BLE DEV.N R3

User manual

June 30, 2014 v1.0

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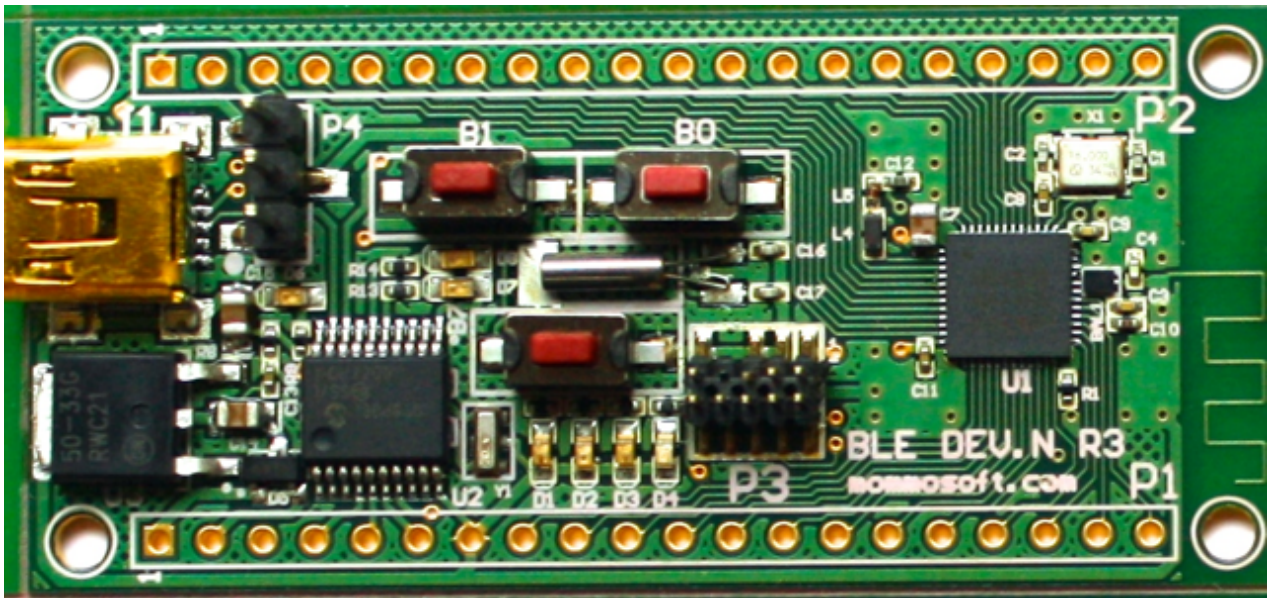
Board Overview

The nRF51822 development board is a low-cost development platform for Nordic's ARM® Cortex™ - M0-based microcontroller nRF51822.

The main purpose of the board is to accelerate designing, debugging and testing of software applications based on nRF51822.



Development board set contents

The nRF51822 development board set contains the following items:

- nRF51822 development board
- 2 x 20 single row pin headers (2.54mm pitch)
- Battery holder CR1216

Using the nRF51822 development board

The recommended steps for using the nRF51822 development board are:

- Put the nRF51822 development board on your favorite breadboard
- Connect the other necessary elements from your project to board by cables
- Connect the nRF51822 development board to PC by USB mini cable. If this is the first connection to PC you will be asked to install the driver for MCP2200 - Microchip's USB-to-UART serial converter embedded into the board. Usually the installation is automatic. Just in case this is the MCP2200 driver.
- Program and debug using Programmer/Debugger and IDE

Features

The nRF51822 development board includes the following features:

- nRF51822 - Bluetooth low energy and 2.4GHz proprietary SoC – U1
- USB mini-B connector for USB device – J1
- Red, Green, Blue and Yellow user LEDs – D1, D2, D3 and D4
- Three user buttons – B0, B1 and B7
- All SoC port pins brought out to headers on a 0.1-in (2.54-mm) grid
- The programming and debugging (SWD) interface P3. The development board is tested with Programmer/Debugger J-Link LITE ARM.
- power sources:
  - USB device – +5V
  - Vin - external source – from 4.8V to 30V
  - +3.3V - external source +3.3V stabilized
- MCP2200 – additional debugging interface ("printf", etc.)
- Preloaded quick start application "blinky"
- Supports all Nordic's software and examples

Specifications

Parameter		Value
Board supply voltage		4.8V to 30V
Board supply current	1 LED on	~5mA
	+ LED on	+ 5mA per LED
Dimensions	board	61mm x 27mm
	holes	2200mils(55.88mm) x 900mils(22.86mm)

Hardware Description

The block diagram in Figure 2-1 shows the main peripheral features of the development board. This chapter describes how these peripherals operate and interface to the microcontroller.

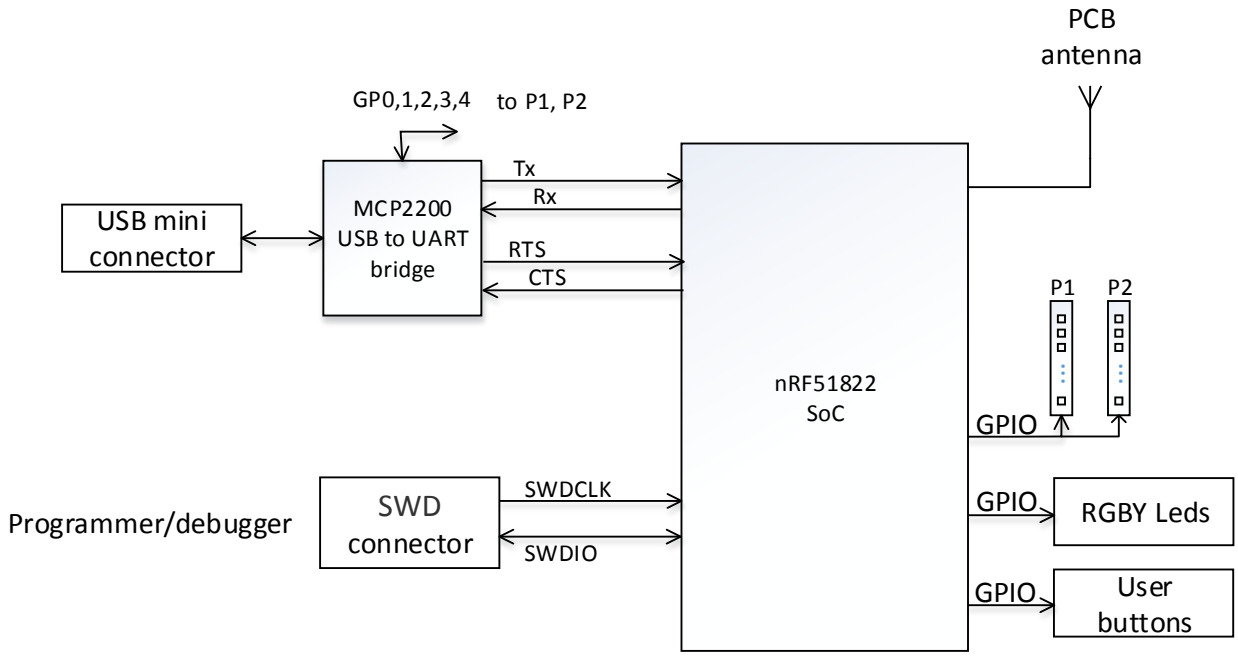


Figure 0-1

Functional description

Microcontroller

The development board is based on Nordic's nRF512822 SoC – an ultra-low power 32-bit ARM Cortex-M0-based microcontroller with 256-KB Flash memory, 16-KB SRAM, 16-MHz operation and a wide range of other peripherals. See the nRF51822 link for complete device details.

All of the microcontroller port pins are routed to 0.1-in (2.54-mm) pitch connectors P1 and P2. An internal multiplexer allows different peripheral functions to be assigned to each of these GPIO pins. When adding external circuitry, consider the additional load on the evaluation board power rails.

The nRF51822 microcontroller is factory-programmed with a quickstart demo program "blinky". The quickstart program resides in on-chip Flash memory and runs each time power is applied, unless the quickstart application has been replaced with a user program.

USB Device

The development board includes a USB mini-B connector to allow for USB 2.0 device operation. The Microchip's MCP2200 USB to UART bridge is used to make connection between SoC and PC.

The GPIO pin P0.17 is used to send data from SoC to bridge and P0.16 is used to send data from bridge to SoC. The GPIO pins P0.18 and P0.19 are connected to RTS and CTS in case of using hardware flow control. To use this feature the user has to make proper peripheral configuration during initialization process.

If the user wants to use these pins for other purposes he may cut the connections by special cut places in the bottom side of the circuit board or to configure some of these pins

like inputs during configuration of MCP2200. The Tx pin (P0.16) can't be configure like input.)

The bridge MCP2200 has GPIO pins that can be configured from PC and used for debugging purposes. They are connected to the connectors as follows:

MCP2200 GPIO pin	Header pin
GP0	P1 - 6
GP1	P1 - 5
GP2	P1 - 4
GP3	P2 - 1
GP4	P2 - 2

User switches and user LEDs

The nRF51822 development board comes with Red, Green, Blue and Yellow LEDs. These LEDs can be configured for use in custom user applications. They are connected to the following GPIO pins by cutting places:

LED	**GPIO pin**	**Color (*)**
D1	P0.08	Blue
D2	P0.09	Green
D3	P0.10	Yellow
D4	P0.15	Red

(*) the color may vary

Three user buttons are included on the board. The user buttons can be configured for use in custom user applications. They are connected to the following GPIO pins by cutting places:

Button	**GPIO pin**
B0	P0.00
B1	P0.01
B7	P0.07

If the user wants to use these pins for other purposes he may cut the connections by the cutting places.

These way connected LEDs and buttons corresponds to most used LEDs and buttons in Nordic's SDK examples. So the examples will work on this board without any changes. The only exception is pull up configuration for buttons – in file "nrf6310.h" the NRF_GPIO_PIN_NOPULL define must be changed to NRF_GPIO_PIN_PULLUP.

The evaluation board also has a green power LED.

Headers

There are two rows of 20 holes on the board. They form connectors labeled P1 and P2. The set contains two 20 pin headers that can be soldered to these connectors. This is useful for working with breadboards or for stacking.
The connector P3 is for programming / debugging by SWD interface.

VTG	1	2	SWDIO
GND	3	4	SWDCLK
GND	5	6	NC
NC	7	8	NC
GND	9	10	NC

The connector P4 is for cutting SoC power and doing hardware reset (nRF51822 has not reset pin during debugging).

Power Management

Power Supplies

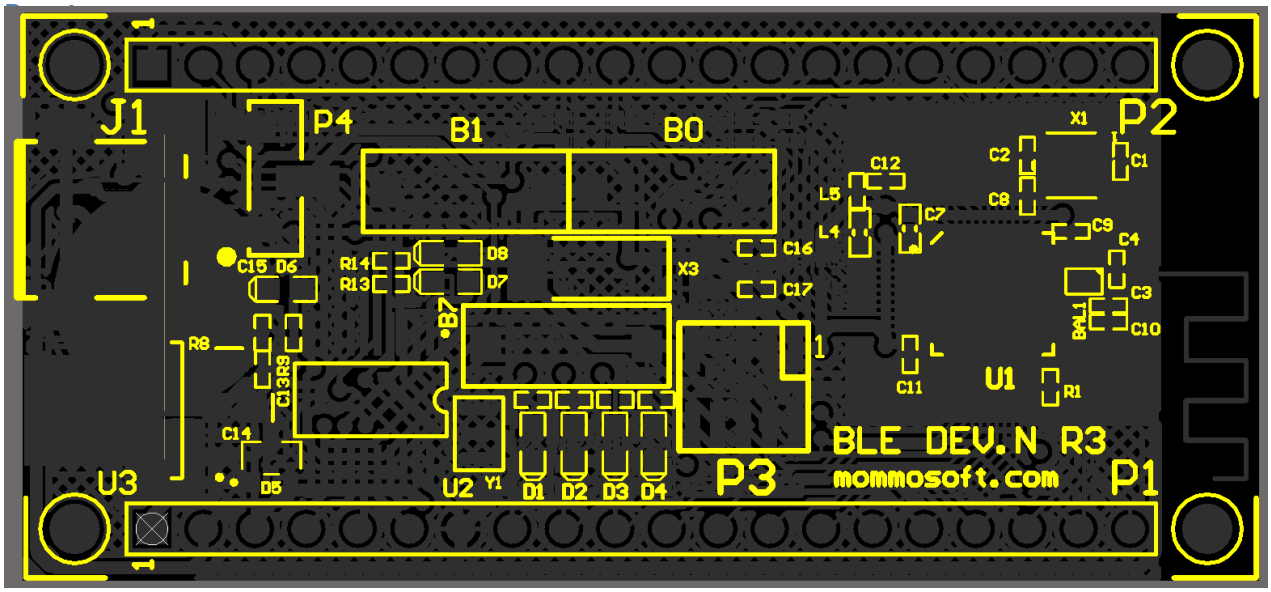
The power supply scheme is:**Error! Reference source not found.**.

The LP2950 is used to stabilize the voltage to 3.3V - the supply voltage for SoC nRF51822.
The nRF51822 development board can be supplied with power by 4 sources:

- USB – when the development board is connected to USB port by cable. +5V from Vbus is used as power source for development board. Keep in mind that usually the normal USB port provides up to 100mA.
- Vin – this can be any external unstabilized or stabilized DC voltage source. The voltage must be between 4.3V and 30V. If the development board is connected to USB port or has power +5V and the voltage applied to Vin is >5V the board will be powered by Vin. If Vin is <5V - the board will be powered by USB or +5V;
- +5V - this is the Vbus from USB. The user can use this pin to power other elements with +5V. If there is not connection with USB this pin is equal to Vin and can be used to power the board in same way.
- +3.3V – this is the output LP2950. The user can use this pin to power other elements with +3.3V. If no other power sources connected to board this pin can be used to power the board with +3.3V from external stabilized source.

Clocking

The development board uses a 16.0-MHz crystal and 32.768 kHz crystal (pin 14 (P0.27) and pin 15 (P0.26)). The 32.768 kHz crystal is connected to pins 14 (P0.27) and 15 (P0.26) by cutting places on bottom side of the board.



As it is described in "nRFF51 Series Reference Manual" the pins SWDIO and nRESET share the same physical pin. This means that in Debug mode the only way for full reset is removing and re-applying voltage to the chip. This can be done by removing jumper from connector P4 and putting it back.

Debugger Interface (DIF)

The programming/debugging of SoC can be done by Serial wire Debug (SWD) interface (connector P3).

Software Development

Software Description

The nRF51822 development board is factory programmed with:

- s110_nrf51822_6.0.0_softdevice.hex from the Nordic's SDK;
- bootloader from nrf51_sdk_v5_2_0_39364 – configuration "dfu_dual_bank_hci";
- blinky example from nrf51_sdk_v5_2_0_39364 – programmed to board using bootloader.

Source Code

Tool Options

Programming the nRF51822 development board with user code

Follow the next easy steps:

1) compile the user code -> name.hex;
2) start "nRFgo Studio";
3) in "Device manager" section choose "nRF51 Bootloader";
4) Browse the file name.hex;
5) Select COM port;
6) Select baudrate 38400;
7) Check "Use flowcontrol";

8) Press “Program”;
9) Press button B7, remove jumper, put jumper back, release B7 – the LED D4 must lit (Bootloader is active);
10) Press OK

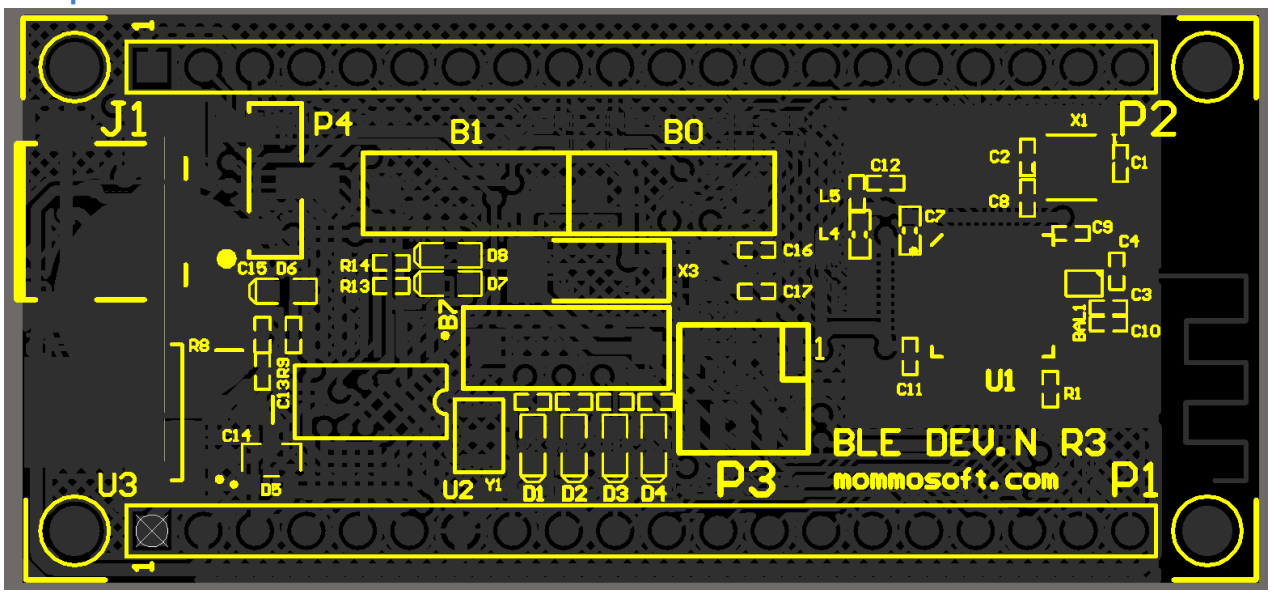
References, PCB Layout, and Bill of Materials

References

The following useful references are available for download:

- nRF51822 overview;
- other useful downloads from Nordic
- Microchip's MCP2200 USB-to-UART serial converter
- voltage regulator LP2950

Component Locations



Schematics