

## Getting started with X-NUCLEO-IDB05A2 BLE expansion board based on the BlueNRG-M0 module for STM32 Nucleo

### Introduction

The X-NUCLEO-IDB05A2 Bluetooth low energy expansion board is based on the BlueNRG-M0 BLE network processor module.

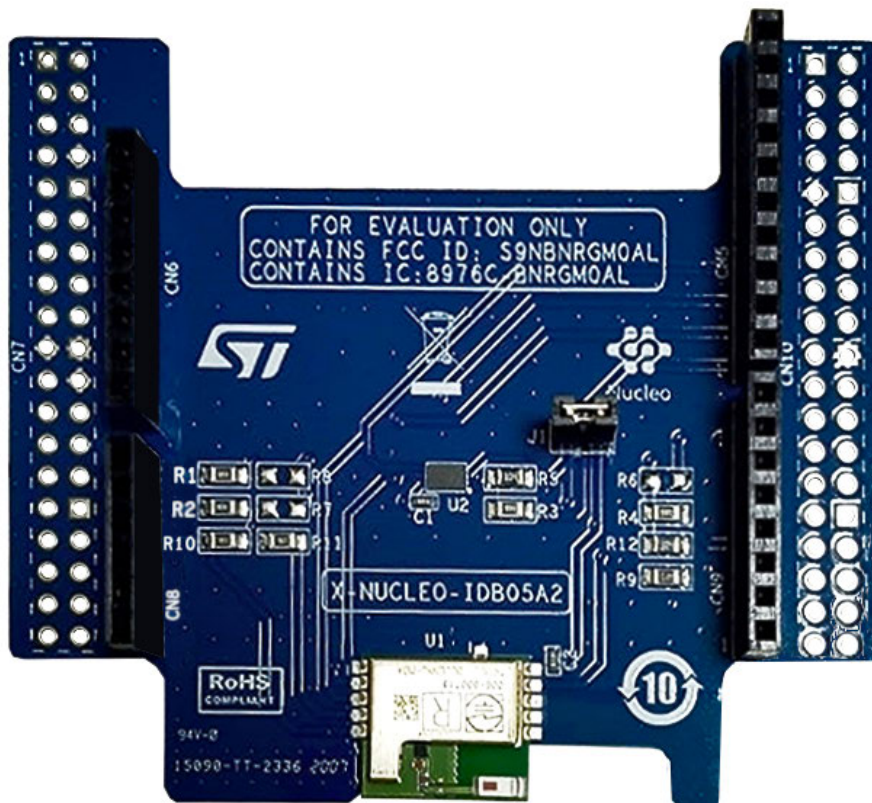
The BlueNRG-M0 is Bluetooth v4.2 compliant, FCC and IC certified (FCC ID: S9NBNRGM0AL; IC: 8976C-BNRGM0AL). It supports simultaneous master/slave roles and can behave as a Bluetooth low energy sensor and hub device at the same time.

The BlueNRG-M0 provides a complete RF platform in a tiny form factor, with integrated radio, antenna, high frequency and LPO oscillators.

The X-NUCLEO-IDB05A2 is compatible with the ST morpho (not mounted) and Arduino UNO R3 connector layout.

The X-NUCLEO-IDB05A2 interfaces with the STM32 microcontroller via the SPI pin and allows changing the default SPI clock, SPI chip select and SPI IRQ by replacing a resistor on the expansion board.

**Figure 1.** X-NUCLEO-IDB05A2 expansion board



# 1 Getting started

## 1.1 Overview

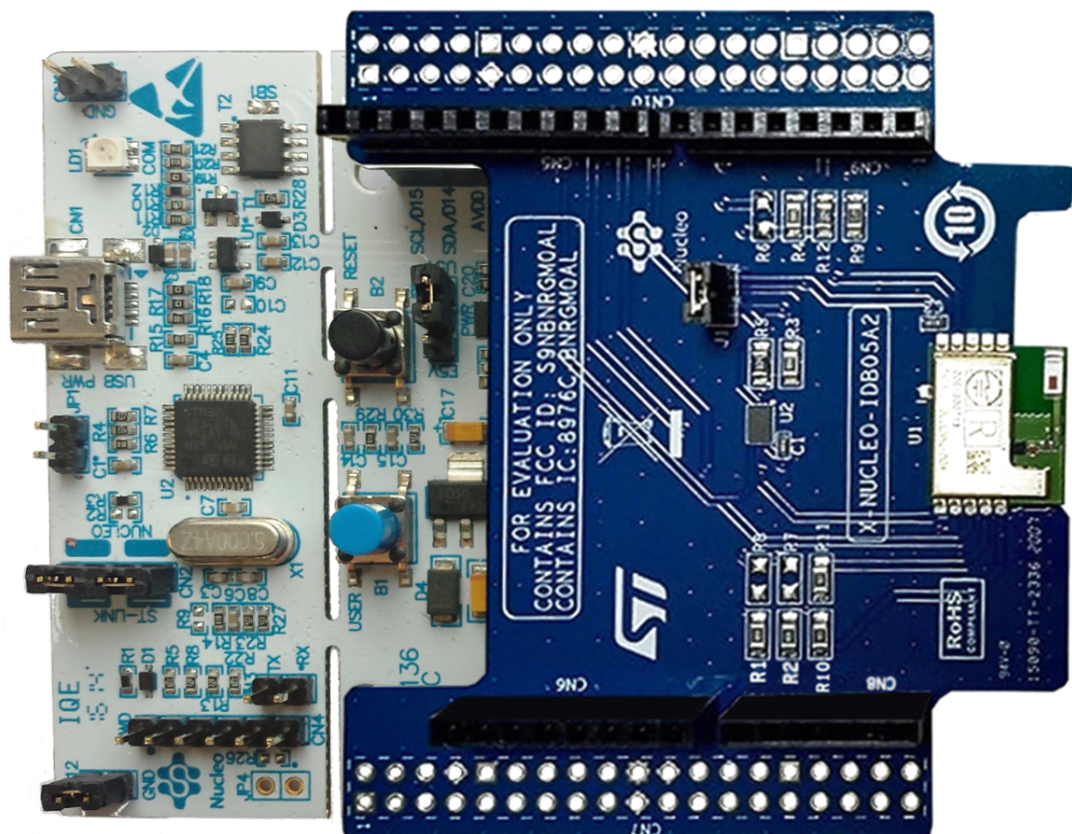
The main features of the X-NUCLEO-IDB05A2 expansion board are:

- STM32 Nucleo expansion board based on the BlueNRG-M0 Bluetooth v4.2 compliant, FCC and IC certified module (FCC ID: S9NBNRGM0AL; IC: 8976C-BNRGM0AL)
- BlueNRG-M0 main features:
  - Embedded Bluetooth low energy protocol stack (GAP, GATT, SM, L2CAP, LL, RFPHY)
  - Embedded BlueNRG-MS network processor
  - On-board chip antenna
- Small form factor: 11.5 mmx13.5 mm
- Equipped with Arduino UNO R3 connector
- Scalable solution capable of cascading multiple boards for larger systems
- Free comprehensive development firmware library and samples for BlueNRG-MS, compatible with STM32Cube firmware
- RoHS compliant

## 1.2 Hardware requirements

The X-NUCLEO-IDB05A2 expansion board can be plugged onto any STM32 Nucleo, although complete testing has only been performed using the NUCLEO-L053R8 and NUCLEO-F401RE development boards. To function correctly, the X-NUCLEO-IDB05A2 must be connected to the STM32 Nucleo board as shown below.

Figure 2. X-NUCLEO-IDB05A2 and STM32 Nucleo stack



### 1.3 System requirements

To use the [STM32 Nucleo](#) development boards with the [X-NUCLEO-IDB05A2](#) expansion board, you need:

- a Windows PC/laptop (Windows 10 or above) to install the firmware package ([X-CUBE-BLE1](#))
- 128 MB of RAM
- 40 MB of hard disk free space
- a type A to Mini-B USB cable to connect the [STM32 Nucleo](#) board to the PC
- an STM32 Nucleo development board ([NUCLEO-F401RE](#) or [NUCLEO-L053R8](#))
- an [X-NUCLEO-IDB05A2](#) expansion board

### 1.4 Board setup

- Step 1.** Connect the jumper on J1 connector.
- Step 2.** Connect the [X-NUCLEO-IDB05A2](#) expansion board to the [STM32 Nucleo](#) development board as shown in [Figure 2](#).
- Step 3.** Power the [STM32 Nucleo](#) board via the Mini-B USB cable.
- Step 4.** Program the firmware in the STM32 MCU using the firmware example provided.
- Step 5.** Reset the board MCU using the reset button available on the [STM32 Nucleo](#) board.  
The evaluation stack is ready to be used.

## 2 Hardware description and configuration

### 2.1 Connection details

The BlueNRG-M0 module embedded in the X-NUCLEO-IDB05A2 expansion board can be connected to the STM32 Nucleo development board through connectors CN5, CN6, CN8 and CN9.

**Table 1. X-NUCLEO-IDB05A2 and NUCLEO-L053R8 connection details (left connector)**

| Signal name                              |       |       |     |     |     |     |            |                        |                        |     |     |         |         |
|--|-------|-------|-----|-----|-----|-----|------------|------------------------|------------------------|-----|-----|---------|---------|
| NC                                       | IOREF | RESET | 3V3 | 5V  | GND | GND | VIN        | A0                     | A1                     | A2  | A3  | A4      | A5      |
| Connector name                           |       |       |     |     |     |     |            |                        |                        |     |     |         |         |
| CN6 Power                                |       |       |     |     |     |     | CN8 Analog |                        |                        |     |     |         |         |
| Pin number                               |       |       |     |     |     |     |            |                        |                        |     |     |         |         |
| 1  | 2     | 3     | 4   | 5   | 6   | 7   | 8          | 1                      | 2                      | 3   | 4   | 5       | 6       |
| NUCLEO-L053R8 MCU port                   |       |       |     |     |     |     |            |                        |                        |     |     |         |         |
|  |       |       |     |     |     |     |            | PA0                    | PA1                    | PA4 | PB0 | PC1/PB9 | PC0/PB8 |
| X-NUCLEO-IDB05A2 expansion board signals |       |       |     |     |     |     |            |                        |                        |     |     |         |         |
|  |       |       | 3V3 | GND | GND |     |            | SPI_IRQ <sup>(1)</sup> | SPI_CSN <sup>(1)</sup> |     |     |         |         |

1. Alternative pin.

**Table 2. X-NUCLEO-EEPRMA2 and NUCLEO-L053R8 connection details (right connector)**

| Signal name                              |     |      |     |                        |          |          |                        |                        |               |             |      |     |     |                        |      |     |     |
|--|-----|------|-----|------------------------|----------|----------|------------------------|------------------------|---------------|-------------|------|-----|-----|------------------------|------|-----|-----|
| D15                                      | D14 | AREF | GND | D13                    | D12      | D11      | D10                    | D9                     | D8            | D7          | D6   | D5  | D4  | D3                     | D2   | D1  | D0  |
| Connector name                           |     |      |     |                        |          |          |                        |                        |               |             |      |     |     |                        |      |     |     |
| CN5 Digital                              |     |      |     |                        |          |          |                        |                        | CN9 Digital   |             |      |     |     |                        |      |     |     |
| Pin number                               |     |      |     |                        |          |          |                        |                        |               |             |      |     |     |                        |      |     |     |
| 10                                       | 9   | 8    | 7   | 6                      | 5        | 4        | 3                      | 2                      | 1             | 8           | 7    | 6   | 5   | 4                      | 3    | 2   | 1   |
| NUCLEO-L053R8 MCU port                   |     |      |     |                        |          |          |                        |                        |               |             |      |     |     |                        |      |     |     |
| PB8                                      | PB9 |      |     | PA5                    | PA6      | PA7      | PB6                    | PC7                    | PA9           | PA8         | PB10 | PB4 | PB5 | PB3                    | PA10 | PA2 | PA3 |
| X-NUCLEO-IDB05A2 expansion board signals |     |      |     |                        |          |          |                        |                        |               |             |      |     |     |                        |      |     |     |
|  |     |      | GND | SPI_CLK <sup>(1)</sup> | SPI_MISO | SPI_MOSI | SPI_CSN <sup>(1)</sup> | SPI_IRQ <sup>(1)</sup> | SPI_EEPROM_nS | BlueNRG_RST |      |     |     | SPI_CLK <sup>(2)</sup> |      |     |     |

1. Optional.

2. Alternative pin.

### 2.2 SPI and GPIO connection options

SPI and GPIO connection options between the STM32 and BlueNRG-MS hosted on the BlueNRG-M0 module can be used for board operation in different configurations when several expansion boards are used and there is a conflict of signals.

**Table 3. BlueNRG-MS interface (optional) with the STM32 Nucleo board**

| BlueNRG-MS signal          | BlueNRG-M0 pin | Default STM32 port | Optional STM32 port  |
|----------------------------|----------------|--------------------|--|
| BlueNRG-MS_IRQ             | 4 – SPI_IRQ    | PA0                | PC7<br>To use the optional connection mount R8, unmount R1 |
| BlueNRG-MS_CS <sub>n</sub> | 10 – SPI_CS    | PA1                | PB6<br>To use the optional connection mount R7, unmount R2 |
| BlueNRG-MS_SCLK            | 7 – SPI_CLK    | PB3                | PA5<br>To use the optional connection mount R6, unmount R4 |

## 2.3 Current measurements

To monitor the power consumption of the [X-NUCLEO-IDB05A2](#) board, insert an ammeter probe between pins 1 and 2 of the jumper on the J1 connector.

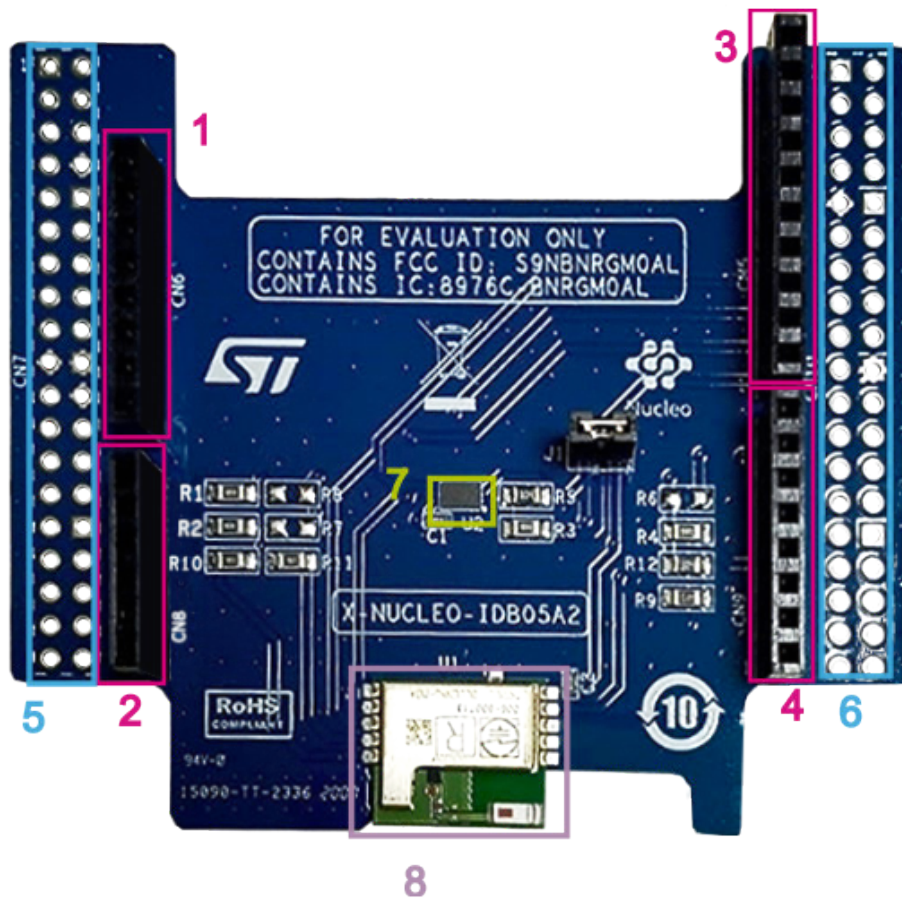
Since the power consumption of [BlueNRG-MS](#) is very low during most of its operating time, an accurate instrument in the range of a few  $\mu\text{A}$  may be required.



## 2.4 X-NUCLEO-IDB05A2 component placement

Figure 3. X-NUCLEO-IDB05A2 component placement details

1. Arduino UNO R3 connector
2. Arduino UNO R3 connector
3. Arduino UNO R3 connector
4. Arduino UNO R3 connector
5. ST morpho connector (not mounted)
6. ST morpho connector (not mounted)
7. SPI EEPROM
8. BlueNRG-M0 module



## 3 Component description

### 3.1 BlueNRG-M0 module

The [BlueNRG-M0](#) is an easy-to-use, Bluetooth v4.2 compliant, BLE master/slave network processor module. It supports multiple simultaneous roles and can behave as a Bluetooth low energy sensor and hub device at the same time.

**Table 4. BlueNRG-M0 details**

| Feature           | Description              |
|-------------------|--------------------------|
| Sales type        | BlueNRG-M0               |
| Package           | <a href="#">ECOPACK2</a> |
| Operating voltage | 1.7 to 3.6 V             |

### 3.2 SPI EEPROM

The [M95640-R](#) is a 64 Kbit serial SPI bus EEPROM with high-speed clock interface. The device can be used to store the configuration parameters related to applications or settings of the [BlueNRG-M0](#) module.

**Table 5. SPI EEPROM details**

| Feature           | Description   |
|-------------------|---------------|
| Sales type        | M95640-RMC6TG |
| Package           | MLP8          |
| Operating voltage | 1.8 to 5.5 V  |

## 4 Formal notices required by the U.S. Federal Communications Commission ("FCC")

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Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authorization to operate this equipment.

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 any interference that may cause undesired operation.

This device uses, generates and radiates radio frequency energy. The radio frequency energy produced by this device is well below the maximum exposure allowed by the Federal Communications Commission (FCC).

The X-NUCLEO-IDB05A2 expansion board embeds the BlueNRG-M0 certified module (FCC ID: S9NBNRGM0AL).



## 5 Formal notices required by the Industry Canada ("IC")

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English:

This device complies with Industry Canada license-exempt RSS standard(s). 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.

French:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. Exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The [X-NUCLEO-IDB05A2](#) expansion board embeds the [BlueNRG-M0](#) certified module (IC: 8976C-BNRGM0AL).

## 6 Schematic diagrams

Figure 4. X-NUCLEO-IDB05A2 circuit schematic - ST morpho and Arduino UNO R3 connectors

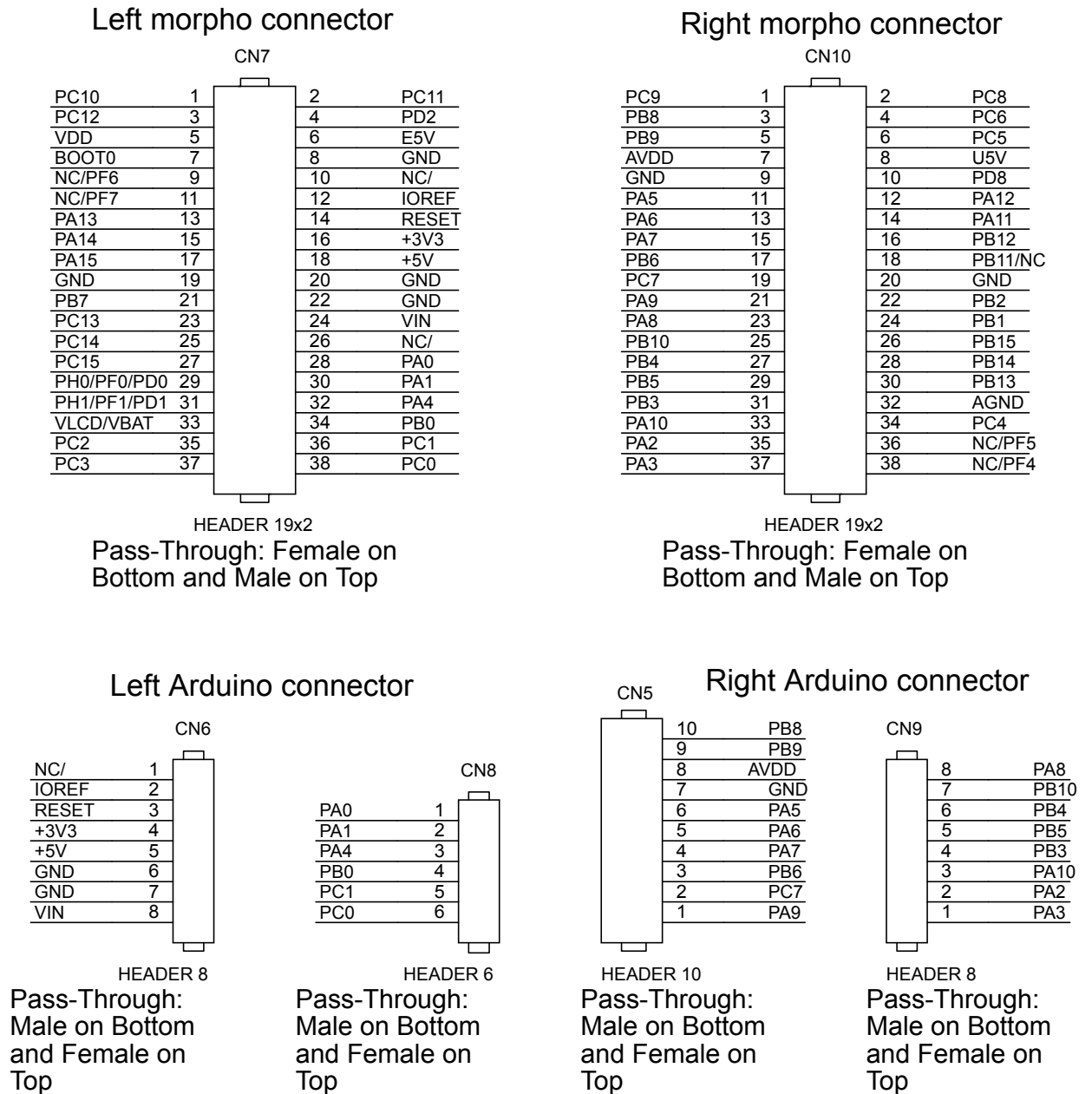


Figure 5. X-NUCLEO-IDB05A2 circuit schematic - STM32 Nucleo connections

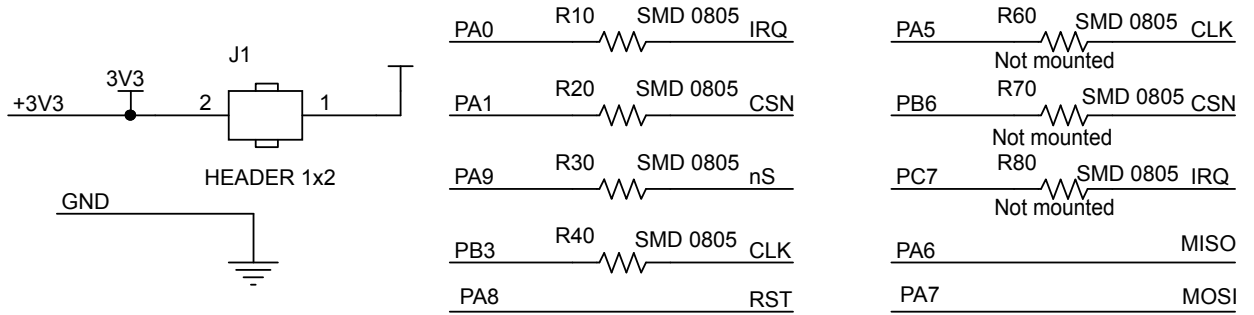


Figure 6. X-NUCLEO-IDB05A2 circuit schematic - BlueNRG-M0A module

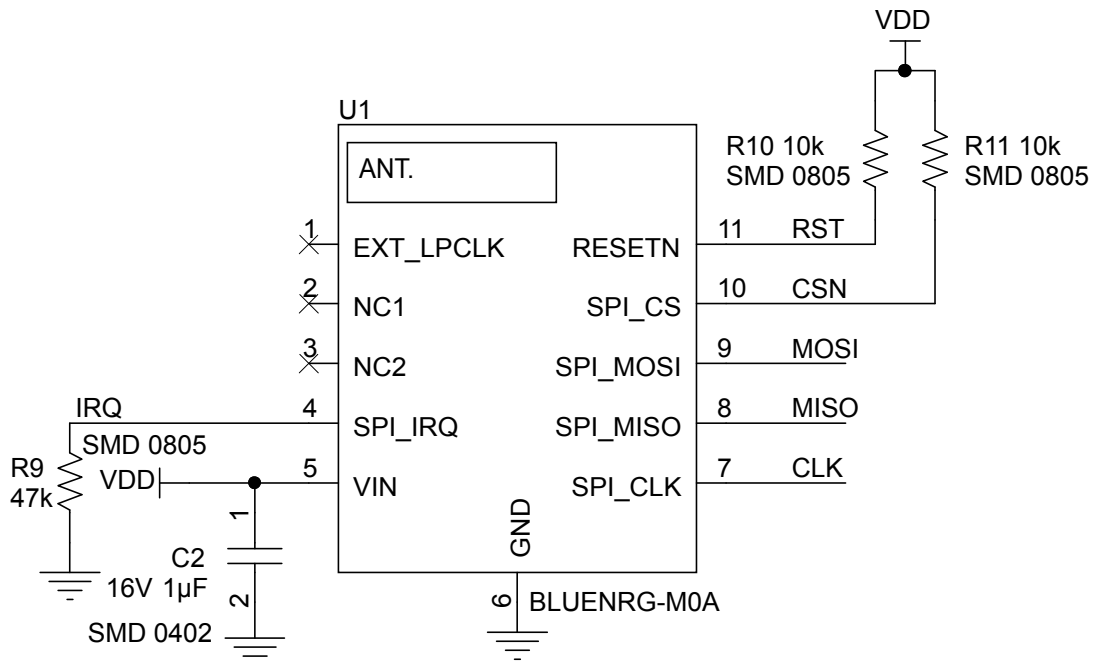
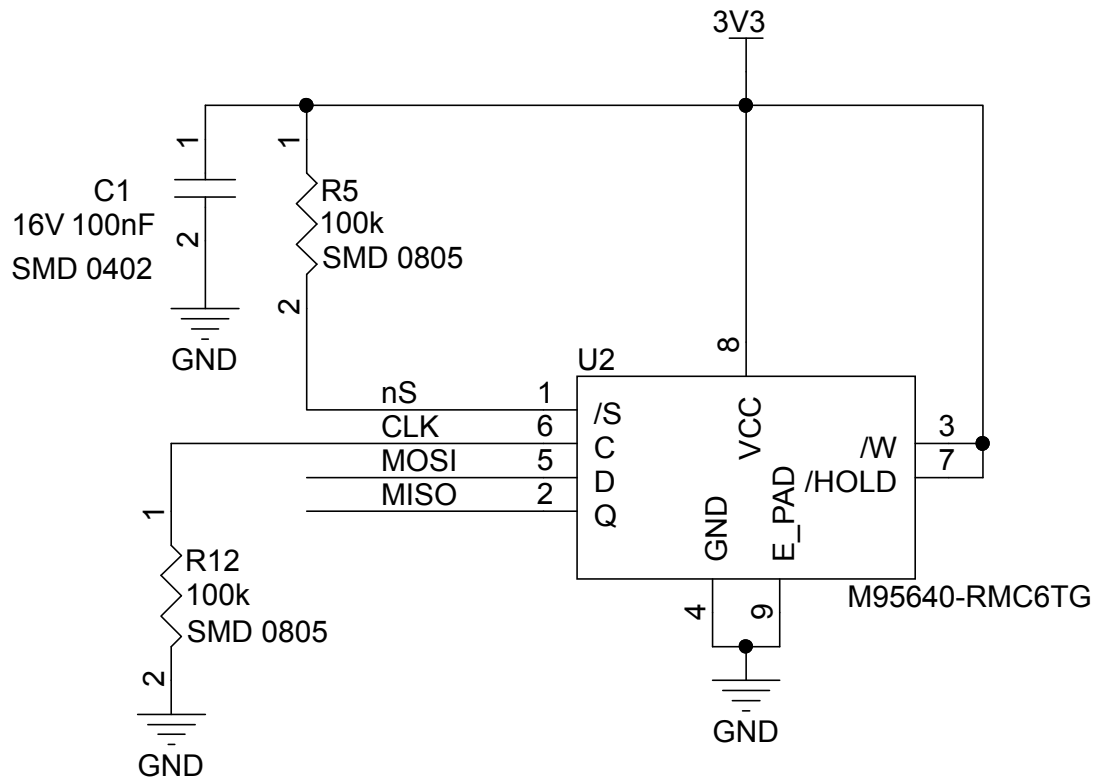


Figure 7. X-NUCLEO-IDB05A2 circuit schematic - EEPROM



## 7 Bill of materials

**Table 6. X-NUCLEO-IDB05A2 bill of materials**

| Item | Q.ty | Ref.                                       | Part/Value   | Description                                  | Manufacturer | Order code                    |
|------|------|--|--|--|--------------|-------------------------------|
| 1    | 1    | C1   | 100 nF, SMD0402, 16 V, $\pm 10\%$  | Ceramic X7R                                  | Murata       | GRM155R71C104KA88D            |
| 2    | 1    | C2   | 1 $\mu$ F, SMD0402, 16 V, $\pm 10\%$   |  | Any          |                               |
| 3    | 1    | CN5  | CN5 10 pins, Pass-Through: Male on Bottom, Female on Top. 10x1, 2.54 mm pitch                            | Arduino Connector                            | SAMTEC       | SSQ-110-03-F-S                |
| 4    | 2    | CN6, CN9                                   | CN6 and CN9 8 pins, Pass-Through: Male on Bottom, Female on Top. 8x1, 2.54 mm pitch                      | Arduino Connector                            | SAMTEC       | SSQ-108-03-F-S                |
| 5    | 2    | CN7, CN10 NOT MOUNTED                      | Morpho Connectors CN7 and CN10 38 pins, Pass-Through: Female on Bottom, Male on Top. 19x2, 2.54 mm pitch | Morpho Connector                             | SAMTEC       |                               |
| 6    | 1    | CN8  | Arduino Connector CN8 6 pins, Pass-Through: Male on Bottom, Female on Top. 6x1, 2.54mm pitch             | Arduino Connector                            | SAMTEC       | SSQ-106-03-F-S                |
| 7    | 1    | J1 2 pin jumper required with 2 pin header | HEADER 1X2   | Jumper                                       | Any          |                               |
| 8    | 7    | R1,R2,R3,R4,R6,R7, R8 R6,R7,R8 NOT MOUNTED | 0, SMD 0805, $\pm 1\%$   | Resistors                                    |              |                               |
| 9    | 2    | R5,R12                                     | 100k, SMD 0805, $\pm 1\%$ ,  | Resistors                                    | Any          |                               |
| 10   | 1    | R9   | 47k, SMD 0805, $\pm 1\%$ ,   | Resistors                                    | Any          |                               |
| 11   | 2    | R10, R11                                   | 10k, SMD 0805, $\pm 1\%$   | Resistors                                    | Any          |                               |
| 12   | 1    | U1   | BLUENRG-M0A, SMD 11 pins   | Very low power network processor module      | ST           | <a href="#">BLUENRG-M0A</a>   |
| 13   | 1    | U2   | M95640-RMC6TG, UFDFPN8   | 64 Kbit SPI bus EEPROM with high-speed clock | ST           | <a href="#">M95640-RMC6TG</a> |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 07-Apr-2020 | 1        | Initial release. |



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