Getting started with the X-NUCLEO-NFC07A1 NFC/RFID tag IC expansion board based on ST25DV64KC for STM32 Nucleo

Introduction
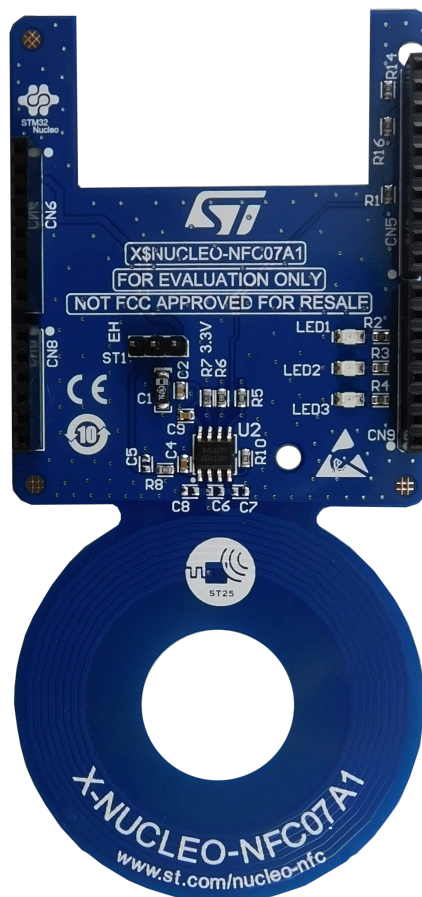
The X-NUCLEO-NFC07A1 dynamic NFC/RFID tag IC expansion board is based on the ST25DV64KC dynamic NFC/RFID tag IC with a 64-Kbit dual interface EEPROM and fast transfer mode feature. It can be powered through the STM32 Nucleo development board or directly through the received carrier electromagnetic field.

The X-NUCLEO-NFC07A1 expansion board is compatible with the Arduino UNO R3 connector pin assignment and can easily be plugged onto any STM32 Nucleo development board. You can stack other expansion boards to evaluate different devices that work together with the dynamic NFC tag.

The board also features a single-layer antenna with a diameter of 54 mm and copper etched on the PCB.

The expansion board package with order code X-NUCLEO-NFC07A1 contains the X$NUCLEO-NFC07A board.

Figure 1. **X-NUCLEO-NFC07A1 expansion board**

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1 Getting started

1.1 Hardware and software requirements

To operate correctly, connect the X-NUCLEO-NFC07A1 expansion board to an STM32 Nucleo development board as shown below.

Figure 2. **X-NUCLEO-NFC07A1 expansion board plugged to an STM32 Nucleo development board**
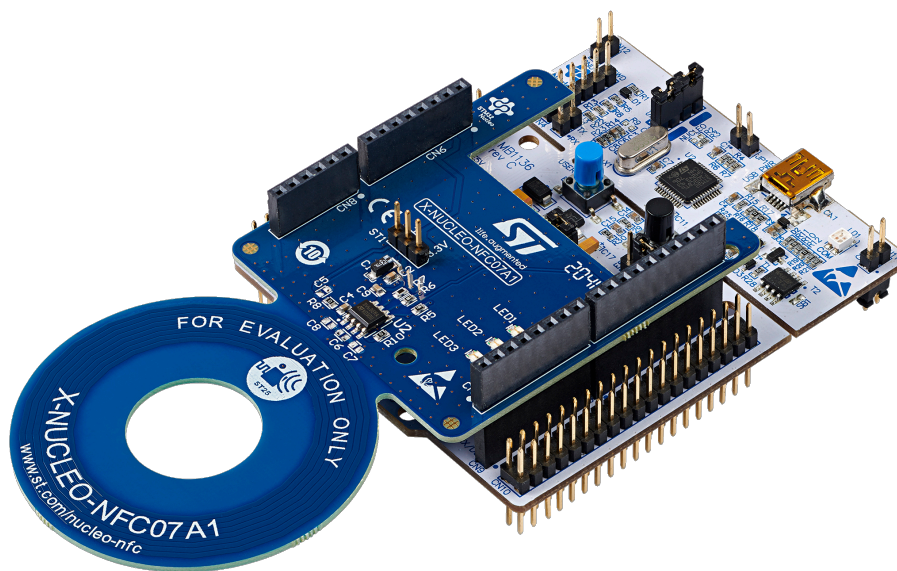
The X-NUCLEO-NFC07A1 is designed to be used with any STM32 Nucleo development board, even if complete testing has been performed using the NUCLEO-L053R8 (based on the STM32L053R8 ultra-low power Arm® Cortex®-M0+ MCU) and the NUCLEO-F401RE (hosting the STM32F401RE dynamically efficient MCU based on Arm® Cortex®-M4).

To use the STM32 Nucleo development boards with the X-NUCLEO-NFC07A1 expansion board, the following software and hardware specifications are required:

- a PC or laptop with Microsoft Windows ® 7 and above to install the software package (X-CUBE-NFC7)
- a type A to mini-B USB cable to connect the STM32 Nucleo development board to your PC or laptop
- the X-CUBE-NFC7 software package

1.2 Board setup

To set up the board:

Step 1. Check that the jumper on the X-NUCLEO-NFC07A1 ST1 connector is in place.
This jumper provides the required voltage to the device on the board (see Section 2.1.1 Power supply option for further details).

Step 2. Connect the X-NUCLEO-NFC07A1 on top of the STM32 Nucleo development board as shown in Figure 2.

Step 3. Power the STM32 Nucleo development board using the Mini-B USB cable.

Step 4. Program the firmware in the STM32 Nucleo development board using the provided firmware example.

Step 5. Reset the MCU board using the reset button available on the STM32 Nucleo development board.
The evaluation kit is ready to be used.

2 Hardware description and configuration

The X-NUCLEO-NFC07A1 expansion board allows the user to test the functionality of the ST25DV64KC dynamic NFC/RFID tag IC with a 64-Kbit dual interface EEPROM.

The EEPROM is organized in blocks of 512 bytes, arranged by pages of 4 bytes in I²C mode, and in 128 blocks of 4 bytes in RF mode. It can be powered through the STM32 Nucleo development board or directly through the received carrier electromagnetic field.

The ST25DV64KC features a general purpose output (GPO) and an energy harvesting feature that lets you output the energy coming from the RF field on the V_{out} analog pin and acts on ST1 jumper to enable it.

The ST25DV64KC can act as a mailbox in fast transfer mode in both directions between the RF terminal (such as an e-reader or a smart phone) and the microcontroller through the I²C. In this case, messages are stored in the RAM instead of EEPROM. This mode allows exchanging up to 256 byte payload data via RF and I²C interfaces.

A user configurable output pin can also be used as an interrupt for the microcontroller, and toggles during field change (available even when RF is disabled) (e.g., RF Busy, MailBox filled, EEPROM update, RF user Interrupt and RF User Set/Reset).

These functions can be exploited using the firmware package contained in the X-CUBE-NFC7 software.

Note: *To program the microcontroller on the STM32 Nucleo board refer to user manuals UM1724," STM32 Nucleo-64 board", and UM1725, "Description of STM32F4 HAL and LL drivers", available on www.st.com.).*

The STM32 Nucleo and the X-NUCLEO-NFC07A1 are connected through CN5, CN6, CN8, and CN9 connectors as detailed in the following tables.

Table 1. Interconnections between the STM32 Nucleo board and the X-NUCLEO-NFC07A1 expansion board (left side)

Signal	Connector	Pin number	STM32 Nucleo board (MCU port)	X-NUCLEO-NFC07A1 expansion board
NC	CN6 Power	1	-	-
IOREF		2	-	3V3
RESET		3	-	-
3V3		4	-	3V3
5V		5	-	-
GND		6	-	GND
GND		7	-	GND
VIN		8	-	-
A0	CN8 Analog	1	PA0	-
A1		2	PA1	-
A2		3	PA4	-
A3		4	PB0	-
A4		5	PC1/PB9[1]	-
A5		6	PC0/PB8[1]	-

1.   *Acting on the STM32 Nucleo board solder bridge*

Table 2. Interconnections between the STM32 Nucleo board and the X-NUCLEO-NFC07A1 expansion board (right side)

Signal	Connector	Pin number	STM32 Nucleo board (MCU port)	X-NUCLEO-NFC07A1 expansion board
D15	CN5 Digital	10	PB8	ST25DV_SCL
D14		9	PB9	ST25DV_SDA
AREF		8	-	-

Signal	Connector	Pin number	STM32 Nucleo board (MCU port)	X-NUCLEO-NFC07A1 expansion board
GND	CN5 Digital	7	-	GND
D13		6	PA5	-
D12		5	PA6	ST25DV_GPO
D11		4	PA7	-
D10		3	PB6	-
D9		2	PC7	-
D8		1	PA9	-
D7	CN9 Digital	8	PA8	-
D6		7	PB10	-
D5		6	PB4	MCU_LED1
D4		5	PB5	MCU_LED2
D3		4	PB3	-
D2		3	PA10	MCU_LED3
D1		2	PA2	-
D0		1	PA3	-

2.1 Power supply and GPIO connection options

2.1.1 Power supply option

The on-board jumper (ST1) allows the user to select the ST25DV power source: external (the power supply of the STM32 Nucleo development board) or ST25DV energy harvesting, indicated on the board silkscreen with 3.3 V and EH, respectively.

2.1.2 GPIO option

You can disconnect the ST25DV_GPO optional signal from the STM32 Nucleo development board by removing R1.

The same option applies to the lines driving the three general-purpose LEDs (MCU_LED1, MCU_LED2, and MCU_LED3) that can be dedicated to other purposes (by removing R2, R3 and R4, respectively).

In case you modify these connections, update the firmware to enable proper use of the STM32 Nucleo resources.
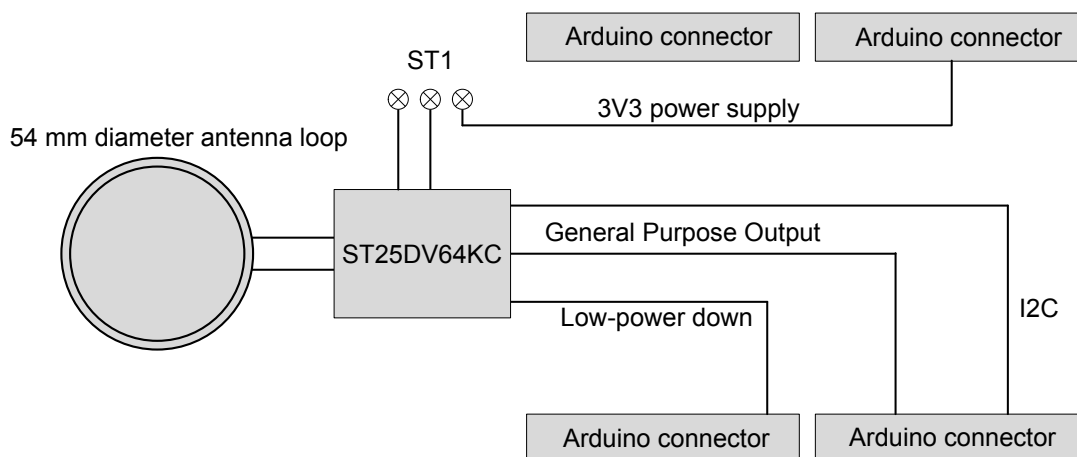
2.2 Board components

Figure 3. **X-NUCLEO-NFC07A1 expansion board component placement**

1. Arduino connector
2. Arduino connector
3. ST25DV64KC

2.3 Block diagram
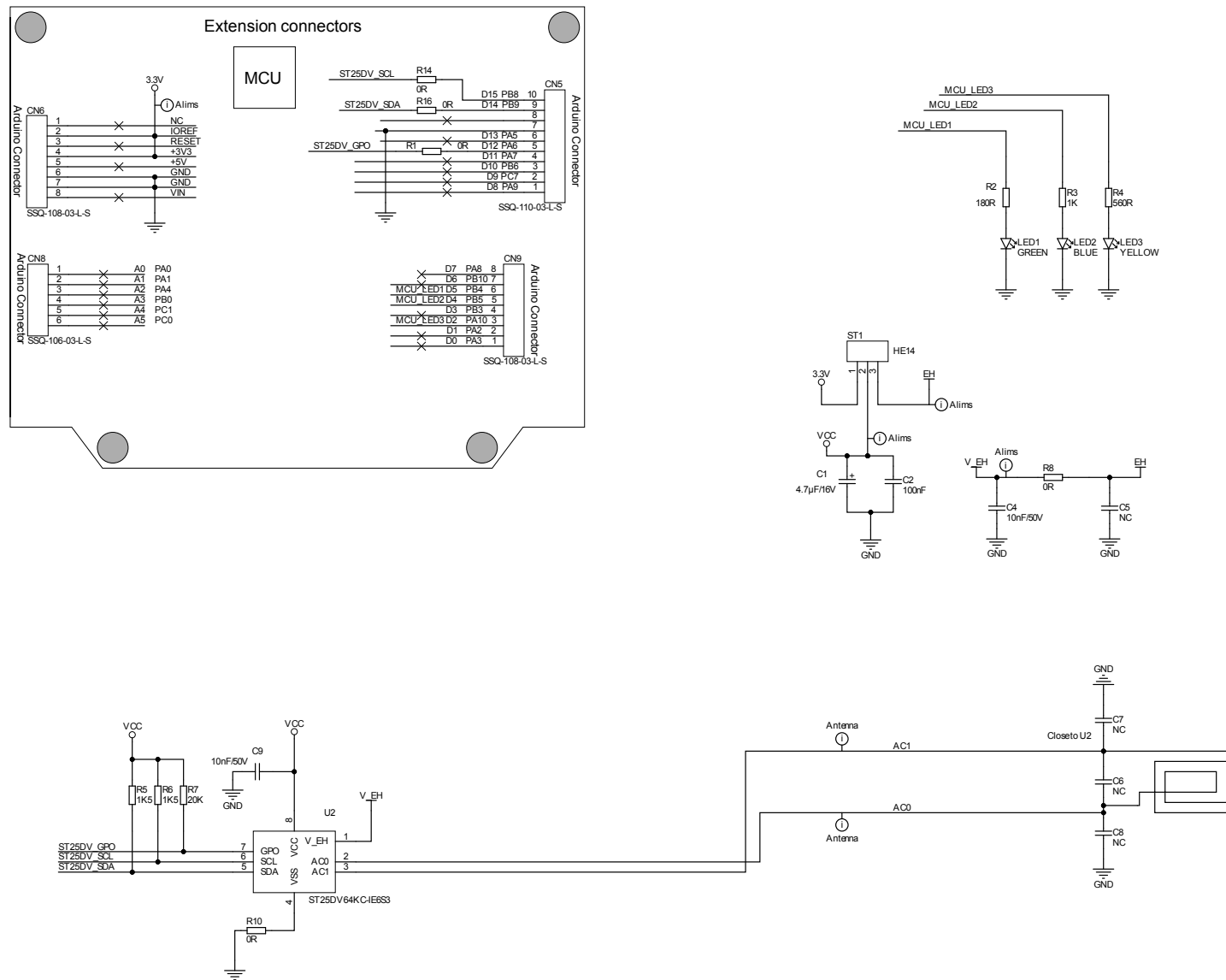
Figure 4. X-NUCLEO-NFC07A1 block diagram

2.4 Operating information

The X-NUCLEO-NFC07A1 frequency band or operating frequency is 13.56 MHz.

Its power output is < 60 dBµA/m at 10 m (measured 10.01 dBµA/m at 10 m).

3   Schematic diagrams

Figure 5. X-NUCLEO-NFC07A1 circuit schematic

4 Bill of materials

Item	Q.ty	Ref.	Part/Value	Description	Manufacturer	Order code
1	1	C1	4u7, 1206, 16V, +/-10%	CAPACITOR 293D475X9016A2TE3 4.7µF	VISHAY	293D475X9016A2TE3
2	1	C2	100nF, 0603, 16V, +/-10%	CAPACITOR 100nF	KEMET	C0603C104K4RAC7081
3	2	C4, C9	10nF, 0603, 50V, +/-10%	CAPACITOR 10nF	KEMET	C0603C103K5RACTU
4	4	C5, C6, C7, C8	0603	CAPACITOR 0603 (not fitted)	KEMET	C0603C103K5RACTU
5	1	CN5		CONNECTOR SSQ-110-03-L-S 1x10Pts	SAMTEC	SSQ-110-03-L-S
6	2	CN6, CN9		CONNECTOR SSQ-108-03-L-S 1x8Pts	SAMTEC	SSQ-108-03-L-S
7	1	CN8		CONNECTOR SSQ-106-03-L-S 1x6Pts	SAMTEC	SSQ-106-03-L-S
8	1	LED1	GREEN 2 x 1.6mm	LED GREEN 598-8270-107F	DIALIGHT	598-8270-107F
9	1	LED2	BLUE 2 x 1.6mm	LED BLUE 598-8291-107F	DIALIGHT	598-8270-107F
10	1	LED3	YELLOW 2 x 1.6mm	LED YELLOW 598-8240-107F	DIALIGHT	598-8240-107F
11	5	R1, R8, R10, R14, R16	0603, 50V, +/-5%	RESISTOR 0R	BOURNS	CR0603-J/-000ELF
12	1	R2	0603, 50V, +/-5%	RESISTOR 180R	PANASONIC	ERJH3GJ181V
13	1	R3	0603, 50V, +/-5%	RESISTOR 1K	YAGEO	AC0603JR-071KL
14	1	R4	0603, 50V, +/-5%	RESISTOR 560R	PANASONIC	ERJPA3F5600V
15	2	R5, R6	0603, 50V, +/-5%	RESISTOR 1K5	YAGEO	AC0603FR-071K5L
16	1	R7	0603, 50V, +/-5%	RESISTOR 20K	VISHAY	CRCW060320K0FKEAHP
17	1	ST1		CONNECTOR TSW-103-07-G-S 1x3Pts	SAMTEC	TSW-103-07-G-S
18	1	U2	SO8	CI ST25DV64KC-IE6S3 SO8	ST	ST25DV64KC-IE6S3

5 Board versions

Table 3. X-NUCLEO-NFC07A1 versions

Finished good	Schematic diagrams	Bill of materials
X$NUCLEO-NFC07A1 [1]	X$NUCLEO-NFC07A1 schematic diagrams	X$NUCLEO-NFC07A1 bill of materials

1. This code identifies the X-NUCLEO-NFC07A1 evaluation board first version.

6 Regulatory compliance information

Formal Notice Required by the U.S. Federal Communications Commission

FCC NOTICE

This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine

whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

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À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Formal product notice required by EU

The X-NUCLEO-NFC07A1 board is in conformity with the essential requirements of the Directive 2014/53/EU (RED) and of the Directive 2015/863/EU (RoHS). Harmonized standards applied are listed in the EU Declaration of Conformity.

Revision history

Table 4. Document revision history

Date	Revision	Changes
19-Jan-2022	1	Initial release.
01-Mar-2022	2	Updated introduction. Added Section 2.4 Operating information and Section 6 Regulatory compliance information.

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