

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



Notice: For dedicated assistance, submit a request through our online support portal at www.st.com/support.

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

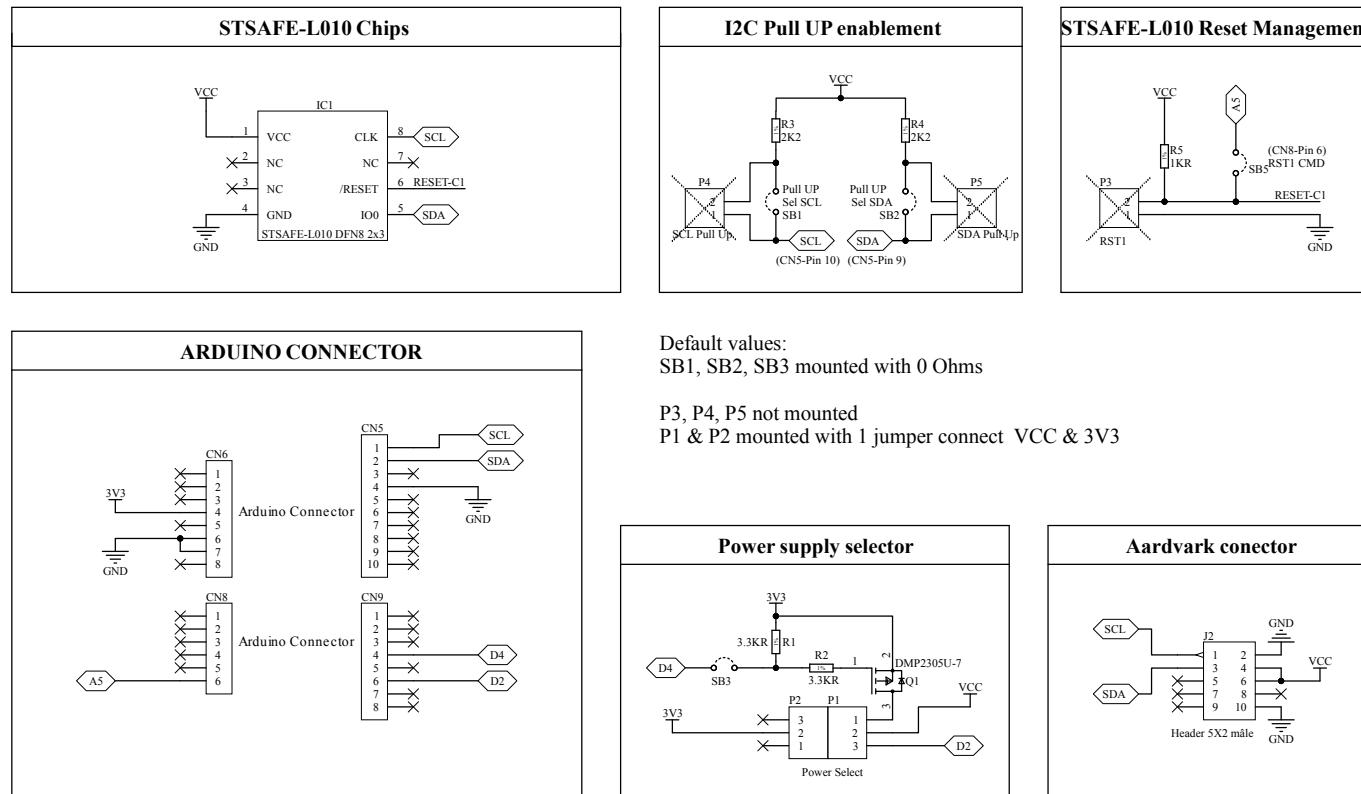
Table 1. X-NUCLEO-ESE02A1 expansion board jumper and solder bridge functions

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, UFDFPN 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)

For evaluation only; not FCC approved for resale

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.

Notice for Innovation, Science and Economic Development Canada (ISED)

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

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).

Notice for the European Union

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).

Notice for the United Kingdom

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.

Contents

1	Getting started	2
1.1	Hardware requirements	2
1.2	System requirements	2
2	Hardware description	3
2.1	Jumpers and solder bridges	3
3	STM32 series microcontroller software	4
4	Schematic diagrams	5
5	Bill of materials	6
6	Board versions	8
7	Regulatory compliance information	9
	Revision history	10

List of figures

Figure 1.	X-NUCLEO-ESE02A1 expansion board.....	1
Figure 2.	X-NUCLEO-ESE02A1 circuit schematic.....	5

List of tables

Table 1.	X-NUCLEO-ESE02A1 expansion board jumper and solder bridge functions	3
Table 2.	X-NUCLEO1-ESE02A1 bill of materials	6
Table 3.	X-NUCLEO-ESE02A1 versions	8
Table 4.	Document revision history	10

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice.

In the event of any conflict between the provisions of this document and the provisions of any contractual arrangement in force between the purchasers and ST, the provisions of such contractual arrangement shall prevail.

The purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

The purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of the purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

If the purchasers identify an ST product that meets their functional and performance requirements but that is not designated for the purchasers' market segment, the purchasers shall contact ST for more information.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2025 STMicroelectronics – All rights reserved