UM1879
User manual

Discovery kit with STM32L476VG MCU

Introduction

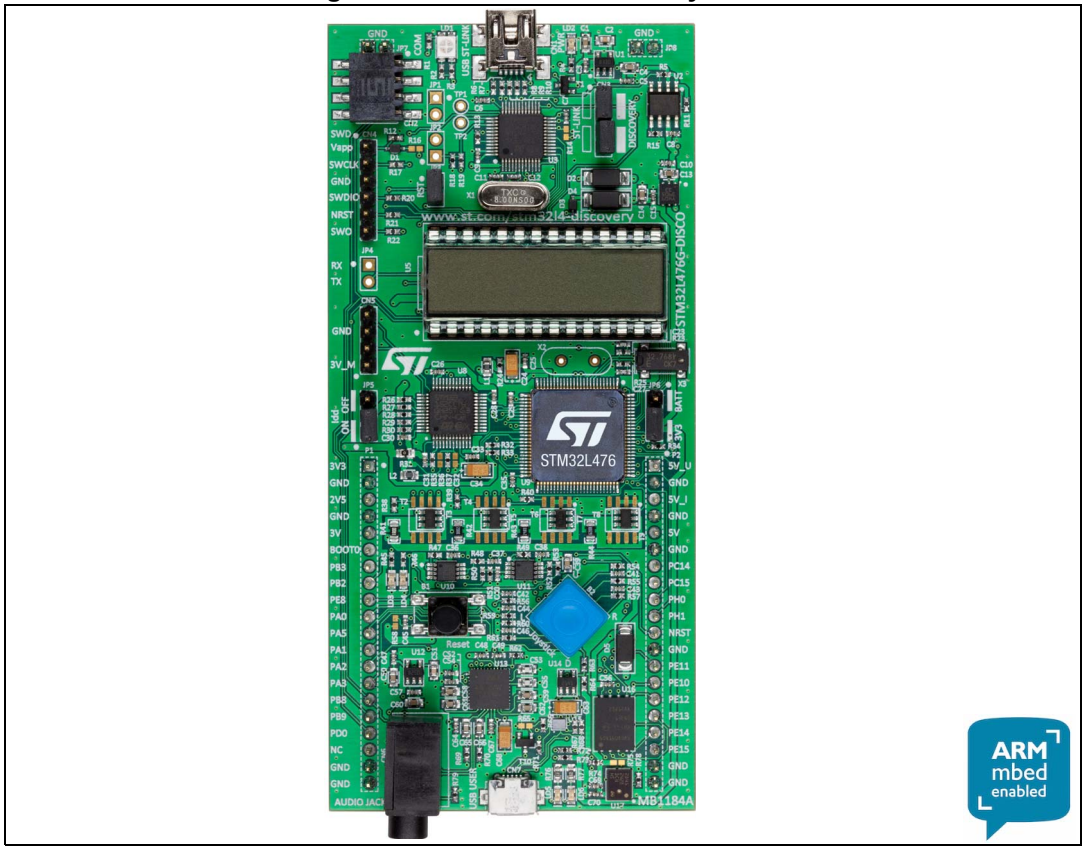
The STM32L476 Discovery kit (32L476GDISCOVERY) helps the user to discover the STM32L4 ultra-low-power features and to develop and share applications.

It is based on the STM32L476VGT6 microcontroller with three I^2Cs, three SPIs, six USARTs, CAN, SWPMI, two SAIs, 12-bit ADCs, 12-bit DAC, LCD driver, internal 128 Kbytes of SRAM and 1 Mbyte of Flash memory, Quad-SPI, touch sensing, USB OTG FS, LCD controller, FMC, JTAG debugging support.

The 32L476GDISCOVERY includes an ST-LINK/V2-1 embedded debugging tool interface, LCD (24 segments, 4 commons), LEDs, push-button, joystick, USB OTG FS, audio DAC, MEMS (Microphone, 3 axis gyroscope, 6 axis compass), Quad-SPI Flash memory, embedded ammeter measuring STM32 consumption in low-power mode.

External boards can be connected thanks to the extension and probing connectors.

Figure 1. STM32L476 Discovery board



1. Picture not contractual.

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1 Features

- STM32L476VGT6 microcontroller featuring 1 Mbyte of Flash memory and 128 Kbytes of RAM in LQFP100 package
- On-board ST-LINK/V2-1 supporting USB reenumeration capability
- Three different interfaces supported on USB:
  - Virtual Com Port
  - Mass storage
  - Debug port
- ARM® mbed™-enabled (see http: //mbed.org)
- LCD 24 segments, 4 commons in DIP 28 package
- Seven LEDs:
  - LD1 (red/green) for ST-LINK/V2-1 USB communication
  - LD2 (red) for 3.3 V power on
  - LD3 overcurrent (red)
  - LD4 (red), LD5 (green) two user LEDs
  - LD6 (green), LD7 (red) USB OTG FS LEDs
- Push-button (reset)
- Four-direction joystick with selection
- USB OTG FS with Micro-AB connector
- SAI Audio DAC, stereo with output jack
- Digital microphone MEMS
- Accelerometer and magnetometer MEMS
- Gyroscope MEMS
- 128-Mbit Quad-SPI Flash memory
- STM32 current ammeter with 4 ranges and auto calibration
- I^2C extension connector for external board
- Four power supply options:
  - ST-LINK/V2-1
  - USB FS connector
  - External 5V
  - CR2032 battery (not provided)
- Extension connectors
- Comprehensive free software including a variety of examples, part of STM32Cube package

2 Demonstration software

The demonstration software is preloaded in the STM32L476VGT6 Flash memory for an easy demonstration of the device peripherals in stand-alone mode. The latest versions of the demonstration source code and associated documentation can be downloaded from www.st.com/stm32l4-discovery.

3 Ordering information

To order the Discovery kit based on the STM32L476VG MCU, use the order code: STM32L476G-DISCO.

4 Delivery recommendations

Some verifications are needed before using the board for the first time to make sure that nothing has been damaged during the shipment and that no components are unplugged or lost. When the board is extracted from its plastic bag, check that no component remains in the bag. In particularly, make sure that the following jumpers on top side of the board are plugged: CN3, JP3, JP5, and JP6.

The battery CR2032 is not provided.

5 Conventions

Table 1 provides conventions used in the present document.

Table 1. ON/OFF conventions

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Solder bridge SBx ON	SBx connections closed by solder
Solder bridge SBx OFF	SBx connections left opened

6 Bootloader limitations

Boot from system Flash memory results in executing **bootloader** code stored in the system Flash memory protected against writing and erasing. This allows in-system programming (ISP), that is, flashing the STM32 user Flash memory. It also allows writing data into RAM. The data come in via one of communication interfaces such as USART, SPI, I^2C bus, USB or CAN.

Bootloader version can be identified by reading the Bootloader ID at the address 0x1FFF6FFE.

The STM32L476VGT6 part soldered on the 32L476GDISCOVERY main board is marked with a date code corresponding to its date of manufacturing. STM32L476VGT6 parts with the date code prior or equal to week 22 of 2015 are fitted with **bootloader V 9.0** affected by the limitations to be worked around, as described hereunder. Parts with the date code starting from week 23 of 2015 contain bootloader V 9.2 in which the limitations no longer exist.

To locate the visual date code information on the STM32L476VGT6 package, refer to its datasheet (DS10198) available at *www.st.com*, section Package Information. Date code related portion of the package marking takes Y WW format, where Y is the last digit of the year and WW is the week. For example, a part manufactured in week 23 of 2015 bares the date code 5 23.

Bootloader ID of the bootloader V 9.0 is 0x90.

The following limitations exist in the bootloader V 9.0:

1. RAM data get corrupted when written via USART/SPI/I^2C/USB interface

Description:

Data write operation into RAM space via USART, SPI, I^2C bus or USB results in wrong or no data written.

Workaround:

To correct the issue of wrong write into RAM, download the STSW-STM32158 bootloader V 9.0 patch package from the *www.st.com* website and load "Bootloader V9.0 SRAM patch" to the MCU, following the information in readme.txt file available in the package.

2. User Flash memory data get corrupted when written via CAN interface

Description:

Data write operation into user Flash memory space via CAN interface results in wrong or no data written.

Workaround:

To correct the issue of wrong write into Flash memory, download the STSW-STM32158 bootloader V 0.9 patch package from the *www.st.com* website and load "Bootloader V9.0 CAN patch" to the MCU, following the information in readme.txt file available in the package.

7 Hardware layout and configuration

The STM32L476 Discovery board is designed around the STM32L476VGT6 (100-pin LQFP package). The hardware block diagram (see *Figure 2*) illustrates the connection between the STM32L476VGT6 and the peripherals (9-axis motion sensors, digital microphone MEMS, LCD segment, 128 Mbytes of Quad-SPI Flash memory, SAI Audio DAC stereo with 3.5mm output jack, USB OTG FS, IDD current measurement, LEDs, push-button, joystick) and the *Figure 3* will help to locate these features on the STM32L476 Discovery board.

Figure 2. Hardware block diagram

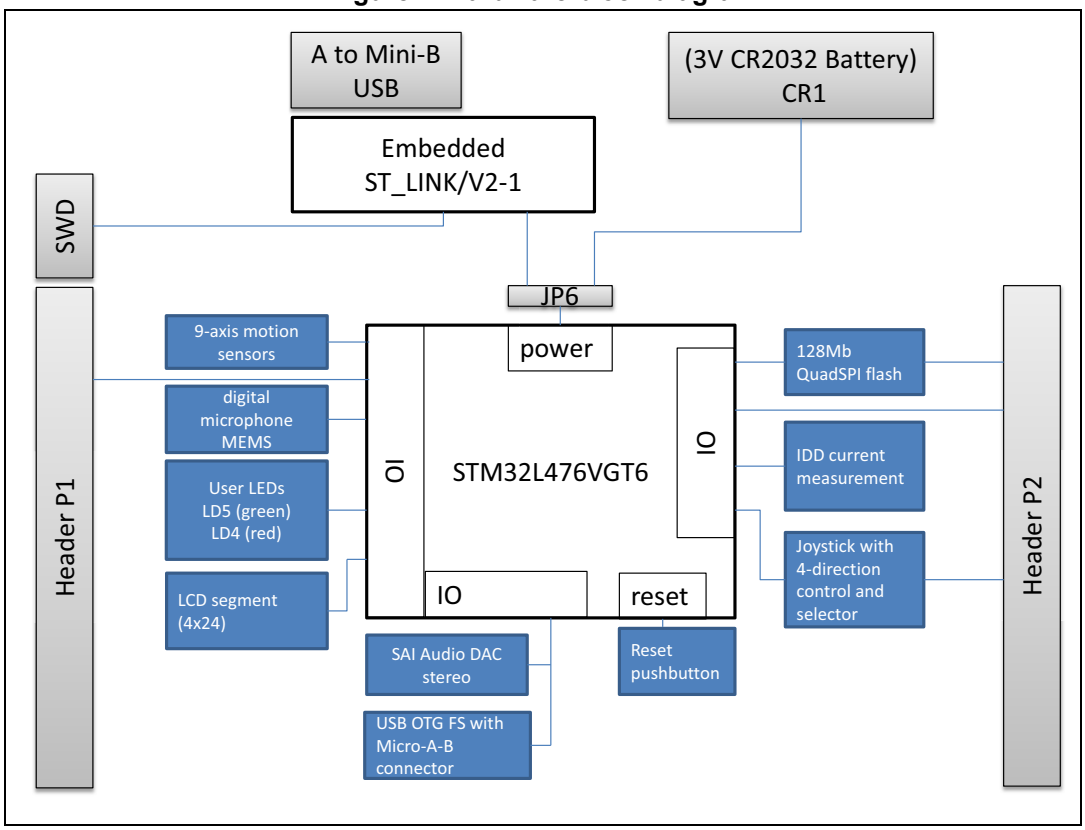


Figure 3. STM32L476 Discovery board top layout

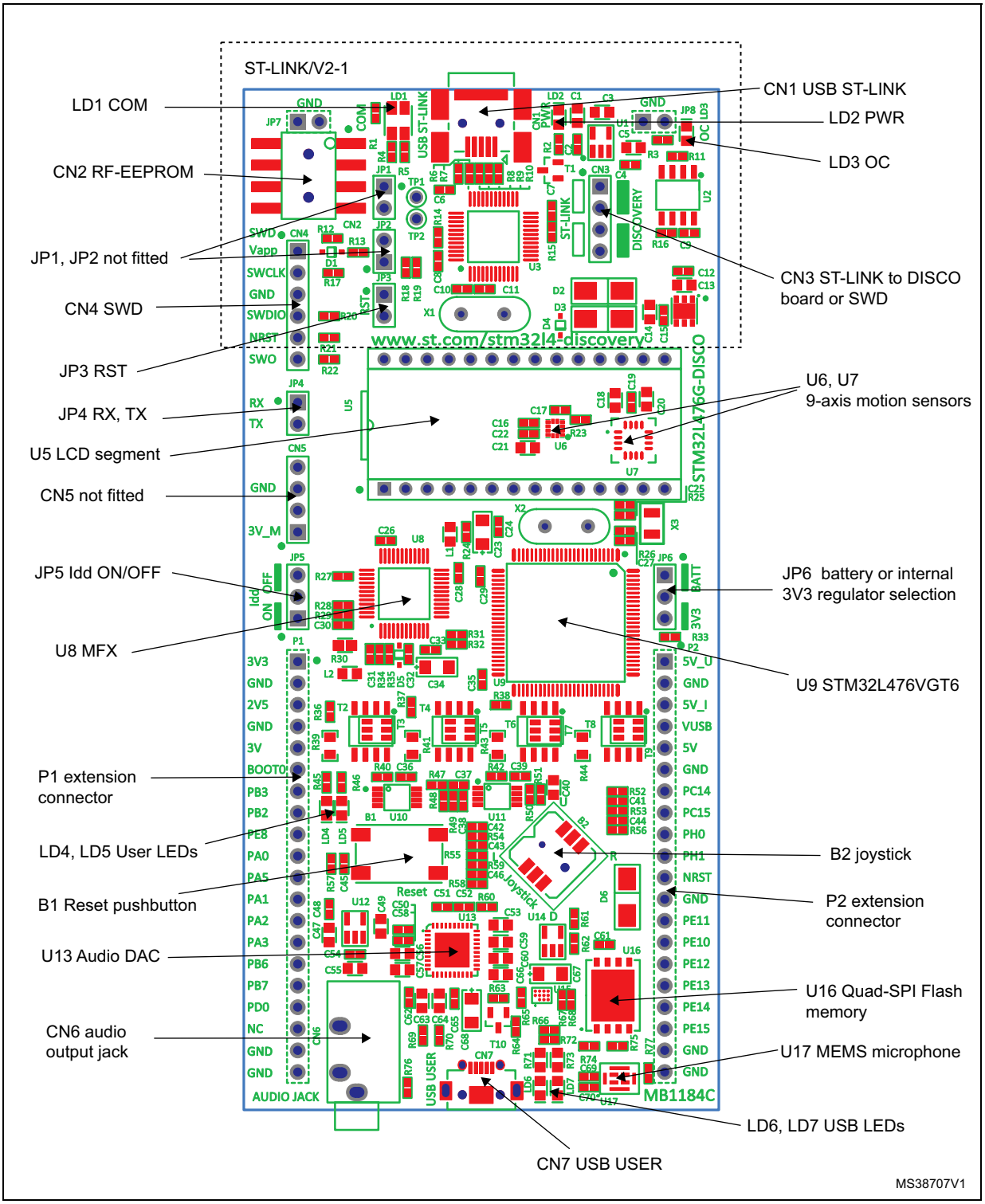
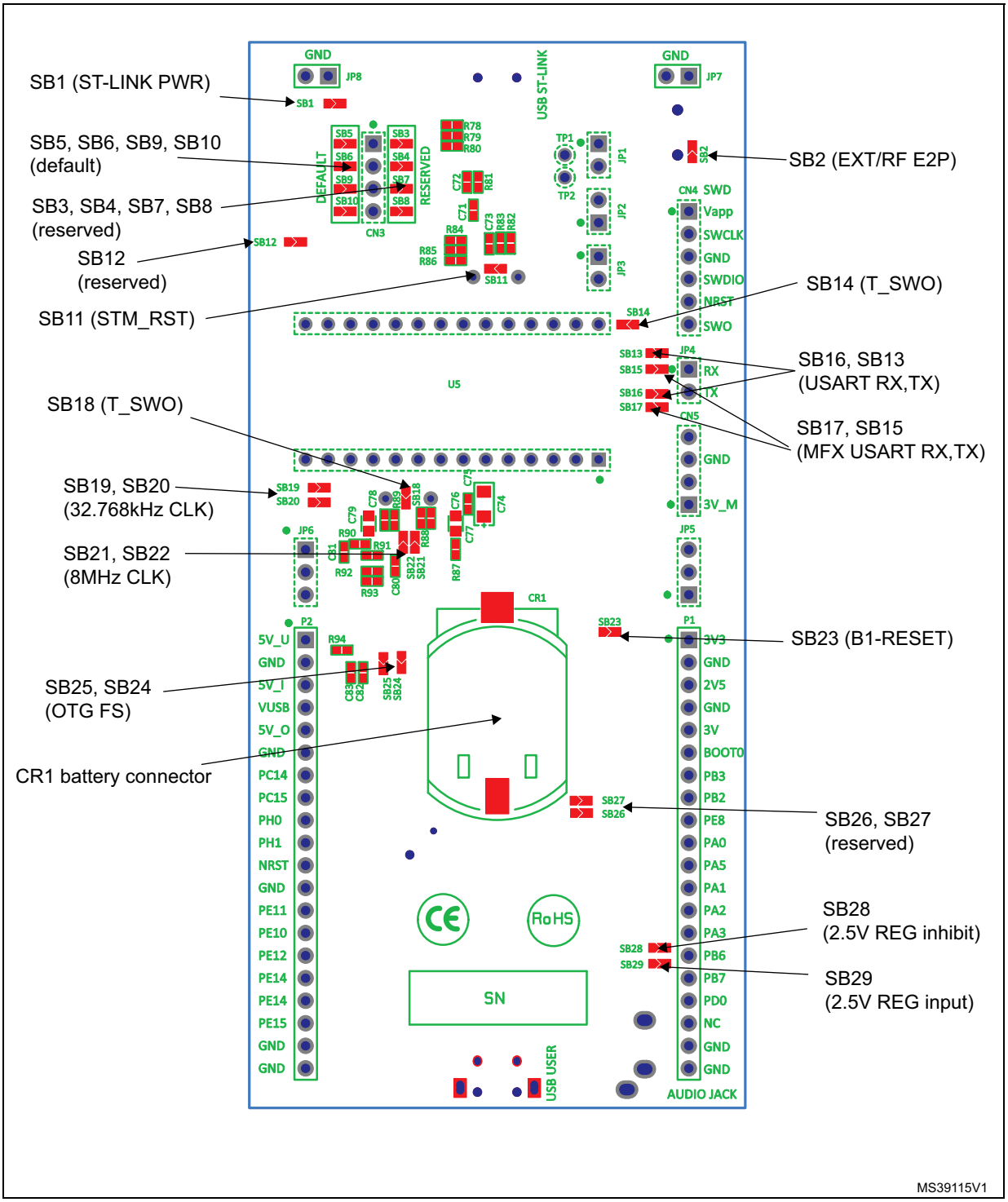


Figure 4. STM32L476 Discovery board bottom layout



7.1 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the STM32L476 Discovery board. Compared to ST-LINK/V2 the changes are listed below.
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

These features are no more supported on ST-LINK/V2-1:

- SWIM interface
- Application voltage lower than 3 V

For all general information concerning debugging and programming features common between V2 and V2-1 refer to *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32* User manual (UM1075).
There are two different ways to use the embedded ST-LINK/V2-1 depending on the jumper states:

- Program/debug the STM32L476VGT6 on board (*Section 7.1.3*)
- Program/debug an STM32 in an external application board using a cable connected to SWD connector CN4 (*Section 7.1.4*)

Table 2. Jumper states

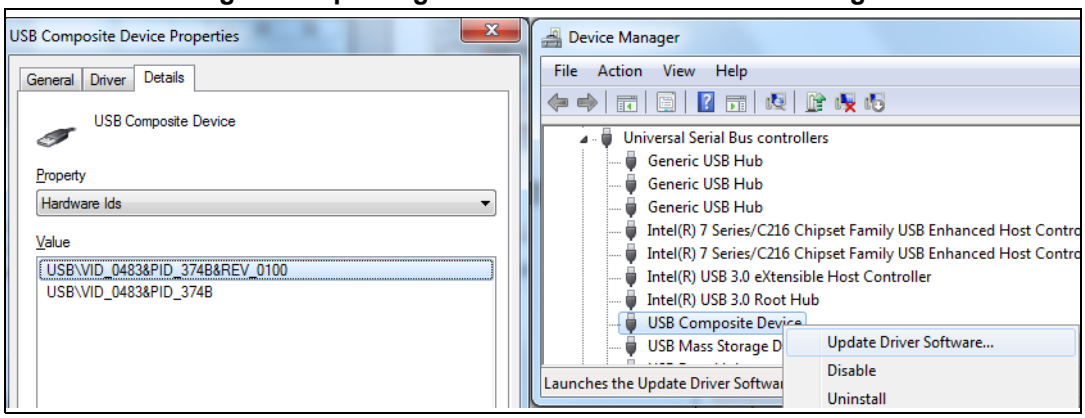
Jumper state	Description
Both CN3 jumpers ON	ST-LINK/V2-1 functions enabled for on-board programming (default)
Both CN3 jumpers OFF	ST-LINK/V2-1 functions enabled for external board through external CN4 connector (SWD supported)

7.1.1 Drivers

The ST-LINK/V2-1 requires a dedicated USB driver, which can be found on the *www.st.com* website for Windows 7, 8 and XP.

In case the STM32L476 Discovery board is connected to the PC before the driver is installed, some interfaces may be declared as “Unknown” in the PC device manager. In this case the user must install the driver files, and update the driver of the connected device from the device manager.

Figure 5. Updating the list of drivers in device manager



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

7.1.2 ST-LINK/V2-1 firmware upgrade

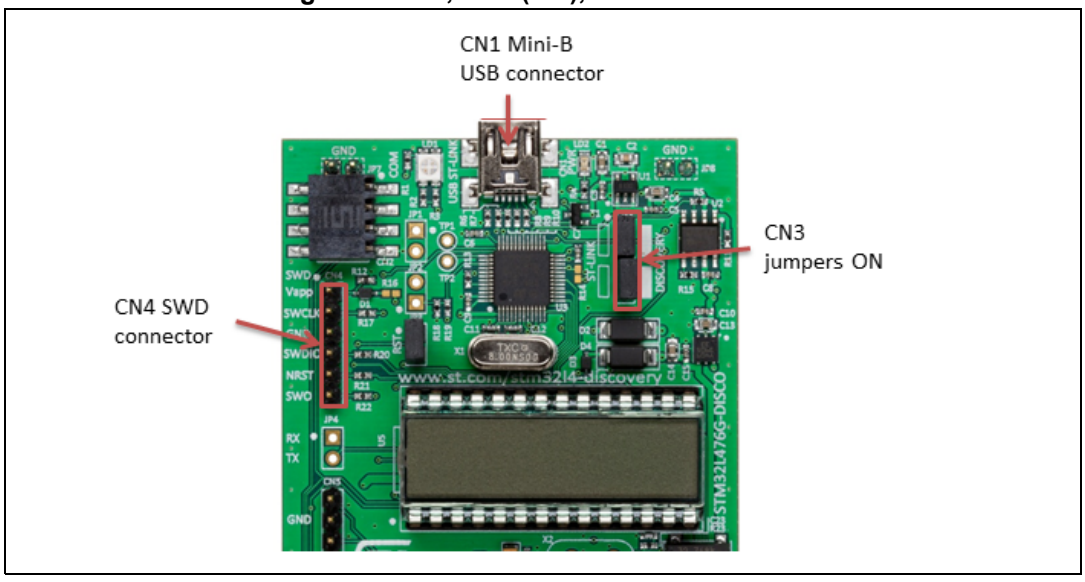
The ST-LINK/V2-1 embeds a firmware upgrade mechanism for in-situ upgrade through the USB port. As the firmware may evolve during the life time of the ST-LINK/V2-1 product (for example a new functionality, bug fixes, support for new microcontroller families), it is recommended to visit the *www.st.com* website before starting to use the STM32L476 Discovery board and periodically, in order to stay up-to-date with the latest firmware version.

7.1.3 Using ST-LINK/V2-1 to program/debug the STM32L476VGT6 on board

To program the STM32L476VGT6 on board, simply plug in the two jumpers on CN3, as shown in *Figure 6* in red, and connect the STM32L476 Discovery board to the PC through the Mini-B USB ST-LINK/V2-1 CN1 connector.
Make sure the jumpers JP3, JP6.3V3, and JP5.ON are set.

Do not use the CN4 connector.

Figure 6. CN1, CN3 (ON), CN4 connections



7.1.4 Using ST-LINK/V2-1 to program/debug an external STM32 application board

To use the ST-LINK/V2-1 to program the STM32 on an external application board (out of the STM32L476VGT6 on board), remove the two jumpers from CN3 as shown in *Figure 7* in red, and connect the board to the CN4 software debug connector according to *Table 3*.

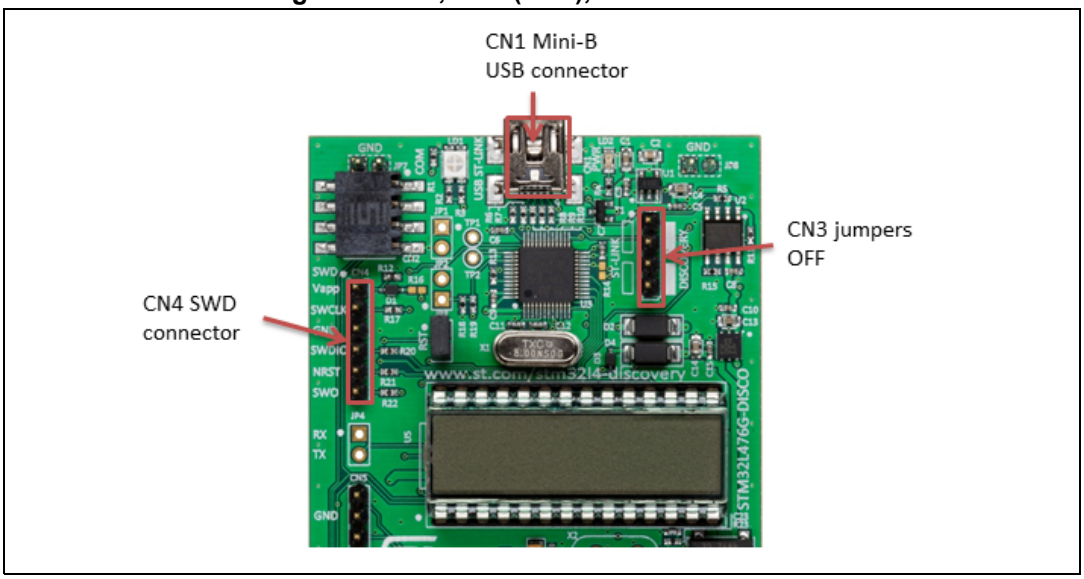
Make sure the jumpers JP6.3V3, and JP5.OFF are set.

JP3, must be ON if CN4 pin 5 (NRST) is used in the external application board.

Table 3. Debug connector CN4

Pin	CN4	Designation
1	Vapp	VDD from application
2	SWLCK	SWD clock
3	GND	Ground
4	SWDIO	SWD data input/output
5	NRST	RESET of target MCU
6	SWO	Reserved

Figure 7. CN1, CN3 (OFF), CN4 connections



7.2 Power supply

The power supply is provided with four options:

- ST-LINK/V2-1: CN1
- CR2032 battery (not provided): CR1
- External 5V: 5V_I
- USB FS connector: USB USER CN7

- ST-LINK/V2-1:

  JP6 needs to be placed in position 3V3. JP3 is closed. JP5 is in position ON. CN3 jumpers are ON.

  The STM32L476G Discovery board can be powered from the ST-LINK USB connector CN1 (5V_USB_ST_LINK). Only the ST-LINK circuit has the power before the USB enumeration, as the host PC only provides 100mA to the board at that time.

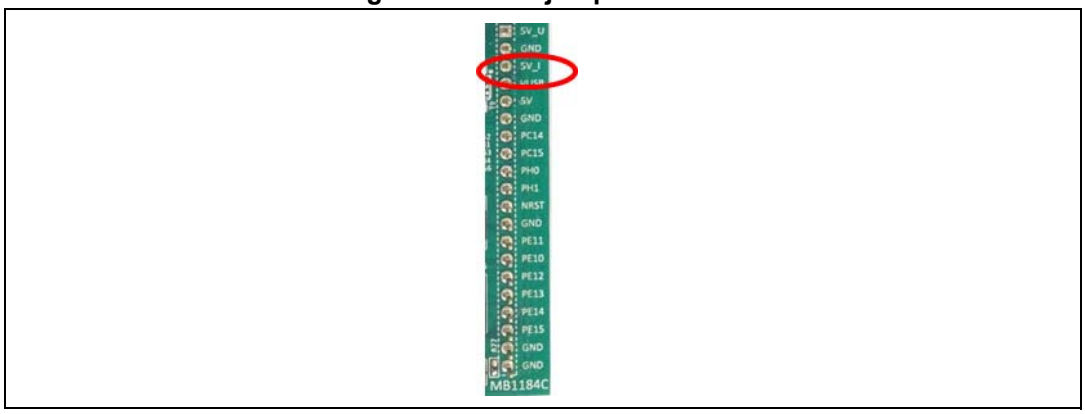
  During the USB enumeration, the STM32L476 Discovery board requires 300 mA of current to the host PC. If the host is able to provide the required power, the STM32L476 is powered and the red LED LD2 is turned ON, thus the STM32L476 Discovery board and its extension board can consume no more than 300 mA current. If the host is not able to provide the required current, the STM32L476 and the extension board are not power supplied. As a consequence the red LED LD2 remains turned OFF. In such case it is mandatory to use an external power supply, as explained in the next section.

Warning: If the maximum current consumption of the STM32L476 Discovery board and its extension board exceeds 300 mA, it is mandatory to power the STM32L476 Discovery board using an external power supply connected to 5V_I.

Note: In case this board is powered by a USB charger or a USB battery connected on CN1, there is no USB enumeration, the led LD2 remains OFF and the STM32L476 is not powered. In this specific case only, fit the jumper JP2 to allow the STM32L476 to be powered anyway. Remove this jumper JP2 if then a host PC is connected to the ST-LINK/V2-1 CN1 connector to supply the board.

- CR2032 battery inserted in CR1 (bottom side):
  - The CR2032 battery is not provided
  - JP6 needs to be placed in position BATT. JP3 is opened. JP5 is in position ON
  - The battery supplies the 3V3 and 3V power domains on board. All the peripherals are powered, except the ST-LINK, which can only be supplied through the USB connector CN1
- External 5V_I or USB USER CN7 (USB FS connector):
  - External 5V_I: The pin 3 5V_I of P2 header can be used as input for an external power supply. In this case, the STM32L476 Discovery board must be powered by a power supply unit or by an auxiliary equipment complying with the standard EN-60950-1: 2006+A11/2009, and must be Safety Extra Low Voltage (SELV) with a limited power capability.
  - To use the USB USER CN7 to power supply the board, a jumper needs to be placed between VUSB pin 4 and the pin 3 5V_I of P2 header (see *Figure 8*).

Figure 8. Board jumper location



In this condition it is still possible to use the USB ST-LINK for communication, for programming or debugging, but it is mandatory to power supply the board first using 5V_I or USB USER CN7 then connect the USB ST-LINK cable to the PC. Proceeding this way ensures that the enumeration occurs thanks to the external power source.

The following power sequence procedure must be respected:

1. Connect the external power source to 5V_I or USB USER CN7.
2. Power on the external power supply 5V_I or USB USER CN7.
3. Check that LD2 is turned ON.
4. Connect the PC to USB ST-LINK connector CN1.

If this order is not respected, the board may be supplied by 5V_USB_ST_LINK first then by 5V_I or USB USER CN7 and the following risks may be encountered:

1. If more than 300 mA current is needed by the board, the PC may be damaged or the current supply can be limited by the PC. As a consequence the board is not powered correctly.
2. 300 mA is requested at enumeration (since JP2 must be OFF) so there is risk that the request is rejected and the enumeration does not succeed if the PC cannot provide such current. Consequently the board is not power supplied (LED LD2 remains OFF).

Note: The headers pins 5V (except in battery mode), 3V3, 2V5, 3V can be used as output power supply when an extension board is connected to the P1 and P2 headers. The power consumption of the extension board must be lower than 100 mA.

7.3 Clock source

The STM32L476VGT6 MCU uses:

- A 32.768 KHz low-speed source:
  - By default, the X3 crystal on board
  - From an external oscillator through P2 header (pin 7 labeled ‘PC14’). The configuration needed is:

    SB19 opened, SB20 closed, R26 removed
- A system clock source:
  - By default, generated by an internal STM32L476VGT6 oscillator. The configuration needed is:

    SB18 opened, SB21 and SB22 closed
  - Or driven by an X2 Crystal on board (not fitted). The configuration needed is:

    SB18, SB21 and SB22 opened

    X2, R88, R89, C77, C78 fitted
  - Or driven by a MCO signal (8MHz) from the ST-LINK MCU STM32F103CBT6 (U3).The configuration needed is:

    SB18 closed, SB22 opened

    R89 not fitted
  - Or driven externally from PH0 through the P2 header, pin 9 labeled ‘PH0’.The configuration needed is:

    SB22 closed, SB18 opened

    R89 not fitted

Note: Refer to Oscillator design guide for STM8S, STM8A and STM32 microcontrollers Application note (AN2867).

7.4 Reset source

The reset signal NRST of the STM32L476 Discovery board is low active and the reset sources include:

- The reset button B1, connected by default to NRST (SB23 closed)
- The embedded ST-LINK/V2-1
- The external reset pin 11 of P2 header connector, labeled ‘NRST’
- The external reset from SWD connector CN4, pin 5

Table 4. Reset related jumper

Jumper	Description
JP3	When JP3 is closed, the SWD connector CN4 pin 5 and the embedded ST-LINK/V2-1 are connected to NRST. Default Setting: closed
	JP3 is opened, no connection between CN4 and ST-LINK/V2-1 to NRST. This must be used when the ST-LINK/V2-1 is not powered (i.e STM32L476 Discovery board) is powered by the CR2032 battery

7.5 User interface: LCD, joystick, LEDs

The STM32L476 Discovery board features sept LEDs with the following functionalities:

- 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/V2-1
- LD2 PWR: the red LED indicates that the board is powered
- LD3 OC: the red LED indicates a fault when the board is in current limit (510 mA)
- LD4 user: the red LED is a user LED connected to the I/O PB2 of the STM32L476VGT6
- LD5 user: the green LED is a user LED connected to the I/O PE8 of the STM32L476VGT6
- LD6, LD7: USB OTG FS LEDs, see *Section 7.8*

Four-direction joystick (B2) with selection and a reset push-button (B1) are available as input devices.

An LCD 4x24 segments, 4 commons, multiplexed 1/4 duty, 1/3 bias is mounted on the DIP28 connector U5.

7.6 Boot0 configuration

Boot0 is by default grounded through a pull-down R91.

It is possible to set Boot0 high, removing R91 and putting a jumper between P1 header pin 6 BOOT0 and pin 5 3V.

7.7 Quad-SPI NOR Flash memory

128-Mbit Quad-SPI NOR Flash memory is connected to Quad-SPI interface of STM32L476VGT6.

7.8 USB OTG FS

The STM32L476 Discovery board supports USB OTG Full Speed communication via a USB Micro-AB connector (CN7) and a USB power switch (U14) connected to VBUS. The board can be powered by this USB connection as described in *Section 7.2*.

A green LED LD6 will be lit in one of these cases:

- The power switch (U14) is ON and STM32L476 Discovery board works as a USB host
- VBUS is powered by another USB host when STM32L476 Discovery board works as a USB device

Red LED LD7 will be lit when an overcurrent occurs.

In order to connect the OTG_FS_VBUS and OTG_FS_ID signals from the connector CN7 to the OTG FS hardware IP of STM32L476VGT6, remove the LCD from its socket U5, and close SB24 and SB25.

The default configuration is: the LCD is connected to U5, and SB24 and SB25 are opened. In this case the OTG_FS_VBUS and OTG_FS_ID signals from CN7 are connected to the OTG FS peripheral of the STM32L476VGT6 available on PC11 and PC12.

7.9 USART configuration

The USART interface available on PD5 and PD6 of the STM32L476VGT6 can be connected to the ST-LINK MCU to use the Virtual Com Port function.

To use the Virtual Com Port function with:

- The on-board STM32L476VGT6: set SB13 and SB16 ON (SB15, SB17 must be OFF).
- An external MCU: remove solder from SB13 and SB16, solder a two pins header on JP4, then RX and TX of the external MCU can be connected directly to RX and TX of JP4.

(For more details see *Section 8: Schematics*)

7.10 Audio DAC and MEMS microphone

An audio stereo DAC CS43L22 (U13) is connected to SAI interface of STM32L476VGT6.

The STM32L476VGT6 controls the audio DAC via the I2C1 bus which is shared with the I^2C extension connector CN2.

I2C1 is also available on the connector P1, pins labeled ‘PB6’ (I2C1_SCL) and ‘PB7’ (I2C1_SDA).

The stereo output jack connector is CN6.

Note: I^2C *address of CS43L22 is 0x94.*

A MEMS audio sensor omnidirectional digital microphone provides a digital signal in PDM format to the STM32L476VGT6.

7.11 9-axis motion sensors

STM32L476 Discovery board supports some 9-axis motion sensors, composed of:

- L3GD20 (U7): a three-axis digital output gyroscope
- LSM303C (U6): a 3D accelerometer and 3D magnetometer module

which are connected to STM32L476VGT6 through SPI.

7.12 I^2C extension connector CN2

Figure 9. Connector CN2

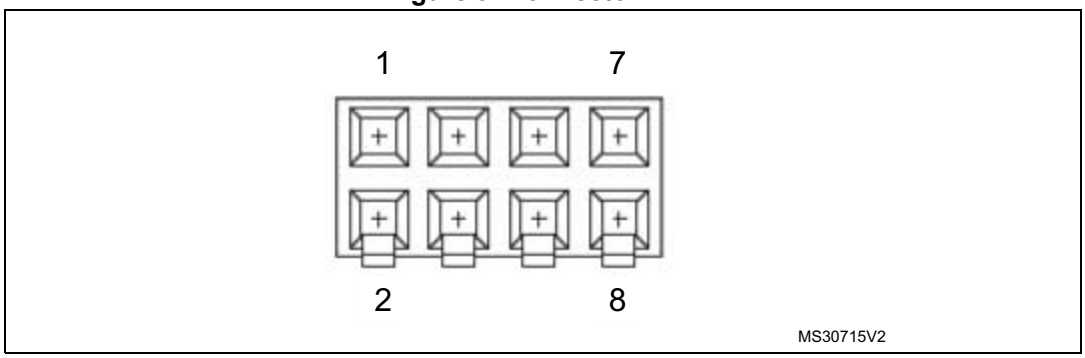


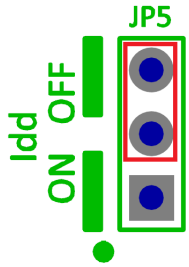
Table 5. Connector CN2

Pin number	Description	Pin number	Description
1	I2C1_SDA (PB7)	5	+3V3
2	NC	6	NC
3	I2C1_SCL (PB6)	7	GND
4	EXT_RST(PD0)	8	NC

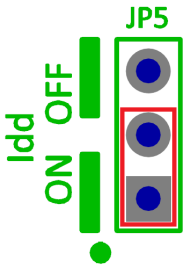
7.13 MCU current ammeter

The jumper JP5, labeled Idd, allows the consumption of STM32L476VGT6 to be measured directly by a built-in current ammeter circuit able to measure from 60nA to 50mA or by removing the jumper and connecting an ammeter:

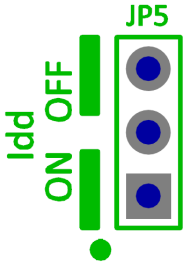
- Jumper on position OFF: STM32L476VGT6 is powered (default).



- Jumper on position ON: an on-board module is designed to measure from 60nA to 50mA by using several MOSFETs and switching automatically depending on the read value.



- No jumper on JP5: an ammeter must be connected to measure the STM32L476VGT6 current through pin 1 and 2 (if there is no ammeter, the STM32L476VGT6 is not powered).



7.14 Extension connector P1 and P2

The P1 and P2 headers can connect the STM32L476 Discovery board to a standard prototyping/wrapping board. STM32L476VGT6 GPIOs are available on these connectors.

P1 and P2 can also be probed by an oscilloscope, logical analyzer or voltmeter.

Table 6. Extension connector

P1		P2	
Pin number	**function**	**Pin number**	**function**
1	3V3	1	5V_U (5V_USB_ST_LINK)
2	GND	2	GND
3	2V5	3	5V_I (5V INPUT)
4	GND	4	VUSB (USB OTG FS VBUS)
5	3V	5	5V
6	BOOT0	6	GND
7	PB3	7	PC14
8	PB2	8	PC15
9	PE8	9	PH0
10	PA0	10	PH1
11	PA5	11	NRST
12	PA1	12	GND
13	PA2	13	PE11
14	PA3	14	PE10
15	PB6	15	PE12
16	PB7	16	PE13
17	PD0	17	PE14
18	NC	18	PE15
19	GND	19	GND
20	GND	20	GND

7.15 Solder bridges

Table 7 describes each solder bridge. The default state is indicated in bold.

Table 7. Solder bridges

Bridge	State	Description
SB1 (ST-LINK PWR)	**ON**	ST-LINK module is powered
	OFF	ST-LINK module is not powered
SB2 (EXT/RF E2P)	ON	5V connected to CN2.8
	OFF	5V is not connected to CN2.8
SB3, SB4, SB7, SB8 (RESERVED)	**OFF**	Reserved, do not modify
SB5, SB6, SB9, SB10 (DEFAULT)	**ON**	Reserved, do not modify
SB11 (STM_RST)	ON	No incidence on NRST signal of STM32F103CBT6
	OFF	NRST signal of STM32F103CBT6 is connected to GND
SB12	**OFF**	Reserved
SB16, SB13 (USART RX, TX)	**ON**	PA2, PA3 of STM32F103CBT6 are connected to PD6, PD5 of STM32L476VGT6
	OFF	PA2, PA3 of STM32F103CBT6 are not connected to PD6, PD5 of STM32L476VGT6
SB17, SB15 (MFX USART RX,TX)	ON	PA10 of STM32F103CBT6 are not connected to PB3 of STM32L476VGT6
	OFF	PA2, PA3 of STM32F103CBT6 are connected to MFX USART RX,TX
SB14 (T_SWO)	ON	PA10 of STM32F103CBT6 is connected to PB3 of STM32L476VGT6
	OFF	PA10 of STM32F103CBT6 is not connected to PB3 of STM32L476VGT6
SB18 (MCO)	ON	If SB22 is also ON, MCO is connected to PH0
	OFF	MCO is not connected to PH0
SB19, SB20 (32.768kHz CLK)	**ON**	PC14, PC15 are connected to X3 crystal
	OFF	PC14, PC15 are not connected to X3 crystal
SB21, SB22 (8MHz CLK)	**ON**	PH0, PH1 are connected to X2 crystal (X2 is not fitted)
	OFF	PH0, PH1 are not connected to X2 crystal
SB23 (B1-RESET)	**ON**	B1 push-button is connected to NRST of STM32L476 Discovery board
	OFF	B1 push-button is not connected to NRST of STM32L476 Discovery board

Table 7. Solder bridges (continued)

Bridge	State	Description
SB24, SB25 (OTG FS)	**ON**	OTG_FS_VBUS signal is connected to PA9 OTG_FS_ID signal is connected to PA10
	OFF	OTG_FS_VBUS signal is not connected to PA9 OTG_FS_ID signal is not connected to PA10
SB26	**ON**	Reserved, do not modify
SB27	**OFF**	Reserved, do not modify
SB28 (2.5V REG inhibit)	**ON**	U12 (2.5V regulator) input is inhibited
	OFF	U12 input is not inhibited
SB29 (2.5V REG input)	ON	5V is connected to U12 input
	OFF	5V is not connected to U12 input

8 Schematics

Figure 10. STM32L476 Discovery board design top sheet

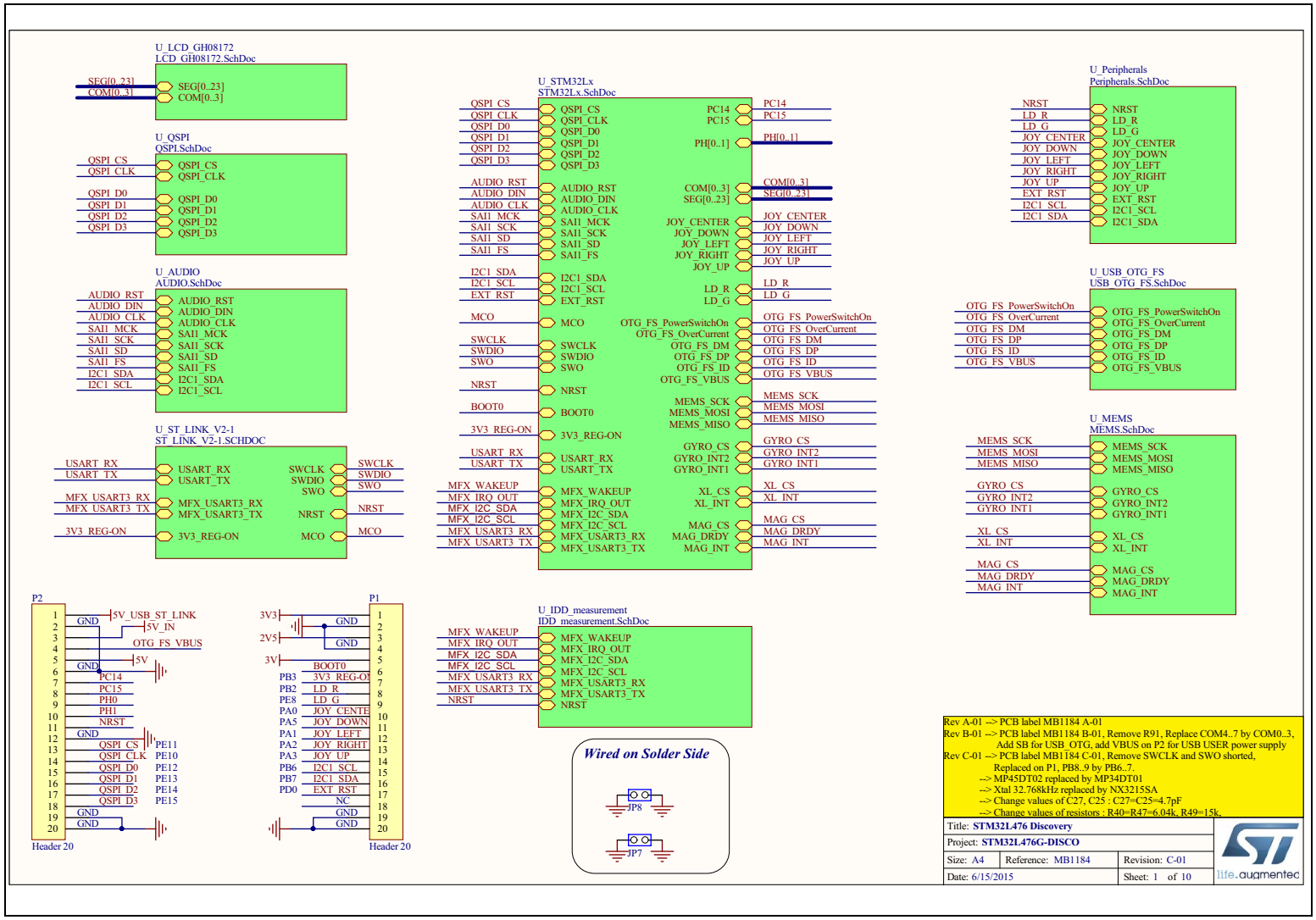


Figure 11. ST-LINK/V2-1 with support of SWD only

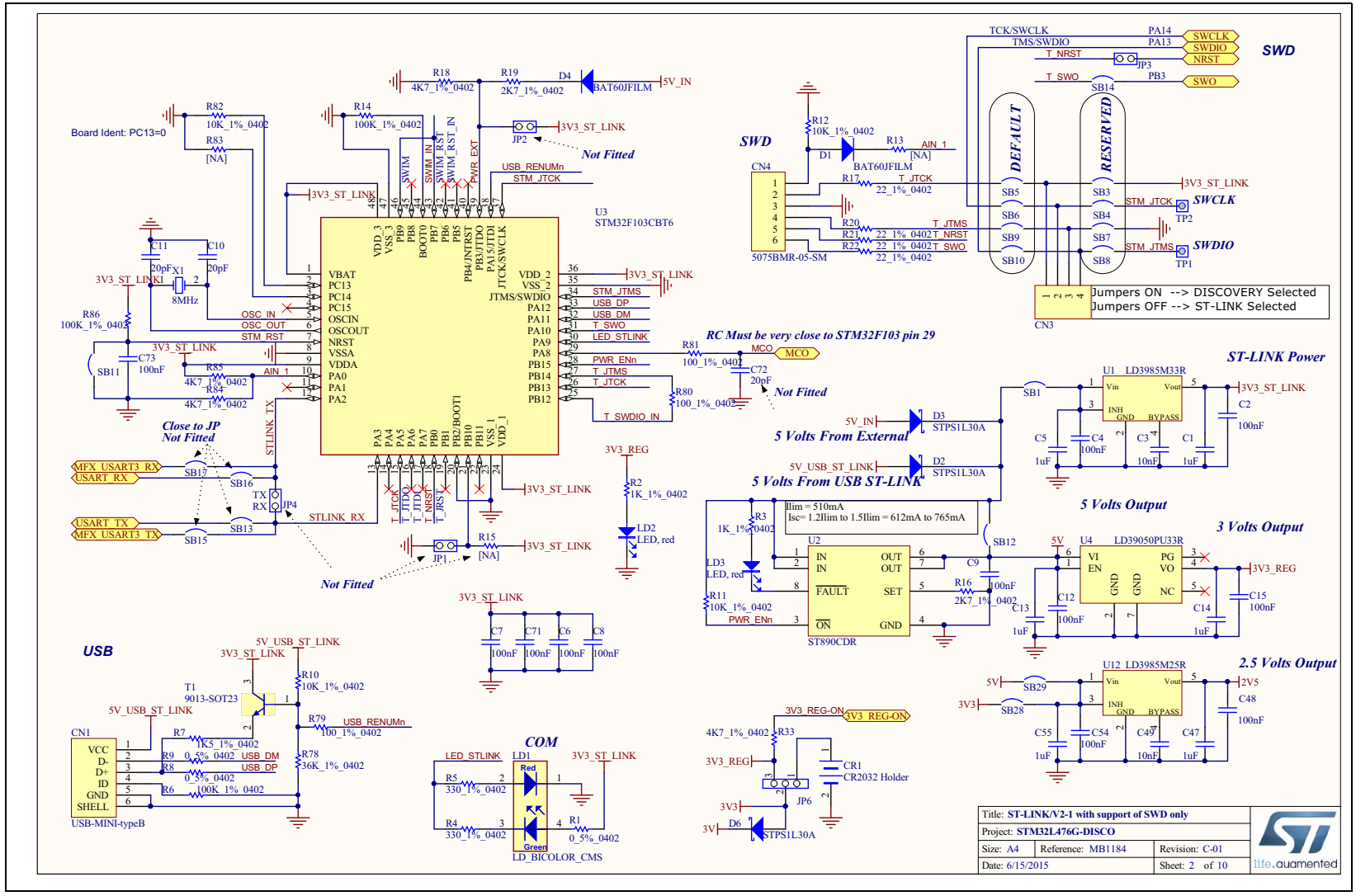


Figure 12. STM32L476VGT6 MCU

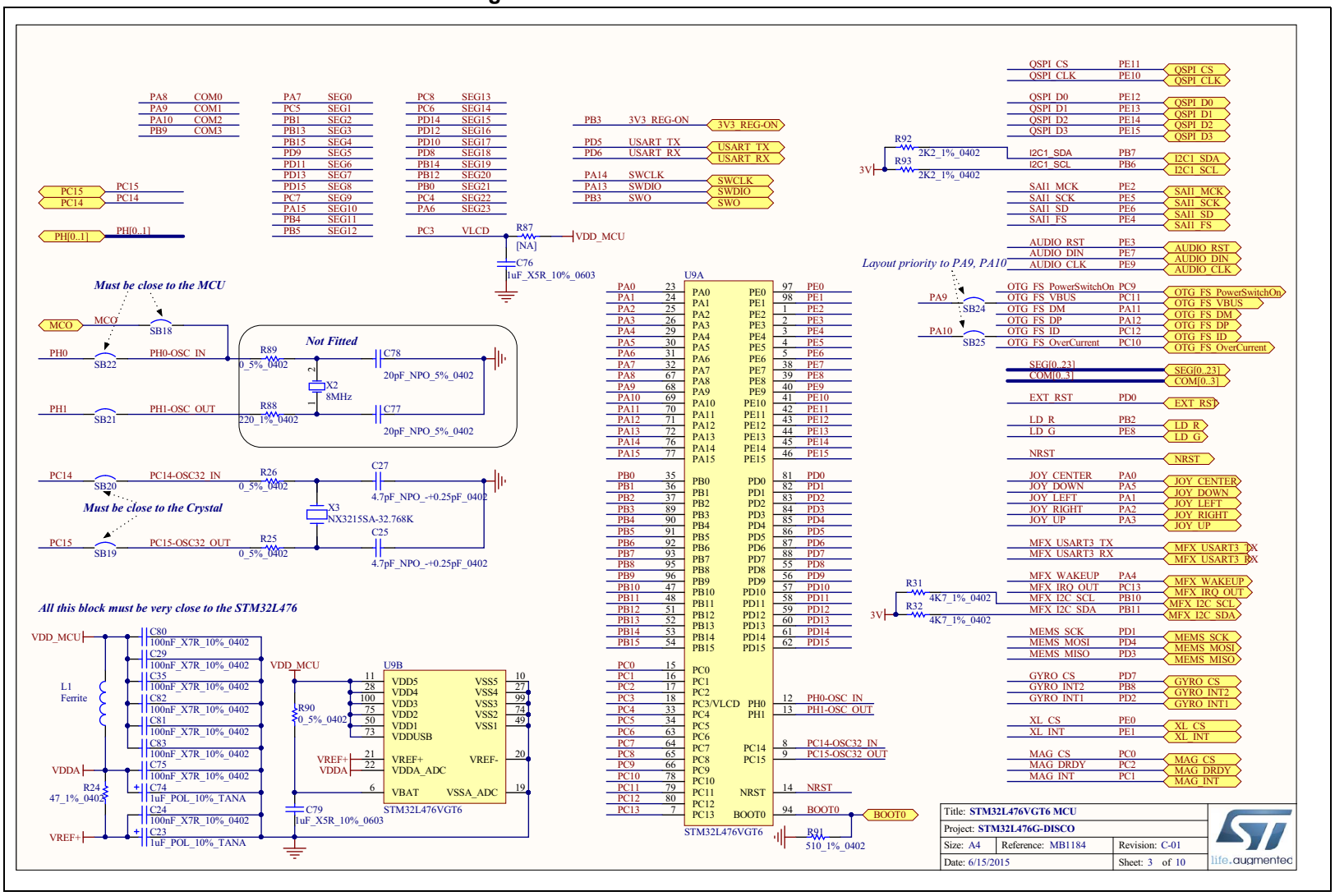


Figure 13. IDD measurement / MFX (Multi Function eXpander)

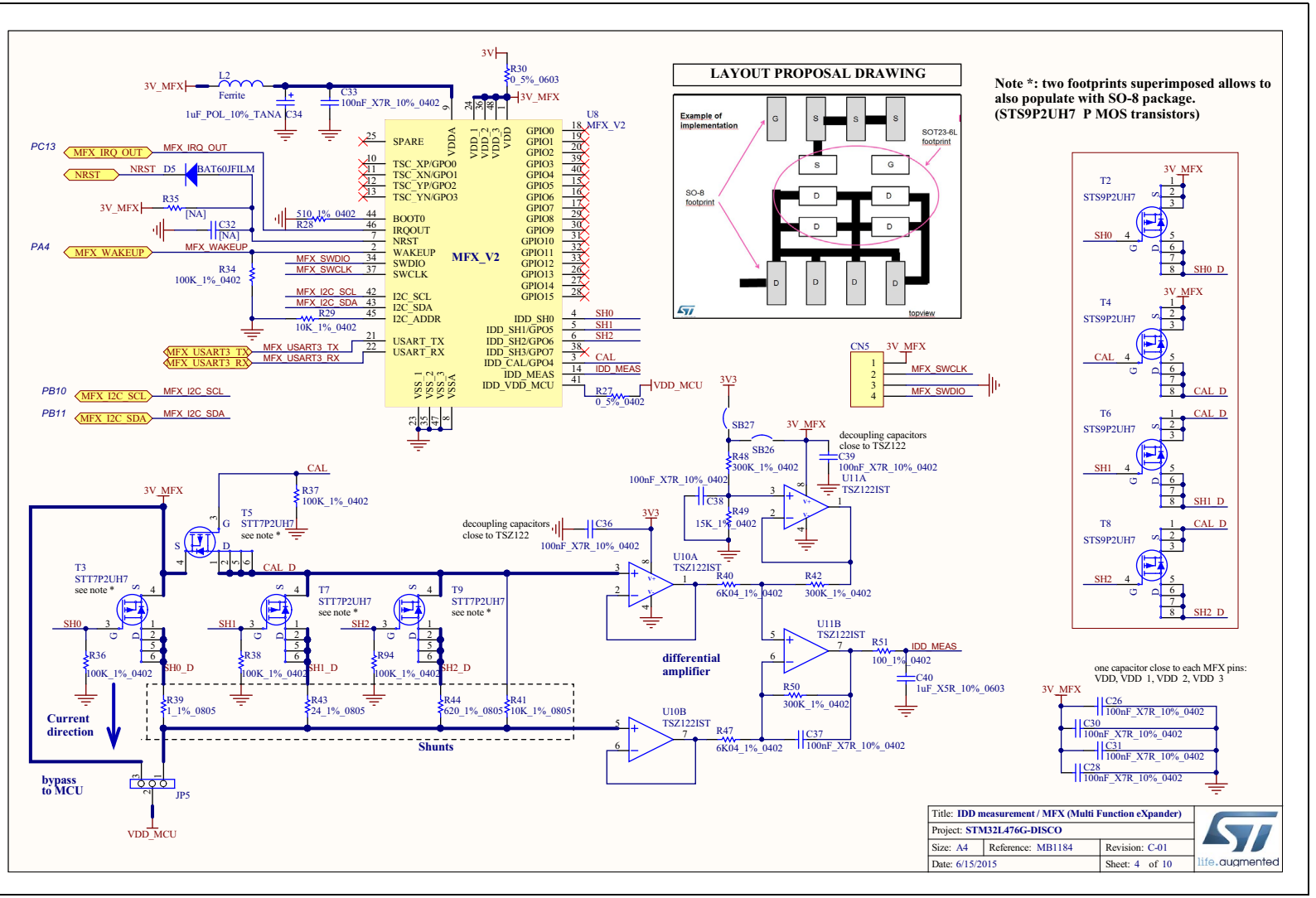


Figure 14. Joystick ACP, LEDs and push-button

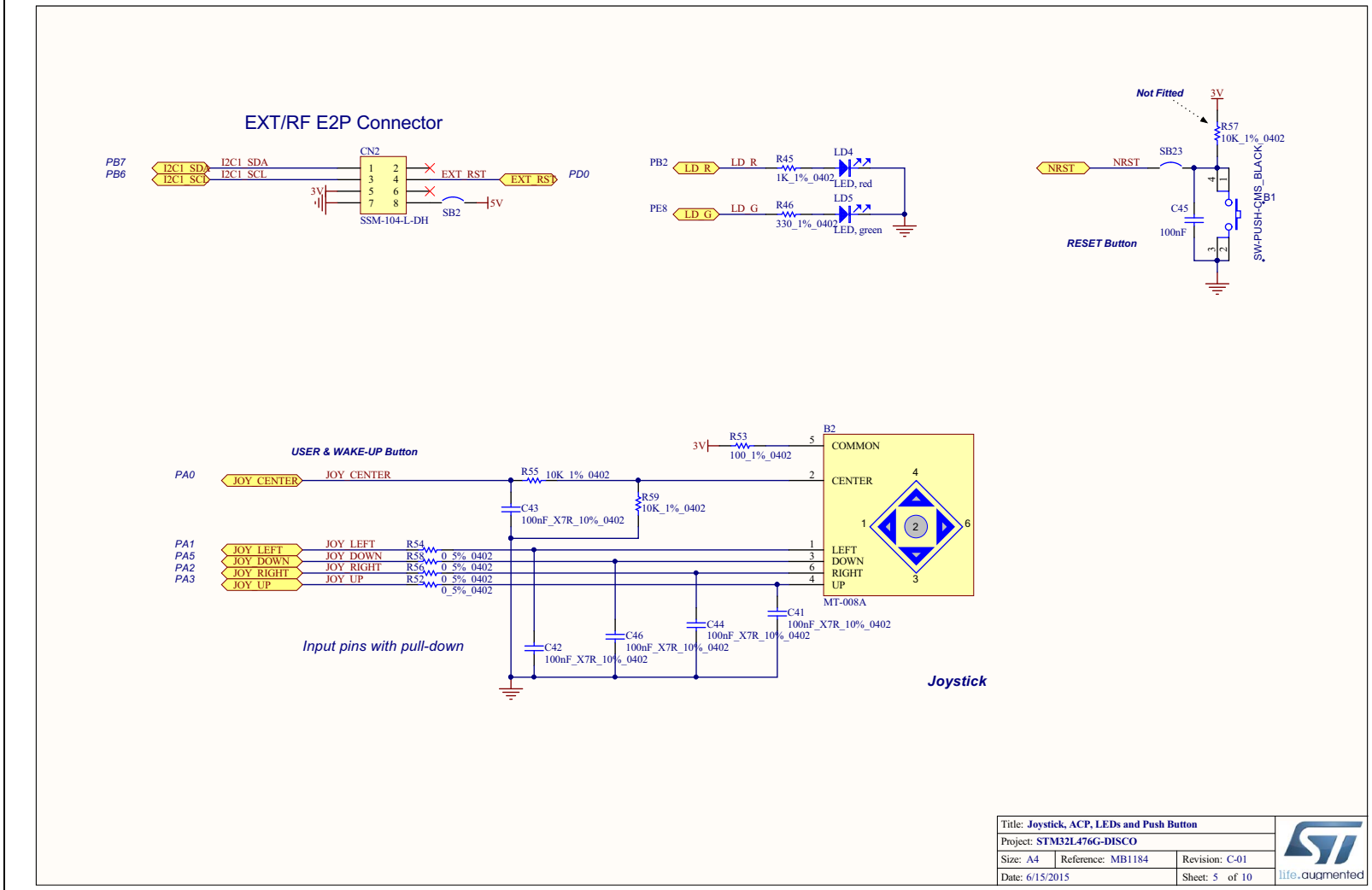


Figure 15. LCD display

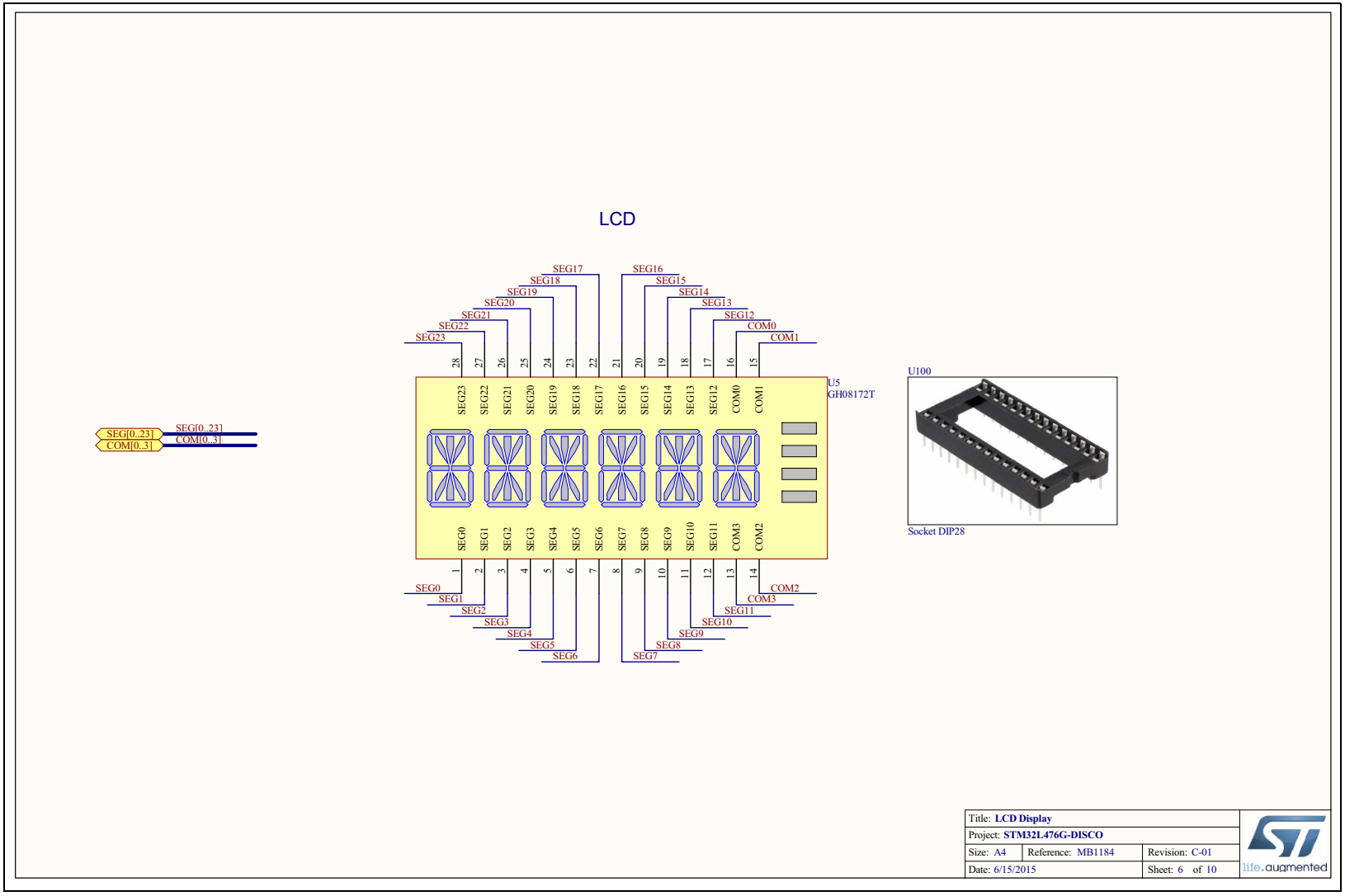


Figure 16. OTG USB FS

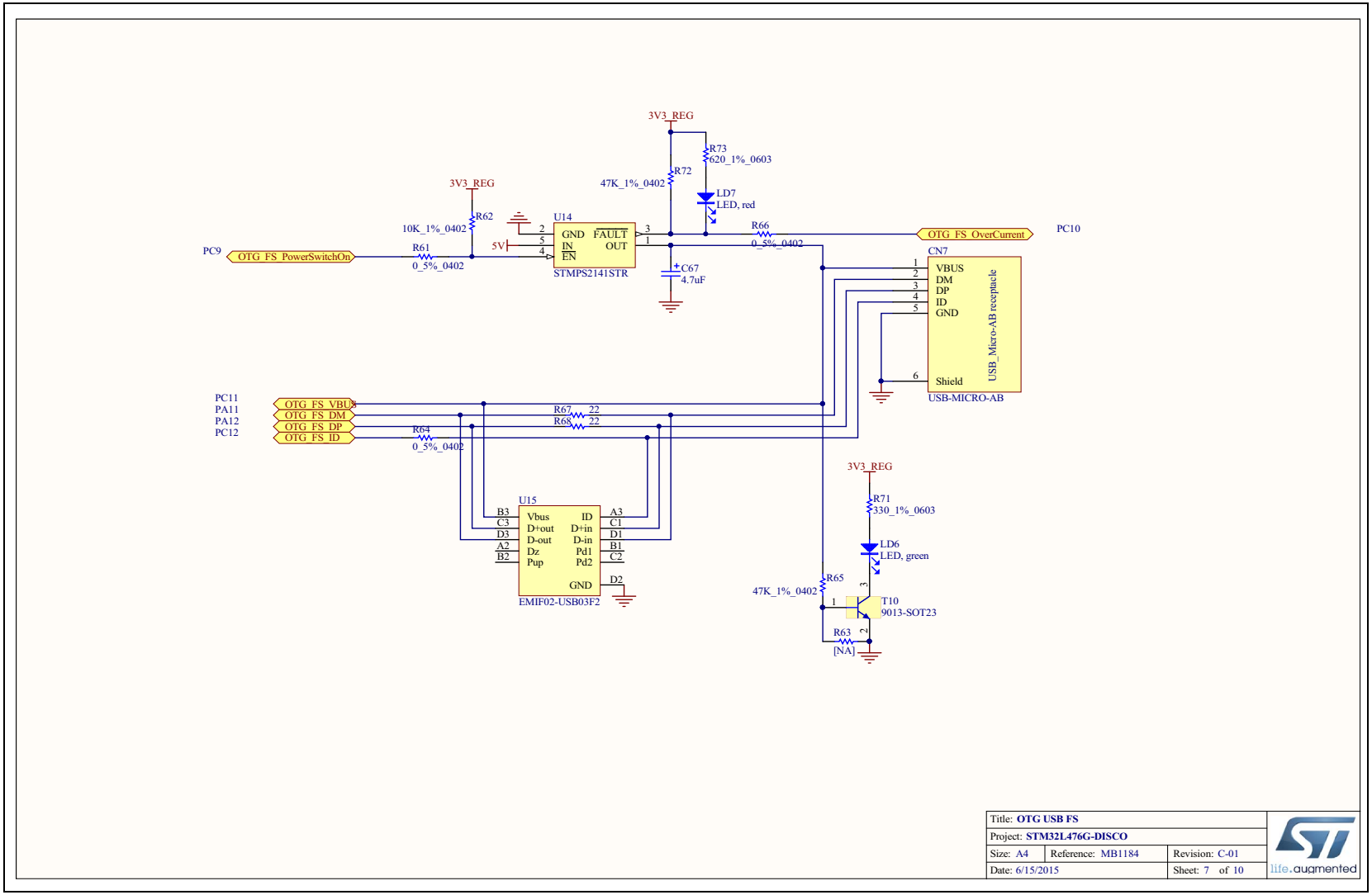


Figure 17. Audio DAC and microphone MEMS

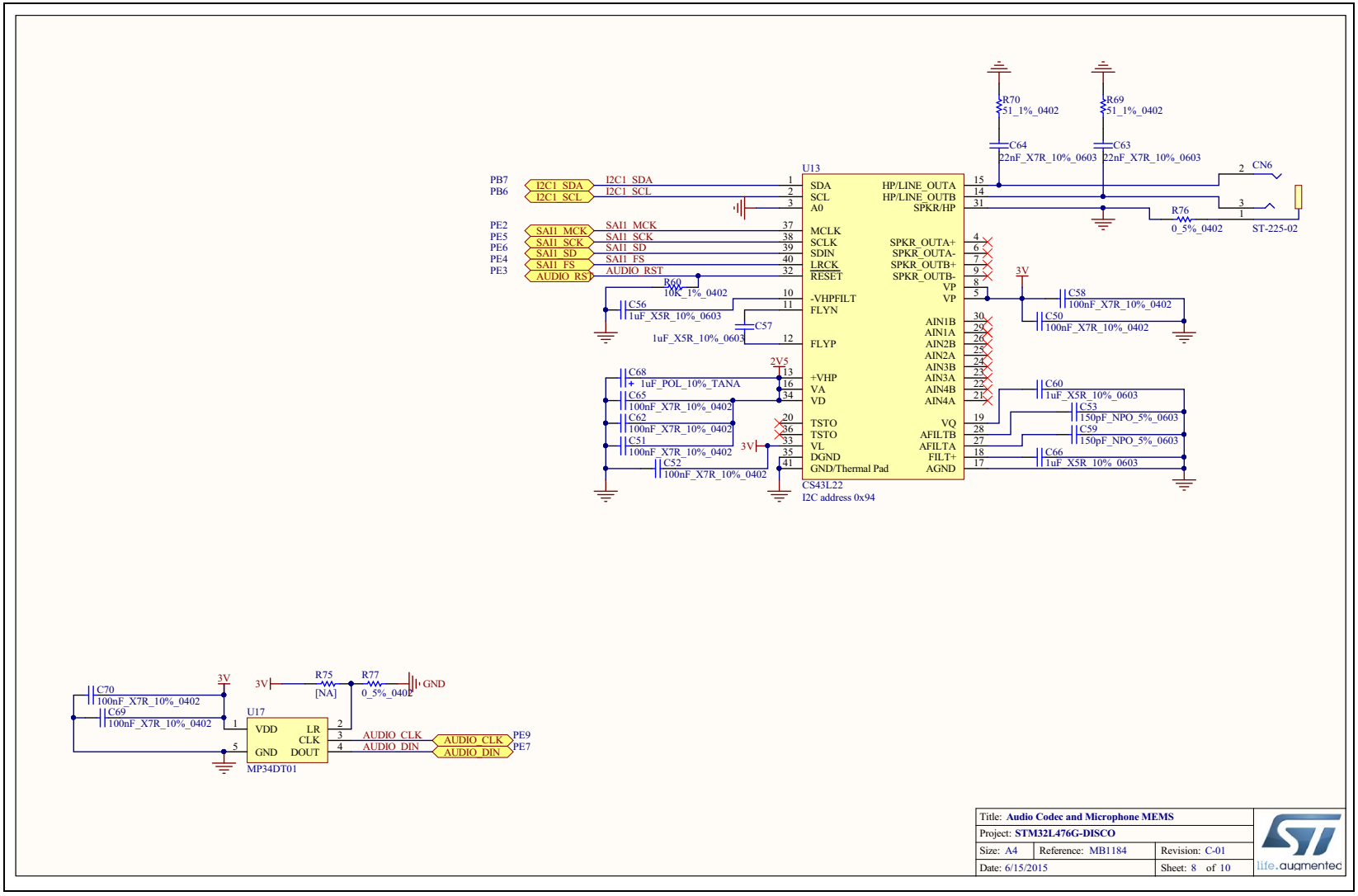


Figure 18. Quad-SPI Flash memory

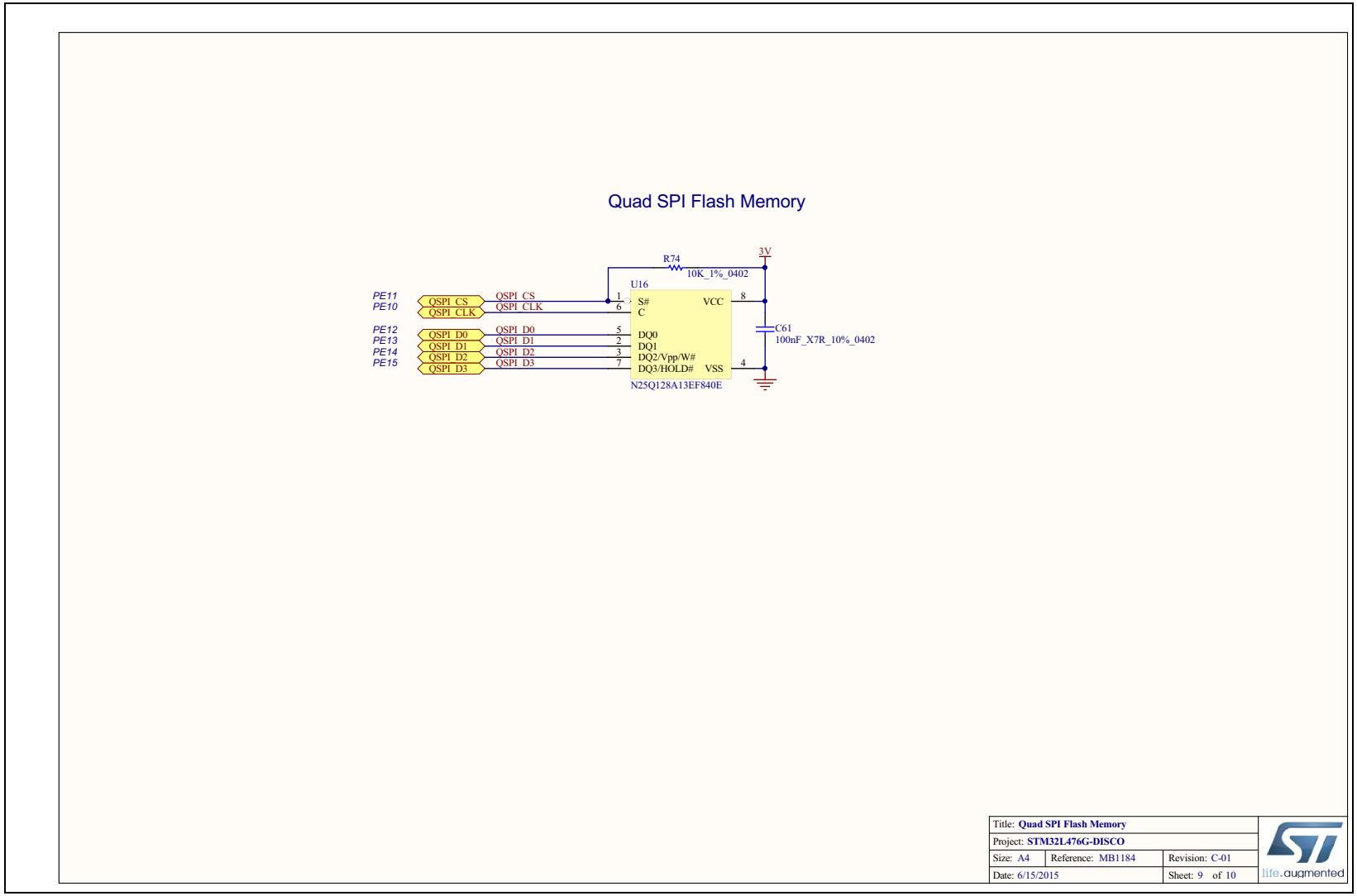
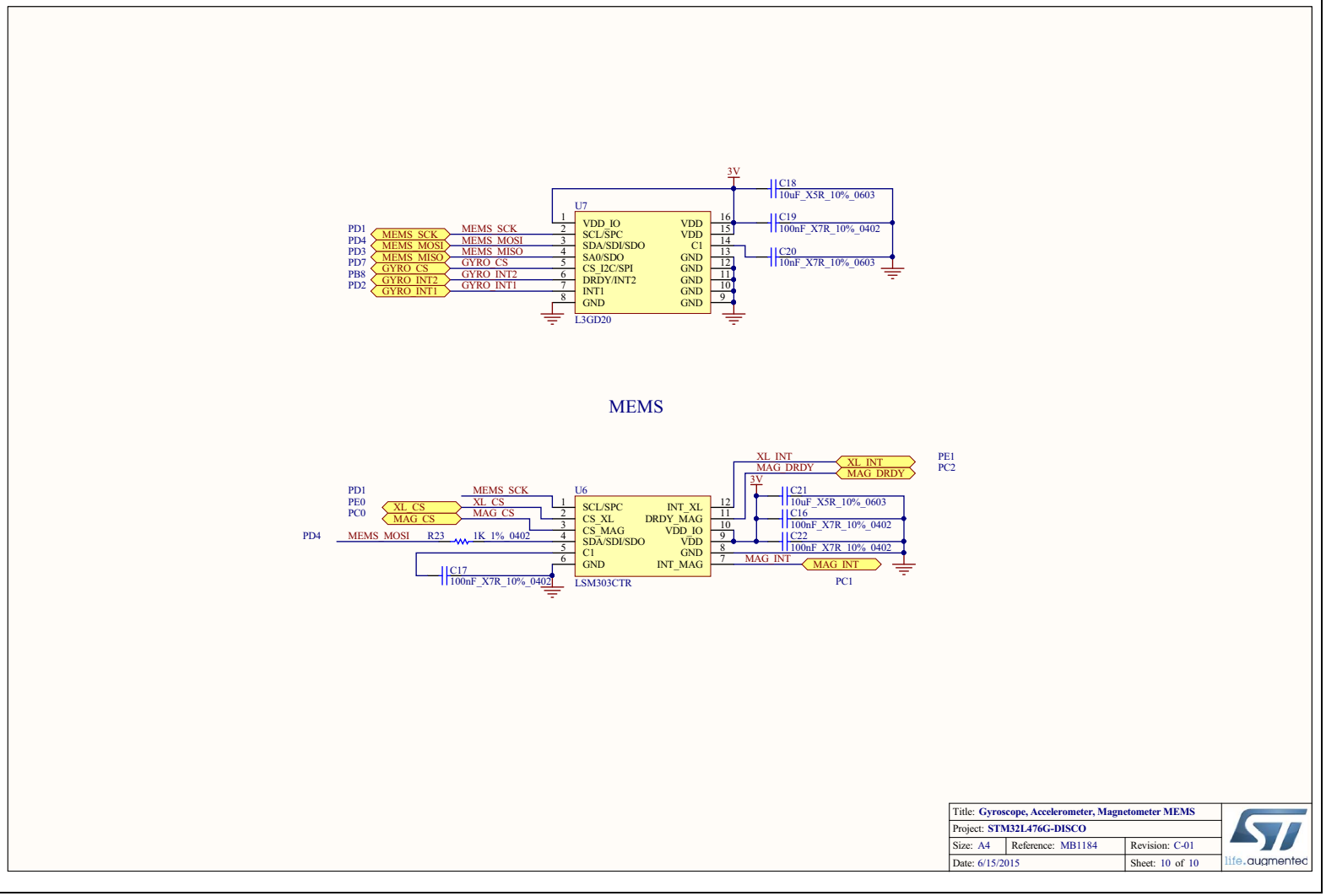


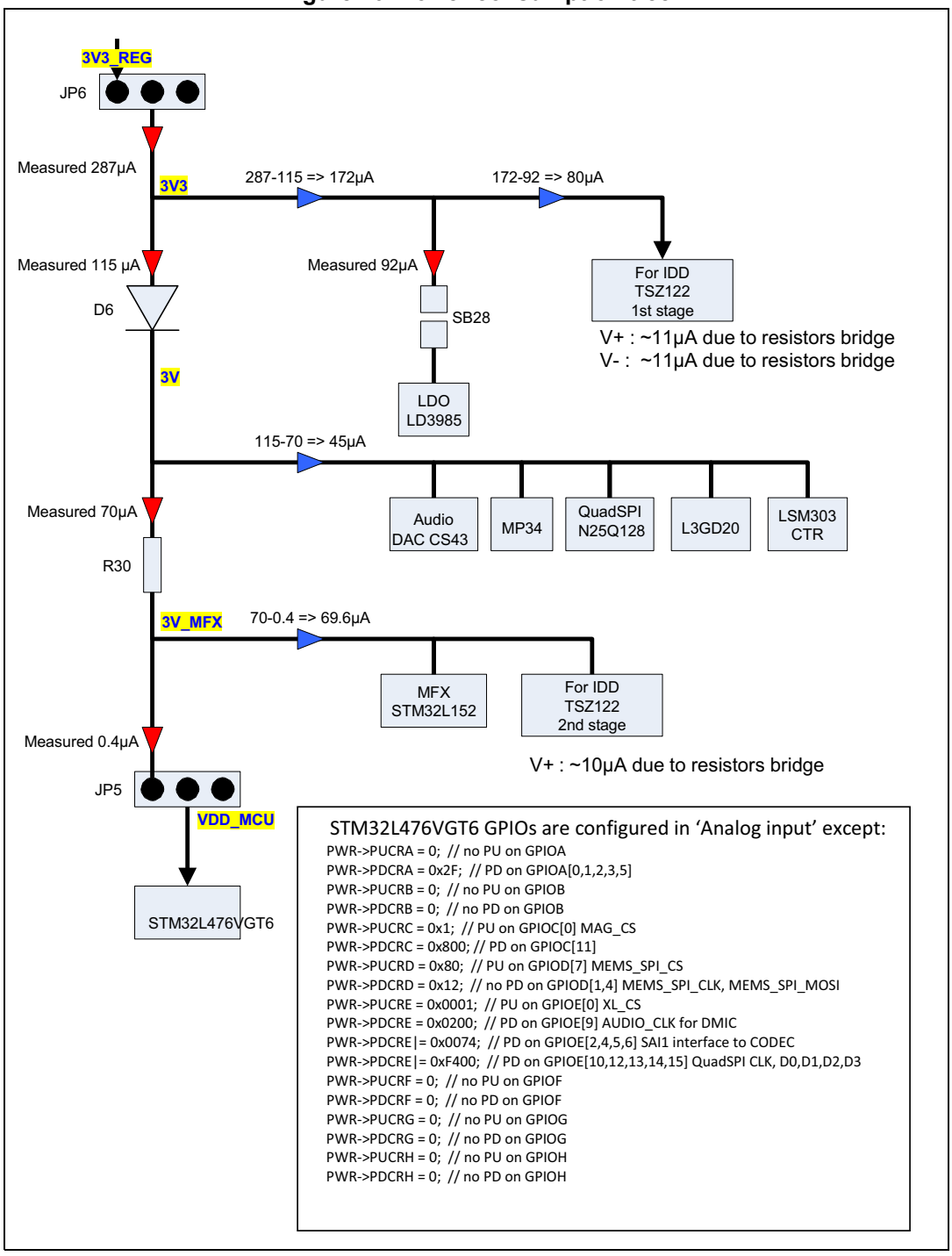
Figure 19. Gyroscope, accelerometer, magnetometer MEMS



Appendix A Power consumption measurements

The power consumption measurements of the STM32L476 Discovery board are reflected in *Figure 20*. Note the GPIO configuration of the STM32L476VGT6 in standby mode.

Figure 20. Power consumption tree



The total measured power consumption of the STM32L476 Discovery board is 287µA, which is as expected.

Table 8 gives for each peripheral the theoretical power consumption value. It is extracted from the vendor's product datasheet. The typical values are given under the same conditions as used for the power consumption measurement (see *Figure 20: Power consumption tree*). Refer to those product datasheets for more details about the conditions.

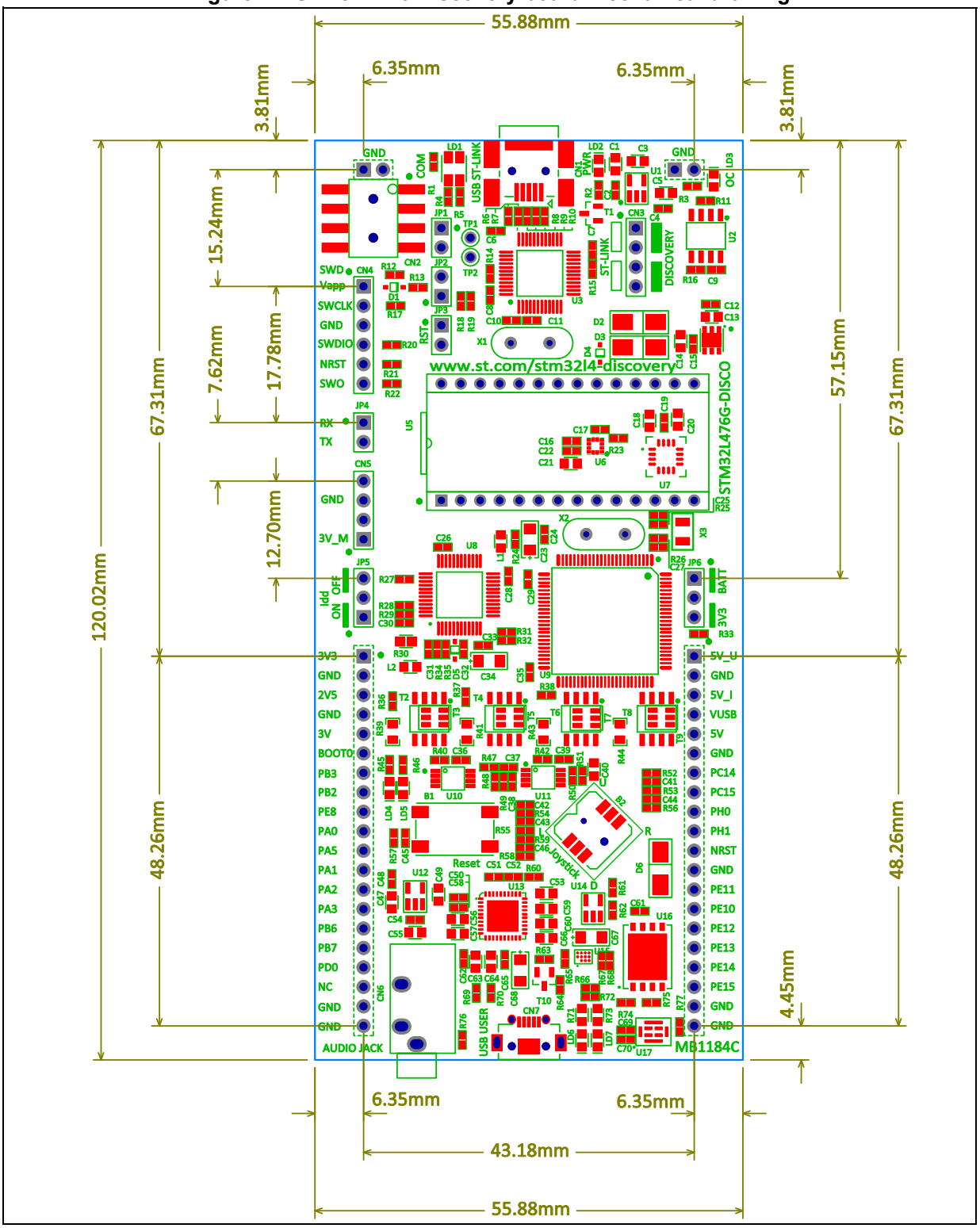
The theoretical total power consumption of the STM32L476 Discovery board is ~295uA.

Table 8. Typical power consumption of the STM32L476 Discovery board

MB1184-C01 component	Typical theoretical consumption (uA)	Conditions
LD3985M25R_U12	85	On mode: VINH=1.2V
TSZ122IST_U10	58	-
Differential +	11	Current in R40+R42
Differential -	11	Current in R47+R50
CS43L22_U13	0	Reset pin 32 and all clocks and lines are hold Low
MP34DT01_U17	33	IddPdn, input clock in static mode
N25Q128A13EF840E_U16	14	Standby current
L3GD20_U7	5	IddPdn, Supply current in power-down mode
LSM303CTR_U6	10	IddPdn, current consumption in power-down mode
TSZ122IST_U11	58	-
Bridge Op Amp	10	Current in R48+R49
MFX_U8	0.3	Standby mode. All GPIOs in 'Analog Input' except WAKEUP input with external PD (R34)
STM32L476VGT6_U9	0.3	Standby mode, GPIOs configuration described above
TOTAL STM32L476 Discovery board	295.6	-

Appendix B Mechanical drawing

Figure 21. STM32L476 Discovery board mechanical drawing



Appendix C Compliance statements

C.1 Federal Communications Commission (FCC) and Industry Canada (IC) Compliance Statement

C.1.1 FCC Compliance Statement

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.

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's 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.

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.

C.2 IC Compliance Statement

C.2.1 Compliance Statement

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

C.2.2 Déclaration de conformité

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

Revision history

Table 9. Document revision history

Date	Revision	Changes
17-Jul-2015	1	Initial release.
04-Aug-2015	2	Added *Section 6: Bootloader limitations*.
24-Mar-2016	3	Added *Section Appendix C: Compliance statements*.

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