

Getting started with the X-NUCLEO-EEICA1 standard I2C EEPROM memory expansion board based on M24256E-F and M24M01E-F series for STM32 Nucleo

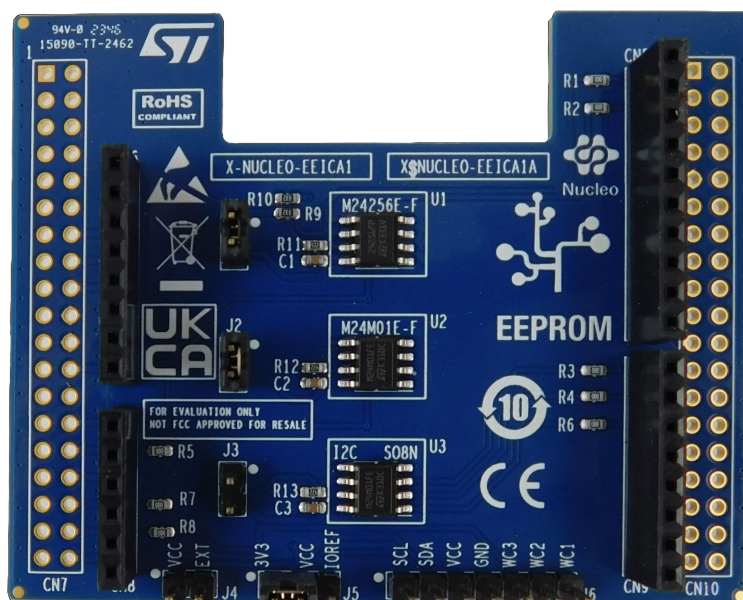
Introduction

The **X-NUCLEO-EEICA1** expansion board is designed for **M24256E-F** and **M24M01E-F** series I²C EEPROM for data reading and writing.

The expansion board acts as an external storage device that can be used to store data such as manufacturing traceability, calibration, user settings, error flags, data logs and monitoring data to make applications more flexible and accurate.

The **X-NUCLEO-EEICA1** expansion board can be plugged on top of an STM32 Nucleo-144 (via ZIO connectors) or STM32 Nucleo-64 (via Arduino® UNO R3 connectors).

Figure 1. X-NUCLEO-EEICA1 expansion board



1 Acronyms and abbreviations

Table 1. List of acronyms

Acronym	Description
EEPROM	Electrically erasable programmable read-only memory
MHz	Megahertz
MCU	Microcontroller unit
I ² C	Inter-integrated circuit

2 Getting started

2.1 Overview

The [X-NUCLEO-EEICA1](#) main features are:

- **M24256E-F:**
256-Kbit serial I²C bus EEPROM with configurable device address and preprogrammed device address
 - 256 Kbit (32 Kbytes) of EEPROM
 - Page size: 64 bytes
 - Additional identification page
 - Random and sequential read modes
 - Write protection of the whole memory array
 - Configurable device address
 - Preprogrammed device address (on demand)
- **M24M01E-F:**
1-Mbit serial I²C bus EEPROM with configurable device address, software write protection registers and preprogrammed device address
 - 1 Mbit (128-Kbyte) of EEPROM
 - Page size: 256 bytes
 - Additional 256-byte identification page
 - Configurable device address register
 - Preprogrammed device address (on demand)
 - Software write protection register
 - Hardware write protection of the whole memory array
 - Random and sequential read modes
- Compatible with the following I²C bus modes:
 - 1 MHz (fast mode plu)
 - 400 kHz (fast mode)
 - 100 kHz (Standard mode-default)
- A free comprehensive development firmware library and sample implementation are available when the [X-NUCLEO-EEICA1](#) expansion board is plugged on top of a [NUCLEO-F401RE](#), [NUCLEO-L053R8](#), [NUCLEO-G474RE](#) or [NUCLEO-H743ZI](#) development board
- Developer can choose and solder an EEPROM to be tested using the evaluation software provided

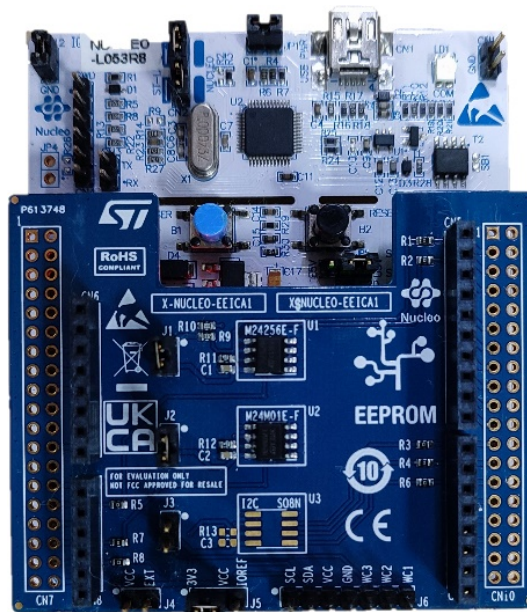
2.2 Typical applications

The [X-NUCLEO-EEICA1](#) expansion board acts as an external storage device that can be used for storing data such as manufacturing traceability, calibration data, user setting, error flags, data log, and monitoring data to make applications more flexible and accurate.

2.3 Hardware requirements

To use [STM32 Nucleo](#) development boards with the [X-NUCLEO-EEICA1](#) expansion board, connect the boards as shown below.

Figure 2. X-NUCLEO-EEICA1 expansion board connected to an STM32 Nucleo development board



The EEPROM communicates with the [STM32 Nucleo](#) development board host microcontroller through the I2C signals available on the Arduino UNO R3 connector.

The [X-NUCLEO-EEICA1](#) has been designed to be used on any STM32 Nucleo board, although complete testing has been performed using the [NUCLEO-F401RE](#), [NUCLEO-L053R8](#), [NUCLEO-G474RE](#) and [NUCLEO-H743ZI](#) boards.

2.4 System requirements

To use the [STM32 Nucleo](#) development boards with the [X-NUCLEO-EEICA1](#) expansion board you need:

- A Windows PC/laptop (Windows 7 or above) to install the firmware package (X-CUBE-EEPRMA1)
- A type a to mini and Micro-B USB cable to connect the [STM32 Nucleo](#) board to the PC
- An STM32 Nucleo development board ([NUCLEO-F401RE](#), [NUCLEO-L053R8](#), [NUCLEO-G474RE](#) or [NUCLEO-H743ZI](#))
- An [X-NUCLEO-EEICA1](#) expansion board

2.5 Board setup

Ensure the following jumper settings as shown in the table below:

Table 2. X-NUCLEO-EEICA1 jumper settings

Jumper	Name	Configuration (for X-NUCLEO-EEICA1 board)
J1	M24_VCC1	1-2
J2	M24_VCC2	1-2
J5	Voltage source	1-2

3 Hardware description and configuration

3.1 Interconnection details

The X-NUCLEO-EEICA1 expansion board and the NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-G474RE or NUCLEO-H743ZI board connection details are listed below.

Table 3. X-NUCLEO-EEICA1 and NUCLEO-F401RE 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-F401RE MCU port													
								PA0	PA1	PA4	PB0	PC1	PC0
NUCLEO-F401RE MCU signals													
	3.3 V REF	RESET	3.3 V input/ output	5 V output	GND	GND	POWER INPUT	ADC1_0	ADC1_1	ADC1_4	ADC1_8	ADC1_11(PC1) or I2C1_SDA(PB9)	ADC1_10(PC0) or I2C1_SCL(PB8)
X-NUCLEO-EEICA1 expansion board signals													
NC	IOREF		3V3		GND	GND			M24_WC1		M24_WC2	M24_WC3	

Table 4. X-NUCLEO-EEICA1 and NUCLEO-F401RE 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-F401RE MCU port																	
PB8	PB9			PA5	PA6	PA7	PB6	PC7	PA9	PA8	PB10	PB4	PB5	PB3	PA10	PA2	PA3
NUCLEO-F401RE MCU signals																	
I2C1_SDA	I2C1_SCL																
X-NUCLEO-EEICA1 expansion board signals																	
M24_I2C_SCL	M24_I2C_SDA									I2C_E2	I2C_E1	I2C_E0					

Table 5. X-NUCLEO-EEICA1 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/PB 9	PC0/PB 8
NUCLEO- L053R8 MCU signals													
	3.3 V REF	RESET	3.3 V input/ output	5 V output	GND	GND	POWER INPUT	ADC_IN0	ADC_IN1	ADC_IN4	ADC_IN8	ADC_IN11(PC1) or I2C1_SDA(PB9)	ADC_IN10(PC0) or I2C1_SCL(PB8)
X-NUCLEO-EEICA1 expansion board signals													
NC	IOREF		3V3		GND	GND			M24_WC1		M24_WC2	M24_WC3	

Table 6. X-NUCLEO-EEICA1 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
NUCLEO- L053R8 MCU signals																	
I2C1_SDA	I2C1_SCL																
X-NUCLEO-EEICA1 expansion board signals																	
M24_I2C_SCL	M24_I2C_SDA									I2C_E2	I2C_E1	I2C_E0					

Table 7. X-NUCLEO-EEICA1 and NUCLEO-G474RE 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- G474RE MCU port													
								PA0	PA1	PA4	PB0	PC1/PB 9	PC0/PB 8
NUCLEO- G474RE MCU signals													
	3.3 V REF	RESET	3.3 V input/ output	5 V output	GND	GND	POWER INPUT	ADC_IN0	ADC_IN1	ADC_IN4	ADC_IN8	ADC_IN11(PC1) or I2C1_SDA(PB9)	ADC_IN10(PC0) or I2C1_SCL(PB8)
X-NUCLEO-EEICA1 expansion board signals													
NC	IOREF		3V3		GND	GND			M24_WC1		M24_WC2	M24_WC3	

Table 8. X-NUCLEO-EEICA1 and NUCLEO- G474RE 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- G474RE MCU port																	
PB8	PB9			PA5	PA6	PA7	PB6	PC7	PA9	PA8	PB10	PB4	PB5	PB3	PA10	PA2	PA3
NUCLEO- G474RE MCU signals																	
I2C1_SDA	I2C1_SCL																
X-NUCLEO-EEICA1 expansion board signals																	
M24_I2C_SCL	M24_I2C_SDA									I2C_E2	I2C_E1	I2C_E0					

Table 9. X-NUCLEO-EEICA1 and NUCLEO- H743ZI connection details (left connector)

Signal name													
NC	IOREF	RESET	3V3	5V	GND	GND	VIN	A0	A1	A2	A3	A4	A5
Connector name													
CN8 Power								CN9 Analog					
Pin number													
1	3	5	7	9	11	13	15	1	3	5	7	9	11
NUCLEO- H743ZI MCU port													
								PA3	PC0	PC3	PB1	PC2/PB 9	PF10/P B8
NUCLEO- H743ZI MCU signals													
	3.3 V REF	RESET	3.3 V input/ output	5 V output	GND	GND	POWER INPUT	ADC12_INP15	ADC123_INP10	ADC12_INP13	ADC12_INP5	ADC123_INP12/ I2C1_SDA	ADC3_INP6/ I2C1_SCL
X-NUCLEO-EEICA1 expansion board signals													
NC	IOREF		3V3		GND	GND			M24_WC1		M24_WC2	M24_WC3	

Table 10. X-NUCLEO-EEICA1 and NUCLEO- H743ZI connection details (right connector)

Signal name																	
D15	D14	AVDD	AVDD	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Connector name																	
CN7										CN10							
Pin number																	
2	4	6	8	10	12	14	16	18	20	2	4	6	8	10	12	14	16
NUCLEO- H743ZI MCU port																	
PB8	PB9	AVDD	AVDD	PA5	PA6	PA7	PD14	PD15	PF12	PF13	PE9	PE11	PF14	PE13	PF15	PG14	PG9
NUCLEO- H743ZI MCU signals																	
I2C_A_SCL	I2C_A_SDA																
X-NUCLEO-EEICA1 expansion board signals																	
M24_I2C_SCL	M24_I2C_SDA									I2C_E2	I2C_E1	I2C_E0					

3.2 Current measurement

J5 can be used to monitor the I²C device power consumption. Connect an ammeter probe between the connector pin 2 and pin 3 for measurements.

3.3 X-NUCLEO-EEICA1 component placement details

Figure 3. X-NUCLEO-EEICA1 component placement details

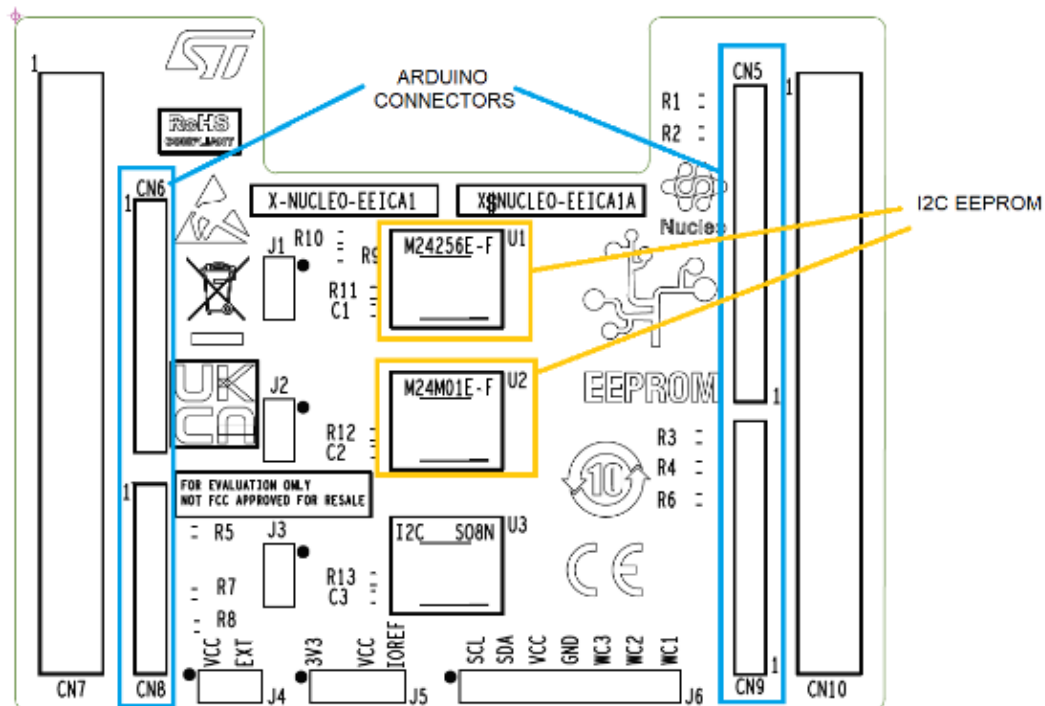


Figure 4. X-NUCLEO-EEICA1 top view layout

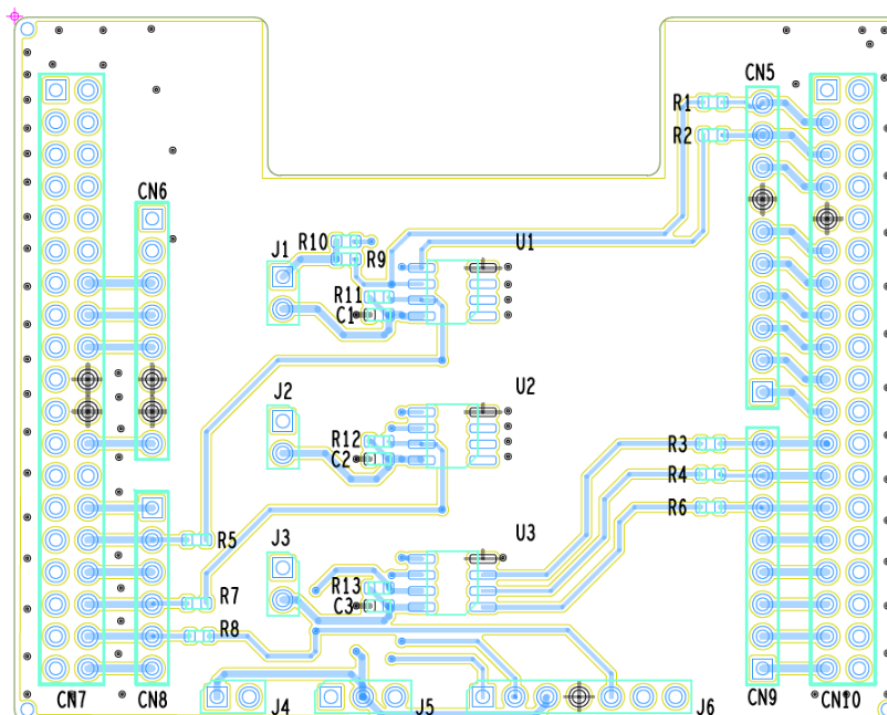
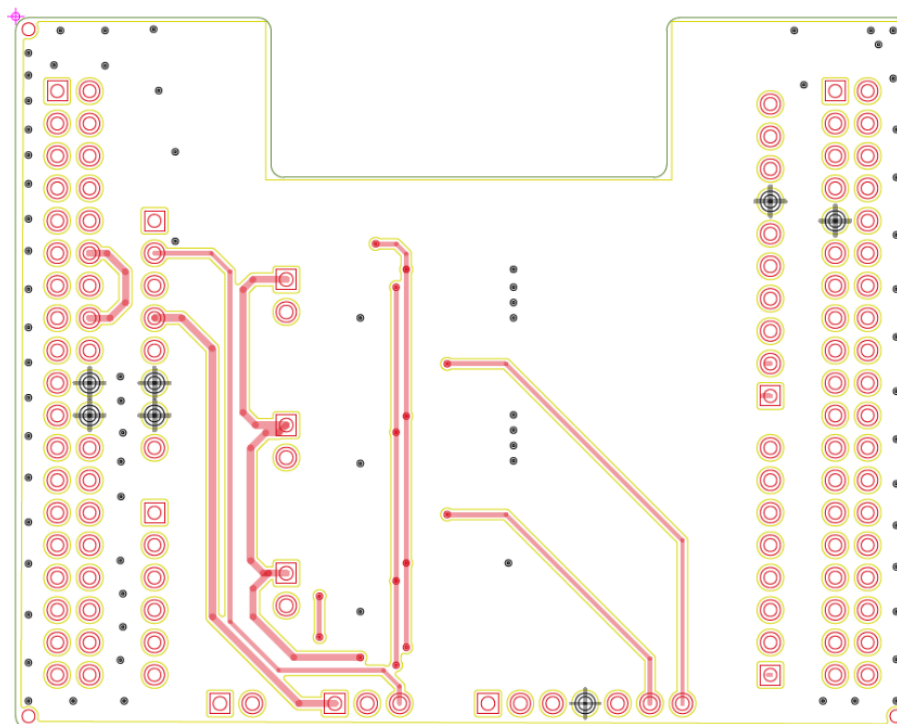


Figure 5. X-NUCLEO-EEICA1 bottom view layout



4 Component description

4.1 M24256E-F

Table 11. M24256E-F details

Feature	Description
Sales type	M24256E-F
Package	FMN6TP
Single supply voltage	1.6 to 5.5 V (ambient operating temperature)

4.2 M24M01E-F

Table 12. M24M01E-F details

Feature	Description
Sales type	M24M01E-F
Package	FMN6TP
Single supply voltage	1.6 to 5.5 V (ambient operating temperature)

5 External EEPROMs

You can easily solder a specific I2C EEPROM density to be used with the X-NUCLEO-EEICA1 expansion board.

Figure 6. External I2C EEPROM provision on X-NUCLEO-EEICA1 expansion board

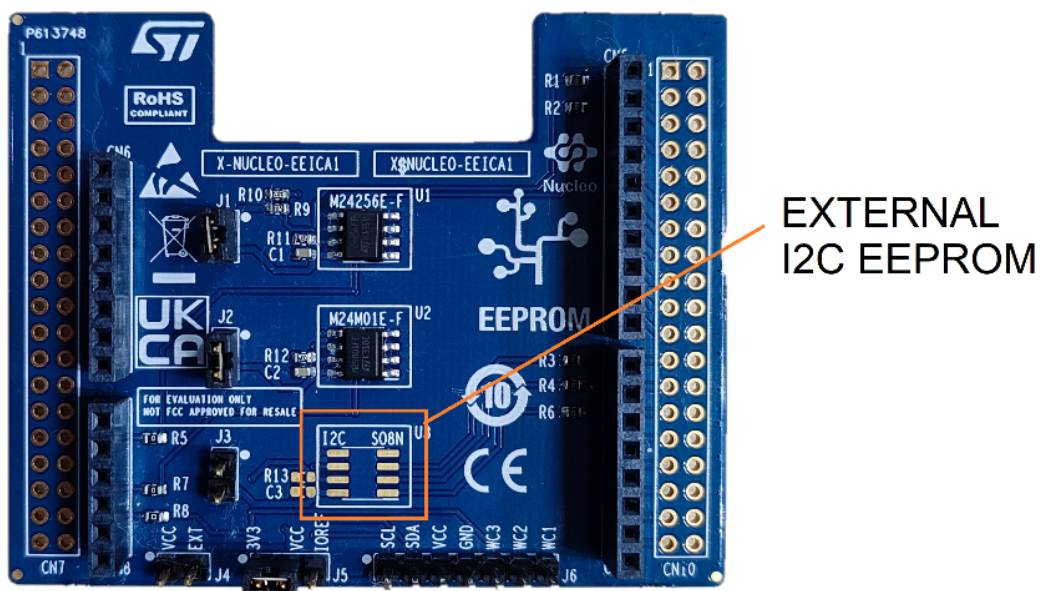
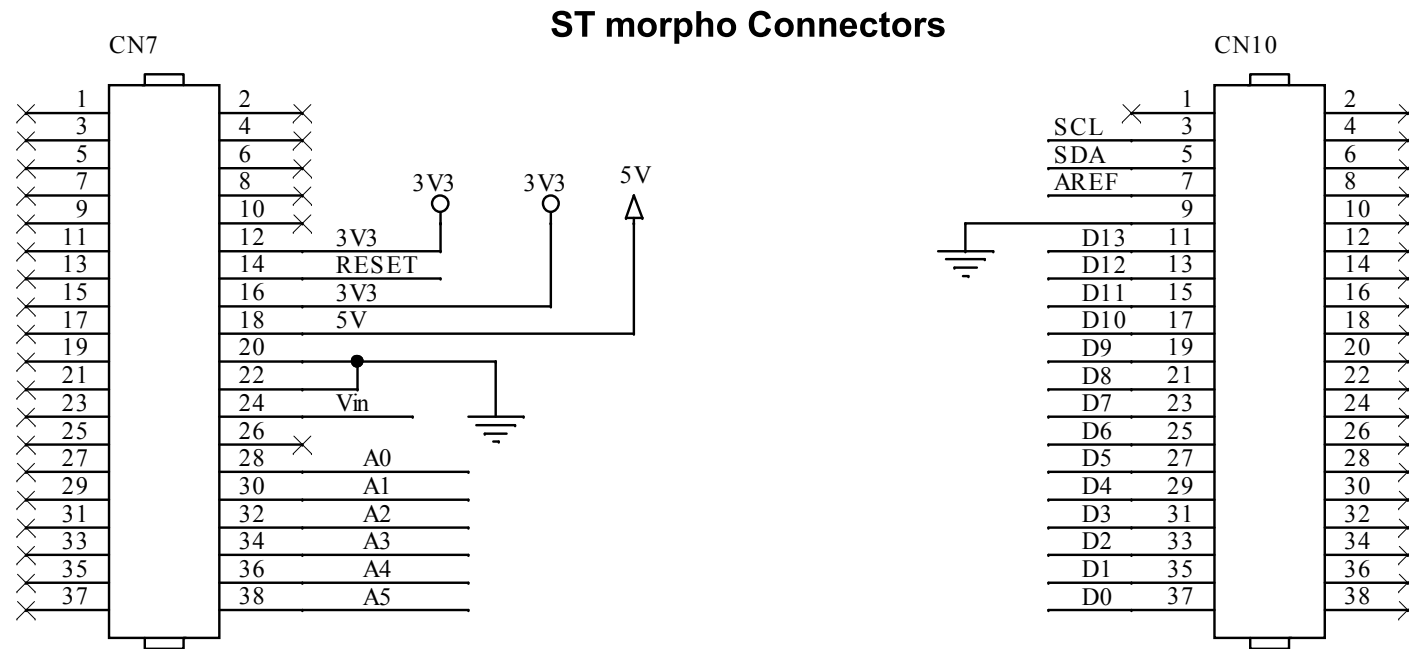
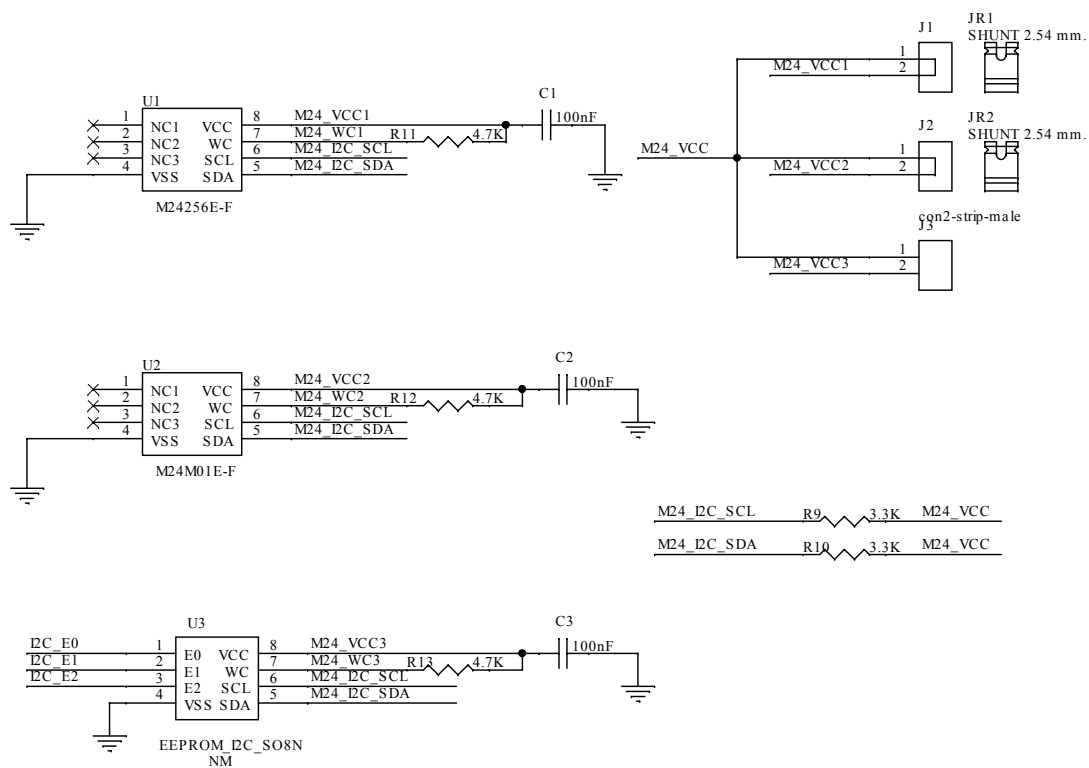


Figure 7. X-NUCLEO-EEICA1 circuit schematic (1 of 4)



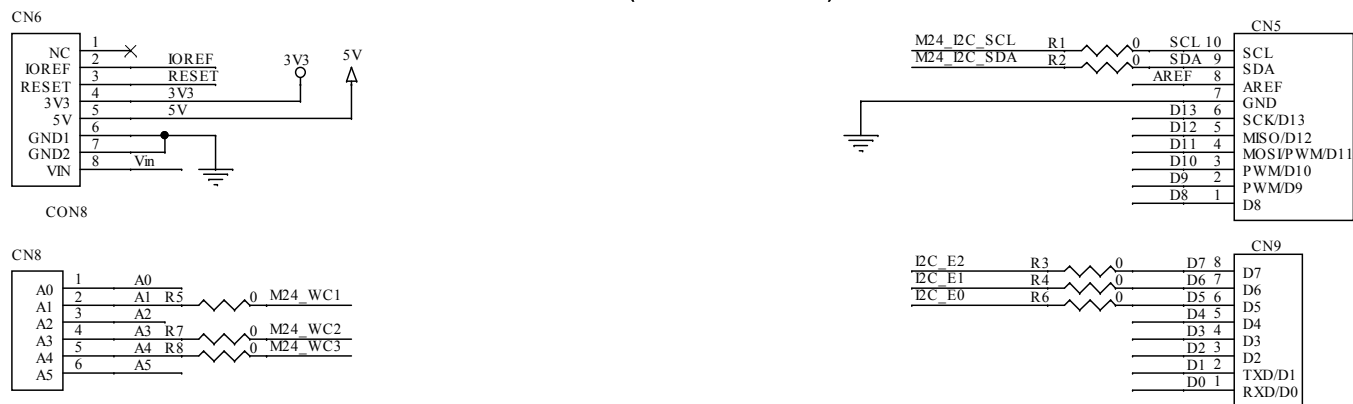
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Figure 8. X-NUCLEO-EEICA1 circuit schematic (2 of 4)



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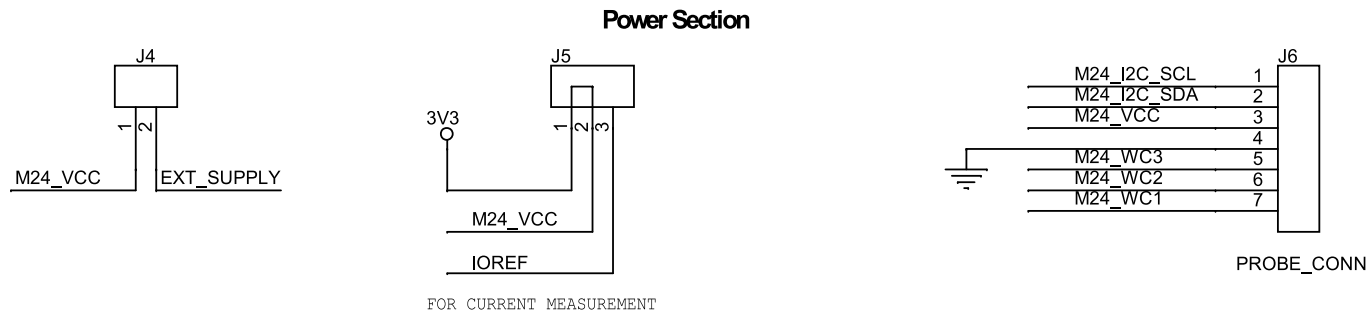
Nucleo Connectors (ARDUINO UNO R3)



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Figure 10. X-NUCLEO-EEICA1 circuit schematic (4 of 4)



	J4	J5
1. 3V3 (Default)	Unshort 1 and 2	Short 1 and 2
2. IOREF	Unshort 1 and 2	Short 2 and 3
3. External Supply	Short 1 and 2	Connectors to be left open

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7 Bill of materials

Table 13. X-NUCLEO-EEICA1 bill of material

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	3	C1 C2 C3	100nF	CAP CER 0.1UF 16V X7R 0603	KEMET	C0603C104K4RACTU
2	1	CN5	CON10	CONN SOCKET 10POS	Samtec Inc.	SSQ-110-03-G-S
3	2	CN6 CN9	CON8	CONN SOCKET 8POS	Samtec Inc.	SSQ-108-03-G-S
4	2	CN7 CN10	HEADER 19x2	CONN SOCKET 19X2 Not mounted	Samtec Inc.	SSQ-119-03-T-D
5	1	CN8	CON6	CONN SOCKET 6POS	Samtec Inc.	SSQ-106-03-G-S
6	4	J1 J2 J3 J4	con2-strip-male	CONN HEADER .100 STR 3POS	Samtec Inc.	TSW-102-07-F-S
7	1	J5	con3-strip-male	CONN HEADER .100 STR 3POS	Samtec Inc.	TSW-103-07-F-S
8	1	J6	PROBE_CONN	CONN HEADER .100 STR 7POS	Wurth Elektronik	61300711121
9	2	JR1 JR2	2.54 mm	JUMPER	Wurth Elektronik	60900213421
10	8	R1 R2 R3 R4 R5 R6 R7 R8	0	RES SMD 0 OHM JUMPER 1/10W 0603	TE Connectivity Passive Product	CRG0603ZR
11	2	R9 R10	3.3K	RES 3.3K OHM 5% 1/10W 0603	Yageo	RC0603JR-073K3L
12	3	R11 R12 R13	4.7K	RES 4.7K OHM 1% 1/10W 0603	Yageo	RC0603FR-074K7L
13	1	U1	M24256E-F, SO8	256-Kbit serial I ² C bus EEPROM	ST	M24256E-FMN6TP
14	1	U2	M24M01E-F, SO8	1-Mbit serial I ² C bus EEPROM	ST	M24M01E-FMN6TP
15	1	U3	EEPROM_I2C_ SO8N, SO8	Not mounted	Any	

8 Board versions

Table 14. X-NUCLEO-EEICA1 versions

Finished good	Schematic diagrams	Bill of materials
X\$NUCLEO-EEICA1A ⁽¹⁾	X\$NUCLEO-EEICA1 schematic diagrams	X\$NUCLEO-EEICA1 bill of materials

1. This code identifies the X-NUCLEO-EEICA1 evaluation board first version.

9 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.

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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 2015/863/EU (RoHS).

Notice for the United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Revision history

Table 15. Document revision history

Date	Revision	Changes
21-Dec-2023	1	Initial release.

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