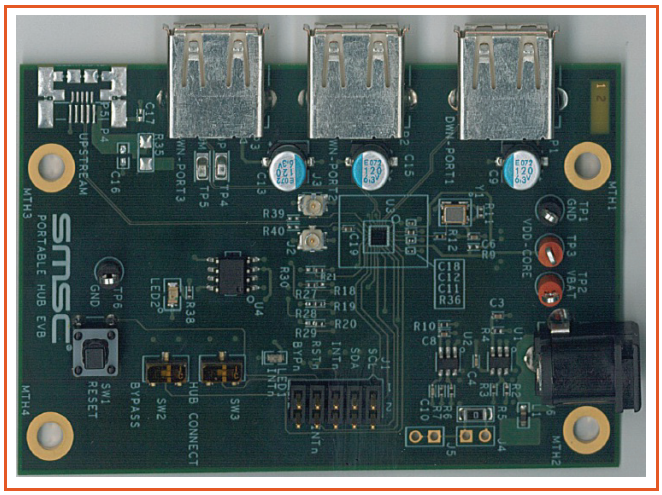
USB3503 Evaluation Board User Manual



USER MANUAL

1 Introduction

This user manual is for the USB3503 Evaluation board. This board can be used to test and evaluate the functionality of the USB3503 and is ideal for early system integration and software development. The USB3503 EVB provides access to the HSIC upstream and USB downstream ports, as well as the I^2C communication pins.

SMSC also has evaluation software that can be used with the USB3503 EVB connected to a Total Phase Aardvark adaptor. This software allows the user to configure the USB3503 in different ways before enumeration as well as monitor and manipulate select status registers during enumeration. The software can be used to prototype microprocessor software, evaluate the different configurations, and test how the desired configuration fits into the entire system.

2 Operation

2.1 Contents of the Kit

The USB3503 EVB includes the basic equipment necessary to evaluate the USB3503. The items included in the kit are:

1. USB3503 EVB
2. 5V DC Power Supply
3. Documentation and Software CD

The kit does **not** include any downstream USB devices, I^2C master hardware, or other components for board customization.

2.2 Initial Bring Up

The USB3503 EVB has a default configuration that allows it to operate as a stand alone hub. To begin, connect the U.FL connectors to the HSIC host. Then, plug the evaluation board into the 5V power supply. The USB3503 EVB will enumerate as a Generic USB Hub, with the VID and PID equal to the default values found in the USB3503 Datasheet.

The default configuration of the USB3503 is to enumerate as a Self Powered Hub. This means that, according to the USB 2.0 specification, the downstream ports are only allowed to provide 500mA of current to the downsteam device.

Refer to the next chapters to see the customization options associated with the evaluation kit.

3 Hardware

The USB3503 EVB is a board that demonstrates the capabilities of the USB3503. The board consists of the HSIC upstream and USB downstream ports, a INT_N LED for visual confirmation of the

interrupts configured, a header exposing the I^2C pins, and additional circuitry that is used for I^2C communication.

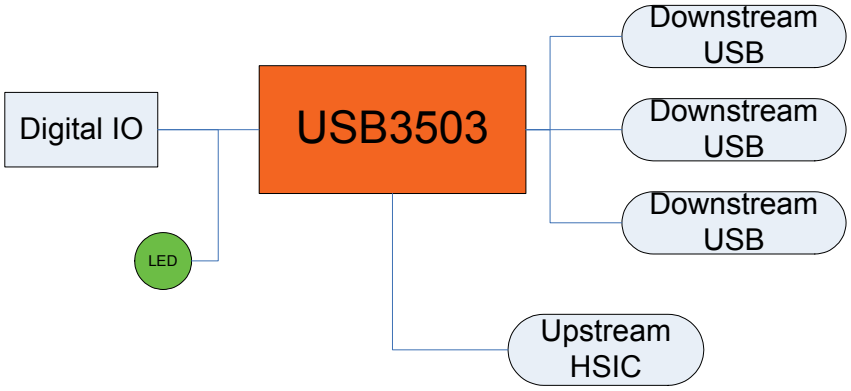


Figure 3.1 Block Diagram of the USB3503 EVB

3.1 HSIC and USB Ports

The downstream USB ports are mounted on the edges of the USB3503 EVB. The downstream ports use the standard USB Type A receptacle. The label for the port is located near the receptacle. The HSIC upstream port uses U.FL connectors for Data and Strobe.

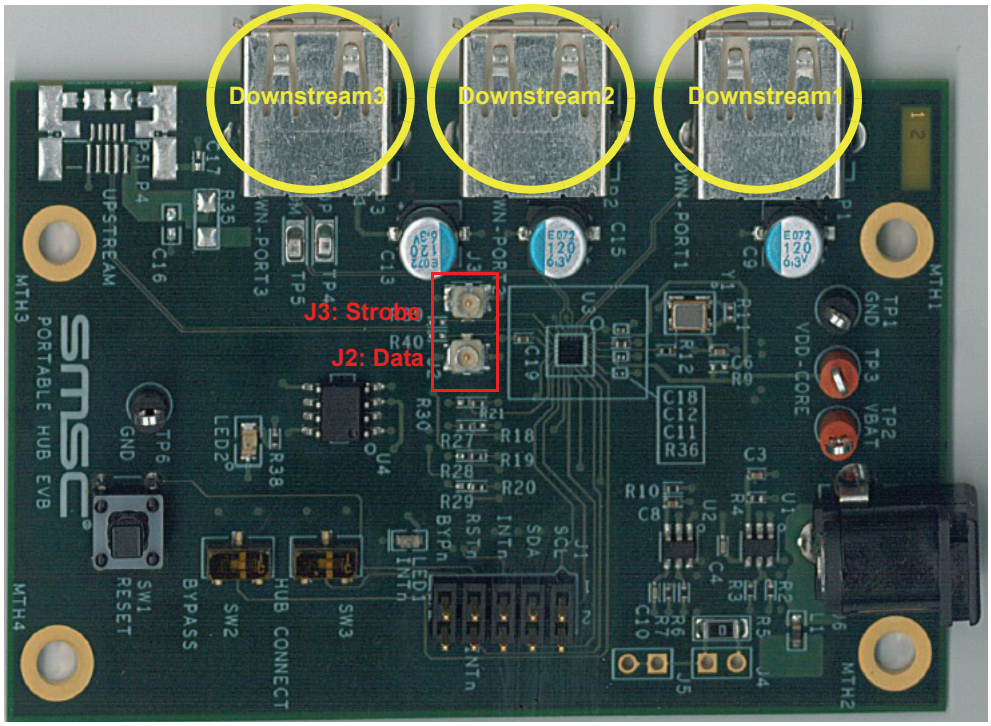


Figure 3.2 Upstream and Downstream Ports

3.2 Test Points, Switches and LEDs

There are multiple test points to confirm that the USB3503 EVB is powered properly. **TP1** and **TP6** connect to GND, **TP2** connects to the VBAT pin, and **TP3** connects to the VDD_CORE_REG pin.

The USB3503 EVB also has three switches to manually control the RESET_N and HUB_CONNECT inputs to the part. Figure 3.3 shows the location of the test points (Red) and switches (Yellow).

The USB3503 SCL, SDA, RESET_N, HUB_CONNECT and INT_B pins are also exposed on the **J1** header. These pins are compatible with the Total Phase Aardvark pinout, where pin 1 of the Aardvark connector connects to pin 1 of header J1 (Refer to Figure 4.1 for the proper way to connect the Aardvark). The INT_N pin is also connected to **LED1** to indicate that an interrupt has occurred. The LED remains lit until the interrupt is cleared, as described in the USB3503 datasheet.

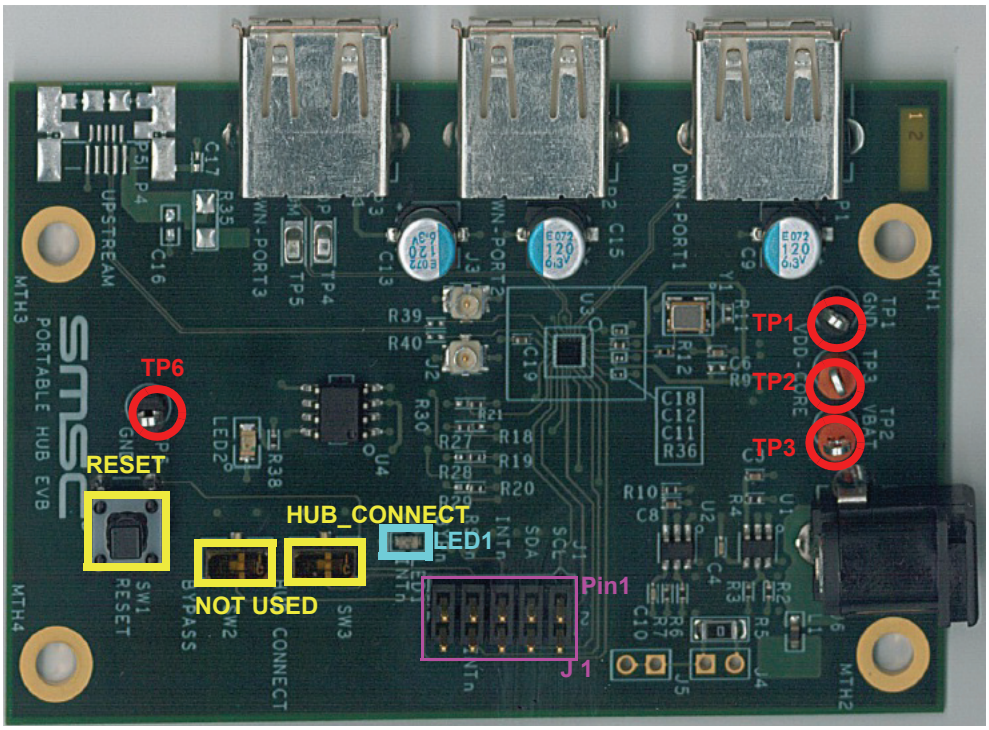


Figure 3.3 Test points, Switches, Header and LED

3.3 Configuration Resistors

There are eight different resistors used to configure the part when the RESET_N pin transitions from Low (0V) to High(>1.25V). These resistors are used for the REF_SEL pins. Because these resistors and pads pull up to the 1.8V regulator, any changes to these resistors will need to be done with the board unpowered. The resistor pads are laid out in a manner that prevents the pull-up resistors from being populated at the same time as the pull-down resistors, as shown in Figure 3.4. The following tables show the proper configuration resistor population requirements for the desired results, the resistor values should match those found in Section 6, "USB3503 EVB Bill of Materials".

Note: The Y1 Oscillator will need to be replaced with the proper frequency if the REF_SEL pins are altered. Refer to Section 6, "USB3503 EVB Bill of Materials" for recommended oscillator specifications.

Table 3.1 REF_SEL Options

R18	R21	R27	R30	REFCLK(MHZ)
EMPTY	EMPTY	INSTALL	INSTALL	38.4
EMPTY	**INSTALL**	**INSTALL**	**EMPTY**	**26.0 (Default)**
INSTALL	EMPTY	EMPTY	INSTALL	19.2
INSTALL	INSTALL	EMPTY	EMPTY	12.0

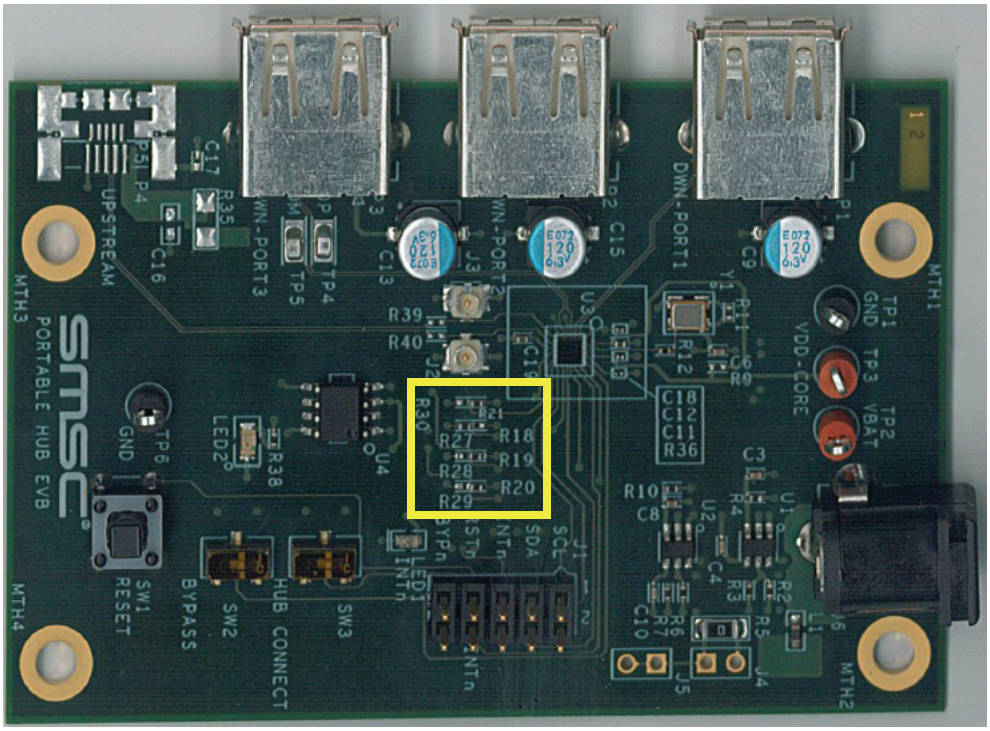


Figure 3.4 Configuration Resistors

3.4 Additional Circuitry

The U1 Regulator provides 3.3V to the VBAT pin, and also supplies power to the 26MHz clock oscillator. If a higher VBAT voltage is desired, remove **R1** and supply the power through **TP2**.

The U2 Regulator provides 1.8V to the VDD_CORE_REG pin as well as providing the pull up voltage for the digital control pins. To provide external power to the VDD_CORE_REG pin remove **R8** and supply the power through **TP3.**

The USB3503 can function with a single power supply; to do this remove **R8** and place a 0Ohm resistor on **R9**. This connects the VDD_CORE_REG pin to the VDD33_BYP pin allowing the USB3503's internal 3.3V regulator to supply the VDD_CORE_REG voltage.

Below is a summary of the different power options and what resistors need to be populated to support these options:

Table 3.2 VBAT and VDD_CORE_REG Source Control

R1	R8	R9	VBAT SOURCE	VDD_CORE_REG SOURCE
INSTALL	INSTALL	EMPTY	Onboard Regulator	Onboard Regulator
EMPTY	INSTALL	EMPTY	External (TP2)	Onboard Regulator
EMPTY	EMPTY	EMPTY	External (TP2)	External (TP3)
INSTALL	EMPTY	INSTALL	Onboard Regulator	VDD33_BYP
EMPTY	EMPTY	INSTALL	External (TP2)	VDD33_BYP

Below are the locations of the resistors on the back side of the board:

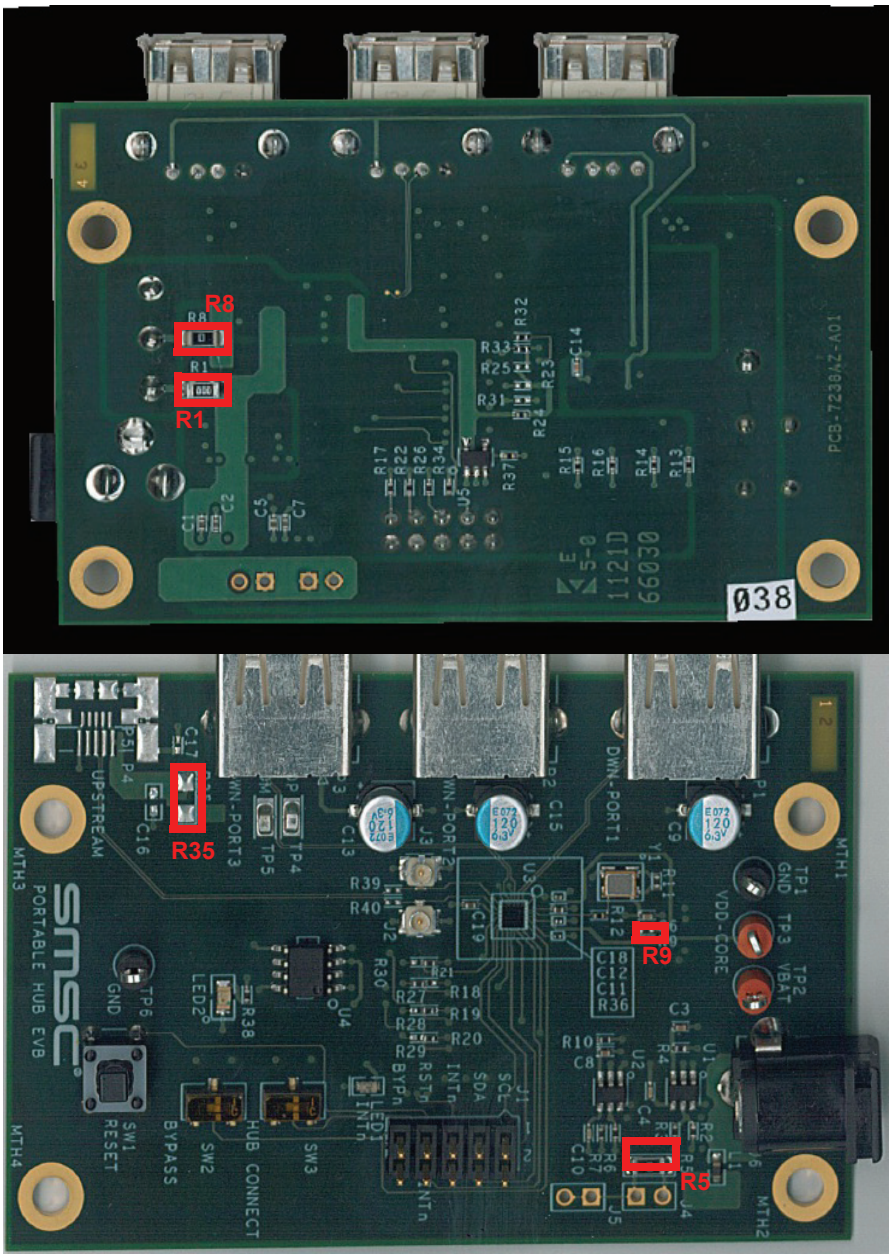


Figure 3.5 Regulator Resistors

4 Software

The USB3503 EVB comes with a CD that contains evaluation software that can be used with the Total Phase Aardvark USB-I^{2}C adaptor (not included with the Evaluation Kit). To install the software, run **Setup.exe**, found on the CD. This will install the USB3503 Evaluation Software, the LabVIEW Run-time engine (to run the executable), and the Total Phase drivers to communicate with the Aardvark. Once the software has been installed, locate and run the **USB3503 Evaluation.exe** program on the computer. Connect the Aardvark to the USB3503 EVB with the red wire facing the power port, as in Figure 4.1.

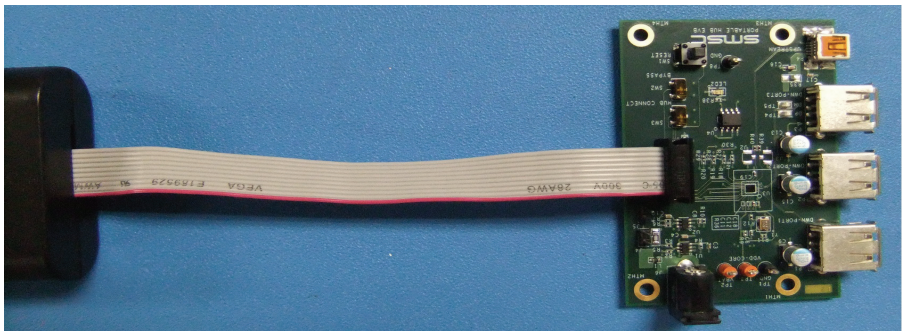


Figure 4.1 Aardvark Connection

The software allows the user to control the digital input pins RESET_N and CONNECT. It also can monitor the INT_N pin for interrupts. There is a section to communicate with the I^2C serial port, as well as some quick configuration and customization options.

Figure 4.2 USB3503 Evaluation Screen

4.1 Digital Control

The RESET_N and HUB_CONNECT pins can be controlled in real time with the **Digital Control** array. Each button in the array corresponds to the pin with the matching name. When the button is orange, the pin is at logic level High. When the button is black the voltage is a logic level Low. Refer to the green box in Figure 4.3 for the digital control array location.

Set the RESET_N pin low to reset the part and place it into the lowest power state. If the CONNECT pin is low when the RESET pin transitions from low to high, the USB3503 will remain in a state that allows the serial interface registers to be manipulated. To enumerate the hub, either write 00h to register E7h, or drive the CONNECT pin high by pressing the CONNECT button in the Digital Control. Once the USB3503 has enumerated, the serial interface registers should not be modified.

Notes: To prevent the Aardvark from driving against another voltage, the Aardvark is running in an Open/Drain mode, therefore it is important that all switches on the board pull the pins up to the Vcc value.

Figure 4.3 Digital Control (Green) and I²C (Yellow) Sections

4.2 I²C Communication

The application also contains a general I²C register read/write section. The **Bit** and **Description** display the serial interface register descriptions found in the USB3503 datasheet. The **Register** display can be used to select the proper serial interface register to manipulate. Click on the **Value** or **Bit** box above to change the value of the register. Once the desired value and register are selected, press the **Write** button to change the value on the part. Click on the **Read** button and the **Value** and **Bit** boxes will update the current value on the part. Refer to the USB3503 datasheet for a detailed description of each register and operation of the device

4.3 Quick Configuration and Customization

The USB3503 Evaluation program also contains some quick configuration and customization options that automatically update the registers to match the desired configuration. The USB3503 can enumerate as a Self Powered or Bus Powered Hub with 1, 2 or 3 downstream ports. The VID, PID, DID and enumeration strings can also be customized to allow the USB3503 to enumerate with whatever identification is desired.

To change these values; update the configuration section to the desired options, then press the **Configure** button. The part will then reset, pull the CONNECT pin low and update the registers as specified. To go with these options either raise the CONNECT pin, or press the **Connect** button.

Figure 4.4 Quick Configuration Options

5 USB3503 EVB Schematic

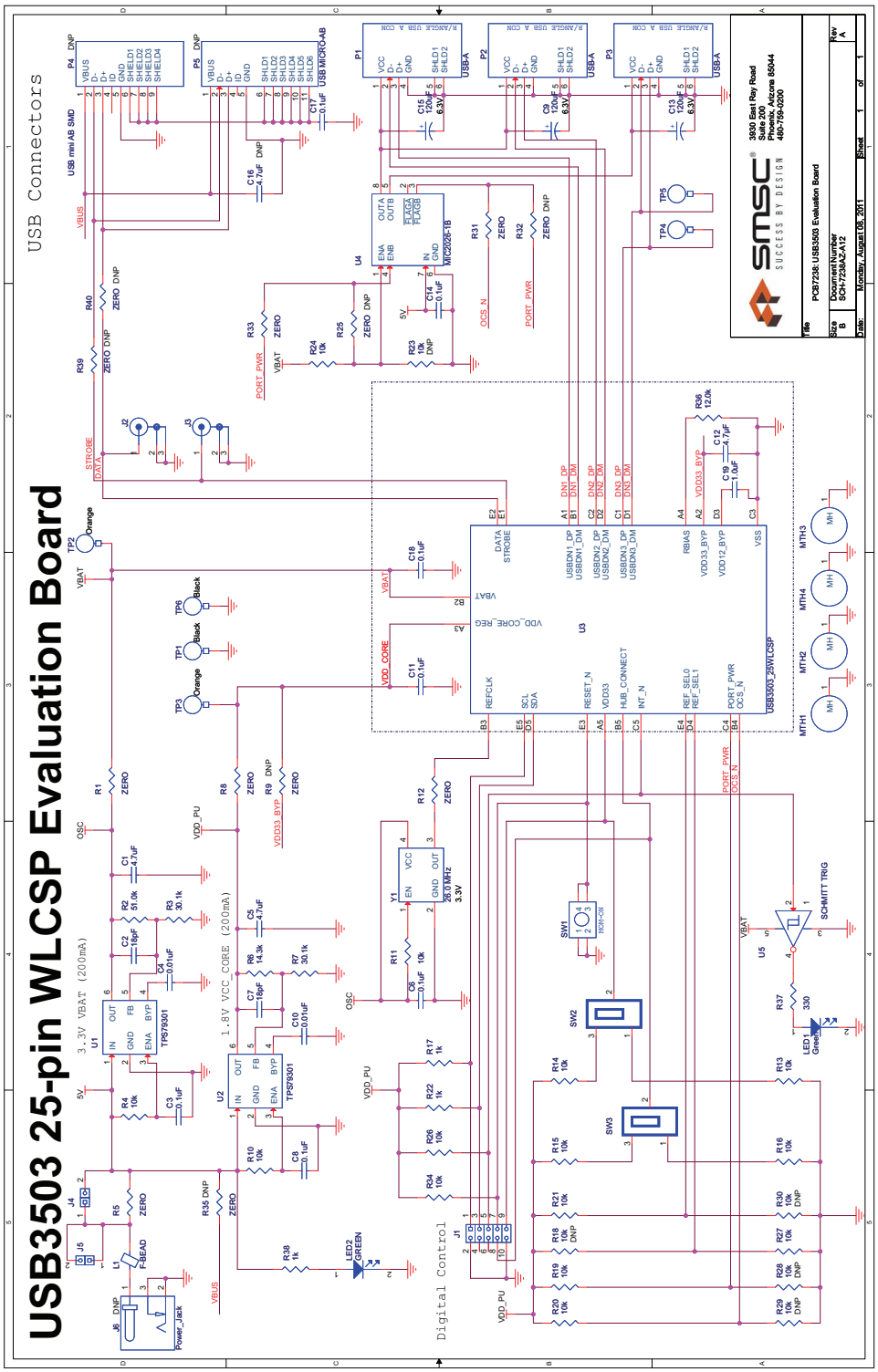


Figure 5.1 USB3503 EVB Schematic

6 USB3503 EVB Bill of Materials

Part ID	Quantity	Part Reference	Description	Digikey_Number	Manuf	Manuf_PN	RoHS	DNP
1	2	C1 C5	CAPACITOR CERAMIC 4.7UF 10V X5R 0603	587-1441-1-ND	TAIYO YUDEN	LMK107BJ475KA-T	Yes	
2	2	C2 C7	CAPACITOR CERAMIC 18PF 50V 0402 SMD	PCC180CQCT-ND	PANASONIC	ECJ-0EC1H180J	Yes	
3	7	C3 C6 C8 C14 **C17**	CAPACITOR CERAMIC 0.1UF 10V X5R 0402	PCC2146CT-ND	PANASONIC	ECJ-0EB1A104K	Yes	C17
4	2	C4 C10	CAPACITOR CERAMIC 0.01UF 16V 10% X7R 060	PCC1750CT-ND	PANASONIC	ECJ-1VB1C103K	Yes	
5	2	C11 C18	CAPACITOR CERAMIC 0.1UF 10V X5R 0201	PCC2424CT-ND	PANASONIC	ECJ-ZEB1A104M	Yes	
6	3	C9 C13 C15	CAP 120UF 6.3V ELECT POLY SMD	565-3188-1-ND	United Chemi-Con	APXE6R3ARA121ME61G	Yes	
7	1	C12	CAPACITOR CERAMIC 4.7UF 6.3V X5R 0402	490-5408-1-ND	MURATA ERIE	GRM155R60J475ME87D	Yes	
8	1	**C16**	CAPACITOR CERAMIC 4.7UF 6.3V X5R 20% 0603	445-1417-1-ND	TDK	C1608X5R0J475M	Yes	C16
9	1	C19	CAPACITOR CERAMIC 1.0UF 6.3V 20% X5R 0402	490-1319-1-ND	MURATA ERIE	GRM155R60J105ME19D	Yes	
10	1	J1	HEADER, 2 X 5, 0.1 INCH, VERTICAL	SAM1030-05-ND	SAMTEC	TSW-105-07-L-D	Yes	
11		J2 J3	CONN RECPT U.FL	H9161CT-ND	HIROSE	U.FL-R-SMT (10)	Yes	
12	2	**J4 J5**	HEADER, 1 X 2, 0.1 INCH, VERTICAL	WM6402-ND	MOLEX	22-28-4020	Yes	J4 J5
13	1	J6	CONNECTOR POWER JACK 2.1X5.5MM HIGH CURR	CP-002AH-ND	CUI STACK	PJ-002AH	Yes	
14	1	L1	FERRITE BEAD, 120 OHM, 0.5A, 0.1DCR, 0603	P10750CT-ND	PANASONIC	EXC-3BP121H	Yes	
15	1	LED1	LED GREEN SMT	404-1005-1-ND	STANLEY	BG1111C-TR	Yes	
16	1	LED2	LED GREEN 2X1.2MM 568NM GN WTR CLR SMD	754-1131-1-ND	Kingbright	APT2012SGC	Yes	
17	4	MTH1 MTH2 MTH3 MTH4	MOUNTING PAD MTG250C140D					
18	3	P1 P2 P3	RECEPTACLE, USB, STYLE B, RIGHT ANGLE	609-1045-ND	FCI	87520-0010BLF	Yes	
19	1	**P4**	CONNECTOR RECEPT USB MINI AB 5POS RT ANG	WM17122CT-ND	MOLEX	56579-0576	Yes	P4
20	0	**P5**	CONNECTOR RECEPT MICRO USB TYPE AB SMT	A97799CT-ND	TYCO ELECTRONICS	1981584-1	Yes	P5
21	2	R1 R5 R8 **R35**	RESISTOR ZERO OHM 1/4W 5% 1206	311-0.0ERCT-ND	YAGEO	RC1206JR-070RL	Yes	R35
22	1	R2	RES 51.0K OHM 1/10W 1% 0402 SMD	P51.0KLCT-ND	Panasonic - ECG	ERJ-2RKF5102X	Yes	
23	2	R3 R7	RES 30.1K OHM 1/10W 1% 0402 SMD	P30.1KLCT-ND	Panasonic - ECG	ERJ-2RKF3012X	Yes	
24	15	R4 R10 R11 R13 R14 R15 R16 **R18** R19 R20 R21 **R23** R24 R26 R27 **R28 R29 R30** R34	RESISTOR 10K OHM 1/16W 5% 0402 SMD	P10KJCT-ND	PANASONIC	ERJ-2GEJ103X	Yes	R18 R23 R28 R29 R30
25	1	R6	RES 14.3K OHM 1/10W 1% 0402 SMD	P14.3KLCT-ND	Panasonic - ECG	ERJ-2RKF1432X	Yes	
26	4	**R9** R12 **R25** R31 **R32** R33 **R39 R40**	RESISTOR ZERO OHM 1/16W 5% 0402 SMD	311-0.0JRCT-ND	YAGEO	RC0402JR-070RL	Yes	R9 R25 R32 R39 R40
27	3	R17 R22 R38	RESISTOR 1.0K OHM 1/16W 5% 0402 SMD	P1.0KJCT-ND	PANASONIC	ERJ-2GEJ102X	Yes	
28	1	R36	RESISTOR 12.0K OHM 1/20W 1% 0201 SMD	P12.0KABCT-ND	PANASONIC	ERJ-1GEF1202C	Yes	
29	1	R37	RESISTOR 330 OHM 1/16W 1% 0402 SMD	311-330LRCT-ND	YAGEO	RC0402FR-07330RL	Yes	
30	1	SW1	SWITCH TACTILE 6MM EXTEND ACT 160GF	EG1861-ND	E-SWITCH	TL1105SPF160Q	Yes	
31	2	SW2 SW3	SWITCH SLIDE SPDT SMD GULL	563-1022-1-ND	COPAL ELECTRONICS	CJS-1200TB	Yes	
32	2	TP1 TP6	TEST POINT LOOP COMPACT BLACK	5006K-ND	KEYSTONE	5006	Yes	
33	2	TP2 TP3	TEST POINT LOOP COMPACT ORANGE	5008K-ND	KEYSTONE	5008	Yes	
34	2	TP4 TP5	TEST POINT	5015KCT-ND	KEYSTONE	5015	Yes	
35	2	U1 U2	IC 200MA LDO LINEAR REG SOT23-6	296-15305-1-ND	TEXAS INSTRUMENTS	TPS79301DBVRQ1	Yes	
36	1	U3	USB3503_25WLCSP		SMSC	USB3503	Yes	
37	1	U4	POWER SWITCH USB MIC2026-1B	576-2137-ND	MICREL	MIC2026-1YM	Yes	
38	1	U5	IC SCHMITT-TRG INV GATE SOT23-5	296-1092-1-ND	TEXAS INSTRUMENTS	SN74AHC1G14DBVR	Yes	
39	1	Y1	OSCILLATOR PROG 3.3V +-50PPM SMD	AP3S3EC-ND	ABRACON	AP3S-26.0MHz	Yes	

Figure 6.1 USB3503 EVB Bill of Materials

7 User Manual Revision History

Table 7.1 Customer Revision History

REVISION LEVEL & DATE	SECTION/FIGURE/ENTRY	CORRECTION
Rev. 1.0 (05-06-13)		Co-branded document
Rev. 1.0 (09-12-11)	Document release	