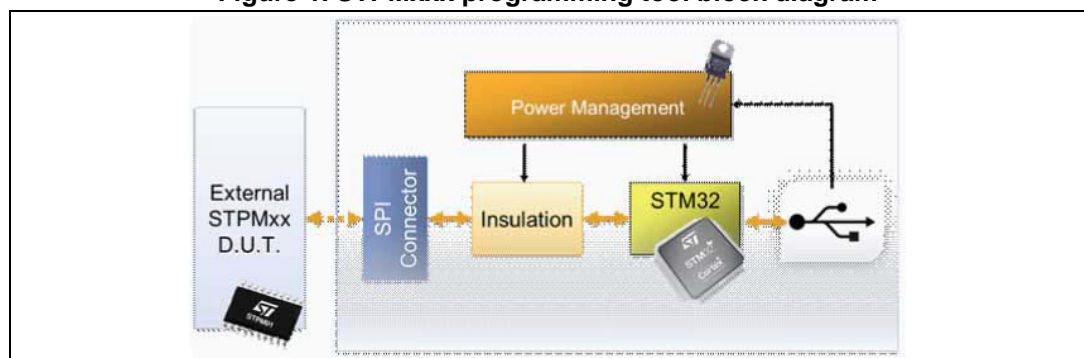## Introduction

This evaluation board is a tool for programming the STPMxxx energy meter ICs family. The board has been developed to provide an insulated USB interface between a PC and the STPMxx evaluation boards. The PC runs the GUI to program and read the internal registers of the energy meter device. The board includes the following sections shown in *Figure 1*:

- USB interface

- Power management

- Microcontroller

- Insulated SPI connector

Figure 1. STPMxxx programming tool block diagram

Contents

1 Overview

1.1 Recommended reading

This document describes how to configure and use the STPMxxx programming tool board.

Additional information can be found in the following documents:

- ST devices datasheets referenced in this document
- Third party device datasheets
- UM0412
- UM1488

1.2 Safety precautions

The board can be connected to a high voltage AC metrology board (D.U.T.) as it offers galvanic insulation to the digital section. This board is strictly intended for use by expert technicians. Due to the high voltage (220 VAC) involved, special care must be taken with regard to personal safety.

There is no protection against accidental human contact with high voltages.

After disconnection of the board from the mains, the live parts must not be touched immediately due to the energized capacitors.

It is mandatory to use a mains insulation transformer to perform any tests on the board in which test instruments such as spectrum analyzers or oscilloscopes are used.

Do not connect any oscilloscope probes to high voltage sections in order to avoid damaging instruments and demonstration tools.

Warning: **ST assumes no responsibility for any consequences which may result from the improper use of this tool.**

1.3 Getting technical support

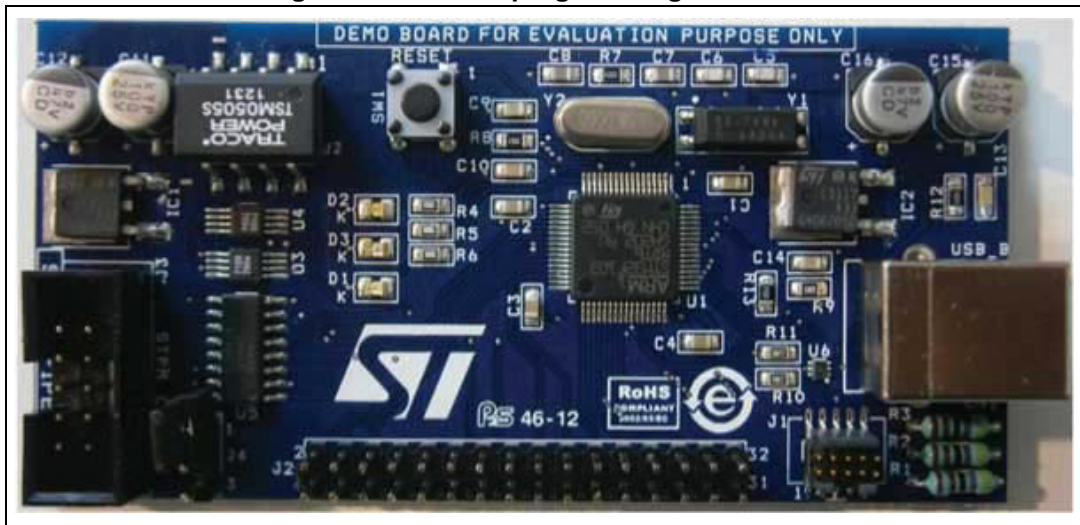Technical assistance is provided free to all customers. For technical assistance, documentation, upgrades and information about products and services, please refer to your local ST distributor/office.

1.4 Package list

The STPMxxx programming tool board package includes the following items:

- The STPMxxx programming tool board (*Figure 2*)
- A CD-ROM with software and documentation

Figure 2. STPMxxx programming tool board

2 STPMxx programming tool board components

The board includes a USB interface, a power management unit, a microcontroller and an insulation section for the SPI connector to the energy metrology board being tested.

2.1 Microcontroller

The system is managed by the STM32F103 microcontroller. It is based on the 32-bit ARM Cortex-M3 core with 72 MHz maximum frequency, 384 KB Flash and 64 KB SRAM embedded memories; for further details please refer to the STM32F103 high density family datasheets.

2.2 Debug

Software debug is via a 10-pin JTAG connection; it is possible to use a 10-pin to 20-pin adapter to use standard 20-pin JTAG tools.

Figure 3. JTAG Connector

Table 1 shows the pin out of the JTAG connector.

Table 1. JTAG pin out

PIN number	Function
1	3.3V
2	TMS
3	GND
4	TCK
5	GND
6	TDO

Table 1. JTAG pin out (continued)

PIN number	Function
7	N.C.
8	TDI
9	GND
10	nRESET

2.3 Reset

The Reset sources are:

- Power on reset
- JTAG reset from an in-circuit emulator
- The RESET button (SW1).

2.4 Power supply

The board is powered directly by the USB connector. It includes a linear voltage regulator.

The power supply is based on the LD1117ADT33TR device. The insulated section is powered by an insulated DC-DC module (U5).

Figure 4. Power supply section

2.5 Insulated metrology board connection

The metrology board under test is connected by an insulated connector compatible with all meter IC evaluation boards:

- STEVAL-IPE010V2
- STEVAL-IPE016V1
- STEVAL-IPE017V1
- STEVAL-IPE018V1

Figure 5. Power supply section

The STPMxx is controlled by the MCU with an SPI communication bus and digital control line. Table 2 shows the MCU resources mapping for energy meter IC management:

Table 2. STM32F resources - STPMxx function mapping

STM32F resource	Energy meter function
PA9	SYN
SPI1-MISO (PA6)	SDA/MISO
SPI1-MOSI (PA7)	MOSI
SC1-SCLK (PA5)	SCL
PA4	SCS

These signals are insulated by two buffers which are driven by two GPIOs mapped as shown in Table 3:

Table 3. STM32F resources - Buffers function mapping

STM32F resource	Buffer function
PA3	Output Enable (active low)
PA8	Input Enable (active low)

2.6 Status LEDs

Table 4. LED description and STM32W mapping

LED	Function
D1	Application activity (green)
D3	USB activity (red)
D2	USB data receiving activity (yellow)

2.7 Jumpers

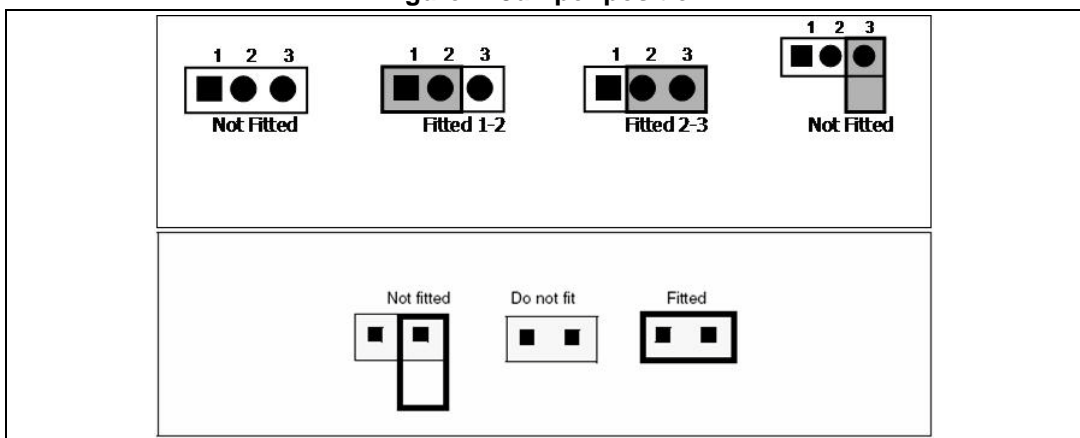### 2.7.1 Jumper placement

Figure 6. Jumper placement

2.7.2 Jumper position

Figure 7. Jumper position

2.7.3 Jumper description and default value

Table 5. Jumpers descriptions

Jumper	Description	Default
J4	Power Supply option for D.U.T. board: 1-2: 3.3V 2-3: 5V	2-3

2.8 Pushbutton description

Table 6. Pushbutton descriptions

Button	Description (MCU mapping)
SW1 (RESET)	MCU reset

2.9 Connectors description

Figure 8. General purpose connectors position

Table 7. Connector descriptions

Connector	Description
CN1	USB type-B connector
J2	GPIOs connector
J3	Metrology board connector
J1	JTAG connector

2.9.1 STM32 JTAG connector

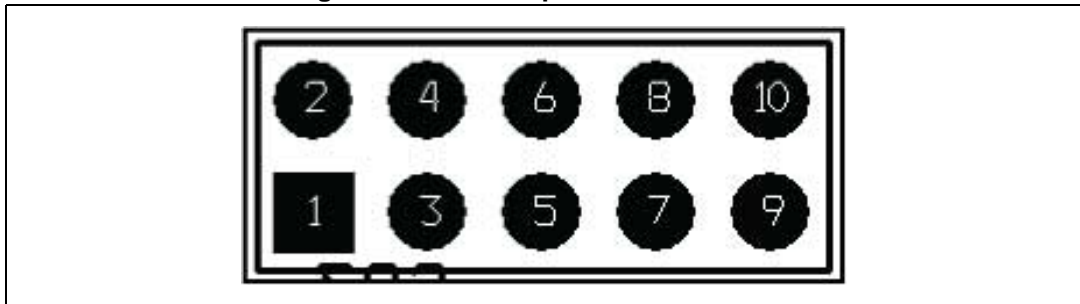**Figure 9. STM32 10 pin JTAG connector**

Table 8. JTAG connector pin mapping

Pin	Description	Pin	Description
1	VCC	6	TDO
2	TMS	7	N.C.
3	GND	8	TDI
4	TCK	9	GND
5	GND	10	Reset

2.9.2 Metrology IC board connector

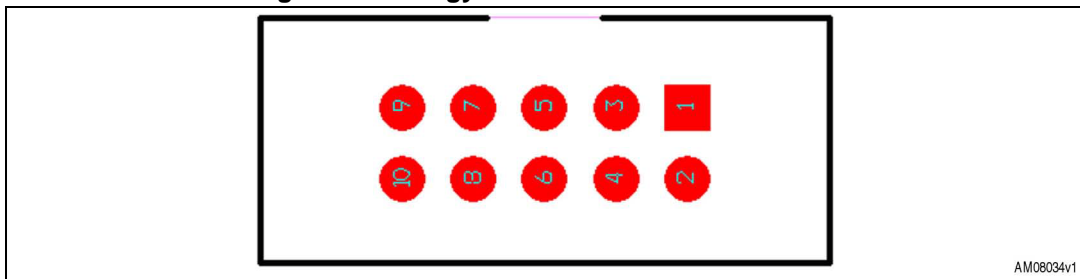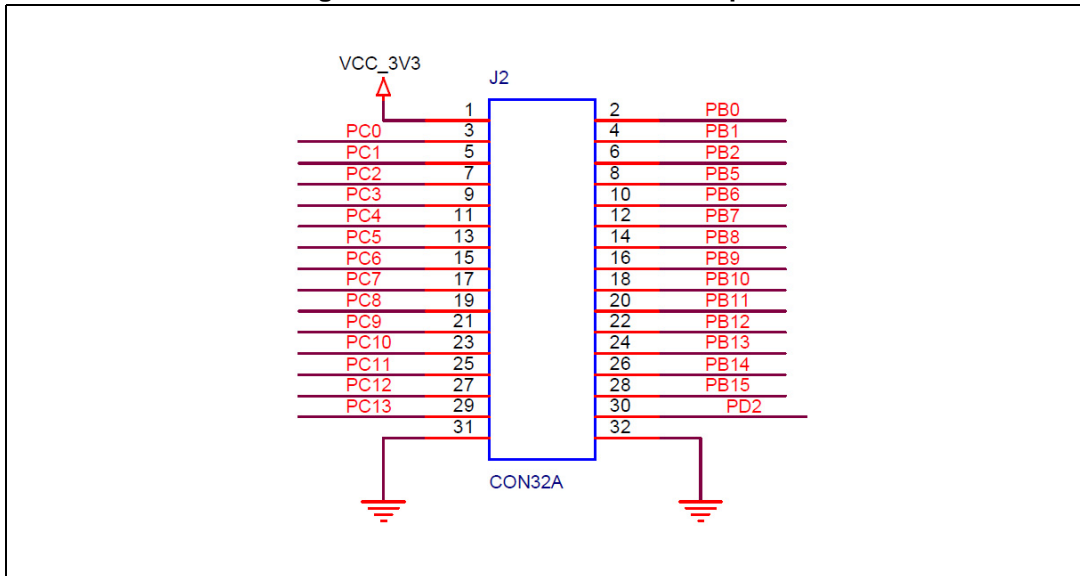**Figure 10. Energy meter calibration connector**

Table 9. Energy meter connector pin mapping

Pin	Description	Pin	Description
1	N.C	6	SCL
2	MOSI	7	N.C.
3	GND	8	SYN
4	SDA	9	N.C.
5	SCS	10	Vcc

2.9.3 GPIOs connector

Figure 11. GPIOs connector description

3 STPMxx programming tool operation

3.1 Normal operation mode

For normal operation, the board implements virtual COM port functionality for PC communication via USB. Before connecting it to a PC for the first time, install the STM32 Virtual COM Port Driver which is available for download at the following ST web page: http://www.st.com/internet/mcu/product/216826.jsp.

The board is designed to be used with a dedicated PC GUI for STPMxx energy meter family ICs. The GUI for STPMC1 evaluation boards is available for download at the following ST web page: http://www.st.com/internet/evalboard/product/252571.jsp. For more details, refer to "UM1488: STPMC1 evaluation software". The GUI for STPM01 evaluation boards is available for downloading at the ST web page. For more details, refer to user manual UM1599: The STPM01 and STPM1x evaluation software.

3.2 DFU mode

The board supports firmware upgrade via USB connection. To boot the MCU in DFU mode, connect (using a jumper) pin 1 and pin 3 of the GPIOs connector; as soon as the board starts the DFU procedure, LED D3 (Red) turns on. Before running the board in this mode, you should install the DFU demonstration software on the PC; it is available for download at the following ST web page: http://www.st.com/internet/mcu/product/216826.jsp. For more details regarding STM32 DFU functionality, refer to the following user manual: UM0412: Getting started with DfuSe USB device firmware upgrade STMicroelectronics extension.

The board was tested with version 3.0.2 of the DFU software.
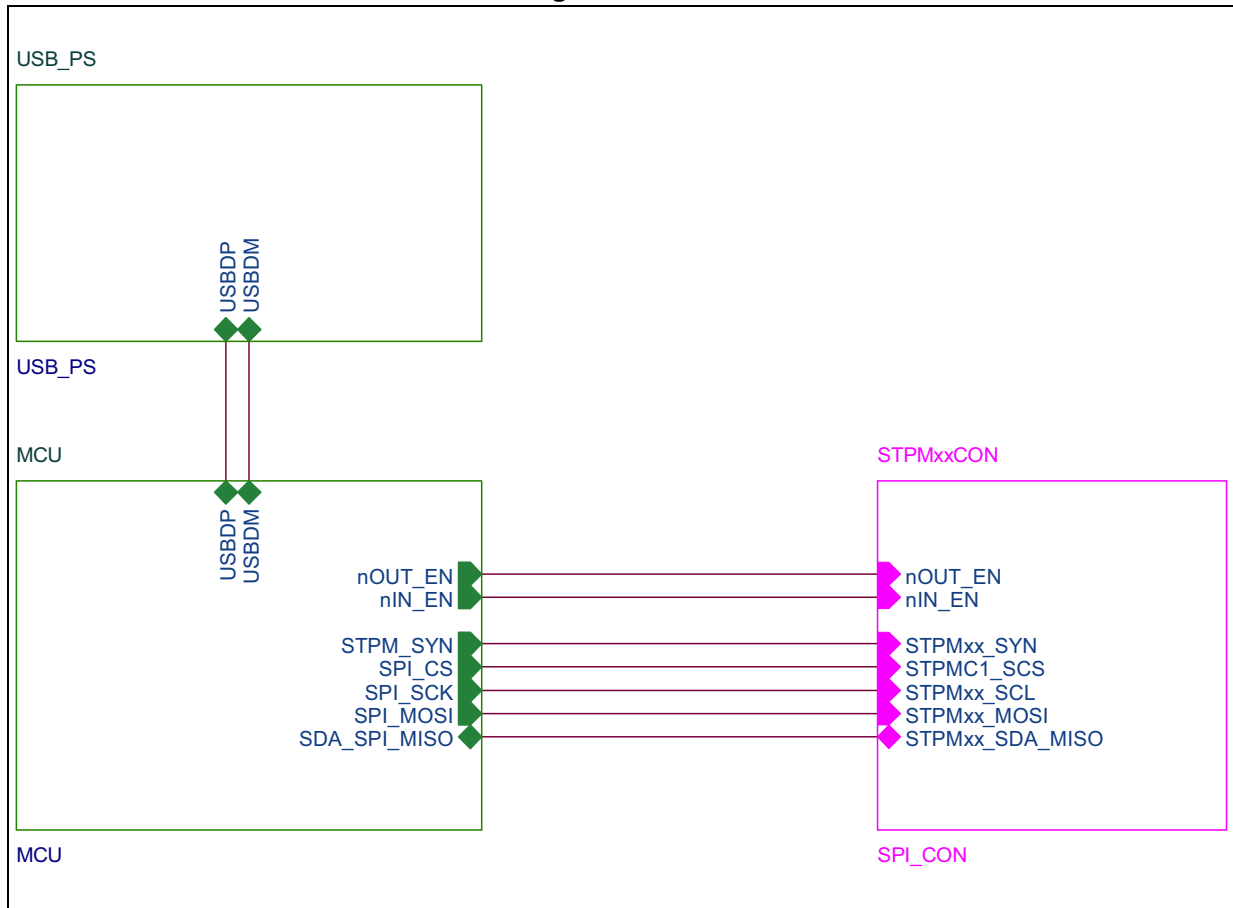
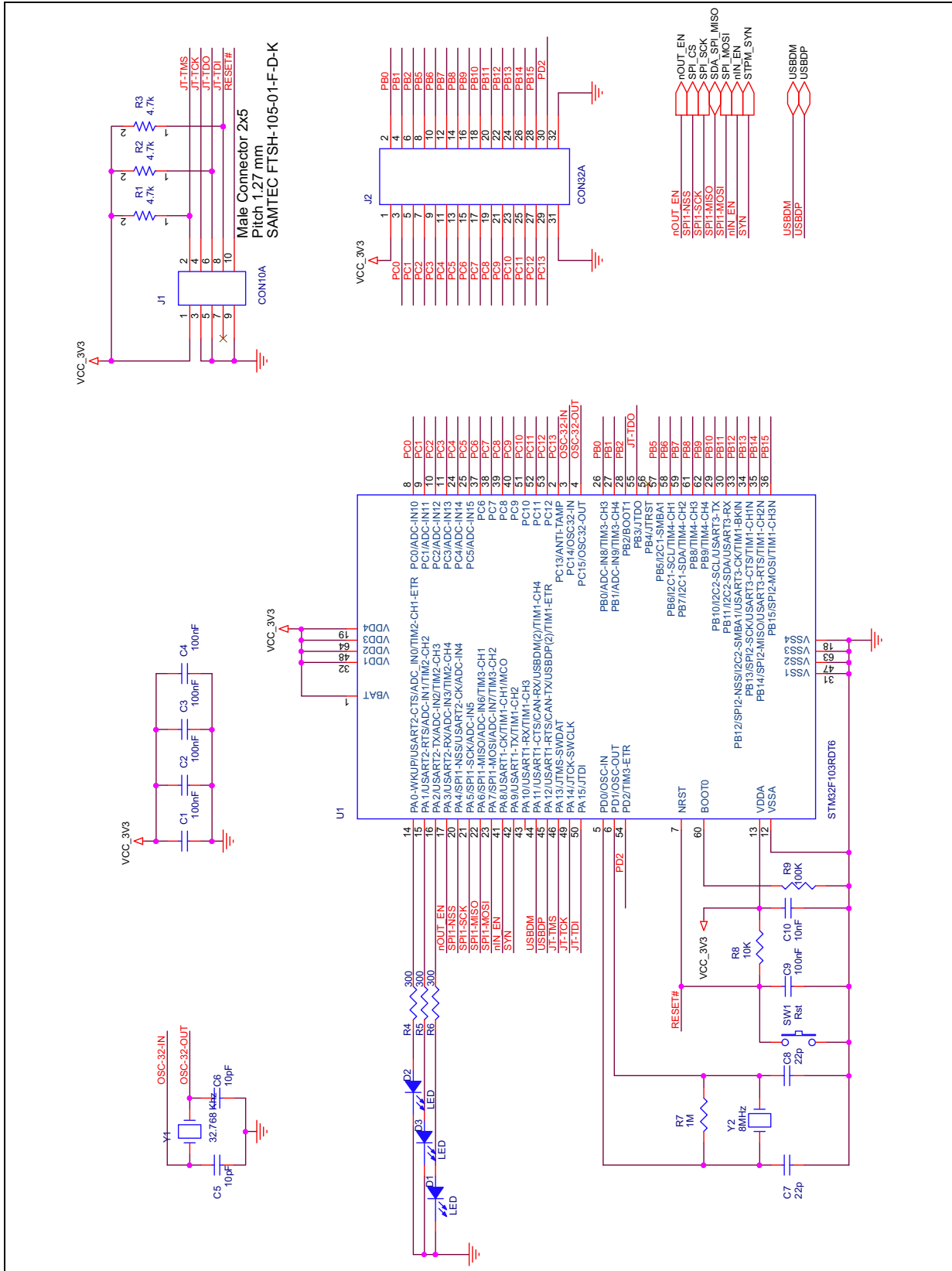# 4 Test circuit

Figure 12. TOP

Figure 13. STM32F103

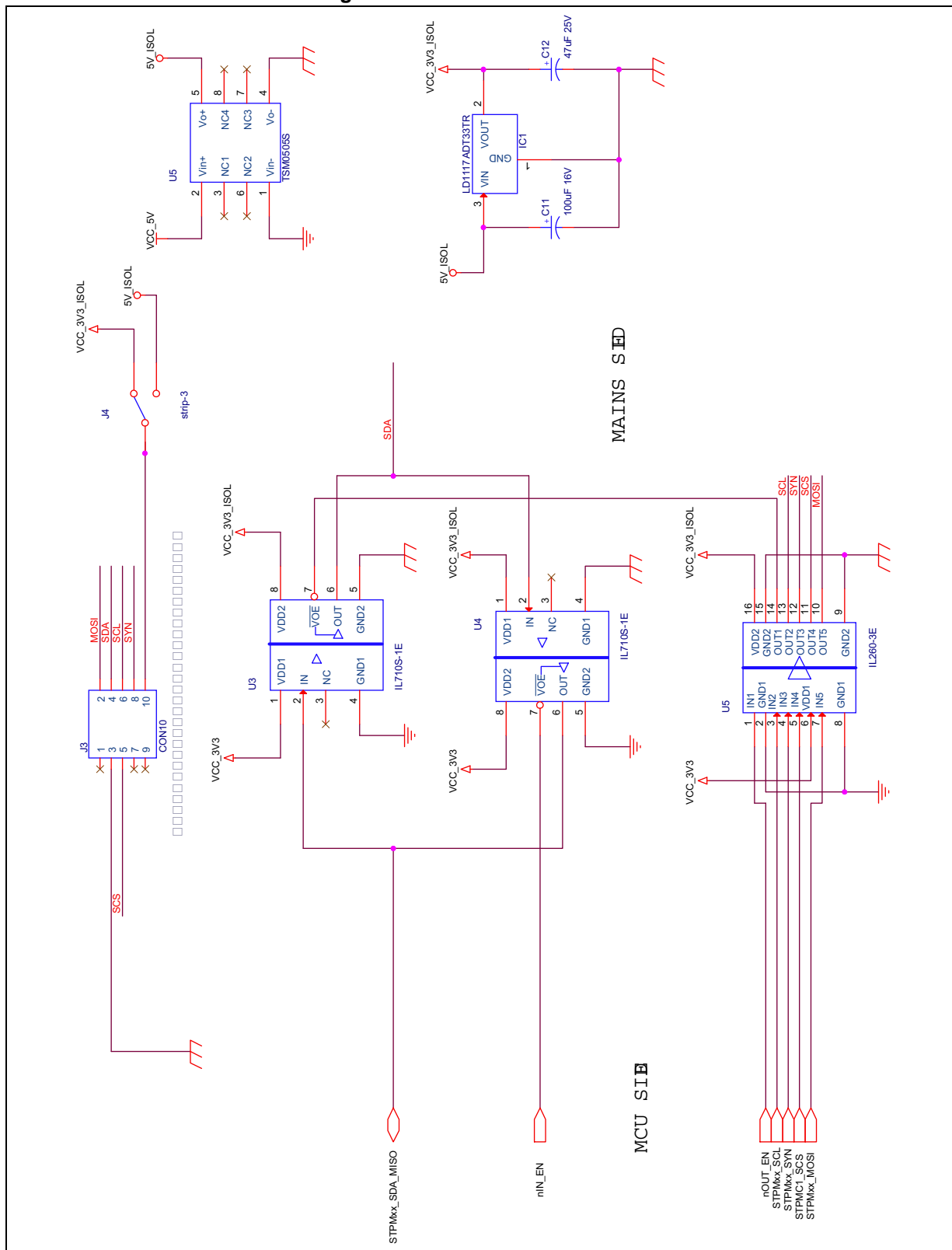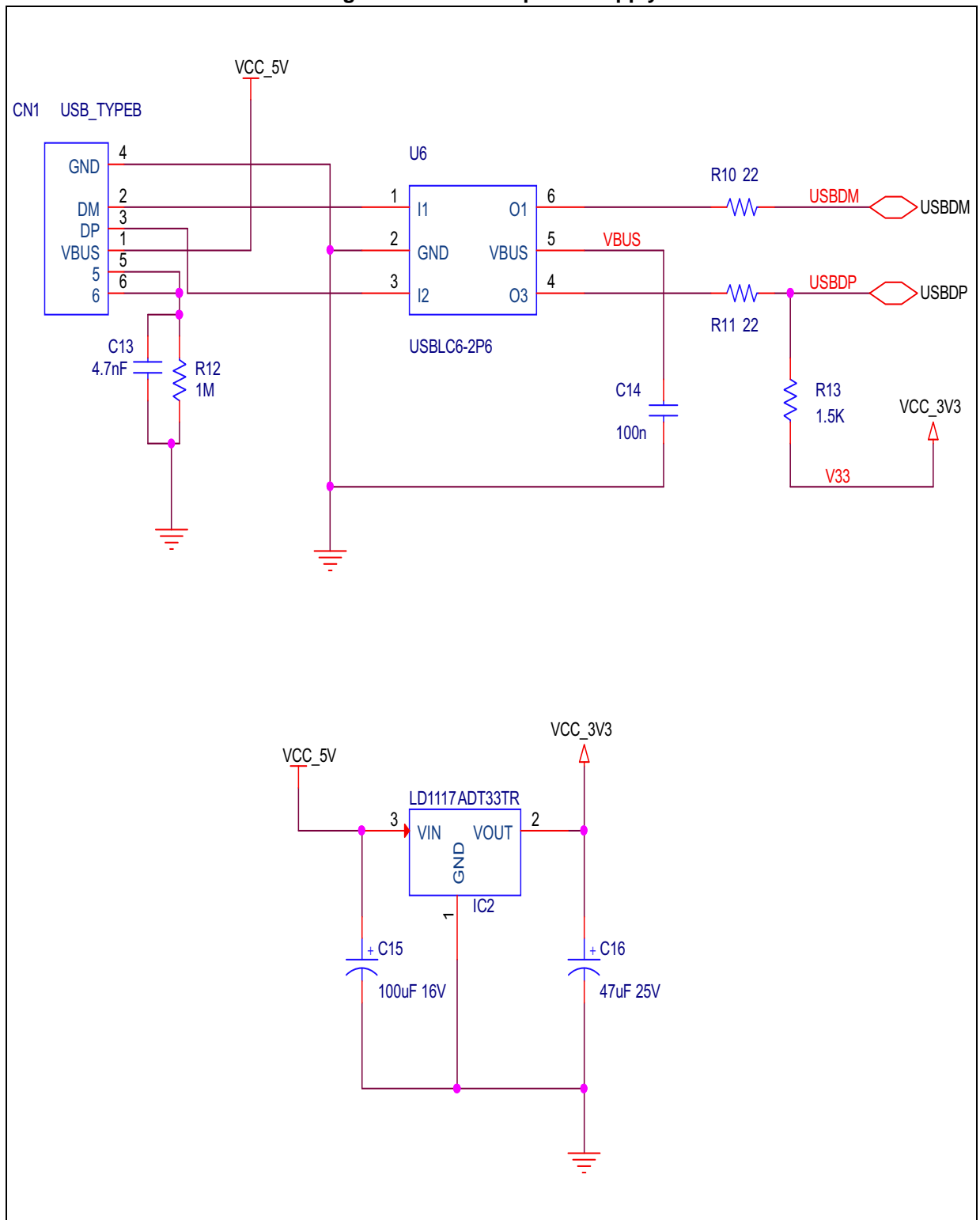**Figure 14. STPMxxx connections**

Figure 15. USB and power supply

5 Bill of material

Table 10. Bill of material

Item	Qty	Reference	Part / value	Tol. %	Voltage current	Watt	Technology information	Package - footprint	Manufacturer
– 1	1	CN1	USB_TYPEB					USB_TYPEB_S	
– 2	6	C1,C2,C3, C4,C9,C1 4	100nF	10%	25V		X7R ceramic	sm/C_0805	
– 3	2	C5,C6	10pF	10%	25V		X7R ceramic	sm/C_0805	
– 4	2	C7,C8	22pF	10%	25V		X7R ceramic	sm/C_0805	
– 5	1	C10	10nF	10%	25V		X7R ceramic	sm/C_0805	
– 6	2	C11,C15	100uF 16V	20%	25V		Electrolityc	SM/CT_47UF_2 5V	
– 7	2	C12,C16	47uF 25V	20%	25V		Electrolityc	SM/CT_47UF_2 5V	
– 8	1	C13	4.7nF	10%	25V		X7R ceramic	sm/C_0805	
– 9	2	IC1,IC2	LD1117ADT3 3TR					DPAK_REAL	ST
– 10	1	J1	CON10A					CONNECTOR SAMTEC FTS105	SAMTEC
– 11	1	J2	CON32A					BLKCON.100/V H/TM2OE/W.20 0/32	
– 12	1	J3	CON10					WALCON.100/V H/TM2OES/W.3 25/10	
– 13	1	J4	JUMPER					JUMP-M-254-2	
– 14	3	R1,R2,R3	4.7k	5%		0.125		AX/RC05	
– 15	3	R4,R5,R6	300R	1%		0.125		SM/R_0805	
– 16	2	R7,R12	1M	1%		0.125		SM/R_0805	
– 17	1	R8	10K	1%		0.125		SM/R_0805	
– 18	1	R9	100K	1%		0.125		SM/R_0805	
– 19	2	R10,R11	22R	1%		0.125		SM/R_0805	
– 20	1	R13	1.5K	1%		0.125		SM/R_0805	
– 21	1	SW1	Rst					SWITCH_TE FSM2JH	
– 22	1	U1	STM32F103 RDT6					QUAD.50M/64/ WG12.60	ST
– 23	1	U2	TSM0505S					SOJ.050/14/WB. 450/L.400	

Table 10. Bill of material (continued)

Item	Qty	Reference	Part / value	Tol. %	Voltage current	Watt	Technology information	Package - footprint	Manufacturer
– 24	2	U3,U4	IL710S-1E					SOG.025/8/WG. 275/L.150	NVE
– 25	1	U5	IL260-3E					SOG.050/16/WG .244/L.400	NVE
– 26	1	U6	USBLC6-2P6					SOT-666	ST
– 27	1	Y1	32.768 KHz					QUARTZ SMD 4PIN_S	
– 28	1	Y2	8MHz					Cer. Resonator	
– 29	1	D1	green LED					SM/D_0805_21	Kingbright
– 30	1	D2	yellow LED					SM/D_0805_21	Kingbright
– 31	1	D3	red LED					SM/D_0805_21	Kingbright

6 References

- STM23F10xxx datasheet
- STM32F10xxx reference manual
- STM32F10xFWLib 3.1.2
- STPMxx energy metering ICs family datasheet
- UM0412
- UM1488

7 Revision history

Table 11. Document revision history

Date	Revision	Changes
05-Jun-2014	1	Initial release.

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