

Future Technology Devices International Ltd

Datasheet RPi HUB Module Datasheet

RPi HUB Module connects to a Raspberry-Pi computer and expands the number of interfaces that can be accessed downstream from a Host. RPi HUB Module also provides a dual channel USB UART/245FIFO/SPI/I²C/JTAG/GPIO interface converter.

1 Introduction

The FT2232H based RPi HUB Module is a USB to UART/245FIFO/SPI/I²C/JTAG/GPIO interface expansion module targeted at connecting to Raspberry-Pi computer to expand the number of interfaces. However, it is not limited to this application. It can also be used as a hub device or an FT2232H evaluation module. The module has a USB 2.0 Hi-Speed hub chip which supports up to three external downstream USB ports: 2 via a dual USB connector and 1 via the DIL connector pins. Additionally, by utilising the FT2232H USB Hi-Speed dual-port bridge chip which handles all the USB signalling and protocols, the module can easily support up to two flexible interfacing ports. It is ideal for development purposes to quickly prove functionality of adding USB to a target design.

This module utilises the GL850G USB 2.0 hub controller which provides a low-cost and widely used USB 2.0 hub solution, to provide up to 4 downstream USB ports. The GL850G is a single chip USB hub solution. The GL850G is a full function solution which supports both Individual/Gang power management modes and two-colour (green/amber) status LED.

The FT2232H used on the Module is FTDI's 5th generation of USB devices. The FT2232H is a USB 2.0 Hi-Speed (480Mb/s) to UART/MPSSE IC. The device features two interfaces that can be configured for asynchronous or synchronous serial communications or Parallel FIFO Interface. The two interfaces can also be independently configured via an MPSSE engine. This allows the FT2232H to operate as two UART/Bit-Bang ports or two MPSSE engines which can be used to emulate JTAG, SPI, I²C, Bit-bang or other synchronous serial modes. All I/Os of the RPi HUB Module operate at 3.3V TTL and are 5V safe.

FT2232H's MPSSE interfaces are controlled over USB, for details on MPSSE see: Application Note [AN_108](#).

For more details on FT2232H see: FT2232H datasheet [DS_FT2232H](#).

1.1 Ordering Information

Product Name	Order Code	Description
RPi HUB Module	RPi-HUB-Module	USB HUB and USB to dual channel multi interface converter module designed for Raspberry Pi.

Table 1.1 – Ordering Information



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2 Product Details

2.1 Features

The RPi HUB Module has the following features:

General:

- USB 2.0 Hi-Speed compatible
- One standard USB type A plug to connect to the Host
- USB Hi-Speed FT2232H device for USB-Serial/Bit bang communications. Entire USB protocol handled by USB module
- USB 2.0 Hi-Speed hub controller integrated to support up to 3 downstream USB ports
- External power input connector available to supply external downstream USB ports.
- Support for USB suspend and resume
- Defaults to two independent UART interfaces.
- All I/O pins are 5V Safe
- UART data transfer rates from 300 baud to 12 Mbaud at 3.3V TTL levels
- Synchronous Serial (MPSSE) data rates of up to 30Mbps on JTAG, SPI and I²C
- One dual-port USB type A connector and 0.1" pitch header to support up to 3 downstream USB ports
- Green/Red status LED for downstream USB port 1 & 2.
- LED indicating power supply to external downstream USB ports
- On-board EEPROM 93LC56 for FT2232H configuration
- UHCI / OHCI / EHCI host controller compatible

2.2 Driver Support

Royalty-Free VIRTUAL COM PORT (VCP) DRIVERS for:

- Windows 7 32,64-bit
- Windows Vista
- Windows XP 32,64-bit
- Windows XP Embedded
- Windows CE.NET 4.2 , 5.0 and 6.0
- MAC OS OS-X
- Linux 2.6.32 or later
- ARM Linux
- Android

Royalty-Free D2XX Direct Drivers (USB Drivers + DLL S/W Interface):

- Windows 7 32,64-bit
- Windows Vista
- Windows XP 32,64-bit
- Windows XP Embedded
- Windows CE.NET 4.2, 5.0 and 6.0
- MAC OS OS-X
- Linux 2.6.32 or later
- ARM Linux
- Android

The drivers listed above are all available to download for free from www.ftdichip.com. Various 3rd Party Drivers are also available for various other operating systems - visit www.ftdichip.com for details.

For driver installation instructions please see:

<http://www.ftdichip.com/Support/Documents/InstallGuides.htm>.

2.3 Functions Overview

A block diagram of RPi HUB Module is illustrated in Figure 1.2.

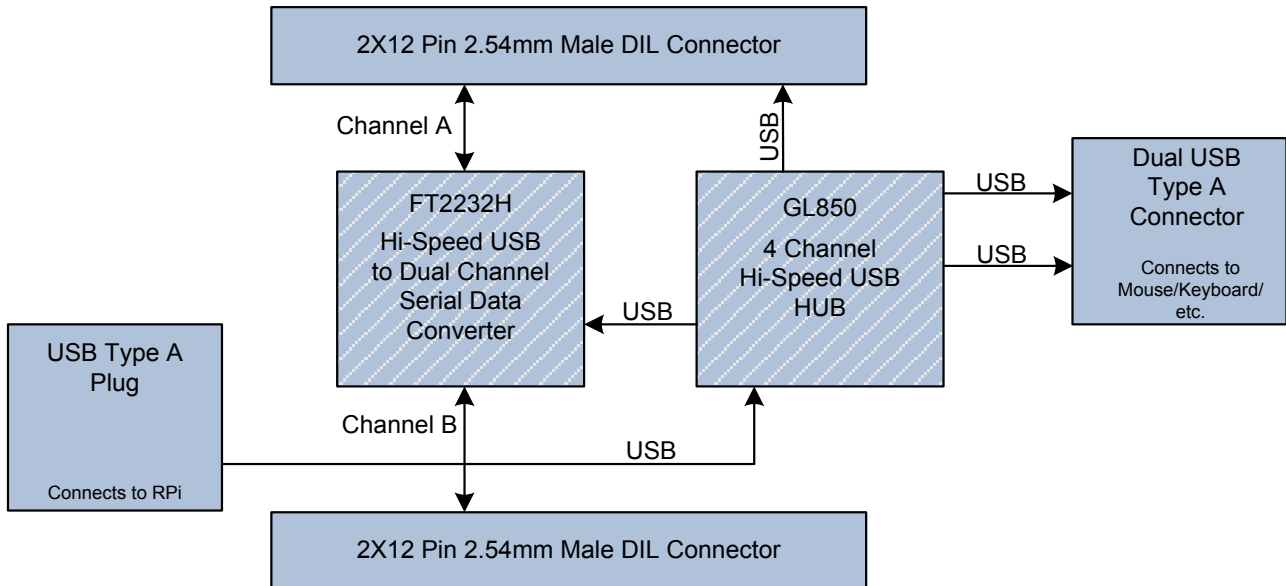


Figure 1.2 – Block diagram of RPi HUB Module

The block diagram Figure 1.2 illustrates: the RPi HUB Module routes the signals from the GL850G and FT2232H devices to two 2X12-pin, 0.1", headers and a dual-port USB type A connector. This allows easy connection to most PCB header sockets and ribbon cables.

To use the FT2232H connected to a RPi. The RPi operating system by default includes the necessary virtual com port (VCP) drivers to access both ports of the FT2232H through the TTY.

FTDI D2XX drivers, which allow access to the FT2232H through a DLL, are available for free by clicking [here](http://www.ftdichip.com/Drivers/D2XX.htm). For more information on FTDI drivers see: <http://www.ftdichip.com/Drivers/D2XX.htm>.

The main target application for the RPi HUB Module is that it can be attached to a Raspberry-Pi computer as an expansion module. The RPi HUB Module expands the interfaces of Raspberry-Pi computer with up to 3 USB ports or 2 serial ports. More information is available on the Raspberry-Pi computer at <http://www.Raspberry-Pi.org/>

3 Pin Out and Signal Description

3.1 Module Connector Descriptions

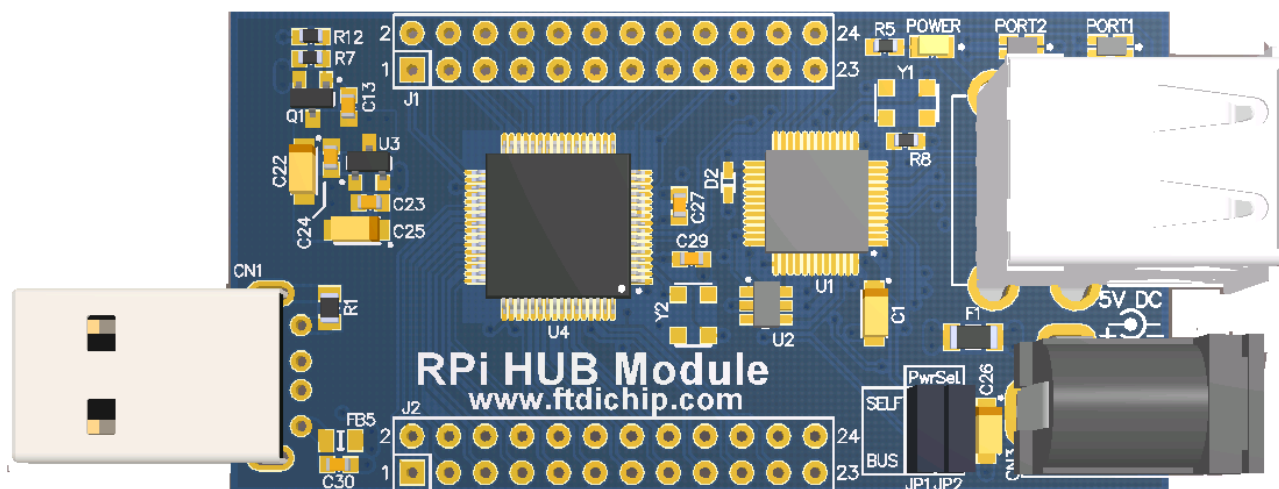


Figure 3.1 – RPi HUB Module Connector Description (Top View)

RPi HUB Module has 4 connectors on the board. The detailed descriptions of these connectors are listed in Table 3.1.

Reference Designator	Description
CN1	USB type A signal connector to connect to the host port
CN2	Dual-port USB type A connector to connect 2 downstream USB devices
CN3	+5V power input from external PSU to power the module.
J1	0.1" 2X12-pin header
J2	0.1" 2X12-pin header

Table 3.1 – RPi HUB Module Connector Descriptions

A detailed description of each pin out is given in the next section.

3.2 FT2232H Pin and Signal Descriptions

A list of functions available for every signal pin of the FT2232H is given in Figure 3.1.

FT2232H										
Pin		Pin functions depend on EEPROM configuration								
Pin #	Pin Name	UART	245 FIFO SYNC	245 FIFO	ASYNC Bit-bang	SYNC Bit-bang	MPSSE	Fast Serial interface	CPU Style FIFO	Host Bus Emulation
Channel A										
16	ADBUS0	TXD	D0	D0	D0	D0	TCK/SK	USES CHANNEL B	D0	AD0
17	ADBUS1	RXD	D1	D1	D1	D1	TDI/DO		D1	AD1
18	ADBUS2	RTS#	D2	D2	D2	D2	TDO/DI		D2	AD2
19	ADBUS3	CTS#	D3	D3	D3	D3	TMS/CS		D3	AD3
21	ADBUS4	DTR#	D4	D4	D4	D4	GPIOL0		D4	AD4
22	ADBUS5	DSR#	D5	D5	D5	D5	GPIOL1		D5	AD5
23	ADBUS6	DCD#	D6	D6	D6	D6	GPIOL2		D6	AD6
24	ADBUS7	RI#	D7	D7	D7	D7	GPIOL3		D7	AD7
26	ACBUS0	TXDEN	RXF#	RXF#	**	**	GPIOH0		CS#	A8
27	ACBUS1	**	TXE#	TXE#	WRSTB#	WRSTB#	GPIOH1		A0	A9
28	ACBUS2	**	RD#	RD#	RDSTB#	RDSTB#	GPIOH2		RD#	A10
29	ACBUS3	RXLED#	WR#	WR#	**	**	GPIOH3		WR#	A11
30	ACBUS4	TXLED#	SIWUA	SIWUA	SIWUA	SIWUA	GPIOH4		SIWUA	A12
32	ACBUS5	**	CLKOUT	**	**	**	GPIOH5		**	A13
33	ACBUS6	**	OE#	**	**	**	GPIOH6		**	A14
34	ACBUS7	**	**	**	**	**	GPIOH7		**	A15
Channel B										
38	BDBUS0	TXD		D0	D0	D0	TCK/SK	FSDI	D0	CS#
39	BDBUS1	RXD		D1	D1	D1	TDI/DO	FSCLK	D1	ALE
40	BDBUS2	RTS#		D2	D2	D2	TDO/DI	FSDO	D2	RD#
41	BDBUS3	CTS#		D3	D3	D3	TMS/CS	FSCTS	D3	WR#
43	BDBUS4	DTR#		D4	D4	D4	GPIOL0		D4	IORDY
44	BDBUS5	DSR#		D5	D5	D5	GPIOL1		D5	CLKOUT
45	BDBUS6	DCD#		D6	D6	D6	GPIOL2		D6	I/O0
46	BDBUS7	RI#		D7	D7	D7	GPIOL3		D7	I/O1
48	BCBUS0	TXDEN		RXF#	**	**	GPIOH0		CS#	**
52	BCBUS1	**		TXE#	WRSTB#	WRSTB#	GPIOH1		A0	**
53	BCBUS2	**		RD#	RDSTB#	RDSTB#	GPIOH2		RD#	**
54	BCBUS3	RXLED#		WR#	**	**	GPIOH3		WR#	**
55	BCBUS4	TXLED#		SIWUB	SIWUB	SIWUB	GPIOH4	SIWUB	SIWUB	**
57	BCBUS5	**		**	**	**	GPIOH5		**	**
58	BCBUS6	**		**	**	**	GPIOH6		**	**
59	BCBUS7	PWRSVAV #	PWRSVAV #	PWRSVAV#	PWRSVAV#	PWRSVAV#	GPIOH7	PWRSVAV#	PWRSVAV#	PWRSVAV#
60	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#	PWREN#
36	SUSPEND#	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND #	SUSPEND#
Configuration memory interface										
63	EECS									
62	EECLK									
61	EEDATA									

Table 3.2 – FT2232H Functions Table

3.3 Module Pin and Signal Descriptions

The pin descriptions of J1 and J2 are given in Table 3.2 and Table 3.3.

Connector Pin	Name	Description
J1-1	AC7	FT2232H ACBUS7 pin
J1-2	AC6	FT2232H ACBUS6 pin
J1-3	AC5	FT2232H ACBUS5 pin
J1-4	AC4	FT2232H ACBUS4 pin
J1-5	AC3	FT2232H ACBUS3 pin
J1-6	AC2	FT2232H ACBUS2 pin
J1-7	AC1	FT2232H ACBUS1 pin
J1-8	AC0	FT2232H ACBUS0 pin
J1-9	AD7	FT2232H ADBUS7 pin
J1-10	AD6	FT2232H ADBUS6 pin
J1-11	AD5	FT2232H ADBUS5 pin
J1-12	AD4	FT2232H ADBUS4 pin
J1-13	AD3	FT2232H ADBUS3 pin
J1-14	AD2	FT2232H ADBUS5 pin
J1-15	AD1	FT2232H ADBUS1 pin
J1-16	AD0	FT2232H ADBUS0 pin
J1-17	SUSPEND#	FT2232H SUSPEND# pin
J1-18	GND	Ground
J1-19	PWRN#	FT2232H PWREN# pin
J1-20	RESET#	FT2232H RESET# pin
J1-21	PAMBER4	USB hub downstream port 4 Overcurrent LED indicator signal pin
J1-22	PGREEN4	USB hub downstream port 4 LED Traffic indicator signal pin
J1-23	DP4	USB hub downstream port 4 D+ signal pin
J1-24	DM4	USB hub downstream port 4 D- signal pin

Table 3.2 – RPi HUB Module Connection – J1

Connector Pin	Name	Description
J2-1	BD0	FT2232H BDBUS0 pin
J2-2	BD1	FT2232H BDBUS1 pin
J2-3	BD2	FT2232H BDBUS2 pin
J2-4	BD3	FT2232H BDBUS3 pin
J2-5	BD4	FT2232H BDBUS4 pin
J2-6	BD5	FT2232H BDBUS5 pin
J2-7	BD6	FT2232H BDBUS6 pin
J2-8	BD7	FT2232H BDBUS7 pin
J2-9	BC0	FT2232H BCBUS0 pin
J2-10	BC1	FT2232H BCBUS1 pin
J2-11	BC2	FT2232H BCBUS2 pin
J2-12	BC3	FT2232H BCBUS3 pin
J2-13	BC4	FT2232H BCBUS4 pin
J2-14	BC5	FT2232H BCBUS5 pin
J2-15	BC6	FT2232H BCBUS6 pin
J2-16	BC7	FT2232H BCBUS7 pin
J2-17	DATA	FT2232H EEDATA pin
J2-18	GND	Ground
J2-19	CLK	FT2232H EECLK pin
J2-20	VCCSW	Switchable power sourced from VBUS
J2-21	CS	FT2232H EECS pin
J2-22	VCC3V3	3.3VDC generated from VCC (output)
J2-23	VBUS	USB +5V VBUS power pin (output) from upstream USB port
J2-24	VCC5V	+5v power pin.

Table 3.3 – RPi HUB Module Connection – J2

In most cases, the FT2232H pin is connected directly to the associated pin on J1 or J2.

There are also several LEDs available on the FT2232H Hub-I/O to indicate the status of power and USB hub port. Detailed functions of LEDs are described in Table 3.4.

LED Reference Designator	Colour	Function Description
POWER	Yellow	Power active to downstream USB ports indicator
PORT1	Red	Overcurrent status of downstream USB port 1 indicator
PORT1	Green	Enumeration status of downstream USB port 1 indicator
PORT2	Green	Enumeration status of downstream USB port 2 indicator
PORT2	Red	Overcurrent status of downstream USB port 2 indicator

Figure 3.4 – Functions of status LEDs on the module

4 Guide to Supplying Power

When RPi HUB Module is connected to Raspberry Pi board it must be powered from external +5V power supply. The Raspberry Pi board can be powered by connecting P1-02 header to J2-24 on RPi HUB Module. To date, the Raspberry Pi uses a 140mA fuse on the power line to the USB connector; this fuse will not allow an adequate amount of current to power the RPi HUB Module from this USB connector.

USB Bus powered configuration may be used with other host devices, such as PCs or laptops. To enable external power supply feature, switch the jumper JP1 and JP2 to SELF position, pins 2 & 3 shorted for both jumpers. The maximum total current consumed by the external USB devices on downstream port 1 and 2 is 1A. If the total current exceeds 1A, the fuse on the RPi HUB Module will disconnect the power to the USB downstream ports. If this occurs then LEDs PORT1 and PORT2 on the module will illuminate red to indicate over-current status.

When powered from USB bus power, the estimated current consumed by the circuits on the module is between 100-300mA depending on the application. User should ensure that the host can supply this current via USB potation.

5 Mechanical Details

The mechanical details of the RPi HUB Module are shown in Figure 5.1:

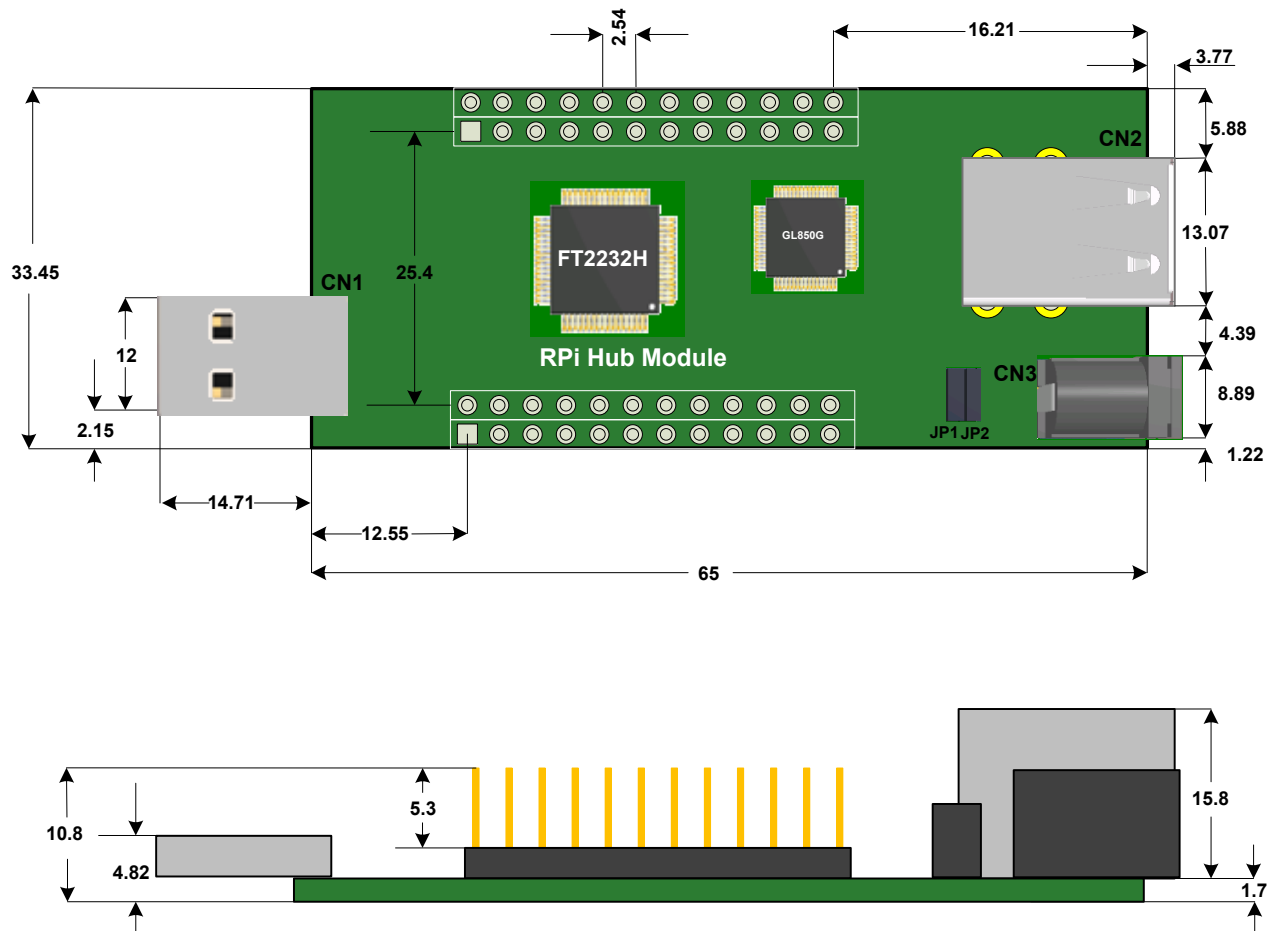


Figure 5.1 – RPi HUB Module Dimensions diagram

All dimensions are in millimetres.

The headers J1 and J2 are mounted to the top of the PCB and the overall height is 10.8mm, with a body which exposes 5.3mm of the pins. The pins are 0.025 inch square.

6 Schematic Diagram

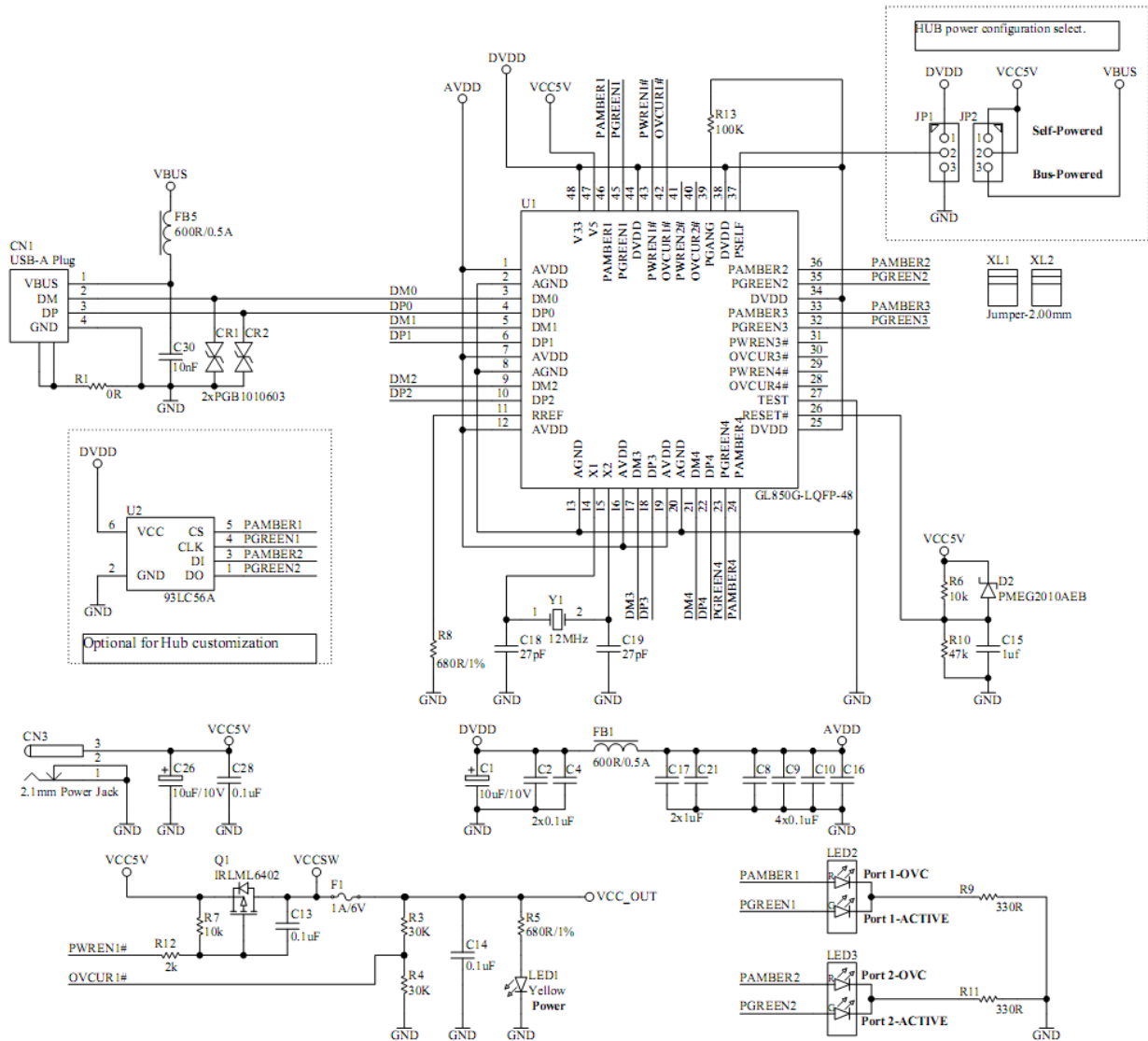


Figure 6.1 – RPi HUB Module Schematic Part 1 of 2

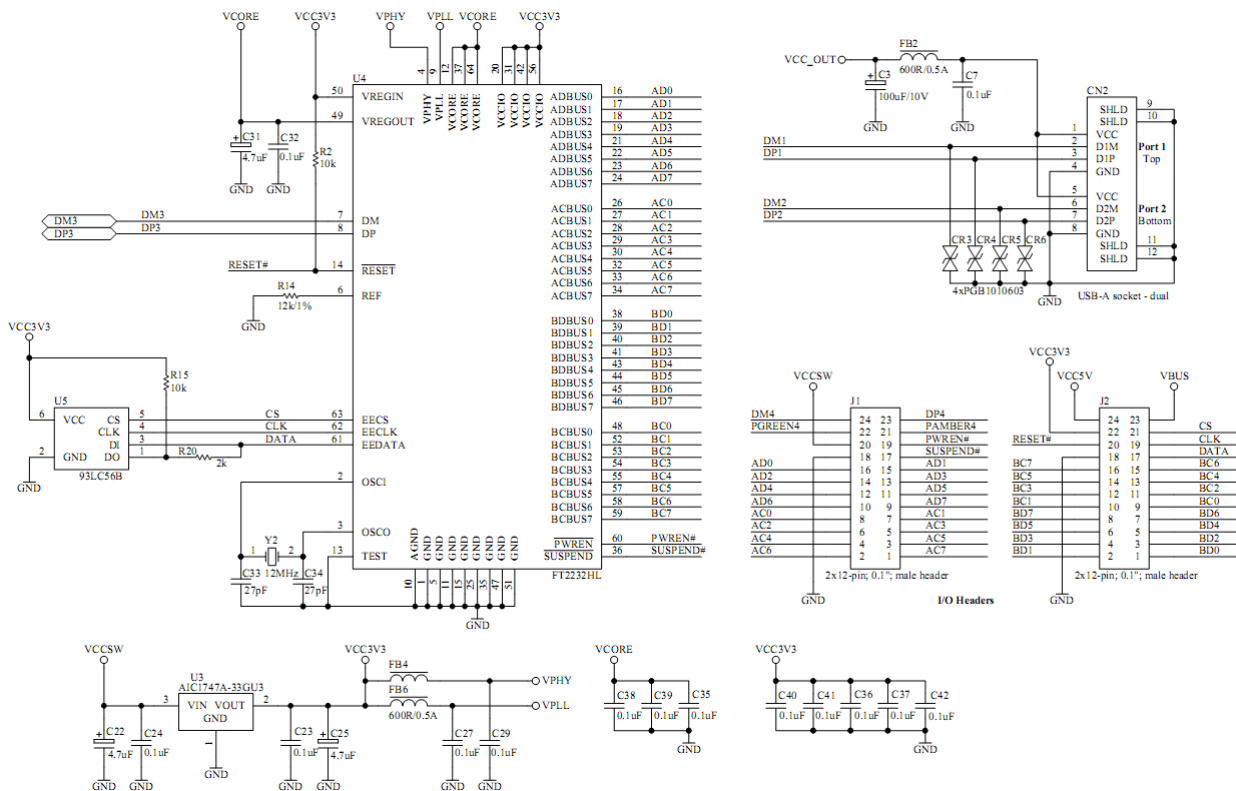


Figure 6.2 – RPi HUB Module Schematic Part 2 of 2

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Appendix A – FT2232H EEPROM Configuration

The RPi HUB Module utilizes an EEPROM which contains the USB configuration descriptors for the FT2232H. When the RPi HUB Module is plugged into a PC or a USB reset is performed, the PC will read these descriptors. The default values stored into the EEPROM are defined in Table 7.1.

Parameter	Value	Notes
USB Vendor ID (VID)	0403h	FTDI default VID (hex)
USB Product ID (PID)	6010h	FTDI default PID (hex)
Serial Number Enabled?	Yes	
Serial Number	See Note	A unique serial number is generated and programmed into the EEPROM during device final test.
Pull down I/O Pins in USB Suspend	Disabled	Enabling this option will make the device pull down on the UART interface lines when the power is shut off (PWREN# is high).
Manufacturer Name	FTDI	
Product Description	FT2232H RPi HUB Module	
Max Bus Power Current	90mA	
Power Source	Bus Powered	
Device Type	FT2232	
USB Version	0200	Returns USB 2.0 device description to the host.
Remote Wake Up	Enabled	Taking RI# low will wake up the USB host controller from suspend.
High Current I/Os	Enabled	Enables the high drive level on the I/O pins
Load VCP Driver	Enabled	Makes the device load the VCP driver interface for the device.

Table 7.1 – Default Internal EEPROM Configuration

The EEPROM for FT2232H chip on the RPi HUB Module can be re-programmed over USB using the utility program FT_Prog. FT_Prog can be downloaded from <http://www.ftdichip.com/Support/Utilities.htm>. Users who do not have their own USB Vendor ID but who would like to use a unique Product ID in their design can apply to FTDI for a free block of unique PIDs. Contact FTDI support for this service.

Appendix B – References

[FT2232H Datasheet](#)

[Application and Technical Notes](#)

Appendix C – List of Figures and Tables

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Appendix D – Revision History

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