UM2271
User manual

Discovery kit with STM32L4R9AI MCU

Introduction

The 32L4R9IDISCOVERY kit is a complete demonstration and development platform for the STMicroelectronics Arm® Cortex®-M4 core-based STM32L4R9AI microcontroller. Leveraging the innovative ultra-low power oriented features, 640 Kbytes of embedded RAM, graphics performance (Chrom-ART Accelerator™) and DSI controller offered by the STM32L4R9AI, the 32L4R9IDISCOVERY kit enables users to easily prototype applications with state-of-the-art energy efficiency, as well as providing stunning audio and graphics rendering with direct support for an AMOLED DSI round display. For even more user-friendliness, the on-board ST-LINK/V2-1 debugger provides out-of-the-box programming and debugging capabilities.

The STM32L4R9AI microcontroller features four I2Cs, five USARTs, one ULP UART, three SPIs, two SAIs, one SDIO, one USB 2.0 full-speed OTG, two CANs, one FMC parallel synchronous interface, one 12-bit ADC, one 12-bit DAC, two ULP analog comparators, two op amps, one 2 data-lane DSI display, one digital filter for sigma delta modulator and SWP interface, two Octo-SPI interfaces, 8- to 14-bit camera interface, one touch sensing controller interface, JTAG and SWD debugging support.

This Discovery board offers everything required for users to get started quickly and develop applications easily.The hardware features on the board help to evaluate the following peripherals: USB OTG FS, microSD™ card, 8-bit camera interface, 16-Mbit PSRAM, PMOD and STMod+ connectors, IDD measurement, full-duplex I2S with an audio codec and stereo headset jack including an analog microphone, DFSDM with a pair of MEMS digital microphones on board, 512-Mbit Octo-SPI Flash memory device, I2C extension connector, 1.2" AMOLED display using a one data-lane DSI interface with a capacitive touch panel. The Arduino™ compatible connectors expand the functionality with a wide choice of specialized shields. The integrated ST-LINK/V2-1 provides an embedded in-circuit debugger and programmer for the STM32 MCU.

Figure 1. 32L4R9IDISCOVERY top view

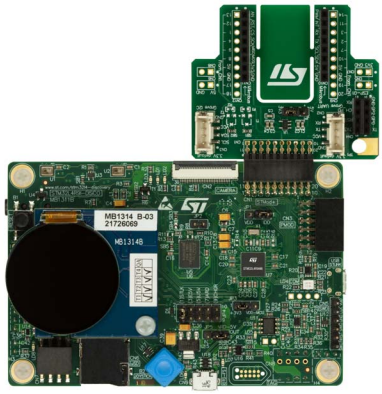
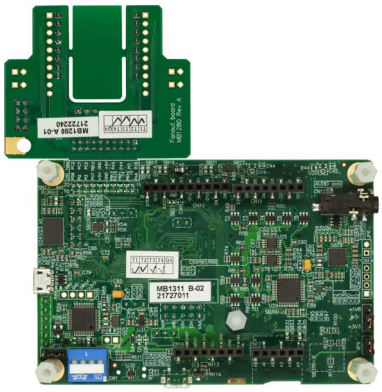


Figure 2. 32L4R9IDISCOVERY bottom view



Pictures are not contractual

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1 Features

- STM32L4R9AI Arm-based microcontroller with 2-Mbyte Flash memory and 640-Kbyte RAM in UFBGA169 package
- 1.2" 390x390 pixel AMOLED round display panel with 16 million colors depth, MIPI® DSI interface and capacitive touch panel
- USB OTG FS
- On-board current measurement
- SAI audio codec
- ST-MEMS digital microphones
- 16-Mbit asynchronous PSRAM
- 512-Mbit Octo-SPI Flash
- 2 user LEDs
- 1 reset push-button
- 4-direction joystick with selection button
- Board connectors:
  - 8-bit camera
  - USB OTG FS with Micro-AB
  - Stereo headset jack including analog microphone input
  - microSD card
- Board expansion connectors:
  - Arduino™ Uno V3
  - STMod+
  - PMOD
  - EXT_I2C
- Flexible power supply options:
  - ST-LINK USB V_{BUS} or external sources
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, virtual COM port and debug port
- Comprehensive free software libraries and examples available with the STM32Cube package
- Support of a wide choice of integrated development environments (IDEs), including IAR™, Keil® and GCC-based IDEs

arm

2 Product marking

Evaluation tools marked as “ES” or “E” are not yet qualified and are therefore not ready to be used as reference design or in production. Any consequences arising from such usage

will not be at ST's charge. In no event will ST be liable for any customer usage of these engineering sample tools as reference designs 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 at *www.st.com*).
- next to the evaluation tool ordering part number, that is stuck or silkscreen printed on the board

This board features a specific STM32 device version which allows the operation of any stack or library. This STM32 device shows a 'U' marking option at the end of the standard part number and is not available for sales.

3 System requirements

- Windows® OS (7, 8 and 10), Linux® 64-bit or macOS®
- USB Type-A to Micro-B cable

4 Development toolchains

- Keil MDK-ARM(a)
- IAR EWARM(a)
- GCC-based IDEs including free SW4STM32 from AC6

5 Demonstration software

The demonstration software, included in the STM32Cube package corresponding to the on-board MCU, is preloaded in the STM32 Flash memory for easy demonstration of the device peripherals in standalone mode. The latest versions of the demonstration source code and associated documentation are downloadable from the www.st.com/stm32l4-discovery web page.

6 Ordering information

To order the 32L4R9IDISCOVERY kit, refer to *Table 1*.

a. On Windows only

Table 1. Ordering information

Order code	Target STM32
STM32L4R9I-DISCO	STM32L4R9AII6

7 Technology partners

MACRONIX:

512-Mbit Octo-SPI NOR Flash memory device, part number MX25LM51245GXDI00

GOVISIONOX OPTOELECTRONICS:

1.2 inch 390x390 AMOLED display, part number G1120TB103GF-001

8 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, I2C bus, USB or CAN.

Bootloader version is identified by reading the bootloader ID at the address 0x1FFF6FFE. Its value is 0x91 for bootloader V9.1 and 0x92 for V9.2.

The STM32L4R9AII6 part soldered on the 32L4R9IDISCOVERY main board is marked with a date code corresponding to its date of manufacturing. STM32L4R9AII6 parts with a date code prior or equal to week 37 of 2017 are fitted with bootloader V9.1 affected by the limitations to be worked around, as described hereunder. Parts with the date code starting from week 38 of 2017 contain bootloader V9.2 in which the limitations no longer exist.

To locate the visual date code information on the STM32L4R9II6 package, refer to its datasheet (DS12023) 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 38 of 2017 bares the date code 7 38.

There is also another mean to identify the need for workaround: before opening the blister of the Discovery Kit, just check the back side of the blister. At the bottom left corner, if the reference number is equal or higher than 32L4R9IDISCO/ 02-0, it means the bootloader version is V9.2 and there is no need to apply workaround. Any other inferior number like 01-0 needs the workaround.

Bootloader ID for the bootloader V9.1 is 0x91.

The following limitation exists in the bootloader V9.1:

Some user Flash memory data get corrupted when written via SPI interface

Description:

During bootloader SPI Write Flash operation, some random 64-bits (2 double-words) may be left blank at 0xFF

Workarounds:

WA1: add a delay between sending Write command and its ACK request. Its duration should be the duration of the 256-Byte Flash write time.

WA2: read back after each write operation (256 bytes or at end of user code flashing) and in case of error start write again.

WA3: Using bootloader, load a patch code in RAM to write in Flash memory through same Write Memory write protocol as bootloader (code provided by ST). The patch code is available for download from *www.st.com* website with a readme.txt file containing usage instructions.

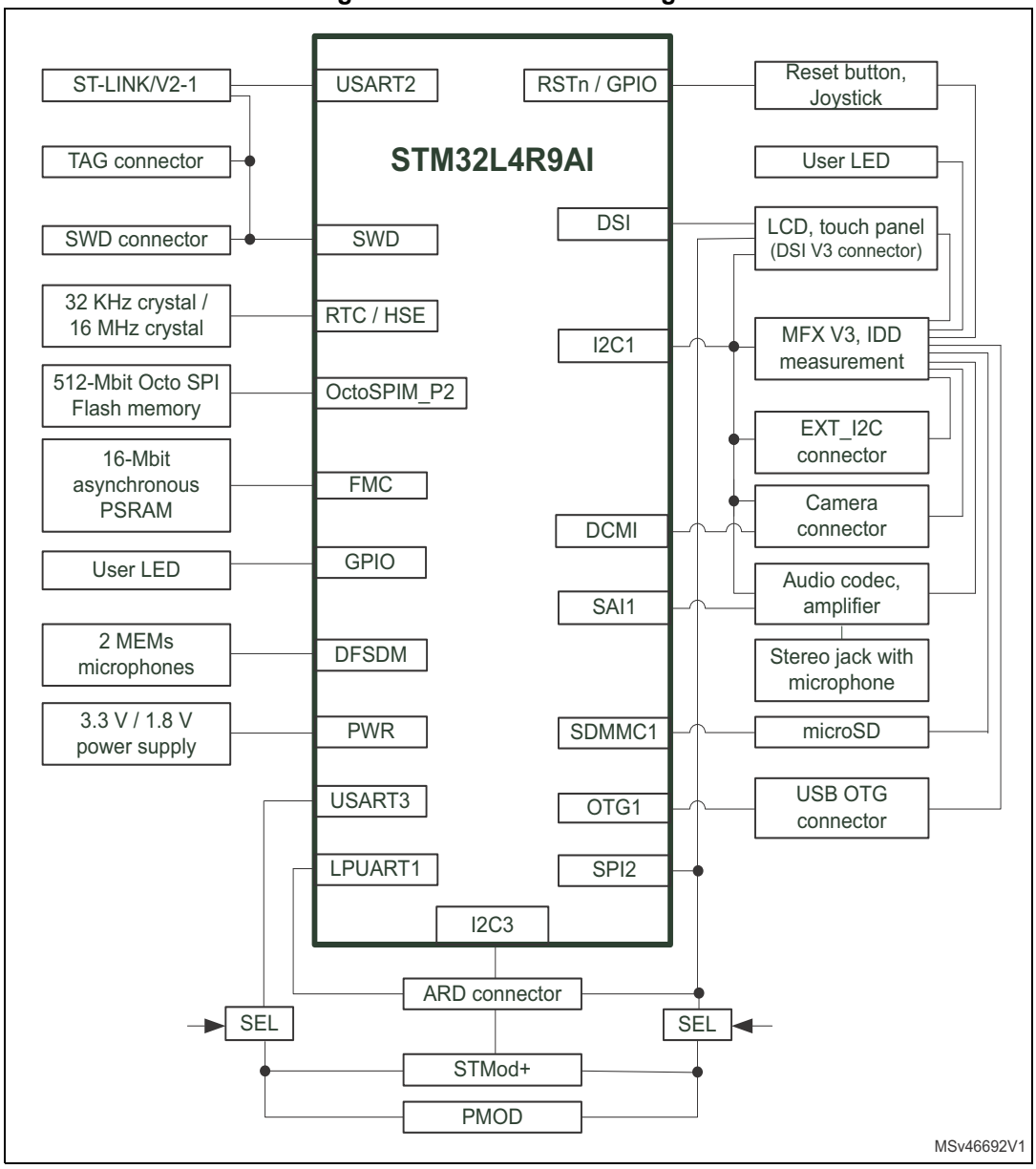
9 AMOLED display limitation

Warning: **Permanent image sticking may occur if AMOLED displays same image for an extended period of time.**

10 Hardware layout and configuration

32L4R9IDISCOVERY board is designed around the STM32L4R9AI (169 ball UFBGA package DSI version). The hardware block diagram *Figure 3* illustrates the connection between STM32L4R9AI and peripherals (PSRAM, Octo-SPI Flash, DSI color display, USB OTG connector, USART, audio, camera connector, STMod+ and PMOD connectors, IDD measurement, joystick, microSD card, I^2C extension connector, Arduino™ Uno V3 shields and embedded ST-LINK). *Figure 4* and *Figure 5* help the user to locate these features on the board. Mechanical drawing for 32L4R9IDISCOVERY and round DSI display boards is described in *Figure 6*.

Figure 3. Hardware block diagram



10.1 32L4R9IDISCOVERY layout

Figure 4. 32L4R9IDISCOVERY top side layout

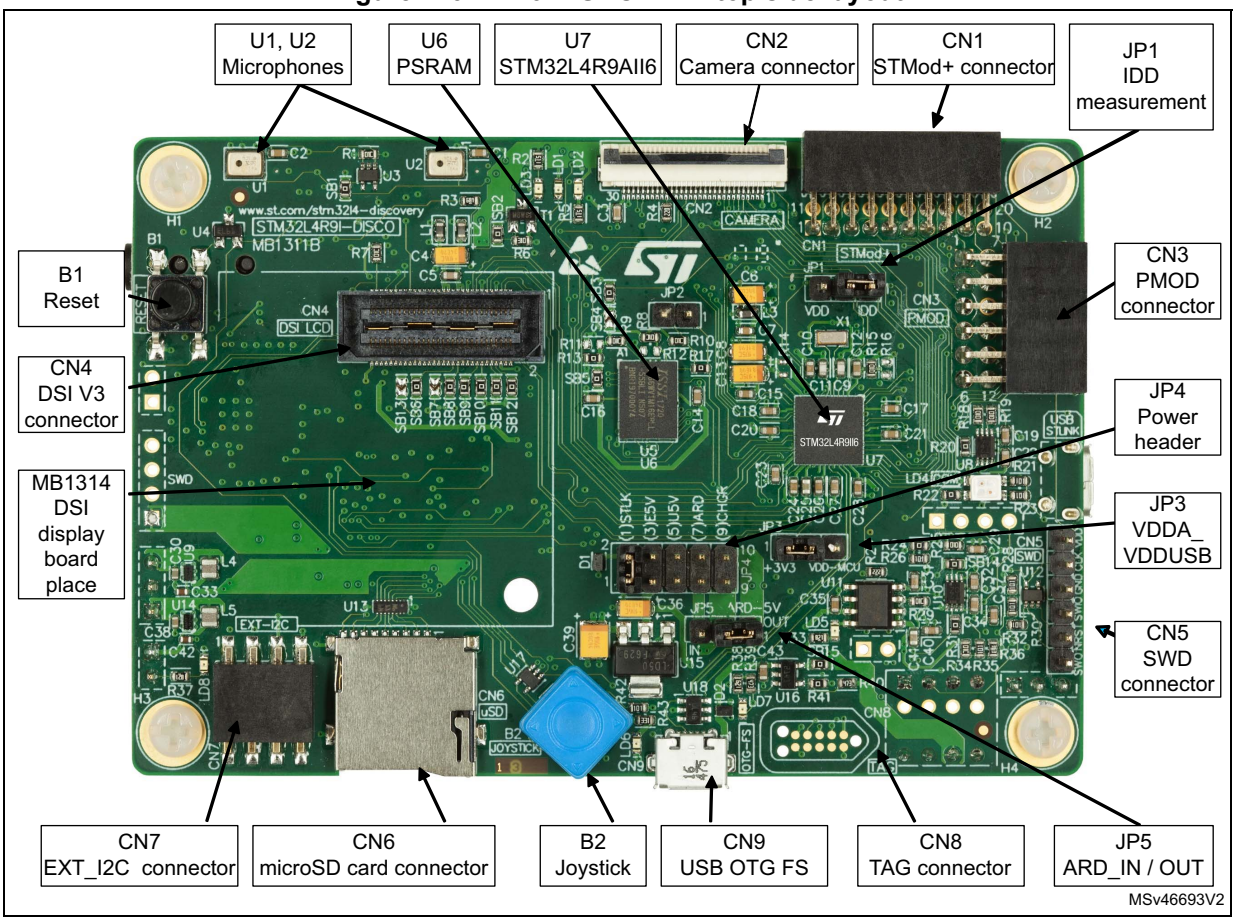
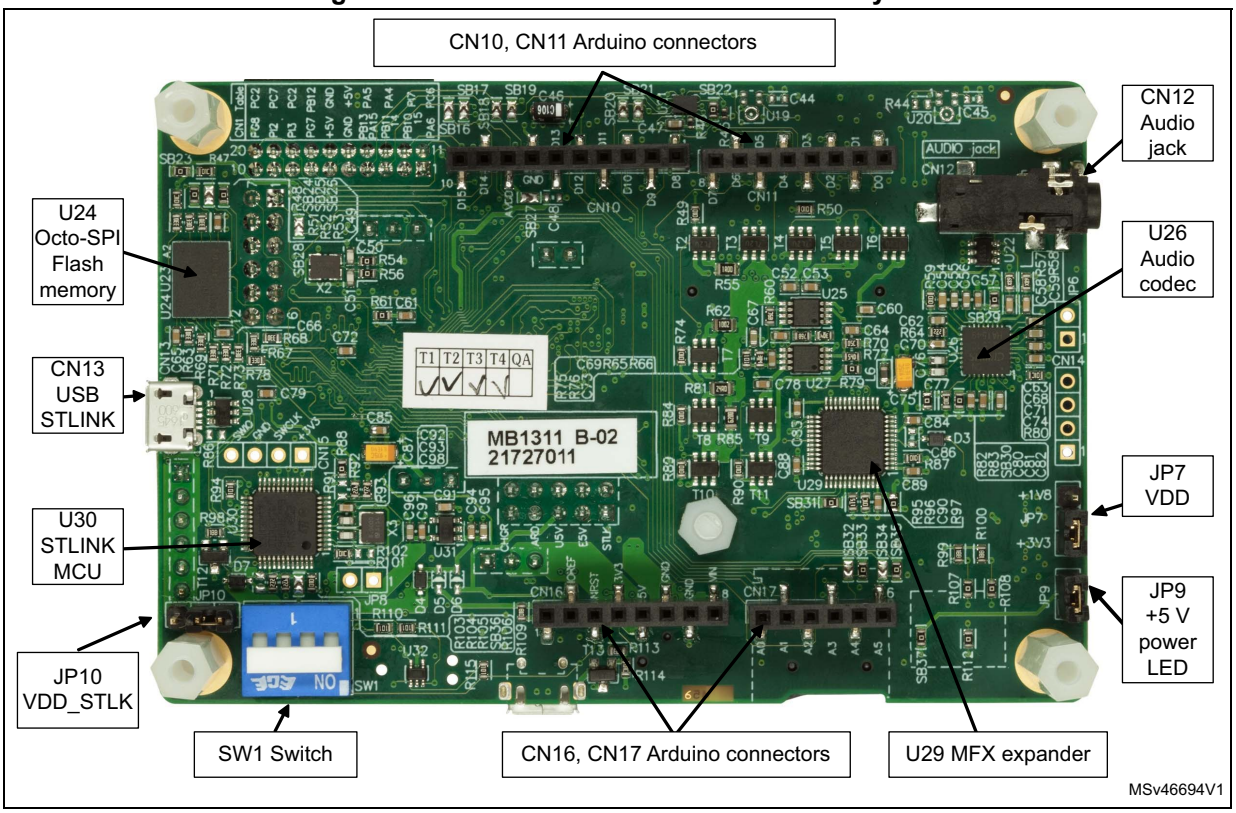
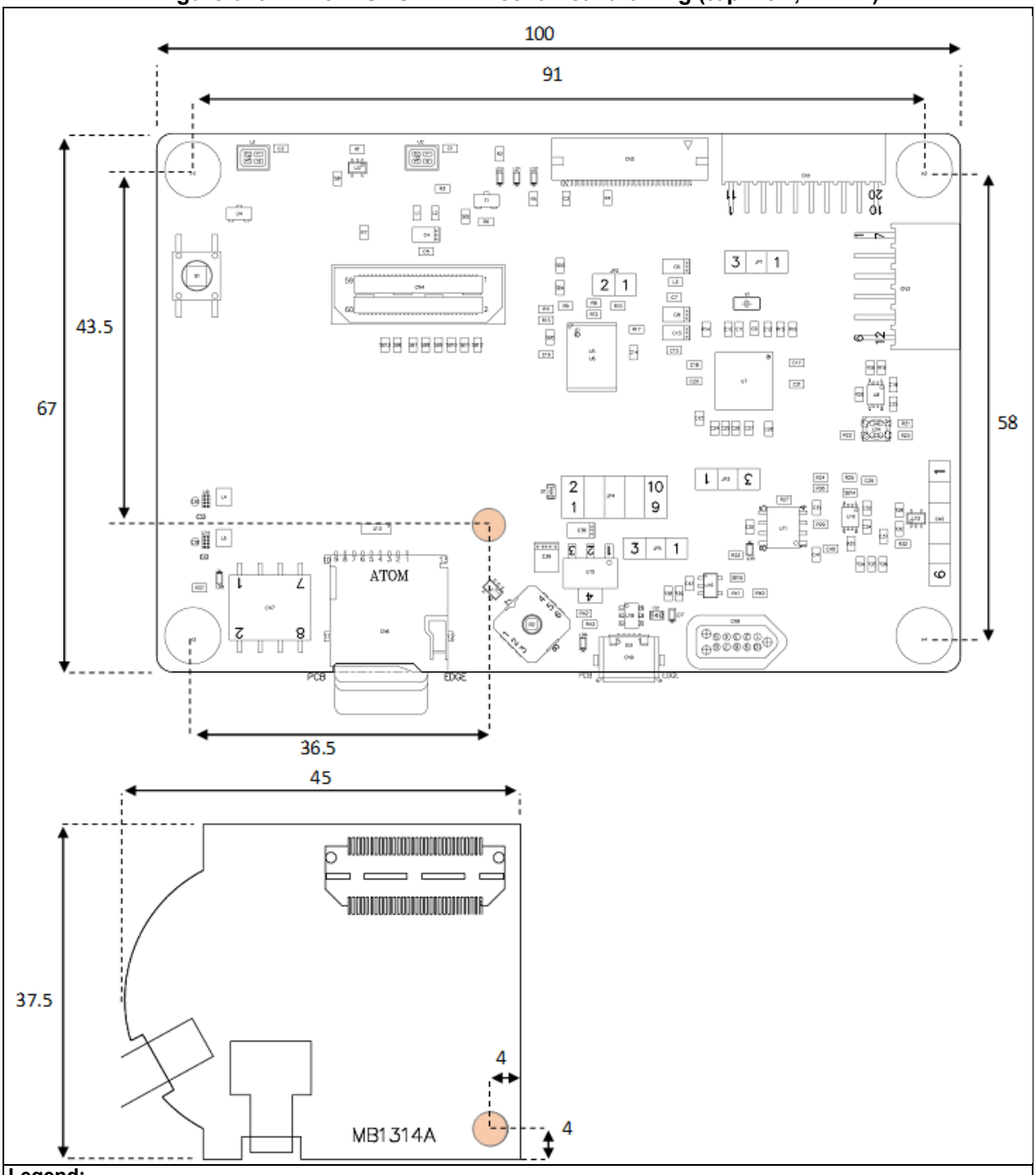


Figure 5. 32L4R9IDISCOVERY bottom side layout



10.2 32L4R9IDISCOVERY mechanical drawing

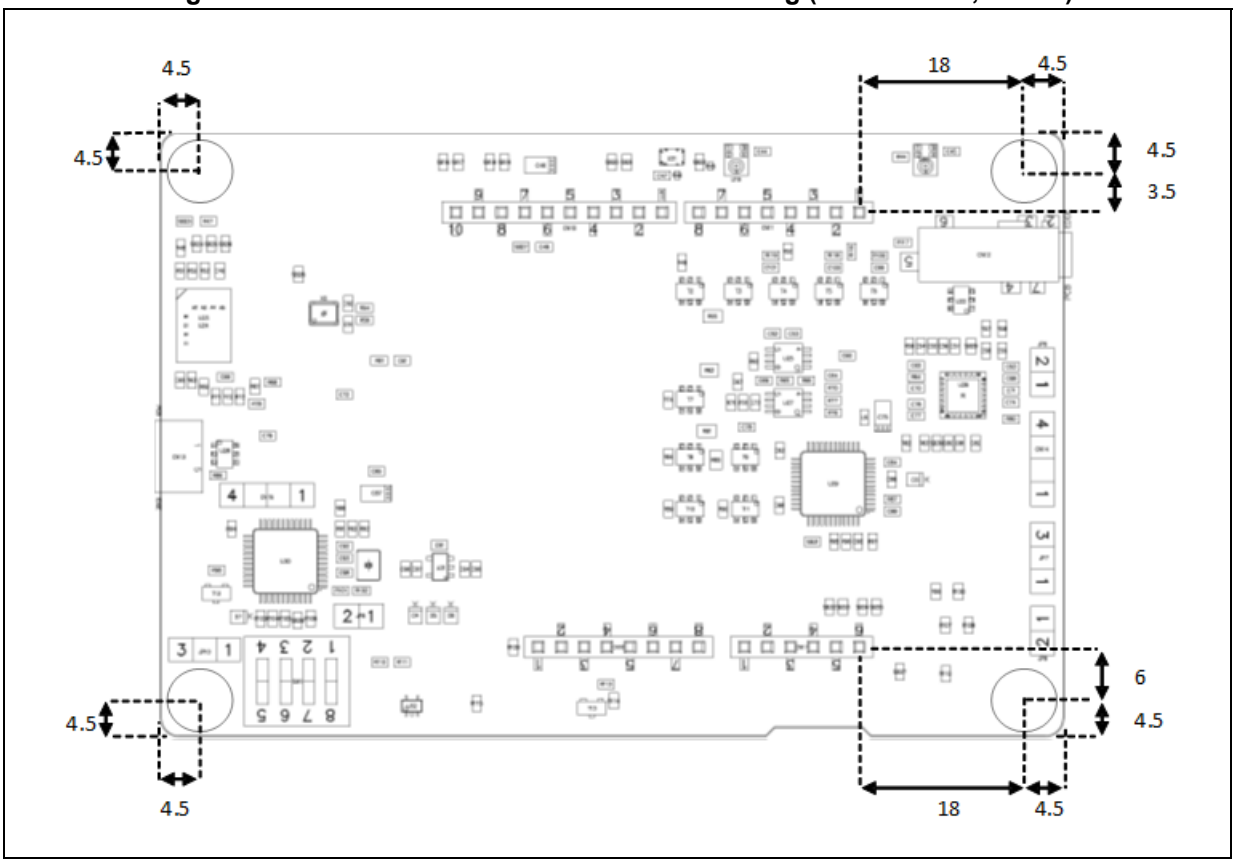
Figure 6. 32L4R9IDISCOVERY mechanical drawing (top view, in mm)



Legend:

= Indicates the mounting hole between the 32L4R9IDISCOVERY board (at the top of *Figure 6*) and the round DSI display board (at the bottom of *Figure 6*)

Figure 7. 32L4R9IDISCOVERY mechanical drawing (bottom view, in mm)



Plastic spacer height = 13 mm, overall height = 26 mm ± 1 mm

10.3 Embedded ST_LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the 32L4R9IDISCOVERY board. Compared to ST-LINK/V2, the changes are listed below:

- new features supported on ST-LINK/V2-1:
  - USB software re-enumeration
  - Virtual Com port interface on USB
  - Mass storage interface on USB
  - USB power management request for more than 100 mA power on USB
- features no more supported on ST-LINK/V2-1:
  - SWIM interface
  - Application voltage lower than 3 V

For general information concerning the debugging and programming features that are common to both versions V2 and V2-1, refer to ST-LINK/V2 in-circuit debugger/programmer.

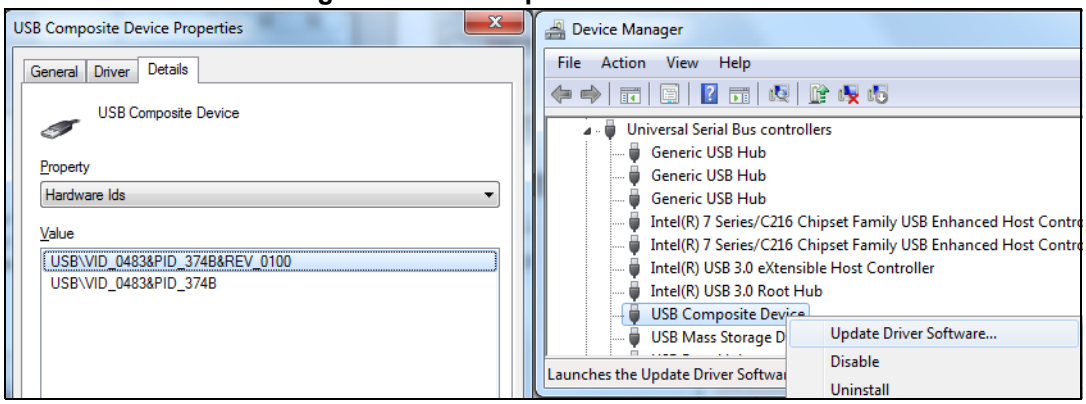
10.3.1 Drivers

Before connecting the 32L4R9IDISCOVERY to a Windows (7, 8, 10) PC via USB, a driver for ST-LINK/V2-1 must be installed. It is available on the *www.st.com* website.

If 32L4R9IDISCOVERY is connected to the PC before the driver is installed, some interfaces of the board 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 as shown on *Figure 8: How to update driver software*

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

Figure 8. How to update driver software



10.3.2 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 (such as new functionality, bug fixes or support for new microcontroller families), it is recommended to visit *www.st.com* before starting to use the 32L4R9IDISCOVERY and periodically, in order to stay up-to-date with the latest firmware version.

10.4 Low-power consumption status

There is a way to make the board get into very low power consumption status in which the current on +5 V may be below 20 uA. How to get into the low power mode:

1. The connections between ST-LINK/V2-1 and MCU must be disconnected by micro switch SW1 manually (see *Table 3* below). Set JP4 on (7) ARD position, and put JP5 in ARD-5V IN position. Remove JP10. Then, connect an external 5 V power supply on CN16 pin 5 5V and on GND.
2. Peripherals (including display, CTP and PSRAM) are powered off by MOSFET which is controlled by MFX_GPIO8 / MFX_aGPIO2 (put them as input floating), and by setting

all peripherals related I/Os to inactive level (input pull-down or input is good option according to I/Os).

3. Disconnect JP9 to remove +5 V from LD8 power LED, disconnect JP10 (or put it in 2-3 position), power off OCTOSPI (remove SB23/SB24) and configure related I/Os as input pull down.
4. Peripherals may be setup by FW to reach power down mode. All I/Os must be configured in non-consuming states. Set MFX_V3 to sleep mode, get SD card out of its socket slot. Set the Audio Codec in power down.

10.5 TAG and SWD

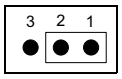
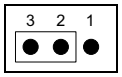
One TAG interface footprint CN8 is reserved on 32L4R9IDISCOVERY and is usable to debug and program the on-board MCU.

Note: Micro switch SW1 must be put in Off position. R24 and R31 must be disconnected.

The SWD 6-pin header CN5 added on 32L4R9IDISCOVERY, connected to on board ST-LINK MCU, is usable to debug and program an external MCU.

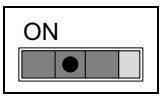
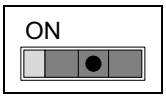
VDD from the external board is 1.8 V or 3.3 V, thanks to the on board voltage converter.

Table 2. JP10: VDD_STL setting

Jumper	Setting	Description
JP10		Default setting. VDD_STL gets power from 32L4R9IDISCOVERY. ST-LINK is then usable to program the on-board MCU.
		VDD_STL gets power from external through CN5. ST-LINK is then usable to program an external MCU.

SW1 switch enables the debug and programing functions through USB STLK CN13 connector. SW1 is accessible on bottom side of 32L4R9IDISCOVERY. By default, SW1 is in On position. To put micro switch in Off position, just push away the switch from ON position as shown in *Table 3*.

Table 3. SW1 switch setting

Switch	Setting	Description
SW1		Default setting. SW1 switch is On. It allows debug and program capabilities through USB STLK CN13 connector. When SW1 is On, a VBUS power must be present on USB STLK CN13 connector.
		SW1 is Off. Set this position if USB STLK CN13 is not used. Debug and program functions are not available.

10.6 Power supply

10.6.1 Power supply sources

32L4R9IDISCOVERY is designed to be powered by +5 V DC power supply. It is possible to configure the 32L4R9IDISCOVERY to use any of the sources listed in *Table 4*. Check also detailed configuration on next page.

By Default, 32L4R9IDISCOVERY is powered through USB STLINK connector CN13, JP4 header has a jumper on (1) STLK, and SW1 is placed in ON position to allow debug and program features.

Choosing any other power source connector than CN13 requires either:

- to place SW1 in OFF position (with no debug/program possibility)
- to let SW1 in ON position, but connecting a USB PC host or Charger on CN13 is mandatory (for this configuration, refer to *Section 10.6.5* for correct powering sequence)

For SW1 switch setting description, please refer to *Table 3*.

Table 4. 32L4R9IDISCOVERY power sources configuration

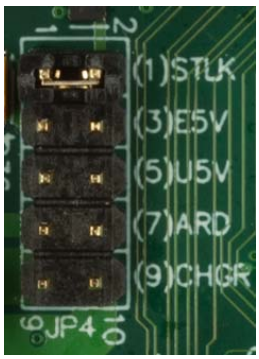
JP4 configuration (function)	Power source connector (pin name)	Voltage	Available current
(1) STLK (USB_STLINK)	CN13 (VBUS)	5 V	500 mA
(3) E5V (ARDUINO)	CN16 (VIN)	6 V - 9 V => 5 V	Arduino™ Uno V3 shield dependent
(5) U5V (USB_OTG_FS)	CN9 (VBUS)	5 V	VBUS supply dependent
(7) ARD (ARDUINO)	CN16 (ARD-5V)(1)	5 V	Arduino™ Uno V3 shield dependent
(9) CHGR (USB_STLINK)	CN13 (VBUS)	5 V	VBUS supply dependent

1. ARD-5V is a power output pin to Arduino™ Uno V3 connector CN16 (default) or a power input pin from Arduino™ Uno V3 connector CN16, according to JP5 setting. See *Table 6* below.

Note: 32L4R9IDISCOVERY 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 limited power capability.

Figure 9 shows a physical description of the 10-pin header JP4 default configuration.

Figure 9. JP4 default configuration



Detailed description of all JP4 possible configurations are listed below and in *Table 5*:

- **STLK**: 5 V from the ST-LINK/V2-1 USB connector CN13 with 500 mA current limitation. Power mechanism of supplying the board by STLINK/V2-1 is explained *Section 10.6.3*. A jumper must be placed in location STLK of JP4, connecting pins 1 and 2. The green LED LD8 is lit on to confirm presence of 5 V voltage.
- **E5V**: 5 V from the 6 V to 9 V DC from VIN pin of Arduino™ Uno V3 compatible connector CN16 (the U15 regulator is converting VIN into a 5 V voltage). The VIN input voltage is limited to 9 V to keep temperature of the regulator U15 within its thermal safe area. A jumper must be placed connecting pins 3 and 4 of JP4. The green LED LD8 is lit on to confirm presence of 5 V voltage. Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
- **U5V**: 5 V from the 5 V DC of USB OTG FS user connector CN9. A jumper must be placed in location USB of JP4, connecting pins 5 and 6.The green LED LD8 is lit on to confirm presence of 5 V voltage. Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
- **ARD**: 5 V from the 5V pin of Arduino™ Uno V3 compatible connector CN16. A jumper must be placed in location ARD of JP4, connecting pins 7 and 8. Connect the pins 2 and 3 of JP5 to get power from Arduino™ Uno V3 (see *Table 6*). The green LED LD8 is lit on to confirm presence of 5 V power from Arduino™ Uno V3. Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
- **CHGR**: 5 V from 5 V DC power charger connected to USB STLINK (CN13). A jumper must be placed in location CHGR of JP4, connecting pins 9 and 10. The green LED LD8 is lit on to confirm presence of 5 V voltage. When this CHGR input is chosen, the 500 mA on-board limitation is no more effective. If 32L4R9IDISCOVERY is powered by an external USB charger, then the debug on CN13 is not available. If 32L4R9IDISCOVERY is powered by an external USB PC port, user must pay attention that this USB PC supports the sourcing of required current. SW1 may be placed in OFF position if debug or program features are not used.

Table 5. JP4: power source selector setting

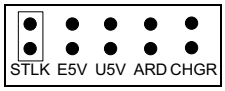
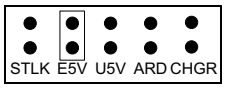
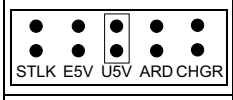
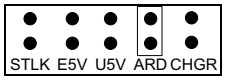
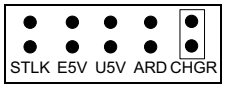
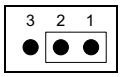
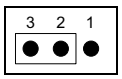
Jumper	Setting	Description
JP4		Default setting. 32L4R9IDISCOVERY is supplied though CN13 Micro-B ST-LINK/V2-1 connector.
		32L4R9IDISCOVERY is supplied though Arduino™ Uno V3 connector CN16 (VIN). Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
		32L4R9IDISCOVERY is supplied though USB OTG FS connector CN9. Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
		32L4R9IDISCOVERY powers ARDUINO or is supplied by ARDUINO, according to JP5 setting in *Table 6* below. Place SW1 in OFF position, or let SW1 in ON position and follow *Section 10.6.5*.
		32L4R9IDISCOVERY is supplied though CN13 Micro-B ST-LINK/V2-1 connector.

Table 6. JP5: ARD 5 V input/output voltage selection setting

Jumper	Setting	Description
JP5		Default setting. 32L4R9IDISCOVERY supplies 5 V to Arduino™ Uno V3 connector CN16 (on 5V pin).
		32L4R9IDISCOVERY is supplied by 5 V from Arduino™ Uno V3 connector CN16 (from 5V pin). In that case, JP4 must be placed in ARD position.

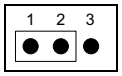
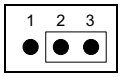
10.6.2 MCU power supply options

32L4R9IDISCOVERY offers possibility to supply the MCU under 1.8 V or 3.3 V. The JP7 jumper must be placed on +3V3 to supply the MCU with 3.3 V, connecting pins 1 and 2. The jumper may be placed on +1V8 of JP7 to supply the MCU with 1.8 V, connecting pins 2 and 3 (see *Table 7*).

Functions listed below are not compatible with the +1V8 setting of JP7:

- OCTOSPI
- PSRAM
- ARDUINO Uno Revision 3
- CAMERA
- microSD card
- ADC measurements (except if JP3 is set at +3V3, or except if VREF+ configuration is changed)
- USB OTG FS (except if JP3 is set at +3V3)

Table 7. JP7: VDD setting

Jumper	Setting	Description
JP7		Default setting. VDD is powered from +3V3 regulator.
		VDD is powered from +1V8 regulator.

10.6.3 Supplying 32L4R9IDISCOVERY through ST-LINK/V2-1 USB

To power the board through ST-LINK/V2-1, the USB host (a PC) must be connected with the 32L4R9IDISCOVERY standard Micro-B USB receptacle, via a USB cable. This event starts the USB enumeration procedure. In its initial phase, the current supply capability of the USB host port is limited to 100 mA. It is enough because only ST-LINK/V2-1 part of 32L4R9IDISCOVERY draws power at that time. If the solder bridge SB36 is open (default setting), the U11 ST890 power switch is set to Off position, which isolates the remainder of the board from the power source. In the next phase of the enumeration procedure, the host PC informs the ST-LINK/V2-1 facility of its capability to supply up to 500 mA current. If the answer is positive, the ST-LINK/V2-1 sets the U11 ST890 switch to On position to supply power to the remainder of the board. If the PC USB port is not capable of supplying up to 500 mA, another power source must be used (See *Section 10.6.1* for details).

The ST890 power switch protects the host USB port against current demand exceeding 625 mA, in case a short circuit occurs on the board (the red LED fault LD5 lights on).

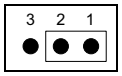
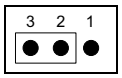
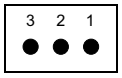
32L4R9IDISCOVERY may also be supplied by STLINK USB power source with no enumeration, such as a USB charger. In this particular case, ST-LINK/V2-1 turns the ST890 power switch on regardless of enumeration procedure result and passes the power unconditionally to the board. The green LED LD8 lights on whenever the whole board is powered.

10.6.4 Measurement of MCU current consumption

Jumper JP1 allows the consumption of STM32L4R9AI to be measured directly by a built-in MCU current ammeter circuit (MFX_V3, able to measure from 60 nA to 50 mA) or by removing the jumper and replace it by an external ammeter (see *Table 8*).

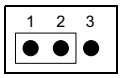
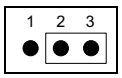
To measure the MCU consumption in standby or shutdown modes, MFX_V3 needs to run software. To wake up MCU from these modes, it is necessary to press the Reset button B1, or to wait a few seconds.

Table 8. JP1: IDD_MCU measurement setting

Jumper	Setting	Description
JP1		Default setting. A module on the board is designed to measure from 60 nA to 50 mA by using several MOSFET, and switching automatically depending on the read value.
		STM32L4R9AI is powered by VDD. MCU current measurement is not possible
		No jumper on JP1: an ammeter may be connected on pins 2 and 3 to measure STM32L4R9AI current (if there is no ammeter, STM32L4R9AI is not powered).

VDDA and VDDUSB power inputs from STM32L4R9AI may be connected to two different power sources, +3V3 or VDD_MCU. These power inputs may be included or not in the IDD current measurement of VDD_MCU, depending on the JP3 jumper configurations described in *Table 9*.

Table 9. JP3: VDDA and VDDUSB, settings

Jumper	Setting	Description
JP3		Default setting. VDDA and VDDUSB power pins of STM32L4R9AI are supplied with +3V3. the IDD measurement does not include their current consumption. USB OTG FS is functional even if JP7 is set on +1V8.
		VDDA and VDDUSB power pins of STM32L4R9AI are supplied with VDD_MCU. The IDD measurement includes their current consumption.

10.6.5 Program or debug when power supply not from ST-LINK/V2-1

To power the board from another connector than CN13, while keeping debug and program features possible, the following power sequence procedure must be respected:

1. Put a jumper on JP4 at desired location and set SW1 switch to ON position.
2. Connect the corresponding external power source.
3. Check the green LED LD8 is turned on.
4. Connect the PC to ST-LINK/V2-1 USB connector CN13.

Proceeding this way ensures that the enumeration succeeds, thanks to the external power source. If this order is not respected, the board may be powered by VBUS first from ST-LINK, and the following risks may be encountered:

- If more than 500 mA current is needed by the board, PC may be damaged or current is limited by PC. As a consequence the board is not powered correctly.
- 500 mA is requested at the enumeration, so there is a risk that the request is rejected and enumeration does not succeed if PC does not provide such current.

10.7 Clock sources

Two clock sources are used by STM32L4R9AI: one on LSE input and another on HSE input.

LSE clock source

The available clock source is **X1**, 32 kHz crystal for the STM32L4R9AI embedded RTC.

HSE clock source

The second clock source available by default is **X2**, 16 MHz crystal for the STM32L4R9AI HSE system clock.

Note that another HSE clocking option is available on PCB: MCO output from STLINK MCU to STM32L4R9AI HSE input. Please refer to *Appendix B: Solder bridges*.

10.8 Reset Source

The general reset of 32L4R9IDISCOVERY is active low. The reset sources are listed below:

- Reset button B1
- Embedded ST-LINK/V2-1, SW1 micro-switch set to On (default setting)
- Arduino™ Uno V3 compatible connector CN16 pin 3

The general reset is connected to following peripheral reset functions:

- STM32L4R9AI MCU reset
- Octo-SPI Flash reset
- MFX_V3 reset
- Camera reset

10.9 Boot configuration

After reset, STM32L4R9AI boots from one of the three different embedded memory locations, depending on BOOT0 and BOOT1 bits:

- Boot from the main Flash memory (MCU internal Flash). This is the default configuration.
- Boot from the system memory ISP (in-system programming).
- Boot from the SRAM1.

On 32L4R9IDISCOVERY board, the boot configuration of the MCU is controlled by the BOOT0 signal on PH3 pin.

BOOT0 is by default grounded through the R15 pull-down resistor.

It is possible to set BOOT0 high by removing resistor R15 and populating resistor R16 with a 0 ohm resistor. In this case, please take care that PH3 (multiplexed with BOOT0 function) is not used as a GPIO.

Please check below *Table 10* for other boot modes.

Table 10. Boot modes

nBOOT1 FLASH_OPTR[23]	nBOOT0 FLASH_OPTR[27]	BOOT0 pin PH3	nSWBOOT0 FLASH_OPTR[26]	Boot Memory Space Alias
X	X	0	1	Main Flash memory is selected as boot area
X	1	X	0	Main Flash memory is selected as boot area
0	X	1	1	Embedded SRAM1 is selected as boot area
0	0	X	0	Embedded SRAM1 is selected as boot area
1	X	1	1	System memory is selected as boot area
1	0	X	0	System memory is selected as boot area

10.10 Audio codec

A Cirrus codec CS42L51-CNZ U26 connected to the SAI1 interface of STM32L4R9AI offers possibility to connect a stereo headphone or headset with a mono analog microphone.

The I²C-bus addresses of CS42L51-CNZ are 0x95 and 0x94.

10.11 DFSDM

Two ST-MEMS MP34DT01TR digital microphones U1 and U2 are available on 32L4R9IDISCOVERY. The two microphones are located at a distance of 21 mm from each other. They are connected to the STM32 DFSDM by the PC2 port, generating the clock, and by PB12 port, collecting the PDM interleaved data. These microphones are powered by MIC_VDD (PH2 of STM32L4R9AI).

The two DFSDM interface signals (clock and data), are also accessible on the STMod+ connector CN1. Before using STMod+, the user must follow the recommendations below:

- If STMod+ pin 17 is used, SB1 (DOUT) must be disconnected first.
- If STMod+ pins 18 or 20 are used, MIC_VDD GPIO (PH2) must be activated at high level first.

10.12 PSRAM

Two PSRAM footprints are supported on the design, both connected to STM32L4R9AI FMC interface:

- A 16-Mbit asynchronous PSRAM (U5), using up to A19 address, is soldered by default. Reference is IS66WV1M16EBLL-55BLI.
- A 32-Mbit synchronous PSRAM (U6), using up to A20 address, may be used. Reference is IS66WVC2M16ECLL-7010BLI.
  By default, this PSRAM (U6) is exclusive with CAMERA function (due to DCMI_D4 function multiplexed with A20 of MCU). In case CAMERA is used at the same time than

PSRAM, it is possible to change two solder bridges to deactivate A20 on PSRAM (tied to high, usable density 16 Mbits) and DCMI_D4 is used for CAMERA.

Note: Limitation: the two PSRAM are not compatible with JP7 setting at +1V8.

See *Appendix B: Solder bridges* for possible PSRAM configuration change.

10.13 USB OTG FS

32L4R9IDISCOVERY supports USB OTG FS (full-speed) communication via the USB Micro-AB connector (CN9) and USB power switch (U16) connected to VBUS.

A green LED LD6 is lit in one of the following cases:

- Power switch (U16) is On and 32L4R9IDISCOVERY works as a USB host.
- VBUS is powered by another USB host when 32L4R9IDISCOVERY works as a USB device.

The red LED LD7 is lit in case of overcurrent.

10.13.1 32L4R9IDISCOVERY as USB device

The 32L4R9IDISCOVERY board may work as USB device on CN9 in any power source configuration. If the board is supplied by an external power source on CN9 (JP4 on (5)U5V), user must pay attention that power source delivers sufficient amount of current for the complete 32L4R9IDISCOVERY board setup. Refer to *Section 10.6.1* for detailed configuration.

10.13.2 32L4R9IDISCOVERY as USB host

When the board works as a USB host on CN9, it supplies the 5 V to the USB peripheral using one of the following sources:

- ST-LINK/V2-1 USB Micro-B connector CN13 (jumper put in STLK or CHGR location of JP4)
- an external 5 V source connected to pin 5 of the Arduino™ Uno V3 connector CN16 (jumper put in ARD location of JP4)
- an external source between 6 V and 9 V, connected to VIN pin of Arduino™ Uno V3 connector CN16 (jumper put in E5V location of JP4)

The green LED LD8 is lit on to confirm the presence of the 5 V source.

The power switch STMPS2141STR is controlled by the port MFX_GPIO13 to deliver the 5 V power to the USB device connected to the USB connector CN9. When MFX_GPIO13 is pulled down to ground, the power switch is closed, and the green LED LD6 confirms the 5 V presence for the USB device. The red LED LD7 FAULT is lit when an over-current occurs.

For more details please refer to *Section 10.6: Power supply*.

Limitation: when the 32L4R9IDISCOVERY board is configured as a USB host, and if a USB High-power device is to be used on CN9, it may be necessary to change default JP4 setting to power the board from another Power source than (1) STLK or (9) CHGR. Please take care sufficient amount of current is available from this other power source and refer to *Section 10.6.1* for detailed configuration.

10.14 Octo-SPI Flash memory

A 512-Mbit Octo-SPI user Flash memory (MX25LM51245GXDI00 from MACRONIX) is connected to OCTOSPIM_P2 interface of STM32L4R9AI. By default, OCTOSPI_RESET of Flash memory has been connected to the general reset of 32L4R9IDISCOVERY.

See *Appendix B: Solder bridges* for possible Octo-SPI Flash configuration change.

Note: Limitation: the Octo-SPI Flash memory is not compatible with JP7 setting at +1V8.

10.15 Virtual COM port

The serial interface USART2 is directly available as a virtual COM port of the PC, connected to the ST-LINK/V2-1 USB connector CN13. Please check the application software settings related to virtual COM port.

10.16 Buttons and LEDs

The blue button B2 is a four-directions joystick with a selection mode when pressed in the center. The logic state is high when one of the five-position switch (left, right, up, down, selection) is pressed. The center position (Select function) is connected to a wake-up pin of the microcontroller PC13. The other four directions are mapped on MFX GPIOs.

The black button B1 near the display is the Reset button. It is used to reset the board and may wake-up MCU from standby and shutdown IDD measurement modes.

Two user LEDs located near the camera connector CN2 are available for the user (see *Figure 4*): LD1, LD2, from left to right, with orange and green color respectively. To light on a LED, a low logic state 0 must be written in the corresponding GPIO.

- LD1 (orange) is managed by MFX function
- LD2 (green) is managed by STM32L4R9AI main MCU

Table 11. LD1 and LD2 details

LED	MCU port control	color
LD1	PB0 (MFX_GPIO0 from MFX)	Orange
LD2	PH4 (from main MCU)	Green

Other LEDs are present on the 32L4R9IDISCOVERY. Find below a summary list of all buttons and LEDs, with their description.

Table 12. Buttons and LEDs

Reference	Color	Function	Comment
B1	black	RESET	For MCU, OCTO-SPI Flash, MFX_V3, CAMERA

Table 12. Buttons and LEDs (continued)

Reference	Color	Function	Comment
B2	blue	SELECT	with Wake-up alternate function, PC13
		UP	MFX_GPIO1, PB1
		DOWN	MFX_GPIO2, PB2
		RIGHT	MFX_GPIO3, PB3
		LEFT	MFX_GPIO4, PB4
LD1	orange	USER1	MFX_GPIO0, PB0
LD2	green	USER2	PH4
LD3	green	ARDUINO	PB13
LD4	red/green	ST-LINK COM	Green during communication
LD5	red	ST-LINK USB FAULT	Current higher than 625 mA
LD6	green	VBUS USB OTG FS	Status also available on PA9
LD7	red	USB OTG FS OVCR	Overcurrent detection, also on MFX_GPIO14, PB14
LD8	green	5V POWER	Lit on to confirm +5V presence on board

11 Connectors

11.1 Arduino™ Uno V3 connectors CN10, CN11, CN16 and CN17

CN10, CN11, CN16 and CN17 are female connectors compatible with Arduino™ Uno Revision 3 standard. Most of shields designed for Arduino™ Uno V3 fit to 32L4R9IDISCOVERY board.

Table 13. Arduino™ Uno V3 compatible connectors

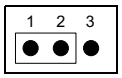
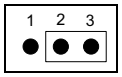
Left connectors						Right connectors				
CN No.	Pin No.	Pin Name	MCU Pin	Function		Function	MCU Pin	Pin Name	Pin No.	CN No.
-						I2C3_SCL	PG7	D15	10	CN10 Digital
						I2C3_SDA	PG8	D14	9	
						AVDD	-	AVDD	8	
						Ground	-	GND	7	
CN16 Power	1	-	-	E5V test		SPI2_SCK	PB13	D13	6	
	2	IOREF	-	VDD		SPI2_MISO	PB14	D12	5	
	3	NRST	NRST	Reset		TIM3_CH2, SPI2_MOSI	PB15	D11	4	
	4	3V3	-	3V3output (note 1)		TIM5_CH4, SPI2_NSS	PI0	D10	3	
	5	5V	-	5Vinput/output		TIM8_CH1N	PH13	D9	2	
	6	GND	-	Ground		-	PH15	D8	1	
	7	GND	-	Ground		-				
	8	VIN	-	+6V to +9V power input (note 2)	-	-	PA4	D7	8	CN11 Digital
-						TIM3_CH1	PB4	D6	7	
CN17 Analog	1	A0	PA7	ADC1_IN12		TIM5_CH2	PA1	D5	6	
	2	A1	PC4	ADC1_IN13		-	PG6	D4	5	
	3	A2	PC3	ADC1_IN4		TIM15_CH2	PF10	D3	4	
	4	A3	PB0	ADC1_IN15		-	PG11	D2	3	
	5	A4	PA0 or PG8 (note 3)	ADC1_IN5 or I2C3_SDA (note 3)		LPUART1_TX	PC1	D1	2	
	6	A5	PA5 or PG7 (note 3)	ADC1_IN10 or I2C3_SCL (note 3)		LPUART1_RX	PC0	D0	1	

1. The 3V3 on ARD connector PIN4 is not a power input for 32L4R9IDISCOVERY board, to simplify power architecture.
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 on the regulator U15, it may overheat and could be damaged.
3. By default, pin 5 and pin 6 of CN17 connector are connected to ADC MCU input ports PA0 and PA5 respectively, thanks to configuration of solder bridges: SB33 and SB35 closed, SB32 and SB34 opened. In case it is necessary to connect I2C interface signals on pins 5 and 6 of CN17 instead of ADC inputs, open SB33 and SB35, and close SB32 and SB34.

Before using any Arduino™ Uno V3 Shield, it is important to refer to *Section 10.6.1* for a correct configuration of JP4 and JP5. VREF+, the voltage reference used by the internal DAC and ADC of STM32L4R9AI, has three different power sourcing capabilities:

- from STM32L4R9AI MCU Internal buffer generation (Default). VREFBUF internal ADC / DAC voltage reference is set to 2.5V by default.
- from an external Arduino™ Uno V3 shield, connected to connector CN10. In that case, SB27 needs to be connected to bring AVDD on VREF+, a 100nF is necessary on C48 and VREFBUF needs to be de-activated.
- from a VDDA power supply generated on 32L4R9IDISCOVERY board. VDDA is also connected to VDDUSB of STM32L4R9AI. In that case, mounting a 0 ohm resistor on R14 is necessary. VREFBUF needs to be de-activated. A jumper JP3 also needs to be set as below description.

Table 14. JP3, VDDA and VDDUSB, settings

Jumper	Setting	Description
JP3 VDDA Setting		Default setting. Jumper on PIN1/2, VDDA get power from +3V3
		Jumper on PIN2/3, VDDA get power form VDD_MCU (See warning below)

Warning: **When VDDA=VDD_MCU and if VDD_MCU=1.8 V (check JP7 setting), there is huge leakage current and a risk of damaging MCU I/Os in case 3.3 V logic level is connected to ADC input I/Os of STM32L4R9AI. Also, ADC measurements is not functional in default configuration**

Caution: The I/Os of STM32 microcontroller are 3V3 compatible instead of 5 V for Arduino™ Uno V3.

Note: *Limitation: the Arduino™ Uno V3 is not compatible with JP7 setting at +1V8.*

See *Appendix B: Solder bridges* for possible Arduino™ Uno V3 configuration change.

11.2 DSI display, backlight and touch panel connector CN4

All the necessary signals to interface with round DSI display board are available through the DSI V3 connector CN4.

Figure 10. DSI display connector CN4

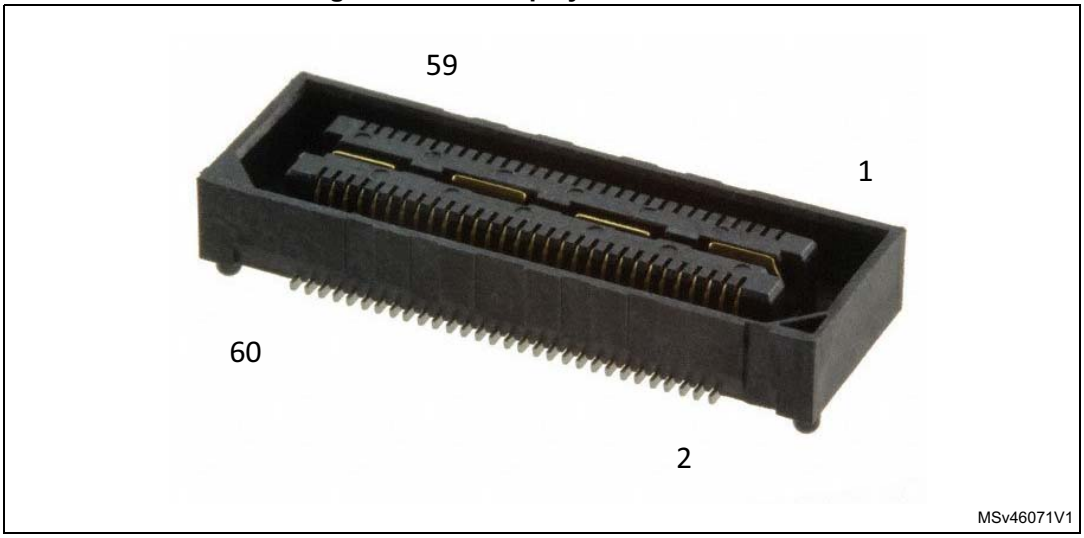


Table 15. DSI display connector CN4

Function	GPIO port	Signal name	CN6 pin number		Signal name	GPIO port	Function
General ground	-	GND	1	2	NC	-	-
Differential DSI clock	-	DSI_CK_P	3	4	TOUCH_INT	MFX_GPIO9	Touch panel interrupt
Differential DSI clock	-	DSI_CK_N	5	6	GND	-	General ground reference
General ground	-	GND	7	8	DSI_D2_P	-	Not connected
Differential DSI data 0	-	DSI_D0_P	9	10	DSI_D2_N	-	Not connected
	-	DSI_D0_N	11	12	GND	-	General ground
General ground	-	GND	13	14	DSI_D3_P	-	Not connected
Differential DSI data 1	-	DSI_D1_P	15	16	DSI_D3_N	-	Not connected
	-	DSI_D1_N	17	18	GND	-	General ground
General ground	-	GND	19	20	NC	-	-
Power output	-	+5v	21	22	SPI_CS	PH14	SPI chip select

Table 15. DSI display connector CN4 (continued)

Function	GPIO port	Signal name	CN6 pin number		Signal name	GPIO port	Function
Power output	-	+5v	23	24	SPI2_SCK	PB13	SPI clock
-	-	NC	25	26	SPI2_MOSIp	PB15	SPI data
SM3321 ground	-	BLGND	27	28	SPI_DCX	PB14	SPI data/control
SM3321 ground	-	BLGND	29	30	NC	-	-
-	-	NC	31	32	RESERVED	-	-
-	-	NC	33	34	NC	-	-
-	-	NC	35	36	3V3	-	3V3 voltage reference
-	-	NC	37	38	VDDIO	-	IOVDD reference
-	-	NC	39	40	I2C1_SDA	PG13	Touch panel I2C data
-	-	NC	41	42	NC	-	-
DSI_SWIRE control output	PA8	DSI_SWIRE	43	44	I2C1_SCL	PB6	Touch panel I2C clock
-	-	NC	45	46	NC	-	-
-	-	NC	47	48	NC	-	-
DSI tearing effect input	PF11	TE	49	50	NC	-	-
-	-	NC	51	52	NC	-	-
DSI Backlight control output	PB1	DSI_BL_CTRL	53	54	NC	-	-
-	-	NC	55	56	NC	-	-
DSI and Touch panel Reset output	MFX_ GPIO10	DSI_RESET	57	58	NC	-	-
-	-	NC	59	60	1V8	-	1.8V voltage reference
General ground	-	GND	61	62	GND	-	General ground
General ground	-	GND	63	64	GND	-	General ground

See *Appendix B: Solder bridges* for possible DSI display configuration change.

11.2.1 DSI AMOLED display

Warning: Permanent image sticking may occur if AMOLED displays same image for an extended period of time.

The DSI display is based on a round AMOLED Touch sensitive panel of 1.2 inch and 390x390 pixels. The display module reference is IEG1120TB103GF-001 from Govisionox Optoelectronics. It displays up to 16M colors. The round DSI display module board reference is MB1314. The DSI interface of MB1314 is only one data-lane width and a clock lane, but the 32L4R9IDISCOVERY board supports DSI displays with up to two data-lane width. The DSI_V3 connector interface also enables the use of dedicated low power modes of display, thanks to the available SPI2 interface (MB1314 does not use it). It is also possible to use some of USART3 signals to control a low power mode (SB6 and SB8 are respectively exclusive with SB13 and SB7).

The DSI_TE signal PF11 is used as an input of the main microcontroller connected to the display signal TE (tearing effect). DSI_TE signal is used to synchronize the refresh of the display memory by the microcontroller with the display scan, this to avoid visible artefacts.

DSI_3V3_PWRON signal (MFX_GPIO8, low level active) controls the 3V3 level power supplies provided on the DSI_V3 connector interface. DSI_1V8_PWRON signal (MFX_aGPIO2) controls the 1V8 level power supplies provided on the DSI_V3 connector interface. Both must be used to enable or disable display, TP and PSRAM. They allows to disconnect those peripherals when doing low power IDD measurement.

DSI_RESET signal (MFX_GPIO10, low level active) controls the reset for the display and the Touch panel.

An optional DSI_SWIRE signal PA8 offers additional possibility to control the voltage for any display supply during initialization (not used by MB1314 by default). PA8 is exclusive with another function from 32L4R9IDISCOVERY board: CAMERA clock Interface (MCO), which is the default setting.

11.2.2 Backlight and OLED power supplies generation

This function is handled by the power driver circuit SM3321, included on the MB1314 DSI display Board. SM3321 is a switching mode boost converter supplied by the 3V3 rail of the DSI_V3 connector interface. SM3321 is controlled either by the AMOLED driver circuit itself (default configuration), either by DSI_BL_CTRL (PB1) from main MCU, either from the DSI_SWIRE (PA8) interface from main MCU. SM3321 provides all necessary voltage references to AMOLED display.

If used, the signal DSI_BL_CTRL switches on the backlight with a high level. It is possible to dim the backlight intensity by applying a low frequency PWM signal to DSI_BL_CTRL (1 to 10 kHz typically).

11.2.3 Touch panel

The touch panel is a capacitive touch panel using an I2C interface. The touch panel IC reference is FT3267, and is located on the MB1314 board. The FT3267 I2C1 default addresses are 0x71 and 0x70.

Touch panel interrupt output DSI_TOUCH_INT is connected to MFX_GPIO9. It is used as touch panel detection indication. MFX_GPIO10 resets capacitive touch panel and DSI display.

11.3 USB OTG FS connector CN9

An USB OTG full speed communication link is available at USB Micro AB receptacle connector CN9. Micro AB receptacle enables USB host and USB Device features.

MFX_GPIO13 is used to enable on-board VBUS power when in host mode.

Limitation: when the 32L4R9IDISCOVERY board is configured as a USB host, and if a USB High-power device is to be used on CN9, it may be necessary to change default JP4 setting to power the board from another Power source than (1) STLK or (9) CHGR. Please take care sufficient amount of current is available from this other Power source and refer to *Section 10.6.1* for detailed configuration.

Figure 11. USB OTG FS Micro-AB connector CN9

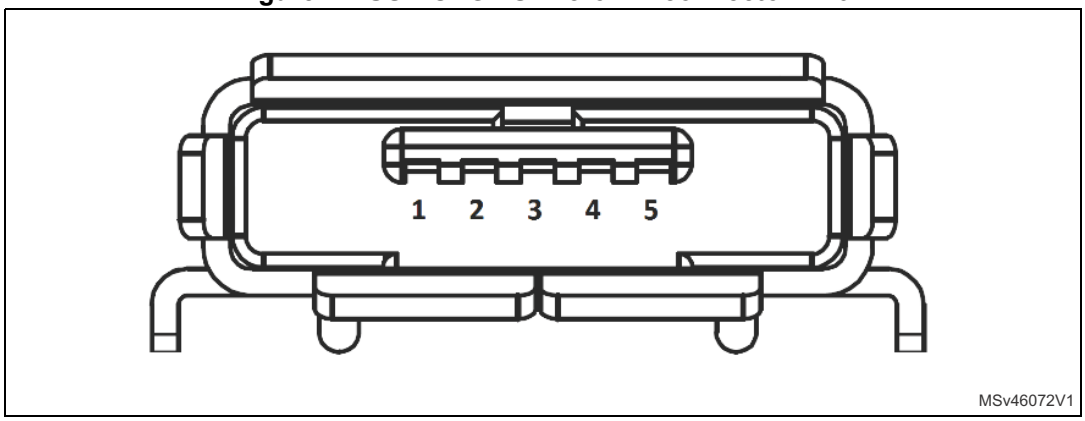


Table 16. USB OTG FS Micro-AB connector CN9

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

11.4 ST-LINK/V2-1 USB Micro-B connector CN13

The USB connector CN13 is used to connect the embedded ST-LINK/V2-1 to the PC.

Figure 12. USB Micro-B connector CN13

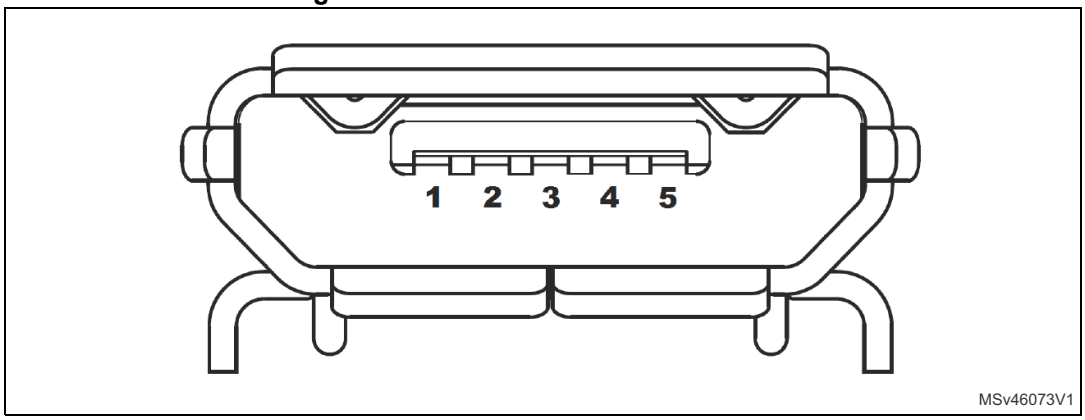


Table 17. USB Micro-B connector CN13

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

11.5 microSD card connector CN6

microSD cards with 4 Gbytes or more capacity are inserted in the receptacle CN6. Four data bits of the SDMMC1 interface, CLK and CMD signals of the STM32L4R9AI are used to communicate with the microSD card at +3V3 only. The card insertion is detected by the MFX_GPIO5: when a microSD card is inserted, the logic level is 0, otherwise it is 1.

Figure 13. microSD connector CN6 (top view)

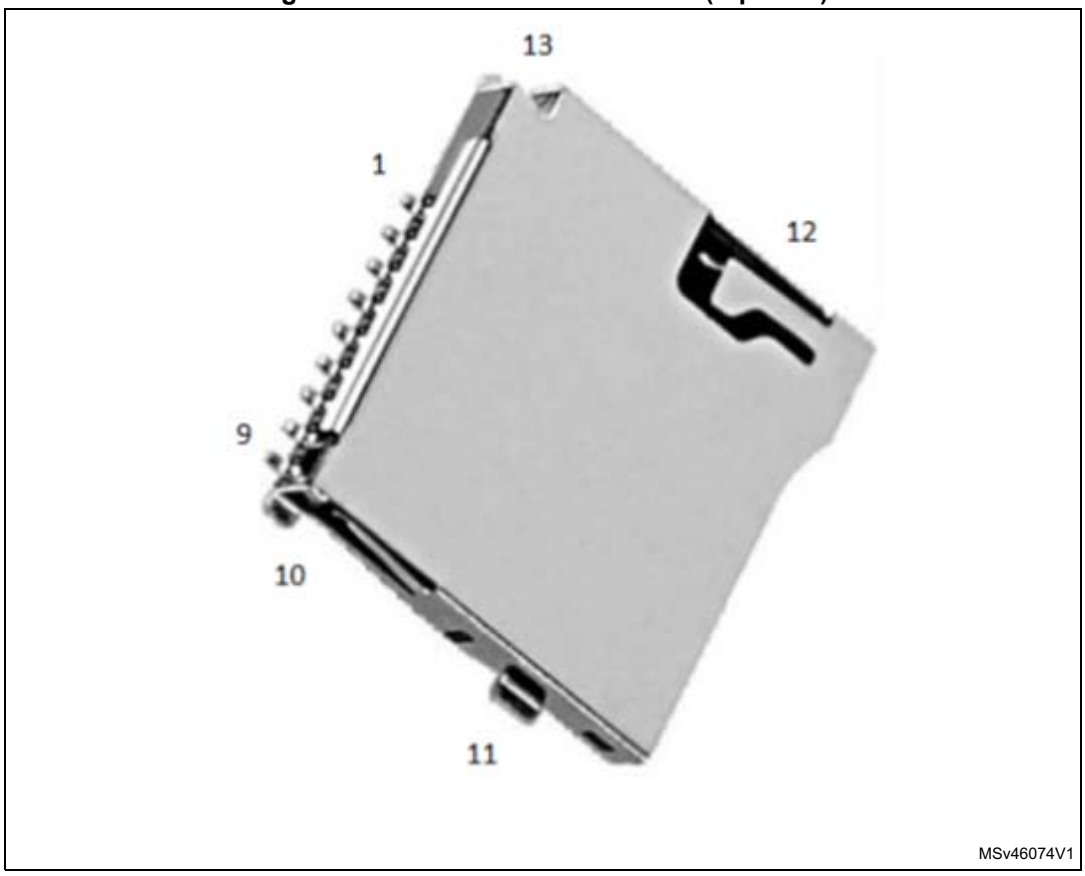


Table 18. microSD connector CN6

Pin number	Description	Pin number	Description
1	SDMMC1_D2 (PC10)	6	GND
2	SDMMC1_D3 (PC11)	7	SDMMC1_D0 (PC8)
3	SDMMC1_CMD (PD2)	8	SDMMC1_D1 (PC9)
4	VDD (+3V3)	9	µSD_DETECT (MFX_GPIO5)
5	SDMMC1_CLK (PC12)	10-11-12	GND (casing)

Note: Limitation: the microSD is not compatible with JP7 setting at +1V8.

11.6 STMod+ connector CN1

The standard 20-pin STMod+ connector is available on 32L4R9IDISCOVERY board to increase compatibility with external boards and modules from the Ecosystem of microcontrollers. By default, it is designed to support an ST dedicated Fanout board which allows connecting different modules or board extensions from different manufacturers. Fanout board also embeds a 3V3 regulator and I2C level shifters. Schematics of Fanout board is available in *Figure 35.: Fanout board (MB1280)*. For more detailed information,

please refer to ST Fanout board user manual and to relevant datasheets of associated modules.

For details about STMod+ interface, please refer to STMod+ connector interface specification.

Figure 14. STMod+ connector CN1

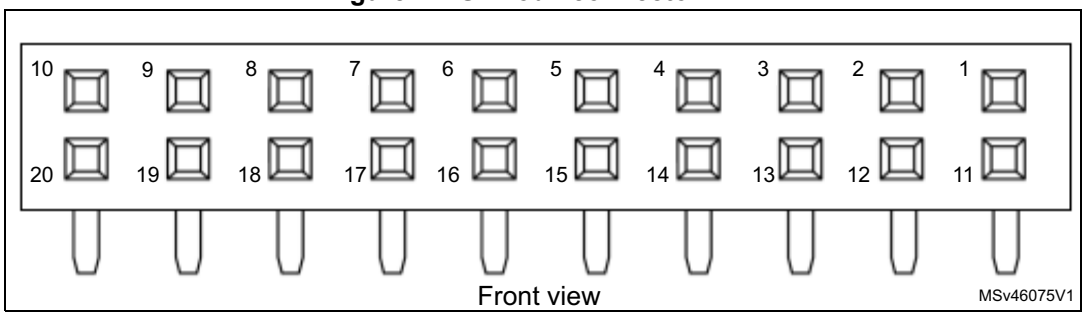


Table 19. STMod+ connector CN1

Pin number	Description	Pin number	Description
1	SPI2_CS/USART3_CTS (PA6)	11	INT (PC6)
2	SPI2_MOSIp/USART3_TXD (PB15/PB10)	12	RST (PI7)
3	SPI2_MISOp/USART3_RXD (PB14/PB11)	13	ADC (PA4)
4	SPI2_SCK/USART3_RTS (PB13/PA15)	14	PWM (PA5)
5	GND	15	+5V
6	+5V	16	GND
7	I2C3_SCL (PG7)	17	GPIO (PB12)
8	SPI2_MOSIs (PI3)	18	GPIO (PC2)
9	SPI2_MISOs (PI2)	19	GPIO (PC7)
10	I2C3_SDA (PG8)	20	GPIO (PC2)

In order to be able to support selection of SPI or UART functions connection on STMod+ by software, a quad SPDT switch has been added. It is controlled by two GPIOs from MFX circuit and enables MCU signal selection for pins 2, 3 and 4. By default, STMod+ connector is selected, and STMOD+_SEL_0 and STMOD+_SEL_1 of MFX circuit are set to support one of the STMod+ interface configuration.

Table 20. Quad SPDT switch configuration

Pin number	SPI	UART / SPI (1)	UART
STMOD+_SEL_0 (GPIO6 of MFX_V3)	0	1	1
STMOD+_SEL_1 (GPIO7 of MFX_V3)	0	0	1
STMod+ pin 1 (directly connected to PA6)	SPI_CS	SPI_CS	USART3_CTS
STMod+ pin 2	SPI2_MOSIp	USART3_TX	USART3_TX

Table 20. Quad SPDT switch configuration (continued)

Pin number	SPI	UART / SPI (1)	UART
STMod+ pin 3	SPI2_MISOp	USART3_RX	USART3_RX
STMod+ pin 4	SPI2_SCK	SPI2_SCK	USART3_RTS

1. UART / SPI defines default configuration for STMOD+_SEL_0 and STMOD+_SEL_1.

Please, take care that this connector shares many GPIOs with other functions on the Board: for more detailed information please refer to *Appendix A: GPIO assignment and sharing*.

In addition, to have a quick look at STMod+ GPIO sharing and multiplexing, and to get a quick view on other Alternate functions available on its pins, please refer to *Appendix C: STMod+ GPIO sharing and multiplexing*.

Note: Limitation: The STMod+ interface is not compatible with JP7 setting at +1V8.

Note: Limitation: if STMod+ pin 17 is used, please take care to disconnect SB1 first. If STMod+ pin 18/20 is used, please activate MIC_VDD GPIO (PH2) at high level first.

11.7 PMOD connector CN3

The standard 12-pin PMOD connector is available on STM32L4R9I-DISCO Discovery board to support low frequency, low I/O pin count peripheral modules. The PMOD interface which has been implemented on STM32L4R9I-DISCO Discovery board is compatible with the PMOD type 2A & 4A I/O signal assignment convention.

Figure 15. PMOD connector CN3

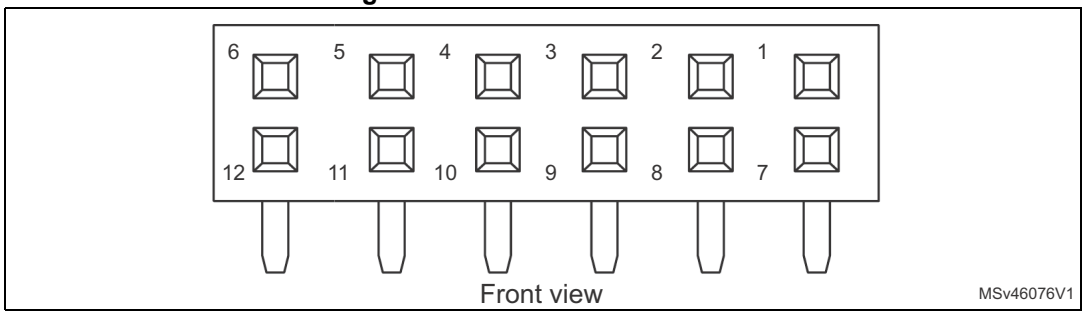


Table 21. PMOD connector CN3

Pin number	Description	Pin number	Description
1	SPI2_CS/USART3_CTS (PA6)	7	INT (PC6)
2	SPI2_MOSIp/USART3_TXD (PB15/PB10)	8	RESET (PI7)
3	SPI2_MISOp/USART3_RXD (PB14/PB11)	9	NA
4	SPI2_SCK/USART3_RTS (PB13/PA15)	10	NA
5	GND	11	GND
6	3V3	12	3V3

In order to be able to support selection of SPI or UART functions connection on PMOD by software, a quad SPDT switch has been added on board. It is controlled by two GPIOs from MFX_V3 circuit and enables MCU signal choice for pins 2, 3 and 4: refer to *Table 20* STMod+ chapter for switch description details (pin 1, 2, 3 and 4 of PMOD are common with STMod+).

By default, STMod+ connector is selected, so STMOD+_SEL_0 and STMOD+_SEL_1 needs to be modified to support one of the PMOD interface configuration. Also, PMOD shares GPIOs with other functions of the Board: for more detailed information please refer to *Appendix A: GPIO assignment and sharing*.

Note: Limitation: the PMOD interface is not compatible with JP7 setting at +1V8.

11.8 Camera module connector CN2

An 8-bit camera module function is supported thanks to the 30-pin dedicated ZIF connector CN2. The reference of camera module to be used is STM32F4DIS-CAM. This module has to be connected with caution before powering on the STM32L4R9I-DISCO Discovery board. The camera module I²C addresses are 0x61 and 0x60. Camera is usable by default, but one might take care about GPIO sharing and multiplexing with other function, in order to program the good configuration. For more detailed information please refer to *Appendix A: GPIO assignment and sharing*.

Note: Limitation: the camera is not compatible with JP7 setting at +1V8.

Figure 16. Camera module connector CN2

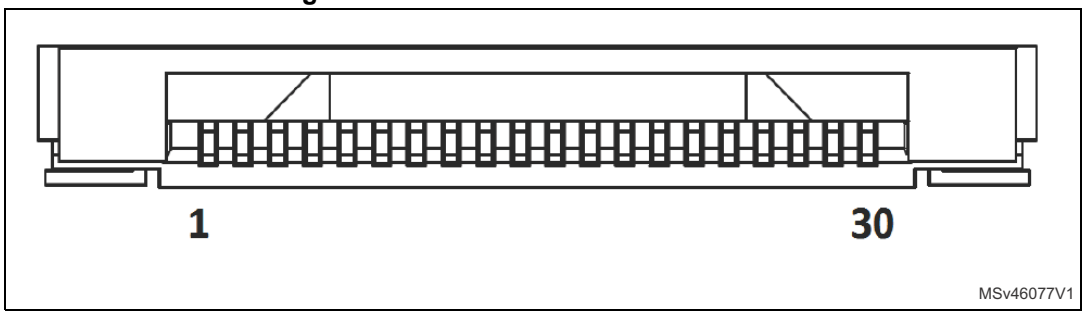


Table 22. Camera module connector CN2

Pin number	Description	Pin number	Description
1	GND	16	GND
2	NC	17	DCMI_HSYNC (PA4)
3	NC	18	NC
4	DCMI_D0 (PC6)	19	DCMI_VSYNC (PI5)
5	DCMI_D1 (PC7)	20	VDD
6	DCMI_D2 (PH11)	21	DCMI_CLK (PA8)
7	DCMI_D3 (PH12)	22	NC
8	DCMI_D4 (PE4)	23	GND
9	DCMI_D5 (PI4)	24	NC

Table 22. Camera module connector CN2 (continued)

Pin number	Description	Pin number	Description
10	DCMI_D6 (PB8)	25	DCMI_PWR_EN (MFX_GPIO12)
11	DCMI_D7 (PI7)	26	DCMI_NRST (NRST from MCU)
12	NC	27	I2C1_SDA (PG13)
13	NC	28	I2C1_SCL (PB6)
14	GND	29	GND
15	DCMI_PIXCK (PH5)	30	VDD

11.9 TAG connector CN8

The TAG connector footprint CN8 is used to connect STM32L4R9AI microcontroller for programming or debugging the board.

Figure 17. TAG connector CN8

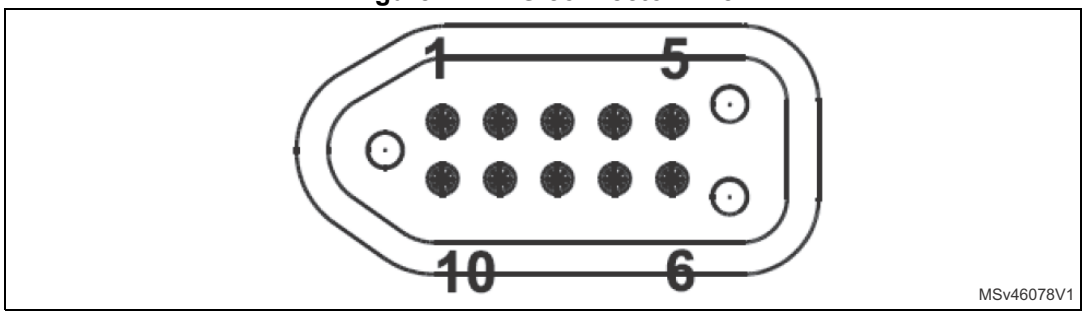


Table 23. TAG connector CN8

Pin number	Description	Pin number	Description
1	VDD	10	NRST (PH3, RESET#)
2	SWDIO (PA13)	9	NA
3	GND	8	NA
4	SWCLK (PA14)	7	NA
5	GND	6	SWO (PB3)

11.10 SWD header CN5

The 6-pin SWD header is used to program or debug an MCU in an external application board using a dedicated cable connected to it. To use this SWD header interface, pins 2 and 3 of JP10 need to be connected with a jumper. Furthermore, SW1 must be set in OFF position while R24 and R31 need to be disconnected.

By default, STLINK/V2-1 is used to program or debug on board MCU. Pin1 and 2 of JP10 are connected, SW1 is in ON position, R24 and R31 are connected.

Table 24. SWD header CN5

Pin number	Description	Pin number	Description
1	VDD	4	SWDIO (PA13)
2	SWCLK (PA14)	5	NRST
3	GND	6	SWO (PB3)

11.11 EXT_I2C connector CN7

The EXT_I2C connector socket is used to connect external modules to I2C1 interface or to monitor the I2C1 interface.

Figure 18. EXT_I2C connector CN7

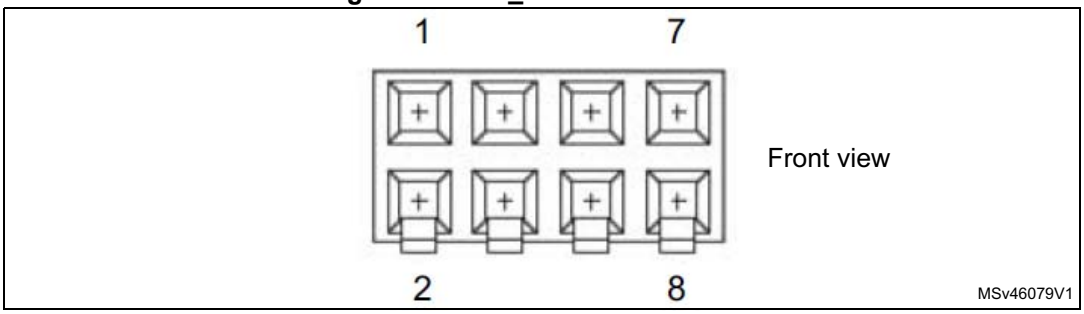


Table 25. EXT_I2C connector CN7

Pin number	Description	Pin number	Description
1	I2C1_SDA (PG13)	5	+3V3
2	NC	6	NC
3	I2C1_SCL (PB6)	7	GND
4	EXT_RESET (MFX_GPIO11)	8	NC

As I2C1 is available for external use, it is important to note that those following I2C1 applications and addresses are already used on board:

Table 26. I2C1 addresses (on board)

Application	R/W I2C address	I2C max. speed	Comment
DSI display Touch Panel	0x71/0x70	400 kHz	Default I2C address
Audio Codec	0x95/0x94	100 kHz	Default I2C address
CAMERA	0x61/0x60	400 kHz	For STM32F4DIS-CAM Module
MFX_V3	0x85/0x84	400 kHz	Default I2C address

Depending on the I2C module plugged into CN7, I2C1 could even be used up to Fast mode + (1 MHz) if Audio Codec is set to OFF mode with AUDIO_RST Low.

11.12 Stereo headset and headphone jack CN12

A stereo headphone or a stereo headset with analog microphone is pluggable into the 3.5 mm standard jack socket CN12.

Figure 19. Stereo headset with microphone jack CN12

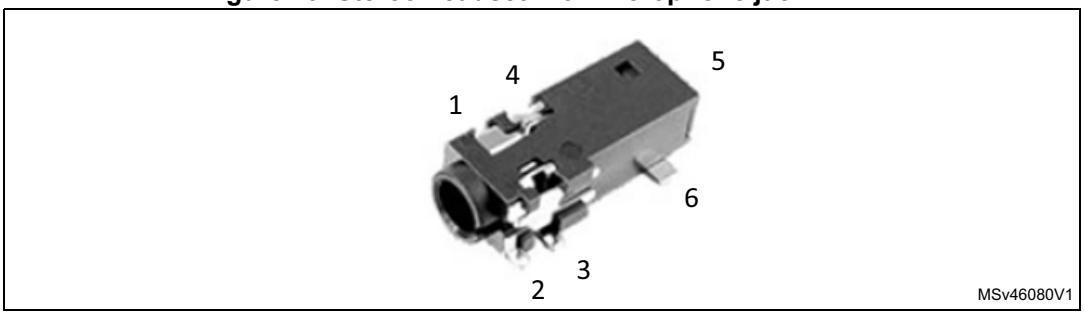


Table 27. Audio jack connector CN12

Pin number	Description	Stereo headset with microphone pinning	
6	OUT_Left	SPK_L (32 ohms typ.)	
4	OUT_Right	SPK_R (32 ohms typ.)	
3	GND	GND	
2	IN_Analog	Microphone	
5	NC	NA	
1	NC		

If a headset is plugged into CN12, the bias of the microphone is driven by the output MICBIAS1 of the codec and the analog audio enters into the codec by the pin AIN3A.

Appendix A GPIO assignment and sharing

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
K3	PA0	-	-	-	ARD_A4 (ADC1_IN5)
M1	PA1	-	-	-	ARD_D5 (TIM5_CH2)
N1	PA2	STLINK_USART2_TX	-	-	-
M2	PA3	STLINK_USART2_RX	-	-	-
N2	PA4	DCMI_HSYNC/DE	STMod+_ADC (ADC_1_IN9)	-	ARD_D7
L3	PA5	-	STMod+_PWM (TIM2_CH1)	-	ARD_A5 (ADC1_IN10)
L4	PA6	-	STMod+_SPI2_CS // STMod+_USART3_CTS (NU)	PMOD_SPI2_CS // PMOD_USART3_CTS (NU)	-
M4	PA7	-	-	-	ARD_A0 (ADC1_IN12)
E11	PA8	DCMI_CLK (MC0) // DSI_SWIRE (NU)	-	-	-
E12	PA9	VBUS	-	-	-
D11	PA10	ID	-	-	-
E13	PA11	DM	-	-	-
D13	PA12	DP	-	-	-
A11	PA13	JTMS/SWDIO	-	-	-
A10	PA14	JTCK/SWCLK	-	-	-
A9	PA15	-	STMod+_USART3_RTS (NU)	PMOD_USART3_RTS (NU)	-
N4	PB0	DSI_USART3_CK (NU)	-	-	ARD_A3 (ADC1_IN15)
L5	PB1	DSI_BL_CTRL (NU) // DSI_SWIRE (NU)	-	-	-
N5	PB2	MFX_WAKEUP_OUT	-	-	-

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing (continued)

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
A6	PB3	JTDO/TRACESWO	-	-	-
A5	PB4	-	-	-	ARD_D6 (TIM3_CH1)
B5	PB5	SAI1_SD_B	-	-	-
C5	PB6	I2C1_SCL	-	-	-
D5	PB7	PSRAM_NL (ADV)	-	-	-
C4	PB8	DCMI_D6	-	-	-
D4	PB9	SAI1_FS_A	-	-	-
N9	PB10	DSI_USART3_TX (NU)	STMod+_USART3_TX	PMOD_USART3_TX	-
H7	PB11	-	STMod+_USART3_RX	PMOD_USART3_RX	-
N12	PB12	DFSDM_1_DATIN1	STMod+_GPIO (NU)	-	-
N13	PB13	DSI_SPI2_SCK (NU)	STMod+_SPI2_SCK	PMOD_SPI2_SCK	ARD_D13 (SPI2_SCK)
M12	PB14	DSI_SPI_D/CX (NU)	STMod+_SPI2_MISOp (NU)	PMOD_SPI2_MISO (NU)	ARD_D12 (SPI2_MISO)
L10	PB15	DSI_SPI2_MOSI (NU)	STMod+_SPI2_MOSIp (NU)	PMOD_SPI2_MOSI (NU)	ARD_D11 (SPI2_MOSI_TIM3_CH2)
J2	PC0	-	-	-	ARD_D0 (LPUART1_RX)
J3	PC1	-	-	-	ARD_D1 (LPUART1_TX)
J4	PC2	DFSDM_1_CKOUT	STMod+_GPIO (NU)	-	-
K1	PC3	-	-	-	ARD_A2 (ADC1_IN4)
K4	PC4	-	-	-	ARD_A1 (ADC1_IN13)
F11	PC6	DCMI_D0	STMod+_INT	PMOD_INT	-
G11	PC7	DCMI_D1	STMod+_GPIO	-	-
F9	PC8	SDMMC_1_D0	-	-	-
G13	PC9	SDMMC_1_D1	-	-	-
D9	PC10	SDMMC_1_D2	-	-	-
E9	PC11	SDMMC_1_D3	-	-	-
F8	PC12	SDMMC_1_CK	-	-	-

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing (continued)

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
E1	PC13	JOY_SEL // WAKEUP	-	-	-
F1	PC14-OSC32_IN	PC14-OSC32_IN	-	-	-
G1	PC15-OSC32_OUT	PC15-OSC32_OUT	-	-	-
B8	PD0	PSRAM_D2	-	-	-
C8	PD1	PSRAM_D3	-	-	-
D8	PD2	SDMMC_1_CMD	-	-	-
E8	PD3	PSRAM_CLK	-	-	-
C7	PD4	PSRAM_NOE	-	-	-
D7	PD5	PSRAM_NWE	-	-	-
E7	PD6	PSRAM_NWAIT	-	-	-
F7	PD7	PSRAM_NE1	-	-	-
K10	PD8	PSRAM_D13	-	-	-
K9	PD9	PSRAM_D14	-	-	-
J10	PD10	PSRAM_D15	-	-	-
J9	PD11	PSRAM_A16	-	-	-
J8	PD12	PSRAM_A17	-	-	-
H8	PD13	PSRAM_A18	-	-	-
H11	PD14	PSRAM_D0	-	-	-
H10	PD15	PSRAM_D1	-	-	-
A4	PE0	PSRAM_NBL0	-	-	-
B4	PE1	PSRAM_NBL1	-	-	-
D3	PE2	SAI1_MCLK_A	-	-	-
D2	PE3	PSRAM_A19	-	-	-
D1	PE4	DCMI_D4 // PSRAM_A20 (NU)	-	-	-

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing (continued)

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
E4	PE5	SAI1_SCK_A	-	-	-
E3	PE6	SAI1_SD_A	-	-	-
L7	PE7	PSRAM_D4	-	-	-
K6	PE8	PSRAM_D5	-	-	-
J6	PE9	PSRAM_D6	-	-	-
H6	PE10	PSRAM_D7	-	-	-
N8	PE11	PSRAM_D8	-	-	-
M8	PE12	PSRAM_D9	-	-	-
L8	PE13	PSRAM_D10	-	-	-
K7	PE14	PSRAM_D11	-	-	-
J7	PE15	PSRAM_D12	-	-	-
F5	PF0	PSRAM_A0	-	-	-
F4	PF1	PSRAM_A1	-	-	-
F3	PF2	PSRAM_A2	-	-	-
G3	PF3	PSRAM_A3	-	-	-
G4	PF4	PSRAM_A4	-	-	-
G5	PF5	PSRAM_A5	-	-	-
H4	PF10	-	-	-	ARD_D3 (TIM15_CH2)
M5	PF11	DSI_TE	-	-	-
N6	PF12	PSRAM_A6	-	-	-
M6	PF13	PSRAM_A7	-	-	-
L6	PF14	PSRAM_A8	-	-	-
K5	PF15	PSRAM_A9	-	-	-
J5	PG0	PSRAM_A10	-	-	-
H5	PG1	PSRAM_A11	-	-	-

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing (continued)

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
H9	PG2	PSRAM_A12	-	-	-
G8	PG3	PSRAM_A13	-	-	-
G7	PG4	PSRAM_A14	-	-	-
G9	PG5	PSRAM_A15	-	-	-
G12	PG6	-	-	-	ARD_D4
G10	PG7	-	STMod+_I2C3_SCL	-	ARD_D15 (I2C3_SCL)
F10	PG8	-	STMod+_I2C3_SDA	-	ARD_D14 (I2C3_SDA)
B7	PG9	OCTOSPIM_P2_IO6	-	-	-
D6	PG10	OCTOSPIM_P2_IO7	-	-	-
E6	PG11	-	-	-	ARD_D2
F6	PG12	OCTOSPIM_P2_NCS	-	-	-
G6	PG13	I2C1_SDA	-	-	-
C6	PG15	OCTOSPIM_P2_DQS	-	-	-
H1	PH0-OSC_IN	PH0-OSC_IN	-	-	-
J1	PH1-OSC_OUT	PH1-OSC_OUT	-	-	-
A2	PH2	MIC_VDD	-	-	-
E5	PH3-BOOT0	PH3-BOOT0	-	-	-
K8	PH4	LED_GREEN	-	-	-
L9	PH5	DCMI_PIXCLK/PDCK	-	-	-
N10	PH8	OCTOSPIM_P2_IO3	-	-	-
C11	PH9	OCTOSPIM_P2_IO4	-	-	-
M9	PH10	OCTOSPIM_P2_IO5	-	-	-
M10	PH11	DCMI_D2	-	-	-
B13	PH12	DCMI_D3	-	-	-
C9	PH13	-	-	-	ARD_D9 (TIM8_CH1N)

Table 28. 32L4R9IDISCOVERY GPIO assignment and sharing (continued)

Pin	GPIO port	GPIO primary interface	STMod+ interface	PMOD interface	ARDUINO interface
A13	PH14	DSI_SPI_USART_CS (NU)	-	-	-
B12	PH15	-	-	-	ARD_D8
A12	PI0	-	-	-	ARD_D10 (SPI2_NSS_TIM5_CH4)
B11	PI1	MFX_INT_IN	-	-	-
B10	PI2	-	STMod+_SPI2_MISOs	-	-
C10	PI3	-	STMod+_SPI2_MOSIs	-	-
D10	PI4	DCMI_D5	-	-	-
E10	PI5	DCMI_VSYNC/RDY	-	-	-
B9	PI6	OCTOSPIM_P2_CLK	-	-	-
B2	PI7	DCMI_D7	STMod+_RST	PMOD_RST	-
B1	PI9	OCTOSPIM_P2_IO2	-	-	-
A1	PI10	OCTOSPIM_P2_IO1	-	-	-
C3	PI11	OCTOSPIM_P2_IO0	-	-	-

Legend:

or = Indicate shared or exclusive functions or interfaces on a GPIO port

(NU) = Function mode which is not usable by default

// = Highlights two exclusive functions available for one interface

(xxx) = Name of the STM32L4R9AI GPIO Alternate function used on this interface

Table 29. MFX_V3 GPIO assignment (LQFP48)

Pin	GPIO port	Implemented functions	Application function name
10	PA0-WKUP	-	-
11	PA1	MFX_aGPIO1	MFX_aGPIO1
12	PA2	MFX_aGPIO2	DSI_1V8_PWRON
13	PA3	-	-
14	PA4	Reserved DAC_Out1	SPARE
15	PA5	MFX_GPIO5	µSD_DETECT
16	PA6	MFX_GPIO6	STMOD+_SEL_0
17	PA7	MFX_GPIO7	STMOD+_SEL_1
29	PA8	MFX_GPIO8	DSI_3V3_PWRON
30	PA9	MFX_GPIO9	DSI_TOUCH_INT
31	PA10	MFX_GPIO10	DSI_RESET
32	PA11	MFX_GPIO11	EXT_RESET
33	PA12	MFX_GPIO12	DCMI_PWR_EN
34	PA13	MFX_SWDIO	MFX_SWDIO
37	PA14	MFX_SWCLK	MFX_SWCLK
38	PA15	MFX_IDD_SH3	SH3
18	PB0	MFX_GPIO0	LED_ORANGE
19	PB1	MFX_GPIO1	JOY_UP
20	PB2	MFX_GPIO2	JOY_DOWN
39	PB3	MFX_GPIO3	JOY_RIGHT
40	PB4	MFX_GPIO4	JOY_LEFT
41	PB5	MFX_IDD_VDD_MCU	IDD_VDD_MCU
42	PB6	MFX_I2C_SCL	I2C1_SCL from main MCU
43	PB7	MFX_I2C_SDA	I2C1_SDA from main MCU
45	PB8	MFX_I2C_ADDR	I2C_ADDR (external pull-down)

Table 29. MFX_V3 GPIO assignment (LQFP48) (continued)

Pin	GPIO port	Implemented functions	Application function name
46	PB9	MFX_IRQ_OUT	MFX_IRQ_OUT
21	PB10	-	-
22	PB11	-	-
25	PB12	MFX_IDD_MEAS	IDD_MEAS
26	PB13	MFX_GPIO13	USB_OTGFS_PPWR_EN
27	PB14	MFX_GPIO14	USB_OVER
28	PB15	MFX_GPIO15	AUDIO_Codec_RESET
2	PC13-ANTI_TAMP	MFX_WAKEUP	MFX_WAKEUP
3	PC14-OSC32_IN	MFX_IDD_CAL	CAL
4	PC15-OSC32_OUT	MFX_IDD_SH0	SH0
5	PH0-OSC_IN	MFX_IDD_SH1	SH1
6	PH1-OSC_OUT	MFX_IDD_SH2	SH2

Appendix B Solder bridges

Following *Table 30* describes each solder bridge. The default state is indicated in bold. ON state means a 0 ohm resistor is soldered. OFF state means SBxx is open.

Table 30. 32L4R9IDISCOVERY solder bridges

Solder bridges	State	Description
SB2 (ARD_D13 Green LED)	**ON**	Enables ARD Green LED control by ARD_D13
	OFF	Disables ARD Green LED
SB27 (ARD_AVDD on VREF+)	ON	Connects VREF+ from MCU to ARD_AVDD
	OFF	ARD_AVDD not connected
SB32, SB34 (I2C3 on ARD_A4/A5)	**OFF**	I2C3 disconnected from ARD_A4/A5, exclusive with SB33, SB35
SB33, SB35 (ADCs on ARD_A4/A5)	**ON**	ADCs inputs connected to ARD_A4/A5, exclusive with SB32, SB34
SB7, SB13 (USART3 on DSI display)	**OFF**	Disconnects USART3_CK/TX from pins 24/26 of DSI V3 connector, exclusive with SB6 and SB8
SB6, SB8 (SPI2 on DSI display)	**ON**	Connects SPI2_SCK/MOSI to pins 24/26 of DSI V3 connector, exclusive with SB7 and SB13
SB23 (VDD on OCTOSPI Flash)	**ON**	Connects OCTOSPI Flash power rails to VDD
	OFF	Disconnects VDD from OCTOSPI Flash
SB25 (OCTOSPI_ECS)	ON	ECS function active (need external pull-up)
	OFF	ECS function not active (no external pull-up)
SB24 (OCTOSPI_RESET)	**ON**	OCTOSPI Flash Reset is connected to General Reset of Board
	OFF	OCTOSPI Flash Reset not connected to General Reset of Board
SB1 (DFSDM_1_DATIN1)	**ON**	PB12 (DFSDM_1_DATIN1) is connected to Digital Microphones by default
	OFF	PB12 (DFSDM_1_DATIN1) is usable by STMod+ on pin 17
SB3 (RESERVED)	**ON**	Reserved, but removable if necessary (PSRAM_A20 to U6)
SB4 (RESERVED)	**OFF**	Reserved, do not modify (PSRAM_A20 to VDD)
SB16, SB17, SB18, SB19, SB20, SB21 (RESERVED)	**OFF**	Reserved, (STMod+/PMOD)
SB36 (RESERVED)	**OFF**	Reserved, (STLINK)

Table 30. 32L4R9IDISCOVERY solder bridges (continued)

Solder bridges	State	Description
SB5 (RESERVED)	**ON**	Reserved, do not modify (PSRAM)
SB14 (RESERVED)	**ON**	Reserved, do not modify (STLINK)
SB9, SB10, SB11, SB12 (RESERVED)	**ON**	Reserved, do not modify (display)
SB15 (RESERVED)	**ON**	Reserved, (USB OTG FS)
SB30 (RESERVED)	**ON**	Reserved, (Audio Codec VL)
SB29 (RESERVED)	**ON**	Reserved, (Audio Codec VD)
SB31 (RESERVED)	**ON**	Reserved, do not modify (MFX, IDD_VDD_MCU)
SB22 (RESERVED)	**ON**	Reserved, do not modify (STMod+/PMOD)
SB26 (RESERVED)	**ON**	Reserved, (OCTOSPI Flash)
SB37 (RESERVED)	**ON**	Reserved, (EXT_I2C)
SB28 (RESERVED)	**OFF**	Reserved, (MCO to HSE input)
SB38 (RESERVED)	**ON**	Reserved, (for U5 PSRAM)
SB39 (RESERVED)	**OFF**	Reserved, (for U6 PSRAM)

Appendix C STMod+ GPIO sharing and multiplexing

Table 31. STMod+ GPIO sharing and multiplexing

Shared or exclusive functions				STMod+[1]								Shared or exclusive functions				
DSI	**ARD**	**PMOD**	**Some other Alternate Functions[2]**	**Basic**	**SB[3]**	**Port**	**Pins**		**Pins**	**Port**	**SB**	**Basic**	**Some other Alternate Functions[2]**	**PMOD**	**ARD**	**CAM**	**Dig Mic**
-	-	CTSS3 / **CSN2**	LCTS1 / T3.1 / T16.1 / [OP2_I+ / AD1.11]	CTSS3 / **CSN2**	-	PA6	1		11	PC6	-	INT	SA2.MCKA / DF1.C3 / T3.1 / T8.1	INT	-	D0	-
TXS3 MOSI2	**MOSI2/T15.2**	**TXS3** MOSI2	**LRX1 / T2.3 / SCL2 / SCL4 / DF1.D7 / [CP1_O]** DF1.C2 / T1.3N / T8.3N / T15.2 / SA2.SDA / RTC_RFIN	**TXS3** MOSI2	20 21	**PB10** PB15	2		12	PI7	-	RST	T8.3	RST	-	D7	-
DC/X	MISO2	**RXS3** MISO2	**SDA2 / SDA4 / LTX1 / DF1.C7 / T2.4 / [CP2.O]** SA2.MCKA / SDA2 / RTSS3 / DF1.D2 / T1.2N / T8.2N / T15.1	**RXS3** MISO2	16 17	**PB11** PB14	3		13	PA4	-	ADC	LT2.O / [AD1.9 / DAC1.1]	-	D7	HSYNC	-
SCK2	**SCK2**	RTSS3 **SCK2**	SA2.FSB / RXS2 / RTS4 / T2.1 / T2.E **SCL2 / CTSS3 / LCTS1 / DF1.C1 / T1.1N / T15.1N / TXC2 / SA2.SCKA**	RTSS3 **SCK2**	18 19	PA15 **PB13**	4		14	PA5	-	PWM	SCK1 / T2.1 / T8.1N / [AD1.10 / DAC1.2]	-	A5	-	-
-	-	-	-	GND	-	GND	5	-	15	+5V	-	+5V	-	-	-	-	-
-	-	-	-	+5V	-	+5V	6		16	GND	-	GND	-	-	-	-	-
-	SCL3	-	DF1.CO / LTX1	SCL3	-	PG7	7		17	PB12	-	GPIO	NSS2 / SA2.FSA / SMBA2 / CKS3 / LRTS1 / RXC2 / DF1.D1	-	-	-	DF1.D1
-	-	-	T8.E	MOSI2	-	PI3	8		18	PC2*	-	GPIO	DF1.CO / MISO2 / LT1.2 / [AD1.3]	-	-	-	DF1.CO
-	-	-	T8.4	MISO2	-	PI2	9		19	PC7	-	GPIO	T3.2 / T8.2 / DF1.D3	-	-	D1	-
-	SDA3	-	LRX1	SDA3	-	PG8	10		20	PC2*	-	GPIO	same as pin 18	-	-	-	DF1.CO

Legend:
= DSI = Arduino Uno = Pmod = Alternate Functions = STMod+ = CAM = Digital Microphone = Supply = GND

1. This *Table 31* gives description of the signals available on the STMod+ connector
   It also shows which signal is shared with other board connector or function
   In some boards, Solder bridges (SB) are present to manually select which function is wired by default (but here, please refer to point (3) below)
   Analog signals are in brackets [xxx]
   The I2C bus on pins 7 / 10 might be shared with built-in discovery slave devices. Please check the slave address of your device when adding it to the bus.

2. RTSS3 stands for USART3_RTS
   AD1.3 stands for ADC_1_IN3
   T1.3N stands for TIM_1_CH3N
   DAC1.1 stands for DAC_1_OUT1
   MOSI2 stands for SPI2_MOSI
   RST stands for RESET
   INT stands for INTERRUPT
   DF1.C3 stands for DFSM1_CKIN3
   SDA3 stands for I2C3_SDA
   LTX1 stands for LP_UART1TX
   LT2.O stands for LPTIM2_OUT
   NSS2 stands for SPI2_NSS
   RXC1 stands for CAN_1_RX
   SA2.SCKA stands for SAI2_SCLK_A

3. The solder bridges (SB) are available on PCB to select chosen Port, but they are not used by default: Instead of SB, an embedded SPDT quad switch is used to select Port. It is controlled by 2 GPIOs from the MFX_V3 Expander (STMOD+_SEL_0 and _1), please see *Table 32* description below (Bold text is default configuration to support MikroBUS modules using MB1280 fan-out board)

Table 32. SPDT quad switch

	SPI	UART / SPI	UART	
STMOD+_SEL_0	0	**1**	1	STMOD+_SEL_0 is GPIO6 of MFX_V3
STMOD+_SEL_1	0	**0**	1	STMOD+_SEL_1 is GPIO7 of MFX_V3
pin 1	CSN2	**CSN2**	CTS3	pin 1 is connected directly to PA6
pin 2	MOSI2	**TXS3**	TXS3	
pin 3	MISO2	**RXS3**	RXS3	
pin 4	SCK2	**SCK2**	RTSS3	

Appendix D Schematics

This section provides design schematics for the 32L4R9IDISCOVERY board and design schematics of the round DSI display and Fanout boards:

Appendix D contains the schematics diagrams listed below:

Figure 20. 32L4R9IDISCOVERY board interconnections (MB1311C)

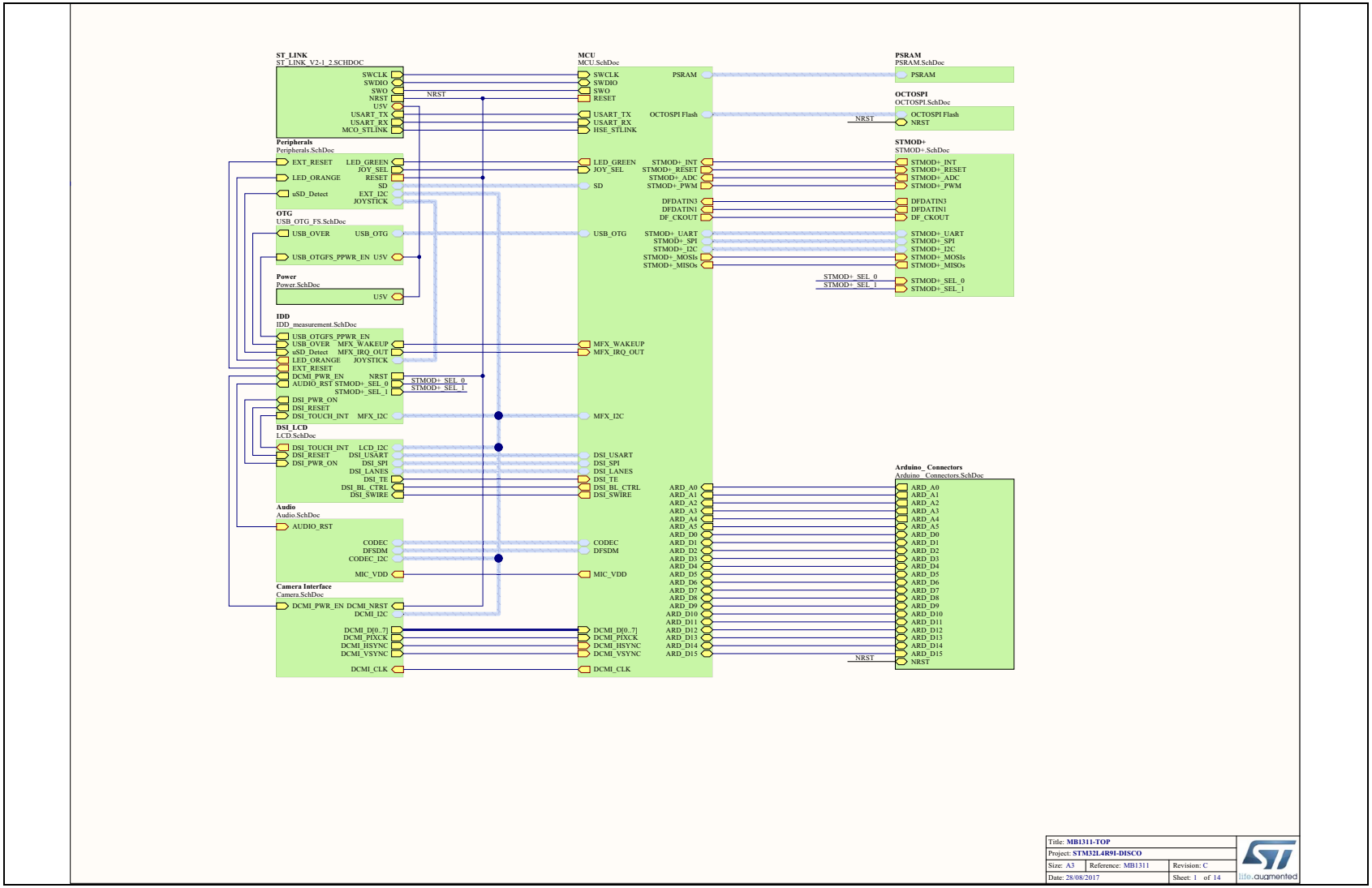


Figure 21. 32L4R9IDISCOVERY power

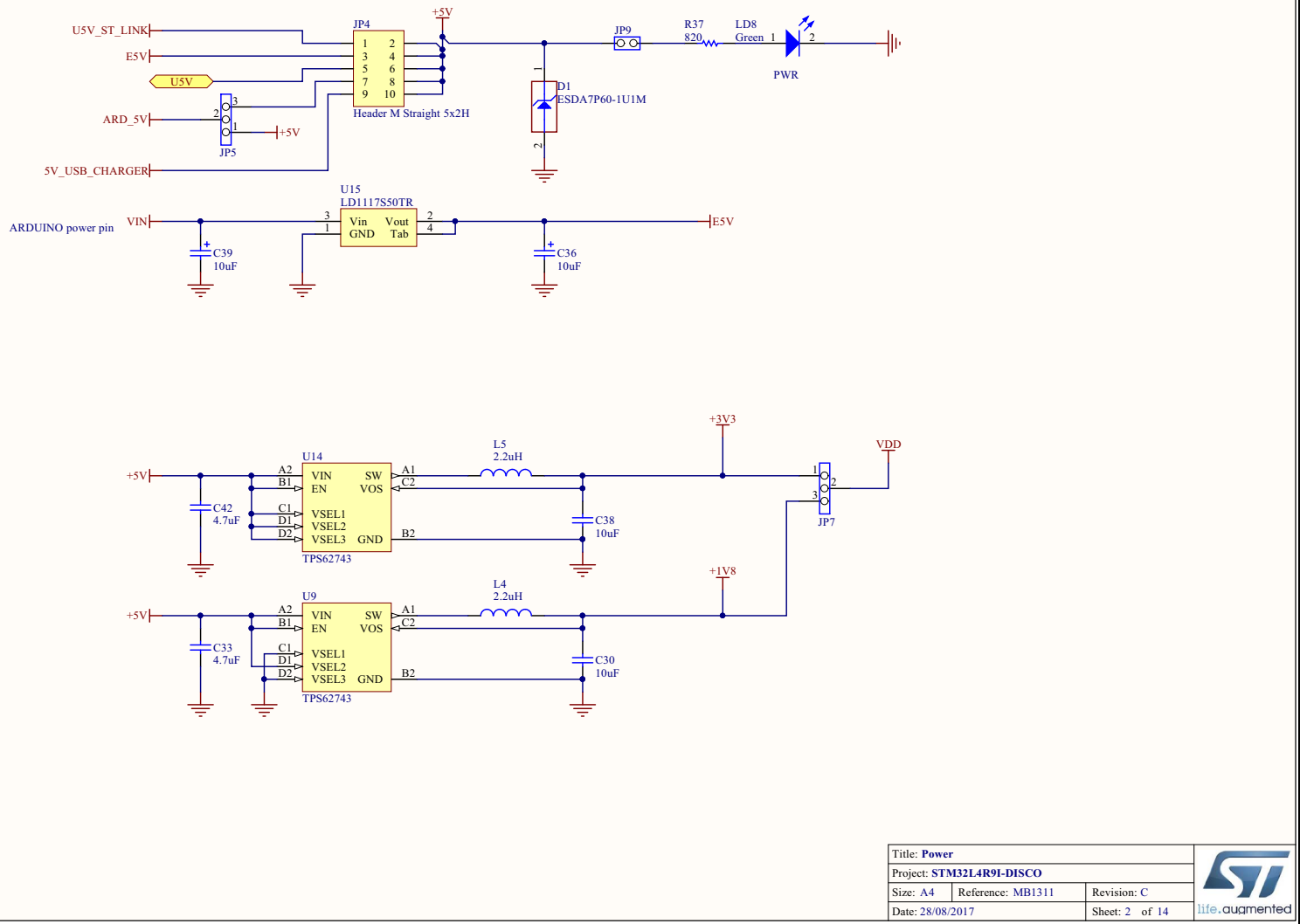
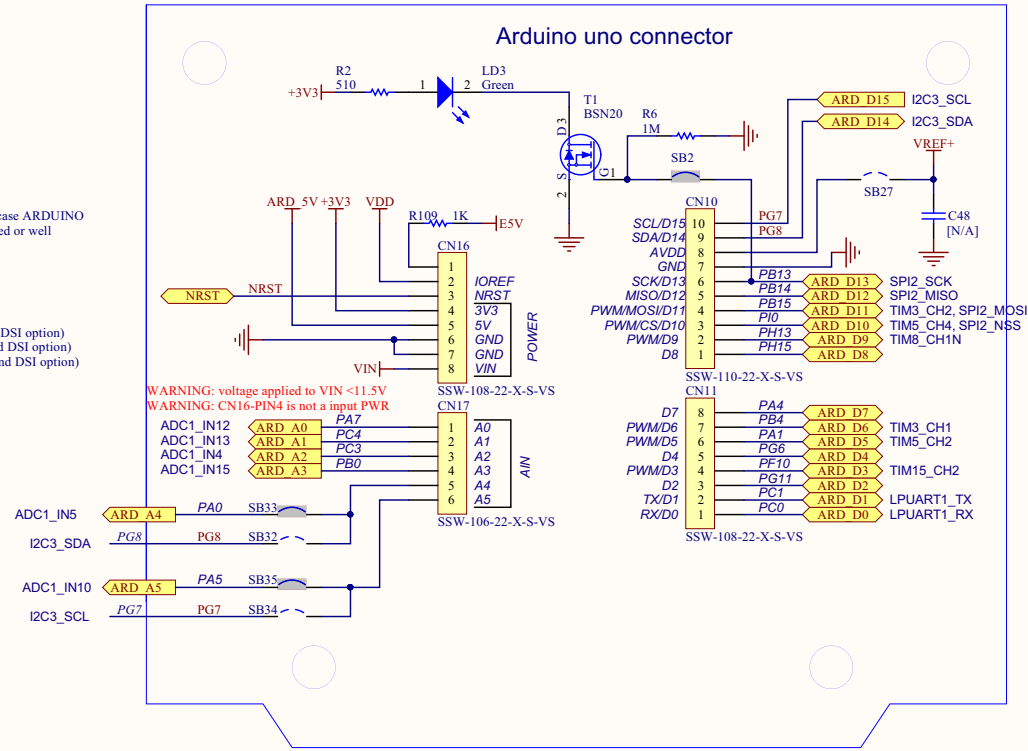


Figure 22. 32L4R9IDISCOVERY Arduino™ Uno V3 connectors

WARNING: Some Arduino IOs are shared with other functions:

Following ARD signals are multiplexed or shared with other functions. In case ARDUINO UNO is connected, take care that the corresponding features are disconnected or well configured :

ARD_D7 : DCMI_HSYNC/DE (Camera conflict)
ARD_A5 : STMOD+_PWM (STMod+ / PMOD conflict)
ARD_D15 : I2C3_SCL (shared with STMod+)
ARD_D14 : I2C3_SDA (shared with STMod+)
ARD_D13 : DSI_SPI2_SCK (SPI2_SCK shared with STMod+/PMOD and DSI option)
ARD_D12 : DSI_SPI_D/CX (SPI2_MISO shared with STMod+/PMOD and DSI option)
ARD_D11 : DSI_SPI2_MOSI (SPI2_MOSI shared with STMod+/PMOD and DSI option)



Title: **Arduino Uno connector**		
Project: **STM32L4R9I-DISCO**		
Size: A4	Reference: MB1311	Revision: C
Date: 28/08/2017		Sheet: 3 of 14

life.augmented

Figure 23. 32L4R9IDISCOVERY ST-LINK/V2-1

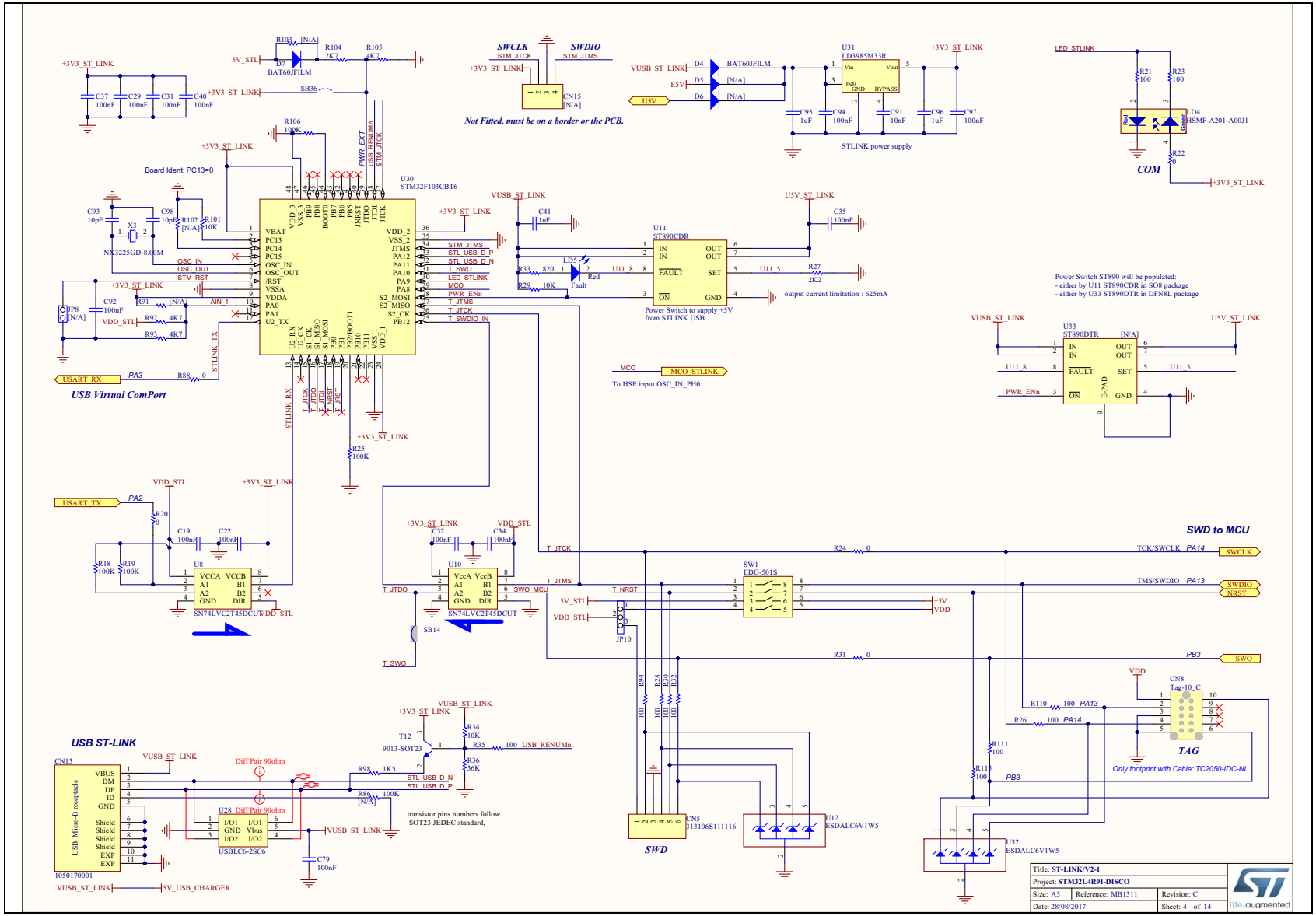


Figure 24. 32L4R9IDISCOVERY Octo-SPI Flash memory

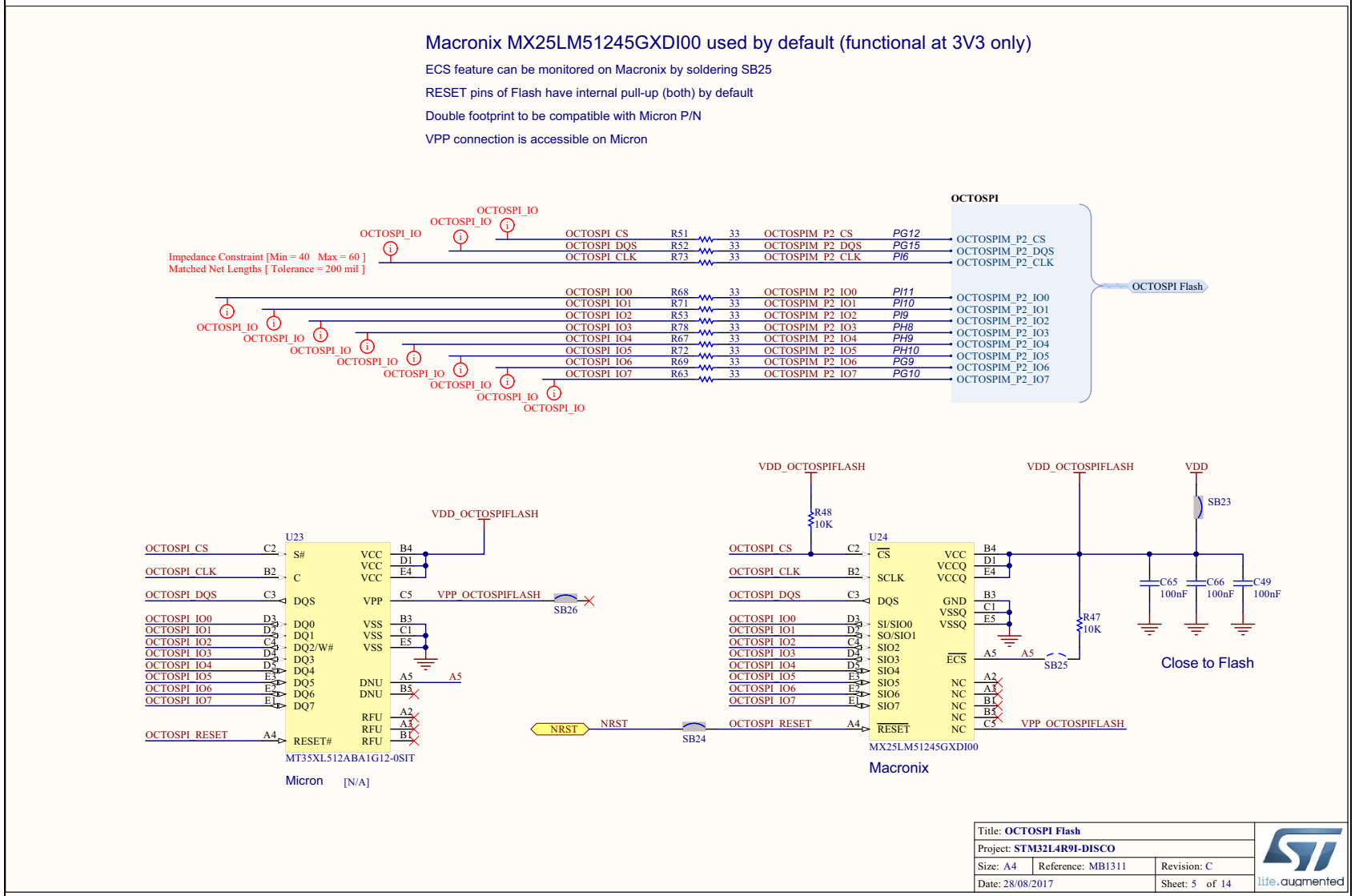


Figure 25. 32L4R9IDISCOVERY peripherals

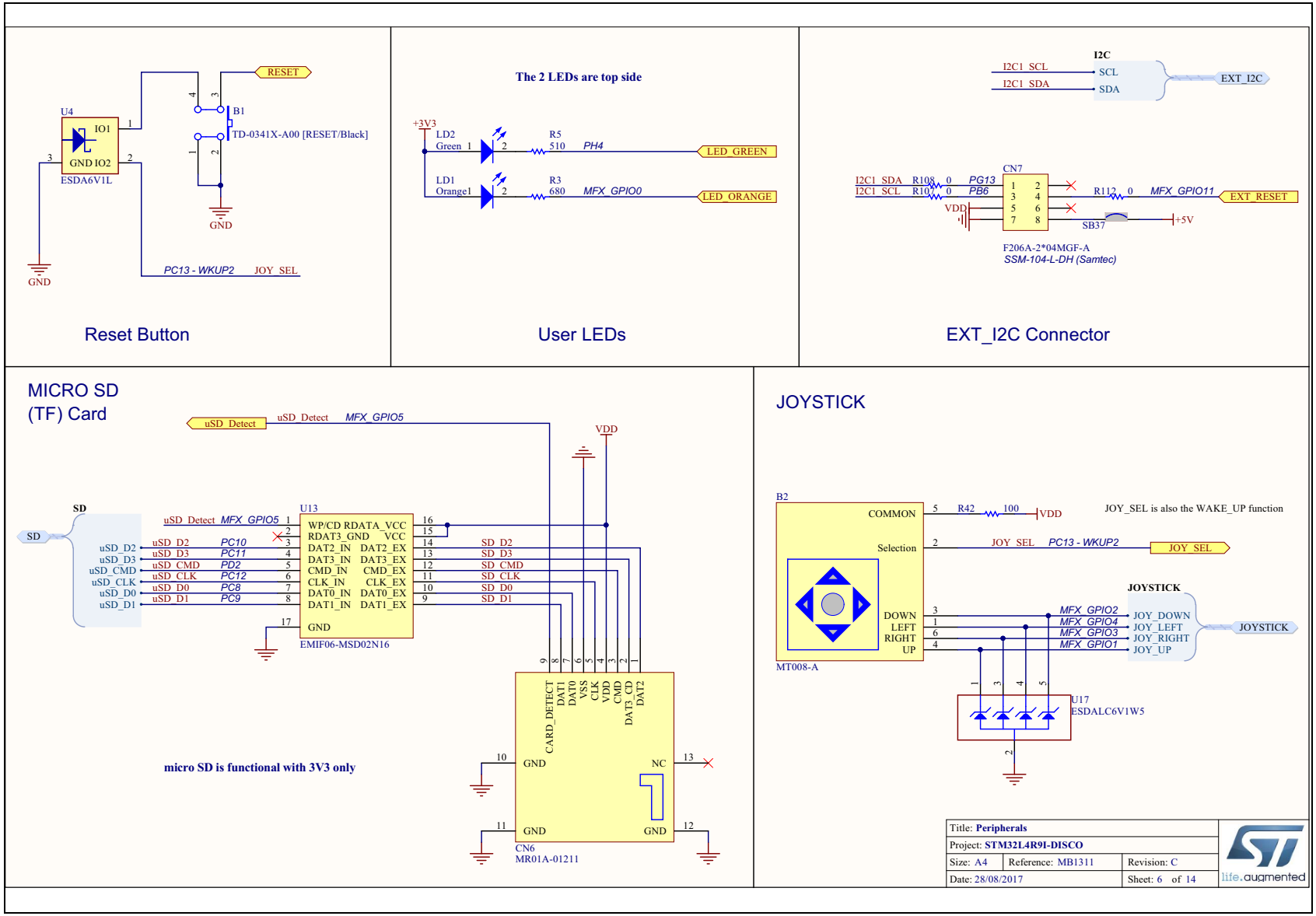


Figure 26. 32L4R9IDISCOVERY USB OTG FS

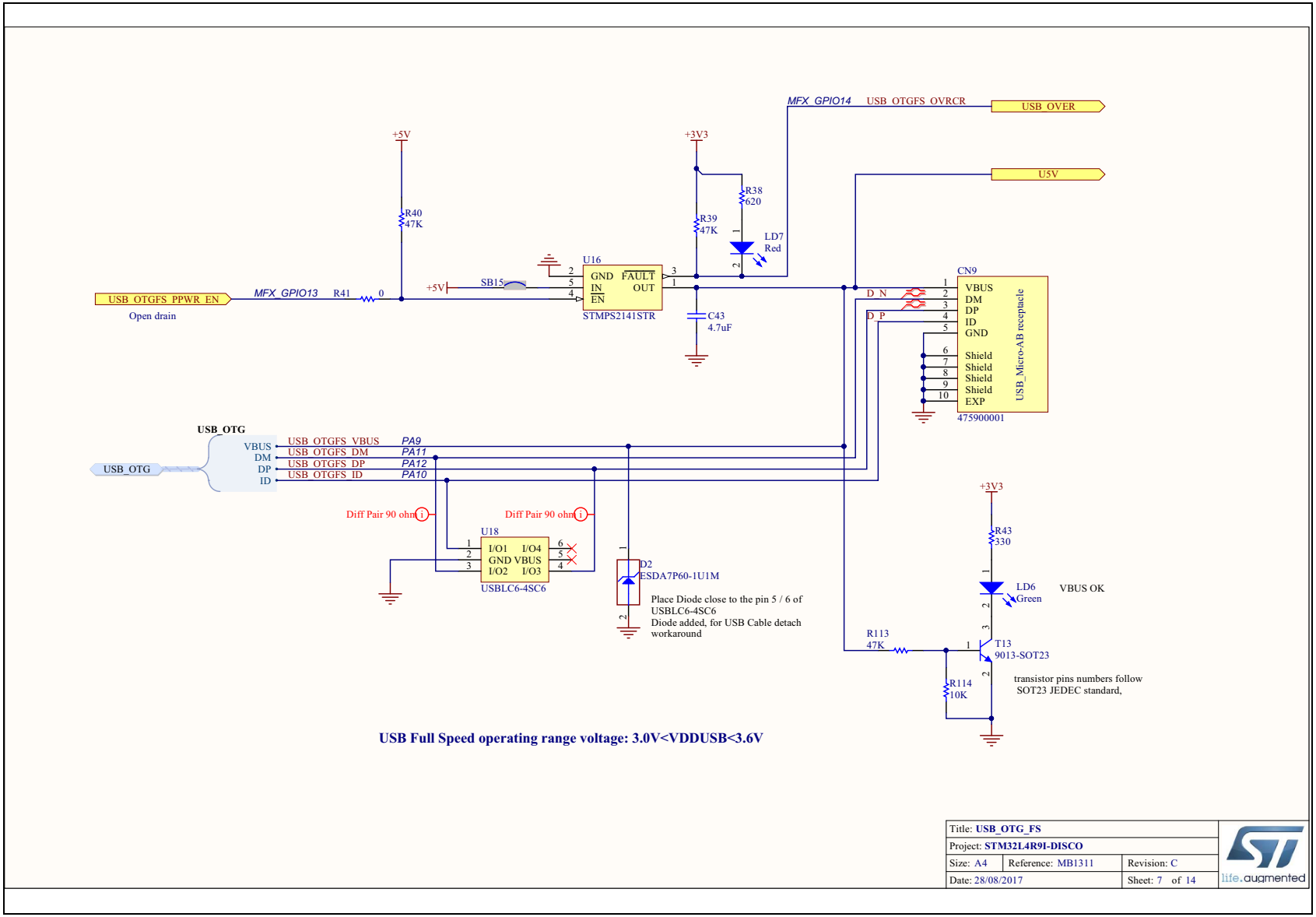


Figure 27. 32L4R9IDISCOVERY Round DSI display interface

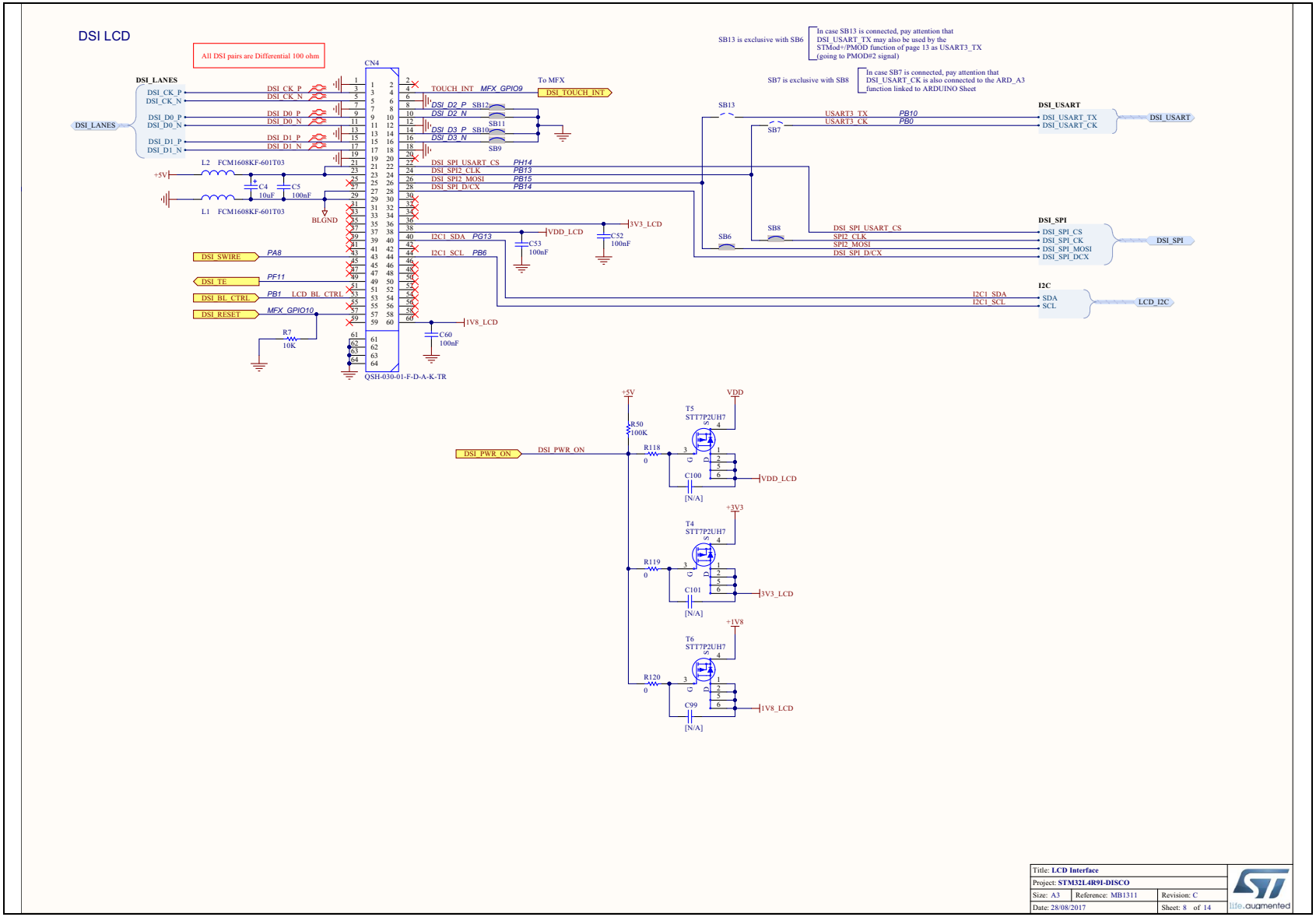


Figure 28. 32L4R9IDISCOVERY IDD measurement and Multi Function eXpander

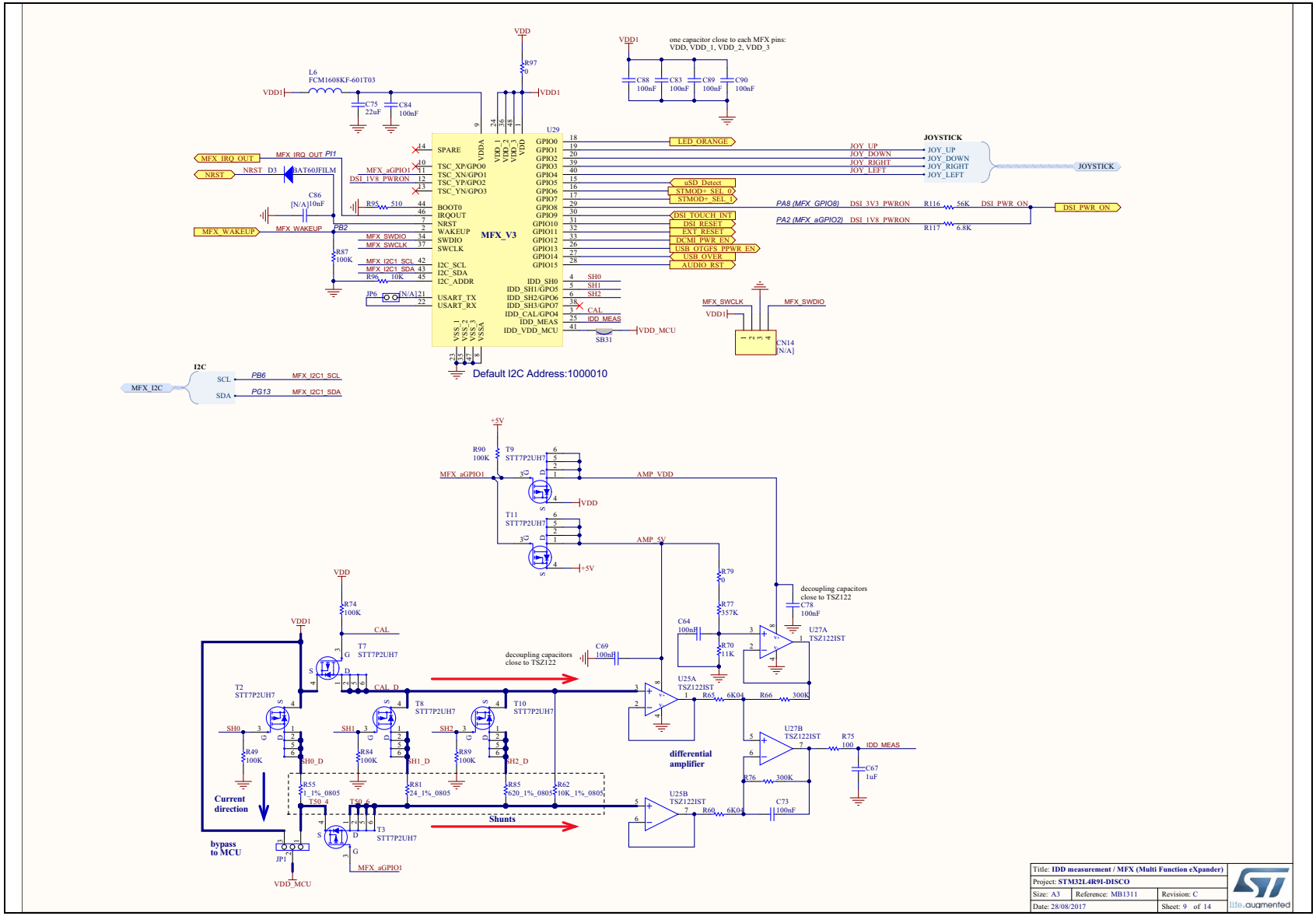


Figure 29. 32L4R9IDISCOVERY microcontroller

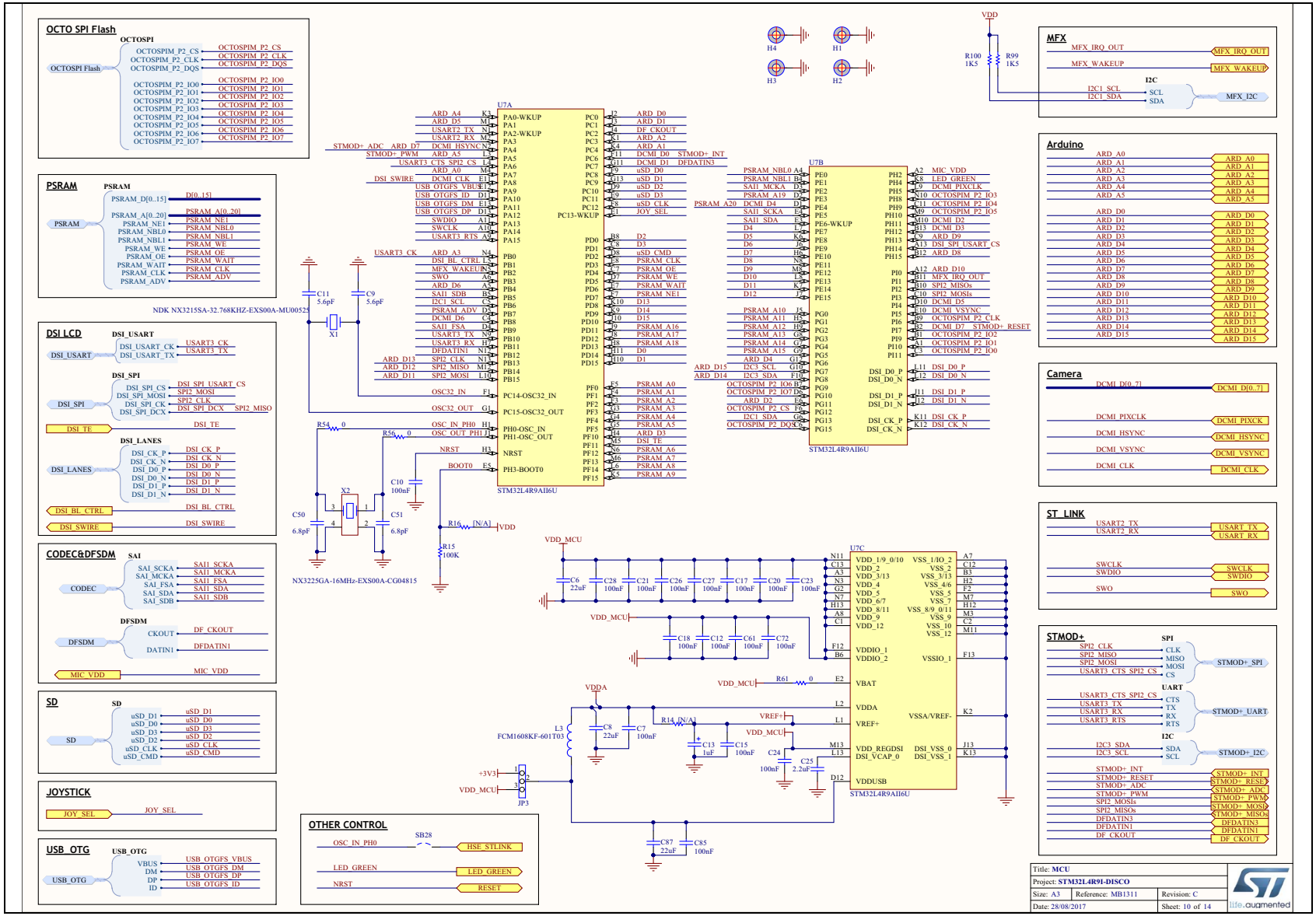


Figure 30. 32L4R9IDISCOVERY PSRAM

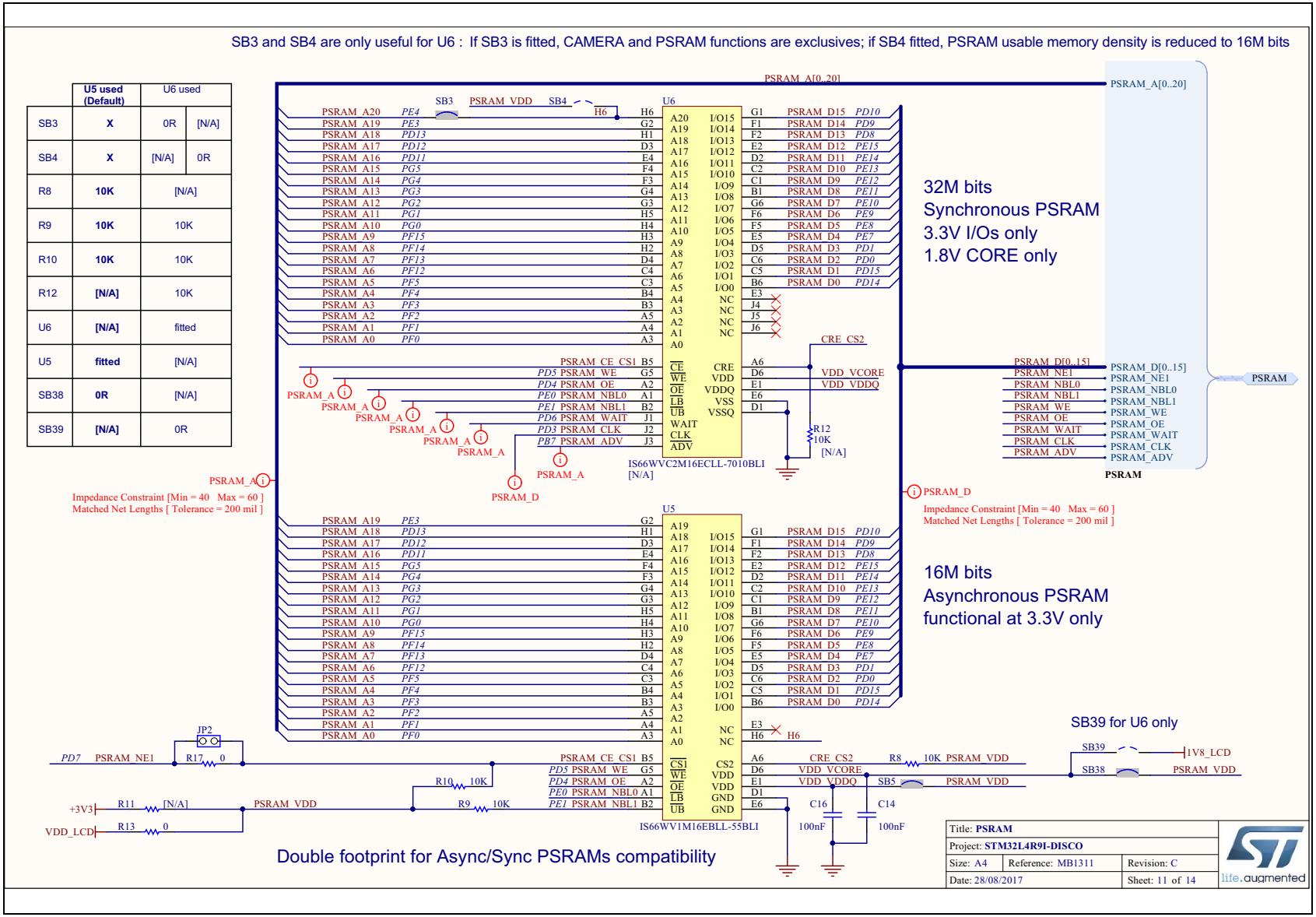


Figure 31. 32L4R9IDISCOVERY camera

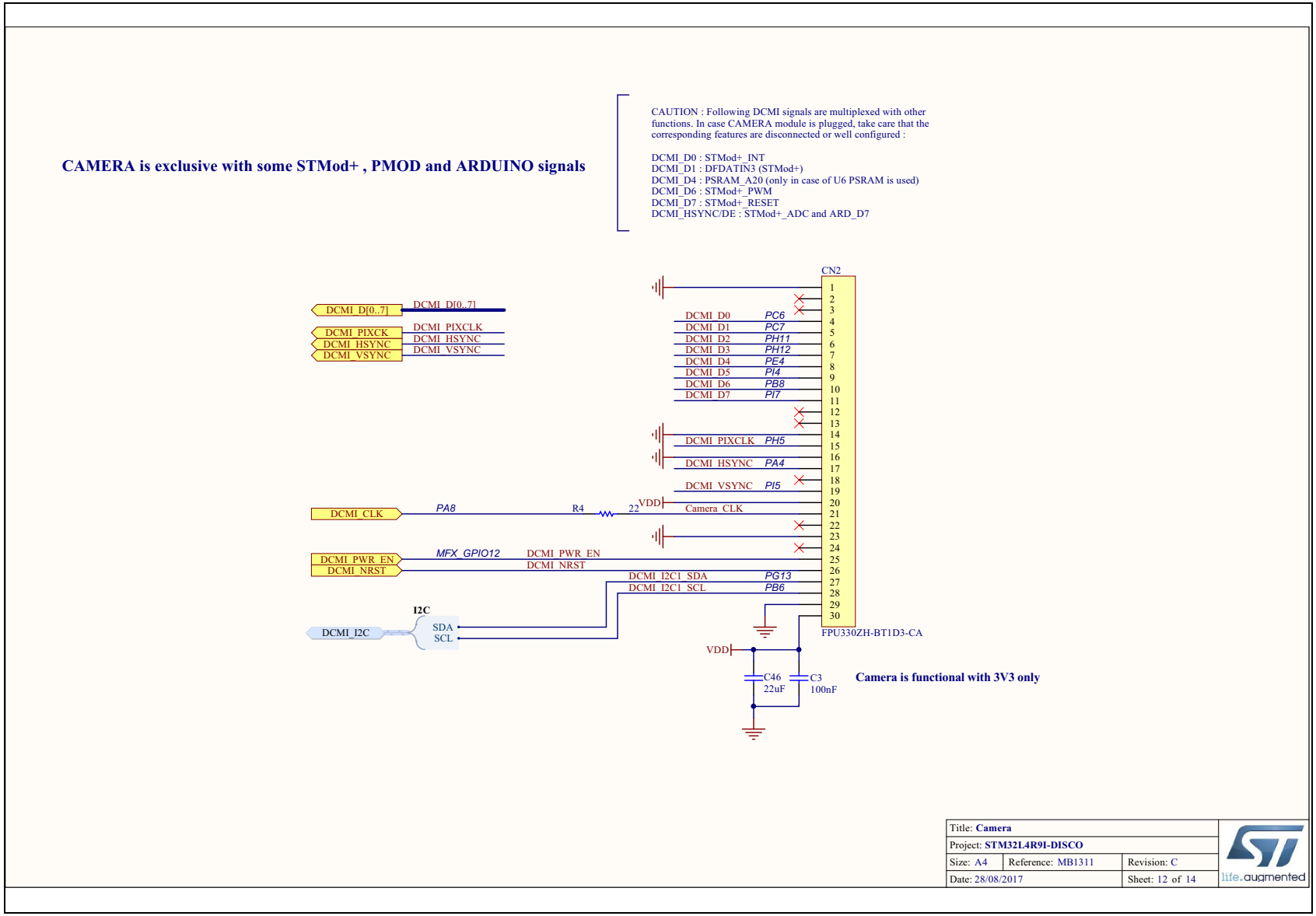
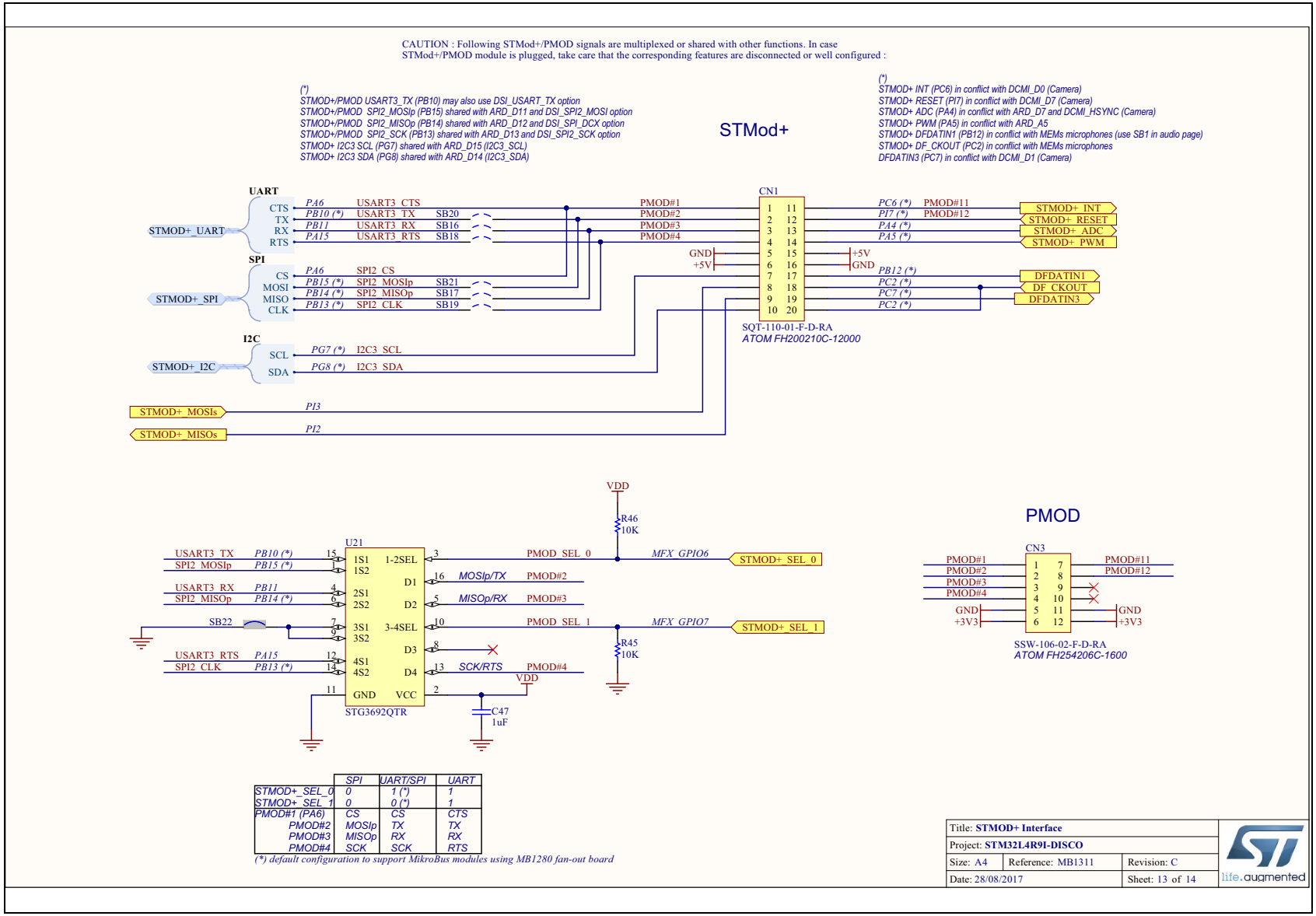


Figure 32. 32L4R9IDISCOVERY STMOD+ interface



	SPI	UART/SPI	UART
STMOD+_SEL_0	0	1 (*)	1
STMOD+_SEL_1	0	0 (*)	1
PMOD#1 (PA6)	CS	CS	CTS
PMOD#2	MOSIp	TX	TX
PMOD#3	MISOp	RX	RX
PMOD#4	SCK	SCK	RTS

Figure 33. 32L4R9IDISCOVERY Audio and DFSDM

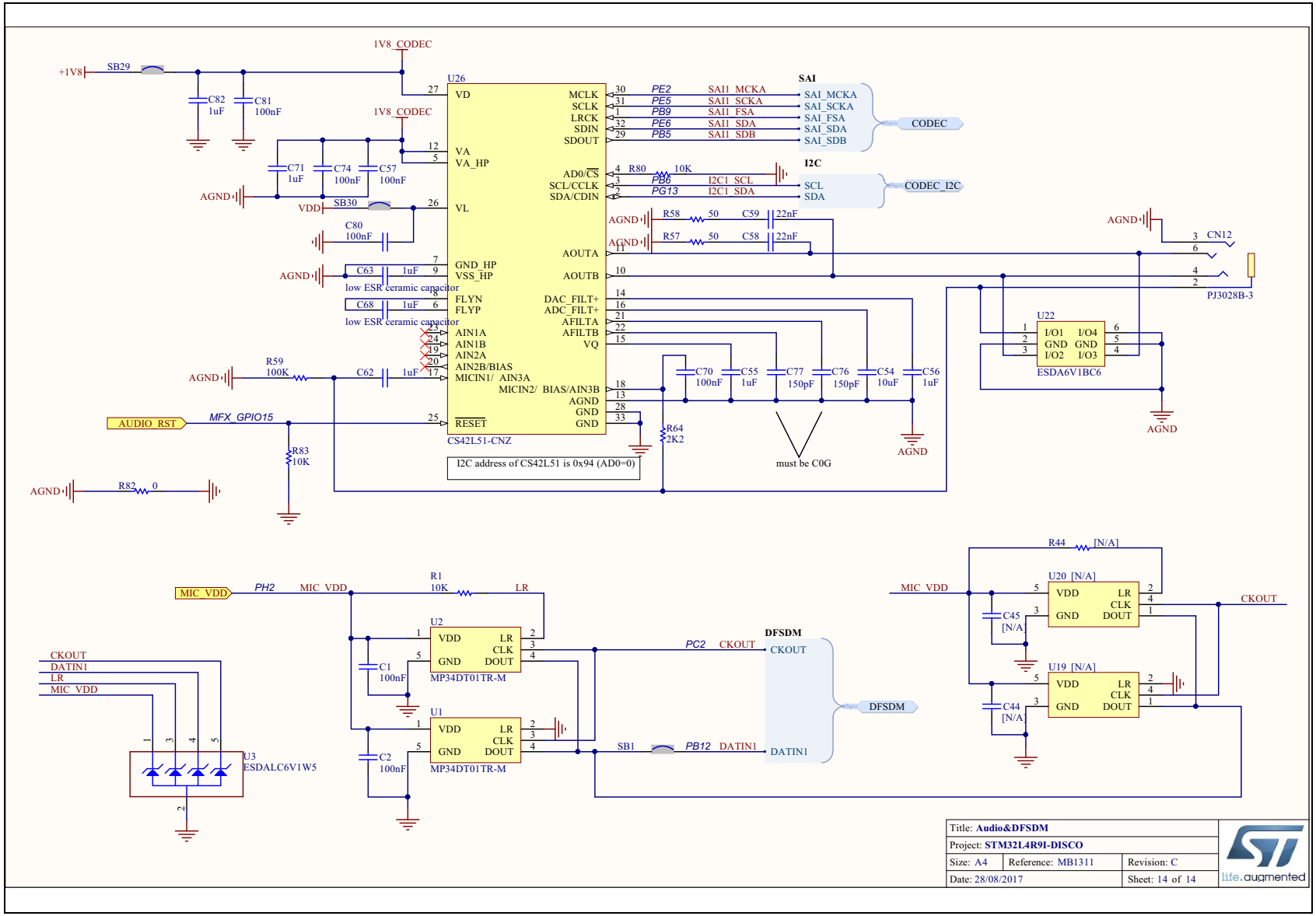


Figure 34. Round DSI display board (MB1314)

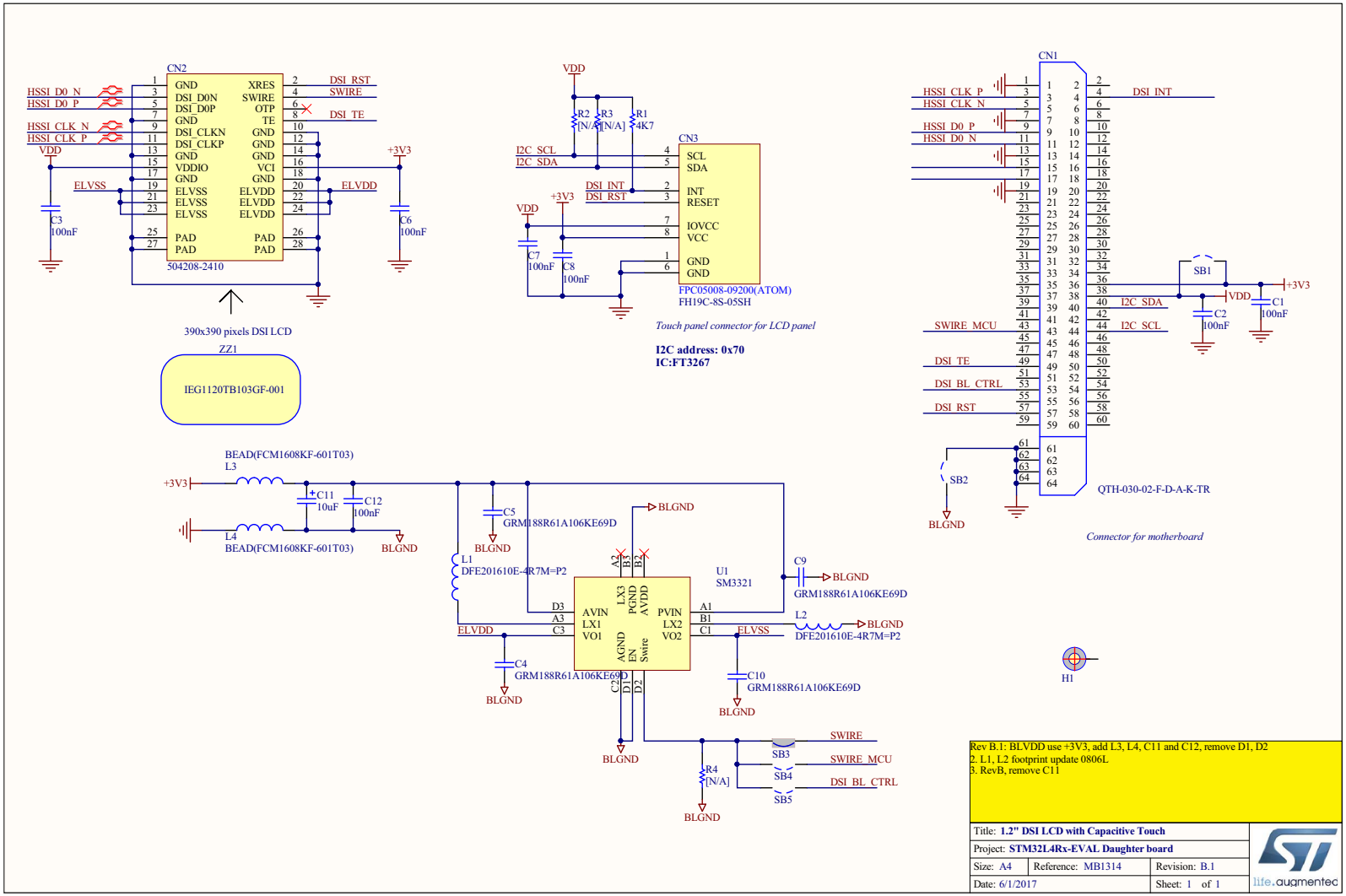
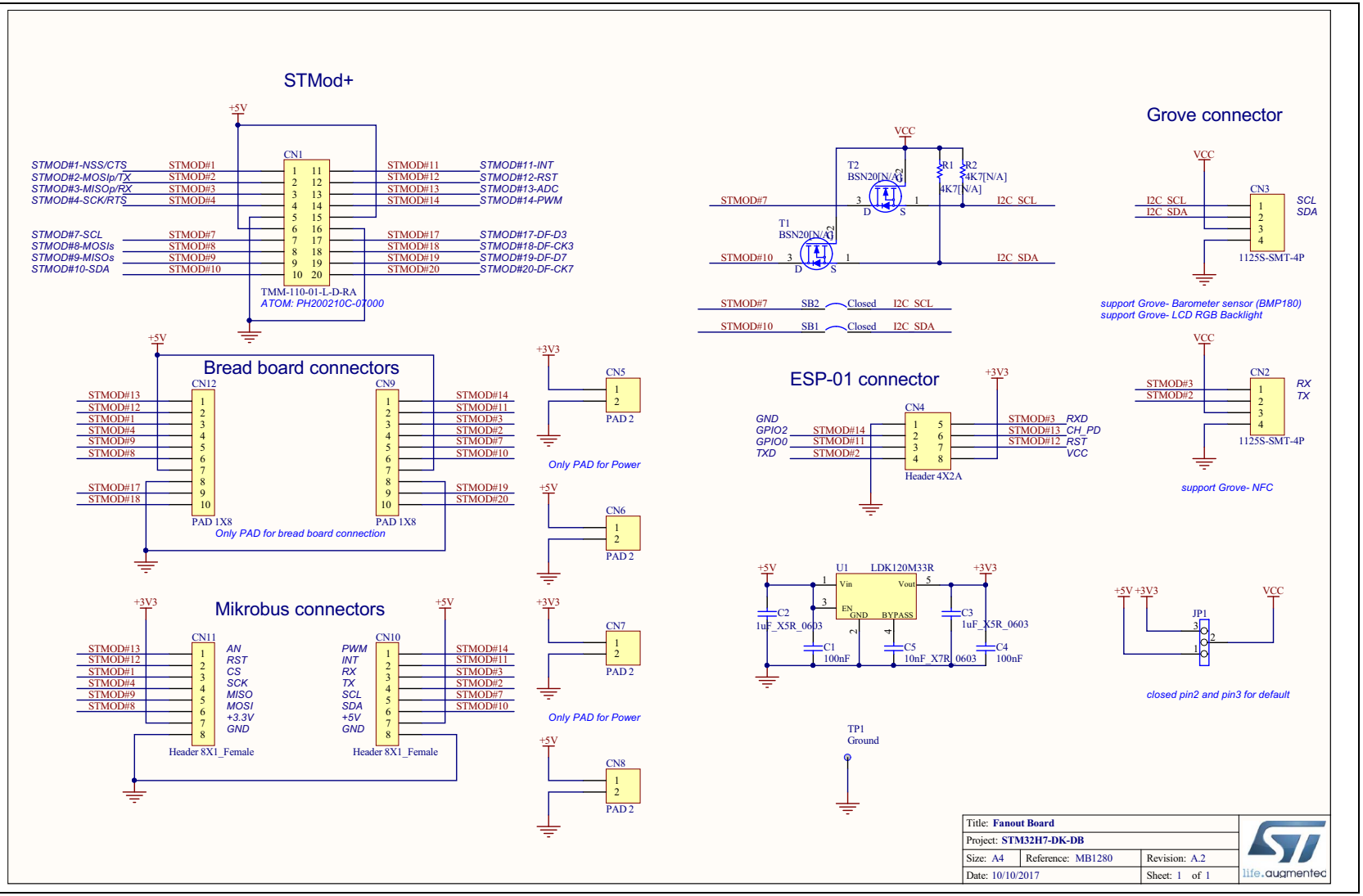


Figure 35. Fanout board (MB1280)



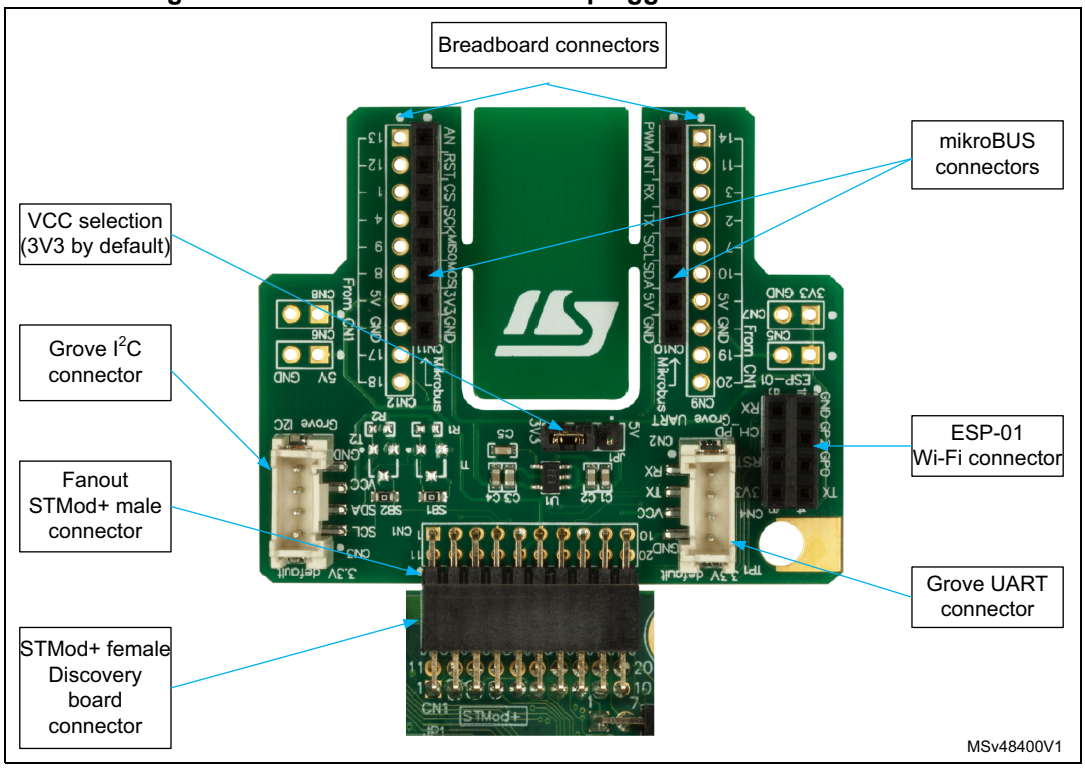
Appendix E Fanout board (MB1280)

The Fanout board (see *Figure 36*) is included in the 32L4R9IDISCOVERY kit. It is connectible to STMod+ connector (CN1) and it provides access to:

- MikroElektronika Click board compatible connectors (CN10 and CN11: two 1x8-pin female connectors)
- ESP-01 compatible connector (CN4: 2x4-pin female connector)
- Seeed Studio™ Grove compatible connectors (CN3 and CN2: two 1x4-pin male connectors)
- Reserved standard 2.54 mm pitch of STMod+ pin header for breadboard.

The main active component for this Fanout board is the 3.3 V regulator U1 (200 mA).

Figure 36. STMod+ Fanout module plugged into CN1 connector



E.1 MikroElektronika mikroBUS™ compatible connector (Fanout CN10 / CN11)

The mikroBUS compatible connector is 2.54 mm pitch with a pair of 1x8-pin female connectors. *Table 33* shows the definition of the pins.

Table 33. Description of the mikroBUS connectors (CN11 and CN10)(1)

STMod+ connector CN11 number	Function of mikroBUS	Pin number	Pin number	Function of mikroBUS	STMod+ connector CN10 number
STMod+#13-ADC	AN	1	1	PWM	STMod+#14-PWM
STMod+#12-RST	RST	2	2	INT	STMod+#11-INT
STMod+#1-CS	CS	3	3	RX	STMod+#3-RX
STMod+#4-SCK	SCK	4	4	TX	STMod+#2-TX
STMod+#9-MISOs	MISO	5	5	SCL	STMod+#7-SCL
STMod+#8-MOSIs	MOSI	6	6	SDA	STMod+#10-SDA
-	+3.3 V	7	7	+5 V	STMod+#6#15 +5V
STMod+#5#16 GND	GND	8	8	GND	STMod+#5#16 GND

1. Please refer to Appendix C to check STMod+ pin sharing with other functions of the 32L4R9IDISCOVERY

The mikroBUS pinout assignment is available at the: http://mikroe.com website.

E.2 ESP-01 Wi-Fi® board compatible connector

The ESP-01 Wi-Fi board connector is 2.54 mm pitch with 2x4-pin female connectors. *Table 34* shows the definition of the pins.

Table 34. Description of the ESP-01 Wi-Fi board connector pins(1)

STMod+ connector number	Function of ESP-01	Pin number	Pin number	Function of ESP-01	STMod+ connector number
STMod+#5#16 GND	GND	1	8	TXD	STMod+#3-RX
STMod+#14	GPIO2	2	7	CH_PD	STMod+#13
STMod+#11	GPIO0	3	6	RST	STMod+#12-RST
STMod+#2-TX	RXD	4	5	VCC	-

1. Please refer to Appendix C to check STMod+ pin sharing with other functions of the 32L4R9IDISCOVERY.

E.3 Compatible connectors for the Grove boards

The two connectors of the Grove board are 2.54 pitch with 1x4-pin male connectors, the part number is 1125S-SMT-4P.

E.3.1 Compatible connector for I2C Grove boards (Fanout CN3)

The CN3 connector is compatible with Grove- Barometer sensor (BMP180) and Grove-LCD RGB Backlight boards using cable for connection. *Table 35* shows the definition of the pins.

Table 35. Description of the I2C Grove board connector pins (CN3)(1)

STMod+ connector NO.	Function of Grove CN3	Pin number
STMod+#7-SCL	SCL	1
STMod+#10-SDA	SDA	2
STMod+#6#15 +5 V	VCC	3
STMod+#5#16 GND	GND	4

1. Please refer to Appendix C to check STMod+ pin sharing with other functions of the 32L4R9IDISCOVERY.

E.3.2 Compatible connector for UART Grove boards (Fanout CN2)

The CN2 connector is compatible with Grove-NFC boards using cable for connection. *Table 36* shows the definition of the pins.

Table 36. Description of the UART Grove board connector pins (CN2)(1)

STMod+ connector	Function of Grove CN2	Pin number
STMod+#3-RX	RX (Grove TX)	1
STMod+#2-TX	TX (Grove RX)	2
STMod+#6#15 +5 V	VCC	3
STMod+#5#16 GND	GND	4

1. Please refer to Appendix C to check STMod+ pin sharing with other functions of the 32L4R9IDISCOVERY.

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

This kit is designed to allow:

1. Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and
2. Software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of 47 CFR, Chapter I (“FCC Rules”), the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

Revision history

Table 37. Document revision history

Date	Revision	Changes
17-Oct-2017	1	Initial version
26-Oct-2017	2	Updated: *Chapter 10.6.1*: clarification on SW1 use *Table 4*: pin name ARD-5V *Table 5*: JP4 CHGR position description *Table 28*: Unused functions *Table 30*: Reserved solder bridges
4-Jan-2018	3	Updated: *Figure 4*: JP1 description *Section 8*: bootloader limitation *Section 10.5* and *Table 3*: SW1 *Section 10.6.1* and *Table 4*: ARD and JP1 *Section 10.9*: boot configuration *Table 12*, *Table 27*, *Table 28* *Appendix F* Added: *Section 10.13.2* and *Section 11.3*: limitation Removed: *Appendix G*