin Name		Type	Pin#	Ball#	Description
CYUSB3312	CYUSB3314 CYUSB3324 CYUSB3326 CYUSB3328				
SUSPEND		I/O	25	G3	Hub suspend status indicator. This pin is asserted if both the SS and USB 2.0 hubs are in the suspend state and is de-asserted when either of the hubs comes out of the suspend state.
Power and Ground					
VDD_EFUSE		PWR	24	H3	1.2 V normal operation, 2.5 V for programming. Customers should connect to 1.2 V
AVDD12		PWR	15, 21, 44, 56, 62, 67	A10, C9, F9, H1, H10, J2	1.2 V analog supply
GND		PWR	50	B5, C6, D5, D7, D9, E9, F2, G9, H6, J1, J3, J9	GND pin
DVDD12		PWR	8, 12, 18, 33, 47, 53, 59, 83	B10, D4, D6, D8, E1, E10, F5, K3, K9	1.2 V core supply
VBUS _US		PWR	22	H2	CYUSB3324/3328: Connect the VBUS_US pin to the local 5 V supply. If ACA-Dock mode is disabled using Configuration Options on page 24, this pin must be connected to VBUS from US port. Other part numbers: This pin must be connected to VBUS from US port.
VBUS_DS		PWR	23	G2	This pin is used to power the Apple-charging circuit in HX3. For BC v1.2 compliance testing, connect pin to GND. For normal operation, connect pin to local 5 V supply.
AVDD33		PWR	9, 70, 75, 80	A4, A7, B6, F3	3.3 V analog supply
VDD_IO		PWR	34, 66, 88	B4, E7, G6	3.3 V I/O supply
USB Precision Resistors					
RREF_USB2		A	7	E2	Connect pin to a precision resistor (6.04 kΩ ±1%) to generate a current reference for USB 2.0 PHY.
RREF_SS		A	32	H5	Connect pin to a precision resistor (200 Ω ±1%) for SS PHY termination impedance calibration.

System Interfaces

Upstream Port (US)

This port is compliant with the USB 3.0 specification and includes an integrated 1.5 kΩ pull-up and termination resistors. It also supports ACA-Dock to enable charging an OTG host connected on the US port.

Downstream Ports (DS1, 2, 3, 4)

DS ports are compliant with the USB 3.0 specification and integrate 15 kΩ pull-down and termination resistors. Ports can be disabled or enabled, and can be set to removable or non-removable options. BC v1.2 charging is enabled by default and can be disabled on each DS port using the configuration options (see Configuration Options).

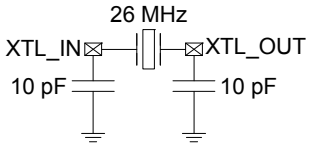
Communication Interfaces (I^2C)

The interface follows the Inter-IC Bus specification, version 3.0, with support for the standard mode (100 kHz) and the fast mode (400 kHz) frequencies. HX3 supports I^2C in the slave and master modes. The I^2C interface supports the multi-master mode of operation. Both the SCL and SDA signals require external pull-up resistors based on the specification. VDD_IO for HX3 is 3.3 V and it is expected that the I^2C pull-up resistors will be connected to the same supply.

Oscillator

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-power drive level (<200 µW). The crystal connection to the XTL_OUT and XTL_IN pins is shown in Figure 14.

Figure 14. Crystal Connection



GPIOs

HX3 GPIOs are used for overcurrent sensing, controlling external power switches, and driving LEDs. These pins can sink up to 4 mA current each. GPIOs also enable pin-straps for input configuration. Refer to Table 6 for more details.

Power Control

The PWR_EN[1-4] and OV_CURR[1-4] pins interface HX3 to external power switches. These pins are used to control power switches for DS port power and monitor overcurrent conditions. The power switch polarity and the power control mode (individual and ganged) can be changed using the configuration options.

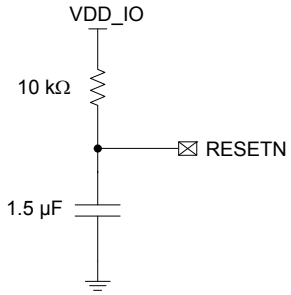
Reset

HX3 operates with two external power supplies, 3.3 V and 1.2 V. There is no power sequencing requirement between these two supplies. However, the RESETN pin should be held LOW until both these supplies become stable.

The RESETN pin can be tied to VDD_IO through an external resistor and to ground (GND) through an external capacitor (minimum 5 ms time constant), as shown in Figure 15. This creates a clean reset signal for power-on reset (POR).

HX3 does not support internal brown-out detection. If the system requires this feature, an external reset should be provided on the RESETN pin when supplies are below their valid operating ranges.

Figure 15. Reset Connection



Configuration Mode Select

Configuration options are selected through the MODE_SEL pins and the pin-strap enable pin (PIN_STRAP). After power-up, these pins are sampled by an on-chip bootloader to determine the configuration options (see Table 5).

Table 5. HX3 Boot Sequence

MODE SEL[1]	MODE SEL[0]	HX3 Configuration Modes
0	0	Reserved. Do not use this mode.
1	1	Internal ROM configuration
0	1	I^2C Master, read configuration from I^2C EEPROM*
1	0	I^2C Slave, configure from an external I^2C Master*

* Download Cypress-provided firmware from www.cypress.com/hx3.

Configuration Options

HX3 can be configured by using one of the following:

- eFuse (one-time programmable memory)
- Pin-Strap (read configuration from dedicated pins at power on)
- External I^2C slave such as an EEPROM
- External I^2C master

The I^2C master/slave configuration overrides the pin-strap configuration. Pin-straps override the eFuse configuration, and the eFuse configuration overrides the internal ROM configuration.

eFuse Configuration

HX3 contains eFuses, which are OTP elements on the chip that can be electrically blown. The eFuses are read by the bootloader to determine the customer-specific configurations. eFuse programming is supported only at factory and distributor locations where programming conditions can be controlled. eFuse programming is supported under the following conditions:

Temperature range of 25 °C–70 °C and programming voltage of 2.5 V–2.7 V.

Pin-Strap Configuration

Pin-straps are supported for select product options (see Table 1 on page 5) to provide reconfigurability without an additional EEPROM. The pin-strap configuration is enabled by pulling the Pin #63 of 88-pin QFN HIGH. Table 6 on page 25 shows the configuration options supported through pin-straps and the GPIOs used for this purpose. Figure 16 and Figure 17 show how the GPIOs need to be connected if pin-strap and LED connection are required or only pin-strap is required.

HX3 samples pin-strap GPIOs at power-up. Floating straps are considered as invalid and the default configuration is used. If PIN_STRAP (Pin #63 of 88-pin QFN) is floating, all strap inputs are considered invalid. A GPIO is considered strapped "1" or "0" when connected with a weak pull-up (10 kΩ) or pull-down (10 kΩ) respectively. After the initial sampling at power-up and reset, the GPIOs are used in their normal functions.

Figure 16. Pin-Strap With LED or LED-Only Connection

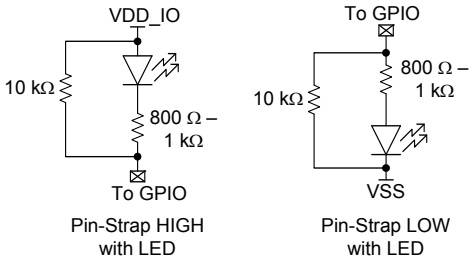


Figure 17. Pin-Strap Connection

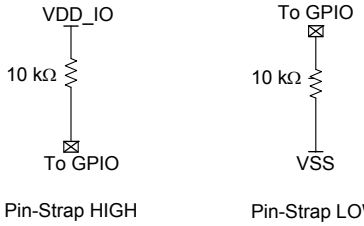


Table 6. Pin-Strap Configuration

88-QFN Pin #	Pin-Strap Name	Strapped '0'[11]		Strapped '1'[11]	
30	I2C_DEV_ID[12]	ID 0: HX3 I²C slave address (7 bits) is 0x60. This is also the default I²C slave address for the 68-pin QFN package.		ID 1: HX3 I²C slave address (7 bits) is 0x58	
31	PWR_SW_POL	Power enable and overcurrent will be active LOW		Power enable and overcurrent will be active HIGH	
2	ACA_DOCK	Disabled		Enabled	
84	PWR_EN_SEL	Individual		Gang	
63	PIN_STRAP[13]	No pin-strapping		Pin-strapping configuration enabled	
4	PORT_DISABLE[1]	PORT_DISABLE[1:0] = b'00: DS1, DS2, DS3, DS4 active b'01: DS1, DS2, DS3 active b'10: DS1, DS2 active b'11: DS1 active Pin-straps cannot enable ports disabled by factory setting.			
3	PORT_DISABLE[0]				
6	NON_REMOVABLE[1][14]	NON_REMOVABLE[1:0] = b'00: DS1, DS2, DS3, DS4 removable b'01: DS1, DS2, DS3 removable b'10: DS1, DS2 removable b'11: DS1 removable			
5	NON_REMOVABLE[0][14]				
85	VID[2]	Reserved. If PIN_STRAP is enabled and CY VID is required, strap VID[2:0] to '1'.			
64	VID[1]				
43	VID[0]				
38	DS1_CDP_EN[15]	strapped '0'	strapped '1'	strapped '0'	strapped '1'
		DS1 CDP enabled	DS1 CDP disabled	DS1 CDP disabled	DS1 CDP enabled
86	DS2_CDP_EN[15]	DS2 CDP enabled	DS2 CDP disabled	DS2 CDP disabled	DS2 CDP enabled
87	DS3_CDP_EN[15]	DS3 CDP enabled	DS3 CDP disabled	DS3 CDP disabled	DS3 CDP enabled
35	DS4_CDP_EN[15]	DS4 CDP enabled	DS4 CDP disabled	DS4 CDP disabled	DS4 CDP enabled

Notes
11. See Figure 16 and Figure 17.
12. I2C_DEV_ID is valid only when HX3 is in I²C slave mode.
13. VID, PORT_DISABLE, NON_REMOVABLE are group straps. If one of the pins in a group strap is floating (INVALID), that group input will be INVALID and the default will not be overwritten.
14. These DS ports are exposed ports and the connected devices can be removed.
15. DSx_CDP_EN will be active LOW input when PWR_SW_POL is set to active LOW; similarly DSx_CDP_EN will be active HIGH input when PWR_SW_POL is set to active HIGH.