STM32F4DISCOVERY

STM32F4 high-performance discovery board

Introduction

The STM32F4DISCOVERY helps you to discover the STM32F4 high-performance features and to develop your applications. It is based on an STM32F407VGT6 and includes an ST-LINK/V2 embedded debug tool interface, ST MEMS digital accelerometer, ST MEMS digital microphone, audio DAC with integrated class D speaker driver, LEDs, pushbuttons and a USB OTG micro-AB connector.

Figure 1.   STM32F4DISCOVERY

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1   Conventions

Table 1 provides the definition of some conventions used in the present document.

Table 1.   ON/OFF conventions

Convention	Definition
Jumper JP1 ON	Jumper fitted
Jumper JP1 OFF	Jumper not fitted
Solder bridge SBx ON	SBx connections closed by solder
Solder bridge SBx OFF	SBx connections left open

2   Quick start

The STM32F4DISCOVERY is a low-cost and easy-to-use development kit to quickly evaluate and start a development with an STM32F4 high-performance microcontroller.

Before installing and using the product, please accept the Evaluation Product License Agreement from www.st.com/stm32f4-discovery.

For more information on the STM32F4DISCOVERY and for demonstration software, visit www.st.com/stm32f4-discovery.

2.1   Getting started

Follow the sequence below to configure the STM32F4DISCOVERY board and launch the DISCOVER application:

1.   Check jumper position on the board, JP1 on, CN3 on (DISCOVERY selected).
2.   Connect the STM32F4DISCOVERY board to a PC with a USB cable 'type A to mini-B' through USB connector CN1 to power the board. Red LED LD2 (PWR) then lights up.
3.   Four LEDs between B1 and B2 buttons are blinking.
4.   Press user button B1 to enable the ST MEMS sensor, move the board and observe the four LEDs blinking according to the motion direction and speed. (If you connect a second USB cable 'type A to micro-B' between PC and CN5 connector then the board is recognized as standard mouse and its motion will also control the PC cursor).
5.   To study or modify the DISCOVER project related to this demo, visit www.st.com/stm32f4-discovery and follow the tutorial.
6.   Discover the STM32F4 features, download and execute programs proposed in the list of projects.
7.   Develop your own application using available examples.

2.2   System requirements

●   Windows PC (XP, Vista, 7)
●   USB type A to Mini-B USB cable

2.3   Development toolchain supporting the STM32F4DISCOVERY

●   Altium, TASKING™ VX-Toolset
●   Atollic, TrueSTUDIO
●   IAR, EWARM
●   Keil™, MDK-ARM

2.4   Order code

To order the STM32F4 high-performance discovery board, use the order code STM32F4DISCOVERY.

3 Features

The STM32F4DISCOVERY offers the following features:

● STM32F407VGT6 microcontroller featuring 1 MB of Flash memory, 192 KB of RAM in an LQFP100 package

● On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)

● Board power supply: through USB bus or from an external 5V supply voltage

● External application power supply: 3V and 5V

● LIS302DL, ST MEMS motion sensor, 3-axis digital output accelerometer

● MP45DT02, ST MEMS audio sensor, omnidirectional digital microphone

● CS43L22, audio DAC with integrated class D speaker driver

● Eight LEDs:

– LD1 (red/green) for USB communication

– LD2 (red) for 3.3V power on

– Four user LEDs, LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)

– 2 USB OTG LEDs LD7 (green) VBus and LD8 (red) over-current

● Two pushbuttons (user and reset)

● USB OTG with micro-AB connector

● Extension header for LQFP100 I/Os for quick connection to prototyping board and easy probing

4 Hardware and layout

The STM32F4DISCOVERY is designed around the STM32F407VGT6 microcontroller in a 100-pin LQFP package.

Figure 2 illustrates the connections between the STM32F407VGT6 and its peripherals (ST-LINK/V2, pushbutton, LED, Audio DAC, USB, ST MEMS accelerometer, ST MEMS microphone, and connectors).

Figure 3 and *Figure 4* help you to locate these features on the STM32F4DISCOVERY.

Figure 2.   Hardware block diagram
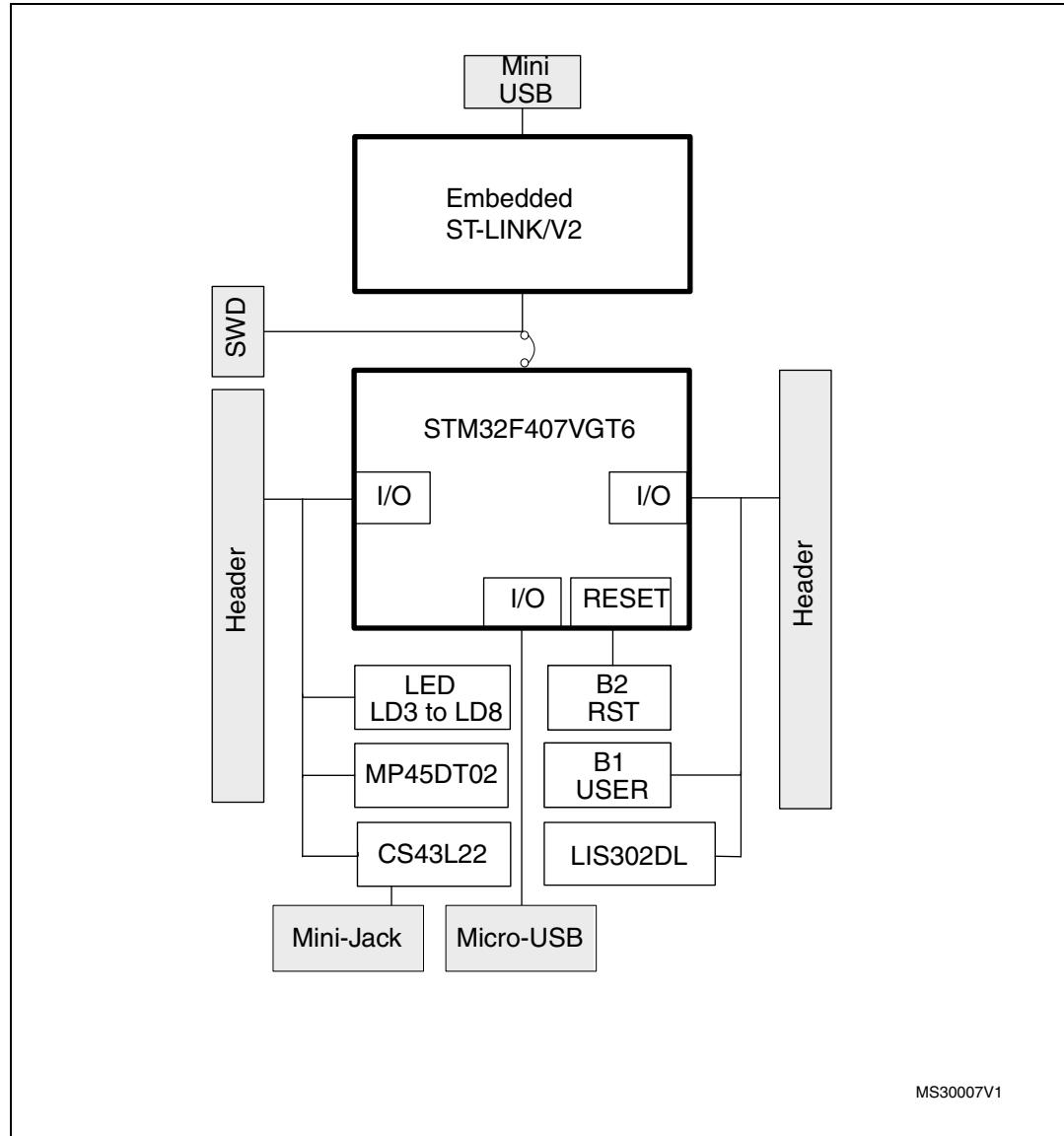
**Figure 3.   Top layout**
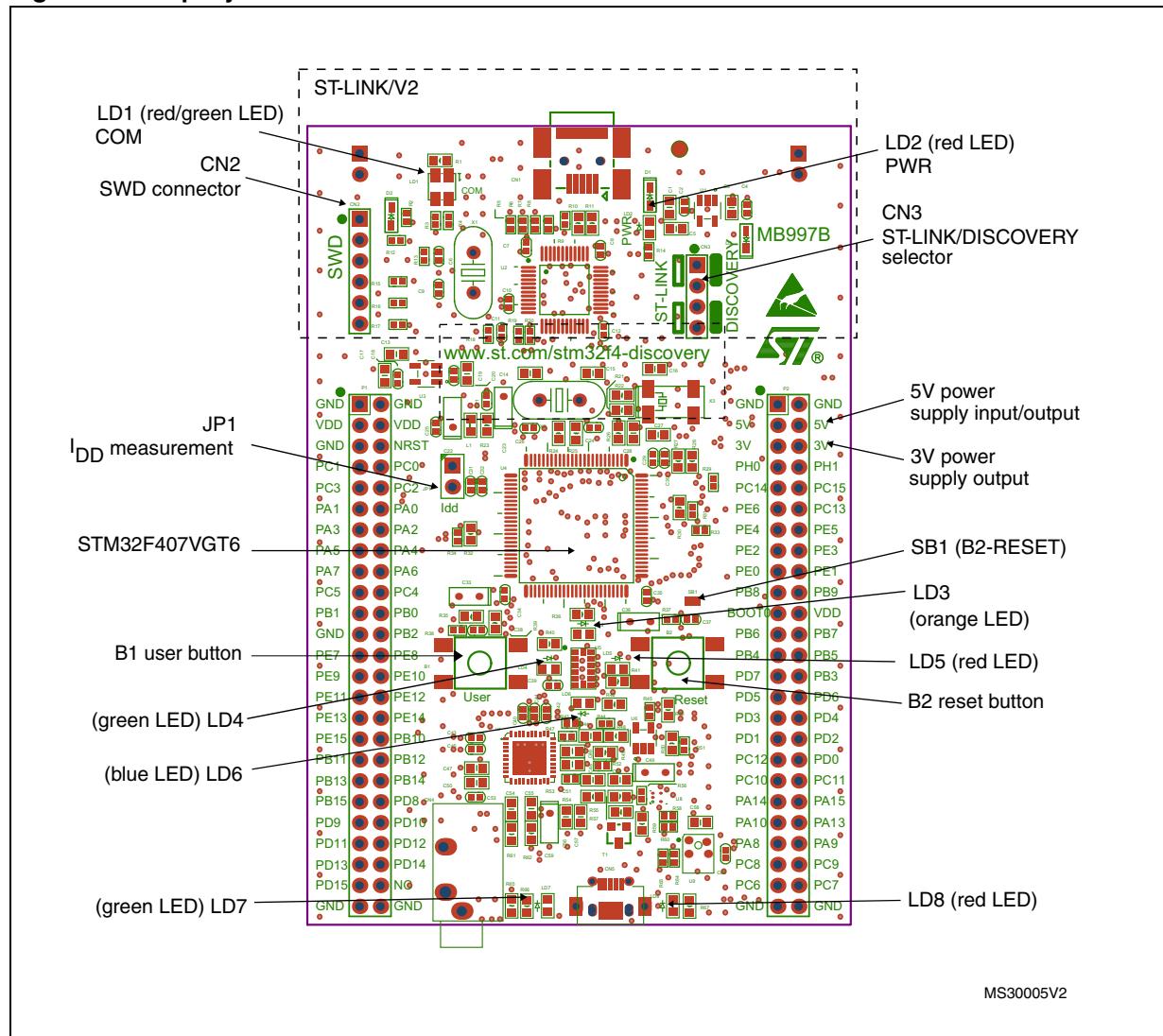
Note: Pin 1 of CN2, CN3, JP1, P1 and P2 connectors are identified by a square.

Figure 4. Bottom layout

SB2, SB4, SB6, SB8 (RESERVED)

SB3, SB5, SB7, SB9 (DEFAULT)

SB12 (SWO)

SB18 (BOOT0)

SB11 (NRST)

SB10 (STM_RST)

SB13 (X2 crystal)

SB14 (X2 crystal)

SB15 (X3 crystal)

SB16 (X3 crystal)

SB17 (VDD from 3V)

SB19 (BOOT1)

SB20 (B1-USER)

MS30004V1
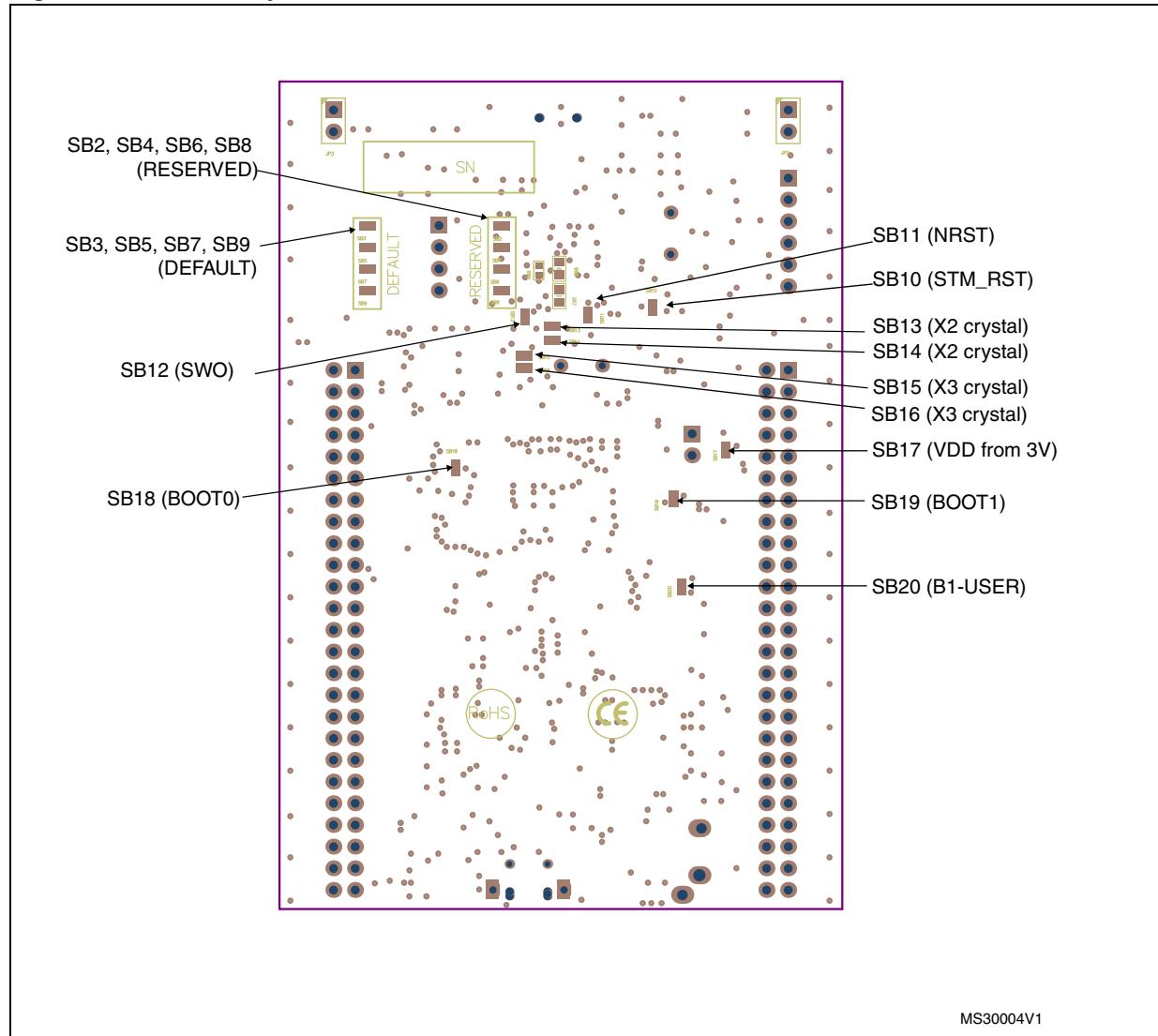
## 4.1 STM32F407VGT6 microcontroller

This ARM Cortex-M4 32-bit MCU with FPU has 210 DMIPS, up to 1 MB Flash/192+4 KB RAM, USB OTG HS/FS, Ethernet, 17 TIMs, 3 ADCs, 15 comm. interfaces and a camera.

Figure 5. STM32F407VGT6 package

STM32F407VGT6

1 Mbyte of Flash memory
192 Kbytes of RAM

LQFP100 14 x 14 mm

MS30003V1
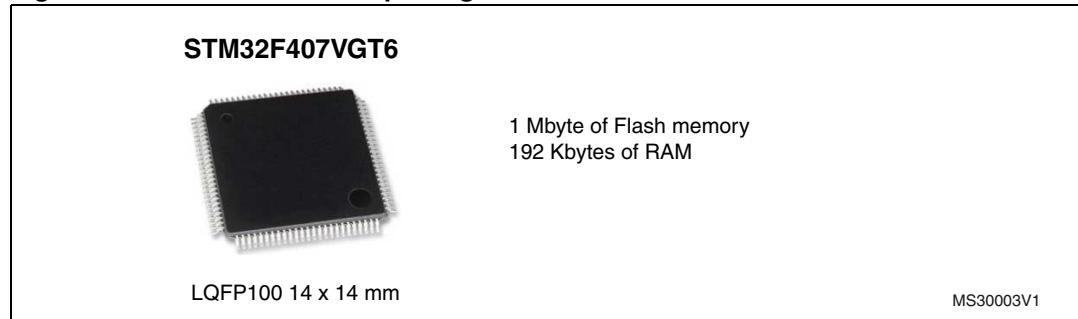
This device provides the following benefits.

● 168 MHz/210 DMIPS Cortex-M4 with single cycle DSP MAC and floating point unit providing:

Boosted execution of control algorithms

More features possible for your applications

Ease of use

Better code efficiency

Faster time to market

Elimination of scaling and saturation

Easier support for meta-language tools

● Designed for high performance and ultra fast data transfers; ART Accelerator, 32-bit, 7-layer AHB bus matrix with 7 masters and 8 slaves including 2 blocks of SRAM, Multi DMA controllers: 2 general purpose, 1 for USB HS, 1 for Ethernet, One SRAM block dedicated to the core, providing performance equivalent to 0-wait execution from Flash Concurrent execution and data transfers and simplified resource allocation

● Outstanding power efficiency; Ultra-low dynamic power, RTC <1 µA typical in VBAT mode, 3.6 V down to 1.7 V VDD, Voltage regulator with power scaling capability, providing extra flexibility to reduce power consumption for applications requiring both high processing and low power performance when running at low voltage or on a rechargeable battery

● Maximum integration: Up to 1 Mbyte of on-chip Flash memory, 192 Kbytes of SRAM, reset circuit, internal RCs, PLLs, WLCSP package available, providing more features in space constrained applications

● Superior and innovative peripherals providing new possibilities to connect and communicate high speed data and more precision due to high resolution

● Extensive tools and software solutions providing a wide choice within the STM32 ecosystem to develop your applications.

Figure 6.   STM32F407VGT6 block diagram
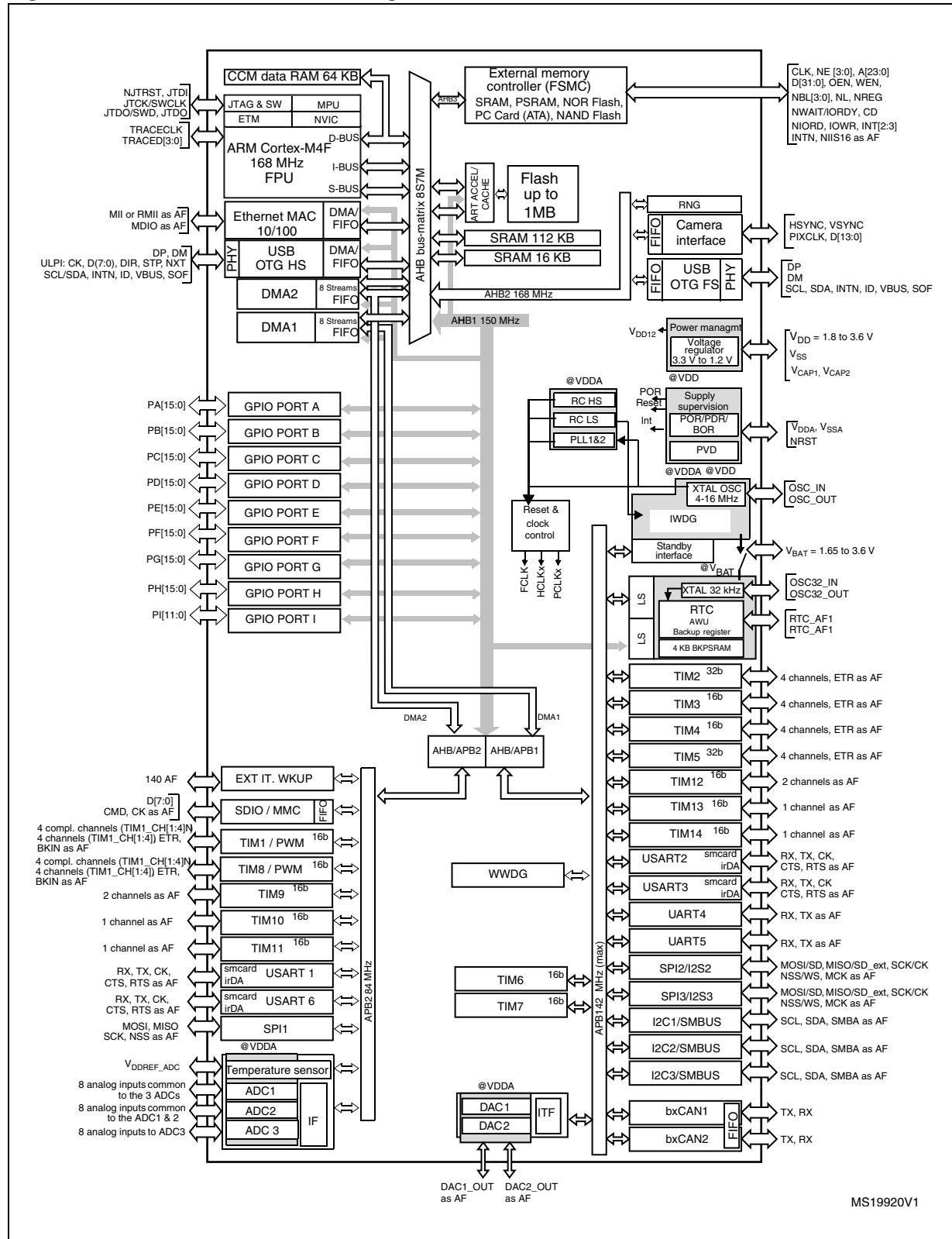
4.2 Embedded ST-LINK/V2

The ST-LINK/V2 programming and debugging tool is integrated on the STM32F4DISCOVERY. The embedded ST-LINK/V2 can be used in 2 different ways according to the jumper states (see *Table 2*):

● Program/debug the MCU on board,

● Program/debug an MCU in an external application board using a cable connected to SWD connector CN2.

The embedded ST-LINK/V2 supports only SWD for STM32 devices. For information about debugging and programming features refer to user manual UM1075 (*ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32*) which describes in detail all the ST-LINK/V2 features.

Figure 7.   Typical configuration

Hardware requirements:
- USB cable type A to mini-B
- computer with Windows XP, Vista or 7

Development toolchain:
Altium, TASKING VX-Toolset,
Atollic, TrueSTUDIO
IAR, EWARM
Keil, MDK-ARM

MS19052V1
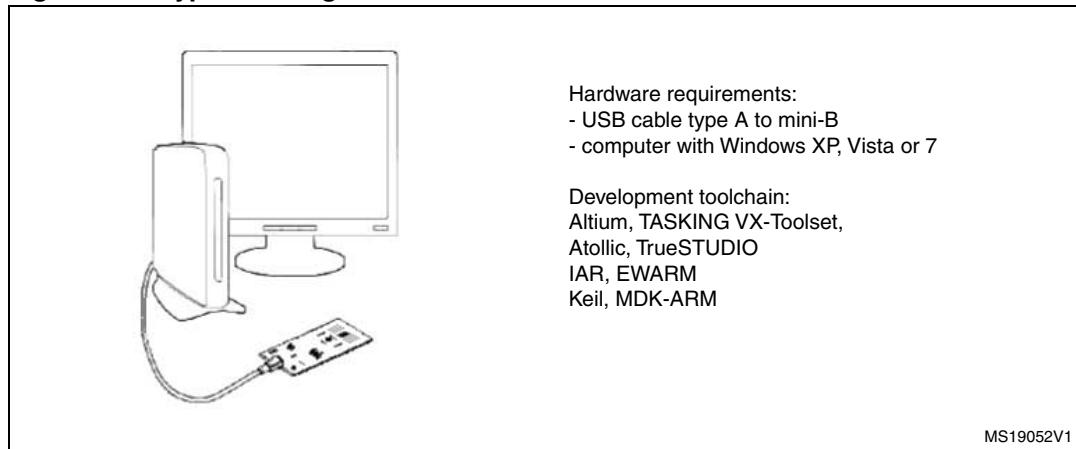
Table 2.   Jumper states

Jumper state	Description
Both CN3 jumpers ON	ST-LINK/V2 functions enabled for on board programming (default)
Both CN3 jumpers OFF	ST-LINK/V2 functions enabled for application through external CN2 connector (SWD supported)

4.2.1   Using ST-LINK/V2 to program/debug the STM32F4 on board

To program the STM32F4 on board, simply plug in the two jumpers on CN3, as shown in *Figure 8* in red, but do not use the CN2 connector as that could disturb communication with the STM32F407VGT6 of the STM32F4DISCOVERY.

Figure 8.   STM32F4DISCOVERY connections image
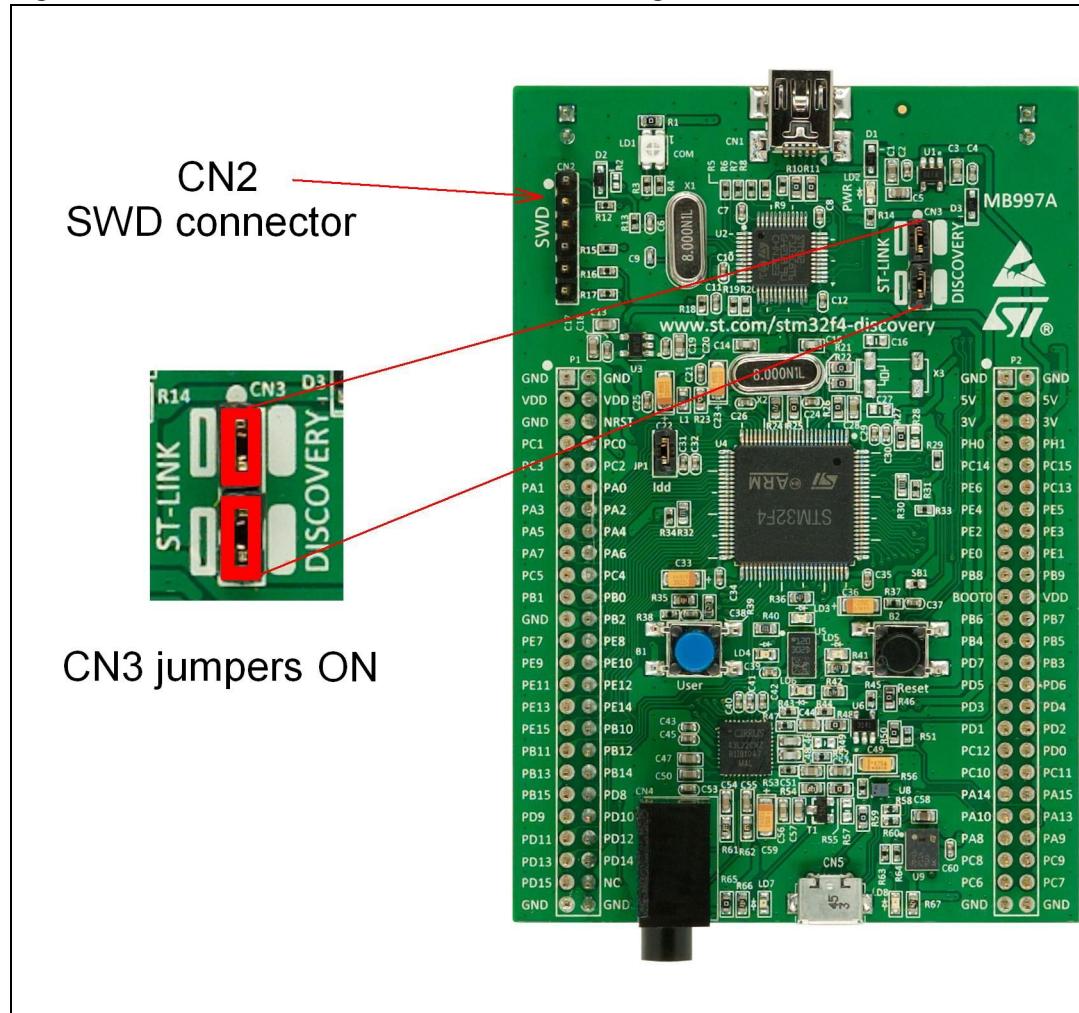
4.2.2 Using ST-LINK/V2 to program/debug an external STM32 application

It is very easy to use the ST-LINK/V2 to program the STM32 on an external application. Simply remove the 2 jumpers from CN3 as shown in *Figure 9*, and connect your application to the CN2 debug connector according to *Table 3*.

Note: *SB11 must be OFF if you use CN2 pin 5 in your external application.*

Table 3. **Debug connector CN2 (SWD)**

Pin	CN2	Designation
1	VDD_TARGET	VDD from application
2	SWCLK	SWD clock
3	GND	Ground
4	SWDIO	SWD data input/output
5	NRST	RESET of target MCU
6	SWO	Reserved

Figure 9. **ST-Link connections image**
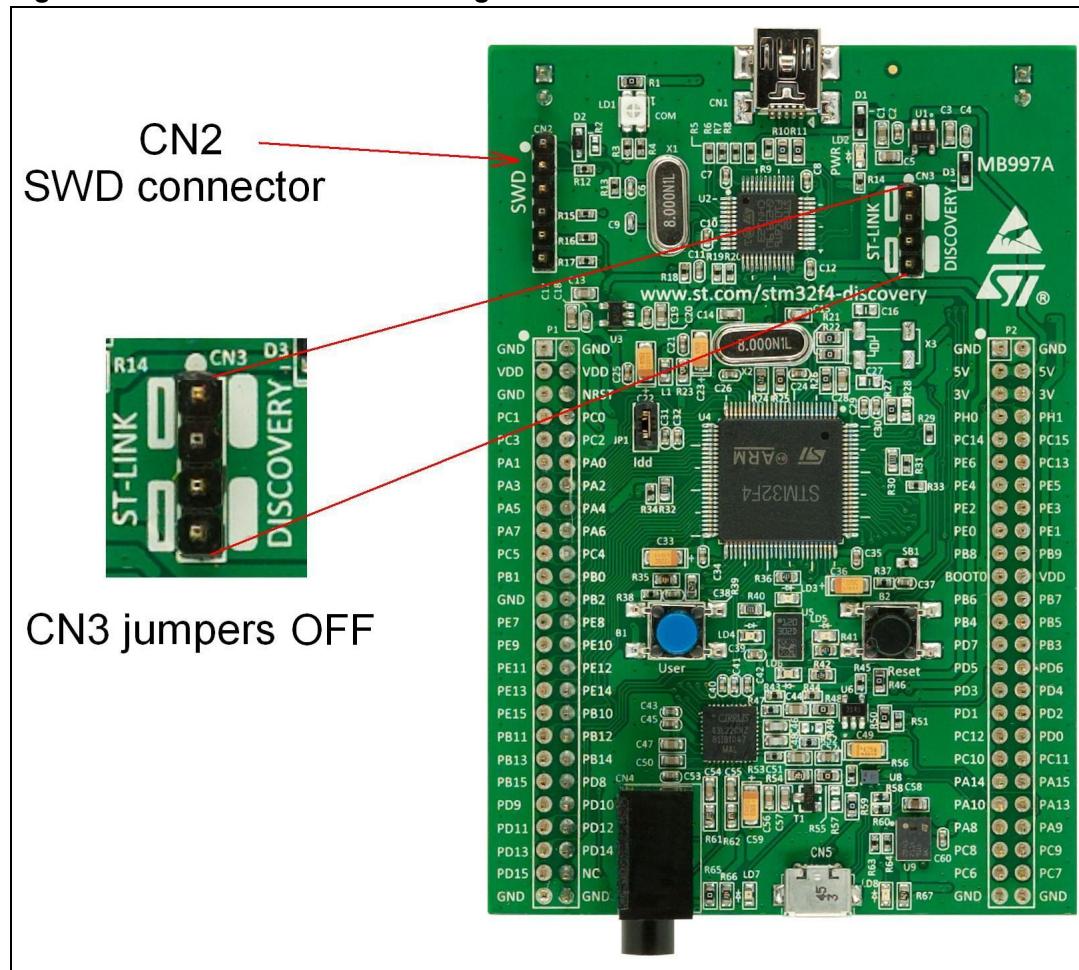
4.3   Power supply and power selection

The power supply is provided either by the host PC through the USB cable, or by an external 5V power supply.

The D1 and D2 diodes protect the 5V and 3V pins from external power supplies:

● 5V and 3V can be used as output power supplies when another application board is connected to pins P1 and P2.
  In this case, the 5V and 3V pins deliver a 5V or 3V power supply and power consumption must be lower than 100 mA.

● 5V can also be used as input power supplies e.g. when the USB connector is not connected to the PC.
  In this case, the STM32F4DISCOVERY board must be powered by a power supply unit or by auxiliary equipment complying with standard EN-60950-1: 2006+A11/2009, and must be Safety Extra Low Voltage (SELV) with limited power capability.

4.4   LEDs

● LD1 COM: LD1 default status is red. LD1 turns to green to indicate that communications are in progress between the PC and the ST-LINK/V2.

● LD2 PWR: red LED indicates that the board is powered.

● User LD3: orange LED is a user LED connected to the I/O PD13 of the STM32F407VGT6.

● User LD4: green LED is a user LED connected to the I/O PD12 of the STM32F407VGT6.

● User LD5: red LED is a user LED connected to the I/O PD14 of the STM32F407VGT6.

● User LD6: blue LED is a user LED connected to the I/O PD15 of the STM32F407VGT6.

● USB LD7: green LED indicates when VBUS is present on CN5 and is connected to PA9 of the STM32F407VGT6.

● USB LD8: red LED indicates an overcurrent from VBUS of CN5 and is connected to the I/O PD5 of the STM32F407VGT6.

4.5   Pushbuttons

● B1 USER: User and Wake-Up button connected to the I/O PA0 of the STM32F407VGT6.

● B2 RESET: Pushbutton connected to NRST is used to RESET the STM32F407VGT6.

4.6   On board audio capability

The STM32F4 uses an audio DAC (CS43L22) to output sounds through the audio mini jack connector.

The STM32F4 controls the audio DAC through the I2C interface and processes digital signals through I2S connection or analog input signal.

● The sound can come independently from different inputs:
  – ST MEMS microphone (MP45DT02): digital using PDM protocol or analog when using the low pass filter.
  – USB connector: from external mass storage such as a USB key, USB HDD, and so on.
  – Internal memory of the STM32F4.
● The sound can be output in different ways through audio DAC:
  – Using I2S protocol
  – Using the STM32F4 DAC to analog input AIN1x of the CS43L22
  – Using the microphone output directly via a low pass filter to analog input AIN4x of the CS43L22

4.7   USB OTG supported

The STM32F4 is used to drive only USB OTG full speed on this board. The USB micro-AB connector (CN5) allows the user to connect a host or device component, such as a USB key, mouse, and so on.

Two LEDs are dedicated to this module:
● LD7 (green LED) indicates when VBUS is active
● LD8 (red LED) indicates an overcurrent from connected device

4.8   Motion sensor (ST MEMS LIS302DL)

The LIS302DL is an ultra compact low-power three-axis linear accelerometer.

It includes a sensing element and an IC interface able to provide the measured acceleration to the external world through I2C/SPI serial interface.

The LIS302DL has dynamically user selectable full scales of ±2g/±8g and it is capable of measuring acceleration with an output data rate of 100 Hz or 400 Hz.

The STM32F4 controls this motion sensor through the SPI interface.

4.9   JP1 (Idd)

Jumper JP1, labeled Idd, allows the consumption of STM32F407VGT6 to be measured by removing the jumper and connecting an ammeter.
● Jumper on: STM32F407VGT6 is powered (default).
● Jumper off: an ammeter must be connected to measure the STM32F407VGT6 current, (if there is no ammeter, the STM32F407VGT6 is not powered).

4.10   OSC clock

4.10.1   OSC clock supply

If PH0 and PH1 are only used as GPIOs instead of as a clock, then SB13 and SB14 are closed and R24, R25 and R68 are removed.

- **MCO from ST-LINK**. From MCO of the STM32F103. This frequency cannot be changed, it is fixed at 8 MHz and connected to PH0-OSC_IN of the STM32F407VGT6. Configuration needed:
  – SB13, SB14 OPEN
  – R25[a] removed
  – R68[a] soldered
- **Oscillator onboard**. From X2 crystal. For typical frequencies and its capacitors and resistors, please refer to the STM32F407VGT6 Datasheet. Configuration needed:
  – SB13, SB14 OPEN
  – R25[a] soldered
  – R68[a] removed
- **Oscillator from external PH0**. From external oscillator through pin 7 of the P2 connector. Configuration needed:
  – SB13 closed
  – SB14 closed
  – R25 and R68 removed

4.10.2   OSC 32 KHz clock supply

If PC14 and PC15 are only used as GPIOs instead of as a clock, then SB15 and SB16 are closed, and R21 and R22 are removed.

- **Oscillator onboard**. From X1 Crystal (not provided). Configuration needed:
  – SB15, SB16 OPEN
  – C16, C27, R21 and R22 soldered.
- **Oscillator from external PC14**. From external oscillator trough the pin 9 of P2 connector. Configuration needed:
  – SB16 closed
  – SB15 closed
  – R21 and R22 removed

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a. As the frequency supplied by X2 is the same as MCO (8 MHz) R25 and R68 are soldered.

4.11 Solder bridges

Table 4. Solder bridges

Bridge	State[1]	Description
SB13,14 (X2 crystal)[2]	**OFF**	X2, C14, C15, R24 and R25 provide a clock. PH0, PH1 are disconnected from P2.
	ON	PH0, PH1 are connected to P2 (R24, R25 and R68 must not be fitted).
SB3,5,7,9 (Default)	**ON**	Reserved, do not modify.
SB2,4,6,8 (Reserved)	**OFF**	Reserved, do not modify.
SB15,16 (X3 crystal)	**OFF**	X3, C16, C27, R21 and R22 deliver a 32 KHz clock. PC14, PC15 are not connected to P2.
	ON	PC14, PC15 are only connected to P2. Remove only R21, R22
SB1 (B2-RESET)	**ON**	B2 pushbutton is connected to the NRST pin of the STM32F407VGT6 MCU.
	OFF	B2 pushbutton is not connected the NRST pin of the STM32F407VGT6 MCU.
SB20 (B1-USER)	**ON**	B1 pushbutton is connected to PA0.
	OFF	B1 pushbutton is not connected to PA0.
SB17 (VDD powered from 3V)	**OFF**	VDD is not powered from 3V, depends on JP1 jumper.
	ON	VDD is permanently powered from 3V, JP1 jumper has no effect.
SB11 (NRST)	**ON**	NRST signal of the CN2 connector is connected to the NRST pin of the STM32F407VGT6 MCU.
	OFF	NRST signal of the CN2 connector is not connected to the NRST pin of the STM32F407VGT6 MCU.
SB12 (SWO)	**ON**	SWO signal of the CN2 connector is connected to PB3.
	OFF	SWO signal is not connected.
SB10 (STM_RST)	**OFF**	No incidence on STM32F103C8T6 (ST-LINK/V2) NRST signal.
	ON	STM32F103C8T6 (ST-LINK/V2) NRST signal is connected to GND.
SB18 (BOOT0)	**ON**	BOOT0 signal of the STM32F407VGT6 MCU is held low through a 510 ohm pull-down resistor.
	OFF	BOOT0 signal of the STM32F407VGT6 MCU is held high through a 10 Kohm pull-up resistor.
SB19 (BOOT1)	**OFF**	The BOOT1 signal of the STM32F407VGT6 MCU is held high through a 10 Kohm pull-up resistor.
	ON	The BOOT1 signal of the STM32F407VGT6 MCU is held low through a 510 ohm pull-down resistor.

1. Default SBx state is shown in bold.

2. SB13 and SB14 are OFF to allow the user to choose between MCO and X2 crystal for clock source.

4.12   Extension connectors

The male headers P1 and P2 can connect the STM32F4DISCOVERY to a standard prototyping/wrapping board. STM32F407VGT6 GPI/Os are available on these connectors. P1 and P2 can also be probed by an oscilloscope, logical analyzer or voltmeter.

Table 5.   MCU pin description versus board function (page 1 of 10)

MCU pin			Board function													
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
BOOT0	VPP	94														21
NRST		14				RESET		NRST						5	6	
PA0-WKUP	USART2_CTS/ USART4_TX/ ETH_MII_CRS/ TIM2_CH1_ETR/ TIM5_CH1/ TIM8_ETR/ ADC123_IN0/ WKUP	23				USER									12	
PA1	USART2_RTS/ USART4_RX/ ETH_RMII_REF_CLK/ ETH_MII_RX_CLK/ TIM5_CH2/ TIMM2_CH2/ ADC123_IN1	24													11	
PA2	USART2_TX/ TIM5_CH3/ TIM9_CH1/ TIM2_CH3/ ETH_MDIO/ ADC123_IN2	25													14	
PA3	USART2_RX/ TIM5_CH4/ TIM9_CH2/ TIM2_CH4/ OTG_HS_ULPI_D0/ ETH_MII_COL/ ADC123_IN3	26													13	

Table 5. MCU pin description versus board function (page 2 of 10)

MCU pin			Board function													
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PA4	SPI1_NSS/ SPI3_NSS/ USART2_CK/ DCMI_HSYNC/ OTG_HS_SOF/ I2S3_WS/ ADC12_IN4/ DAC1_OUT	29	LRCK/AIN1x												16	
PA5	SPI1_SCK/ OTG_HS_ULPI_CK/ TIM2_CH1_ETR/ TIM8_CHIN/ ADC12_IN5/ DAC2_OUT	30			SCL/SPC										15	
PA6	SPI1_MISO/ TIM8_BKIN/ TIM13_CH1/ DCMI_PIXCLK/ TIM3_CH1/ TIM1_BKIN/ ADC12_IN6	31			SDO										18	
PA7	SPI1_MOSI/ TIM8_CH1N/ TIM14_CH1TIM3_CH2/ ETH_MII_RX_DV/ TIM1_CH1N/ RMII_CRS_DV/ ADC12_IN7	32			SDA/SDI/SDO										17	
PA8	MCO1/ USART1_CK/ TIM1_CH1/ I2C3_SCL/ OTG_FS_SOF	67									Free I/O					43
PA9	USART1_TX/ TIM1_CH2/ I2C3_SMBA/ DCMI_D0/ OTG_FS_VBUS	68					GREEN		VBUS				1			44
PA10	USART1_RX/ TIM1_CH3/ OTG_FS_ID/ DCMI_D1	69							ID				4			41

Table 5.　　MCU pin description versus board function (page 3 of 10)

MCU pin			Board function													
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PA11	USART1_CTS/ CAN1_RX/ TIM1_CH4/ OTG_FS_DM	70							DM				2			
PA12	USART1_RTS/ CAN1_TX/ TIM1_ETR/ OTG_FS_DP	71							DP				3			
PA13	JTMS-SWDIO	72						SWDIO						4		42
PA14	JTCK-SWCLK	76						SWCLK						2		39
PA15	JTDI/ SPI3_NSS/ I2S3_WS/ TIM2_CH1_ETR/ SPI1_NSS	77														40
PB0	TIM3_CH3/ TIM8_CH2N/ OTG_HS_ULPI_D1/ ETH_MII_RXD2/ TIM1_CH2N/ ADC12_IN8	35													22	
PB1	TIM3_CH4/ TIM8_CH3N/ OTG_HS_ULPI_D2/ ETH_MII_RXD3/ OTG_HS_INTN/ TIM1_CH3N/ ADC12_IN9	36													21	
PB2		37													24	
PB3	JTDO/ TRACESWO/ SPI3_SCK/ I2S3_CK/ TIM2_CH2/ SPI1_SCK	89						SWO						6		28

Table 5.   MCU pin description versus board function (page 4 of 10)

MCU pin			Board function													
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PB4	NJTRST/ SPI3_MISO/ TIM3_CH1/ SPI1_MISO/ I2S3ext_SD	90														25
PB5	I2C1_SMBA/ CAN2_RX/ OTG_HS_ULPI_D7/ ETH_PPS_OUT/ TIM3_CH2/ SPI1_MOSI/ SPI3_MOSI/ DCMI_D10/ I2S3_SD	91														26
PB6	I2C1_SCL/ TIM4_CH1/ CAN2_TX/ OTG_FS_INTN/ DCMI_D5/ USART1_TX	92	SCL													23
PB7	I2C1_SDA/ FSMC_NL/ DCMI_VSYNC/ USART1_RX/ TIM4_CH2	93														24
PB8	TIM4_CH3/ SDIO_D4/ TIM10_CH1/ DCMI_D6/ OTG_FS_SCL/ ETH_MII_TXD3/ I2C1_SCL/ CAN1_RX	95														19
PB9	SPI2_NSS/ I2S2_WS/ TIM4_CH4/ TIM11_CH1/ OTG_FS_SDA/ SDIO_D5/ DCMI_D7/ I2C1_SDA/ CAN1_TX	96	SDA													20

Table 5.   MCU pin description versus board function (page 5 of 10)

MCU pin			Board function													
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PB10	SPI2_SCK/ I2S2_CK/ I2C2_SCL/ USART3_TX/ OTG_HS_ULPI_D3/ ETH_MII_RX_ER/ OTG_HS_SCL/ TIM2_CH3	47		CLK											34	
PB11	I2C2_SDA/ USART3_RX/ OTG_HS_ULPI_D4/ ETH_RMII_TX_EN/ ETH_MII_TX_EN/ OTG_HS_SDA/ TIM2_CH4	48													35	
PB12	SPI2_NSS/ I2S2_WS/ I2C2_SMBA/ USART3_CK/ TIM1_BKIN/ CAN2_RX/ OTG_HS_ULPI_D5/ ETH_RMII_TXD0/ ETH_MII_TXD0/ OTG_HS_ID	51													36	
PB13	SPI2_SCK/ I2S2_CK/ USART3_CTS/ TIM1_CH1N/ CAN2_TX/ OTG_HS_ULPI_D6/ ETH_RMII_TXD1/ ETH_MII_TXD1/ OTG_HS_VBUS	52													37	
PB14	SPI2_MISO/ TIM1_CH2N/ TIM12_CH1/ OTG_HS_DMUSART3_ RTS/ TIM8_CH2N/ I2S2ext_SD	53													38	

Table 5.   MCU pin description versus board function (page 6 of 10)

MCU pin			Board function												
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PB15	SPI2_MOSI/ I2S2_SD/ TIM1_CH3N/ TIM8_CH3N/ TIM12_CH2/ OTG_HS_DP	54													39	
PC0	OTG_HS_ULPI_STP/ ADC123_IN10	15							PowerOn						8	
PC1	ETH_MDC/ ADC123_IN11	16													7	
PC2	SPI2_MISO/ OTG_HS_ULPI_DIR/ TH_MII_TXD2/ I2S2ext_SD/ ADC123_IN12	17													10	
PC3	SPI2_MOSI/ I2S2_SD/ OTG_HS_ULPI_NXT/ ETH_MII_TX_CLK/ ADC123_IN13	18		DOUT/AIN4x											9	
PC4	ETH_RMII_RX_D0/ ETH_MII_RX_D0/ ADC12_IN14	33													20	
PC5	ETH_RMII_RX_D1/ ETH_MII_RX_D1/ ADC12_IN15	34													19	
PC6	I2S2_MCK/ TIM8_CH1/ SDIO_D6/ USART6_TX/ DCMI_D0/ TIM3_CH1	63														47
PC7	I2S3_MCK/ TIM8_CH2/ SDIO_D7/ USART6_RX/ DCMI_D1/ TIM3_CH2	64	MCLK													48

Table 5.   MCU pin description versus board function (page 7 of 10)

MCU pin			Board function												
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PC8	TIM8_CH3/ SDIO_D0/ TIM3_CH3/ USART6_CK/ DCMI_D2	65														45
PC9	I2S_CKIN/ MCO2/ TIM8_CH4/ SDIO_D1/ I2C3_SDA/ DCMI_D3/ TIM3_CH4	66														46
PC10	SPI3_SCK/ I2S3_CK/ UART4_TX/ SDIO_D2/ DCMI_D8/ USART3_TX	78	SCLK													37
PC11	UART4_RX/ SPI3_MISO/ SDIO_D3/ DCMI_D4/ USART3_RX/ I2S3ext_SD	79														38
PC12	UART5_TX/ SDIO_CK/ DCMI_D9/ SPI3_MOSI/ I2S3_SD/ USART3_CK	80	SDIN													35
PC13	RTC_AF1	7														12
PC14	OSC32_IN	8								OSC32_IN						9
PC15	OSC32_OUT	9								OSC32_OUT						10
PD0	FSMC_D2/ CAN1_RX	81														36

Table 5.   MCU pin description versus board function (page 8 of 10)

MCU pin			Board function												
Main function	**Alternate functions**	**LQFP100**	**CS43L22**	**MP45DT02**	**LIS302DL**	**Pushbutton**	**LED**	**SWD**	**USB**	**OSC**	**Free I/O**	**Power supply**	**CN5**	**CN2**	**P1**	**P2**
PD1	FSMC_D3/ CAN1_TX	82														33
PD2	TIM3_ETR/ UART5_RXSDIO_CMD / DCMI_D11	83														34
PD3	FSMC_CLK/ USART2_CTS	84														31
PD4	FSMC_NOE/ USART2_RTS	85	RESET													32
PD5	FSMC_NWE/ USART2_TX	86					RED				OverCurrent					29
PD6	FSMC_NWAIT/ USART2_RX	87														30
PD7	USART2_CK/ FSMC_NE1/ FSMC_NCE2	88														27
PD8	FSMC_D13/ USART3_TX	55													40	
PD9	FSMC_D14/ USART3_RX	56													41	
PD10	FSMC_D15/ USART3_CK	57													42	
PD11	FSMC_A16/ USART3_CTS	58													43	
PD12	FSMC_A17/ TIM4_CH1/ USART3_RTS	59					GREEN								44	
PD13	FSMC_A18/ TIM4_CH2	60					ORANGE								45	
PD14	FSMC_D0/ TIM4_CH3	61					RED								46	
PD15	FSMC_D1/ TIM4_CH4	62					BLUE								47	

Table 5.   MCU pin description versus board function (page 9 of 10)

Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PE0	TIM4_ETR/ FSMC_NBL0/ DCMI_D2	97			INT1											17
PE1	FSMC_NBL1/ DCMI_D3	98			INT2											18
PE2	TRACECLK/ FSMC_A23/ ETH_MII_TXD3	1			CS_I2C/SPI											15
PE3	TRACED0/ FSMC_A19	2														16
PE4	TRACED1/ FSMC_A20/ DCMI_D4	3														13
PE5	TRACED2/ FSMC_A21/ TIM9_CH1/ DCMI_D6	4														14
PE6	TRACED3/ FSMC_A22/ TIM9_CH2/ DCMI_D7	5														11
PE7	FSMC_D4/ TIM1_ETR	38													25	
PE8	FSMC_D5/ TIM1_CH1N	39													26	
PE9	FSMC_D6/ TIM1_CH1	40													27	
PE10	FSMC_D7/ TIM1_CH2N	41													28	
PE11	FSMC_D8/ TIM1_CH2	42													29	
PE12	FSMC_D9/ TIM1_CH3N	43													30	
PE13	FSMC_D10/ TIM1_CH3	44													31	
PE14	FSMC_D11/ TIM1_CH4	45													32	

Table 5. MCU pin description versus board function (page 10 of 10)

MCU pin			Board function														
Main function	Alternate functions	LQFP100	CS43L22	MP45DT02	LIS302DL	Pushbutton	LED	SWD	USB	OSC	Free I/O	Power supply	CN5	CN2	P1	P2
PE15	FSMC_D12/ TIM1_BKIN	46													33	
PH0	OSC_IN	12								OSC_IN						7
PH1	OSC_OUT	13								OSC_OUT						8
												5V				3
												5V				4
												3V				5
												3V				6
												VDD			3	
												VDD			4	
												VDD				22
								GND	GND			GND	5	3	1	
												GND			2	
												GND			5	
												GND			23	
												GND			49	
												GND			50	
												GND				1
												GND				2
												GND				49
												GND				50

5   Mechanical drawing

Figure 10.   STM32F4DISCOVERY mechanical drawing
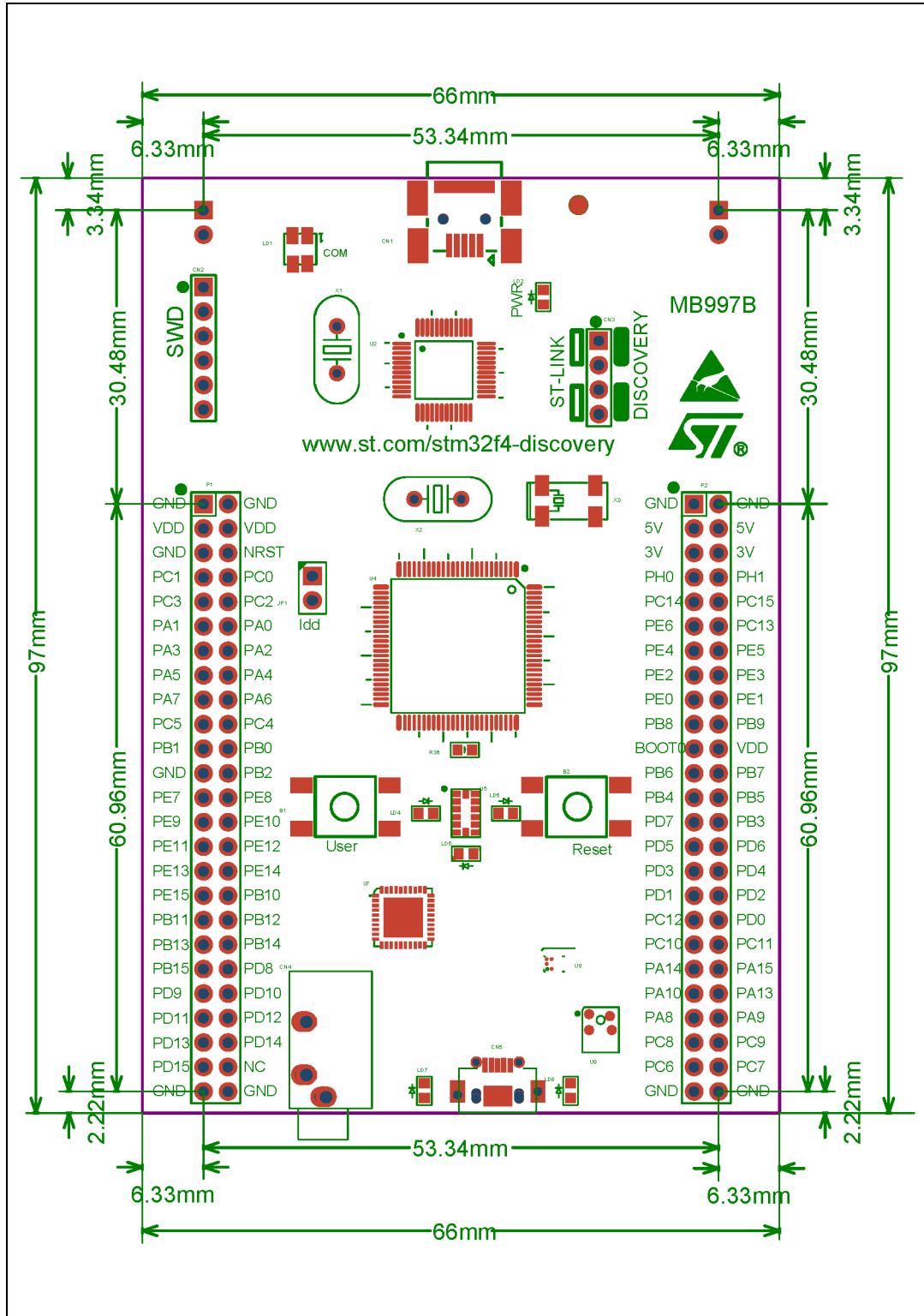
6   Electrical schematics

Figure 11.   STM32F4DISCOVERY
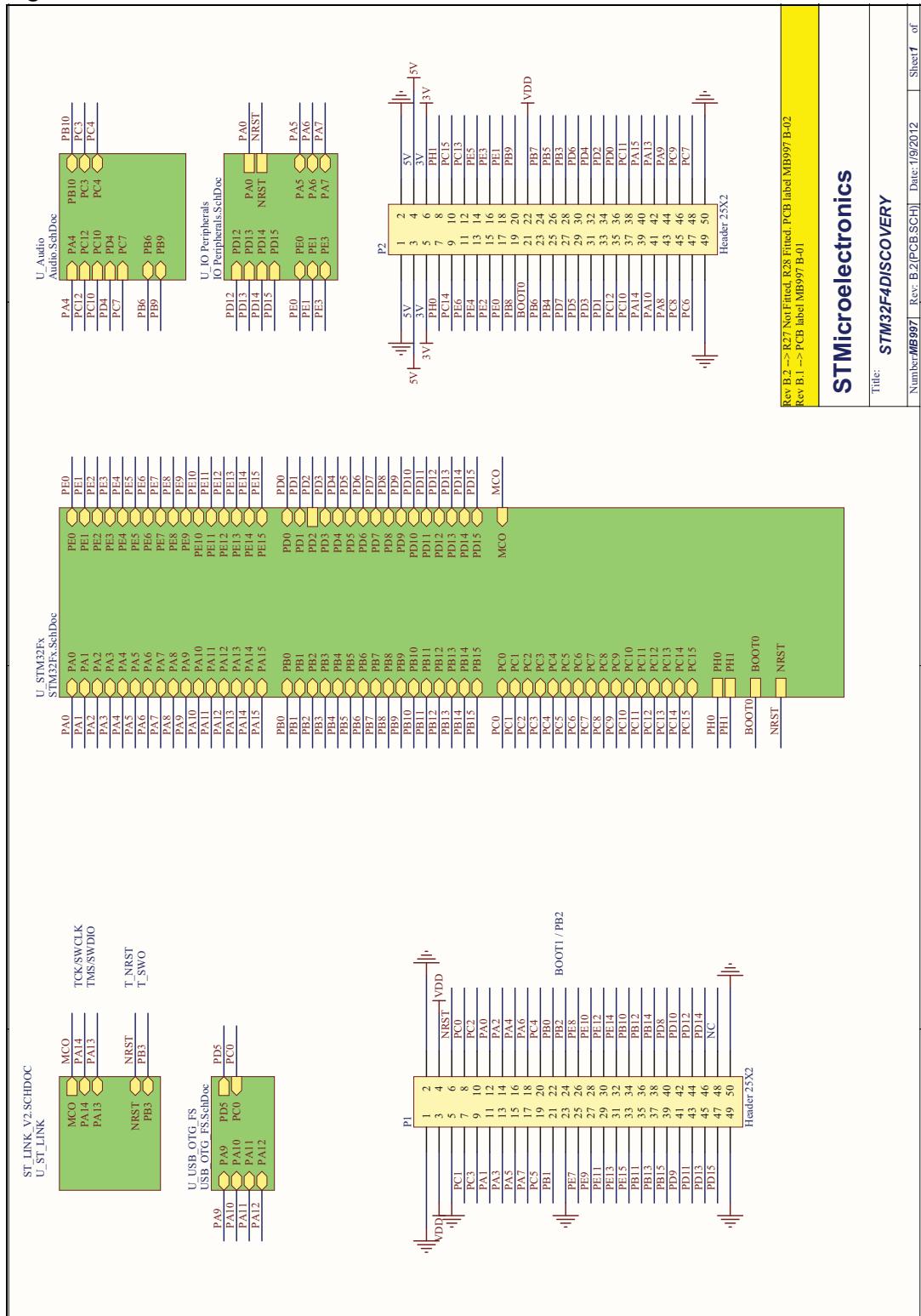
Figure 12. ST-LINK/V2 (SWD only)
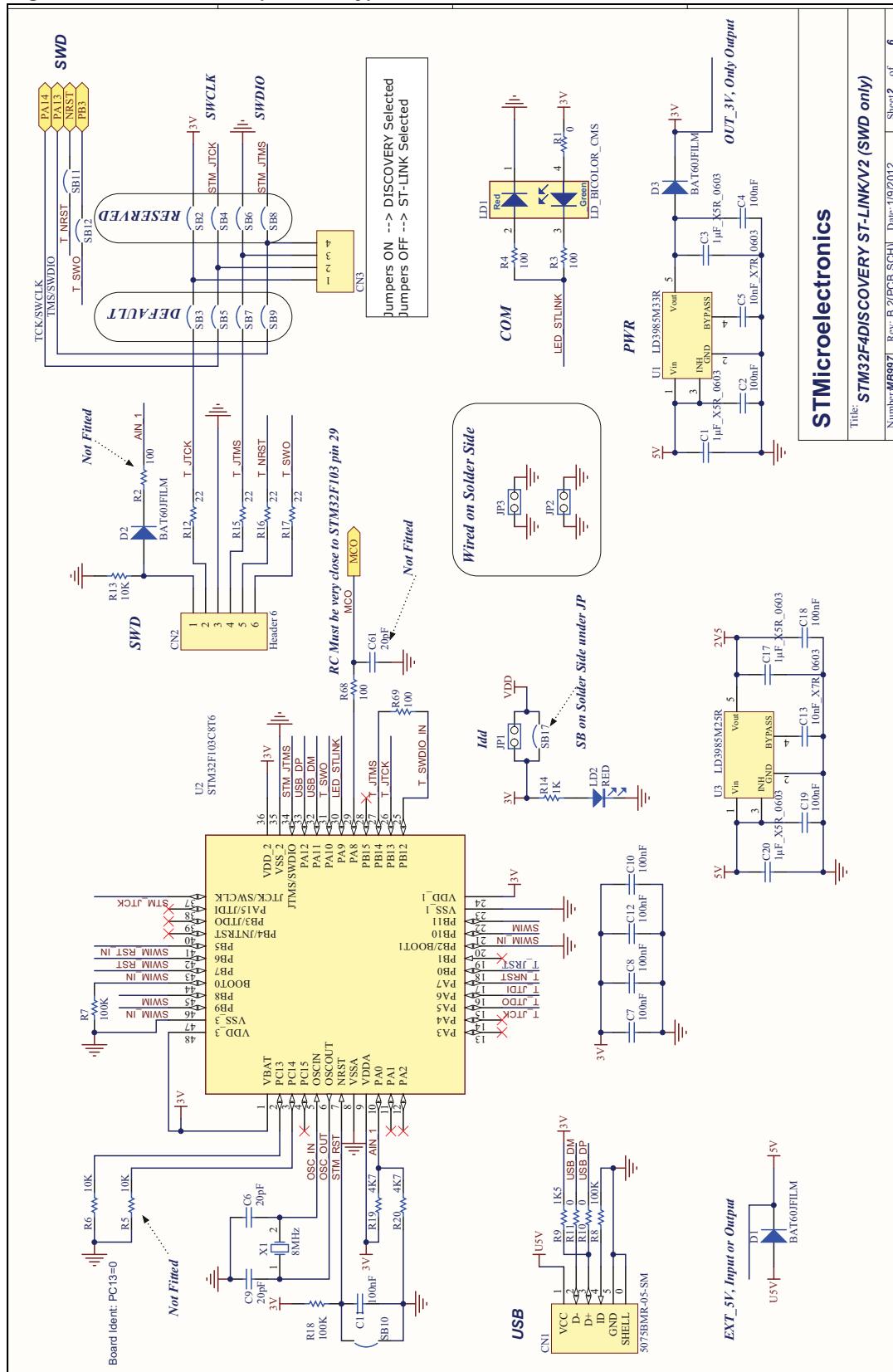
Figure 13. MCU
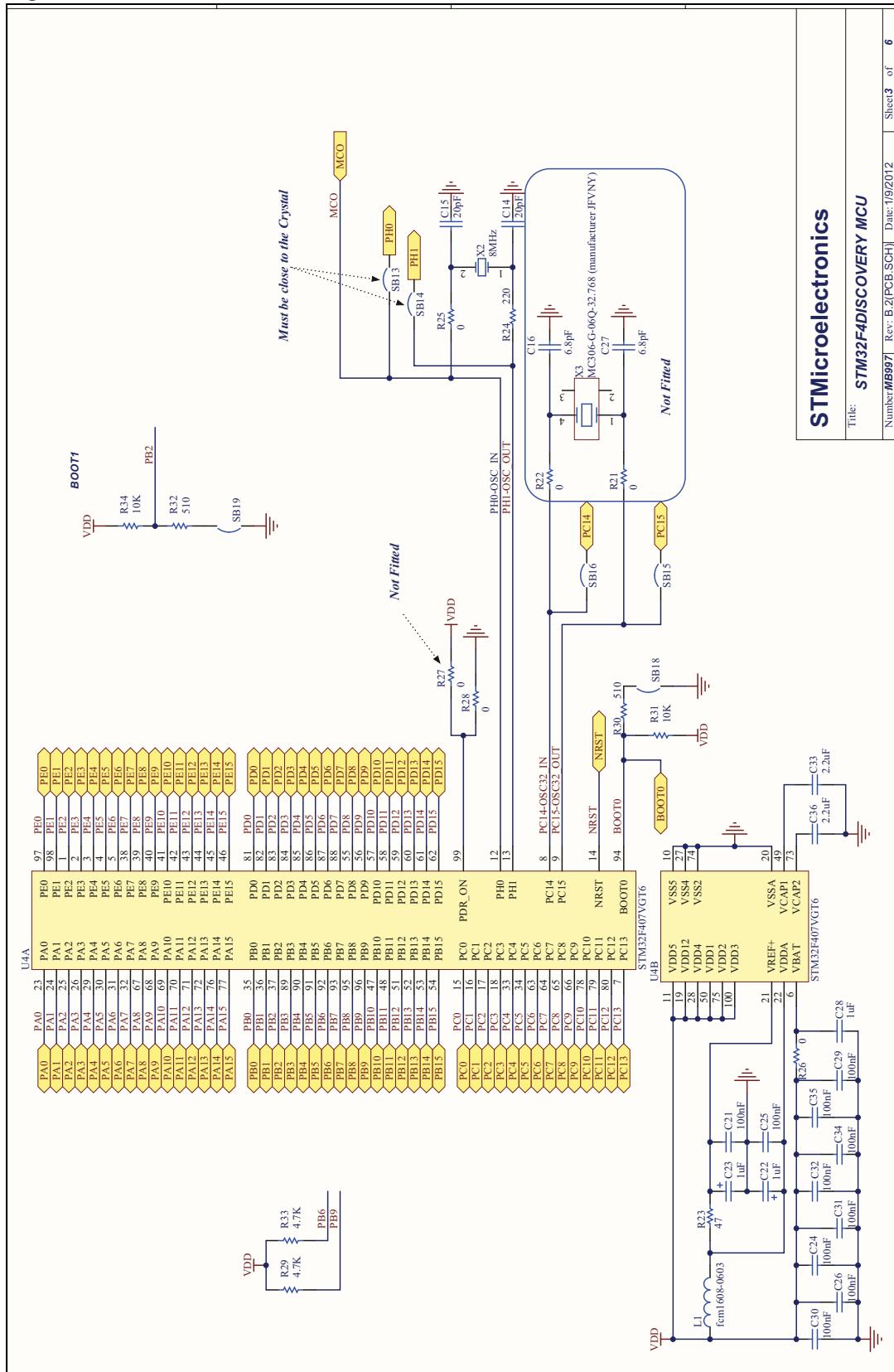
Figure 14. Audio
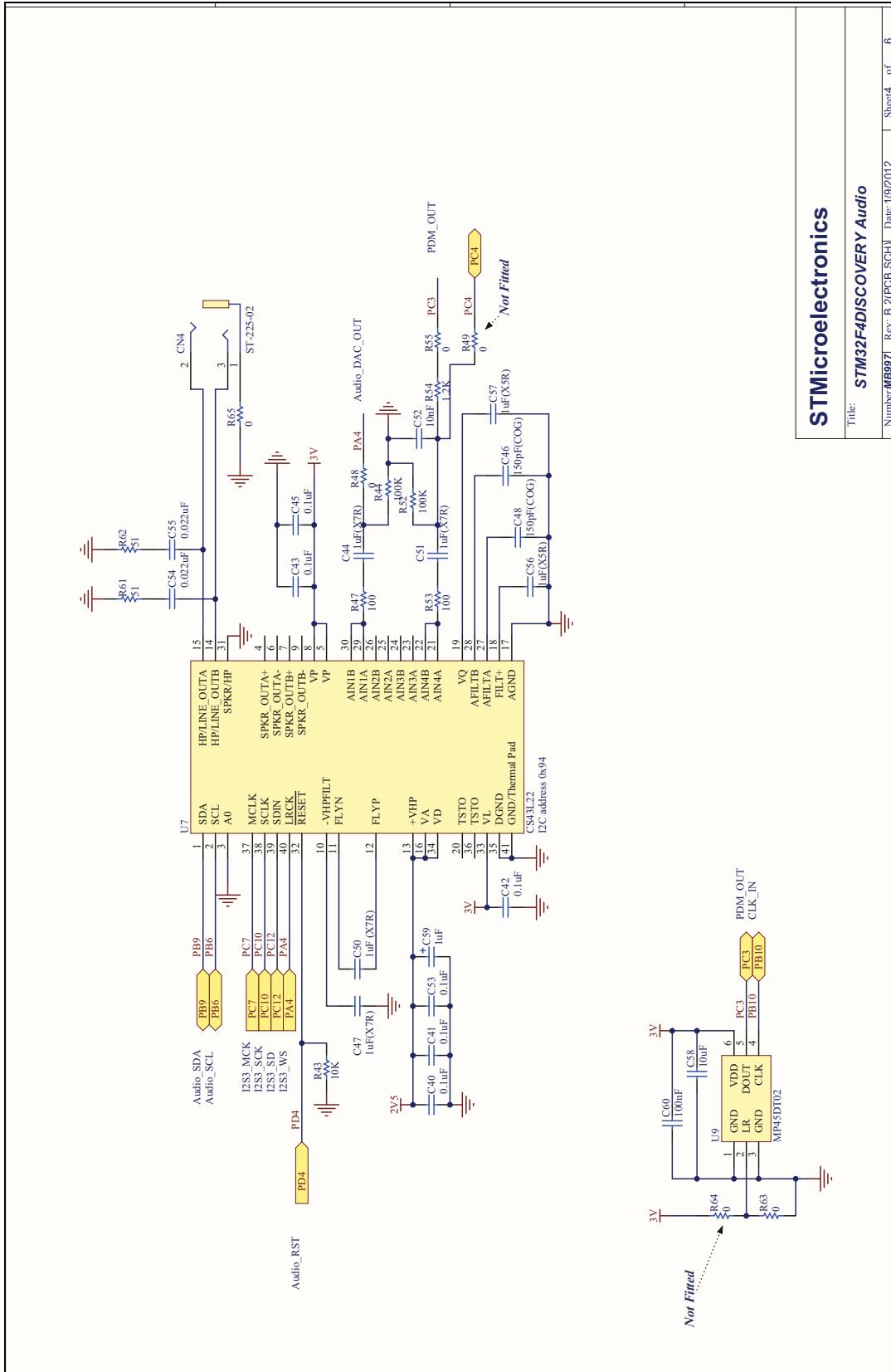
Figure 15.   USB_OTG_FS
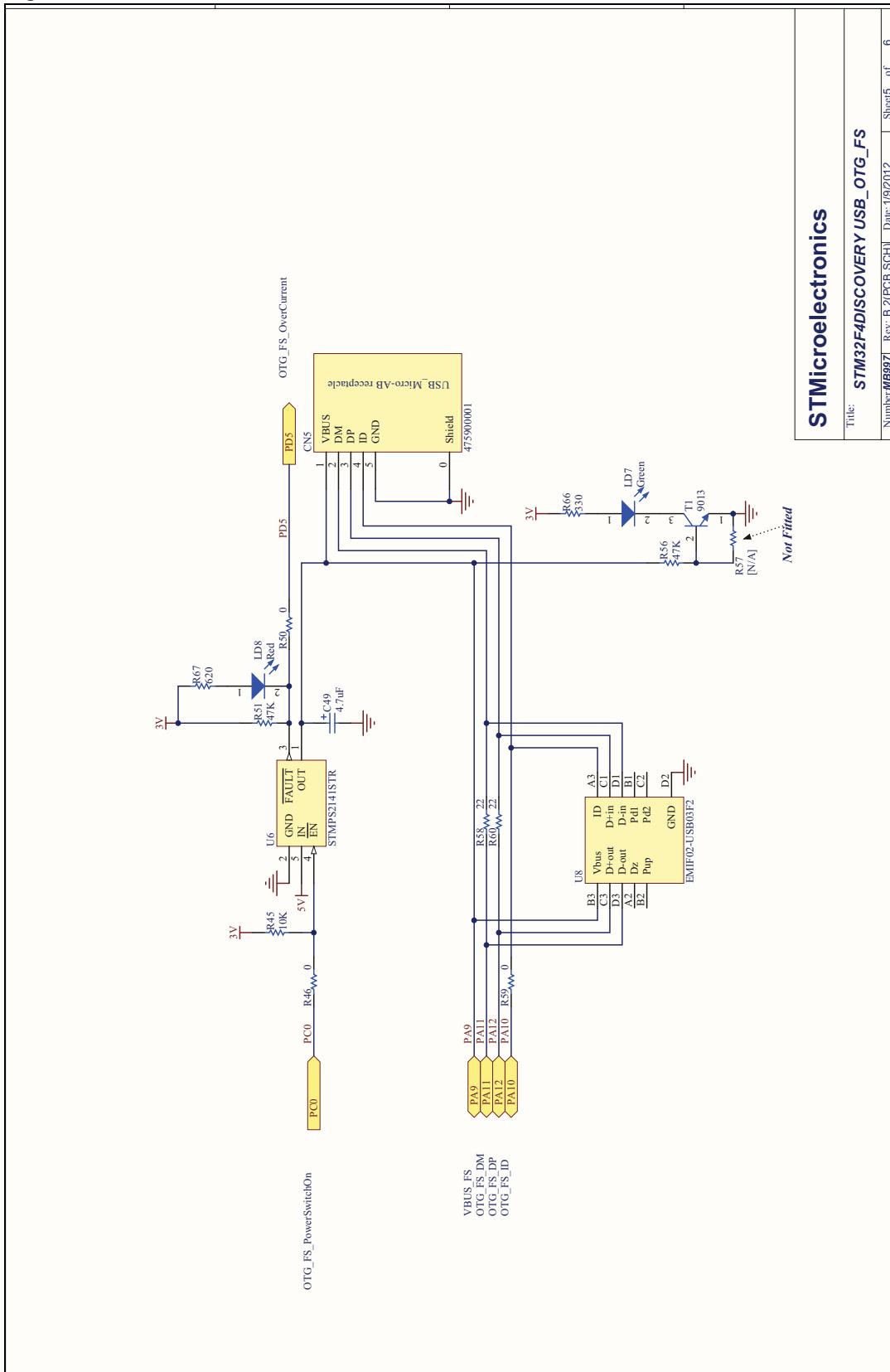
Figure 16.   Peripherals
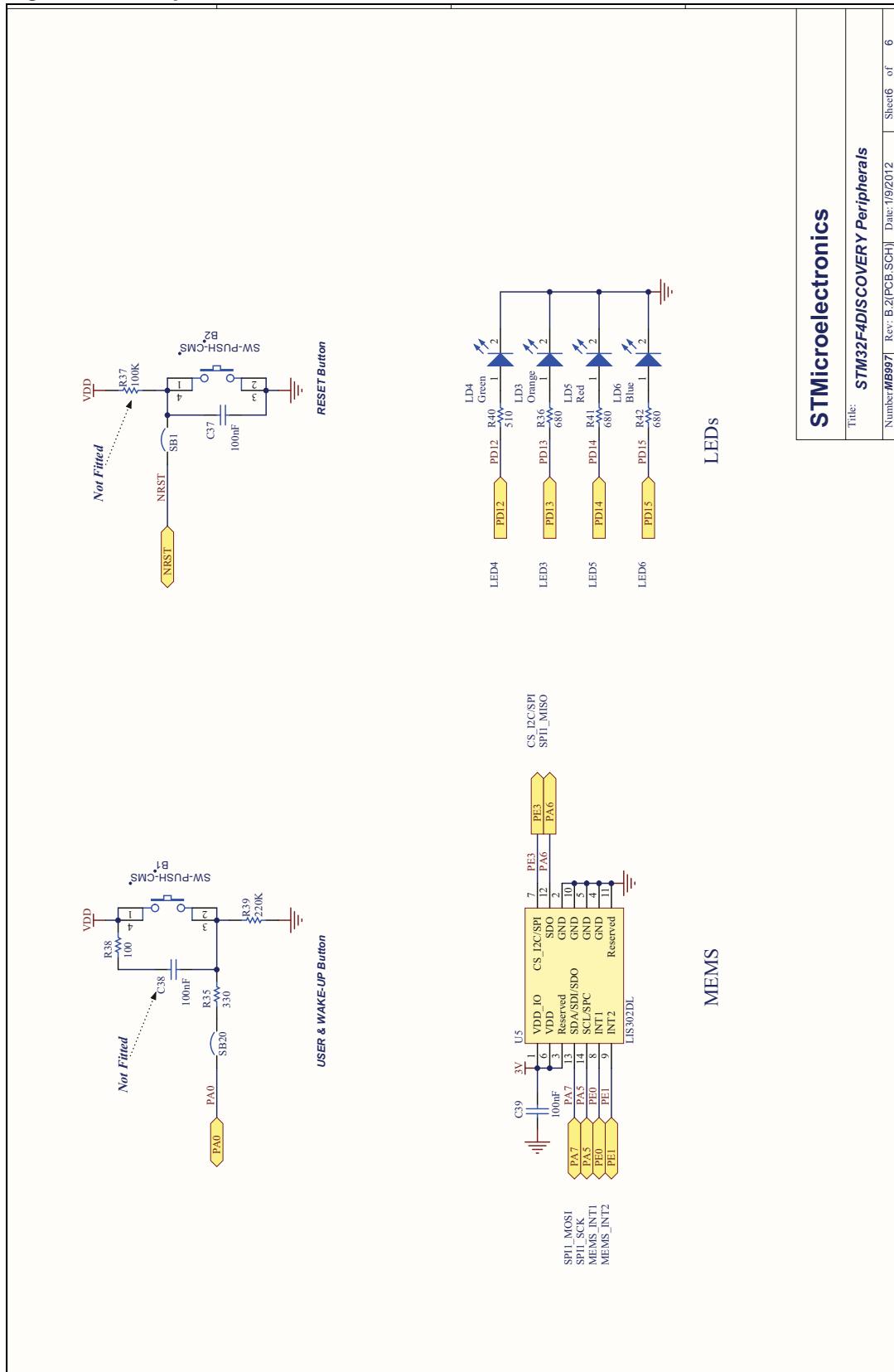
7 Revision history

Table 6.   Document revision history

Date	Revision	Changes
27-Sept-2011	1	Initial release.
19-Jan-2012	2	Added *Section 4.1: STM32F407VGT6 microcontroller* corrected *Figure 3* MCU name, modified *Figure 2* and *Chapter 6: Electrical schematics*.

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