

UM10011_4

ISP1521 Hi-Speed USB Hub Demo Board

Rev. 04.00 — 17 June 2004

User manual

Document information

<i>Info</i>	<i>Content</i>
<i>Keywords</i>	ISP1521, hub controller, USB, universal serial bus
<i>Abstract</i>	This document describes the ISP1521 hub demo board. It also contains the related schematics, the PCB layout, and the Bill of Material.



Revision history

<i>Rev</i>	<i>Date</i>	<i>Description</i>
4.0	June 2004	Updated the schematics.
3.0	Apr 2004	Updated the following: <ul style="list-style-type: none">• Section 2• Section 5.7• Removed Section 5.8 on hybrid power• Section 6.
1.1	Mar 2003	Updated Section 5.7 and Section 6. Corrected I ² C to I ² C-Bus
1.0	Nov. 2002	First release.

Contact information

For additional information, please visit: <http://www.semiconductors.philips.com/>

For sales office addresses, please send an email to: sales.addresses@www.semiconductors.philips.com



This is a legal agreement between you (either an individual or an entity) and Philips Semiconductors. By accepting this product, you indicate your agreement to the disclaimer specified as follows:

DISCLAIMER

PRODUCT IS DEEMED ACCEPTED BY RECIPIENT. THE PRODUCT IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, PHILIPS SEMICONDUCTORS FURTHER DISCLAIMS ALL WARRANTIES, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANT ABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT. THE ENTIRE RISK ARISING OUT OF THE USE OR PERFORMANCE OF THE PRODUCT AND DOCUMENTATION REMAINS WITH THE RECIPIENT. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL PHILIPS SEMICONDUCTORS OR ITS SUPPLIERS BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, DIRECT, INDIRECT, SPECIAL, PUNITIVE, OR OTHER DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR OTHER PECUNIARY LOSS) ARISING OUT OF THIS AGREEMENT OR THE USE OF OR INABILITY TO USE THE PRODUCT, EVEN IF PHILIPS SEMICONDUCTORS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.



Contents

1. INTRODUCTION	5
2. ISP1521 HUB DEMO BOARD FEATURES	5
3. SYSTEM REQUIREMENTS	6
4. POWER SUPPLY ADAPTER REQUIREMENTS	6
5. HUB DEMO BOARD DESCRIPTION	6
5.1. ISP1521 80-Pin LQFP Package	6
5.2. Port Indicators	7
5.3. Power LED Indicator	7
5.4. GoodLink Indicator	7
5.5. Port Power Switch Transistors	8
5.6. Overcurrent Circuit Detection	8
5.7. Power Supply	8
5.8. I ² C-Bus Interface	10
5.9. Other Jumpers	11
5.9.1. J13 (NOOC)	11
5.9.2. J14 (SUSPEND)	11
6. SCHEMATICS	11
7. INSTALLING THE BOARD	19
8. BILL OF MATERIALS FOR THE ISP1521 HUB DEMO BOARD	20
9. REFERENCES	20

GoodLink and I²C-Bus are trademarks of Koninklijke Philips Electronics N.V. Microsoft is a registered trademark of Microsoft Corp. The names of actual companies and products mentioned herein may be the trademarks of their respective owners. All other names, products, and trademarks are the property of their respective owners.

1. Introduction

The ISP1521 is a Hi-Speed Universal Serial Bus (USB) hub IC, with seven downstream facing ports. The ISP1521 Hub Demo Board is designed to demonstrate the features and functionality of the ISP1521.

This document describes the ISP1521 Hub Demo Board. It also contains the related schematics, the PCB layout, and the Bill of Material (BoM).

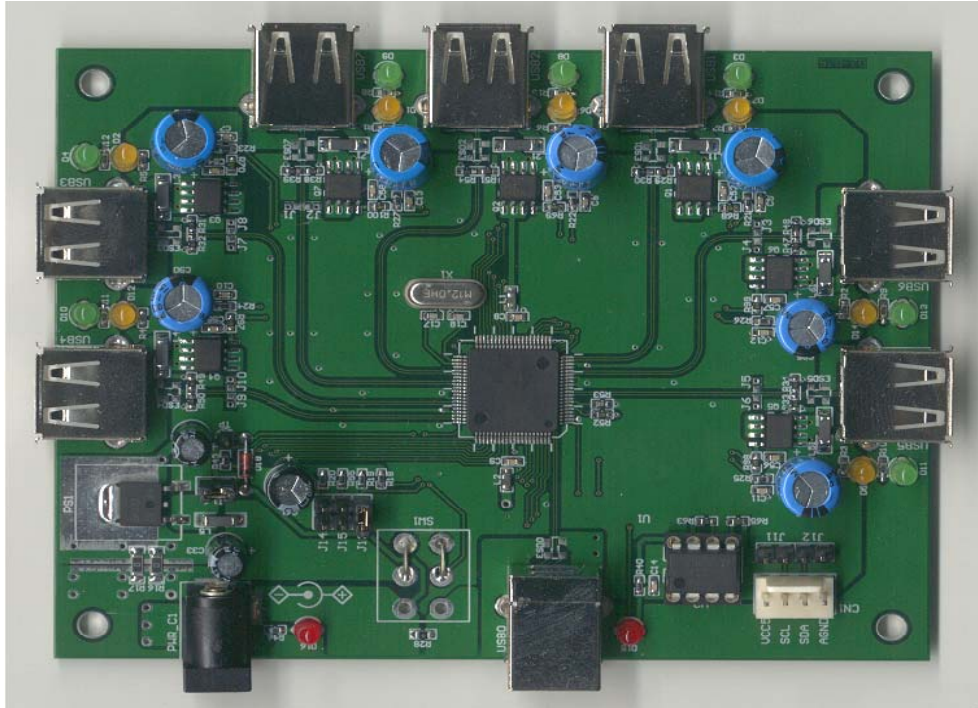


Figure 1-1: ISP1521 Hub Demo Board

2. ISP1521 Hub Demo Board Features

- Complies with *Universal Serial Bus Specification Rev. 2.0*
- Supports self-powered operation
- Configurable number of downstream facing ports (from two to seven)
- Customizable Vendor ID, Product ID and Serial Number (by using an external EEPROM or an external microcontroller)
- Individual power switching and individual overcurrent protection
- USB traffic indication (GoodLink™ LED) on the upstream facing port
- Port status indicators.

3. System Requirements

This hub can be attached to a computer that has a USB or Hi-Speed USB host installed, and running any of these operating systems:

- Windows® 98
- Windows Me
- Windows 2000
- Windows XP
- MacOS®.

If the hub is plugged into a USB host controller, it will work only as a full-speed hub.

4. Power Supply Adapter Requirements

Regulated Output: 5.1 V_{cc} ± 5%, 4 A.

Warning: The power plug polarity is (-) at the core and (+) at the outer shield.

5. Hub Demo Board Description

5.1. ISP1521 80-Pin LQFP Package

The ISP1521 has these port configurations:

- One Hi-Speed USB and USB capable upstream facing port (USB0), and
- Seven Hi-Speed USB and USB capable downstream facing ports (USB1, USB2, USB3, USB4, USB5, USB6, USB7).

The port numbers are marked near the USB connectors on the silkscreen. The downstream facing ports USB3, USB4, USB5, USB6 and USB7 can be disabled. Disabling a port will also disable all higher-number ports. For example, disabling port USB4 will disable ports USB5, USB6 and USB7 as well. Therefore, apart from port USB7, it is not possible to selectively disable a port (For example, only USB5.). By design, ports USB1 and USB2 cannot be disabled.

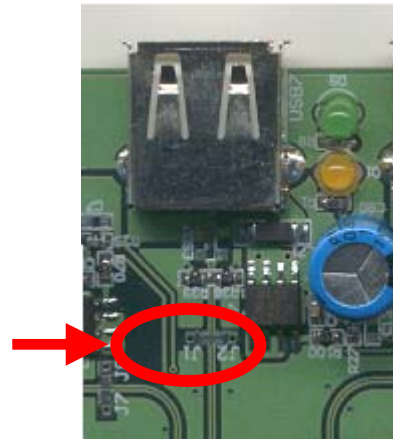
Table 5-1: Jumper Settings vs. Port Activation

J2, J1	J4, J3	J6, J5	J10, J9	J8, J7	Active Ports
OFF, OFF	OFF, OFF	OFF, OFF	OFF, OFF	OFF, OFF	USB1 to USB7*
ON, ON	OFF, OFF	OFF, OFF	OFF, OFF	OFF, OFF	USB1 to USB6
OFF, OFF	ON, ON	OFF, OFF	OFF, OFF	OFF, OFF	USB1 to USB5
OFF, OFF	OFF, OFF	ON, ON	OFF, OFF	OFF, OFF	USB1 to USB4
OFF, OFF	OFF, OFF	OFF, OFF	ON, ON	OFF, OFF	USB1 to USB3
OFF, OFF	OFF, OFF	OFF, OFF	OFF, OFF	ON, ON	USB1 to USB2

*—Default settings.

These jumpers are set to "**ON**" by placing a solder joint on the provided footprints.

J1 and J2 solder joints to disable a port



5.2. Port Indicators

The D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13 and D14 are port indicators.

Conforming to the *Universal Serial Bus Specification Rev. 2.0*, each downstream facing port has two port indicators—green and amber—placed to its right.

If the green LED is ON, it means the device connected to the port was successfully enumerated and is functional.

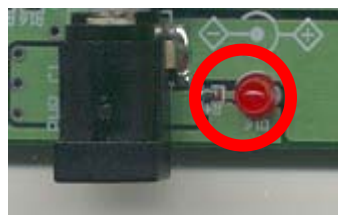
If the amber LED is ON, it means there is an overcurrent condition.

Custom software applications or drivers may flash these LEDs to attract user attention.



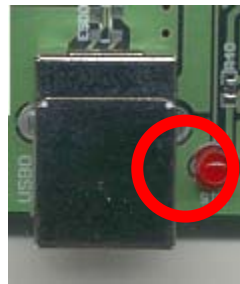
5.3. Power LED Indicator

When power is supplied to the board, LED D16 lights up (red).



5.4. GoodLink Indicator

A Philips GoodLink™ LED D15 (red) is located near the upstream facing port. This LED blinks on every successful USB transactions.



5.5. Port Power Switch Transistors

The hub switches on or off the bus power to each downstream facing port through a low ohmic PMOS transistor.

5.6. Overcurrent Circuit Detection

The integrated analog overcurrent detection circuit of the ISP1521 senses the voltage drop across the power switch. When the port draws too much current, the voltage drop across the power switch exceeds the trip voltage threshold. The overcurrent circuit detects this and automatically switches off the power switch. More information on choosing the switch and trimming the overcurrent detection voltage can be found in the *ISP1521 Hi-Speed Universal Serial Bus hub controller* data sheet.

5.7. Power Supply

To power up the hub, plug the power supply into the power supply socket (PWR_C1). Jumper J15 will set the powering mode in the hub's descriptors as self-powered hub; see Table 5-2.

Table 5-2: Setting the Power Mode Using J15

J15	Power Mode	Logic State
OFF	Self*	1 (HIGH)

*—Default settings.



J15

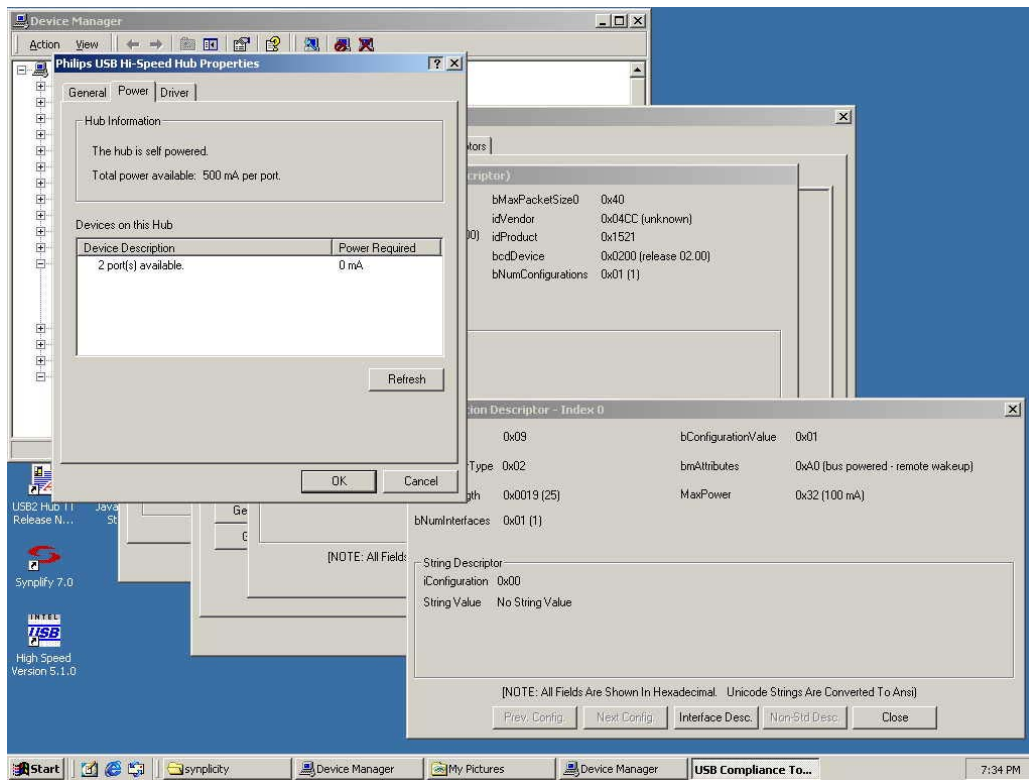


Figure 5-1: Windows Reporting of the Bus-Powered Mode

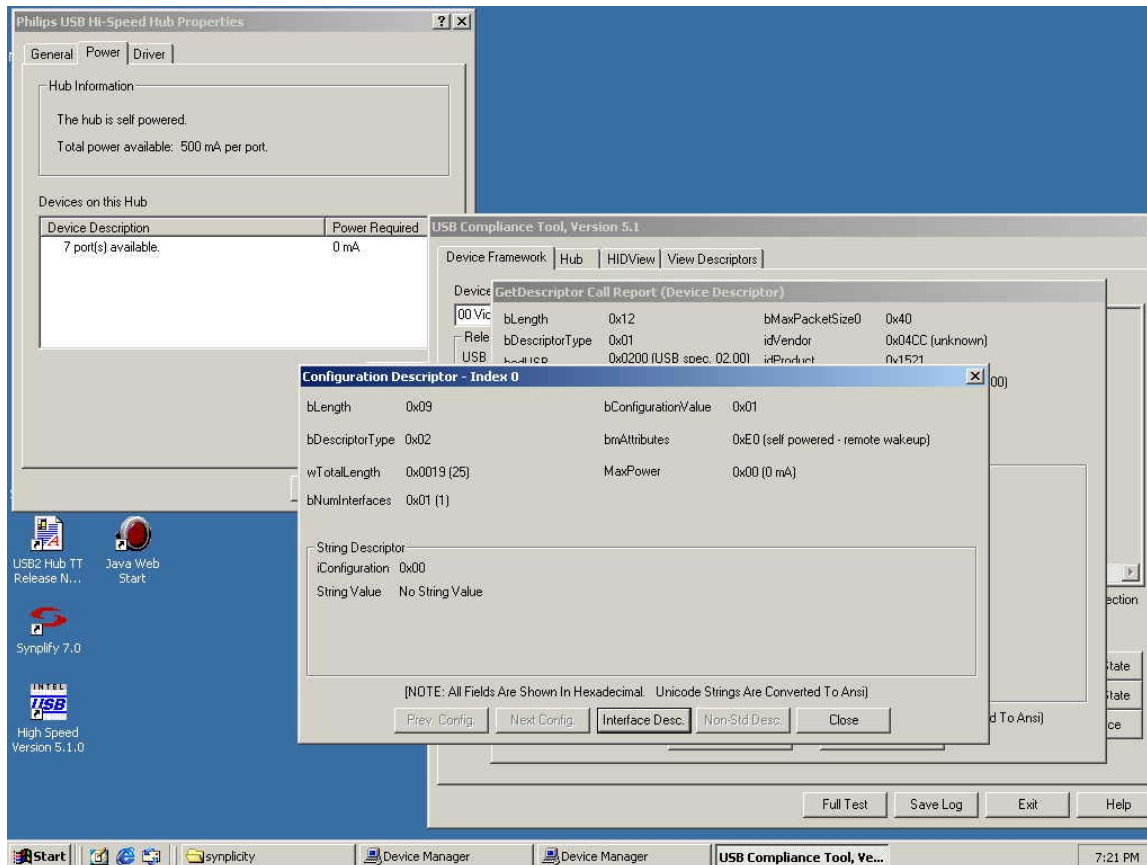


Figure 5-2: Windows Reporting of the Self-Powered Mode

5.8. I²C-Bus Interface

The ISP1521 can use either its USB descriptors from the internal ROM, or from an external I²C-Bus™ EEPROM or microcontroller. Mode selection is done through jumpers J11 and J12 (see Table 5-3).

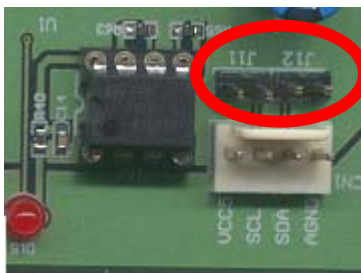
Table 5-3: Mode Selection Using J11 and J12

J11	J12	Mode	SCL	SDA
ON	ON	Internal ROM	LOW	LOW
OFF	OFF	I ² C-Bus EEPROM*	HIGH	HIGH

*—Default settings.

An external I²C-Bus controller acting as a master can also be used to update hub descriptors through the CN1 connector.

Note: The I²C-Bus external EEPROM cannot be programmed on-board.



5.9. Other Jumpers

5.9.1. J13 (NOOC)

This jumper will set the OC capabilities in the hub's descriptors (see Table 5-4).

Table 5-4: Overcurrent Support Selection Using J11 and J12

J13	NOOC	Logic State
OFF	No overcurrent support	1 (HIGH)
ON	Overcurrent support*	0 (LOW)

*—Default settings.

Note: this jumper is for setting the hub's descriptor only. To inhibit the overcurrent detection, the OC pins must be tied to V_{cc} (5 V)

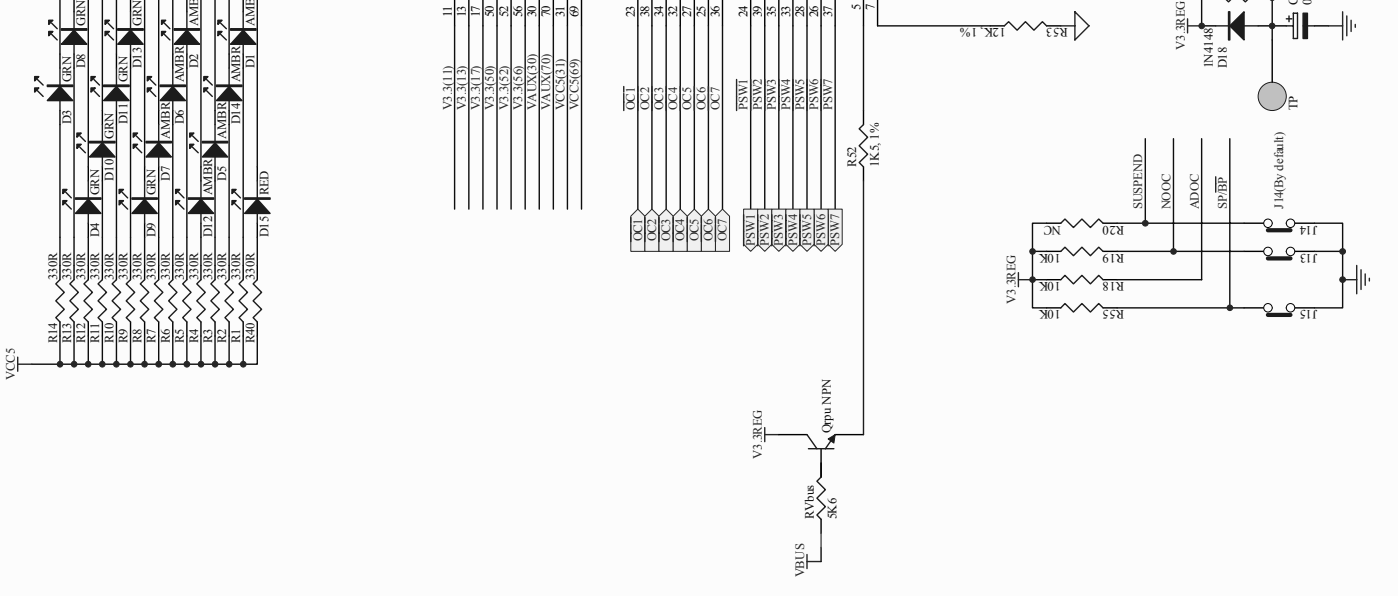
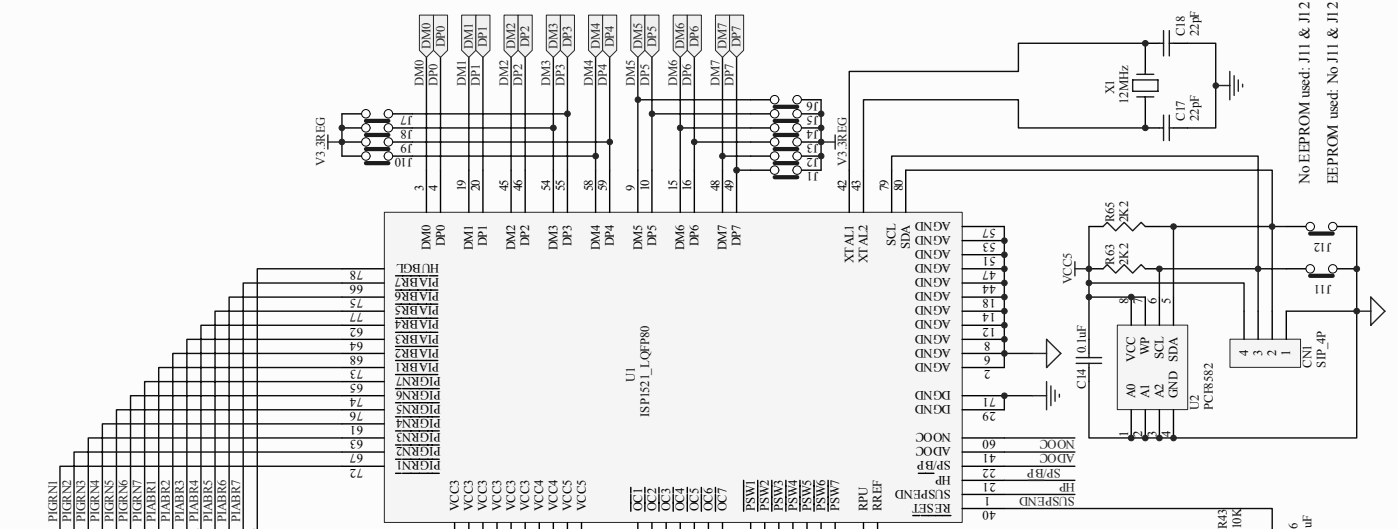
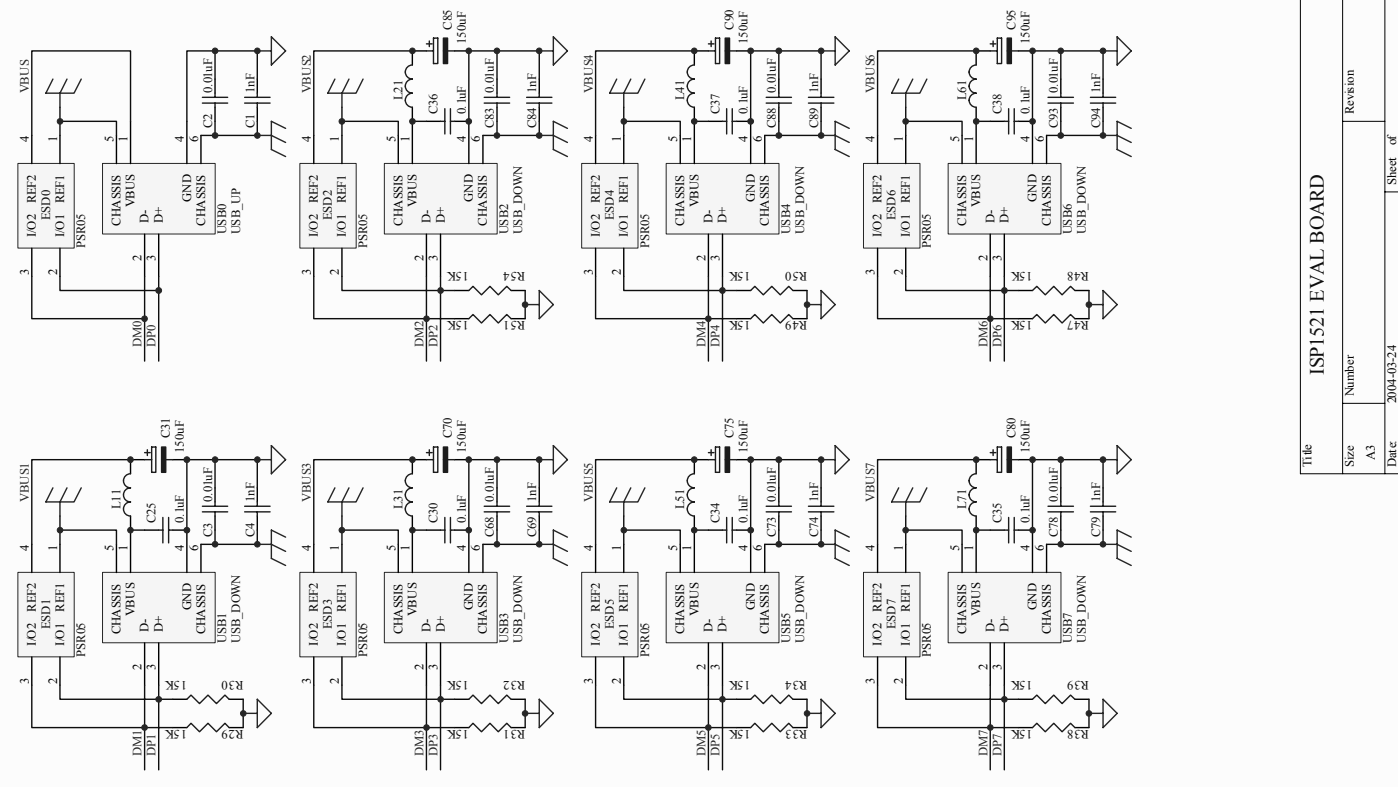
5.9.2. J14 (SUSPEND)

This jumper is provided for debugging purposes. Logic 1 on the SUSPEND signal indicates that the hub is in the suspend mode. In the default setting jumper J14 is used (pulled down to GND).

Table 5-5: J14 Mode Setting

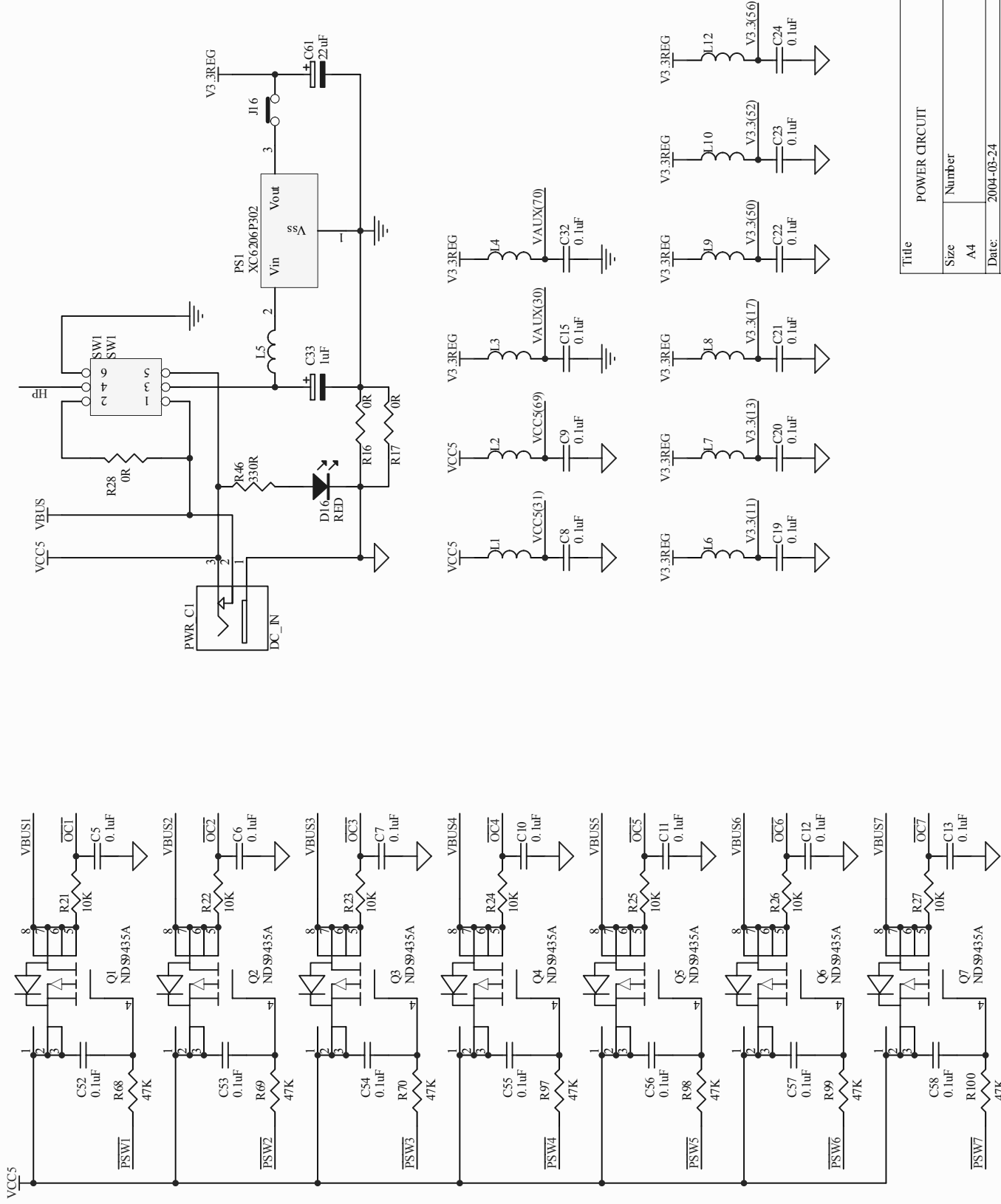
J14	Mode
OFF	Debugging purpose
ON	Normal mode (default)

6. Schematics

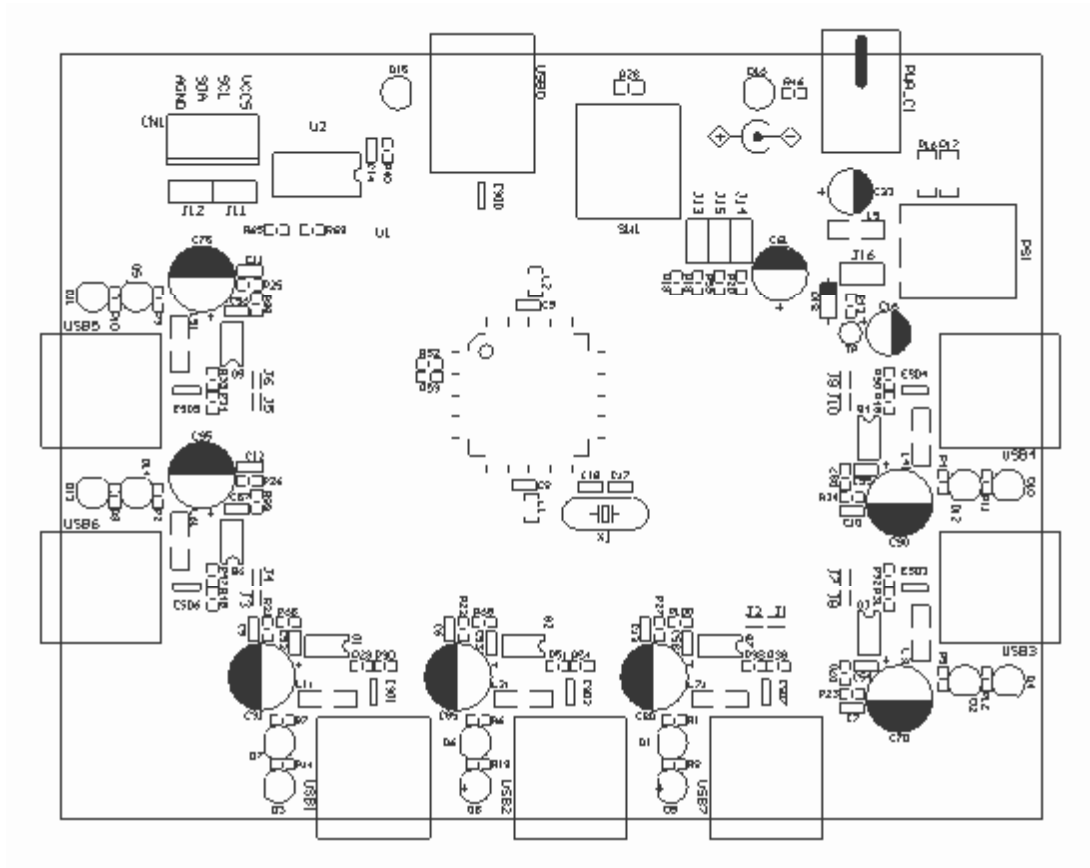


Title		Revision	
Size	Number		
A3			
Date	Sheet of		
2014-05-24	1		
File	C:\My Notebook Raw\... \ISP1521_Update\Sharon By.		

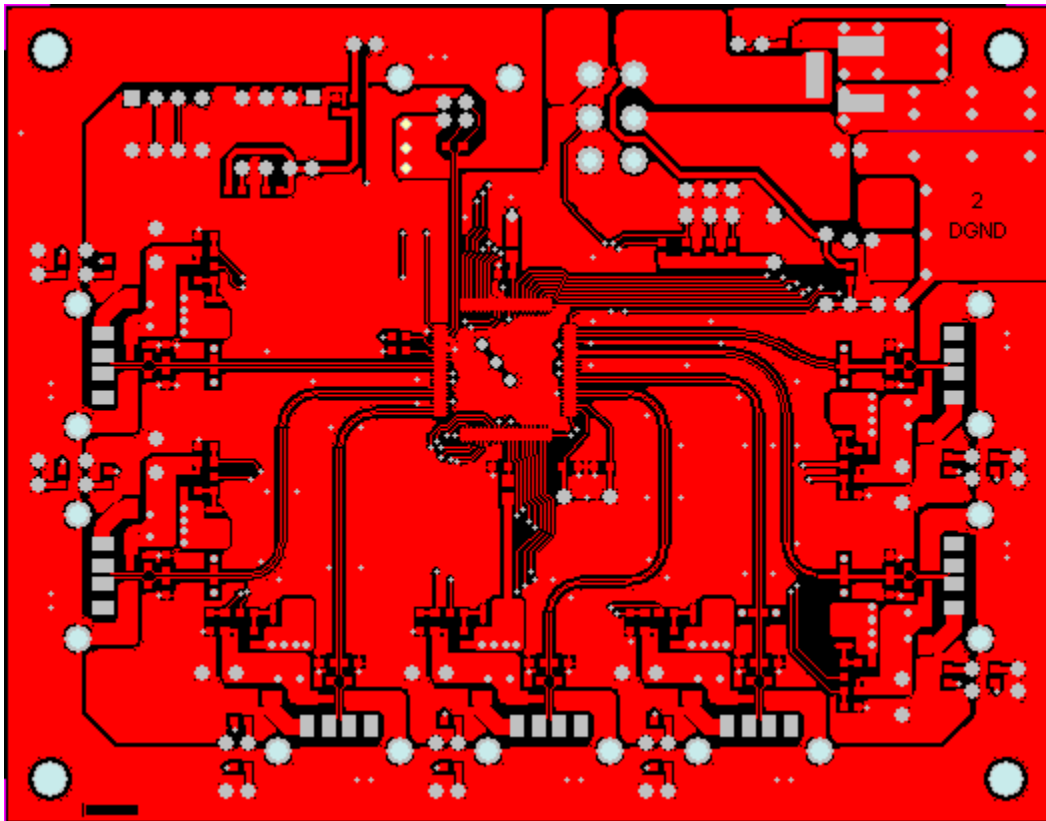
No EEPROM used: J11 & J12
EEPROM used: No J11 & J12



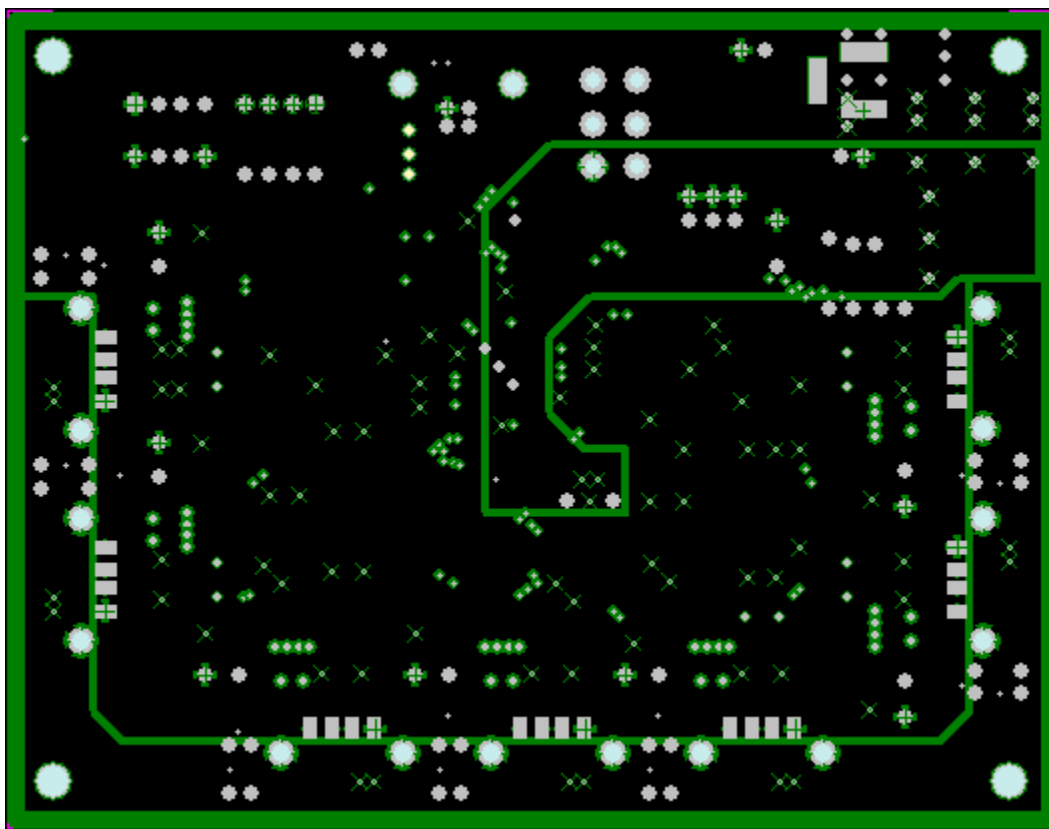
Title		Revision	
Size	A4	Number	
Date:	2004-03-24	Sheet	of
File:	C:\My NoteBook Raw\1.521update\PWR_C00\pwr.sch		



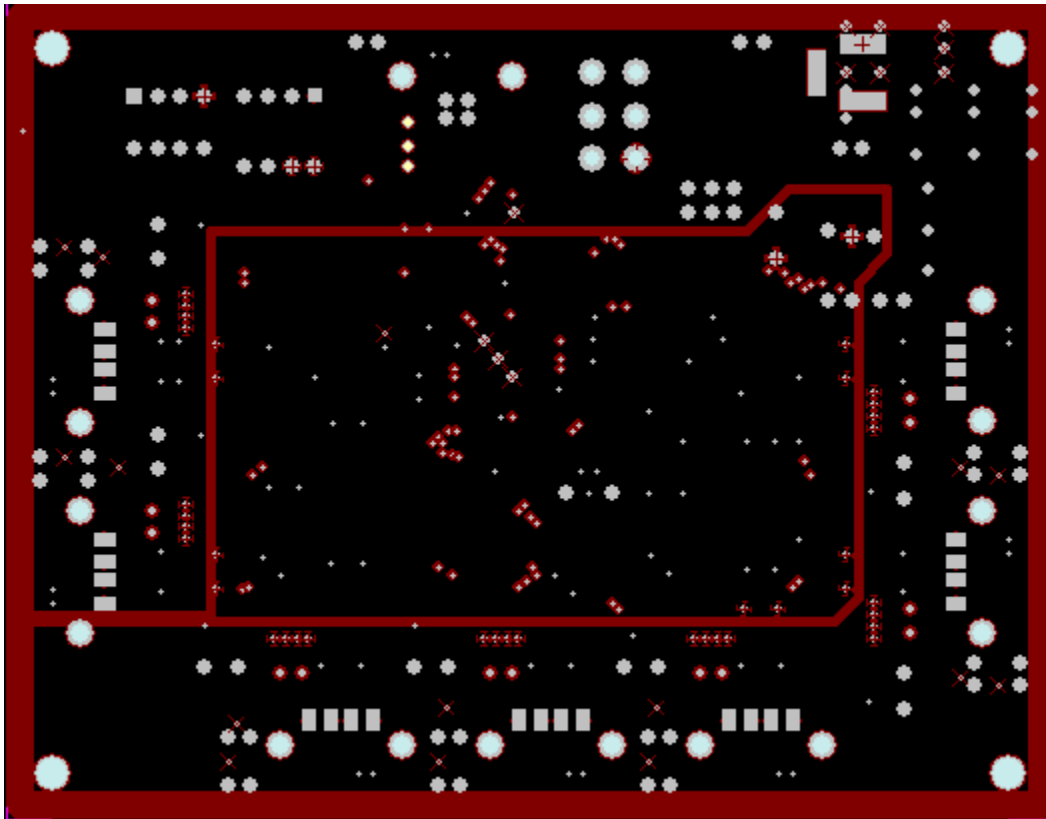
Component Placement



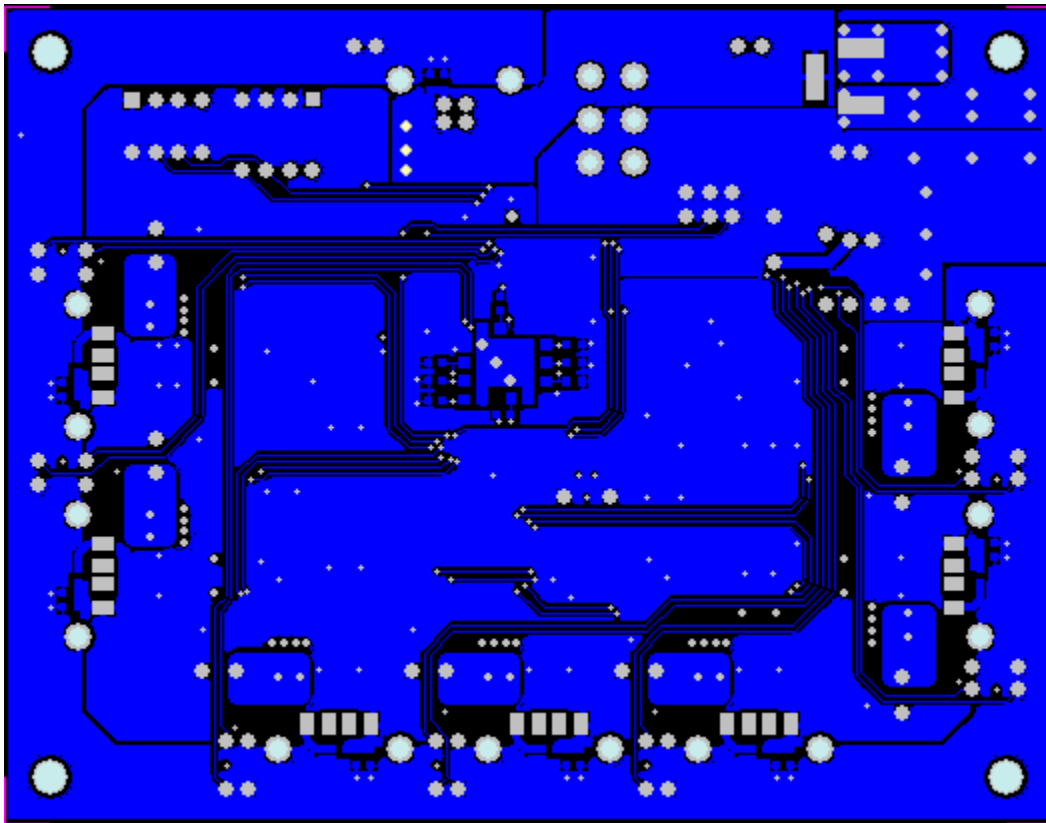
Layer 1: Top Routing



Layer 2: Ground Planes



Layer3: Power Planes



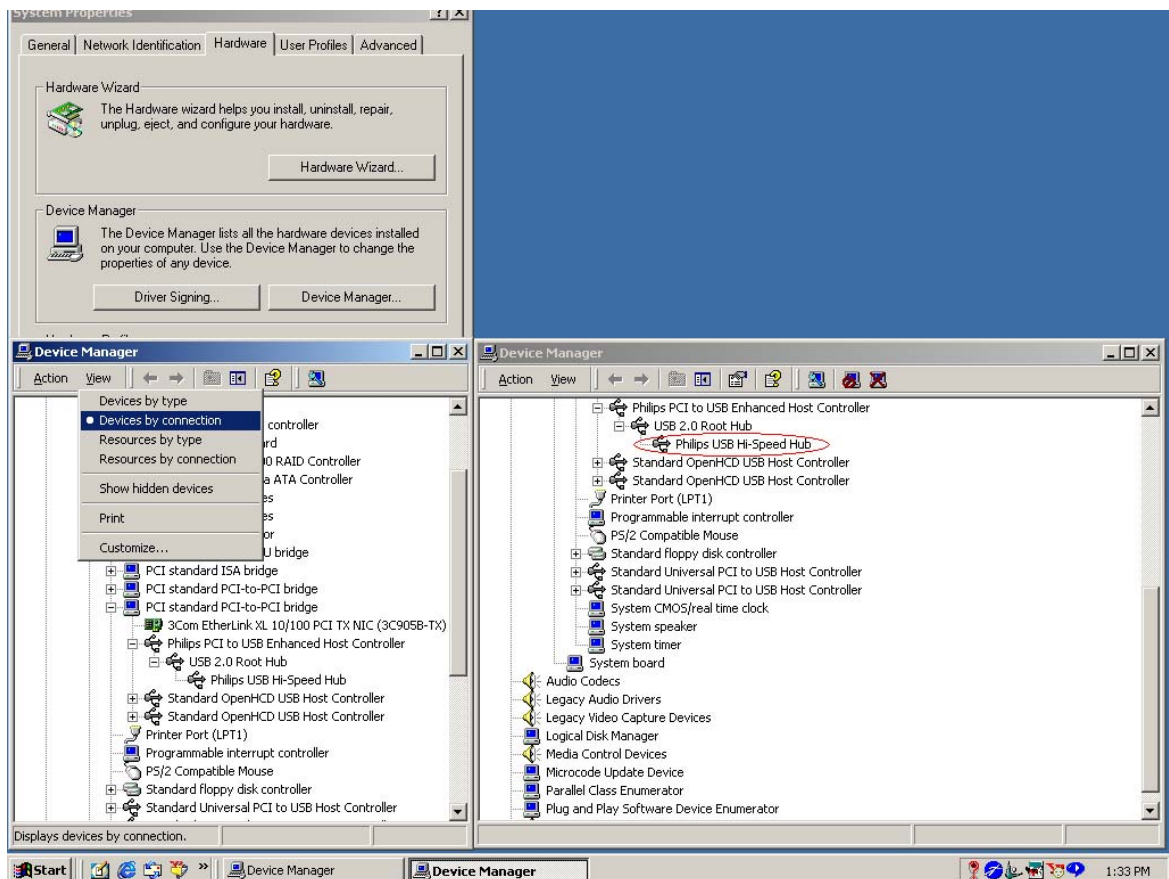
Layer 4: Bottom Routing

7. Installing the Board

Assuming that you have already installed the USB host adapter (including drivers) on a computer running Windows, installing the hub is fairly simple.

1. Plug in power from the power supply to the hub. The power supply must meet the requirements specified in Section 4.
2. Plug a USB cable in the USB0 port, and connect the other end of the cable to the USB host. After a while the GoodLink LED (D15) will start to blink. This means that the enumeration process has successfully completed and the hub is now ready for use.

You can check the driver installation in the Device Manager window. To check whether the hub is correctly installed in high-speed, choose the **View-Devices by connection** command in the Device Manager window.



3. Plug in devices to the downstream facing ports. After these devices are properly enumerated, the green LEDs will turn ON.

8. Bill of Materials for the ISP1521 Hub Demo Board

Part Type	Footprint	Quantity	Designator
0.01 F	0603C	8	C2, C3, C68, C73, C78, C83, C88, C93
0.1 F	0603C	32	C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C19, C20, C21, C22, C23, C24, C25, C30, C32, C34, C35, C36, C37, C38, C52, C53, C54, C55, C56, C57, C58
0 Ω	0603R	1	R55
0 Ω	0805GR	1	R28
0 Ω	1206G	2	R16, R17
100 F/10 V	REC2-25	1	C61
10 k Ω	0603R	11	R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R43, R44
10 F/10 V	REC1-2	1	C33
10 F	REC1-2	1	C16
12 k Ω , 1%	0603R	1	R53
12 MHz, low profile	XTAL7	1	X1
150 F/10 V	REC15-3	7	C31, C70, C75, C80, C85, C90, C95
15 k Ω	0603R	14	R29, R30, R31, R32, R33, R34, R38, R39, R47, R48, R49, R50, R51, R54
1.5 k Ω , 1%	0603R	1	R52
1N4148	DIODE0.3	1	D18
1 nF	0603C	8	C1, C4, C69, C74, C79, C84, C89, C94
22 pF	0603C	2	C17, C18
2.2 k Ω	0603R	2	R63, R65
330 Ω	0603R	16	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R40, R46
47 k Ω	0603R	7	R68, R69, R70, R97, R98, R99, R100
AMBER	LED3	7	D1, D2, D5, D6, D7, D12, D14
BLM21AG221SN1	0805G	10	L1, L2, L3, L4, L6, L7, L8, L9, L10, L12
BLM41P600S	1206CUST	8	L5, L11, L21, L31, L41, L51, L61, L71
DC_IN	DC-JACK2	1	PWR_C1
GREEN	LED3	7	D3, D4, D8, D9, D10, D11, D13
ISP1521	LQFP80-0.5	1	U1
JUMPER	0603	4	J1, J10, J2, J3, J4, J5, J6, J7, J8, J9
JUMPER	RAD0.1	6	J11, J12, J13, J14, J15, J16
BA033-3.3	TO-263/D2PAK	1	PS1
USB_UP	USB-TYPEB	1	USB0
NDS9435A	SO-8	7	Q1, Q2, Q3, Q4, Q5, Q6, Q7
PCF8582	DIP8	1	U2
PSR05	SOT-143	8	ESD0, ESD1, ESD2, ESD3, ESD4, ESD5, ESD6, ESD7
RED	LED3	2	D15, D16
SIP_4P	PS24254-4	1	CN1
SW1	TOGGSW2	1	SW1
Test Point	TP	1	TP1
USB_DOWN	USB-TYPEA	7	USB1, USB2, USB3, USB4, USB5, USB6, USB7

9. References

- *Universal Serial Bus Specification Rev. 2.0* (<http://www.usb.org/>)
- *ISP1521 Hi-Speed Universal Serial Bus hub controller* data sheet.