Hardware

Welcome to the Byte Lab Development Kit (BLDK) hardware documentation. The BLDK is a general purpose development board produced by Byte Lab. The BLDK consists of a peripheral module and a several supported core modules.

This hardware documentation contains all the necessary information to ensure the proper installation, configuration, and use of the BLDK device.

Getting started required hardware

To start using the BLDK, you need:

- The BLDK Peripheral module
- One of the BLDK Core modules
- USB Type-C cable

Hardware schematics and BOMs

A hardware schematics is a concise and structured document that provides essential technical information about a specific hardware component or device.

Typically, a hardware schematics includes the information about:

- General product information
- Electrical specifications
- Mechanical specifications
- Pin configuration
- Functional description
- Recommended operation conditions

Along the hardware schematics, there is a document called a Bill of Materials (BOM). The (BOM) is a comprehensive list of all the components, parts, materials, and assemblies required to manufacture or build a product.

Power supply options

BLDK power supply connectors are located on the Peripheral module. There are two mutually exclusive ways to provide power to the BLDK:

- 5V USB Type-C connector
- 12V DC barrel connector

Flashing and logging data

The BLDK is connected to the computer using the USB Type C cable. In order for the device to communicate with the computer over the serial UART communication protocol, the BLDK uses FTDI (Future Technology Devices International) chip. They provide an easy way to add USB connectivity to microcontrollers, computers, and various other devices. However, FTDI chips can also be used as “dual-port” devices, which means they can offer two independent virtual serial ports over a single USB connection.

More on how the FTDI chip works can be found in the chip’s datasheet (PDF)

Peripheral module

Peripheral module is a required module while developing applications with the BLDK. Along the connectors for power supply and core module headers, peripheral module contains a lot of different sensors, ICs, buttons, LEDs, etc.

Peripheral module datasheet can be found here: Peripheral module schematics (PDF)

Description of Components

This is a display of all the peripheral components located on the peripheral module:

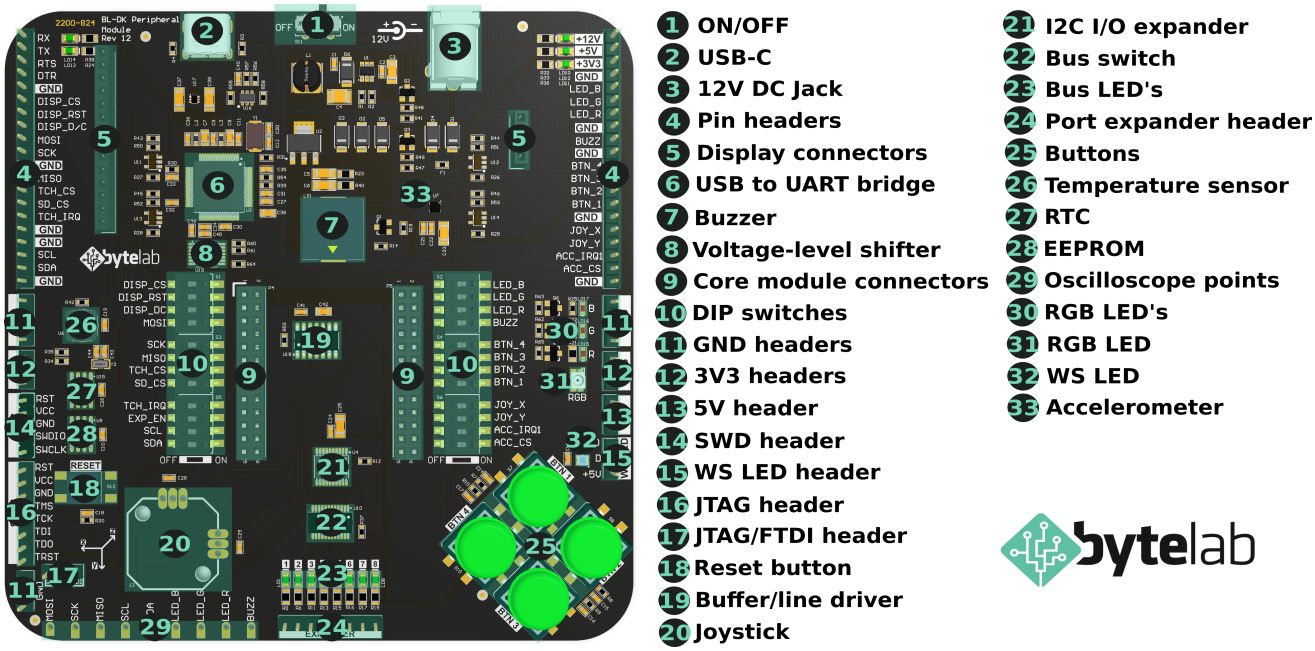

Fig. 1 *Peripheral module components*

The table below shows which component is connected over which interface with its description. Also, there is a link to their datasheets.

Component	Interface	Description	Datasheet
Display	SPI	144-color driver for LCD 320x240 liquid crystal display.	ILI9341
Touchscreen digitizer	I2C	Touch screen controller with a 12-bit 125 kHz A/D converter.	XPT2046
USB to UART	UART	USB to UART bridge with transfer rates up to 12 Mbaud.	FT2232HL
Buzzer	PWM	SMD piezoelectric buzzer.	PKLCS1212E4001-R1
Port expander	I2C	8-bit I/O expander.	PCF8574
Temperature and humidity sensor	I2C	Standard 1.5% RH and 0.1°C accuracy SHT sensor.	SHT31
RTC	I2C	Real-Time Clock optimized for low power consumption.	PCF8523
EEPROM	I2C	Serial Electrically Erasable and Programmable Read-Only Memory.	AT24C08C
Accelerometer	I2C, SPI	High performance three-axis linear accelerometer.	LIS2DH12TR
WS LED	SPI	Intelligent control of the LED light source.	WS2812B-2020
Buttons (4x)	GPIO	4 pull-down user buttons.	
RGB LED's	PWM, GPIO	Red, green and blue LED diodes.	

Component	Interface	Description	Datasheet

DIP switches

Every peripheral component on the board is connected to the core module pin headers, `P4` and `P5`, over the DIP switches. It is possible to connect or disconnect a peripheral component regarding the position of their corresponding DIP switch. If the switch is in position `ON` (right switch position), that means that the peripheral component is connected to te core module header. Similarly, if the switch is in position `OFF` (left switch position), the peripheral component is disconnected from the core module header.

Here is a example of how a peripheral component (button) is connected to the core module header over the DIP switch. Pin `13` on the `P5` core module header is connected to the `S2` DIP switches component over the `BTN1` node. The `S7` button component is connected to the `S2` DIP switches over the `BTN1_SW` node.

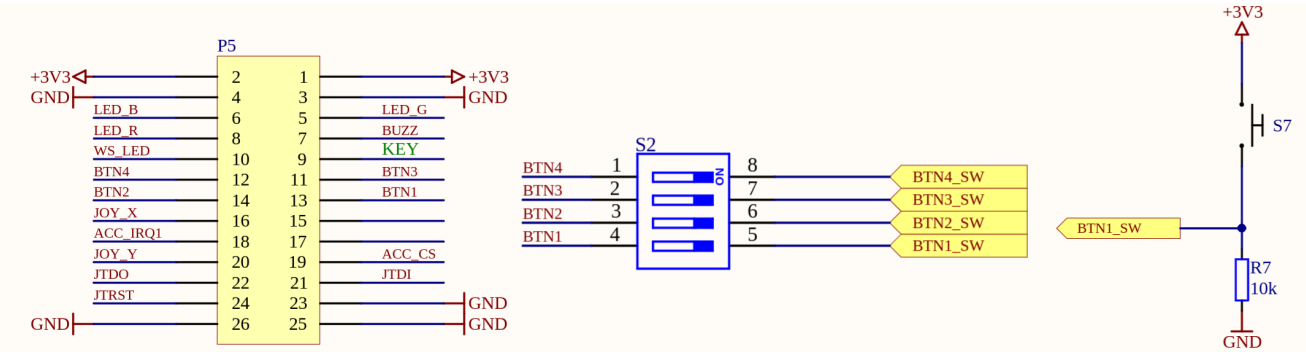

Fig. 2 *DIP switches example*

Note

`BTN1`, `BTN1_SW`, ... are called Net labels. Electrical connectivity between schematic component pins can be created by placing a wire between those pins. This is called physical connectivity since the pins are physically connected with a wire. Connectivity also can be created logically by using suitable net identifiers, such as net labels. As well as providing a human-friendly identifier for a net, a net label allows you to connect points on a circuit without actually physically wiring them together.

The difference between net labels with and without the `_SW` suffix is that label without that suffix marks the node that is connected directly to the core module header and the label with that suffix marks the node that is connecting the

peripheral components to the core module header over the DIP switches.

P1 and P2 pin headers

Pin headers `P1` and `P2` are located on the edge of the PCB. They are always connected to the core module, regardless of the DIP switches position. That means, a pin on the core module is always connected to the corresponding pin on the `P1` or `P2` pin header but the actual peripheral component can be disconnected by changing the position of the DIP switch.

DIP switch example above can be supplemented with the `P2` pin header. Pin `14` of the `P2` pin header is also connected to the `BTN1` node. So that means that the pin `14` is connected directly to the `P5` core module header and to the `S7` button component, but over the `S2` DIP switches.

Core modules

A core module is a hardware module that contains only the SoC from a certain manufacturer and pins compatible with the core module headers (P4 and P5) on the peripheral module.

Here is a list of all suported core modules:

- ESP32 core module
- nRF52 core module
- STM32 core module

ESP32 core module

ESP32 core module is based on the Espressif's ESP32 SoC. The ESP32 SoC's are widely acclaimed for their capabilities in the Internet of Things (IoT) and embedded system applications. The ESP32 combines a dual-core processor, Wi-Fi and BLE connectivity, a rich set of peripherals, and low power consumption, making it an ideal choice for a wide range of projects.

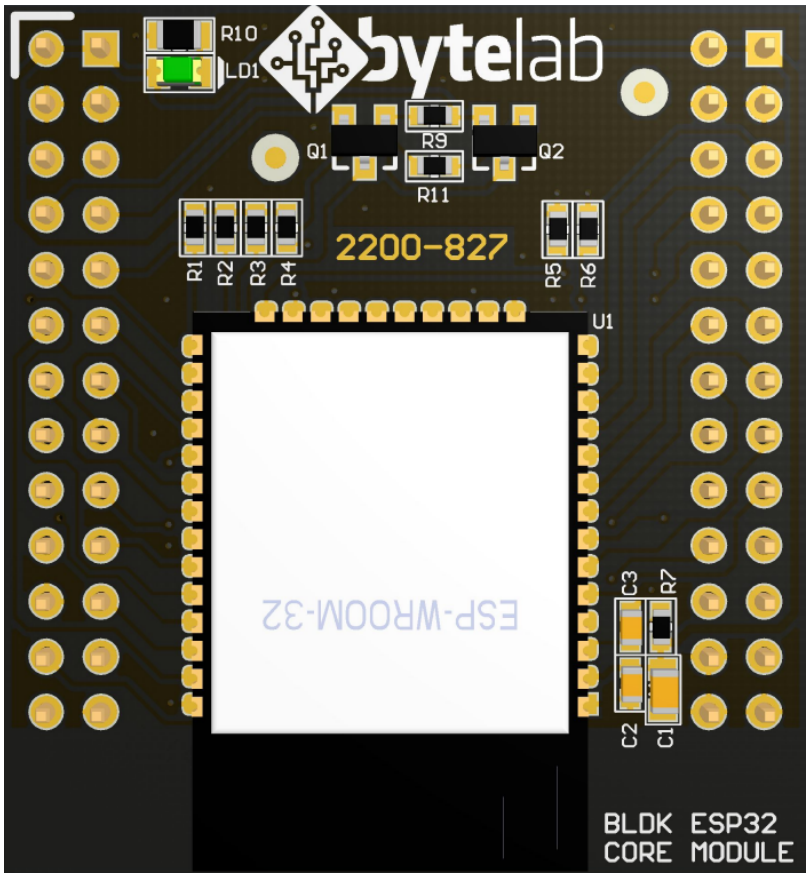

Fig. 3 *ESP32 core module*

ESP32 core module contains ESP32 SoC (with the antenna) and pins compatible with the core module headers located on the Peripheral module. Here is a display of the ESP32 core module:

Pin positions

This is a display of the ESP32 Core module pin positions on the `P1` and `P2` pin headers:

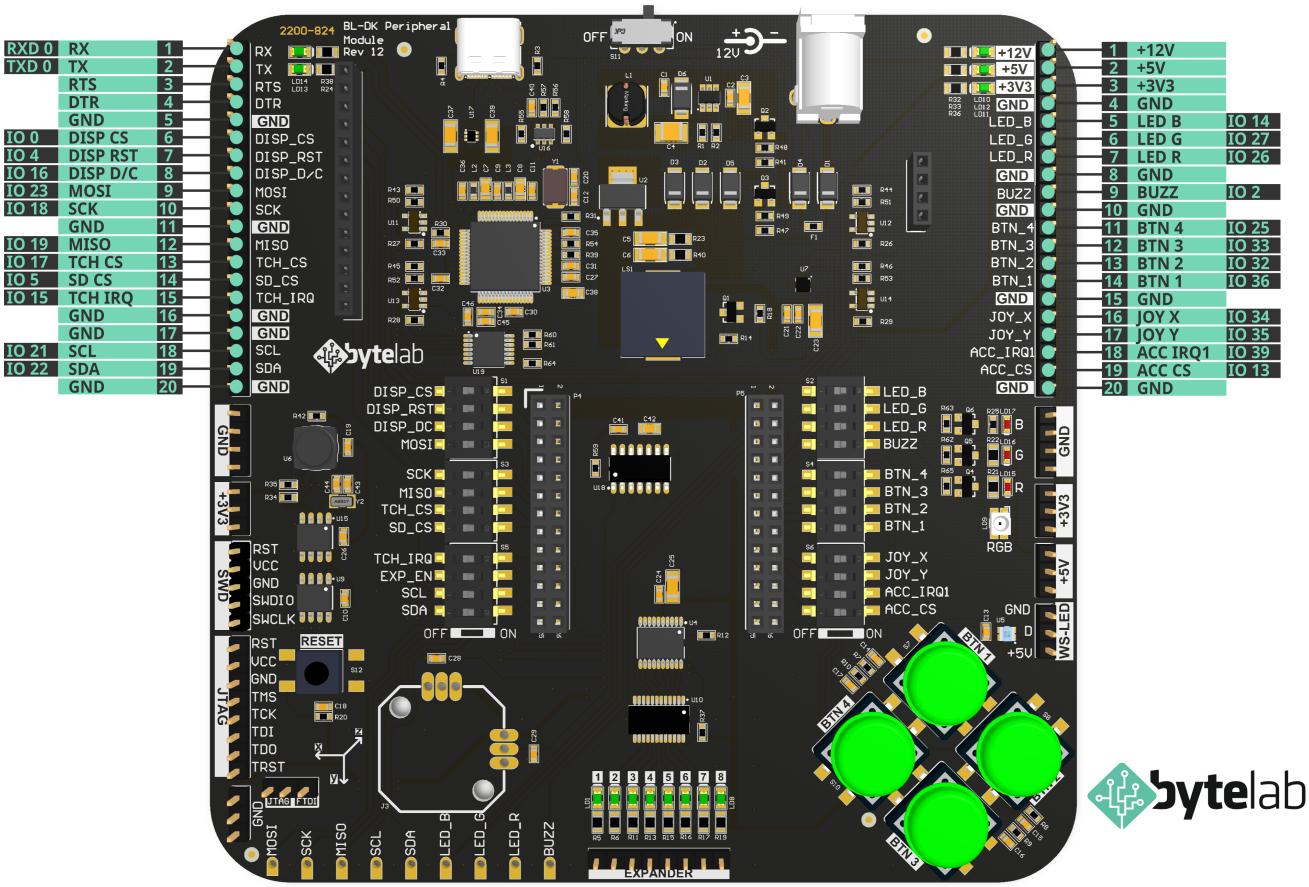

Fig. 4 *ESP32 Core module P1 and P2 pin headers*

Datasheet

Core module datasheet can be found here: ESP32 Core module schematics (PDF)

STM32 core module

STM32 core module is based on the STMicroelectronics's STM32 SoC. The STM32 SoC's are highly regarded in the embedded systems and microcontroller industry for their performance, versatility, and extensive peripheral support. The STM32 series features a wide range of ARM Cortex-M cores, providing options for various processing power requirements. STMicroelectronics provides an extensive software development ecosystem, including the STM32Cube software platform, making it easier for developers to create applications on STM32-based devices. Overall, the STM32 SoCs are a popular choice for embedded systems development due to their robust capabilities and extensive community support.

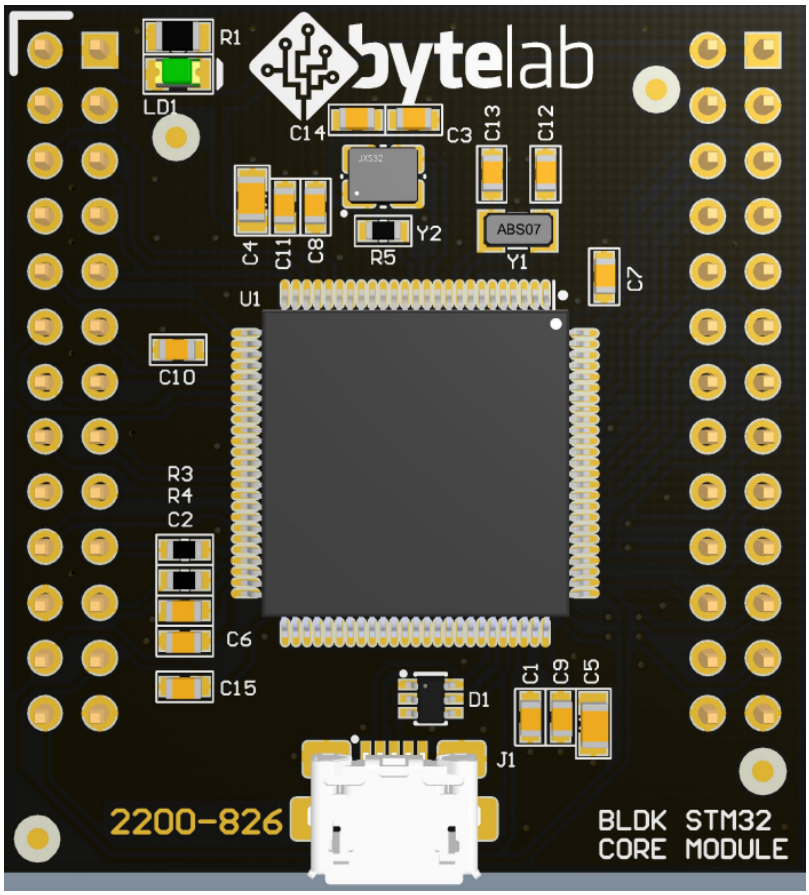

Fig. 5 *STM32 core module*

STM32 core module contains STM32 SoC, Micro USB port, and pins compatible with the core module headers located on the Peripheral module. Here is a display of the STM32 core module:

Pin positions

This is a display of the STM32 Core module pin positions on the `P1` and `P2` pin headers:

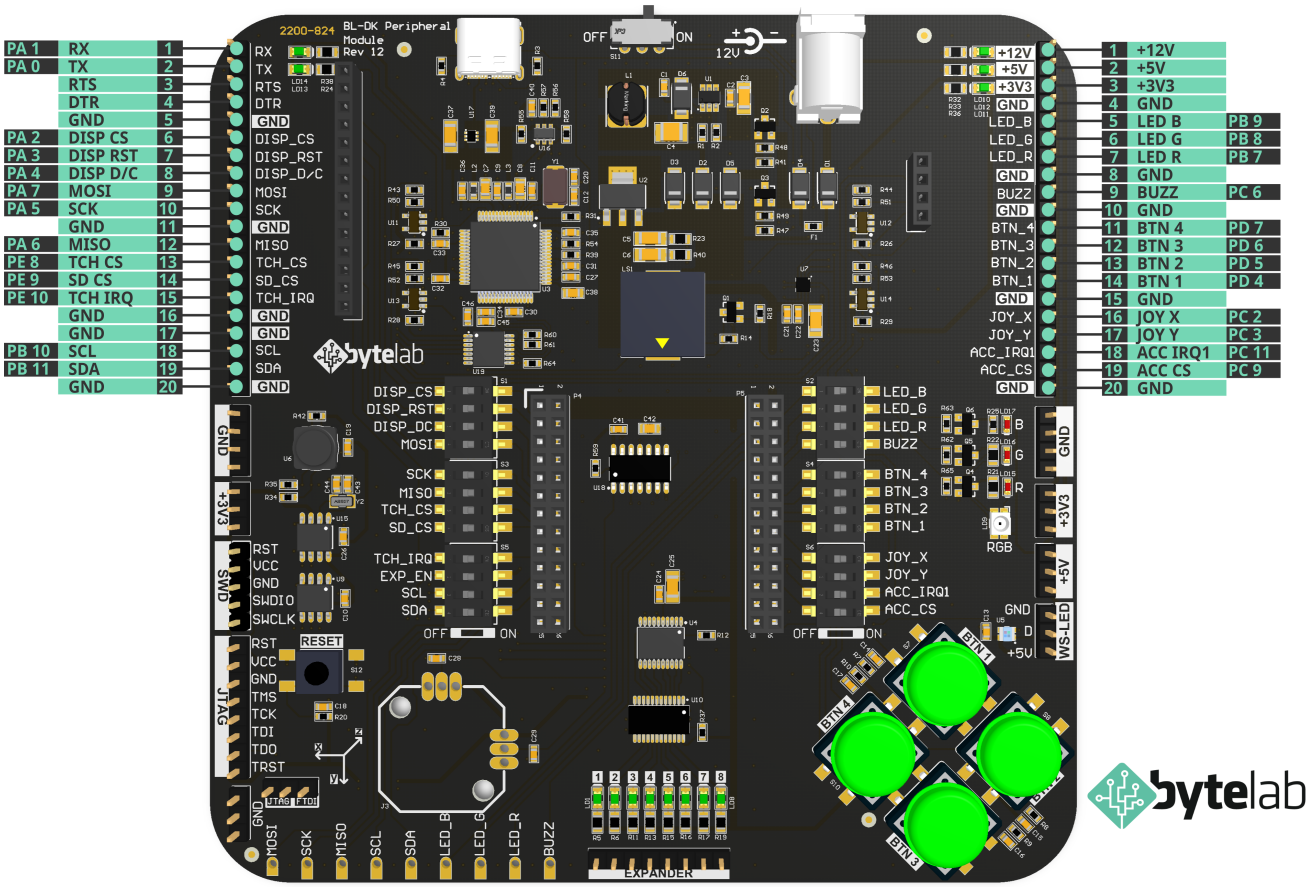

Fig. 6 *STM32 Core module P1 and P2 pin headers*

Datasheet

Core module datasheet can be found here: STM32 Core module schematics (PDF)

nRF52 core module

NRF52 core module is based on the Nordic Semiconductor's nRF52 SoC. The nRF52 Soc's are a family of Bluetooth Low Energy (BLE) microcontrollers. These SoCs are highly specialized for wireless communication applications, particularly in the realm of IoT and wearable devices. The nRF52 series boasts an energy-efficient ARM Cortex-M4 processor and a powerful radio transceiver, making it ideal for applications requiring low power consumption and wireless connectivity. Nordic Semiconductor provides comprehensive development tools and a software development kit (SDK) that simplifies the creation of Bluetooth-enabled products. With its compact size, low energy consumption, and robust wireless capabilities, the nRF52 SoC has gained popularity in various industries where Bluetooth connectivity is a crucial component.

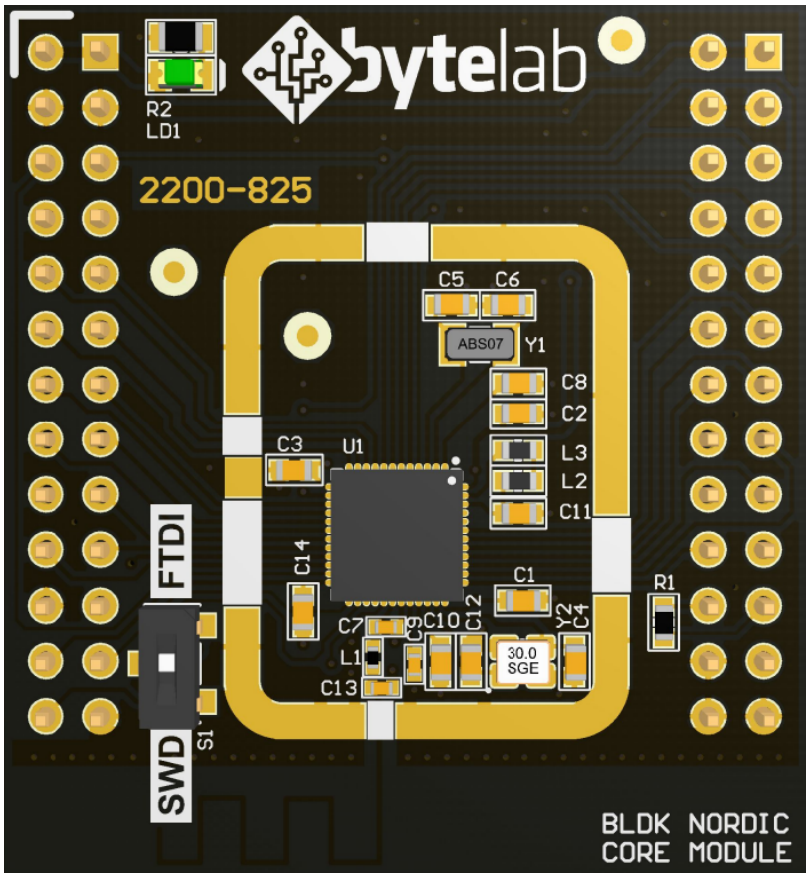

Fig. 7 *nRF52 core module*

NRF52 core module contains nRF52 SoC (with the antenna), FTDI/SWD switch for the internal/external debugging and pins compatible with the core module headers located on the Peripheral module. Here is a display of the nRF52 core module:

Pin positions

This is a display of the nRF52 Core module pin positions on the `P1` and `P2` pin headers:

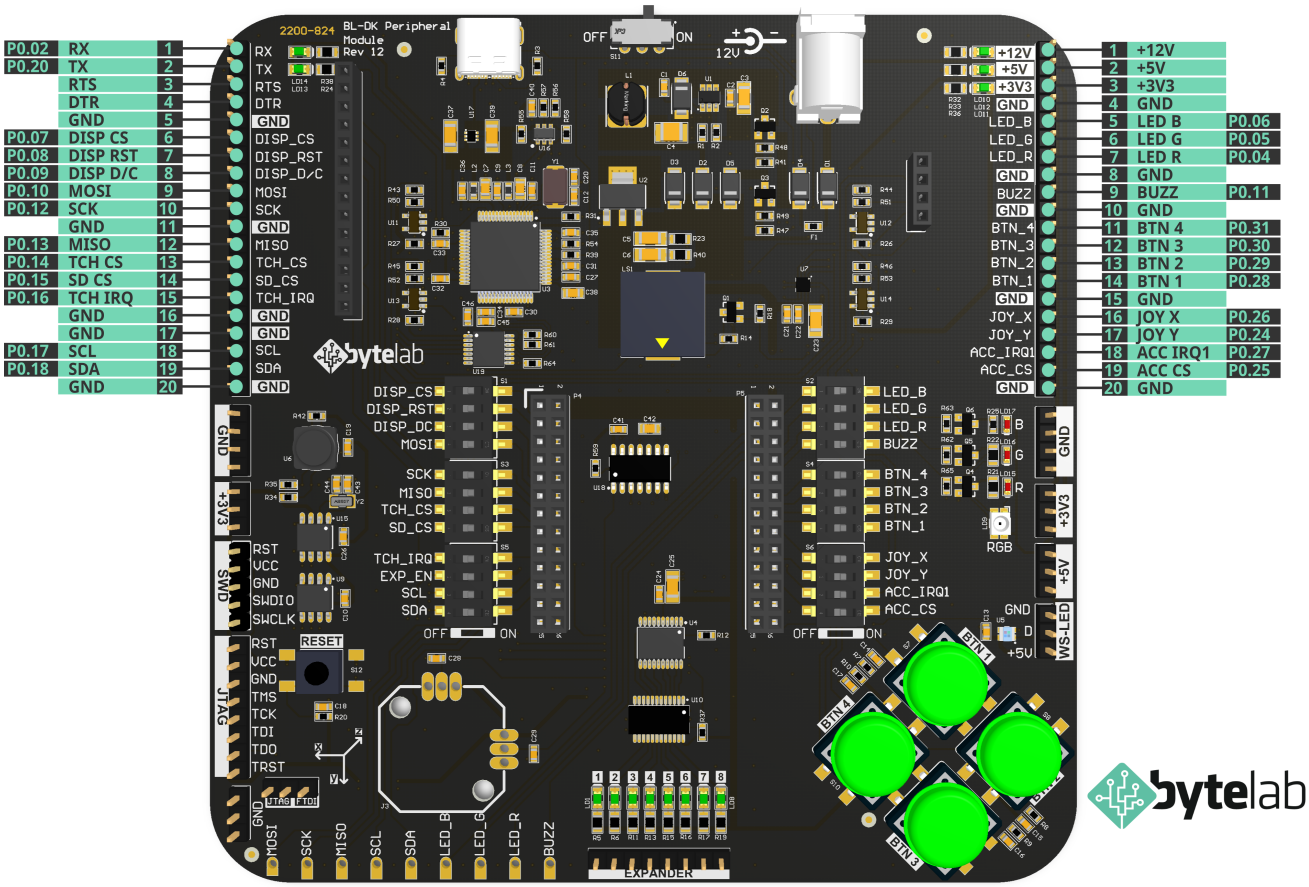

Fig. 8 *nRF52 Core module P1 and P2 pin headers*

Datasheet

Core module datasheet can be found here: nRF52 Core module schematics (PDF)