



nRF51822 mbed Kit

nRF51822-mKIT

User Guide v1.0

1 Introduction

The nRF51822 mbed kit is a stand-alone platform for rapid prototyping of *Bluetooth*® Smart designs with the nRF51822 SoC. The mbed kit gives access to all GPIO pins through pin headers and incorporates a coin-cell battery holder for portability enabling in-situ evaluation and test.

1.1 Minimum requirements

- Computer with a USB port

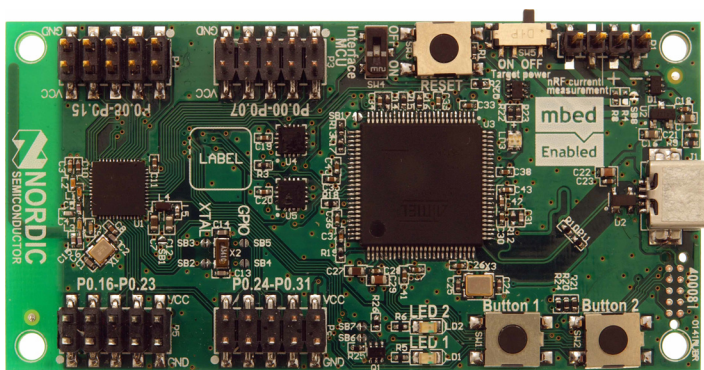
1.2 nRF51822 mbed kit release notes

Date	Kit version	Description
April 2014	1.0	• First release

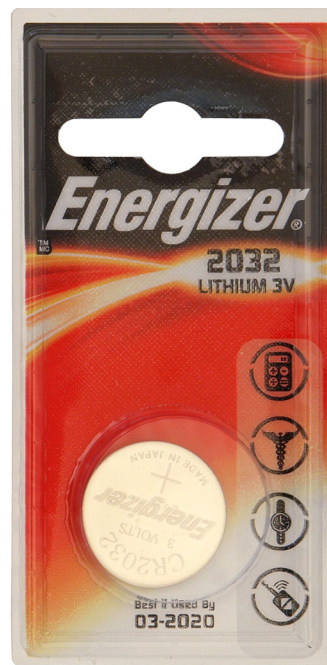
2 Kit content

The nRF51822 mbed kit consists of hardware and access to software components, documentation, and design files from www.mbed.org or www.nordicsemi.com.

2.1 nRF51822 mbed kit hardware content



1 x nRF51822 mbed kit board (PCA10024)



1 x Lithium 3 V battery

Figure 1 nRF51822 mbed kit hardware content

2.2 Downloadable content

The nRF51822 mbed kit includes access to the mbed online toolchain and source code, documentation, hardware schematics, and layout files. To access this information, go to www.mbed.org or www.nordicsemi.com.

2.2.1 nRF51822 documentation

- *nRF51822 mbed Kit User Guide*
- *nRF51 Series Reference Manual*
- *nRF51822 Product Specification*
- *S110 nRF51822 SoftDevice Specification*
- *nRF51822 Product Anomaly Notification*

2.2.2 Schematics, Bill of Materials, PCB layout files, and production files

The ZIP file and its subdirectories contain the hardware design files for the mbed kit.

- Altium Designer files
- Schematics
- PCB layout files
- Production files
 - Assembly drawings
 - Drill files
 - Gerber files
 - Pick and Place files
 - Bill of Materials

3 Getting started

This section shows you how to get access to the mbed web site, tools, libraries, and documentation.

Connect your nRF51822 mbed kit to a computer.

1. Connect your mbed kit to a computer with a USB cable.
2. The status light (**LD3**) will come on, indicating it has power.
3. After a few seconds, the computer will recognize the mbed microcontroller as a standard USB drive.

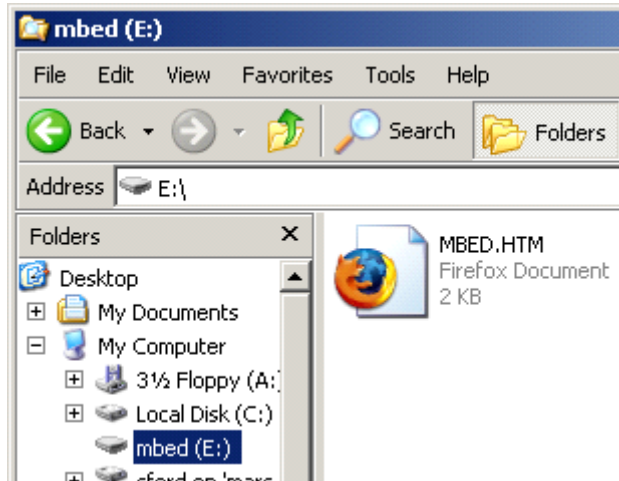


Figure 2 Windows example

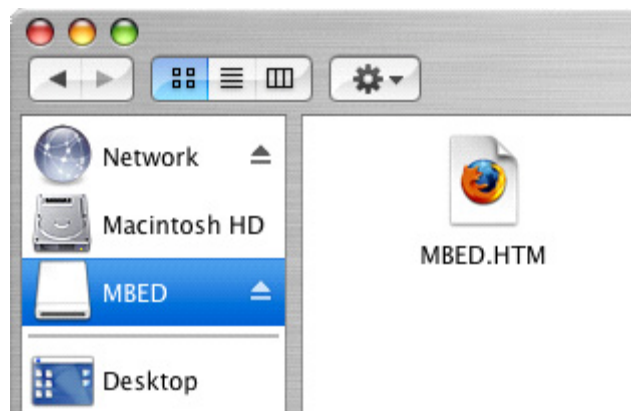


Figure 3 MAC OS example

Click the MBED.HTM file to log in.

1. Go to the new USB Drive and click **MBED.HTM** to open it in a web browser.
2. If you do not have an mbed account, click **Signup** to create your mbed account. Otherwise, log in with your normal username and password. This will give you access to the website, tools, libraries, and documentation.

4 Hardware description

The nRF51822 mbed kit board (PCA10024) is a standalone mbed enabled development board. The board is delivered with an unprogrammed nRF51822 chip.

4.1 Key features

The mbed kit board has the following key features:

- nRF51822 System on Chip combining *Bluetooth* v4.1-compliant 2.4 GHz multiprotocol radio and ARM® Cortex®-M0 processor on a single chip optimized for ultra-low power operation.
- 31 GPIOs accessible on pin headers.
- USB drag and drop programming.
- USB virtual COM port for serial terminal.
- CMSIS-DAP interface for programming and debugging from offline tools.
- Accepts power through:
 - USB
 - External source
 - Single 2032 coin-cell battery, onboard battery holder
- Pin header for current measurement.

4.2 Hardware figures

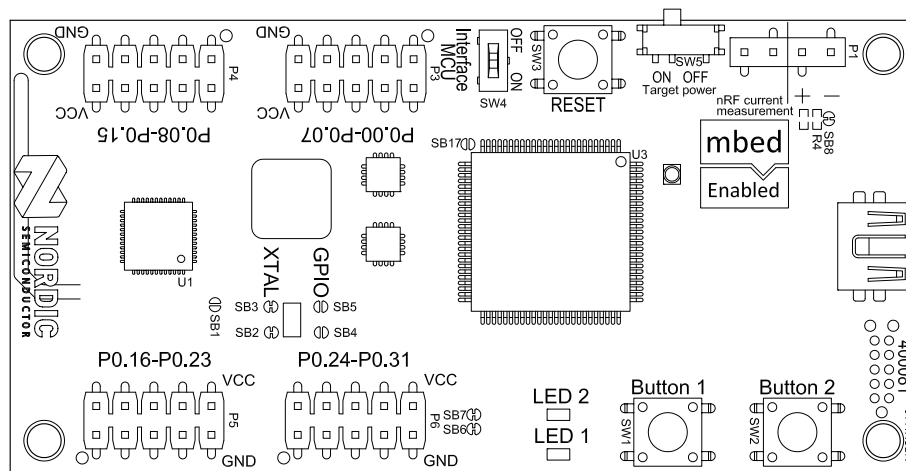


Figure 4 mbed kit board top

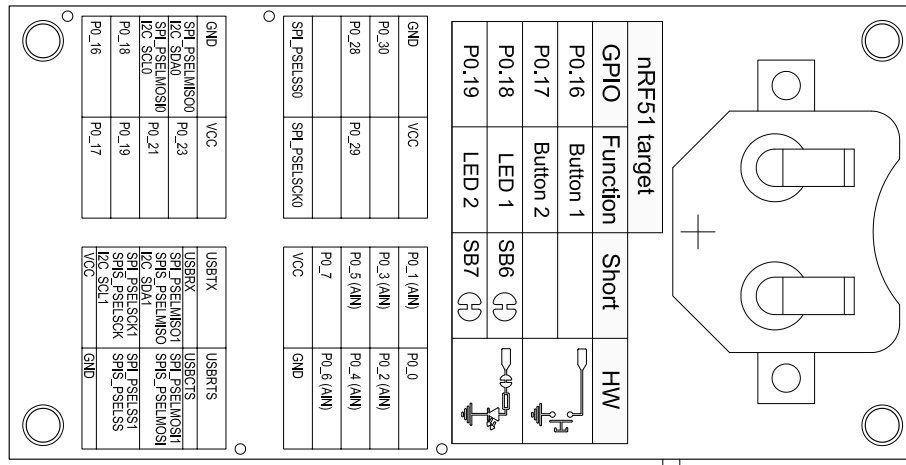


Figure 5 mbed kit board bottom

4.3 nRF51822 reset

The Reset button (**SW3**) is connected to the Interface MCU, therefore the mbed kit board needs to be powered through USB and the Interface MCU switch (**SW4**) must be switched to **ON** in order to reset the nRF51822 chip by pressing the reset button.

When the mbed kit board is powered through external power or a CR2032 battery, cycling the Target power (**SW5**) will result in a power on reset.

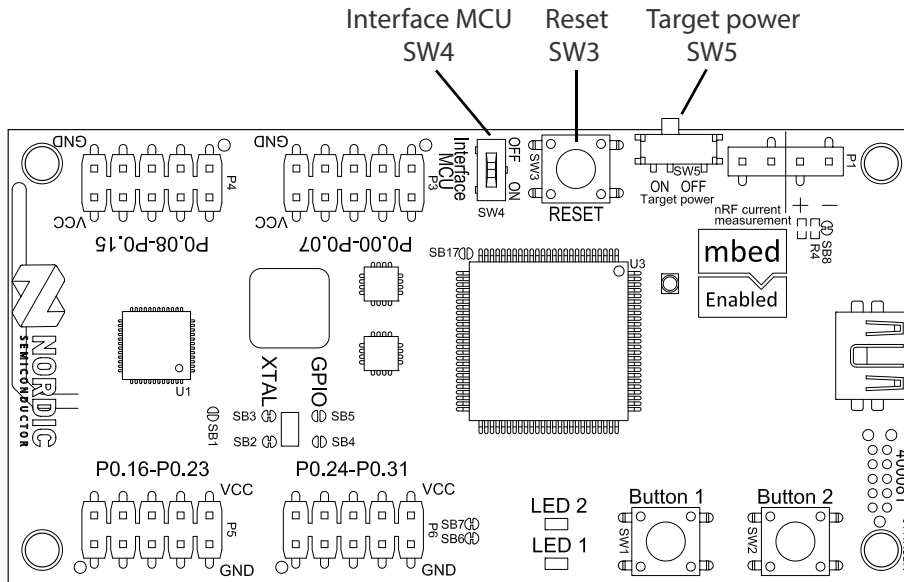


Figure 6 mbed kit board switches

4.4 Power supply

The mbed kit board has several power options as seen in *Figure 7* and *Figure 8*.

- USB
- External power supply through **P1** (1.8 V to 3.6 V)
- CR2032 coin cell battery

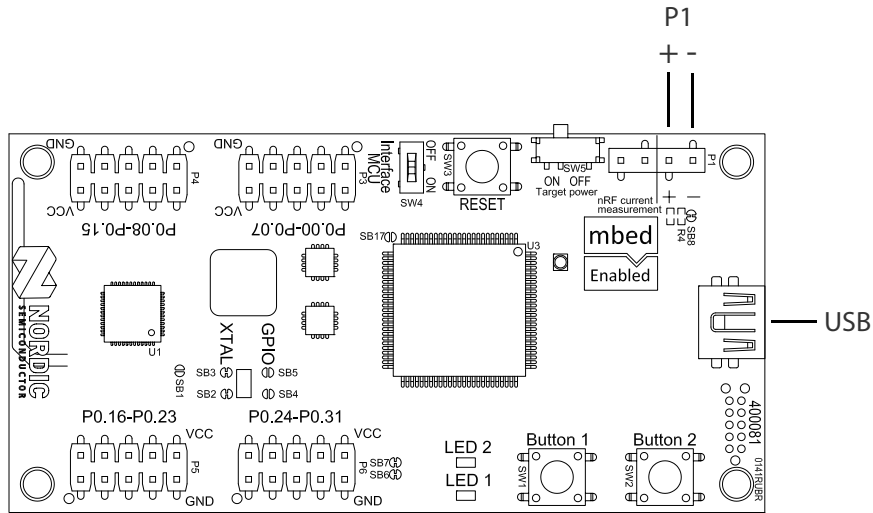


Figure 7 USB and external power supply

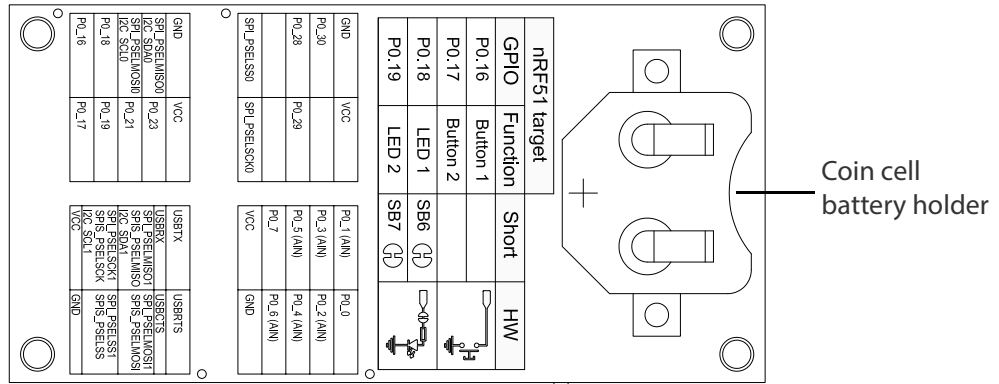


Figure 8 Coin cell battery supply

The 5 V from the USB is regulated down to 3.3 V through an on-board voltage regulator. The battery and external power supply are not regulated. The power sources are routed through a set of diodes (D1A, D1B, and D1C) where the circuit is supplied from the source with the highest voltage.

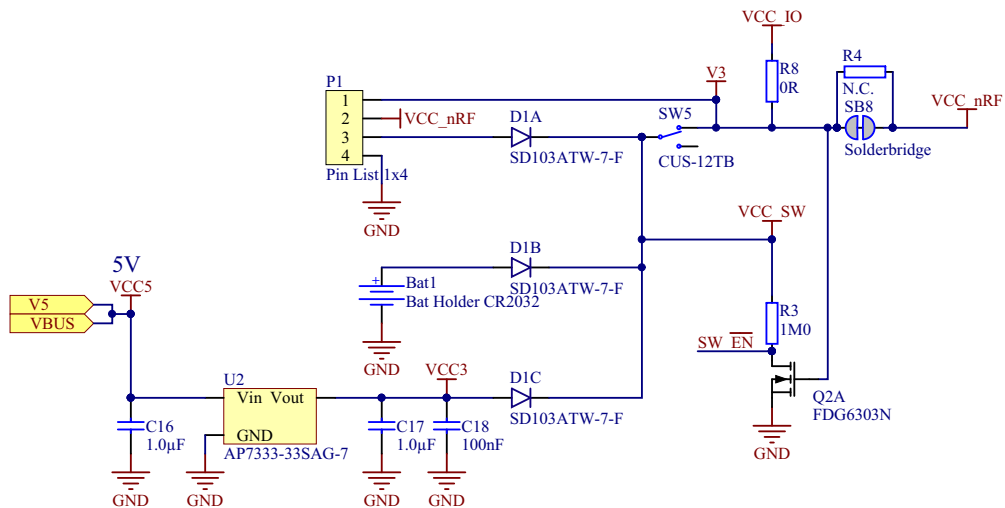


Figure 9 Power supply circuitry

4.5 Interface MCU disconnect

The Interface MCU circuit on the mbed kit board only works when the board is powered through the USB connector. To ensure that the Interface MCU will not hold any of the SWD or UART lines while powered down, the SWD lines will be disconnected automatically when the USB cable is unplugged. However, to disconnect the lines manually, the board is equipped with a switch (**SW4**) that disconnects the lines even if the board is powered through the USB, see **Figure 10**.

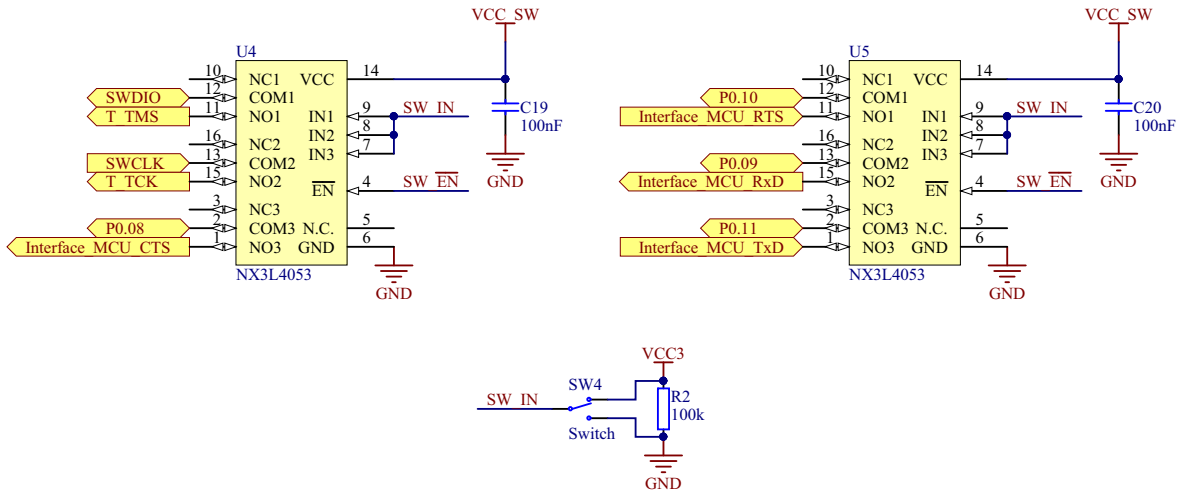


Figure 10 Interface MCU disconnect logic

Note: When using the Interface MCU to program, debug, or enable UART on the nRF51822 chip, you must switch **SW4** to **ON**.

4.6 GPIO interface

Access to the nRF51822 GPIOs is available at connectors **P3**, **P4**, **P5**, and **P6** on the mbed kit board.

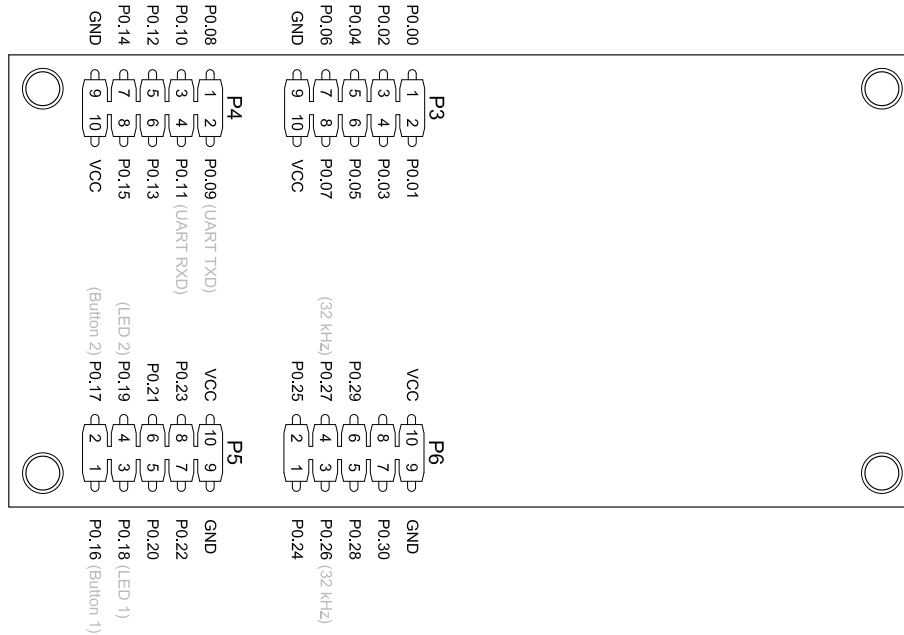


Figure 11 GPIO pin headers

Note: Some pins have default settings.

- P0.26 and P0.27 are by default used for the 32 kHz crystal and are not available on the P6 connector. Please see **Section 4.8 “32.768 kHz crystal”** on page 13 for more information.
- P0.16, P0.17, P0.18, and P0.19 are by default connected to the buttons and LED. Please see **Section 4.7 “Buttons and LEDs”** on page 12 for more information.
- P0.09 and P0.11 are by default used by the UART. Please see **Section 4.9 “UART configuration”** on page 13 for more information.

4.7 Buttons and LEDs

The two buttons and two LEDs on the mbed kit board are connected to dedicated I/Os on the nRF51822 chip. The connections are shown in *Table 1*.

Part	GPIO	Short
Button 1	P0.16	
Button 2	P0.17	
LED 1	P0.18	SB6
LED 2	P0.19	SB7

Table 1 Button and LED connection

If GPIO P0.18 and P0.19 are needed elsewhere, the LEDs can be disconnected by cutting the short on **SB6** and **SB7**, see *Figure 12*.

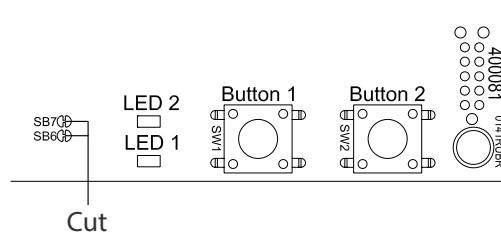


Figure 12 Disconnecting the LEDs

The buttons are active low meaning the input will be connected to ground when the button is activated. The buttons have no external pull-up resistor, so to use the buttons the P0.16 and P0.17 pins must be configured as an input with internal pull-up resistor.

The LEDs are active high, meaning that writing a logical one ('1') to the output pin will light the LED.

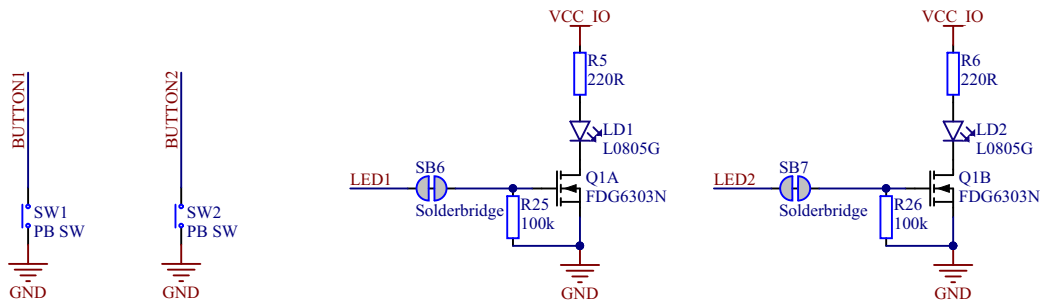


Figure 13 Button and LED configuration

4.8 32.768 kHz crystal

nRF51822 can use an optional 32.768 kHz crystal (X2) for higher accuracy and lower average power consumption. On the mbed kit board, P0.26 and P0.27 are by default used for the 32.768 kHz crystal and are not available as GPIOs on the P6 connector.

If P0.26 and P0.27 are needed as normal I/Os the 32.768 kHz crystal can be disconnected and the GPIO routed to the P6 connector. Cut the shorting track on **SB2** and **SB3**, and solder **SB4** and **SB5**. See *Figure 14* for reference.

Note: The 32.768 kHz crystal has to be selected for the *Bluetooth* examples included in the SDK to work.

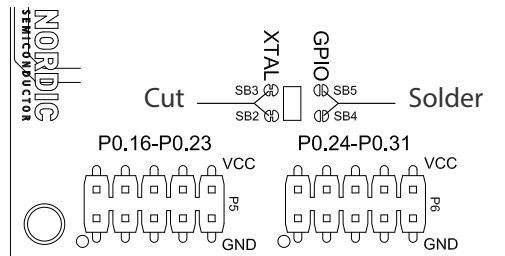


Figure 14 Disconnecting 32.768 kHz crystal and connecting P0.26 and P0.27 to P6

4.9 UART configuration

Table 2 shows an overview of the UART connections on nRF51822 and the Interface MCU.

nRF51822		Interface MCU
Default GPIO	UART	UART
P0.09	TXD	RXD
P0.11	RXD	TXD

Table 2 Relationship of UART connections on nRF51822 and Interface MCU

4.10 Measuring current

The current drawn by the nRF51822 device can be monitored on the mbed kit board. To measure the current, you must first prepare the board by cutting the shorting of solder bridge **SB8**.

There are two ways of measuring the current consumption:

1. Connect an ampere-meter between pin 1 and pin 2 of connector **P1**. This will monitor the current directly.

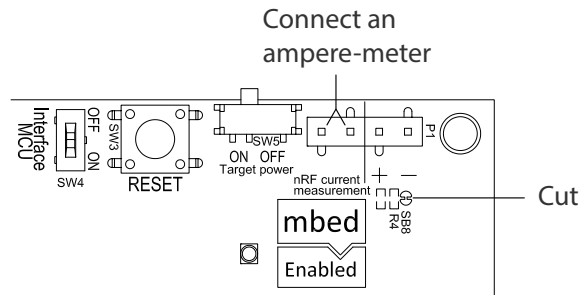


Figure 15 Current measurement with ampere-meter

2. Mount a resistor on the footprint for **R4**. The resistor should not be larger than 10 Ω . Connect an oscilloscope or similar with two probes on pin 1 and pin 2 on the **P1** connector and measure the voltage drop. The voltage drop will be proportional with the current consumption. For example, if a 1 Ω resistor is chosen, 1 mV equals 1 mA.

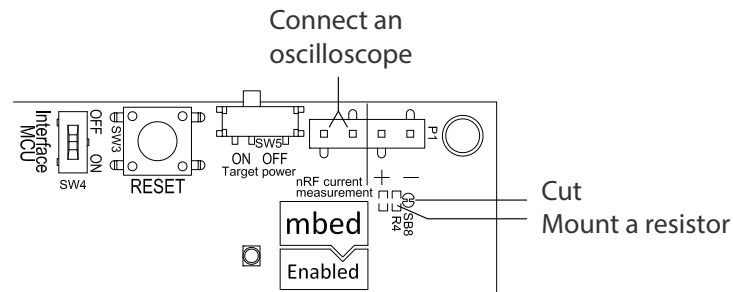


Figure 16 Current measurement with serial resistor and oscilloscope

Note: When measuring ultra-low power (μA level) **SW4** should be switch off to have accurate current measurement.

5 Troubleshooting

The Interface MCU serial port is not working.

In order to use the USB to UART bridge in Windows, make sure that you have the mbed Windows serial port driver installed and that the Interface MCU switch (**SW4**) is set to **ON**.

Reset button is not responding.

See *Section 4.3 "nRF51822 reset"* on page 7.

Liability disclaimer

Nordic Semiconductor ASA reserves the right to make changes without further notice to the product to improve reliability, function or design. Nordic Semiconductor ASA does not assume any liability arising out of the application or use of any product or circuits described herein.

Life support applications

Nordic Semiconductor’s products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Nordic Semiconductor ASA customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Nordic Semiconductor ASA for any damages resulting from such improper use or sale.

Contact details

For your nearest distributor, please visit <http://www.nordicsemi.com>. Information regarding product updates, downloads, and technical support can be accessed through your My Page account on our homepage.

Main office: Otto Nielsens veg 12
7052 Trondheim
Norway
Phone: +47 72 89 89 00
Fax: +47 72 89 89 89

Mailing address: Nordic Semiconductor
P.O. Box 2336
7004 Trondheim
Norway



ARM statement

Keil, µVision, and Cortex are trademarks of ARM Limited. All other brands or product names are the property of their respective holders.

Revision history

Date	Version	Description
April 2014	1.0	First release