

How to use STM32 Nucleo expansion board based on the STSAFE-L010 secure element

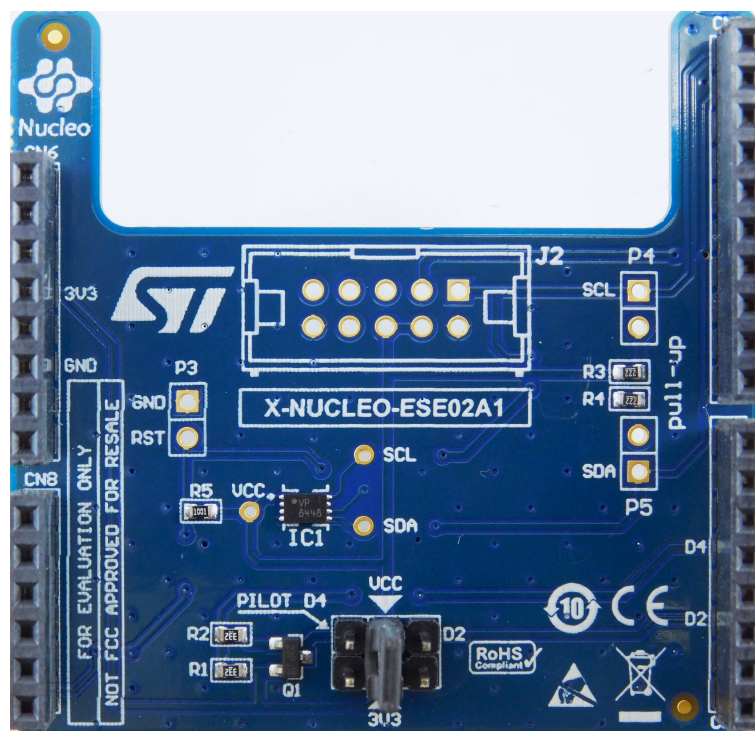
Introduction

The **X-NUCLEO-ESE02A1** expansion board is based on the **STSAFE-L010** secure element. It can be used with any **STM32 Nucleo** development board.

The on-board STSAFE-L010 is customized with a standard profile for evaluation and is compatible with the Arduino UNO R3 connector.

The **X-NUCLEO-ESE02A1** expansion board is used with the free **X-CUBE-STSE01** software package containing sample code to demonstrate how to implement security applications.

Figure 1. X-NUCLEO-ESE02A1 expansion board



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1 Getting started

1.1 Hardware requirements

The [X-NUCLEO-ESE02A1](#) expansion board can be connected to any STM32 Nucleo development board through the matching Arduino UNO R3 connector pins.

Note: Handle the X-NUCLEO-ESE02A1 with care and avoid bending or damaging the pins as the board has male/female pass-through connectors and ESD sensitive components.

1.2 System requirements

To complete the system setup, you need:

- Computer with STM32 Cube IDE (multi-OS development tool) or one of the compatible software development environments: IAR, Arm Keil, software package ([X-CUBE-STSE01](#)) installed on the user PC.

2 Hardware description

The X-NUCLEO-ESE02A1 expansion board has an embedded STSAFE-L010 secure element to allow you to evaluate its authentication and data management services connected to a local or remote host.

This STSAFE-L010 is factory personalized with a generic sample profile.

The main features of the X-NUCLEO-ESE02A1 expansion board are:

- On-board STSAFE-L010 customized with a standard evaluation profile
- HE10 extension connector to mount additional STSAFE devices
- Arduino UNO R3 connector
- Free drivers, middleware and software samples compatible with the STM32 ODE
- RoHS and WEEE compliant

The X-NUCLEO-ESE02A1 interfaces with the STM32 Nucleo microcontrollers via the I²C communication bus.

2.1 Jumpers and solder bridges

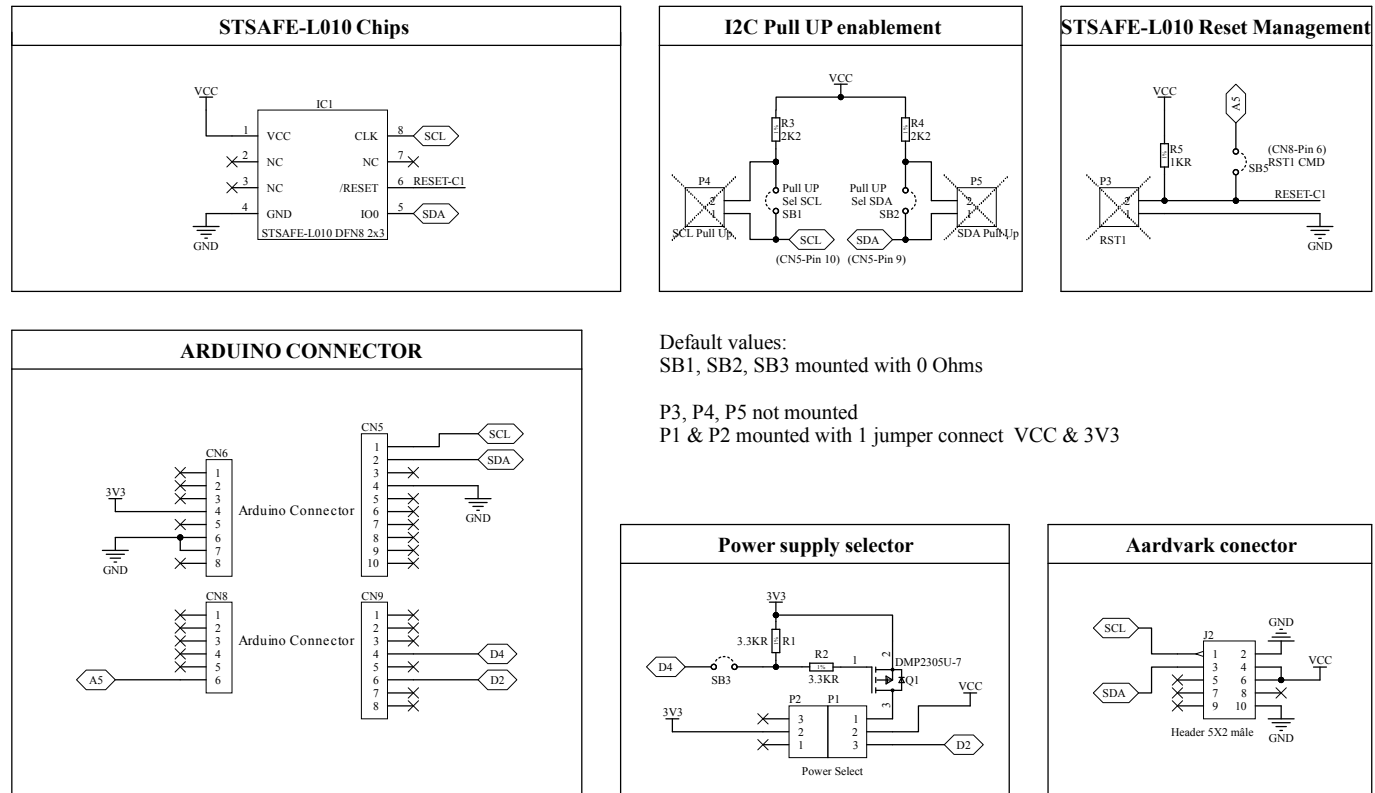
Table 1. X-NUCLEO-ESE02A1 expansion board jumper and solder bridge functions

Jumper	Alternative soldering point	function
P4	SB1	Connects embedded 2.2 kΩ pull-ups to I ² C bus for SCL
P5	SB2	Connects embedded 2.2 kΩ pull-ups to I ² C bus for SDA
P3	SB5	Can be used to drive the STSAFE-L010 reset pin via the STM32 MCU PC0 GPIO
P1		Selection of STSAFE-L010 power supply mode (+3.3 V from Nucleo, from Nucleo D2 GPIO or from Q1 transistor through D4 GPIO)
P2		

3 STM32 series microcontroller software

The STM32 ODE software package [X-CUBE-STSE01](#) provides demonstration source code for any NUCLEO development board with [X-NUCLEO-ESE02A1](#) expansion. The X-CUBE-STSE01 package includes drivers, middleware and several demonstration codes that implement the features of the [STSAFE-L010](#) device family through a host microcontroller. The demonstration codes use the [STSELib](#) middleware built on the STM32Cube software technology. They illustrate authentication and secure data storage use-cases.

Figure 2. X-NUCLEO-ESE02A1 circuit schematic



5 Bill of materials

Table 2. X-NUCLEO1-ESE02A1 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	CN5		'SAMTEC - SSQ-110-24-G-S - EMBASE. 2.54MM. VERTICAL THT. 10 VOIES	SAMTEC	SSQ-110-24-G-S
2	1	CN6		'SAMTEC - SSQ-108-24-G-S - EMBASE. 2.54MM. VERTICAL THT. 8 VOIES	SAMTEC	SSQ-108-24-G-S
3	1	CN8		'SAMTEC - SSQ-106-24-G-S - EMBASE. 2.54MM. VERTICAL THT. 6 VOIES	SAMTEC	SSQ-106-24-G-S
4	1	CN9		'SAMTEC - SSQ-108-24-G-S - EMBASE. 2.54MM. VERTICAL THT. 8 VOIES	SAMTEC	SSQ-108-24-G-S
5	1	IC1	STSAFL010DFSPL01, UDFPN 8 2x3x0.6	STSAFL010DFSPL01, DFN8 3x2	ST	STSAFL010DFSPL01
6	1	J2		3M-30310-6002HB-Connecteur embase 10 voies	3M	3M-30310-6002HB
7	1	P1		2211S-03G MULTICOMP, Header, male, 2.54mm, 3 contacts, traversant	MULTICOMP	2211S-03G
8	1	P2		2211S-03G MULTICOMP, Header, male, 2.54mm, 3 contacts, traversant	MULTICOMP	2211S-03G
9	1	P3		2211S-02G MULTICOMP, Header, male, 2.54mm, 2contacts, traversant	MULTICOMP	2211S-02G
10	1	P4		2211S-02G MULTICOMP, Header, male, 2.54mm, 2contacts, traversant	MULTICOMP	2211S-02G
11	1	P5		2211S-02G MULTICOMP, Header, male, 2.54mm, 2contacts, traversant	MULTICOMP	2211S-02G
12	1	P2.2, P1.2		JUMPER 2 contacts 2,54mm connected P2.2, P1.2 VCC - 3V3	ASSMANN WSW	AKSPLTZ BLACK
13	1	Q1		DMP2305U-7 - DIODES INC. - PMOS 20V 4A RDSon45 mOhm SOT23	Diodes Incorporated	DMP2305U-7
14	1	R1	3.3 kΩ	MULTICOMP MCWR06X3301FTL Résistance CMS 0603 3.3KOhm	MULTICOMP	MCWR06X3301FTL
15	1	R2	3.3 kΩ	MULTICOMP MCWR06X3301FTL Résistance CMS 0603 3.3KOhm	MULTICOMP	MCWR06X3301FTL
16	1	R3	2.2 kΩ	MULTICOMP MCWR06X2201FTL Résistance CMS 0603 2.2KOhm	MULTICOMP	MCWR06X2201FTL
17	1	R4	2.2 kΩ	MULTICOMP MCWR06X2201FTL Résistance CMS 0603 2.2KOhm	MULTICOMP	MCWR06X2201FTL
18	1	R5	1 kΩ	MULTICOMP MCWR06X1001FTL Résistance CMS 0603 1KOhm	MULTICOMP	MCWR06X1001FTL
19	1	SB1		SOLDER BRIDGE	SOLDER BRIDGE	SOLDER BRIDGE
20	1	SB2		SOLDER BRIDGE	SOLDER BRIDGE	SOLDER BRIDGE



Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
21	1	SB3		SOLDER BRIDGE	SOLDER BRIDGE	SOLDER BRIDGE
22	1	SB5		SOLDER BRIDGE	SOLDER BRIDGE	SOLDER BRIDGE

6 Board versions

Table 3. X-NUCLEO-ESE02A1 versions

Finished good	Schematic diagrams	Bill of materials
XN\$ESE02A1A ⁽¹⁾	XN\$ESE02A1A schematic diagrams	XN\$ESE02A1A bill of materials

1. This code identifies the X-NUCLEO-ESE02A1 evaluation board first version.

7 Regulatory compliance information

Notice for US Federal Communication Commission (FCC)

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This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III).

Revision history

Table 4. Document revision history

Date	Revision	Changes
09-Oct-2025	1	Initial release.

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