

Discovery kit for IoT node, multi-channel communication with STM32L4

Introduction

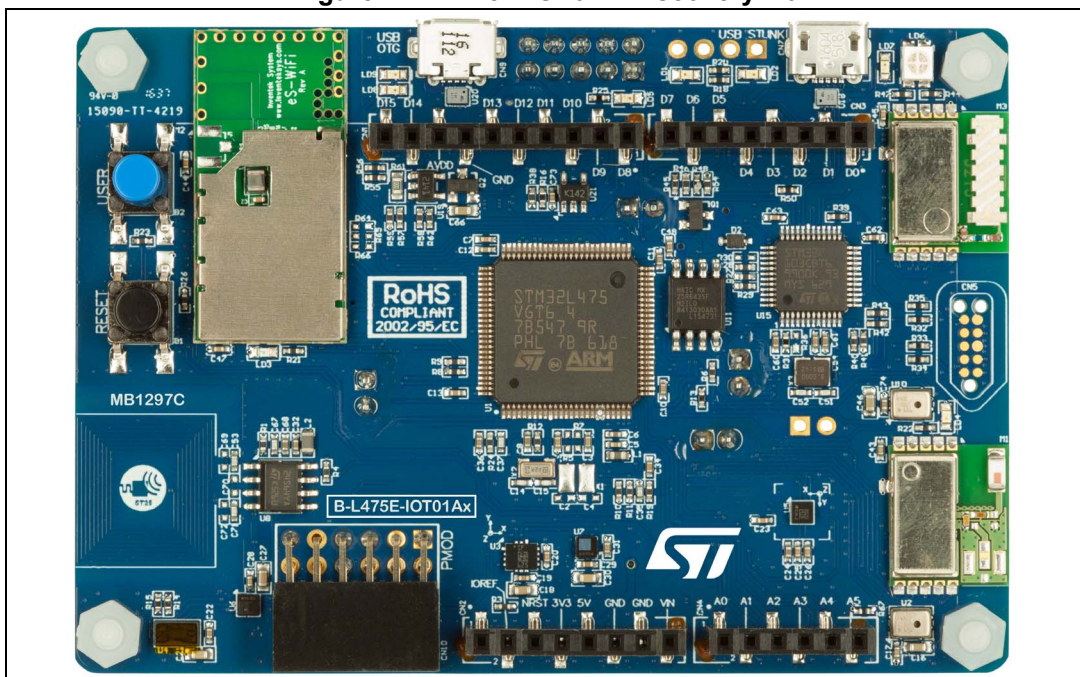
The STM32L4 Discovery kit for the IoT node (B-L475E-IOT01A) allows users to develop applications with direct connection to cloud servers.

The STM32L4 Discovery kit enables a wide diversity of applications by exploiting low-power multilink communication (BLE, Sub-GHz), multiway sensing (detection, environmental awareness) and ARM® Cortex®-M4 core-based STM32L4 Series features.

Arduino™ Uno V3 and PMOD connectivity provide unlimited expansion capabilities with a large choice of specialized add-on boards.

The STM32L4 Discovery kit includes an ST-LINK debugger/programmer and comes with the comprehensive STM32Cube software libraries together with packaged software examples to seamlessly connect to cloud servers. In addition a direct access to the ARM® mbed Enabled™ on-line resources at <http://mbed.org> is available.

Figure 1. B-L475E-IOT01A Discovery kit



1. Picture is not contractual.



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1 Features

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex®-M4 core with 1 Mbyte of Flash memory and 128 Kbytes of SRAM, in LQFP100 package
- 64-Mbit Quad-SPI (Macronix) Flash memory
- Bluetooth® V4.1 module (SPBTLE-RF)
- Sub-GHz (868 or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915)
- Wi-Fi® module Inventek ISM43362-M3G-L44 (802.11 b/g/n compliant)
- Dynamic NFC tag based on M24SR with its printed NFC antenna
- 2 digital omnidirectional microphones (MP34DT01)
- Capacitive digital sensor for relative humidity and temperature (HTS221)
- High-performance 3-axis magnetometer (LIS3MDL)
- 3D accelerometer and 3D gyroscope (LSM6DSL)
- 260-1260 hPa absolute digital output barometer (LPS22HB)
- Time-of-Flight and gesture-detection sensor (VL53L0X)
- 2 push-buttons (user and reset)
- USB OTG FS with Micro-AB connector
- Board expansion connectors:
 - Arduino™ Uno V3
 - PMOD
- 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 including a variety of examples, as part of the STM32Cube package, as well as a cloud connector software expansion, enabling direct access to cloud servers
- Support of wide choice of Integrated Development Environments (IDEs) including IAR™, Keil®, GCC-based IDEs, ARM® mbed Enabled™
- ARM® mbed Enabled™ (see <http://mbed.org>)

2 Product marking

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

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

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

3 System requirements

- Windows® OS (XP, 7, 8 and 10), Linux® 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
- ARM® mbed Enabled™ online

5 Demonstration software

The demonstration software, included in the STM32Cube package, 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 can be downloaded from the www.st.com/stm32app-discovery webpage.

a. On Windows® only.

6 Ordering information

To order the B-L475E-IOT01A Discovery kit for IoT node, depending on the frequency of the Sub-GHz module, refer to [Table 1](#).

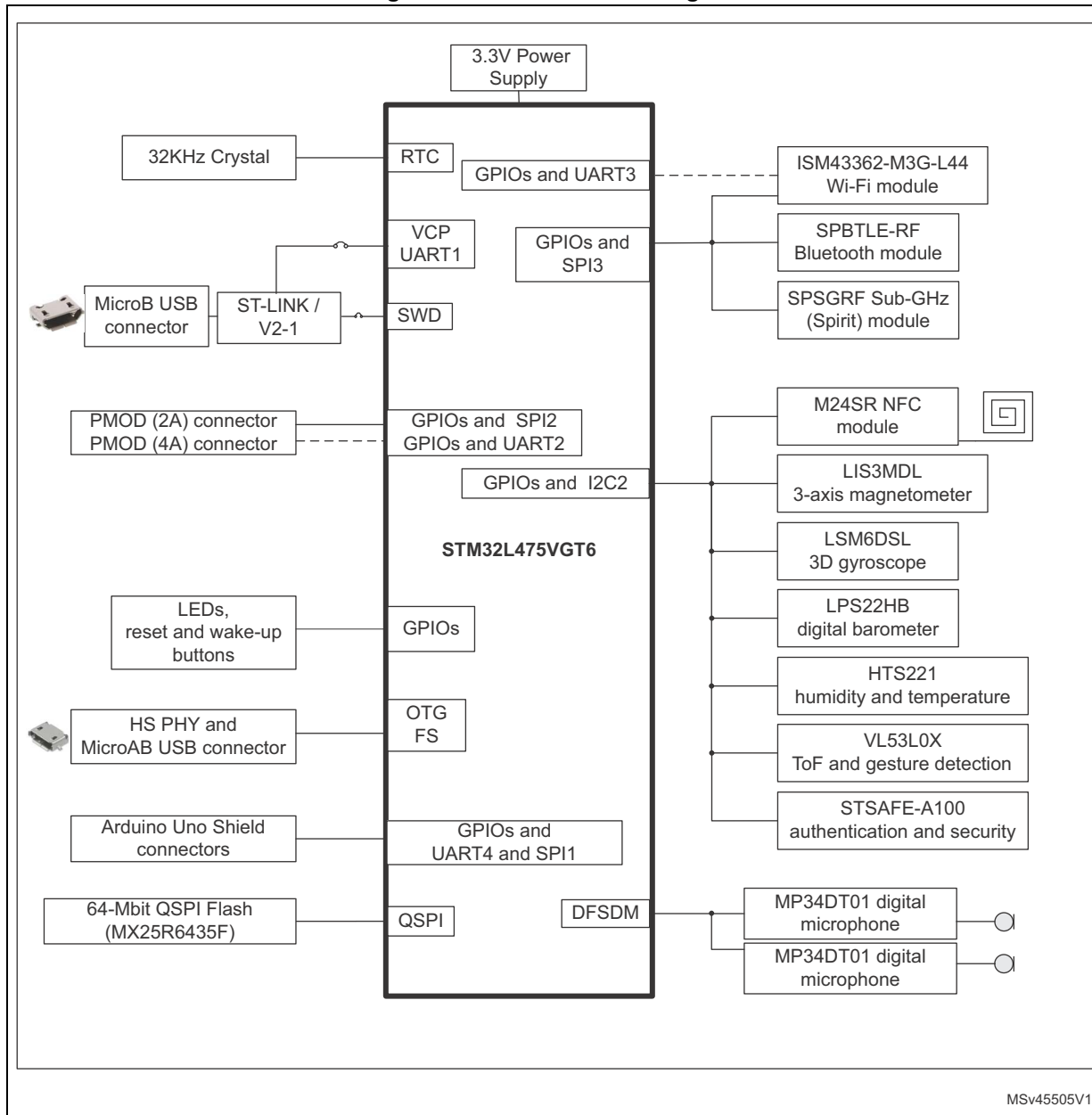
Table 1. Ordering information

Order code	Sub-GHz operating frequency
B-L475E-IOT01A1	915 MHz
B-L475E-IOT01A2	868 MHz

7 Hardware layout and configuration

The STM32L4 Discovery kit for IoT node is designed around the STM32L475VGT6 (100-pin, LQFP package). The hardware block diagram (see [Figure 2](#)) illustrates the connection between the STM32 and peripherals (embedded ST-LINK, Arduino Uno V3 shields, PMOD connector, Quad-SPI Flash memory, USB OTG connectors, digital microphones, various ST-MEMS sensors and the four RF modules (Wi-Fi, Bluetooth, Sub-GHz and NFC)). [Figure 4](#) and [Figure 5](#) help users to locate these features on the STM32L4 Discovery kit.

Figure 2. Hardware block diagram





7.1 STM32L4 Discovery kit for IoT node layout

Figure 3. STM32L4 Discovery kit for IoT node (top view)

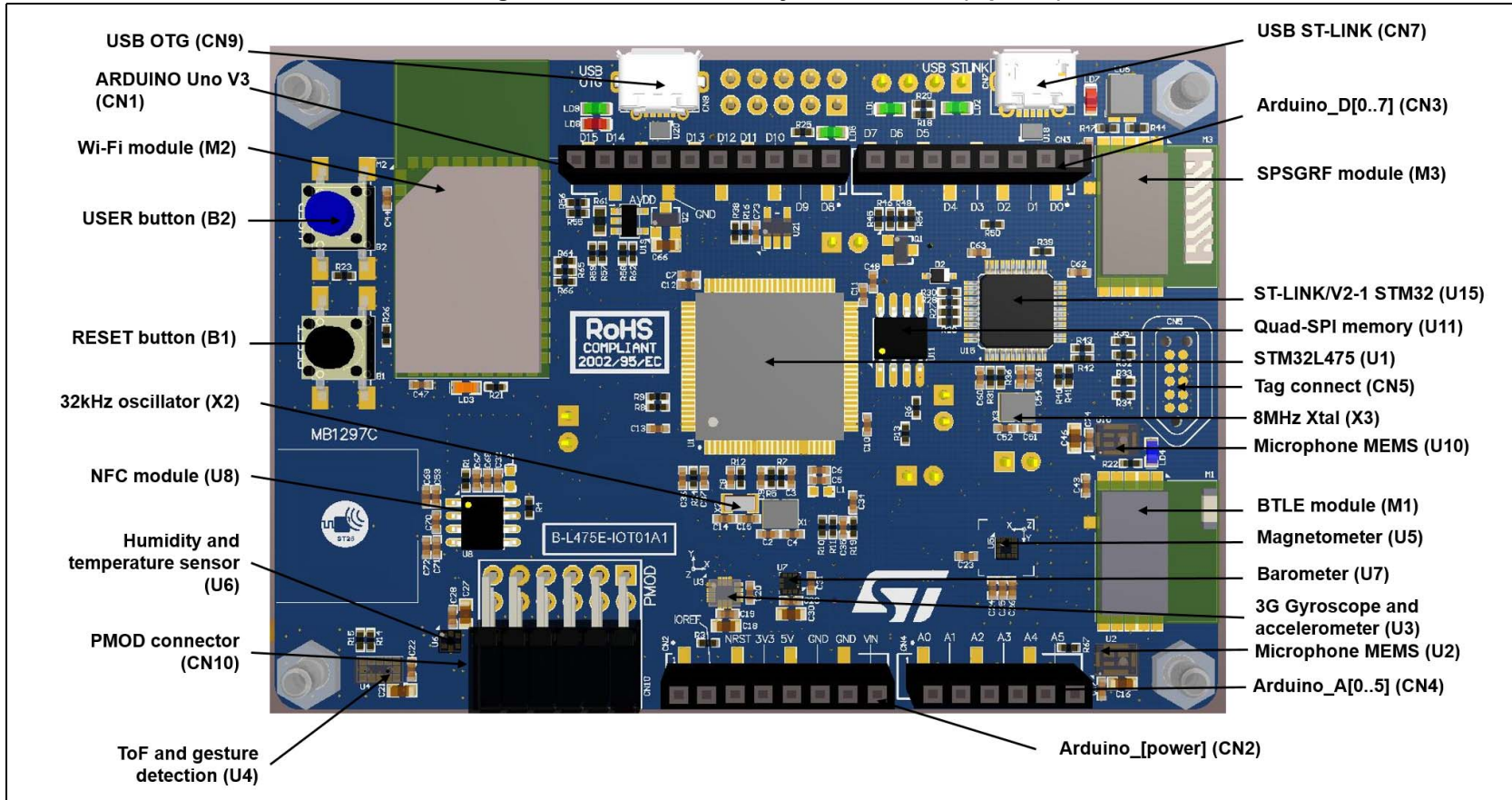
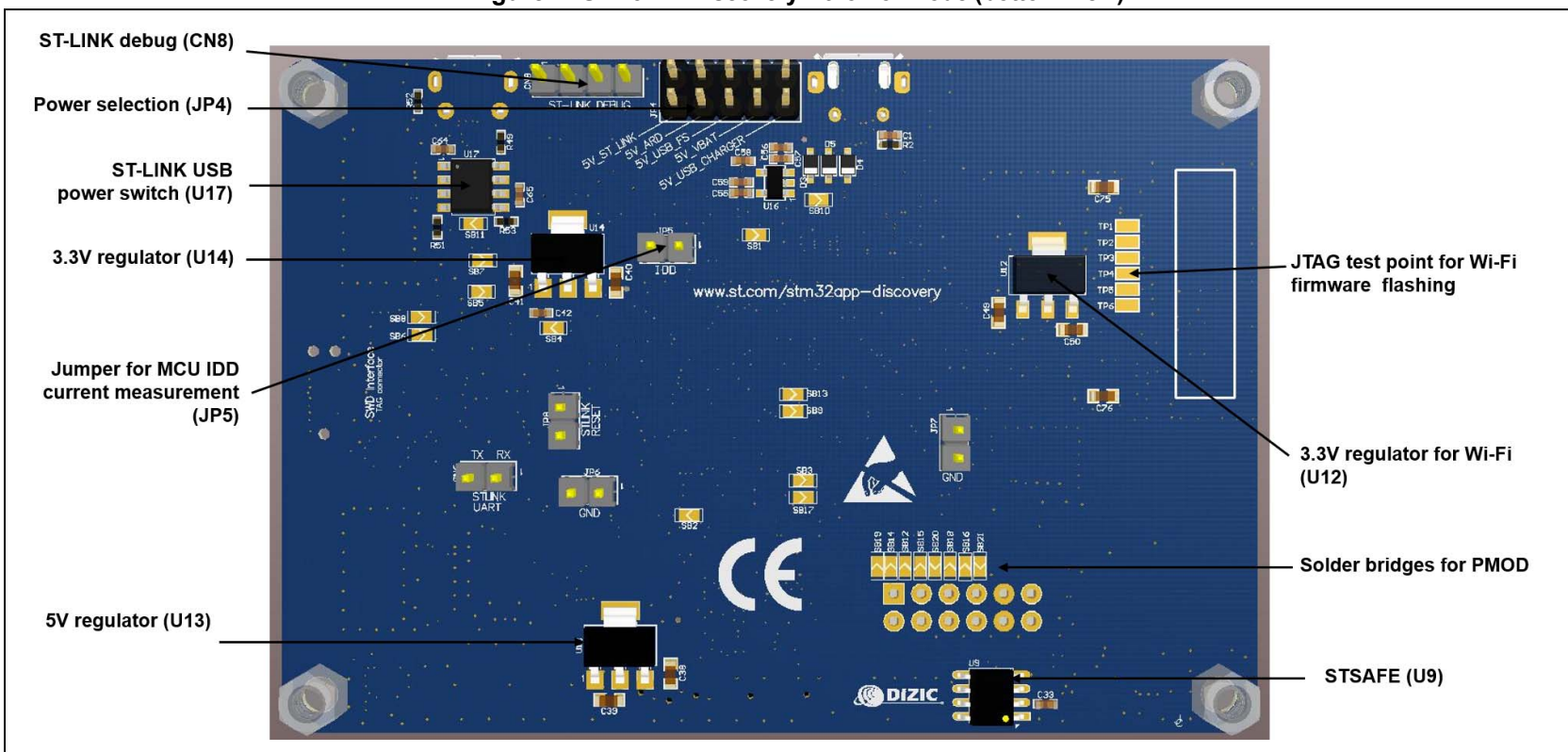
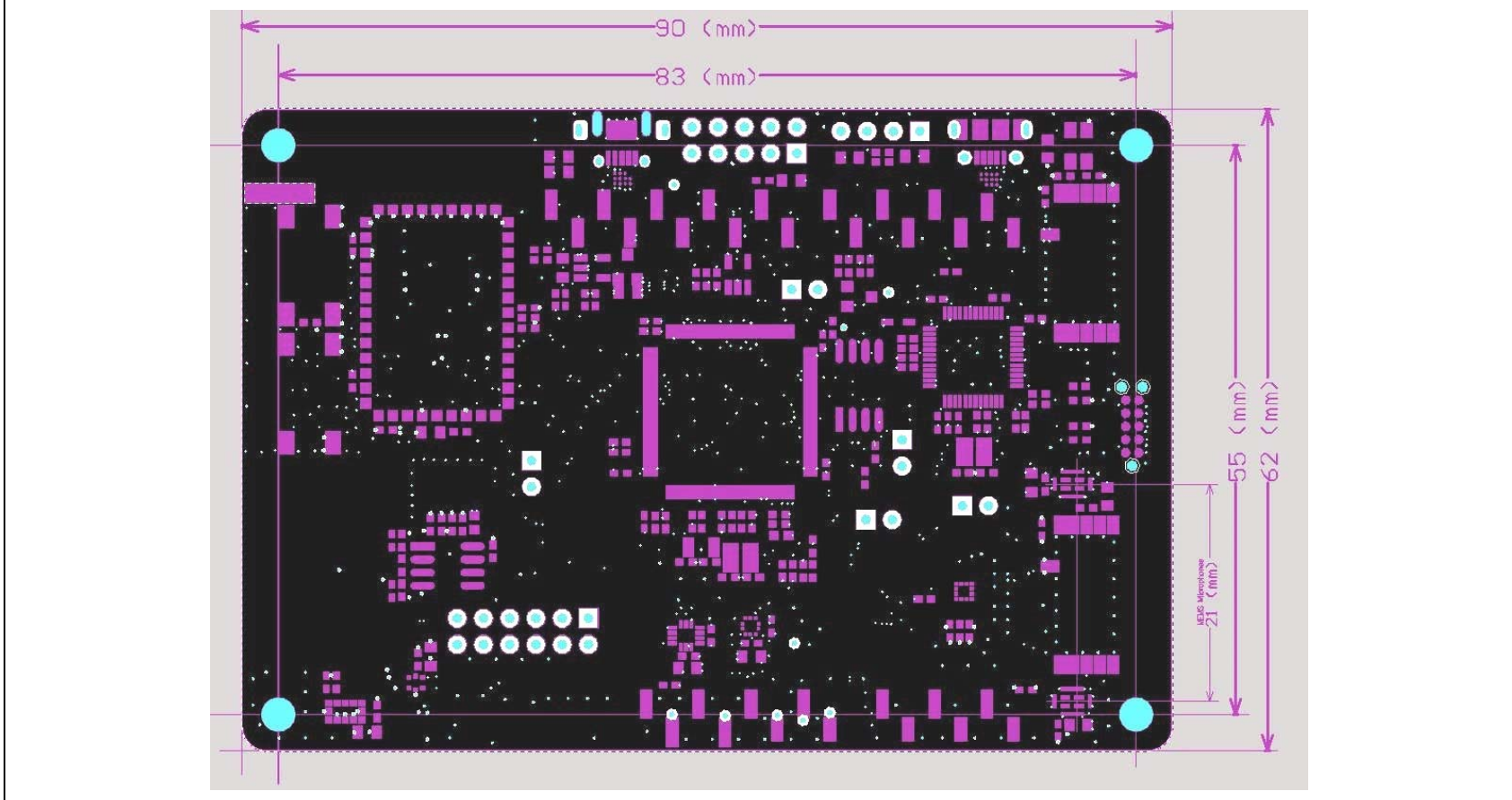


Figure 4. STM32L4 Discovery kit for IoT node (bottom view)



7.2 STM32L4 Discovery kit for IoT node mechanical drawing

Figure 5. STM32L4 Discovery kit for IoT node mechanical drawing



1. Plastic Spacer Height = 14mm, Overall Height = 26mm +/- 1mm.

7.3 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated on the STM32L4 Discovery kit for IoT node. Compared to the ST-LINK/V2 the changes are listed below.

The new features supported on the 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 100 mA power on USB

The following features are no more supported on the 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 versions, refer to *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32 User manual (UM1075)* at the www.st.com website.

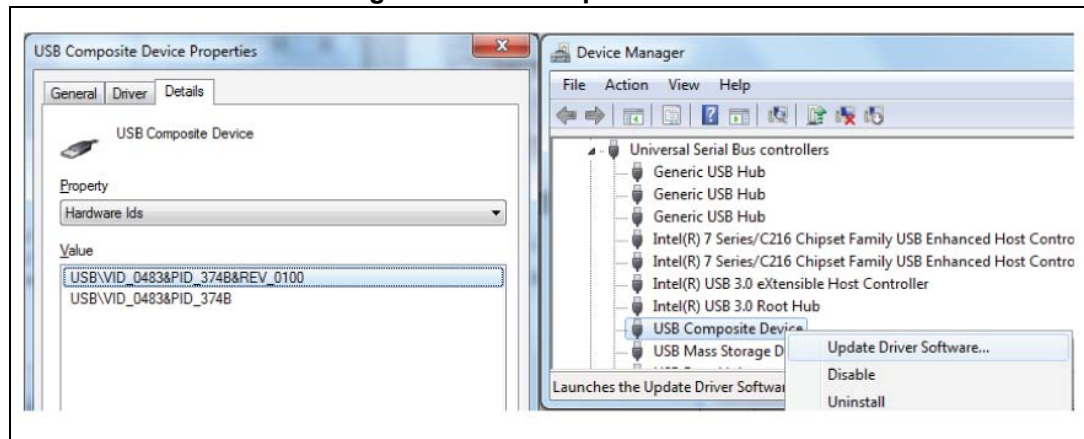
7.3.1 Drivers

Before connecting STM32L475VG to a Windows® PC (XP, 7, 8 or 10) via USB, a driver for the ST-LINK/V2-1 must be installed. It is available at the www.st.com website.

In case the STM32L4 Discovery kit for IoT node is connected to the PC before the driver is installed, some STM32L4 Discovery kit 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 (see *Figure 6*).

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

Figure 6. USB composite device



7.3.2 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 lifetime of the ST-LINK/V2-1 product (for example new functionalities, bug fixes, support for new microcontroller families), it is recommended to visit the www.st.com website, before starting to use the STM32L4 Discovery kit for IoT node and periodically, to stay up-to-date with the latest firmware version.

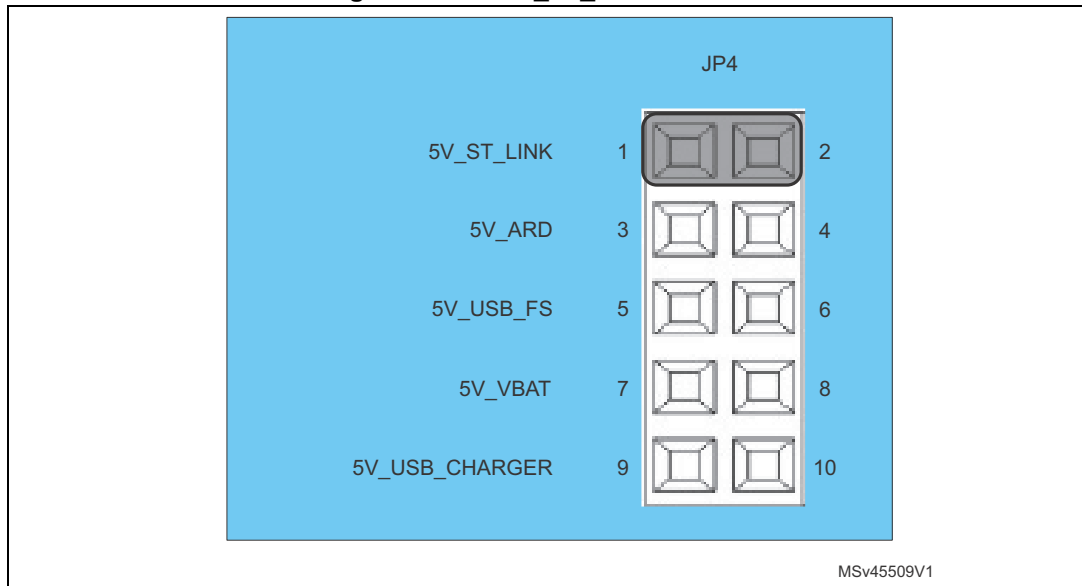
7.4 Power supply

The STM32L4 Discovery kit for IoT node is designed to be powered by 5 V DC power supply. It is possible to configure the STM32L4 Discovery kit to use any of the following five sources for the power supply: 5V_ST_LINK, 5V_ARD, 5V_USB_FS, 5V_VBAT and 5V_USB_CHARGER.

In case of external 5 V DC power adapter, the STM32L4 Discovery kit 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.

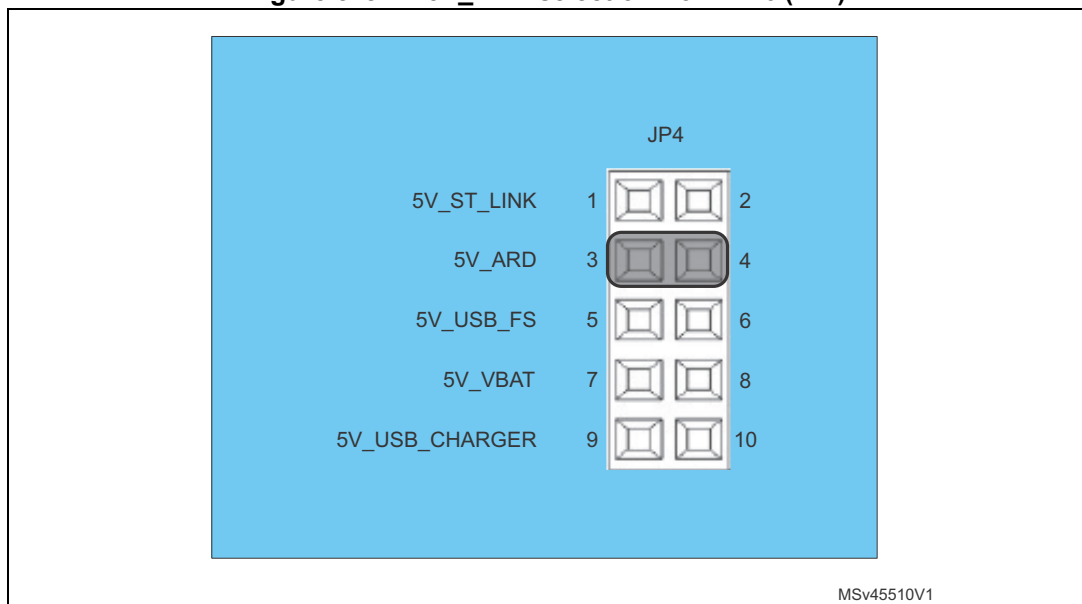
- **5V_ST_LINK** (See [Figure 7](#)) is a 5V DC power with limitation from CN7 (the USB type Micro-B connector of ST-LINK/V2-1). In this case, jumper of JP4 should be on pins 1 and 2 to select the 5V_ST_LINK power source on silkscreen of JP4. This is the default setting. If the USB enumeration succeeds, the 5V_ST_LINK power is enabled, by asserting the PWR_ENn signal (from STM32F103CBT6). This pin is connected to a power switch ST890, which powers the board. This power switch features also a current limitation to protect the PC in case of a short-circuit on board (more than 750 mA). STM32L4 Discovery kit for IoT node can be powered from the ST-LINK USB connector CN7, but only ST-LINK circuit has the power before USB enumeration, because the host PC only provides 100 mA to the board at that time. During the USB enumeration, STM32L4 Discovery kit for IoT node asks for the 500 mA power to the host PC. If the host is able to provide the required power, the enumeration finishes by a "SetConfiguration" command and then, the power transistor ST890 is switched ON, the red LED LD7 is turned ON, thus the STM32L4 Discovery kit for IoT node consumes up to 500 mA current, but no more. If the host is not able to provide the requested current, the enumeration fails. Therefore the ST890 remains OFF and the MCU part including the extension board is not powered. As a consequence the red LED LD7 remains turned OFF. In this case it is mandatory to use an external power supply.

Figure 7. JP4: 5V_ST_LINK selection



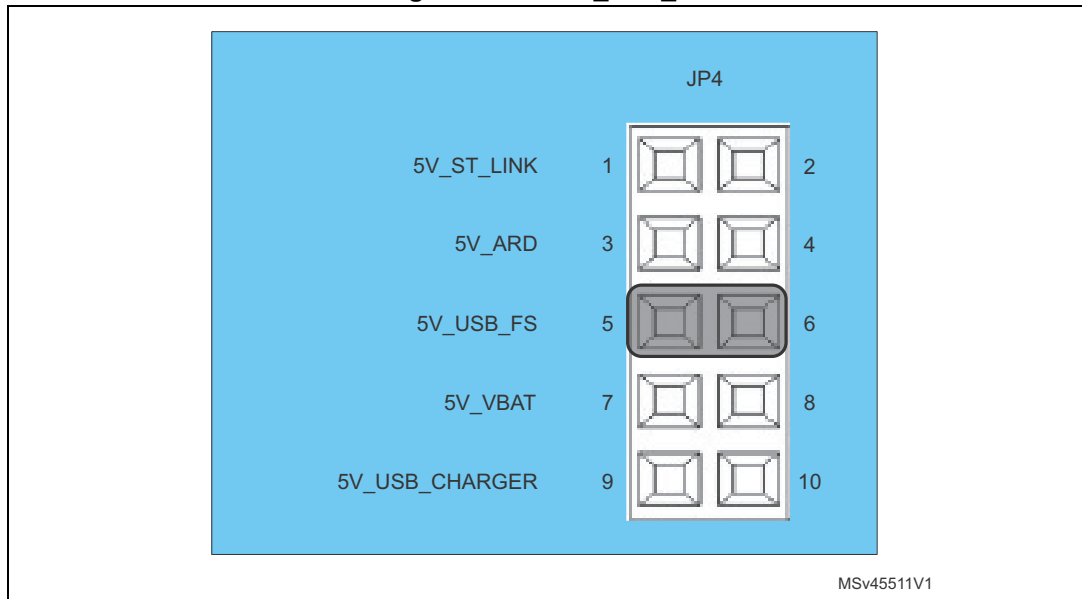
- 5V_ARD** (see [Figure 8](#)) is the 7 to 12 V DC power from Arduino CN2 pin 8 (named VIN on Arduino connector silkscreen). In this case, jumper of JP4 should be on pins 3 and 4 to select the 5V_ARD power source on silkscreen of JP4. In that case, the DC power comes from the power supply through the Arduino Uno V3 battery shield (compatible with Adafruit PowerBoost 500 Shield).

Figure 8. JP4: 5V_ARD selection from CN6 (VIN)



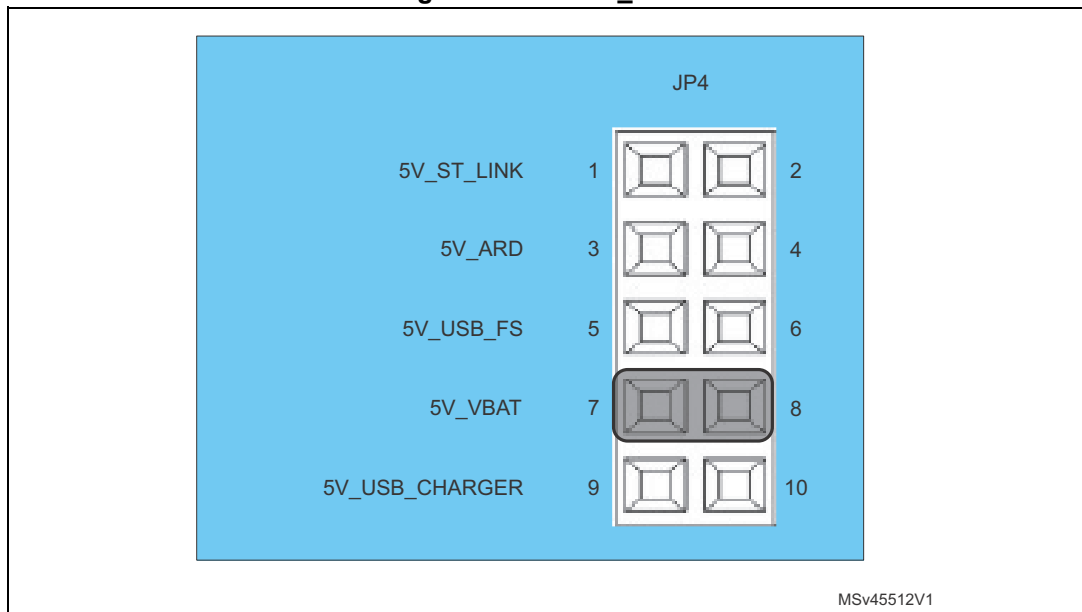
- 5V_USB_FS** (see [Figure 9](#)) is the DC power with 500 mA limitation from CN9, the USB OTG FS micro-AB connector. In this case, jumper of JP4 should be on pins 5 and 6 to select the 5V_USB_FS power source on silkscreen of JP4.

Figure 9. JP4: 5V_USB_FS



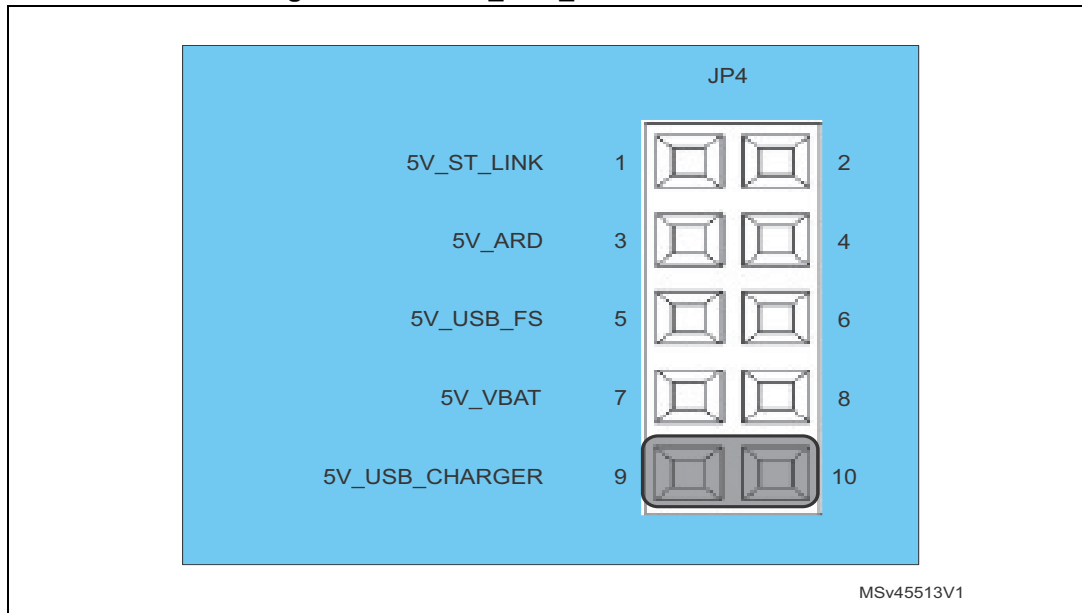
- **5V_VBAT** (see [Figure 10](#)) is the DC power coming from external. In this case, jumper of JP4 should be on pins 7 and 8 to select the 5V_VBAT power source on silkscreen of JP4.

Figure 10. JP4: 5V_VBAT



- **5V_USB_CHARGER** (see [Figure 11](#)) is the DC power charger connected to the USB ST-LINK (CN7). To select the 5V_USB_CHARGER power source on silkscreen of JP4, the jumper of JP4 should be on pins 9 and 10. In this case, if the STM32L4 Discovery kit for IoT node is powered by an external USB charger then the debug is not available. If the PC is connected instead of the charger, the limitation is no longer effective and the PC could be damaged.

Figure 11. JP4: 5V_USB_CHARGER selection



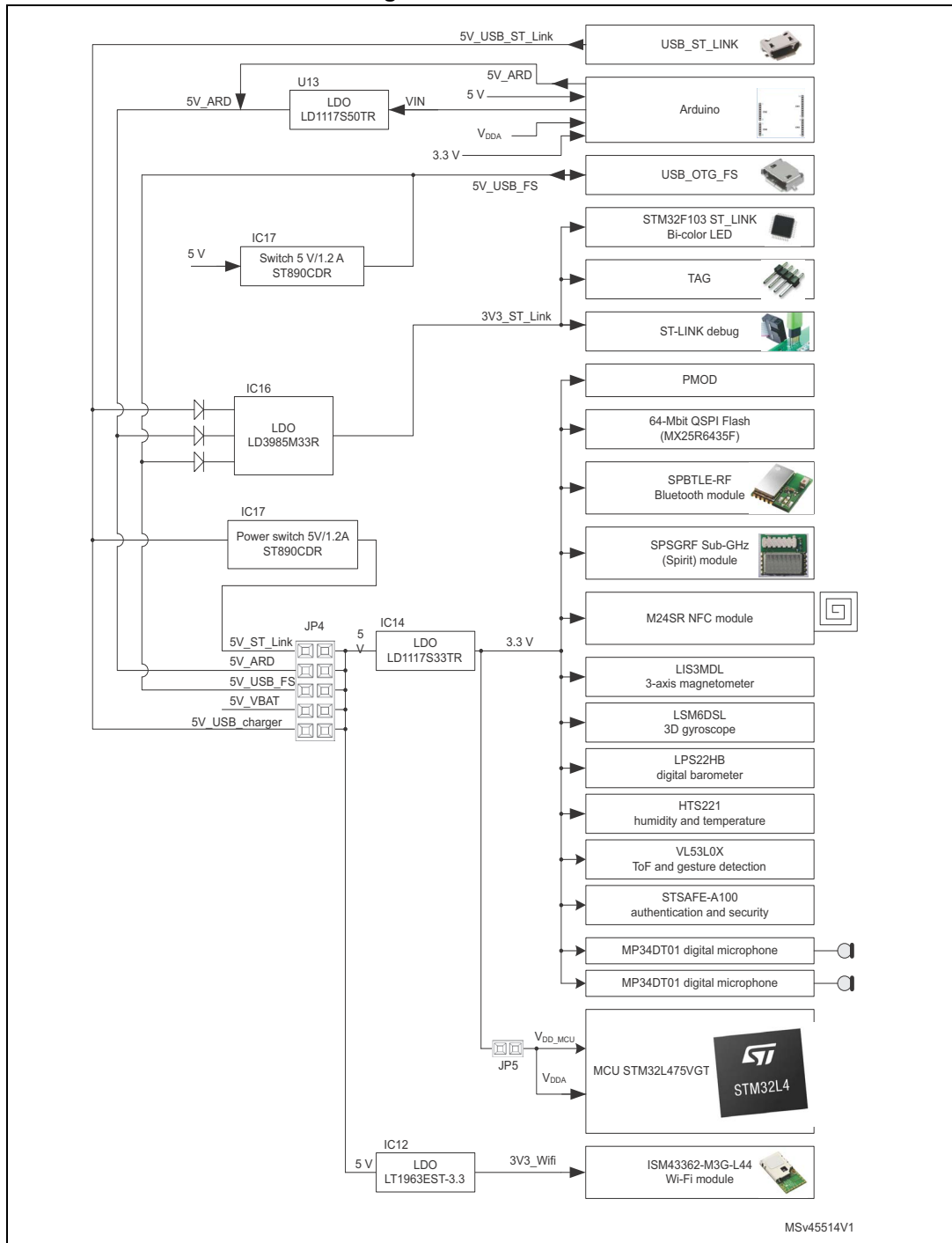
Note: *If the board is powered by a USB charger, there is no USB enumeration, so the led LD7 remains OFF permanently and the board is not powered. In this specific case only, the resistor R30 needs to be soldered, to allow the board to be powered anyway.*

Caution: Do not connect the PC to the ST-LINK (CN7) when R30 is soldered. The PC may be damaged or the board may not be powered correctly.

The green LED LD5 is lit when the STM32L4 Discovery kit for IoT node is powered by the 5 V correctly.

The power tree is showed in the [Figure 12](#).

Figure 12. Power tree



7.5 Programming/debugging when the power supply is not from ST-LINK (5V_ST_LINK)

It is mandatory to power the board first using CN2 (V_{IN}) or CN9 (USB_FS_OTG), then connecting the USB cable to the PC. Proceeding this way ensures that the enumeration succeeds thanks to the external power source.

The following power sequence procedure must be respected:

- Connect the jumper JP4 on (5V_ARD) or (5V_USB_FS)
- Connect the external power source to CN2 in case of an Arduino shield or to CN9 in case of USB FS host interface
- Check that the red LED LD5 is turned ON
- Connect the PC to USB connector CN7

If this sequence is not respected, the board may be powered by V_{BUS} first from ST-LINK, and the following risks may be encountered:

- If more than 500 mA current is needed by the board, the PC may be damaged or current can be 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 the PC cannot provide such current.

7.6 Clock sources

Three clock sources are described below:

- X1 which is the 8 MHz oscillator for STM32L475VG microcontroller. This clock is not implemented in a basis configuration.
- X2 which is the 32.768 KHz crystal for the STM32L475VG embedded RTC
- X3 which is the 8 MHz clock from ST-LINK MCU for the STM32L475VG microcontroller.

7.7 Reset sources

The reset signal of the STM32L4 Discovery kit is active low and the reset sources includes:

- A reset button B1
- An Arduino Uno V3 shield board from CN2
- An embedded ST-LINK/V2-1

7.8 USB OTG FS

The STM32L4 Discovery kit supports USB OTG FS communication via a USB Micro-AB connector (CN9).

To do this the following components must be added by the users:

- 8 MHz crystal (at X1 position); ref: NX3225GD-8.00M
- 8.2 pF capacitor (0402 size) at C2 position
- 8.2 pF capacitor (0402 size) at C4 position

- 0 ohm resistor (0402 size) at R5 position
- 0 ohm resistor (0402 size) at R7 position

The STM32L4 Discovery kit can be powered by the USB connectors at 5 V DC with 500 mA current limitation.

A USB power switch (IC19) is also connected on V_{BUS} and provides power to CN9. The green LED LD9 is lit when either:

- Power switch is ON and STM32L4 Discovery kit works as an USB host
- V_{BUS} is powered by another USB host when STM32L4 Discovery kit works as a USB device.

The red LED LD8 is lit when an over-current occurs.

7.9 Quad-SPI NOR Flash memory

64-Mbit Quad-SPI NOR Flash memory (N25Q128A13EF840F from MICRON) is connected to the Quad-SPI interface of the STM32L475VGT6.

7.10 Virtual COM port

The serial interface USART6 is directly available as a virtual COM port of the PC connected to the ST-LINK/V2-1 USB connector CN7. The virtual COM port settings are configured as: 115200 b/s, 8 bits data, no parity, 1 stop bit, no flow control.

7.11 RF modules

Four RF interfaces are available on the STM32L4 Discovery kit for IoT node board:

- Bluetooth (V4.1 compliant) SPBTLE-RF module
- Sub-GHz (868 or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915),
- Wi-Fi module Inventek ISM43362-M3G-L44 (802.11 b/g/n compliant)
- Dynamic NFC tag based on M24SR with its printed NFC antenna (double layer inductive antenna etched on the PCB).

7.11.1 Bluetooth (V4.1 compliant) SPBTLE-RF module

The ST SPBTLE-RF module (M1) is implemented on top side of the STM32L4 Discovery kit for IoT node board.

The SPBTLE-RF is an easy to use Bluetooth smart master/slave network processor module, compliant with Bluetooth V4.1. The SPBTLE-RF B-Smart module supports multiple roles simultaneously, and it can act at the same time as Bluetooth Smart sensor and hub device.

The entire Bluetooth Smart stack and protocol are embedded into the SPBTLE-RF B-Smart module. The external host application processor, where the application resides, is connected to the SPBTLE-RF B-Smart module through a standard SPI interface (SPI3 of STM32L475VGT6).

The SPBTLE-RF B-Smart module provides a complete RF platform in a tiny form factor (foot print of this module is 13.5 mm x 11.5 mm). Radio, antenna, high frequency and LPO

oscillators are integrated to offer a certified solution to optimize the time to market of the final applications.

Figure 13. SPBTLE-RF module



The main features of the ST SPBTLE-RF module are listed below.

- Bluetooth V4.1 compliant (supports master and slave modes, multiple roles supported simultaneously)
- Embedded Bluetooth low-energy protocol stack (GAP, GATT, SM, L2CAP, LL, RFPHY)
- Bluetooth low-energy profiles provided separately
- Bluetooth radio performance:
- Embedded ST BlueNRG-MS
- Tx power: +4 dBm
- Host interface: SPI, IRQ, and RESET. On-field stack upgrading available via SPI.
- Certification: CE qualified, FCC, IC modular approval certified, BQE qualified
- On-board chip antenna

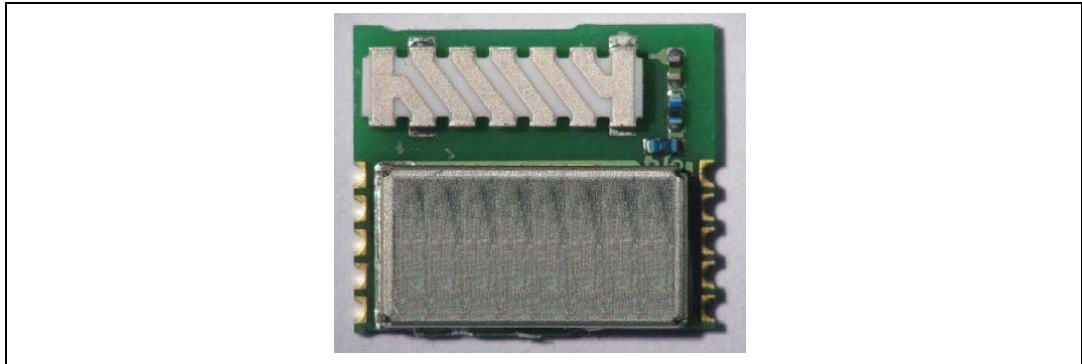
7.11.2 Sub-GHz low-power-programmable RF module (SPSGRF-868 or SPSGRF-915)

Two modules are available depending on the frequency of the Sub-GHz module (M3). The SPSGRF-868 and SPSGRF-915 are easy-to-use, low-power Sub-GHz modules based on the SPIRIT1 RF transceiver, operating respectively in the 868 MHz SRD and 915 MHz ISM bands.

The modules provide a complete RF platform in a tiny form factor (foot print of this module is 13.5 mm x 11.5 mm). The SPSGRF-915 is an FCC certified module (FCC ID: S9NSPSGRF) and IC certified (IC 8976CSPSGRF), while the SPSGRF-868 is certified CE0051.

The modules include four programmable I/O pins and an SPI serial interface (SPI3 of STM32L475VG).

Figure 14. SPSGRF module



The main features of the ST SPSGRF module are listed below.

- Programmable radio features:
 - Based on Sub-1GHz SPIRIT1 transceiver and integrated Balun (BALF-SPI-01D3)
 - Modulation schemes: 2-FSK, GFSK, MSK, GMSK, OOk and ASK
 - Air data rate from 1 to 500 kbps
 - On-board antenna
- Programmable RF output power up to +11.6 dBm
- Host interface: SPI
- General I/O (up to 32 programmable I/O functions on 4 GPIO programmable module pins)
- Two typical carrier frequency versions:
 - SPSGRF-868 with 868 MHz tuned antenna
 - SPSGRF-195 with 915 MHz tuned antenna

7.11.3 Wi-Fi module Inventek ISM43362-M3G-L44 (802.11 b/g/n)

The Inventek ISM43362-M3G-L44 module (M2) is implemented on top side of the STM32L4 Discovery kit for IoT node board. This module is an embedded (eS-WiFi) wireless Internet Connectivity device. The Wi-Fi module hardware consists of an ARM® Cortex® -M3 STM32 host processor, an integrated antenna (or optional external antenna) and a Broadcom Wi-Fi device. The module uses either a UART (UART3 of STM32L475VG) or an SPI (SPI3 of STM32L475VG) interface. As default, an SPI interface is used, as the corresponding firmware (for SPI capability) is downloaded on the Wi-Fi ISM43362-M3G-L44 module. The Wi-Fi module requires no operating system and has a completely integrated TCP/IP stack that only requires AT commands to establish connectivity for wireless product. The foot print of this module is 14.5 mm x 30 mm.

Figure 15. ISM43362-M3G-L44 module



The main features of the Inventek ISM43362-M3G-L44 module are:

- Based on the Broadcom BCM43362 MAC/Baseband/Radio device
- Supports Broadcom WICED SDK
- CPU ARM® Cortex®-M3 32-bit RISC core from ST Microelectronics
- IEEE 802.11n D7.0 -OFDM-72.2 Mbps -single stream w/20 MHz, Short GI
- IEEE 802.11g (OFDM 54 Mbps)
- IEEE 802.11b (DSSS 11 Mbps)
- IEEE 802.11i (Security)
 - WPA (Wi-Fi Protected Access) –PSK/TKIP
 - WPA2 (Wi-Fi Protected Access 2)- AES/CCMP/802.1x Authentication
- GPIO, 5 ADC (SPI interface utilizes ADC pins)
- Power-saving mode allows the design of low-power applications
- Lead Free Design which is compliant with ROHS requirements
- EMI/EMC Metal Shield for best RF performance in noisy environments and to accommodate for lower RF emissions/signature for easier FCC compliance.
- FCC/CE compliance certification

On both MB1297 rev C and MB1297 rev D, the firmware revision inside the Wi-Fi module must be: C3.5.2.3.BETA9. The Wi-Fi module maximum output power is limited to 9 dBm to fulfill FCC/IC/CE requirements. A Wi-Fi output power higher than 9 dBm at the Wi-Fi antenna is not allowed.

Note: Since Wi-Fi and BLE modules are using the same frequency ISM band (2.4 to 2.485 GHz), the simultaneous activity of both modules may affect the RF performances of Wi-Fi and/or BLE (in term of range or throughput).

7.11.4 Dynamic NFC Tag based on M24SR with its printed NFC antenna

M24SR64-Y belongs to the ST25 family which includes all STMicroelectronics NFC/RFID Tag and reader products. The M24SR64-Y device is a dynamic NFC/RFID Tag IC with a dual interface. It embeds an EEPROM memory. It can be operated from an I²C interface or by a 13.56 MHz RFID reader or by an NFC phone. The I²C interface uses a two-wire serial interface, consisting of a bidirectional data line and a clock line. It behaves as a slave in the I²C protocol.

The RF protocol is compatible with ISO/IEC 14443 Type A and NFC Forum Type 4 Tag.

The main features of the M24SR64-Y are:

- I²C interface (I2C2 of STM32L475VGT6). The two-wire I²C serial interface supports 1 MHz protocol.
- Contactless interface:
 - NFC Forum Type 4 Tag
 - ISO/IEC 14443 Type A
 - 106 Kbps data rate
 - Internal tuning capacitance: 25 pF
- Memory:
 - 8-Kbyte (64-kbit) EEPROM
 - Support of NDEF data structure
 - Data retention: 200 years
 - Write cycle endurance:
 - 1 million Write cycles at 25 °C
 - 600 K Write cycles at 85 °C
 - 500 K Write cycles at 105 °C
- Read up to 246 Bytes in a single command
- Write up to 246 Bytes in a single command
- 7-Byte unique identifier (UID)
- 128-bit password protection

7.12 STMicroelectronics sensors

Several STMicroelectronics sensors are available on the STM32L4 Discovery kit for IoT node board, they are listed below:

- 2 on-board ST-MEMS audio sensor omnidirectional digital microphones (MP34DT01)
- Capacitive digital sensor for relative humidity and temperature (HTS221)
- High-performance 3-axis magnetometer (LIS3MDL)
- 3D accelerometer and 3D gyroscope (LSM6DSL)
- 260-1260 hPa absolute digital output barometer (LPS22HB)
- Time-of-Flight and gesture detection sensor (VL53L0X)

7.12.1 Two on-board ST-MEMS microphones (MP34DT01)

The MP34DT01 is an ultra-compact, low-power, omnidirectional, digital ST-MEMS microphone built with a capacitive sensing element and an IC interface.

The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process dedicated to produce audio sensors.

The IC interface is manufactured using a CMOS process that allows designing a dedicated circuit able to provide a digital signal externally in PDM format.

The MP34DT01 has an acoustic overload point of 120 dBSPL with a 63 dB signal-to-noise ratio and -26 dBFS sensitivity.

On the STM32L4 Discovery kit for IoT node, there are two MP34DT01 microphones: one with LR pulled to V_{DD} and the second with LR pulled low. DFSDM1_CKOUT and DFSDM1_DATIN2 are connected for both. In addition, both microphones are spaced at 21 mm apart for the beamforming algorithm to work. Indeed, several algorithm configurations are available for the user to find the best trade off between audio output quality and resource consumption. For more details refer to *STEVAl-IHM038V1: 3-phase BLDC/PMSM motor drive up to 50 W, suitable for fan controllers* User manual (UM1697) on the www.st.com website.

The MP34DT01 is available in a package HCLGA (3x4 x1 mm) 4LD, in a top-port design, SMD-compliant, EMI-shielded package and it is guaranteed to operate over an extended temperature range from -40°C to $+85^{\circ}\text{C}$.

7.12.2 Capacitive digital sensor for relative humidity and temperature (HTS221)

The HTS221 is an ultra-compact sensor for relative humidity and temperature. It includes a sensing element and a mixed signal ASIC to provide the measurement information through digital serial interfaces.

The sensing element consists of a polymer dielectric planar capacitor structure capable of detecting relative humidity variations and it is manufactured using a dedicated ST process.

The HTS221 is available in a small top-holed cap land grid array (HLGA-6L (2 x 2 x 0.9 mm)) package guaranteed to operate over a temperature range from -40°C to $+120^{\circ}\text{C}$.

The main features of the HTS221 are:

- 0 to 100% relative humidity range,
- Low-power consumption: 2 μA @ 1 Hz ODR
- Selectable ODR from 1 Hz to 12.5 Hz
- High rH sensitivity: 0.004% rH/LSB
- Humidity accuracy: $\pm 3.5\%$ rH, 20 to +80% rH
- Temperature accuracy: $\pm 0.5^{\circ}\text{C}$, 15 to $+40^{\circ}\text{C}$
- Embedded 16-bit ADC
- 16-bit humidity and temperature output data
- SPI and I²C interfaces. On the STM32L4 Discovery kit for IoT node, the I2C2 bus from STM32L475VG is used.
- Factory calibrated
- Tiny 2 x 2 x 0.9 mm package
- ECOPACK[®] compliant

7.12.3 High-performance 3-axis magnetometer (LIS3MDL)

The LIS3MDL is an ultra-low-power high-performance three-axis magnetic sensor.

The LIS3MDL has user-selectable full scales of $\pm 4/ \pm 8/ \pm 12/ \pm 16$ gauss.

The self-test capability allows the user to check the functionality of the sensor in the final application.

The device may be configured to generate interrupt signals for magnetic field detection.

The LIS3MDL includes an I²C serial bus interface, that supports standard and fast mode (100 kHz and 400 kHz), and an SPI serial standard interface. On the STM32L4 Discovery kit IoT node, the I2C2 bus from STM32L475VG is used.

The LIS3MDL is available in a small thin plastic land grid array package (LGA-12 (2.0x2.0x1.0 mm)) and is guaranteed to operate over an extended temperature range of -40 °C to +85 °C.

LIS3MDL is also ECOPACK[®], RoHS and “Green” compliant.

7.12.4 3D accelerometer and 3D gyroscope (LSM6DSL)

The LSM6DSL is a system-in-package featuring a 3D digital accelerometer and a 3D digital gyroscope performing at 0.65 mA in high-performance mode and enabling always-on low-power features for an optimal motion experience for the consumer.

The event-detection interrupts enable efficient and reliable motion tracking and contextual awareness, implementing hardware recognition of free-fall events, 6D orientation, click and double-click sensing, activity or inactivity, and wake-up events.

The LSM6DSL supports main OS requirements, offering real, virtual and batch sensors with 4 Kbytes for dynamic data batching.

The LSM6DSL has been designed to implement features such as significant motion, tilt, pedometer functions, step detector and step counter, time stamping and to support the data acquisition of an external magnetometer with ironing correction (hard, soft).

The LSM6DSL has a full-scale acceleration range of $\pm 2/\pm 4/\pm 8/\pm 16$ g and an angular rate range of $\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$ dps.

The registers embedded inside the LSM6DSL may be accessed through both the I²C and SPI serial interfaces. On the STM32L4 Discovery kit for IoT node, the I2C2 bus from STM32L475VGT6 is used.

The LSM6DSL is available in a plastic land grid array (LGA-14L (2.5x3x0.83mm)) package, ECOPACK[®], RoHS and “Green” compliant.

7.12.5 260-1260 hPa absolute digital output barometer (LPS22HB)

The absolute pressure-sensing device LPS22HB is an ultra-compact piezoresistive sensor which functions as a digital output barometer.

The device comprises a sensing element and an IC interface which communicates from the sensing element to the application through I²C or SPI. On the STM32L4 Discovery kit for IoT node the I2C2 bus from the STM32L475VG is used.

The sensing element, which detects absolute pressure, consists of a suspended membrane manufactured using a dedicated process developed by ST.

The LPS22HB is available in a full-mold, holed LGA package (HLGA). It is guaranteed to operate over a temperature range extending from -40 °C to +85 °C. The package is holed to allow external pressure to reach the sensing element.

The main features of the LPS22HB are:

- 260 to 1260 hPa absolute pressure range
- Current consumption down to 3 μ A
- High overpressure capability: 20x full-scale
- Embedded temperature compensation
- 24-bit pressure data output
- 16-bit temperature data output
- ODR from 1 Hz to 75 Hz
- SPI and I²C interfaces
- Embedded FIFO
- Interrupt functions: Data Ready, FIFO flags, pressure thresholds
- Supply voltage: 1.7 to 3.6 V
- High shock survivability: 22,000 g
- Small and thin package
- ECOPACK[®] lead-free compliant

7.12.6 Time-of-Flight and gesture detection sensor (VL53L0X)

The VL53L0X is a new generation Time-of-Flight (ToF) laser-ranging module housed in a small package, providing accurate distance measurement whatever the target reflectance unlike conventional technologies. It can measure absolute distances up to 2 m, setting a new benchmark in ranging performance levels, opening the door to various new applications.

The VL53L0X integrates a leading-edge SPAD array (Single Photon Avalanche Diodes) and embeds an ST second generation FlightSense[™] patented technology.

The VL53L0X 940 nm VCSEL emitter (Vertical Cavity Surface-Emitting Laser), is totally invisible to the human eye, coupled with internal physical infrared filters, it enables longer ranging distance, higher immunity to ambient light and better robustness to cover-glass optical cross-talk.

The main features of the VL53L0X are listed below.

- Fully integrated miniature module:
 - 940 nm Laser VCSEL
 - VCSEL driver
 - Ranging sensor with advanced embedded micro controller
 - 4.4 x 2.4 x 1.0 mm size
- Fast, accurate distance ranging:
 - Measures absolute range up to 2 m
 - Reported range is independent of the target reflectance
 - Operates in high infrared ambient light levels
 - Advanced embedded optical cross-talk compensation to simplify cover glass selection
- Eye safe:
 - Class 1 laser device compliant with the latest standard IEC 60825-1:2014 - 3rd edition. The laser output will remain within Class 1 limits as long as the

STMicroelectronics recommended device settings are used and the operating conditions, specified in the STM32L4 datasheets, are respected. The laser output power must not be increased by any means and no optics should be used with the intention of focusing the laser beam. [Figure 16](#) shows the warning label for Class 1 laser products.

- Easy integration:
 - No additional optics
 - Single power supply
 - I²C interface for device control and data transfer: I2C2 from STM32L475VGT6 is used
 - Xshutdown (Reset) and interrupt GPIO
 - Programmable I²C address

Figure 16. Label for Class 1 laser products



7.13 STSAFE-A 100

The STSAFE-A100 is a highly secure solution that acts as a secure element, providing authentication and data management services to a local or remote host. It consists of a full turnkey solution with a secure operating system running on the latest generation of secure microcontrollers. The STSAFE-A100 can be integrated in IoT (Internet of things) devices, smart-home, smart-city and industrial applications, consumer electronics devices, consumables and accessories. The STSAFE-A100 can be mounted on:

- A device that authenticates to a remote host (IoT device case), the local host being used as a pass-through to the remote server.
- A peripheral that authenticates to a local host, for example games, mobile accessories or consumables.

The STSAFE-A100 is not implemented on the MB1297 Rev C board.

7.14 Buttons and LEDs

The black button B1 located on top side is the reset of the microcontroller STM32L475VGT6. Refer to the [Figure 3: STM32L4 Discovery kit for IoT node \(top view\)](#).

The blue button B1 located top side is available to be used as a digital input or as alternate wake-up function.

When the button is depressed the logic state is “0”, otherwise the logic state is “1”.

Two green LEDs (LD1 and LD2), located on the top side are available for the user. To light a LED a high logic state “1” should be written in the corresponding GPIO.

[Table 2](#) gives the assignment of the control ports to the LED indicators.

Table 2. Button and LED control port

Reference	Color	Name	Comment
B1	black	Reset	-
B2	blue	Wake-up	Alternate function Wake-up
LD1	green	LED1	PA5 (alternate with ARD.D13)
LD2	green	LED2	PB14
LD3	yellow	LED3 (Wi-Fi)	PC9, Wi-Fi activity
LD4	blue	LED4 (BLE)	PC9, Bluetooth activity
LD5	green	5V Power	5 V available
LD6	Bicolor (red and green)	ST-LINK COM	green when communication
LD7	red	Fault Power	Current upper than 750 mA
LD8	red	V _{BUS} OCRCR	PE3
LD9	green	V _{BUS} OK	5 V USB available

7.15 I²C addresses of modules used on MB1297

The [Table 3](#) displays the I²C addresses (read and write) for the modules that are connected to the I2C2 bus.

Table 3. I²C addresses for each module

Modules	Description	SAD[6:0] + R/W	I ² C write address	I ² C read address
HTS221	Capacitive digital sensor for relative humidity and temperature	1011111x	0xBE	0xBF
LIS3MDL	3-axis magnetometer	0011110x	0x3C	0x3D
LPS22HB	MEMS nano pressure sensor	1011101x	0xBA	0xBB
LSM6DSL	3D accelerometer and 3D gyroscope	1101010x	0xD4	0xD5
VL53L0X	Time-of-Flight ranging and gesture detection sensor	0101001x	0x52	0x53
M24SR64-Y	Dynamic NFC/RFID tag IC	1010110x	0xAC	0xAD
STSAFE-A100	-	0100000x	0x40	0x41

8 Connectors

Nine connectors are implemented on the STM32L4 Discovery kit for IoT node:

- CN1, CN2, CN3 and CN4 for Arduino Uno V3 connector
- CN5: Tag connector
- CN7: ST-LINK USB connector,
- CN8: ST-LINK debug connector,
- CN9: USB_OTG_FS connector,
- CN10: PMOD connector.

In addition, one jumper JP5 is used for I_{DD} measurements.

8.1 Arduino Uno V3 connectors

CN1, CN2, CN3 and CN4 are female connectors (SMD component devices) compatible with Arduino Uno V3. Most shields designed for Arduino can fit to the STM32L4 Discovery kit for IoT node.

Example connector references (see [Figure 17](#)):

- CN4: Header 6X1_Female_SMD
- CN3: Header 8X1_Female_SMD
- CN2: Header 8X1_Female_SMD
- CN1: Header 10X1_Female_SMD

Figure 17. Arduino connector (front view)

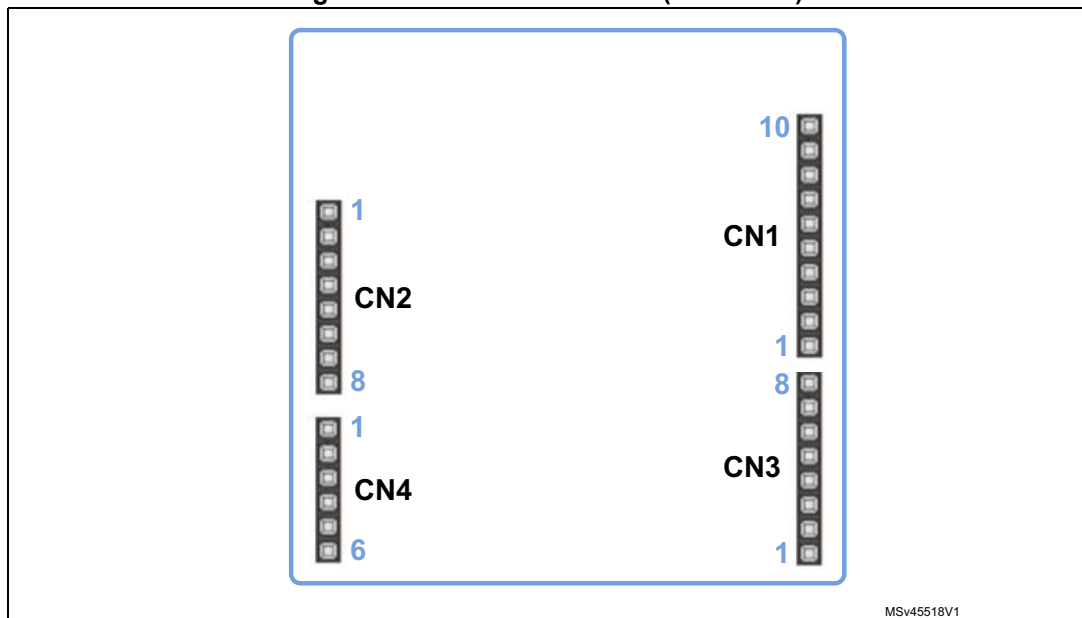


Table 4. Arduino connector pinout

Connector	Pin number	Pin name	Signal name	STM32 pin	Function
CN2	1	NC	-	-	-
	2	IOREF	-	-	3.3 V reference
	3	NRST	STM_NRST	NRST	Reset
	4	3.3 V	-	-	3.3 V input/output
	5	5V	-	-	5V
	6	GND	-	-	GND
	7	GND	-	-	GND
	8	VIN	-	-	Power input
CN4	1	A0	ARD.A0-ADC	PC5	ADC
	2	A1	ARD.A1-ADC	PC4	ADC
	3	A2	ARD.A2-ADC	PC3	ADC
	4	A3	ARD.A3-ADC	PC2	ADC
	5	A4	ARD.A4-ADC	PC1	ADC / I2C3_SDA
	6	A5	ARD.A5-ADC	PC0	ADC / I2C3_SCL
CN1	10	SCL/D15	ARD.D15-I2C1_SCL	PB8	I2C1_SCL
	9	SDA/D14	ARD.D14-I2C1_SDA	PB9	I2C1_SDA
	8	AVDD	VDDA	-	VDDA
	7	GND	GND	-	Ground
	6	SCK/D13	ARD.D13-SPI1_SCK/LED1	PA5	SPI1_SCK / LED1
	5	MISO/D12	ARD.D12-SPI1_MISO	PA6	SPI1_MISO
	4	PWM/MOSI/D11	ARD.D11-SPI1_MISO/PWM	PA7	SPI1_MOSI / TIMxx
	3	PWM/CS/D10	ARD.D10-SPI1_SSN/PWM	PA2	SPI1_NSS / TIM2_CH3
	2	PWM/D9	ARD.D9-PWM	PA15	TIM2_CH1
	1	D8	ARD.D8	PB2	GPIO
CN3	8	D7	ARD.D7	PA4	GPIO
	7	PWM/D6	ARD.D6-PWM	PB1	TIM3_CH4
	6	PWM/D5	ARD.D5-PWM	PB4	TIM3_CH1
	5	D4	ARD.D4	PA3	TIMxx
	4	PWM/D3	ARD.D3-PWM/INT1_EXTI0	PB0	TIM3_CH3 / EXTI0
	3	D2	ARD.D2-INT0_EXTI14	PD14	EXTI14
	2	TX/D1	ARD.D1-UART4_TX	PA0	UART4_TX
	1	RX/D0	ARD.D0-UART4_RX	PA1	UART4_RX

8.2 TAG connector CN5

The TAG connector is implemented on the STM32L4 Discovery kit for IoT node. The TAG connector is a 10-pin footprint supporting SWD mode, which is shared with the same signals as for the ST-LINK.

The TC2050-IDC-NL cable is used to link ST-LINK and TAG connector on the STM32L4 Discovery kit for IoT node, so that the STM32L4 can be easily programmed and debugged without any extra accessory.

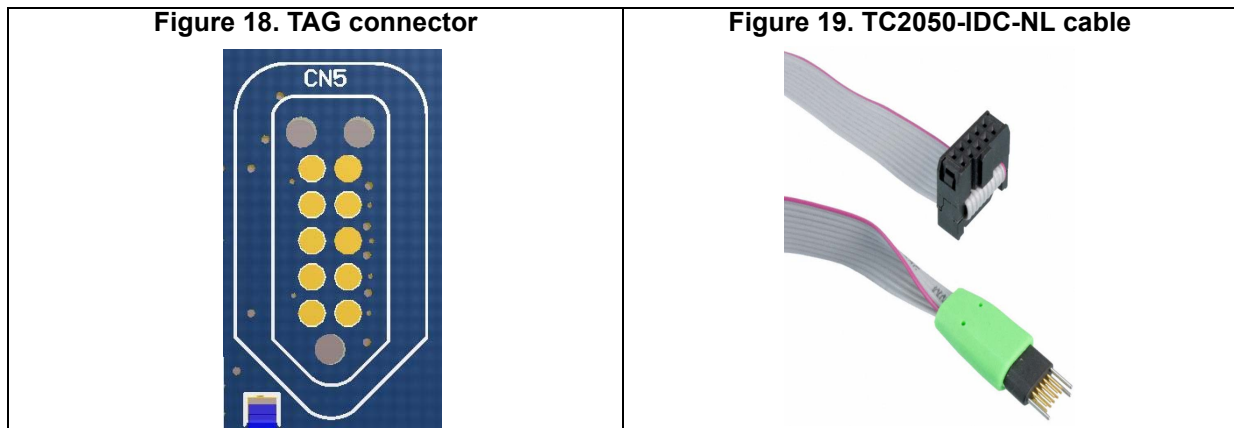


Table 5. TAG connector pinout

Connector	Pin number	Pin name	Signal name	STM32L4 pin	Function
CN5	1	3.3 V	3V3_ST_LINK	-	Power
	2	SWD	SYS_JTMS-SWDIO	PA13	Serial Wire Data Input/Output
	3	GND	-	-	Ground
	4	SWCLK	SYS_JTCK-SWCLK	PA14	Serial Wire Clock
	5	GND	-	-	Ground
	6	SWO	STLINK_JTDO_SWO	PB3	Serial Wire Output
	7	NC	-	-	-
	8	NC	-	-	-
	9	NC	-	-	-
	10	NRST	STM_NRST	NRST	RESET

8.3 ST-LINK/V2-1 USB Micro-B

The USB connector is used to connect the embedded ST-LINK/V2-1 to the PC to program and debug the STM32L475VGT6 microcontroller.

Figure 20. USB Micro-B connector CN7 (front view)

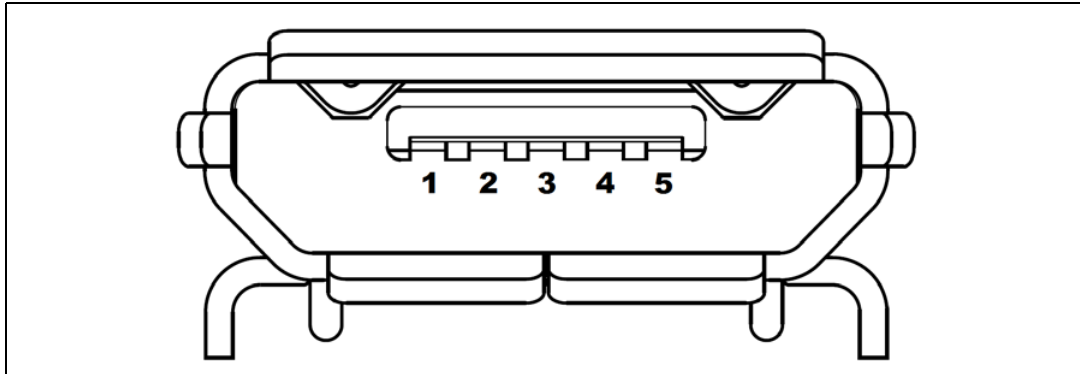


Table 6. USB Micro-B connector

Connector	Pin number	Pin name	Signal name	STM32L4 pin	Function
CN7	1	V _{BUS}	5V_USB_ST_LINK	-	5 V power and detection
	2	DM	USB_STLK_N	PA11	USB diff pair M
	3	DP	USB_STLK_P	PA12	USB diff pair P
	4	ID	USB_STLK_ID	-	USB Identification
	5	GND	-	-	GND

8.4 ST-LINK debug connector CN8

The ST-LINK debug connector is a 1x4-pin, 2.54-mm pitch male connector. It provides access to the embedded SWJ-DP interface of the STM32F103CBT6 MCU. This SWJ-DP interface is a combined JTAG and serial wire debug port that enables either a serial wire debug or a JTAG probe, to be connected to the target.

Table 7. ST-LINK debug connector

Connector	Pin number	Signal name	STM32F103CBT6	Function
CN8	1	3V3_ST_LINK	V _{BAT} , V _{DDA} , V _{DD_1} , V _{DD_2} , V _{DD_3}	3.3 V voltage supply
	2	STM_JTCK	PA14	TCK/SWCLK
	3	GND	All GND pins	GND
	4	STM_JTMS	PA13	JTMS/SWDIO

8.5 USB OTG FS micro-AB

Figure 21. USB OTG FS Micro-AB connector CN9 (front view)

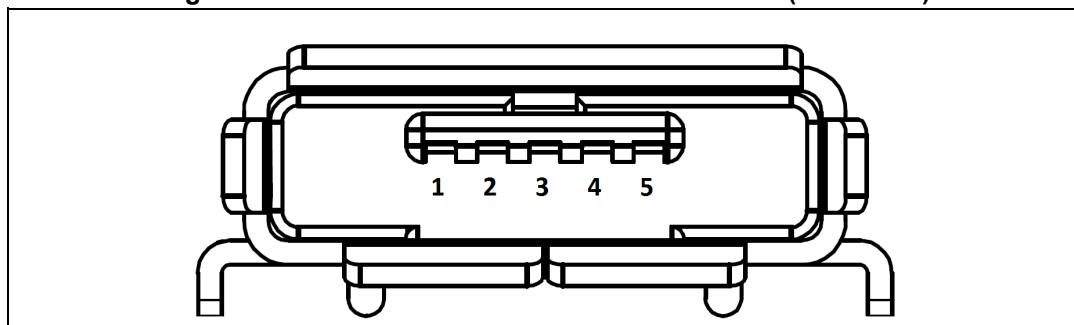


Table 8. USB OTG FS Micro-AB pinout

Connector	Pin number	Pin names	Signal name	STM32L4 pin	Function
CN9	1	V _{BUS}	USB_OTG_5V_VBUS	PA9	5 V power and detection
	2	DM	USB_OTG_FS_DM	PA11	USB diff pair M
	3	DP	USB_OTG_FS_DP	PA12	USB diff pair P
	4	ID	USB_OTG_FS_ID	PA10	USB identification
	5	GND	-	-	GND

Table 9. USB OTG FS power management

Pin number	Pin names	Signal names	STM32L4 pin	Function
IC19-3	FAULT _n	USB_OTG_FS_OVRCCR_EXTI3	PE3	Over Current IT
IC19-4	EN _n	USB_OTG_FS_PWR_EN	PD12	USB Power enable

8.6 PMOD connector CN10

On STM32L4 Discovery kit for IoT node, the PMOD connector provides flexibility in small form factor application. Based on PMOD Digilent standard popular in connectivity, the PMOD connector is implemented in type 2A and 4A.

The related STM32L475VG I/Os for PMOD function are listed in [Table 10](#). The PMOD connector is 2x6 pins with 2.54 mm pitch and right angle female connector.



Table 10. PMOD solder bridge configuration

Alternate configuration (UART)			Standard configuration (SPI)						
STM32L4 pin	Solder bridge configuration	Pin name	STM32L4 pin	Solder bridge configuration	Pin name	PMOD pin number		Pin name	STM32L4 pin
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
PD3	SB14 open; SB19 close	PMOD-UART2_ CTS/SPI2_MISO	PD5	SB14 close; SB19 open	PMOD-UART2_ Tx/SPI2_CSN	1	7	PMOD-IRQ_EXTI2	PD2
PD5	SB15 open; SB12 close	PMOD-UART2_ Tx/SPI2_CSN	PD4	SB15 close; SB12 open	PMOD-UART2_ RTS/SPI2_MOSI	2	8	PMOD-RESET	PD0
PD6	SB18 open; SB20 close	PMOD- UART2_RX	PD3	SB18 close; SB20 open	PMOD-UART2_ CTS/SPI2_MISO	3	9	NC	NC
PD4	SB21 open; SB16 close	PMOD-UART2_ RTS/SPI2_MOSI	PD1	SB21 close; SB16 open	PMOD- SPI2_SCK	4	10	NC	NC
-	-	-	-	-	GND	5	11	GND	-
-	-	-	-	-	3.3 V	6	12	3.3 V	-

8.7 Jumper JP5 for IDD measurements

The STM32 current measurement can be done on JP5. By default a jumper is placed on JP5.

For current measurement configuration, the jumper on JP5 should be removed and an amp-meters should be placed on JP5.

Appendix A STM32L4 Discovery kit for IoT node I/O assignment

Table 11. STM32L4 Discovery kit for IoT node I/O assignment

Pin No.	Pin Name	Feature / Comment	Signal or Label
1	PE2	GPIO_Output	M24SR64-Y-RF_DISABLE
2	PE3	GPIO_EXTI3	USB_OTG_OVRCCR_EXTI3
3	PE4	GPIO_EXTI4	M24SR64-Y-GPO
4	PE5	GPIO_EXTI5	SPSGRF-915-GPIO3_EXTI5
5	PE6	GPIO_EXTI6	SPBTLE-RF-IRQ_EXTI6
6	V _{BAT}	Voltage supply	V _{BAT}
7	PC13	GPIO_EXTI13	BUTTON_EXTI13
8	PC14/OSC32_IN	RTC CLK	RCC_OSC32_IN
9	PC15/OSC32_OUT	RTC CLK	RCC_OSC32_OUT
10	V _{SS}	GND	GND
11	V _{DD}	3.3 V	V _{DD_MCU}
12	PH0/OSC_IN	8MHz CLK	RCC_OSC_IN
13	PH1/OSC_OUT	8MHz CLK	RCC_OSC_OUT
14	NRST	reset	STM_NRST
15	PC0	ADC1_IN1	ARD.A5-ADC
16	PC1	ADC1_IN2	ARD.A4-ADC
17	PC2	ADC1_IN3	ARD.A3-ADC
18	PC3	ADC1_IN4	ARD.A2-ADC
19	V _{SSA}	GND	GND
20	V _{REF-}	GND	GND
21	V _{REF+}	3.3 V	V _{DDA}
22	V _{DDA}	3.3 V	V _{DDA}
23	PA0	UART4_TX	ARD.D1-UART4_TX
24	PA1	UART4_RX	ARD.D0-UART4_RX
25	PA2	TIM2_CH3	ARD.D10-SPI_SSN/PWM
26	PA3	GPIO_Output	ARD.D4
27	V _{SS}	GND	V _{SS}
28	V _{DD}	3.3 V	V _{DD_MCU}
29	PA4	GPIO_Output	ARD.D7
30	PA5	SPI1_SCK	ARD.D13-SPI1_SCK/LED1
31	PA6	SPI1_MISO	ARD.D12-SPI1_MISO

Table 11. STM32L4 Discovery kit for IoT node I/O assignment (continued)

Pin No.	Pin Name	Feature / Comment	Signal or Label
32	PA7	SPI1_MOSI	ARD.D11-SPI1_MOSI/PWM
33	PC4	ADC1_IN13	ARD.A1-ADC
34	PC5	ADC1_IN14	ARD.A0-ADC
35	PB0	TIM3_CH3	ARD.D3-PWM/INT1_EXTI0
36	PB1	TIM3_CH4	ARD.D6-PWM
37	PB2	GPIO_Output	ARD.D8
38	PE7	MEMS microphone	DFSDM1_DATIN2
39	PE8	GPIO_Output	ISM43362-RST
40	PE9	MEMS microphone	DFSDM1_CKOUT
41	PE10	QSPI NOR Flash memory	QUADSPI_CLK
42	PE11	QSPI NOR Flash memory	QUADSPI_NCS
43	PE12	QSPI NOR Flash memory	QUADSPI_BK1_IO0
44	PE13	QSPI NOR Flash memory	QUADSPI_BK1_IO1
45	PE14	QSPI NOR Flash memory	QUADSPI_BK1_IO2
46	PE15	QSPI NOR Flash memory	QUADSPI_BK1_IO3
47	PB10	I2C2_SCL	INTERNAL-I2C2_SCL
48	PB11	I2C2_SDA	INTERNAL-I2C2_SDA
49	V _{SS}	GND	V _{SS}
50	V _{DD}	3.3 V	V _{DD_MCU}
51	PB12	GPIO_Output	ISM43362-BOOT0
52	PB13	GPIO_Output	ISM43362-WAKEUP
53	PB14	GPIO_Output	LED2
54	PB15	GPIO_Output	SPSGRF-915-SDN
55	PD8	USART3_TX	INTERNAL-UART3_TX
56	PD9	USART3_RX	INTERNAL-UART3_RX
57	PD10	GPIO_EXTI10	LPS22HB_INT_DRDY_EXTI10
58	PD11	GPIO_EXTI11	LSM6DSL_INT1_EXTI11
59	PD12	GPIO_EXTI12	USB_OTG_FS_PWR_EN
60	PD13	GPIO_Output	SPBTLE-RF-SPI3_CSN
61	PD14	GPIO_EXTI14	ARD.D2-INT0_EXTI14
62	PD15	GPIO_EXTI15	HTS221_DRDY_EXTI15
63	PC6	GPIO_Output	VL53L0X_XSHUT
64	PC7	GPIO_EXTI17	VL53L0X_GPIO1_EXTI7
65	PC8	GPIO_EXTI18	LIS3MDL_DRDY_EXTI8

Table 11. STM32L4 Discovery kit for IoT node I/O assignment (continued)

Pin No.	Pin Name	Feature / Comment	Signal or Label
66	PC9	GPIO_EXTI9	LED3 (WIFI) & LED4 (BLE)
67	PA8	GPIO_Output	SPBTLE-RF-RST
68	PA9	USB_OTG	USB_OTG_FS_VBUS
69	PA10	USB_OTG	USB_OTG_FS_ID
70	PA11	USB_OTG	USB_OTG_FS_DM
71	PA12	USB_OTG	USB_OTG_FS_DP
72	PA13	ST-LINK	SYS_JTMS-SWDIO
73	V _{DDUSB}	3.3 V	V _{DD_MCU}
74	V _{SS}	GND	GND
75	V _{DD}	3.3 V	V _{DD_MCU}
76	PA14	ST-LINK	SYS_JTCK-SWCLK
77	PA15	TIM2_CH1	ARD.D9-PWM
78	PC10	SPI3_SCK	INTERNAL-SPI3_SCK
79	PC11	SPI3_MISO	INTERNAL-SPI3_MISO
80	PC12	SPI3_MOSI	INTERNAL-SPI3_MOSI
81	PD0	GPIO_Output	PMOD-RESET
82	PD1	GPIO_Output	PMOD-SPI2_SCK
83	PD2	GPIO_EXTI2	PMOD-IRQ_EXTI2
84	PD3	USART2_CTS	PMOD-UART2_CTS/SPI2_MISO
85	PD4	USART2_RTS	PMOD-UART2_RTS/SPI2_MOSI
86	PD5	USART2_TX	PMOD-UART2_TX/SPI2_CSN
87	PD6	USART2_RX	PMOD-UART2_RX
88	PD7	GPIO_Output	STSAFE-A100-RESET
89	PB3	ST-LINK	SYS_JTDO-SWO
90	PB4	TIM3_CH1	ARD.D5-PWM
91	PB5	GPIO_Output	SPSGRF-915-SPI3_CSN
92	PB6	USART1_TX	ST-LINK-UART1_TX
93	PB7	USART1_RX	ST-LINK-UART1_RX
94	BOOT0	Boot	BOOT0
95	PB8	I2C1_SCL	ARD.D15-I2C1_SCL
96	PB9	I2C1_SDA	ARD.D14-I2C1_SDA
97	PE0	GPIO_Output	ISM43362-SPI3_CSN
98	PE1	GPIO_EXTI1	ISM43362-DRDY_EXTI1

Table 11. STM32L4 Discovery kit for IoT node I/O assignment (continued)

Pin No.	Pin Name	Feature / Comment	Signal or Label
99	V _{SS}	GND	GND
100	V _{DD}	3.3 V	V _{DD_MCU}

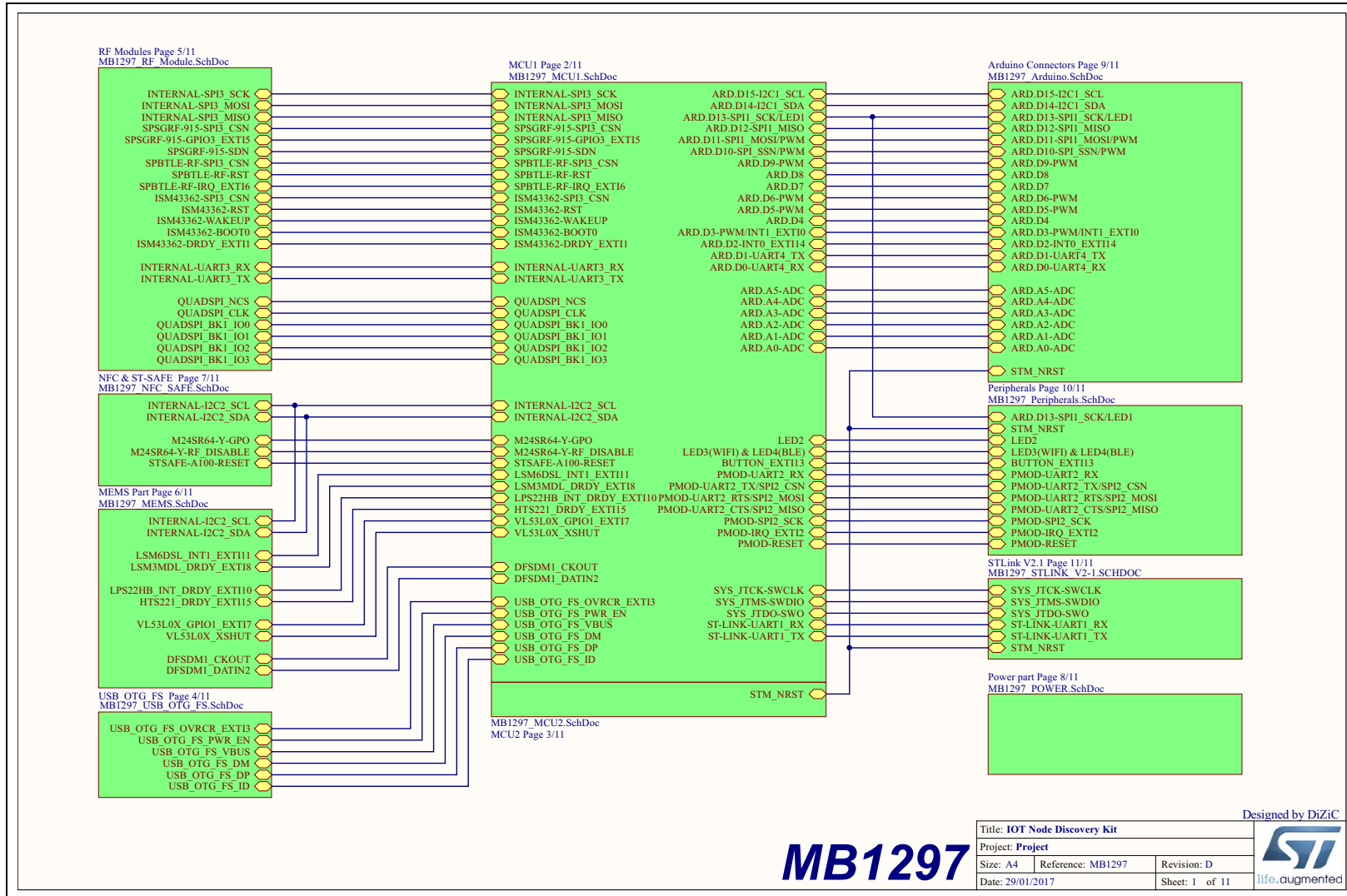
Appendix B Schematics

This section provides the design schematics for the STM32L4 Discovery kit for IoT node:


- Overall schematics for the B-L475E-IOT01A, see [Figure 22](#)
- STM32L475VG MCU, see [Figure 23](#) and [Figure 24](#)
- USB OTG FS, see [Figure 25](#)
- RF Module, see [Figure 26](#)
- ST-MEMS sensors, see [Figure 27](#)
- NFC and STSAFE Part, see [Figure 28](#)
- Power supply, see [Figure 29](#)
- Arduino Uno V3 connector, see [Figure 30](#)
- Peripherals, see [Figure 31](#)
- ST-LINK with support of SWD only, see [Figure 32](#)



Figure 22. STM32L4 Discovery kit for IoT node (top)

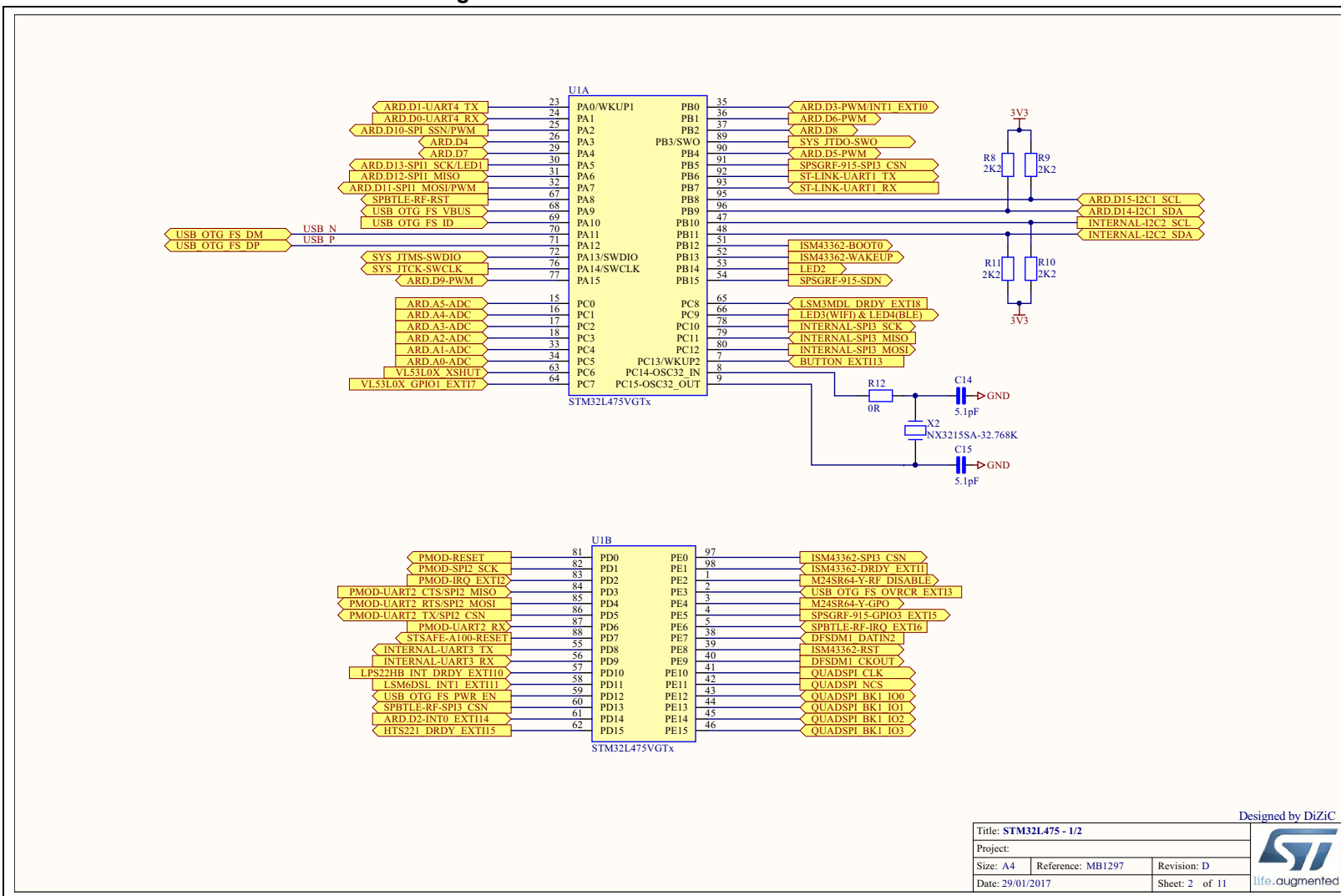


MB1297

Title: IOT Node Discovery Kit			 life.augmented
Project: Project			
Size: A4	Reference: MB1297	Revision: D	
Date: 29/01/2017	Sheet: 1 of 11		

Designed by DiZiC

Figure 23. STM32L475VG microcontroller



Designed by DiZiC

Title: STM32L475 - 1/2			
Project:			
Size: A4	Reference: MB1297	Revision: D	
Date: 29/01/2017	Sheet: 2 of 11		

life.augmented

Figure 24. STM32L475VG microcontroller

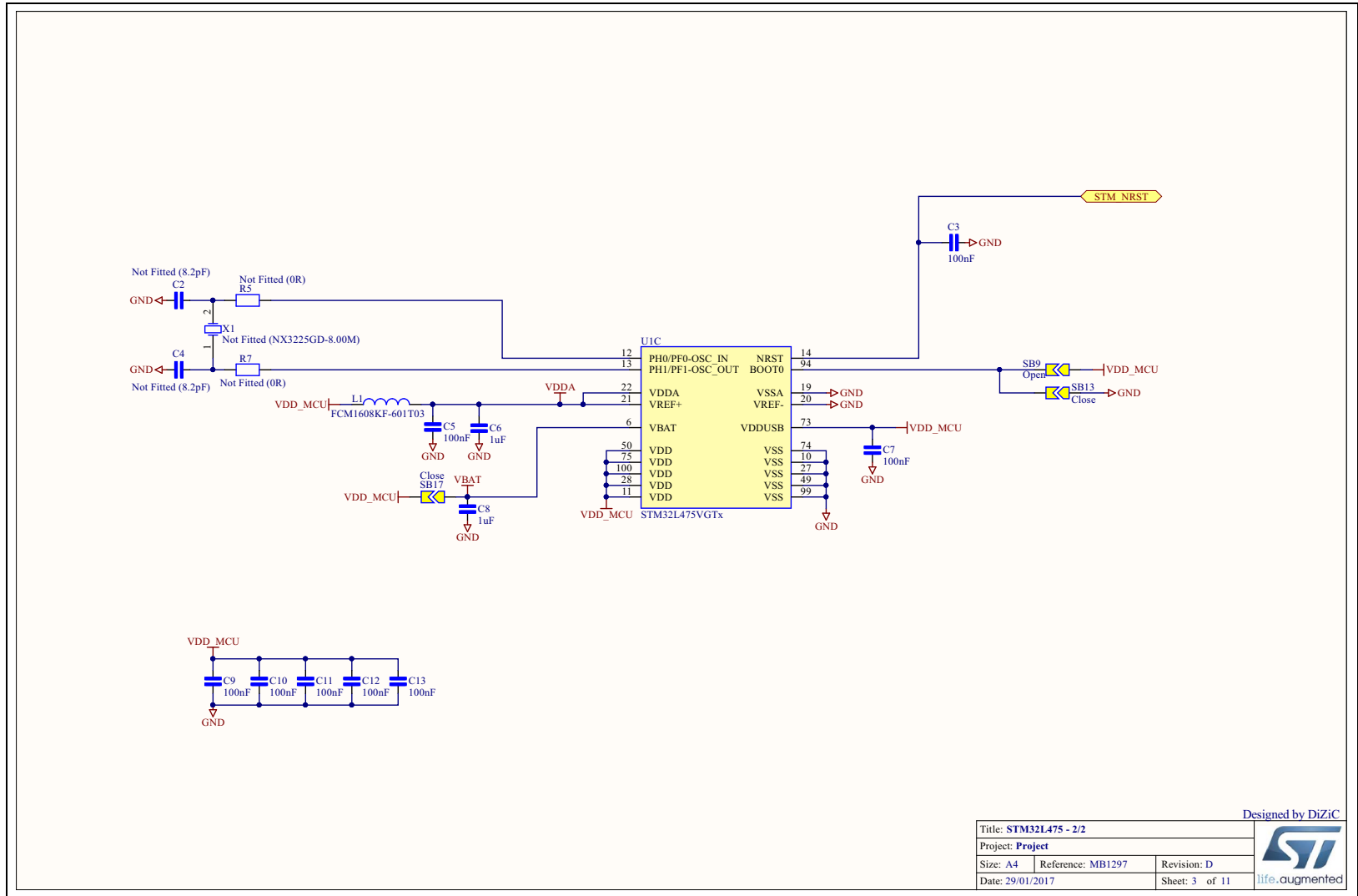


Figure 25. USB OTG FS

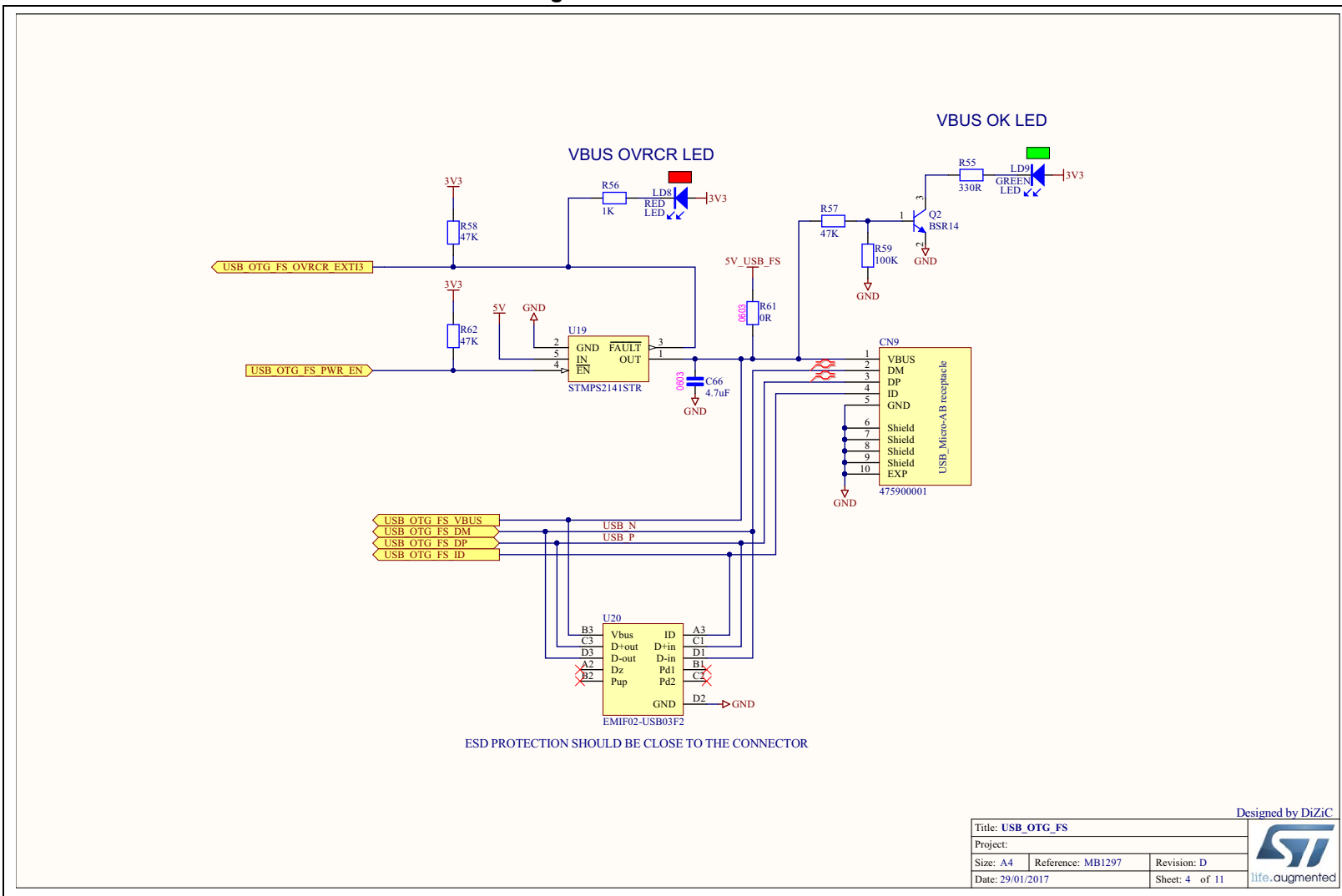
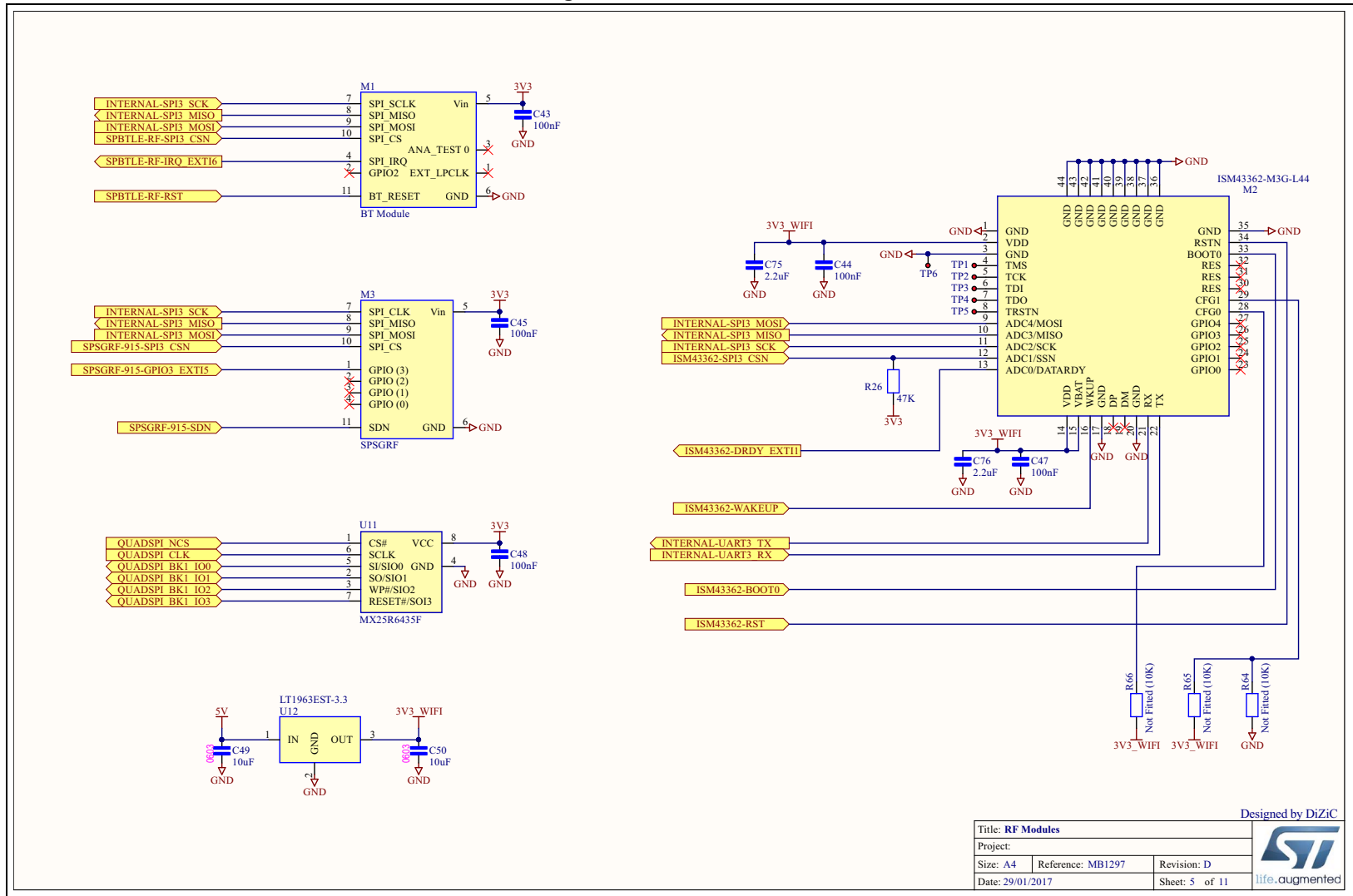




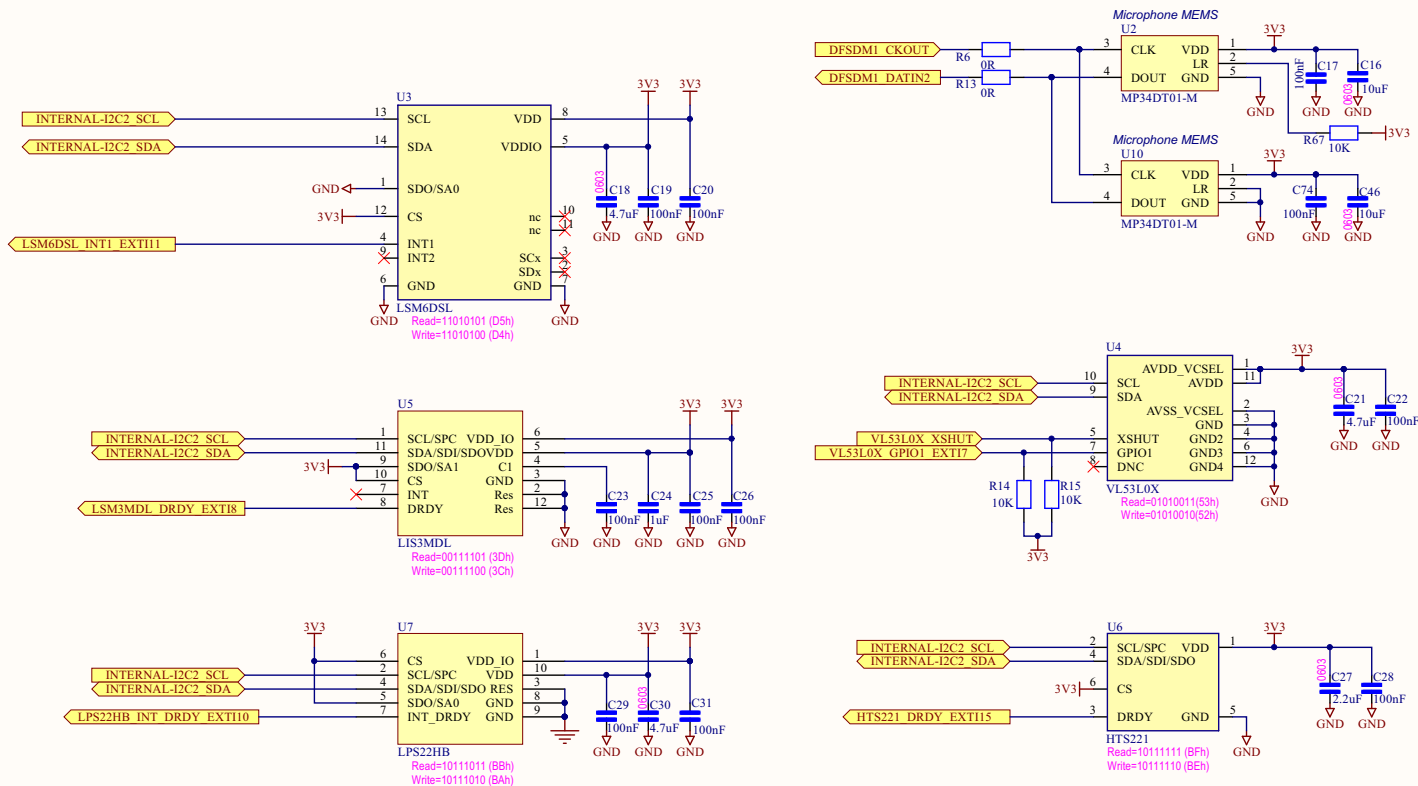
Figure 26. RF module



Designed by DiZiC

Title: RF Modules		
Project:		
Size: A4	Reference: MB1297	Revision: D
Date: 29/01/2017	Sheet: 5 of 11	life.augmented

Figure 27. ST-MEMS sensors

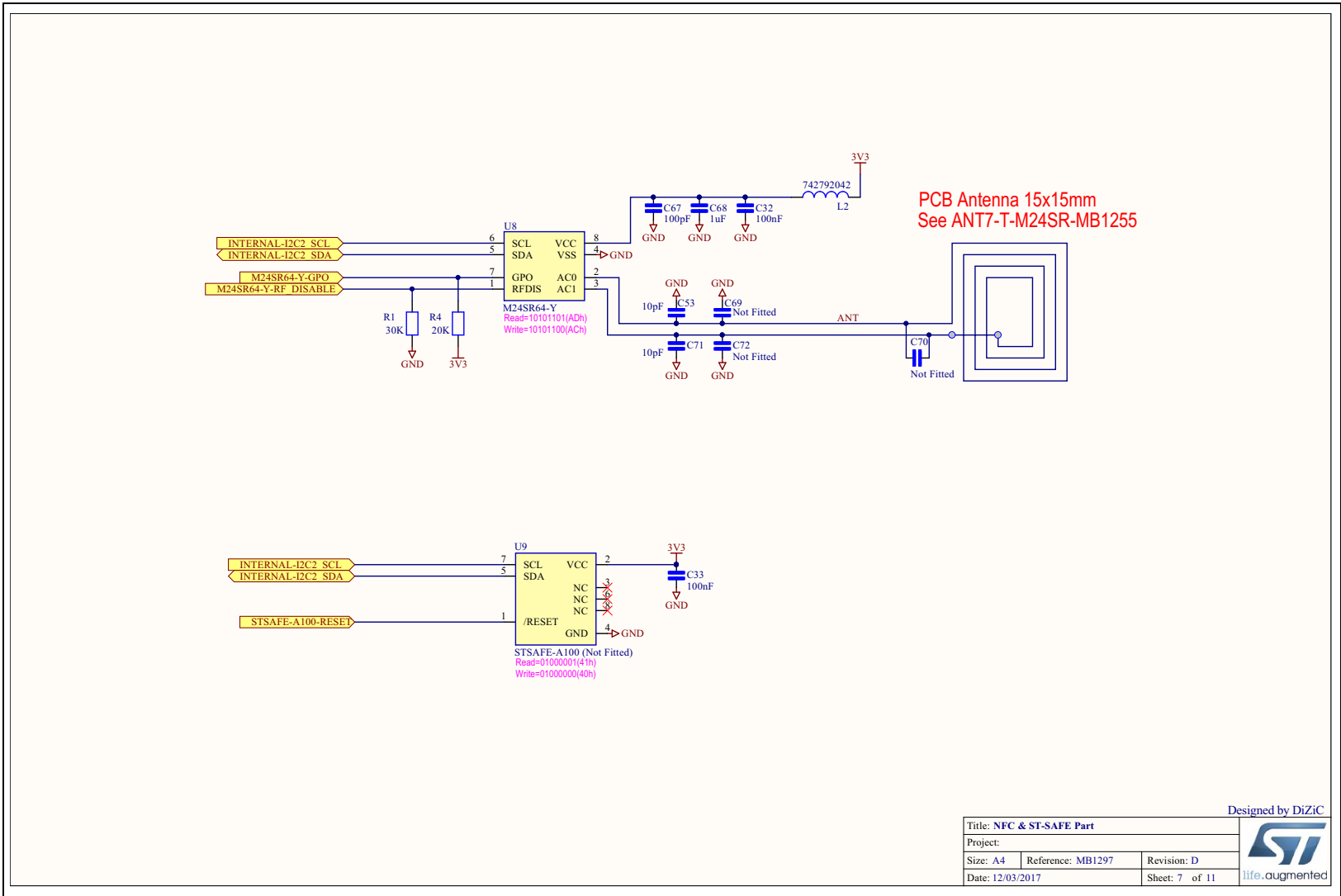


Designed by DiZiC

Title: MEMS Sensors			
Project:			
Size: A4	Reference: MB1297	Revision: D	 life.augmented
Date: 29/01/2017	Sheet: 6 of 11		




Figure 28. NFC and STSAFE part



Designed by DiZiC

Title: NFC & ST-SAFE Part		
Project:		
Size: A4	Reference: MB1297	Revision: D
Date: 12/03/2017	Sheet: 7 of 11	



life.augmented

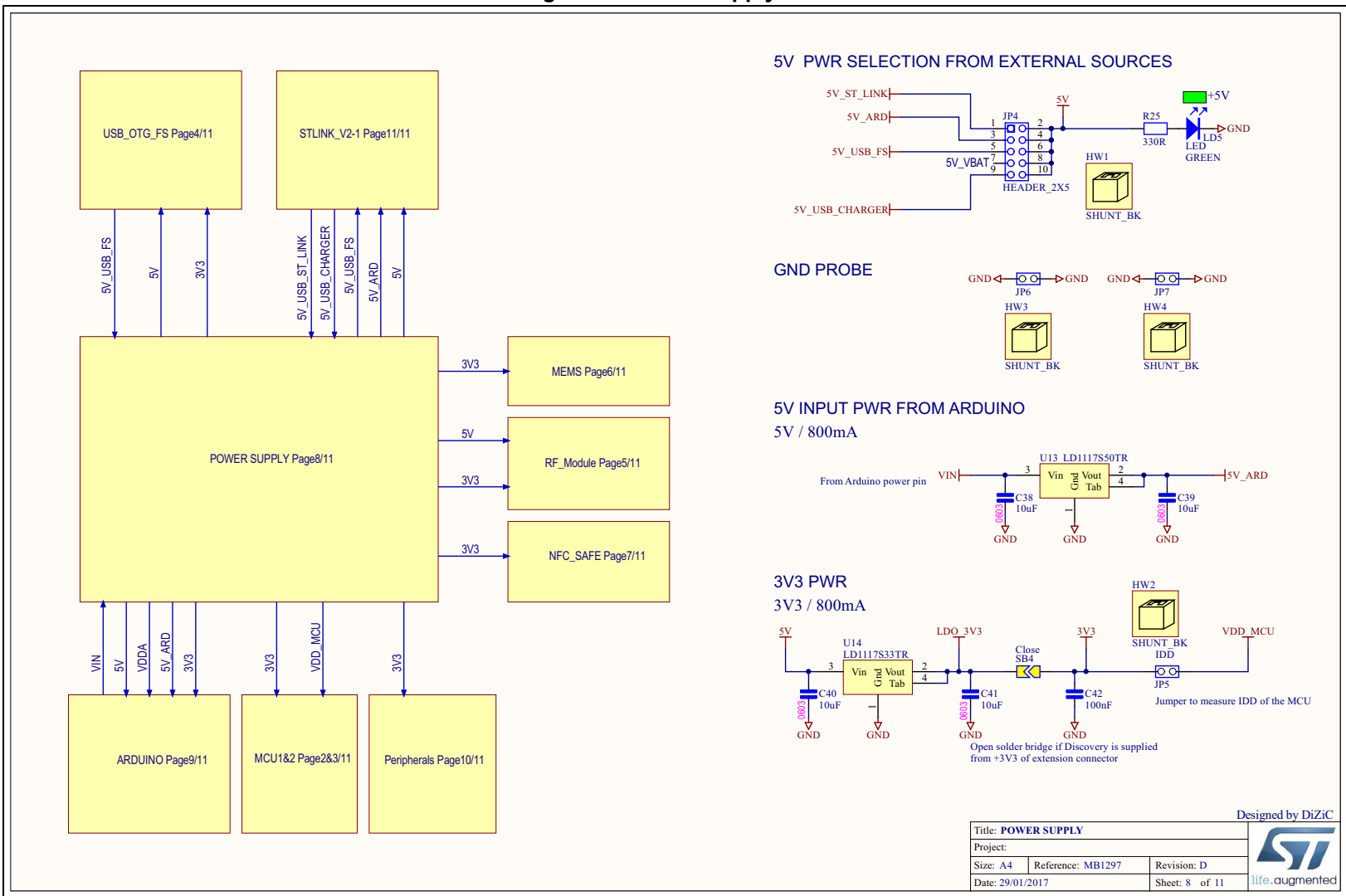
Figure 29. Power supply




Figure 30. Arduino Uno V3 connector

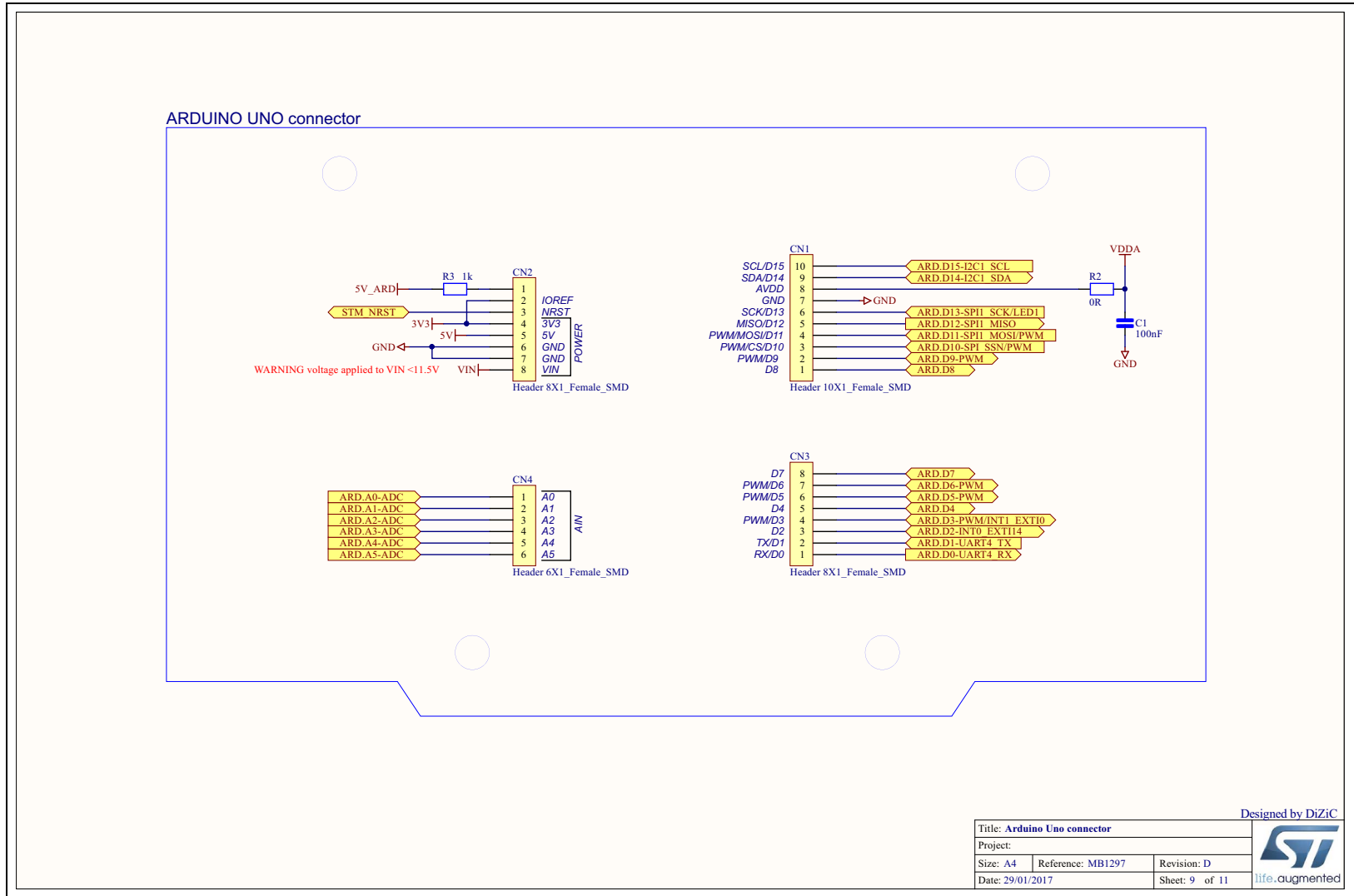


Figure 31. Peripherals

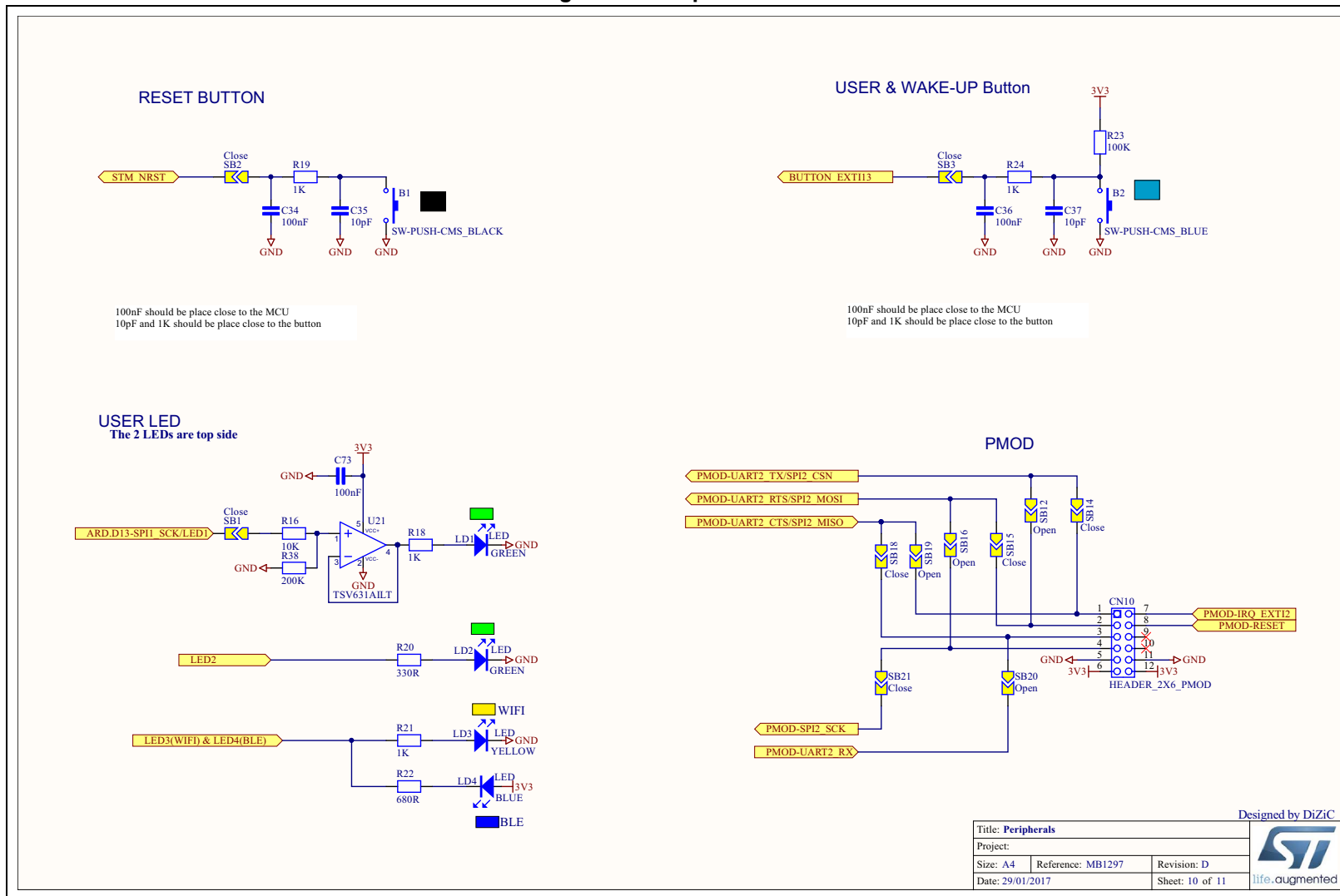
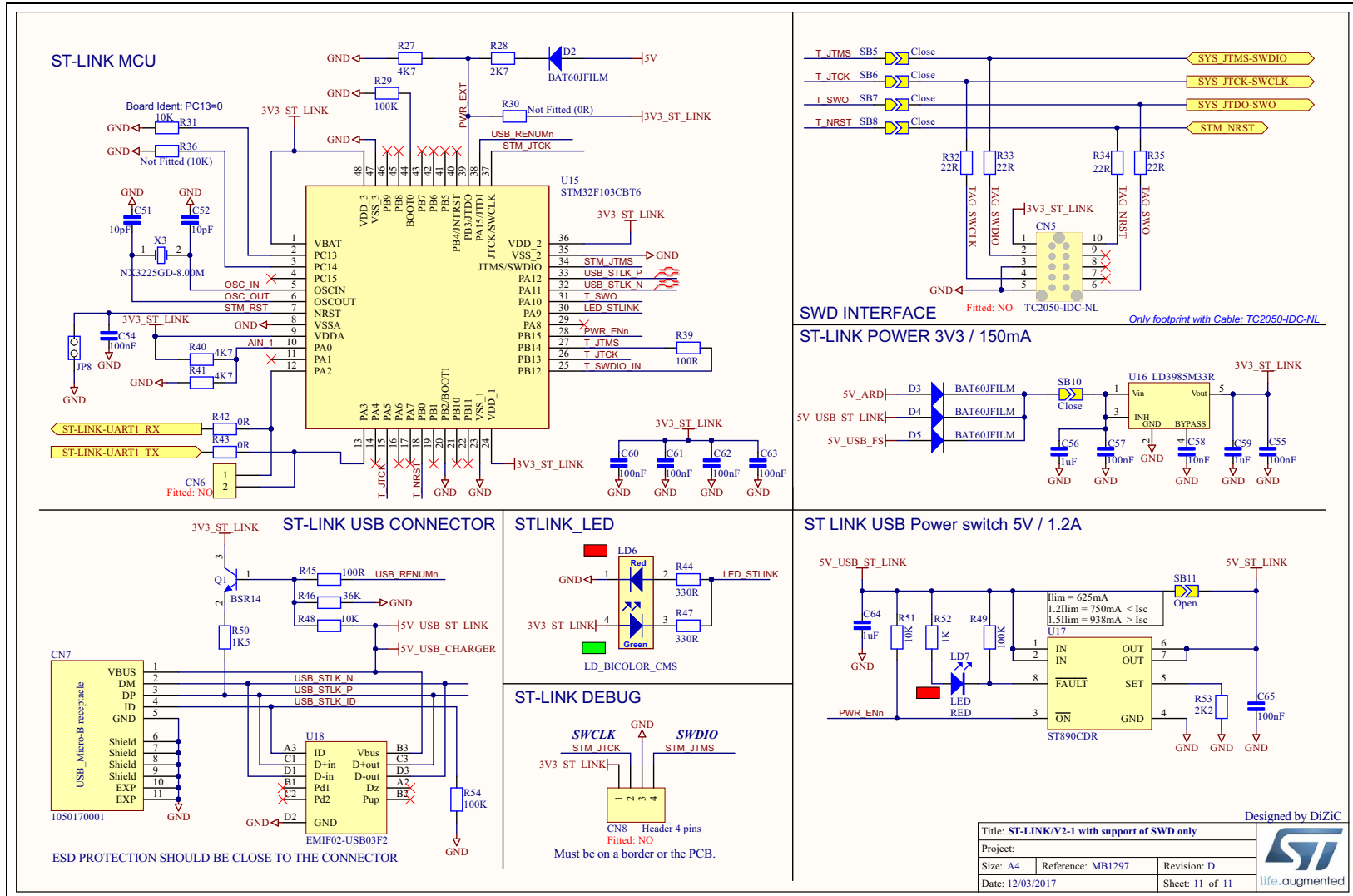




Figure 32. ST-LINK/V2-1 with support of SWD only



Appendix C Board revision history and limitations

Table 12. Board revision history and limitations

Board	Version	Revision details	Known limitations
MB1297	A	Not available; engineering samples only	-
MB1297	B	Not available; engineering samples only	-
MB1297	C-01	<p>First official IoT Discovery kit version with following changes compared to MB1297C schematics:</p> <ul style="list-style-type: none"> – Capacitor value for NFC matching changed (C53 = 10 pF instead of 47 pF and C71 = 10 pF instead of 47 pF) – STSAFE-A100 (U9 component) not fitted on MB1297C – Firmware revision inside the Wi-Fi module must be: C3.5.2.3.BETA9. The Wi-Fi module maximum output power is limited to 9 dBm to fulfill FCC/IC/CE requirements. 	<ul style="list-style-type: none"> – A limitation is present on the MB1297C-01 board. The reset connexion between STM32L4 and the ST-LINK MCU (STM32F103) is not present even if schematics are correct. The software reset is available so that the hardware missing reset may not be necessary. If the hardware reset is needed, a simple workaround is available by soldering an external wire between the SB2 and SB8. – Firmware revision inside the Wi-Fi module must be: C3.5.2.3.BETA9. The Wi-Fi module maximum output power is limited to 9 dBm to fulfill FCC/IC/CE requirements.
MB1297	D-01	<p>Second official IoT Discovery kit. No BOM changes compared to the MB1297 C-01 BOM, that is C53 = 10pF, C71 = 10pF and STSAFE-A100 (U9 component) not fitted.</p> <p>Two pcb changes compared to the MB1297 C-01 pcb:</p> <ul style="list-style-type: none"> – The reset connexion between STM32L4 and the ST-LINK MCU (STM32F103) is implemented of the MB1297 rev D – The pcb below the Wi-Fi antenna has been removed to have more Wi-Fi radiated output power 	<p>Firmware revision inside the Wi-Fi module must be: C3.5.2.3.BETA9. The Wi-Fi module maximum output power is then limited to 9 dBm to fulfill FCC/IC/CE requirements.</p>

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

Applicable for IoT node Discovery kit products with order code B-L475E-IOT01A1 (containing SPSGRF-915 module).

D.1 FCC Compliance Statement

Contains FCC ID: O7P-362

Contains FCC ID: S9NSPBTLERF

Contains FCC ID: S9NSPSGRF

D.1.1 Part 15.19

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

D.1.2 Part 15.105

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

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

8.7.1 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.

8.8 IC Compliance Statement

Contains/Contient IC: 10147A-362

Contains/Contient IC: 8976C-SPBTLERF

Contains/Contient IC: 8976C-SPSGRF

8.8.1 Compliance Statement

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

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

8.8.2 Déclaration de conformité

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

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

8.8.3 RF exposure statement

To satisfy FCC and IC RF Exposure requirements for mobile devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Pour satisfaire aux exigences FCC et IC concernant l'exposition aux champs RF pour les appareils mobiles, une distance de séparation de 20 cm ou plus doit être maintenu entre l'antenne de ce dispositif et les personnes pendant le fonctionnement. Pour assurer la conformité, il est déconseillé d'utiliser cet équipement à une distance inférieure. Cet émetteur ne doit pas être co-situé ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

Revision history

Table 13. Document revision history

Date	Revision	Changes
31-Mar-2017	1	Initial version.
14-Apr-2017	2	Updated Section 7.12.6: Time-of-Flight and gesture detection sensor (VL53L0X) to add Class 1 laser information.
28-Jun-2017	3	Updated: Section 7.11.3: Wi-Fi module Inventek ISM43362-M3G-L44 (802.11 b/g/n) and Section Appendix B: Schematics to reflect MB1297 rev D updates.

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