

Introduction

The STM32F469I-DISCO discovery board (32F469IDISCOVERY) is a complete demonstration and development platform for STMicroelectronics ARM® Cortex® -M4 core-based STM32F469NIH6 microcontroller. This microcontroller features three I²C interfaces, six SPIs with two multiplexed full-duplex I²S interfaces, SDIO, four USART ports, four UART ports, two CAN buses, three 12-bit ADCs, two 12-bit DACs, one SAI, 8 to 14-bit digital camera digital module interface, internal 320+4 Kbytes of SRAM and 2-Mbyte Flash memory, USB HS OTG and USB FS OTG, Ethernet MAC, FMC interface, MIPI DSI interface, Quad-SPI interface, JTAG debugging support. This discovery board offers everything required for users to quickly get started and develop applications easily.

The hardware features on the board help users to evaluate the following peripherals: USB OTG FS, microSD card, Audio DAC with headset jack, digital microphones, SDRAM, Quad-SPI Flash memory, 4" TFT LCD using MIPI DSI interface with capacitive touch panel. The Arduino™ compatible connectors expand the functionality with a wide choice of specialized shields. The extension header makes it possible to easily connect a daughterboard for specific application. The integrated ST-LINK/V2-1 provides an embedded in-circuit debugger and programmer for the STM32 MCU.

Figure 1. STM32F469I-DISCO board (top view)

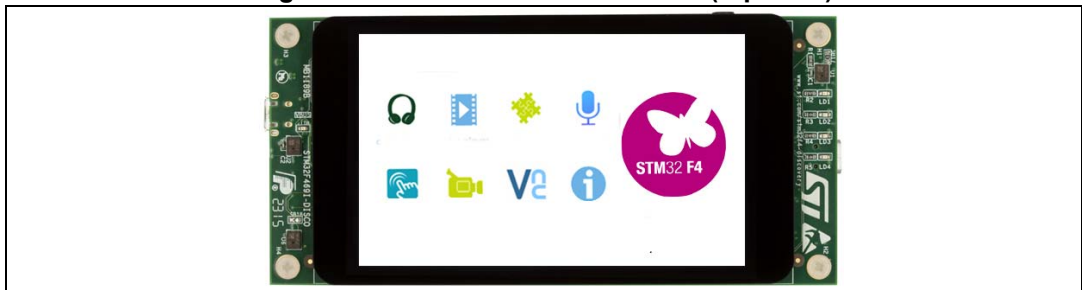
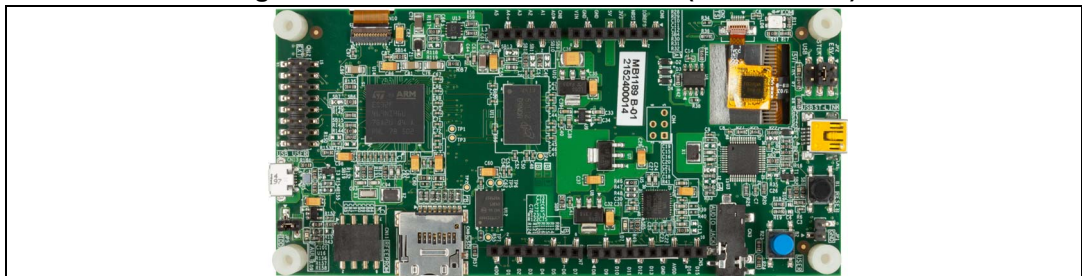


Figure 2. STM32F469I-DISCO board (bottom view)



1. Pictures not contractual.



Contents

1	Features	6
2	Product marking	7
3	Demonstration software	7
4	Order code	7
5	Technology partners	7
6	Hardware layout and configuration	8
6.1	Embedded ST-LINK/V2-1	11
6.1.1	Drivers	11
6.1.2	ST-LINK/V2-1 firmware upgrade	11
6.2	Power supply	12
6.2.1	Power supply sources	12
6.2.2	Supplying the board through ST-LINK/V2-1 USB port	12
6.2.3	Measurement of current IDD drawn by the STM32F469NI	13
6.2.4	Power related jumpers	13
6.3	Clock source	14
6.3.1	HSE clock source	14
6.3.2	LSE clock source	14
6.4	Reset source	14
6.5	Audio outputs	15
6.6	Digital microphones	15
6.7	USB OTG FS	15
6.8	MicroSD card	16
6.9	SDRAM	16
6.10	Quad-SPI NOR Flash memory	16
6.11	Virtual COM port	16
6.12	Arduino connectors	16
6.13	Extension connector CN12	18
6.14	DSI LCD	20

6.15	Buttons and LEDs	21
6.16	I2C extension connector CN11	22
6.17	USB OTG FS Micro-AB connector CN13	22
6.18	MicroSD connector CN9	23
6.19	ST-LINK/V2-1 USB Mini Type B connector CN1	24
6.20	Audio jack CN3	24
7	Schematics	25
	Appendix A Mechanical dimensions.....	37
	Appendix B Federal Communications Commission (FCC) and Industry Canada (IC) Compliance	38
B.1	FCC Compliance Statement	38
B.1.1	Part 15.19	38
B.1.2	Part 15.105	38
B.1.3	Part 15.21	38
B.2	IC Compliance Statement	38
B.2.1	Compliance Statement	38
B.2.2	Déclaration de conformité	38
8	Revision History	39

List of tables

Table 1.	Power related jumpers	13
Table 2.	Arduino compatible connectors	16
Table 3.	Arduino compatible connectors	17
Table 4.	Extension connector pinout	19
Table 5.	DSI LCD module connector (CN10)	20
Table 6.	Port assignment for control of LED indicators	21
Table 7.	I2C extension connector pinout	22
Table 8.	USB OTG FS Micro-AB connector CN13	22
Table 9.	MicroSD connector CN9	23
Table 10.	USB Mini type B connector CN1	24
Table 11.	Document Revision History	39

List of figures

Figure 1.	STM32F469I-DISCO board (top view)	1
Figure 2.	STM32F469I-DISCO board (bottom view)	1
Figure 3.	Hardware block diagram	8
Figure 4.	STM32F469I-DISCO top side layout	9
Figure 5.	STM32F469I-DISCO bottom side layout	10
Figure 6.	USB Composite device	11
Figure 7.	Extension connector CN12	18
Figure 8.	I2C extension connector (front view)	22
Figure 9.	USB OTG FS Micro-AB connector CN13 (front view)	22
Figure 10.	MicroSD connector CN9 (front view)	23
Figure 11.	USB type Mini B connector CN1 (front view)	24
Figure 12.	STM32F469I-DISCO Discovery board	25
Figure 13.	STM32F469I-DISCO MCU	26
Figure 14.	Extension connectors	27
Figure 15.	Power	28
Figure 16.	Peripherals	29
Figure 17.	Audio codec and microphone MEMS	30
Figure 18.	4-inch DSI LCD board	31
Figure 19.	SDRAM	32
Figure 20.	QSPI	33
Figure 21.	USB OTG FS	34
Figure 22.	Arduino UNO connector	35
Figure 23.	ST-LINK/V2-1	36
Figure 24.	Mechanical dimensions in millimeter	37

1 Features

- STM32F469NIH6 microcontroller featuring 2 Mbytes of Flash memory and 324 Kbytes of RAM in BGA216 package
- On-board ST-LINK/V2-1 SWD debugger, supporting USB reenumeration capability:
 - mbed™-enabled (mbed.org)
 - USB functions: USB virtual COM port, mass storage, debug port
- 4-inch 800x480 pixel TFT color LCD with MIPI DSI interface and capacitive touch screen
- SAI Audio DAC, with a stereo headphone output jack
- Three MEMS microphones
- MicroSD card connector
- I2C extension connector
- 4Mx32bit SDRAM
- 128-Mbit Quad-SPI NOR Flash
- Reset and wake-up buttons
- 4 color user LEDs
- USB OTG FS with Micro-AB connector
- Three power supply options:
 - ST-LINK/V2-1 USB connector
 - User USB FS connector
 - VIN from Arduino™ compatible connectors
- Expansion connectors and Arduino™ UNO V3 connectors
- Comprehensive free software including a variety of examples, part of STM32Cube package
- Supported by a wide choice of integrated development environments

2 Product marking

Evaluation tools marked as "ES" or "E" are not yet qualified and therefore they are not ready to be used as reference design or in production. Any consequences deriving from such usage will not be at ST charge. In no event, ST will be liable for any customer usage of these engineering sample tools as reference design or in production.

"E" or "ES" marking examples of location:

- On the targeted STM32 that is soldered on the board (for illustration of STM32 marking, refer to the section "Package information" of the STM32 datasheet available at www.st.com).
- Next to the evaluation tool ordering part number, that is stuck or silk-screen printed on the board.

3 Demonstration software

The demonstration software is preloaded in the STM32F469NIH6 Flash memory and in the MICRON N25Q128A NOR Flash memory. The latest version of the demonstration source code and associated documentation can be downloaded from the www.st.com/stm32f4discovery webpage.

4 Order code

To order the Discovery kit based on the STM32F469NI MCU, use the order code: STM32F469I-DISCO.

5 Technology partners

MICRON:

- 128-Mbit SDRAM device, part number **MT48LC4M32B2**
- 128-Mbit Quad-SPI NOR Flash memory device, part number **N25Q128A**

6 Hardware layout and configuration

STM32F469I-DISCO evaluation board is designed around the STM32F469NIH6 (216-pin TFBGA package). The [Figure 3](#) illustrates the connection between STM32F469NIH6 and peripherals (SDRAM, Quad-SPI Flash memory, color LCD, USB OTG connector, Audio, I²C extension connector, microSD card and embedded ST-LINK). [Figure 4: STM32F469I-DISCO top side layout](#) and [Figure 5: STM32F469I-DISCO bottom side layout](#) will help to locate these features on the actual evaluation board.

Figure 3. Hardware block diagram

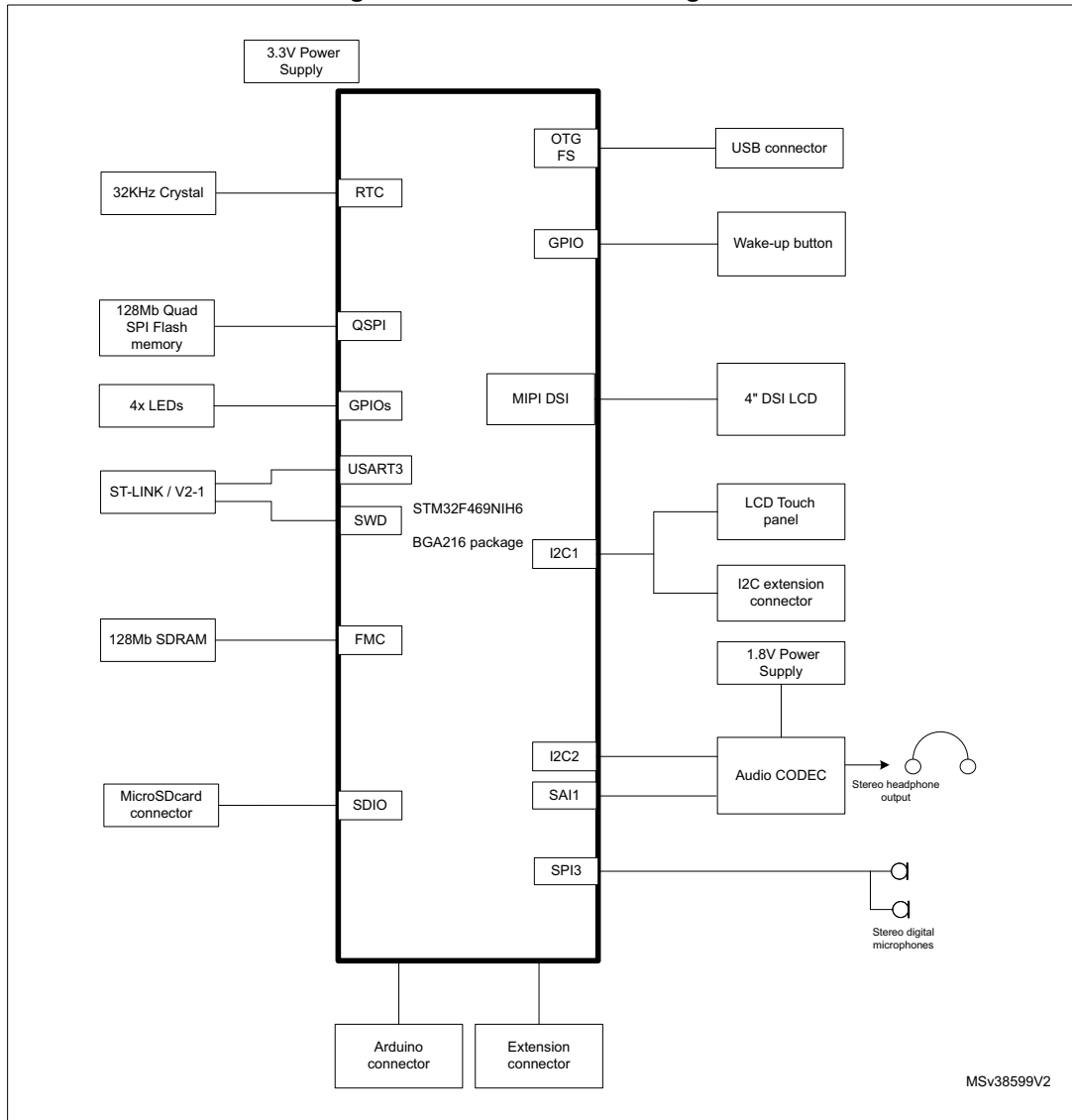


Figure 4. STM32F469I-DISCO top side layout

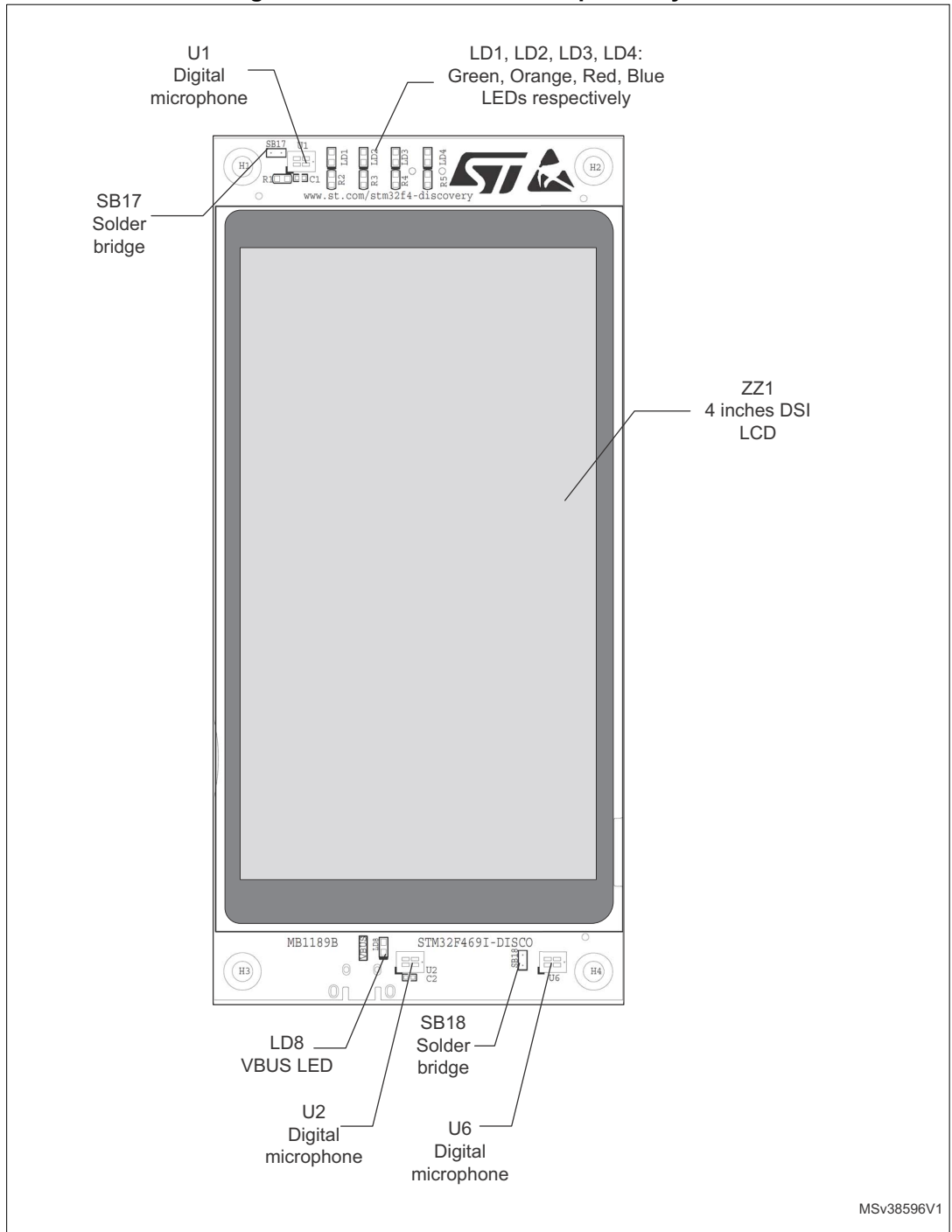
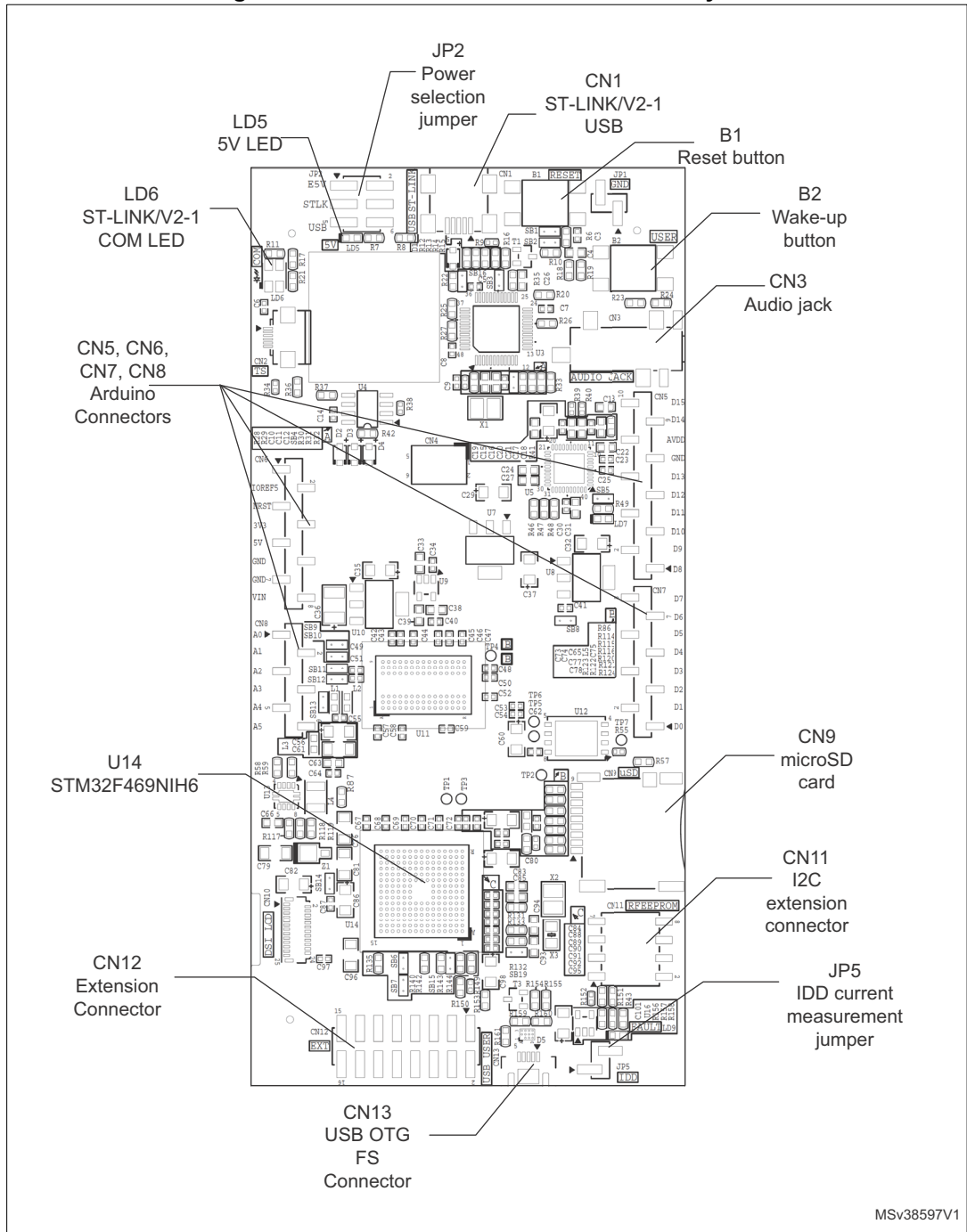


Figure 5. STM32F469I-DISCO bottom side layout



MSv38597V1

6.1 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the STM32469I-DISCO board. Compared to ST-LINK/V2 the new features supported on ST-LINK/V2-1 are:

- USB software re-enumeration
- Virtual COM port interface on USB
- Mass storage interface on USB
- USB power management request for more than 100mA power on USB

This feature is no more supported on ST-LINK/V2-1:

- SWIM interface

For all general information concerning debugging and programming features common between V2 and V2-1 please refer to ST-LINK/V2 User Manual UM1075.

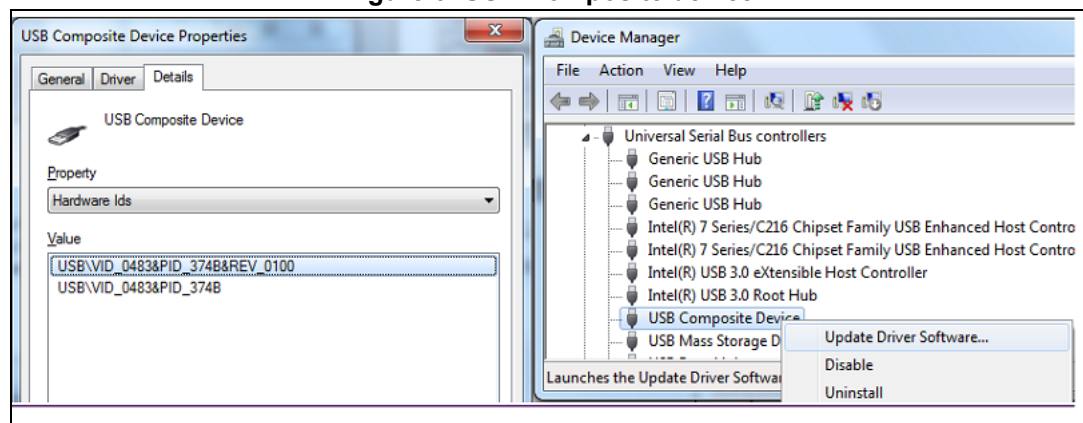
6.1.1 Drivers

Before connecting STM32F469I-DISCO board to a Windows® 7, Windows® 8 or Windows® XP PC via USB, a driver for ST-LINK/V2-1 must be installed. It can be downloaded from the www.st.com webpage.

In case the STM32F469I-DISCO board is connected to the PC before installing the driver, the Windows device manager may report some USB devices found on STM32F469I-DISCO as “Unknown”. To recover from this situation, after installing the dedicated driver downloaded from the www.st.com webpage, the association of “Unknown” USB devices found on STM32F469I-DISCO to this dedicated driver, must be updated in the device manager manually. It is recommended to proceed using USB Composite Device line, as shown in the below [Figure 6](#).

Note: Prefer using the “USB Composite Device” handle for a full recovery.

Figure 6. USB Composite device



6.1.2 ST-LINK/V2-1 firmware upgrade

ST-LINK/V2-1 facility for debug and flashing of the target microcontroller STM32F469NIH6 is integrated on STM32F469I-DISCO board. For its own operation, ST-LINK/V2-1 employs a dedicated MCU with Flash memory. Its firmware determines ST-LINK/V2-1 functionality and performance. The firmware may evolve during the life span of STM32F469I-DISCO to

include new functionality, fix bugs or support new target microcontroller families. It is therefore recommended to keep ST-LINK/V2-1 firmware up to date. The latest version is available at www.st.com. ST-LINK/V2-1 supports a mechanism that allows flashing its dedicated MCU via the USB interface on the hosting board, here STM32F469I-DISCO. The whole process is controlled from a Windows PC application also available at www.st.com.

6.2 Power supply

6.2.1 Power supply sources

STM32F469I-DISCO board is designed to be powered by the following sources:

- 5 V DC from the ST-LINK/V2-1 USB connector CN1 with 500 mA current limitation. Power mechanism of the board supplied by the USB ST-LINK/V2-1 is explained below ([Section 6.2.2: Supplying the board through ST-LINK/V2-1 USB port](#)). Pins 3 and 4 of jumper JP2 should be closed by placing a jumper in location called STLK on silkscreen of the board. Jumper JP5 should be closed. The red LED LD5 is lighted on to confirm the presence of +5 V voltage.
- 5 V DC from the user USB FS connector CN13. Pins 5 and 6 of jumper JP2 should be closed by placing a jumper in location called USB on silkscreen of the board. Jumper JP5 should be closed. The red LED LD5 is lighted on to confirm the presence of +5 V voltage.
- 6 V to 9 V DC from VIN pin of Arduino™ compatible connector CN6. The voltage must be limited to 9 V to keep the temperature of the regulator U10 within its thermal safe area. Pins 1 and 2 of jumper JP2 should be closed by placing a jumper in location called E5V on silkscreen of the board. Jumper JP5 should be closed. The red LED LD5 is lighted on to confirm the presence of +5 V voltage.

In case VIN, +5V is used to power the board, this power source must comply with the standard EN-60950-1: 2006+A11/2009, and must be Safety Extra Low Voltage (SELV) with limited power capability.

6.2.2 Supplying the board through ST-LINK/V2-1 USB port

To power the STM32F469I-DISCO board in this way, the USB host (a PC) gets connected with the STM32F469I-DISCO board via USB cable to ST-LINK/V2-1 connector.

In the first step, only the ST-LINK part U3 is powered by the PC. In fact, before USB enumeration the host PC provides only 100mA to the board at that time. STM32F469I-DISCO board requests for 500mA power to the host PC. If the host is able to provide the required power, the enumeration finishes by a "SetConfiguration" command and then, the power switch ST890 U4 is switched ON, the red LED LD5 is turned ON, thus the board can consume no more than 500mA. If the host is not able to provide such requested current, the enumeration fails. Therefore the ST890 U4 remains OFF and the board will not be powered. As a consequence the red LED LD5 remains turned OFF. In this case it is mandatory to use another power supply source.

To do this, it is important to power the board before connecting it with the host PC, which requires the following sequence to be respected:

1. Set the jumper in JP2 header in E5V position.
2. Connect an external power source to VIN pin 8 of Arduino connector CN6.
3. Check the red LED LD5 is turned on.
4. Connect host PC to USB connector CN1.

The ST890 power switch protects the USB port of the host against current demand exceeding 600 mA, should a short-circuit occur on the board.

The STM32F469I-DISCO board can also be supplied from a USB power source not supporting enumeration, such as a USB charger. In this particular case, the solder bridge SB16 should be closed. ST-LINK/V2-1 turns the ST890 power switch U4 ON regardless of enumeration procedure result and passes the power unconditionally to the board.

6.2.3 Measurement of current IDD drawn by the STM32F469NI

The jumper JP5 should be closed (default) to supply the STM32F469NI MCU. To measure the current IDD drawn by the microcontroller STM32F469NIH6 only, remove the jumper JP5 and replace it by a multimeter.

6.2.4 Power related jumpers

The power supply is configured by setting the related jumpers **JP2**, **JP5** and **solder bridge SB8** as described in [Table 1: Power related jumpers](#).

Table 1. Power related jumpers

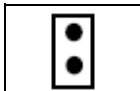


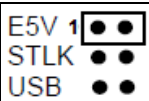

Jumper, solder bridge	Description
JP5	<p>JP5 IDD is used to measure STM32 current consumption manually by multimeter. Default setting: Closed by a jumper</p> 
SB8	<p>By default SB8 is closed to power +3V3 from regulator U7. If the board is powered by the pin 1 of extension connector CN12 or by the pin 4 of the Arduino connector CN6, it is mandatory to open SB8 to avoid reverse current injection in regulator U7. (Default setting): SB8 closed</p>
JP2	<p>JP2 is used to select one of the five possible power supply sources. To supply the board from the ST-LINK/V2-1 USB connector CN1, JP2 should be set as shown to the right: (Default Setting)</p> 

Table 1. Power related jumpers (continued)

Jumper, solder bridge	Description
JP2	To supply the board from the User USB FS connector USB connector CN13, JP2 should be set as shown to the right: 
	To supply the board from the pin 8 VIN of the Arduino compatible connector CN6, JP2 should be set as shown to the right: 
	To supply the board from pin1 of extension connector CN12 or from pin4 of the Arduino compatible connector CN6, JP2 should be set as shown to the right (no jumper): 

6.3 Clock source

6.3.1 HSE clock source

By default the HSE clock source of the STM32F469NIH6 is the 8 MHz crystal X2. In that case, zero ohm R131 is soldered, solder bridge SB19 is open.

It is possible to replace the crystal X2 by the 8 MHz output MCO from the circuit ST-LINK/V2-1 U3. In that case, 100 ohms resistor R35 should be soldered, zero ohm R131 should be removed, solder bridge SB19 should be closed. C26 is not necessary and remains not populated.

6.3.2 LSE clock source

The 32.768 KHz crystal X3 is the clock source for the embedded RTC.

6.4 Reset source

The reset signal of STM32F469I-DISCO board is low active and the reset sources include:

- **Reset button B1**, providing solder bridge SB1 is closed (default setting)
- **Embedded ST-LINK/V2-1**, providing solder bridge SB2 is closed (default setting)
- Arduino compatible connector CN6 pin 3
- Extension connector CN12 pin 4

6.5 Audio outputs

An audio DAC CS43L22 U5 from Cirrus Logic outputs the audio to a stereo headphone jack connector.

The digital audio interface SAI of STM32F469NIH6 is connected to the digital audio input SDIN of the audio DAC. The STM32F469NIH6 controls the audio DAC via the I2C2 bus. Note that I2C speed of the CS43L22 is 100 kHz max.

The PWM loudspeaker output SPKR_OUTA of the CS43L22 is available at pins 15 and 16 of the extension connector CN12. Each of the two terminals of the external loudspeaker should be connected to pins 15 and 16 of CN2 respectively. Insure the terminals of the loudspeaker are not connected to the ground.

The port PE3 STM32F469NIH6 enables the jack headphone output and/or the loudspeaker SPKR_OUT. Providing the audio DAC registers are properly set, it allows to power down the loudspeaker and/or the headphone outputs.

The I2C address of the audio DAC is 0x94.

6.6 Digital microphones

Three STMicroelectronics MP34DT01TR MEMS digital microphones are available on the discovery board STM32F469I-DISCO. Two microphones can be used simultaneously in stereo mode using PDM mode. By default the microphones U2 and U6 are used and connected to the DFSDM of the STM32F469I microcontroller (solder bridges SB17 opened, and SB18 closed). The PDM clock is generated at port PD13 while PDM data are received by the microcontroller at port PD6.

Instead of using the pair of microphones U2 and U6, it is possible to use the pair of microphones U2 and U1. To enable this possibility the solder bridge SB17 should be closed and SB18 opened.

Solder bridges locations are shown in [Figure 4: STM32F469I-DISCO top side layout](#) .

6.7 USB OTG FS

An USB OTG full speed communication is available at connector CN13.

The STM32F469I-DISCO discovery board can be powered by the 5 V DC of this USB OTG FS connection. When the STM32F469I-DISCO is USB host, it supplies the USB peripheral. In this case the board must be supplied by any of the following sources: ST-LINK/V2-1 USB connector CN1 or pin VIN of Arduino connector CN6. Refer to [Section 6.2: Power supply](#) for more details on each supply source.

The green LED LD8 will be lit in one of these cases:

- STM32F469I-DISCO works as an USB host and power switch U16 is switched ON.
- VBUS is powered by another USB host when STM32F469I-DISCO works as an USB device.

Red LED LD9 will be lit when an over-current occurs.

6.8 MicroSD card

MicroSD card with 4 GB or more capacity can be inserted in the receptacle CN9. 4 bits of the SDIO interface of the STM32F469NIH6 are used to communicate with the microSD card. The card detection is read by the GPIO PG2: when a microSD card is inserted, the logic level is 0, otherwise it is 1.

6.9 SDRAM

A 128-Mbit SDRAM MICRON MT48LC4M32B2B5-6A is accessible with the FMC interface of the microcontroller STM32F469NIH6. The data bus is 32 bits wide.

The SDRAM is composed of four banks of 32 Mbits selected by the address bits A14 and A15.

Each of the four banks is organized as 4096 rows by 256 columns by 32 bits. Row and column addresses are pre-selected using the CAS and RAS signals of the FMC bus.

The SDRAM is selected by SDNE0 and can be addressed from 0xC0000000 to 0xC0FFFFFF.

6.10 Quad-SPI NOR Flash memory

A 128-Mbit Quad-SPI NOR Flash memory (N25Q128A13EF840E from MICRON) is connected to Quad-SPI interface of the STM32F469NIH6 microcontroller.

6.11 Virtual COM port

The serial interface USART3 is directly available as a virtual COM port of the PC connected to the ST-LINK/V2-1 USB connector CN1. The virtual COM port settings are configured as: 115200 b/s, 8 bits data, no parity, 1 stop bit, no flow control.

6.12 Arduino connectors

CN5, CN6, CN7 and CN8 are female connectors compatible with Arduino standard. Most shields designed for Arduino UNO rev.3 can fit to the STM32F469I-DISCO discovery board.

Caution: The I/Os of STM32 microcontroller are 3.3 V compatible while Arduino UNO board is 5 V compatible.

Table 2. Arduino compatible connectors

Connector	Pin	Pin name	MCU Pin	Function
LEFT connectors				
CN6 Power	1	-	-	Not connected
	2	IOREF	-	3.3V Ref
	3	NRST	NRST	Reset
	4	+3V3	-	+3.3V input/output ⁽¹⁾

Table 2. Arduino compatible connectors (continued)

Connector	Pin	Pin name	MCU Pin	Function
CN6 Power	5	+5V	-	+5V output
	6	GND	-	Ground
	7	GND	-	Ground
	8	VIN	-	+6V to +9V power input ⁽²⁾
CN8 Analog	1	A0	PB1	ADC12_IN9
	2	A1	PC2	ADC12_IN12
	3	A2	PC3	ADC12_IN13
	4	A3	PC4	ADC12_IN14
	5	A4	PC5 or PB9 ⁽³⁾	ADC12_IN15 or I2C1_SDA ⁽³⁾
	6	A5	PA4 or PB8 ⁽³⁾	ADC12_IN4 or I2C1_SCL ⁽³⁾

1. Before using pin4 of CN6 as +3.3V input, the solder bridge SB8 must be removed. Otherwise the board STM32F469I-DISCO could be damaged by the overcurrent.
2. The external voltage applied to pin VIN should be in the range 6 to 9V at 25°C ambient temperature. If a higher voltage is applied the regulator U10 may overheat and could be damaged.
3. By default pin 5 and pin 6 of connector CN8 are PC5 and PA4 respectively. They are enabled by the default configuration of solder bridges: SB10 and SB12 closed, SB9 and SB11 opened. If necessary to have an I2C interface on pins 5 and 6 of connector CN8, change the configuration solder bridges: open SB10 and SB12, close SB9 and SB11.

Table 3. Arduino compatible connectors

Function	MCU Pin	Pin name	Pin	Connector
RIGHT connectors				
I2C1_SCL	PB8	D15	10	CN5 Digital
I2C1_SDA	PB9	D14	9	
AVDD	-	AVDD	8	
Ground	-	GND	7	
SPI2_SCK	PD3	D13	6	
SPI2_MISO	PB14	D12	5	
TIM12_CH2, SPI2_MOSI	PB15	D11	4	
TIM12_CH1, SPI2_CS	PH6	D10	3	
TIM14_CH1	PA7	D9	2	
-	PG10	D8	1	
-	PG11	D7	8	CN7 Digital
TIM3_CH1	PA6	D6	7	
TIM5_CH3	PA2	D5	6	
-	PG12	D4	5	
TIM5_CH2	PA1	D3	4	

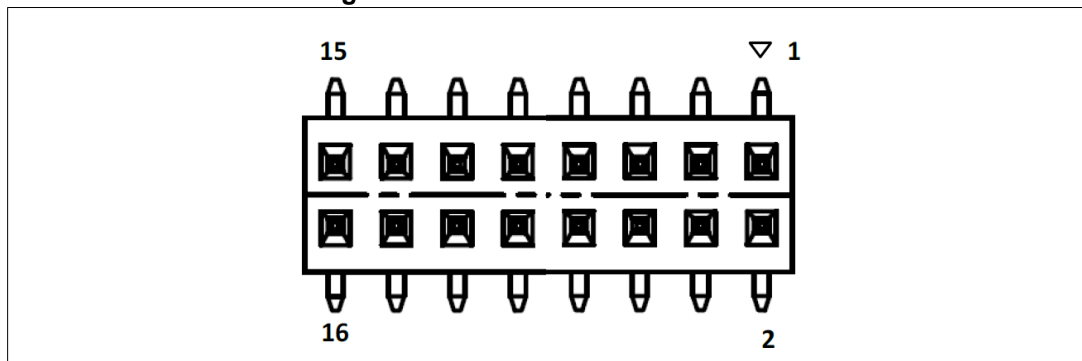
Table 3. Arduino compatible connectors (continued)

Function	MCU Pin	Pin name	Pin	Connector
-	PG13	D2	3	CN7 Digital
USART6_TX	PG14	D1	2	
USART6_RX	PG9	D0	1	

6.13 Extension connector CN12

The extension connector CN12 is a 2.54 mm pitch header located at the bottom side of the STM32F469I-DISCO discovery board. It is composed of 16 square pins of 0.64 mm arranged in double row and it is compatible with usual connectors mating with 2.54 mm headers, having 0.64 mm square posts. Pins 1, 2, 15 and 16 are marked on the silkscreen of the PCB, pin 1 is signaled by a triangle as shown below:

Figure 7. Extension connector CN12



The extension connector gives access to the following communication buses and features:

- CAN2
- USART6 (TX, RX)
- I2S2
- SPI1
- 7 timer channels
- 2 ADC inputs
- A 1W monophonic loudspeaker output
- System signals: NRST, MCO1, ANTI-TAMP1
- Power supply: +3V3, GND

The STM32F469NIH6 ports and extension connector pins numbers are detailed in the following [Table 4: Extension connector pinout](#).

Table 4. Extension connector pinout

Extension connector pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MCU Port	-	-	PA8	NRST	PB4	PC6	PA5	PC7	PB5	PB13	PA15	PB12	PC13	PC1	-	-
CAN2	-	-	-	-	-	-	-	-	Rx	Tx	-	Rx	-	-	-	-
USART6	-	-	-	-	-	Tx	-	Rx	-	-	-	-	-	-	-	-
I2S2	-	-	-	-	-	MCK	-	-	-	CK	-	WS	-	SD	-	-
SPI1	-	-	-	-	-	-	-	-	MOSI	-	NSS	-	-	-	-	-
TIMER	-	-	TIM1_CH1	-	MISO	TIM3/TIM8_CH1	SCK	TIM3/TIM8_CH2	TIM3_CH2	TIM1_CH1N	TIM2_CH1/2_ETR	TIM1_BKIN	-	-	-	-
ADC	-	-	-	-	-	-	ADC1/ADC2_IN5	-	-	-	-	-	-	ADC123_IN11	-	-
SYSTEM	+3V3	GND	MCO1	NRST	-	-	-	-	-	-	-	-	ANTI TAMP1	-	Speaker OUTAN	Speaker OUTAP

6.14 DSI LCD

The LCD module is a 4-inch 800x480 TFT color LCD with capacitive touch panel. The LCD is connected to the MIPI DSI interface of the microcontroller STM32F469NIH6 via the connector CN10. The DSI (Display Serial Interface) is a specification of the MIPI Alliance standard and defines the physical interface and the protocol used by the STM32F469NIH6 microcontroller to communicate with such LCD module.

The following ports of the microcontroller STM32F469NIH6 are dedicated to DSI interface: DSI_D0_N, DSI_D0_P, DSI_CK_N, DSI_CK_P, DSI_D1_N, DSI_D1_P.

In addition to the DSI dedicated ports, the port PH7 of the microcontroller is used to reset both the DSI LCD module and the capacitive touchscreen controller.

The port PJ2, connected to the LCD signal TE (Tearing Effect) is an input of the microcontroller to synchronize the write access from the microcontroller with the LCD scan refresh, to avoid visible artefacts on the display.

LEDK and LEDA signals of the LCD module are the cathode and anode of the backlight LEDs.

This backlight requires a power supply voltage of typically 25 V generated from the +5 V by a switching mode boost converter STLD40DPUR.

By controlling the EN pin of the STLD40DPUR by a low frequency PWM signal, it is possible to switch on/off or to dim the backlight intensity of the LCD module. The control of EN can be done by software or by hardware:

- By default, the EN pin of the STLD40DPUR is controlled by the microcontroller software through DSI commands and CABC signal generated by the LCD module. For such default configuration the resistor R117 is soldered, R119 is not soldered.
- The STM32F469I-DISCO discovery board offers the option to control the EN pin by HW through port PA3. In such case, R117 should be removed and R119 soldered.

Table 5. DSI LCD module connector (CN10)

CN10 pin	Signal name	Description	MCU pins involved
1	ID	Not connect	-
2	GND	Ground	-
3	CABC	Content Adaptive Brightness Control	-
4	GND	Ground	-
5	RESX	Reset, active low	PH7
6	IOVCC	Digital supply voltage	+3V3
7	GND	Ground	-
8	HSSI_D0_N	MIPI-DSI data lane 0 negative-end I/O	DSI_D0_N
9	NC	Not connect	-
10	HSSI_D0_P	MIPI-DSI data lane 0 positive-end I/O	DSI_D0_P
11	GND	Ground	-
12	HSSI_CLK_N	MIPI-DSI clock lane negative-end input	DSI_CK_N
13	NC	Not connect	-

Table 5. DSI LCD module connector (CN10) (continued)

CN10 pin	Signal name	Description	MCU pins involved
14	HSSI_CLK_P	MIPI-DSI clock lane positive-end input	DSI_CLK_P
15	GND	Ground	-
16	HSSI_D1_N	MIPI-DSI data lane 1 negative-end input	DSI_D1_N
17	NC	Not connect	-
18	HSSI_D1_P	MIPI-DSI data lane 1 positive-end input	DSI_D1_P
19	GND	Ground	-
20	NC/ERR	Not connect	-
21	VCC	Analog circuitry power supply	+3V3
22	TE	Tearing effect output pin to synchronize MCU to frame writing	PJ2
23	LEDK	Backlight LED Cathode	-
24	LEDA	Backlight LED Anode	-
25	GND	Ground	-

6.15 Buttons and LEDs

The black button B1 located bottom side is the reset of the microcontroller STM32F469NIH6. Refer to the [Figure 5: STM32F469I-DISCO bottom side layout](#).

The blue button B2 located bottom side is available to be used as a digital input or as alternate function Wake-up. When the button is depressed the logic state is 1, otherwise the logic state is 0.

Four LEDs located top side are available for the user. Refer to the [Figure 4: STM32F469I-DISCO top side layout](#). The LEDs are LD1, LD2, LD3, LD4 from left to right with colors green, orange, red, blue respectively. To light a LED a low logic state 0 should be written in the corresponding GPIO. [Table 6](#) gives the assignment of control ports to the LED indicators.

Table 6. Port assignment for control of LED indicators

LED	Controlled by MCU port	Color
LD1	PG6	Green
LD2	PD4	Orange
LD3	PD5	Red
LD4	PK3	Blue

6.16 I2C extension connector CN11

Figure 8. I2C extension connector (front view)

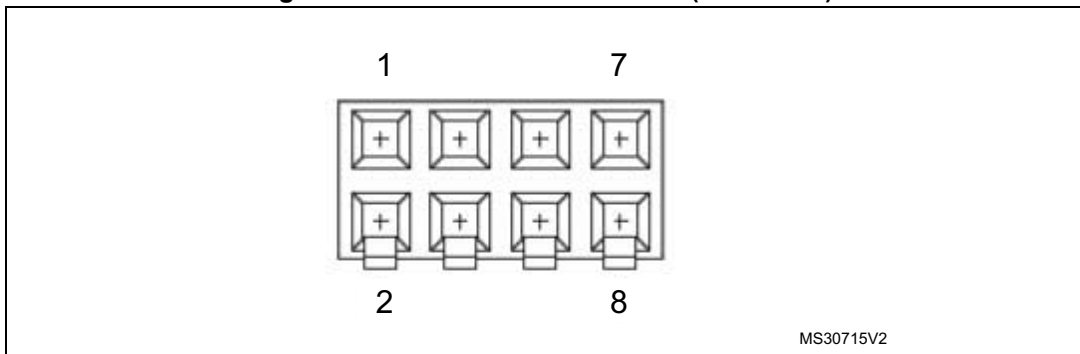


Table 7. I2C extension connector pinout

Pin number	Description	Pin number	Description
1	I2C1_SDA (PB9)	5	+3V3
2	NC	6	NC
3	I2C1_SCL (PB8)	7	GND
4	EXT_RESET(PB0)	8	NC

6.17 USB OTG FS Micro-AB connector CN13

Figure 9. USB OTG FS Micro-AB connector CN13 (front view)

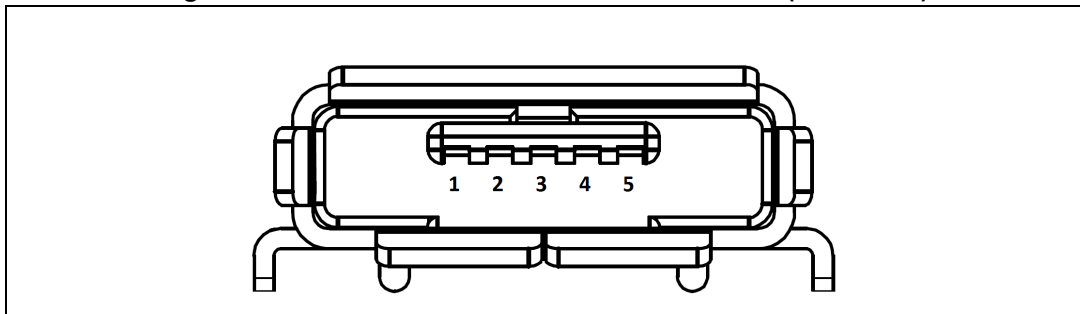


Table 8. USB OTG FS Micro-AB connector CN13

Pin number	Description	Pin number	Description
1	VBUS (PA9)	4	ID (PA10)
2	DM (PA11)	5	GND
3	DP (PA12)	-	-

6.18 MicroSD connector CN9

Figure 10. MicroSD connector CN9 (front view)

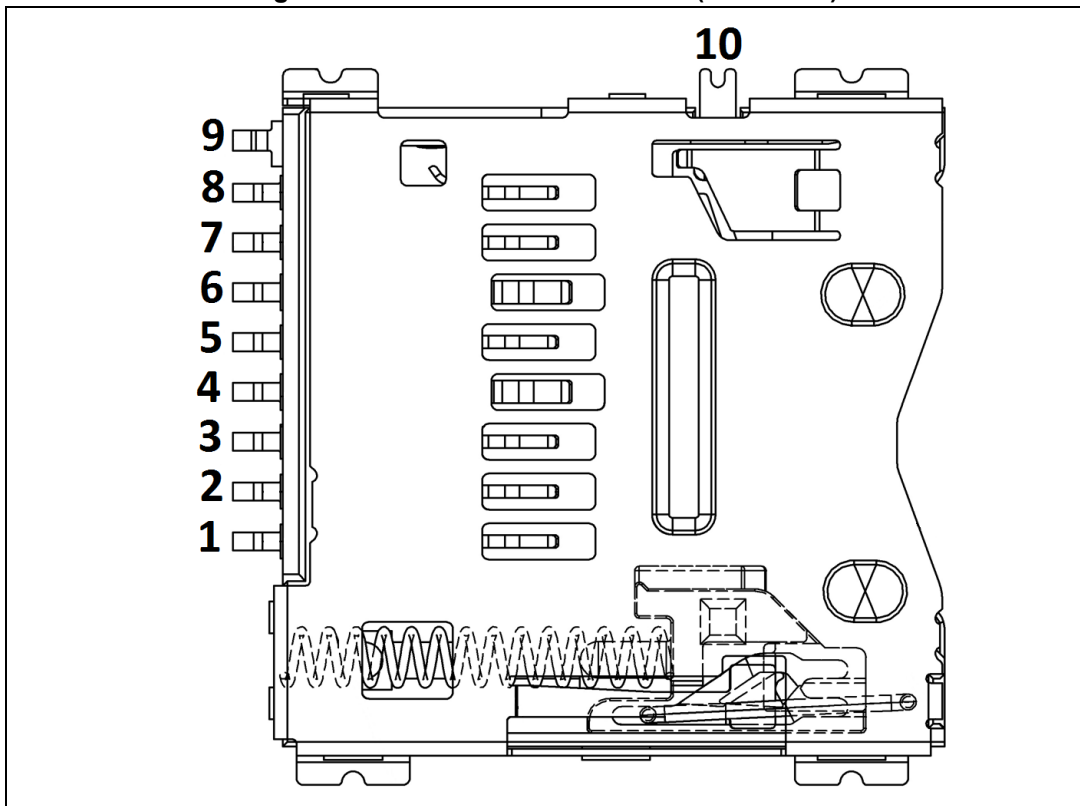


Table 9. MicroSD connector CN9

Pin number	Description	Pin number	Description
1	SDIO_D2 (PC10)	6	GND
2	SDIO_D3 (PC11)	7	SDIO_D0 (PC8)
3	SDIO_CMD (PD2)	8	SDIO_D1 (PC9)
4	+3.3V	9	GND
5	SDIO_CLK (PC12)	10	MicroSDcard_detect (PG2)

6.19 ST-LINK/V2-1 USB Mini Type B connector CN1

The USB connector CN1 is used to connect the embedded ST-LINK/V2-1 to the PC.

Figure 11. USB type Mini B connector CN1 (front view)

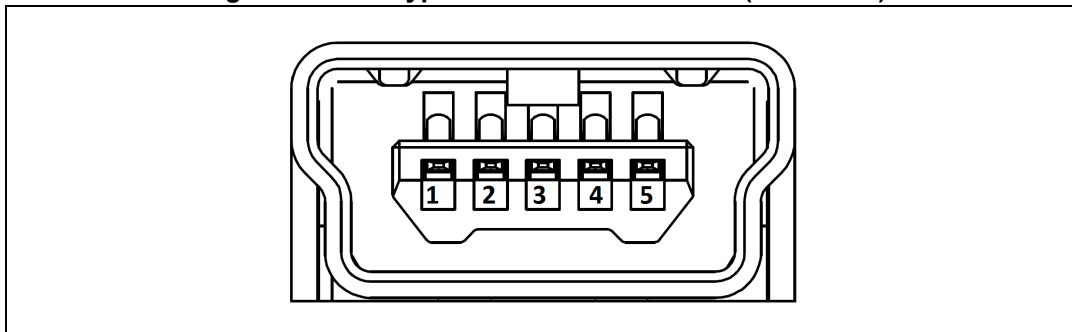


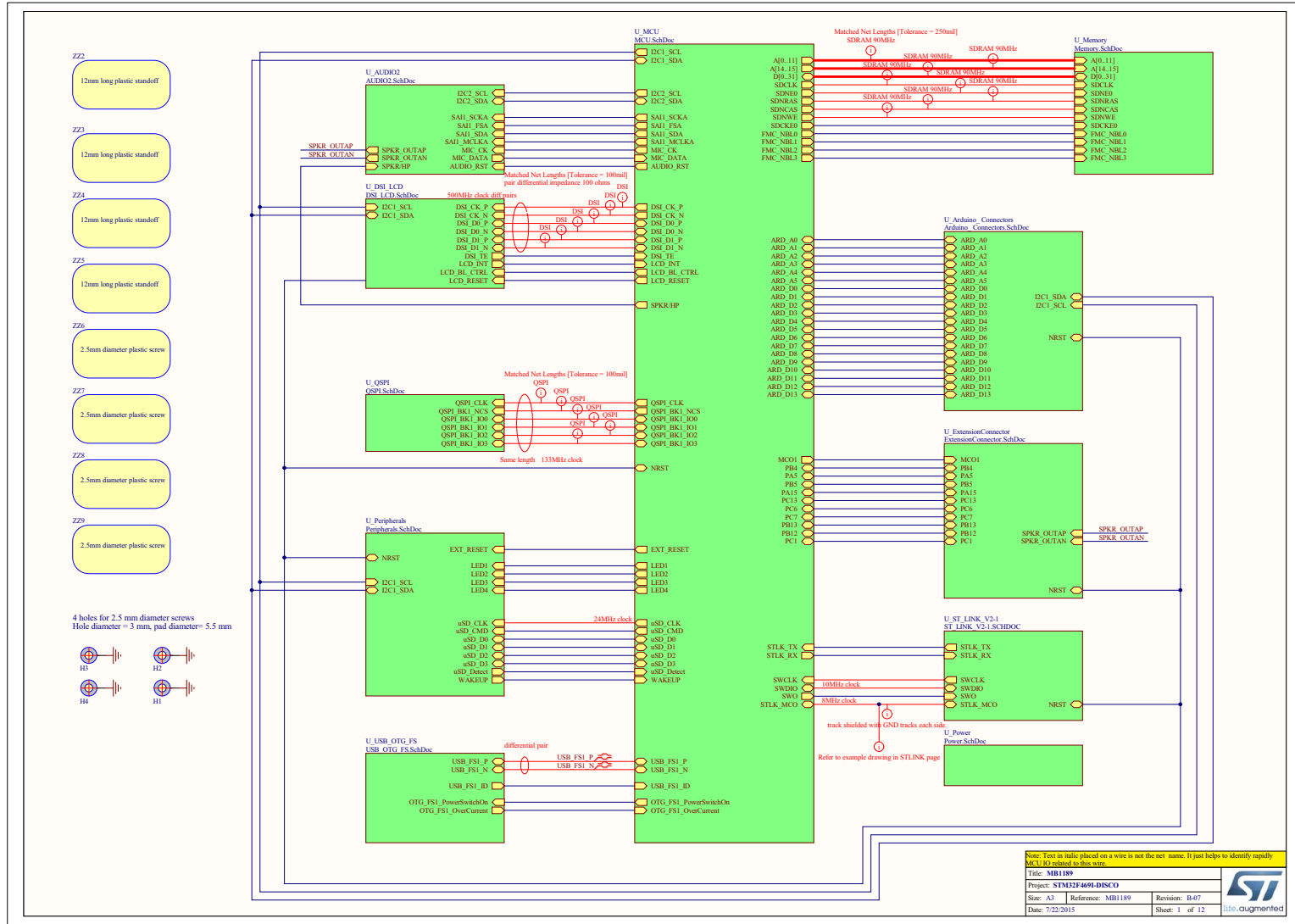
Table 10. USB Mini type B connector CN1

Pin number	Description	Pin number	Description
1	VBUS (power)	4	GND
2	DM	5,6	Shield
3	DP	-	-

6.20 Audio jack CN3

A 3.5 mm stereo audio jack CN3 is available on STM32F469I-DISCO discovery board to connect a headphone.

Figure 12. STM32F469I-DISCO Discovery board



Note: Text in *italic* placed on a wire is not the net name. It just helps to identify rapidly MCU I/O related to this wire.

Title: MB1189				
Project: STM32F469I-DISCO				
Size: A3	Reference: MB1189			Revision: B-07
Date: 7/22/2015	Sheet: 1 of 12			lfo:augmented

Figure 14. Extension connectors

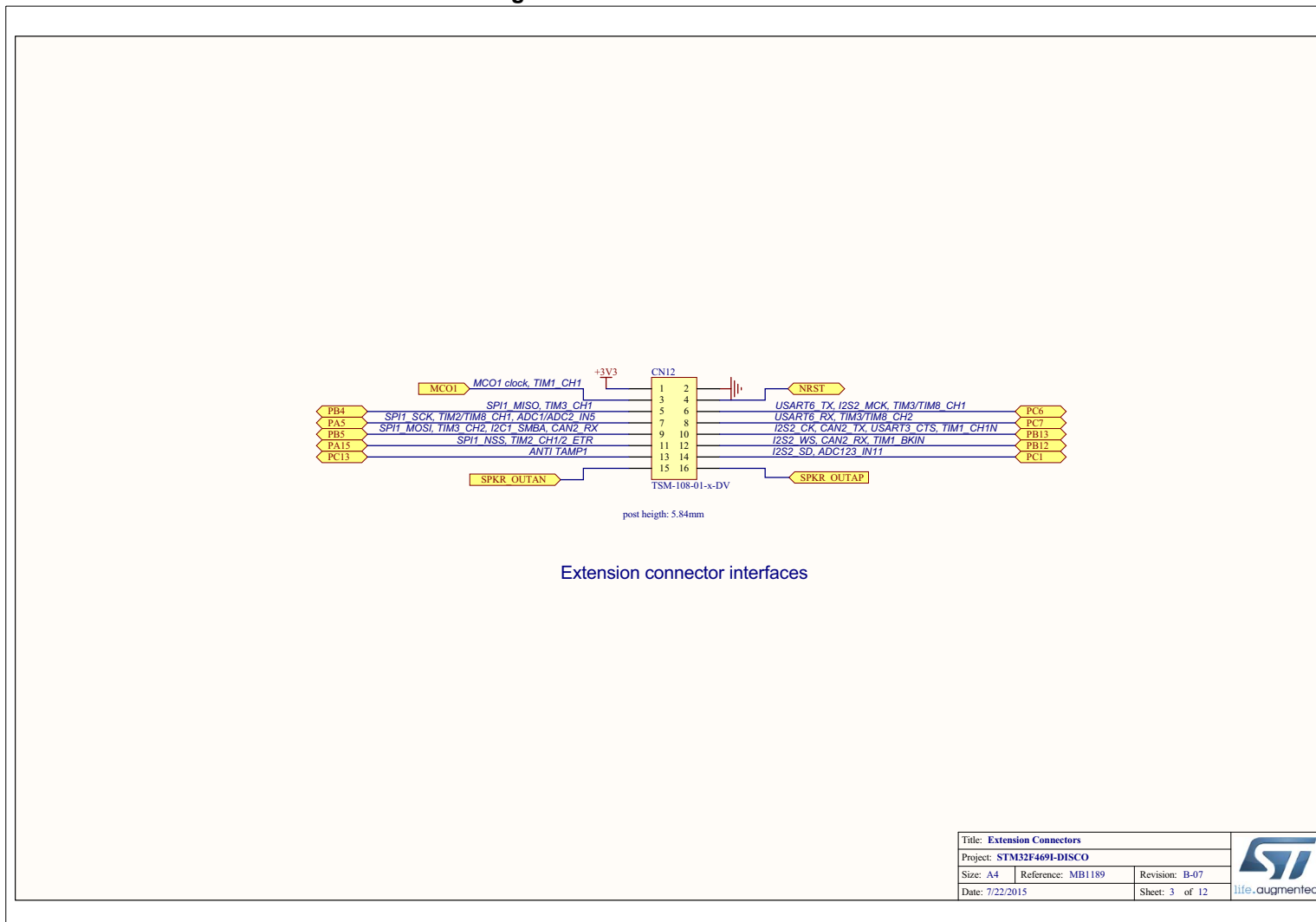




Figure 15. Power

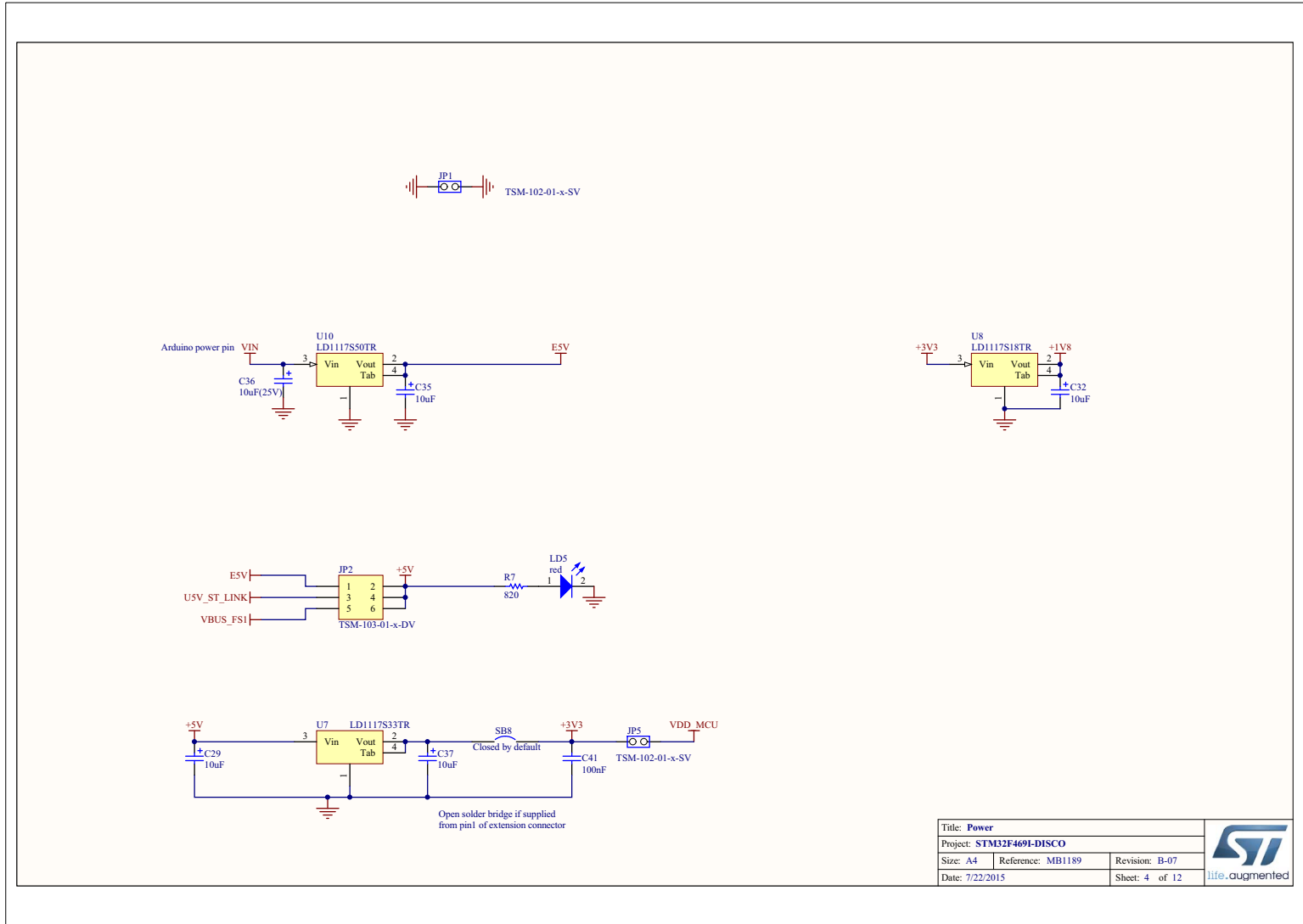


Figure 16. Peripherals

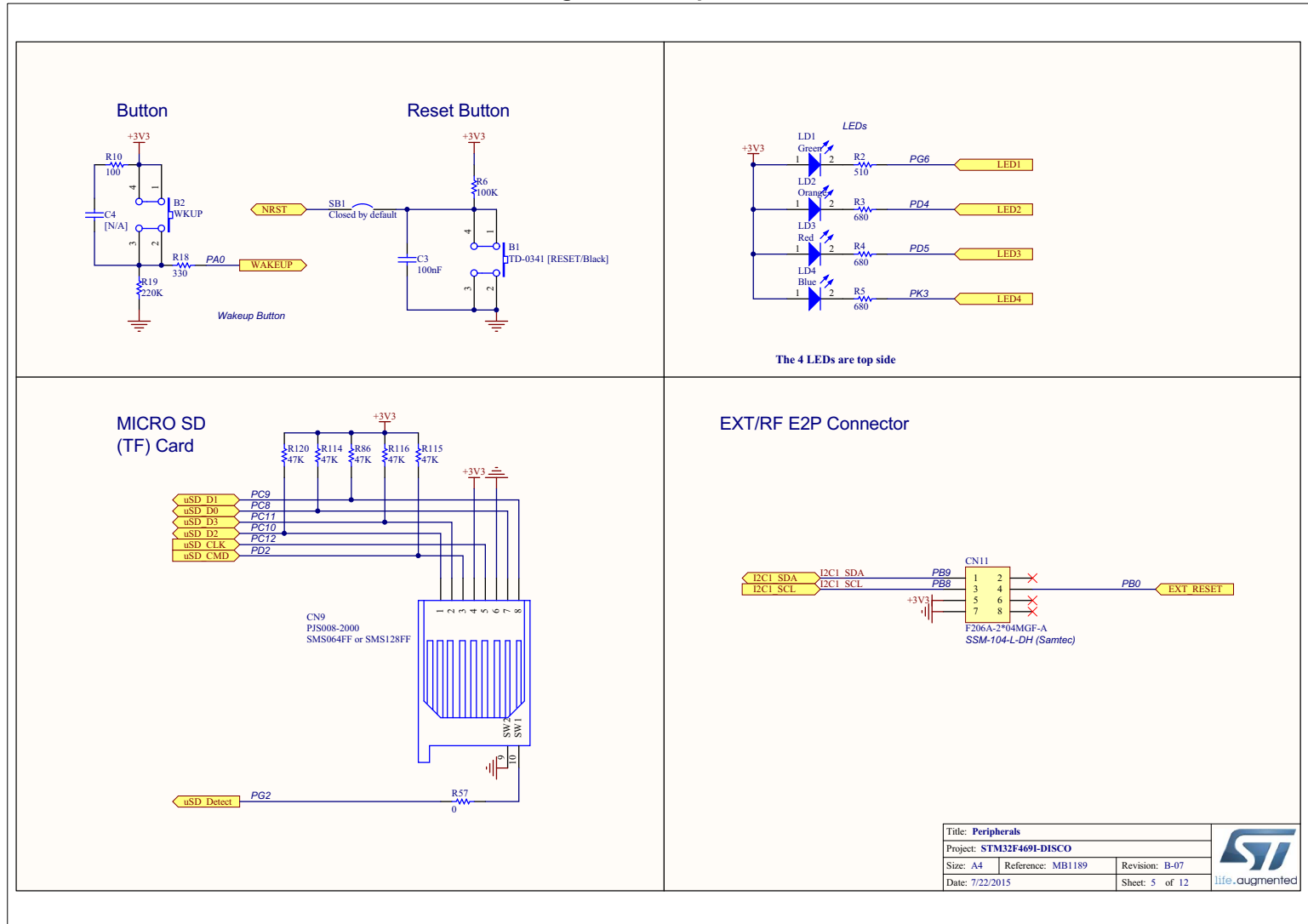




Figure 17. Audio codec and microphone MEMS

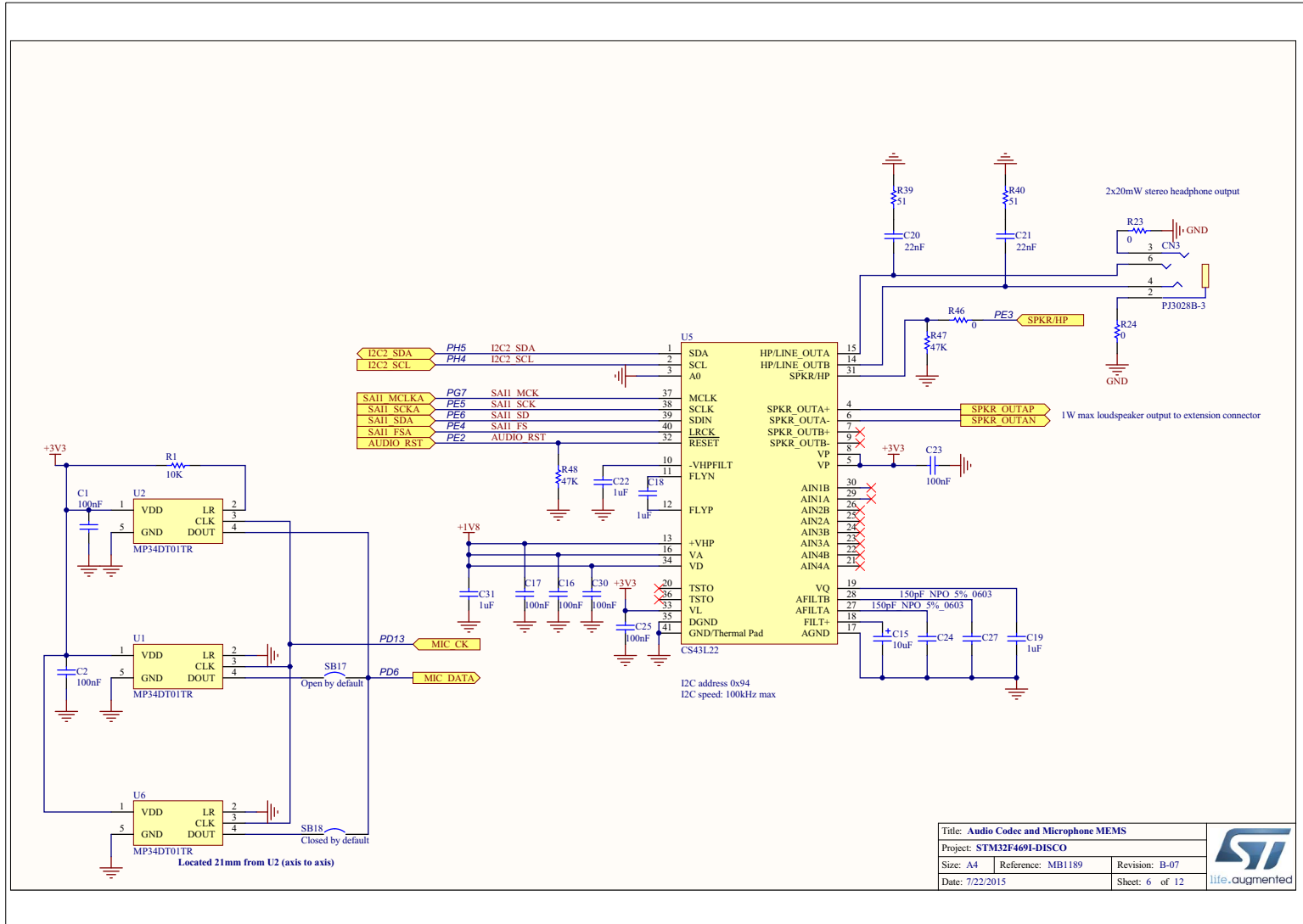


Figure 18. 4-inch DSI LCD board

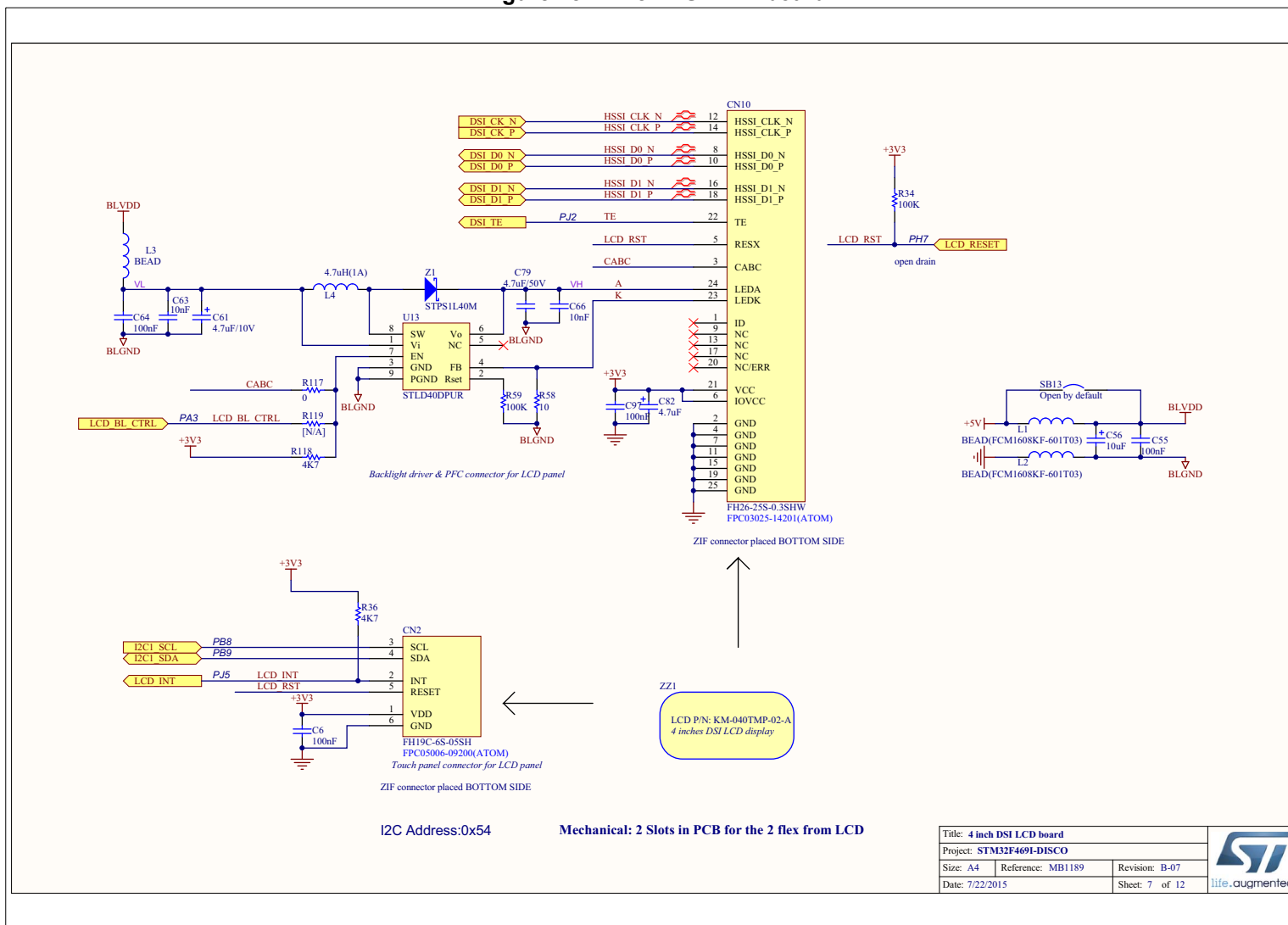




Figure 19. SDRAM

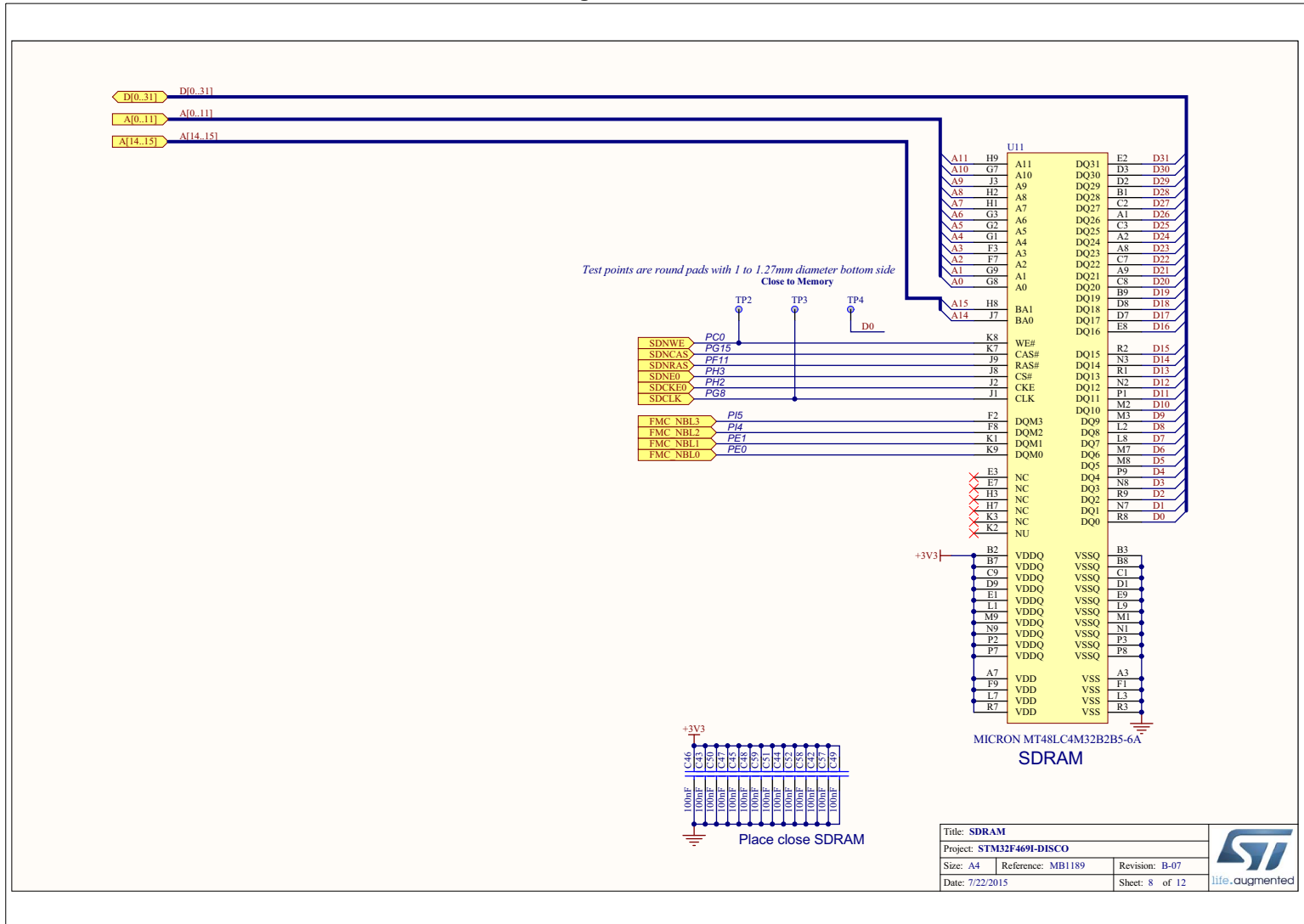


Figure 20. QSPI

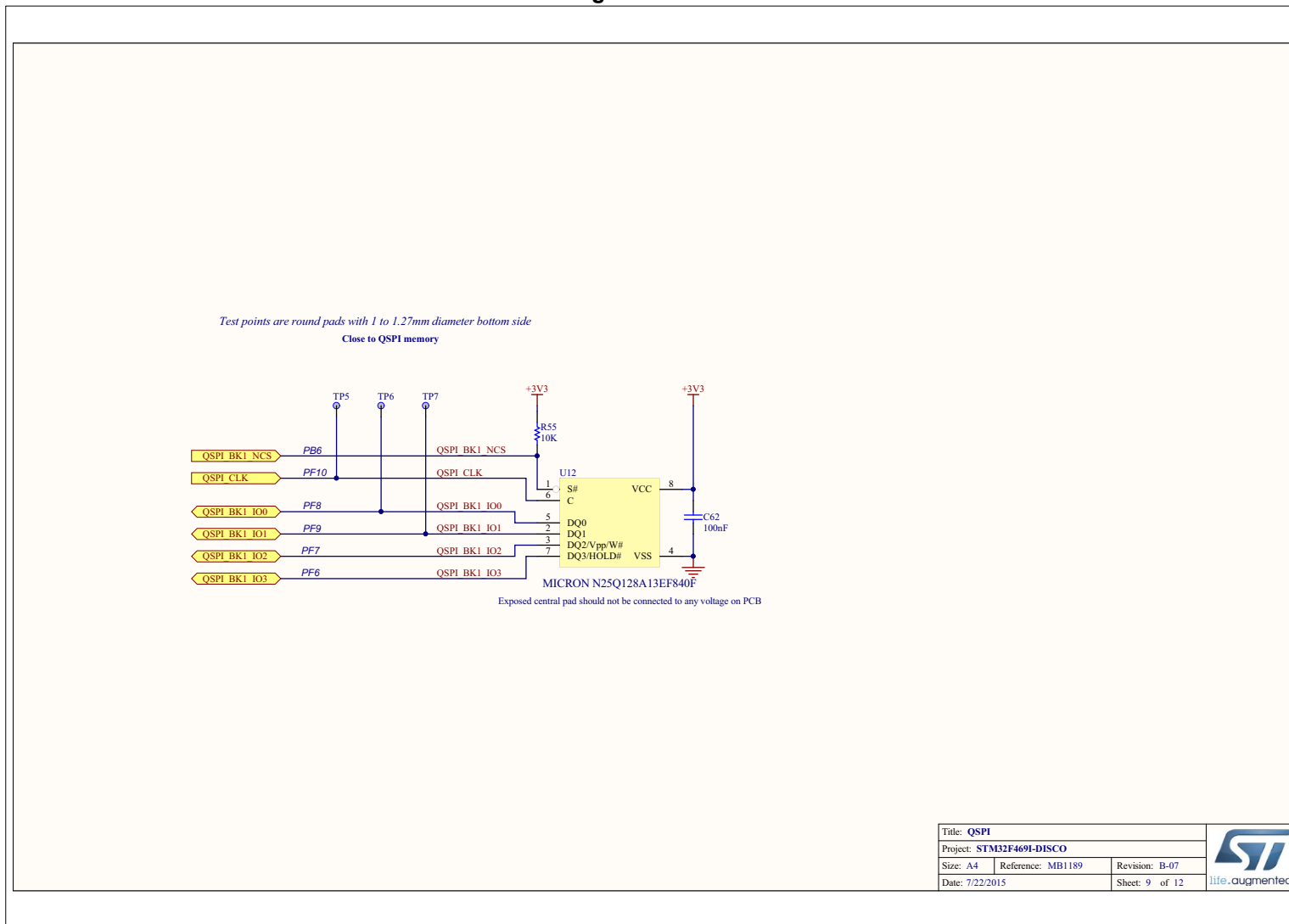




Figure 21. USB OTG FS

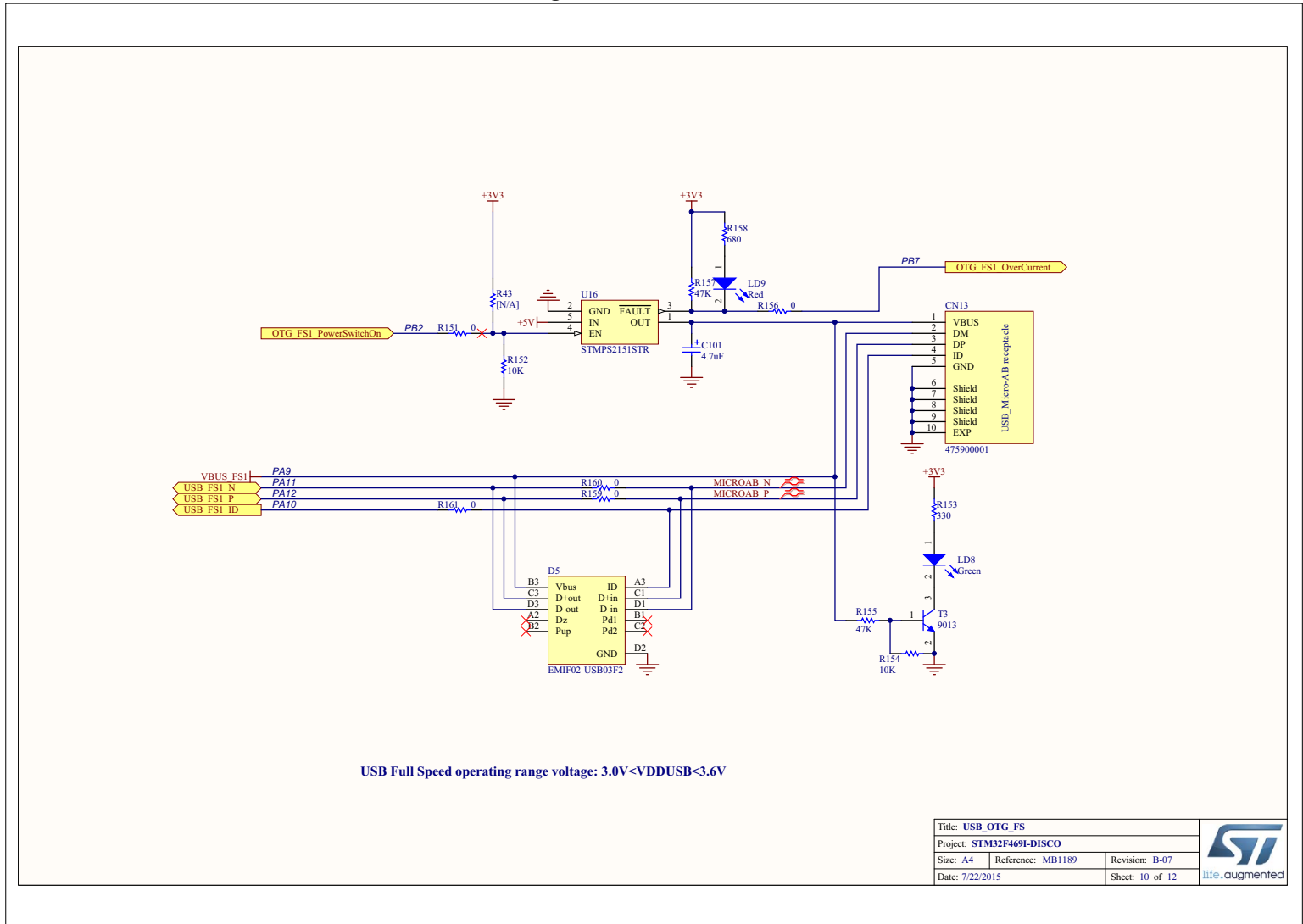
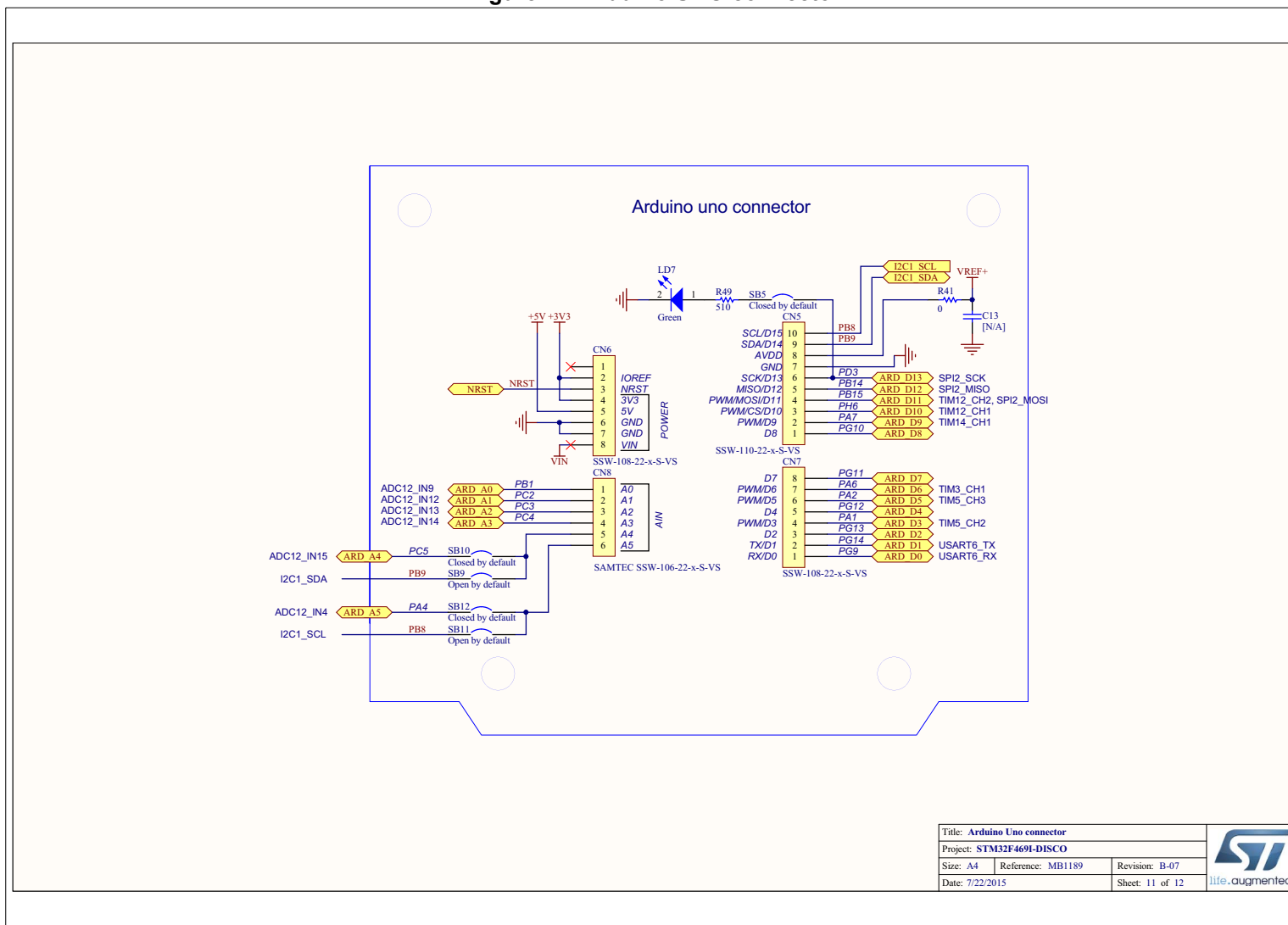


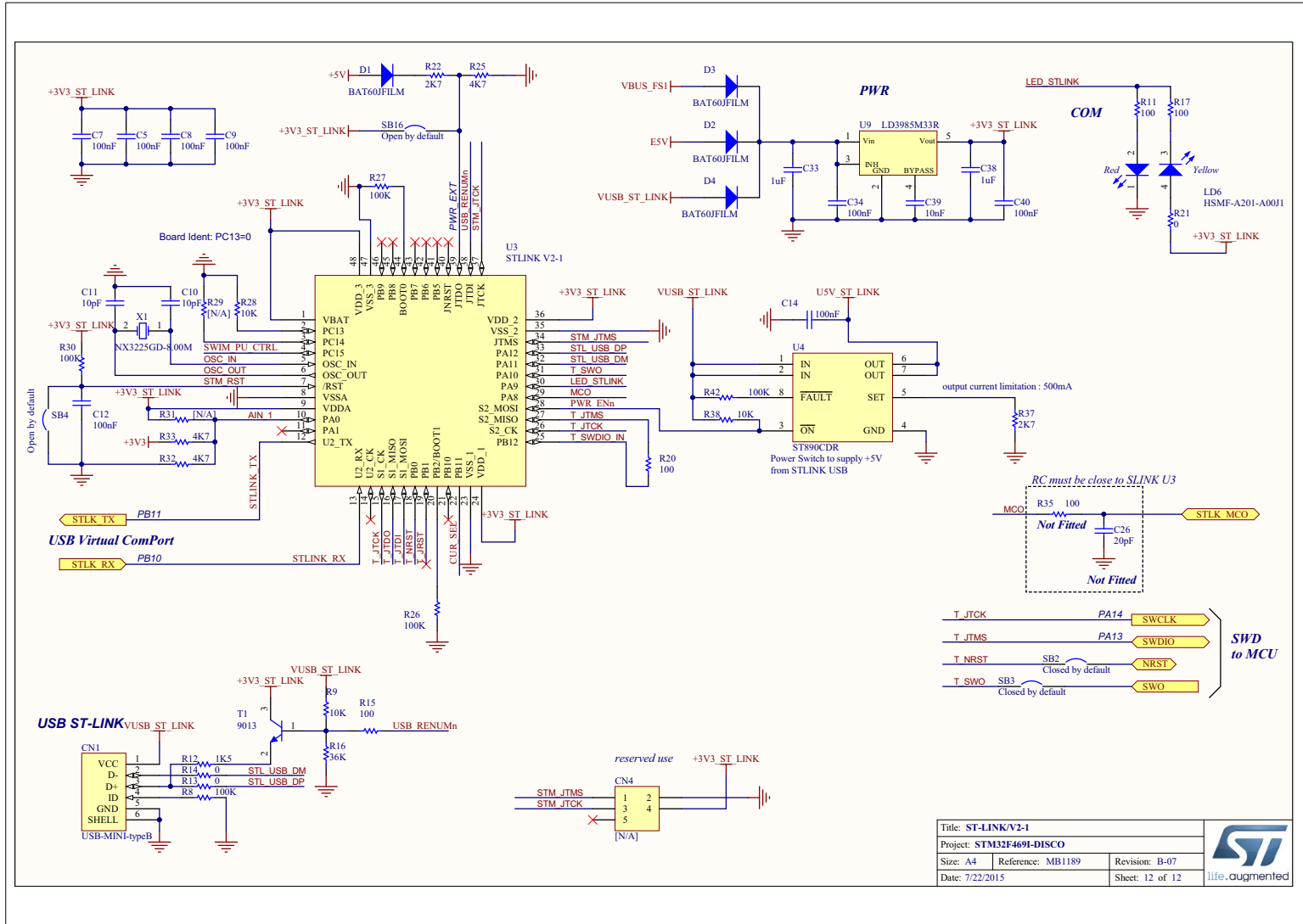
Figure 22. Arduino UNO connector



Title: Arduino Uno connector			
Project: STM32F469I-DISCO			
Size: A4	Reference: MB1189	Revision: B-07	
Date: 7/22/2015	Sheet: 11 of 12		

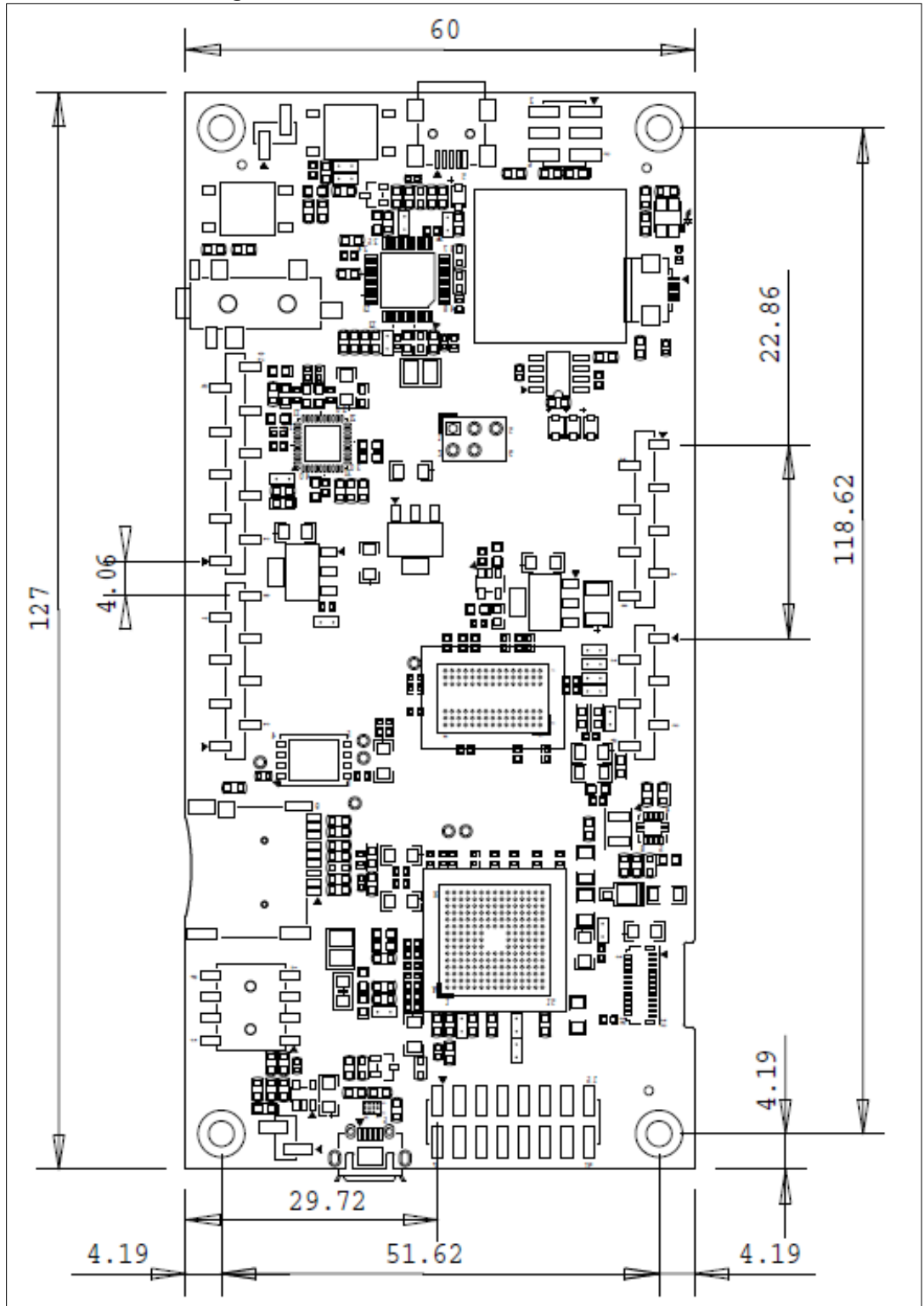


Figure 23. ST-LINK/V2-1



Appendix A Mechanical dimensions

Figure 24. Mechanical dimensions in millimeter



Appendix B Federal Communications Commission (FCC) and Industry Canada (IC) Compliance

B.1 FCC Compliance Statement

B.1.1 Part 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

B.1.2 Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

B.1.3 Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

B.2 IC Compliance Statement

B.2.1 Compliance Statement

Industry Canada ICES-003 Compliance Label: *CAN ICES-3 (B)/NMB-3(B)*

B.2.2 Déclaration de conformité

Étiquette de conformité à la NMB-003 d'Industrie Canada : *CAN ICES-3 (B)/NMB-3(B)*

8 Revision History

Table 11. Document Revision History

Date	Version	Revision Details
19-Sep-2015	1	Initial release.
20-Oct-2015	2	Updated <i>Figure 3: Hardware block diagram</i> Added <i>Section Appendix B: Federal Communications Commission (FCC) and Industry Canada (IC) Compliance</i> and <i>Section 2: Product marking</i>

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved