

Getting started with the X-NUCLEO-53L7A1 expansion board for STM32 Nucleo based on the VL53L7CX

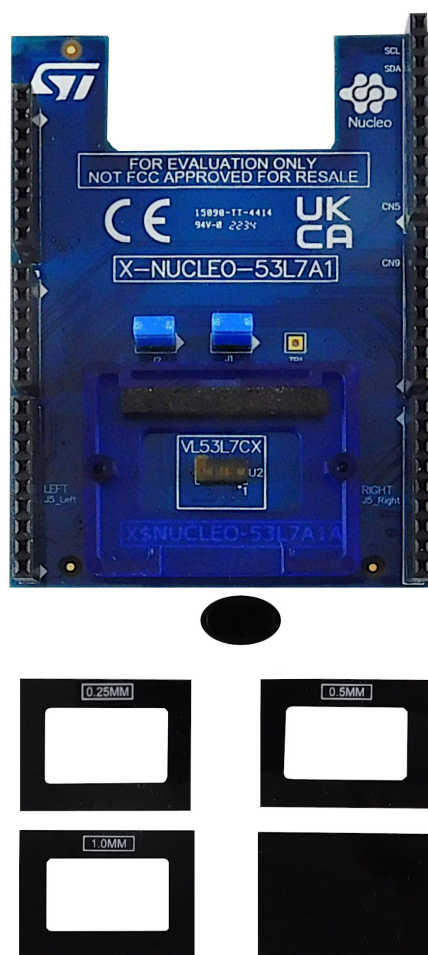
Introduction

The **X-NUCLEO-53L7A1** is an expansion board for any **STM32 Nucleo** development board equipped with the Arduino R3 connectors. It provides a complete evaluation kit that allows you to learn, evaluate, and develop applications using the **VL53L7CX** Time-of-Flight 8x8 multizone ranging sensor with 90° FoV.

The expansion board is delivered with a cover glass holder in which you can fit three different spacers of 0.25, 0.5, and 1 mm height below the cover glass to simulate various air gaps. A small oval cover glass fitting the sensor is included.

Several ST expansion boards can be stacked through the Arduino connectors, which allow, for example, the development of **VL53L7CX** applications with Bluetooth or Wi-Fi interfaces.

Figure 1. X-NUCLEO-53L7A1 expansion board, spacers, cover glass holder, and oval cover glass



1 Getting started

1.1 Safety considerations

1.1.1 Electrostatic precautions

Warning: Take electrostatic precautions, including ground straps, when using the *X-NUCLEO-53L7A1* expansion board. Failure to prevent electrostatic discharge could damage the device.

Figure 2. Electrostatic logo



1.1.2 Laser safety considerations

The *VL53L7CX* contains a laser emitter and corresponding drive circuitry.

The laser output is designed to remain within Class 1 laser safety limits under all reasonably foreseeable conditions including single faults in compliance with IEC 60825-1:2007 and IEC 60825-1:2014.

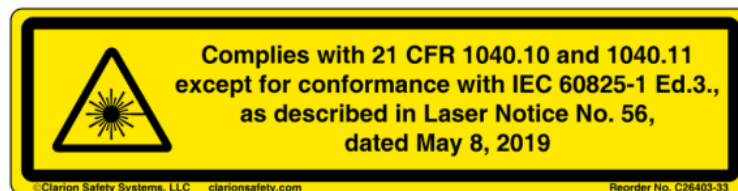
The laser output power must not be increased and no optics should be used with the intention of focusing the laser beam.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Figure 3. Class 1 laser product label



Figure 4. Laser notice 56: applies to IEC 60825-1:2014



1.2 Features

- *VL53L7CX* Time-of-Flight 8x8 multizone ranging sensor with 90° FoV
- Accurate absolute ranging distance, independent of the reflectance of the target
- Up to 350 cm ranging
- Histogram-based technology

- Multiobject detection capability
- 0.25, 0.5, and 1 mm spacers to simulate air gaps
- One cover glass to protect the sensor from dust
- Compatible with [STM32 Nucleo](#) development boards
- Equipped with Arduino® UNO R3 connectors
- Full system software supplied, including code examples and graphical user interface
- RoHS, CE, UKCA, and China RoHS compliant

1.3 VL53L7CX Time-of-Flight sensor characteristics

- Laser wavelength: 940 nm
- Invisible laser radiation
- Maximum laser power emitted: 130 mW
- Integration time: 2 ms minimum

1.4 Spacers and covers

The [X-NUCLEO-53L7A1](#) expansion board is delivered with:

- three spacers of 0.25 mm, 0.5 mm, and 1 mm height, used to simulate different air gaps between the [VL53L7CX](#) and the rectangular-shaped cover glass;
- two nine-pin headers that allow connecting the two breakout boards to the [X-NUCLEO-53L7A1](#) expansion board.

Attention: The [VL53L7CX](#) is delivered with a liner to prevent potential foreign material from piercing the module holes during the assembly process. Remove this liner before use.

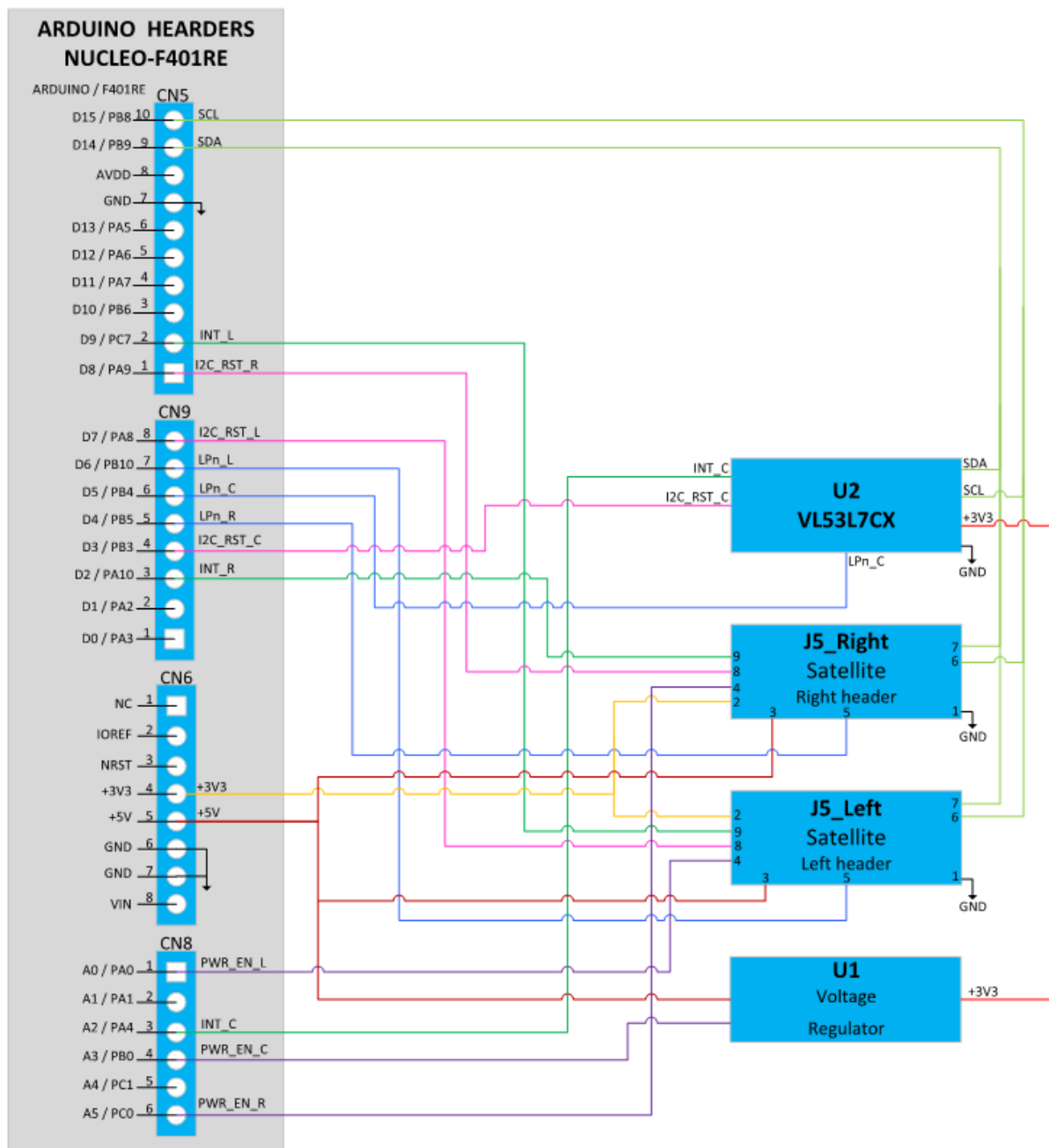
1.5 Ordering information

Table 1. Ordering information

Order code	Core product
X-NUCLEO-53L7A1	VL53L7CX

1.6 Simplified schematic

Figure 5. X-NUCLEO-53L7A1 expansion board - simplified schematic



2 Using the expansion board

The [X-NUCLEO-53L7A1](#) expansion board allows the user to test the [VL53L7CX](#) sensor functionality, to program it and to understand how to develop an application using this sensor.

The [X-NUCLEO-53L7A1](#) integrates:

- the [VL53L7CX](#) sensor;
- Arduino UNO R3 connectors;
- Connectors for [SATEL-VL53L7CX](#) optional breakout boards;

Important: Program a microcontroller to control the [VL53L7CX](#) through the I2C bus.

The application software and an example of the C-ANSI source code are available on the [sensor web page](#).

The [X-NUCLEO-53L7A1](#) expansion board can be connected to the [STM32 Nucleo](#) development board through the Arduino UNO R3 connectors (CN5, CN6, CN8, and CN9) as shown in [Figure 5](#).

3 Breakout boards

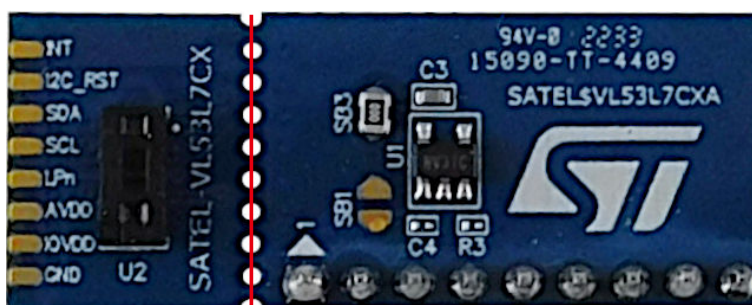
The X-NUCLEO-53L7A1 package does not include the VL53L7CX breakout boards.

You can purchase them in a pack of two PCBs as SATEL-VL53L7CX.

The X-NUCLEO-53L7A1 supplies the VL53L7CX breakout boards at 3.3 V (see Figure 5).

For mechanical integration purposes, it could be interesting to use the mini PCB by breaking the SATEL-VL53L7CX along the red line as shown in the figure below. It is easier to integrate this setup into a customer's device thanks to its small size.

Figure 6. SATEL-VL53L7CX



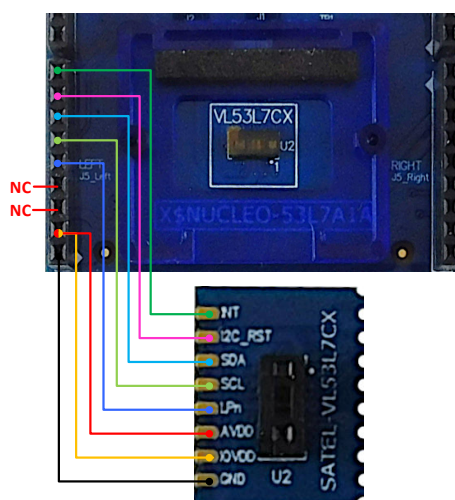
The SATEL-VL53L7CX boards can be directly plugged onto the X-NUCLEO-53L7A1 through the two 9-pin headers (see Figure 7. SATEL-VL53L7CX breakout boards connected to the X-NUCLEO-53L7A1 expansion board).

As an alternative, they can be connected to the X-NUCLEO-53L7A1 by using the mini PCB through flying wires (see Figure 8).

Figure 7. SATEL-VL53L7CX breakout boards connected to the X-NUCLEO-53L7A1 expansion board



Figure 8. VL53L7CX mini PCB flying wire connection to the X-NUCLEO-53L7A1 expansion board



4 Graphical user interface (GUI) and programming example for the X-NUCLEO-53L7A1

To evaluate the [VL53L7CX](#) device performance, use the related GUI.

The [X-NUCLEO-53L7A1](#) expansion board requires the [NUCLEO-F401RE](#) development board to use the GUI.

Important: Despite the fact that the [X-NUCLEO-53L7A1](#) can be stacked on any [STM32 Nucleo](#) board equipped the [Arduino R3](#) connectors, the GUI is designed to work with the [NUCLEO-F401RE](#) only.

Download the GUI (in the Tools and Software tab of the [X-NUCLEO-53L7A1](#) web page) to evaluate the [VL53L7CX](#).

5 Schematic diagrams

Figure 9. X-NUCLEO-53L7A1 circuit schematic (1 of 5)

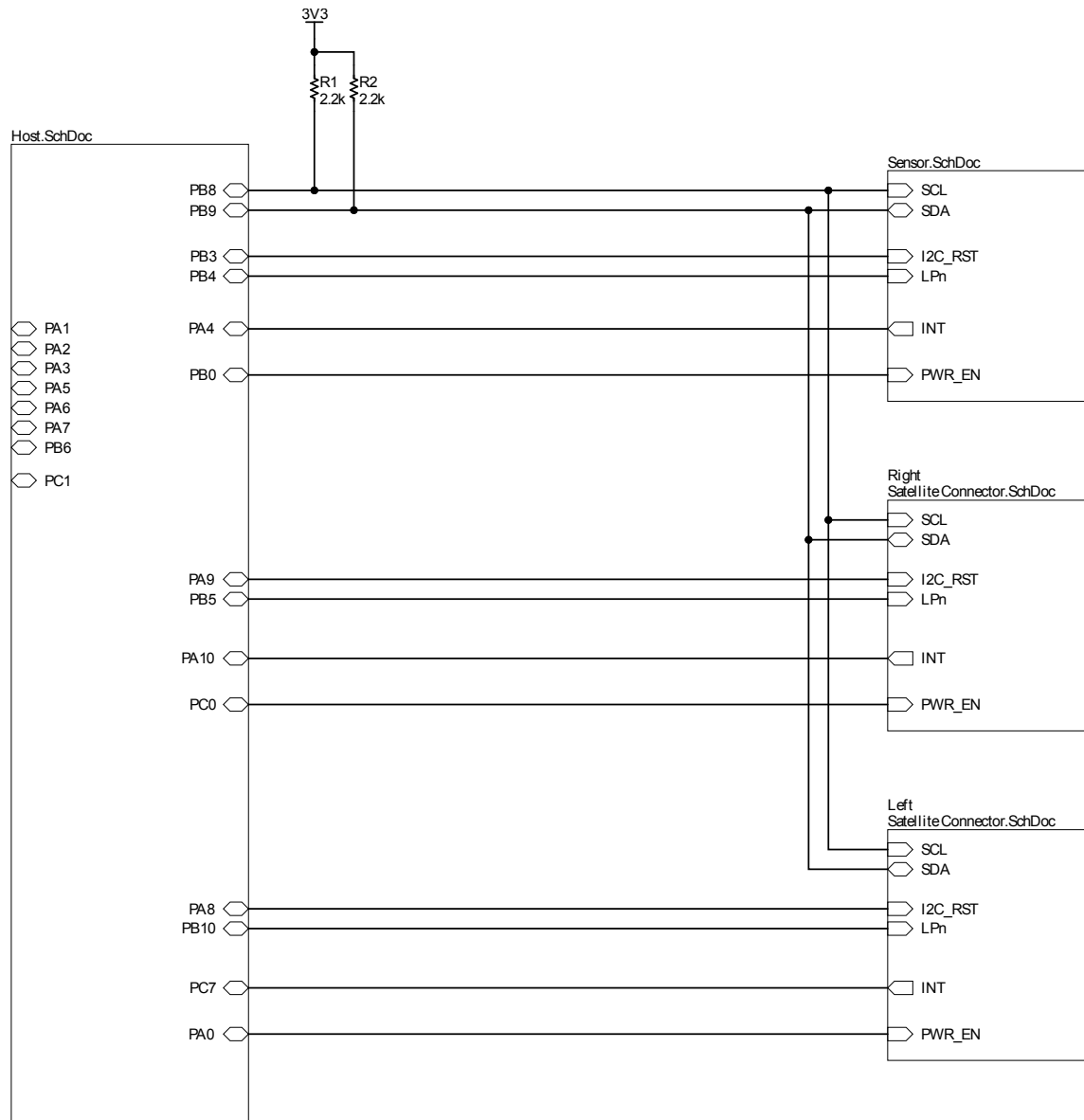


Figure 10. X-NUCLEO-53L7A1 circuit schematic (2 of 5)

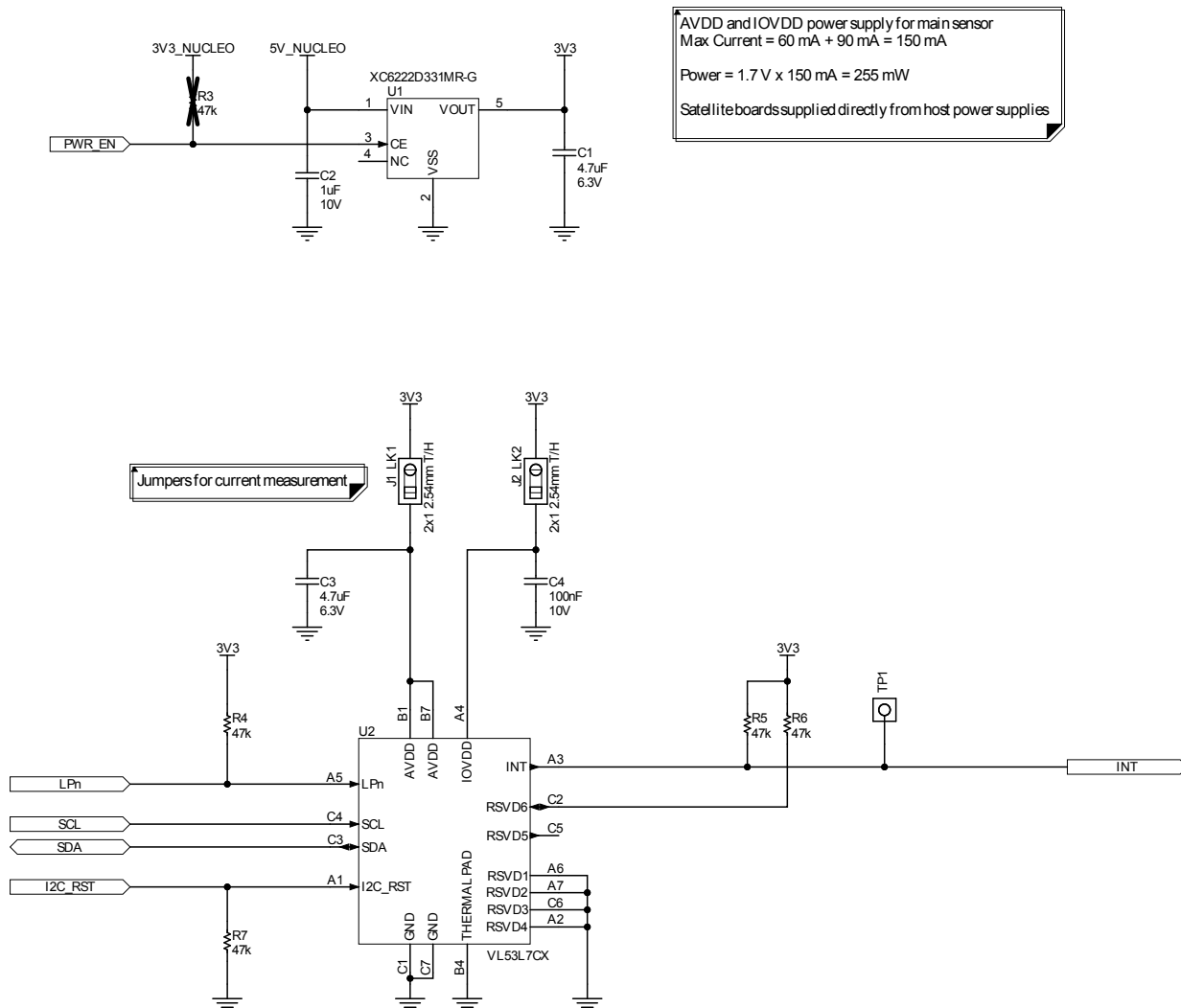


Figure 11. X-NUCLEO-53L7A1 circuit schematic (3 of 5)

Nucleo Arduino Connectors

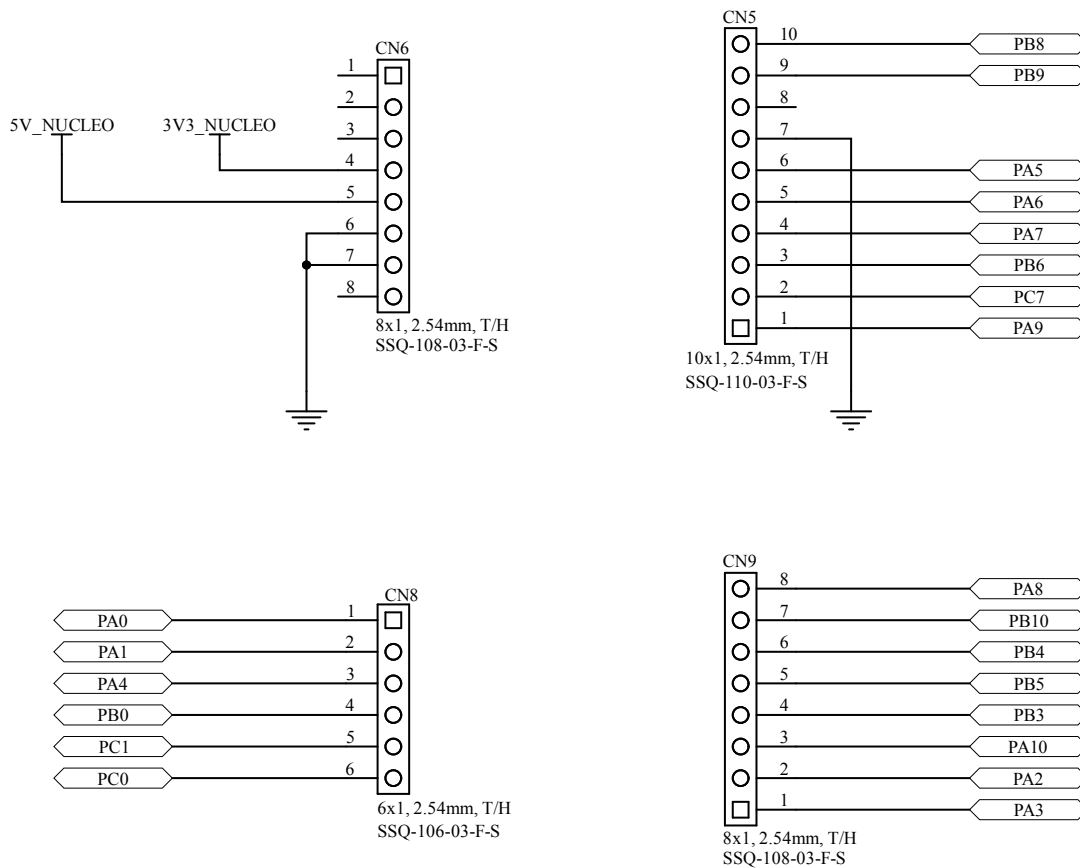


Figure 12. X-NUCLEO-53L7A1 circuit schematic (4 of 5)

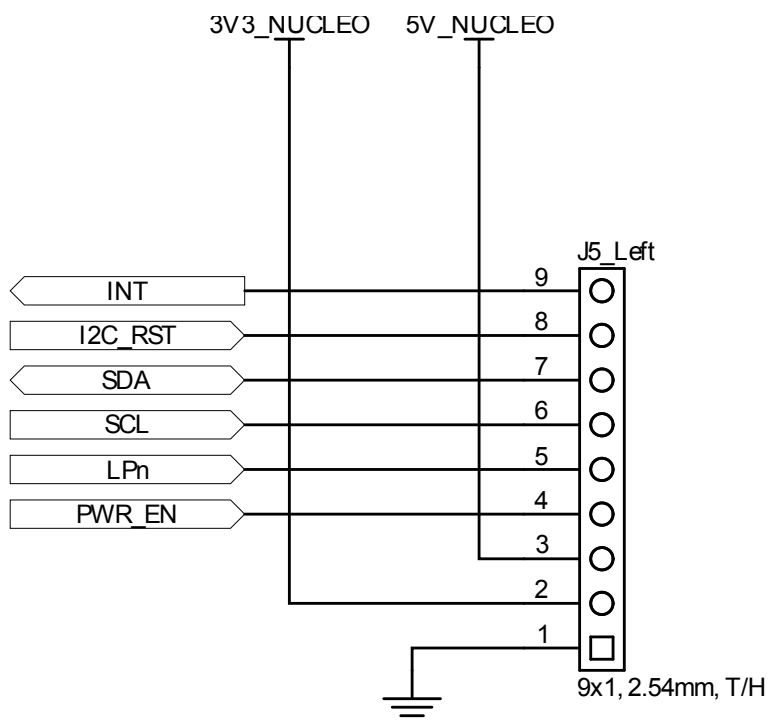
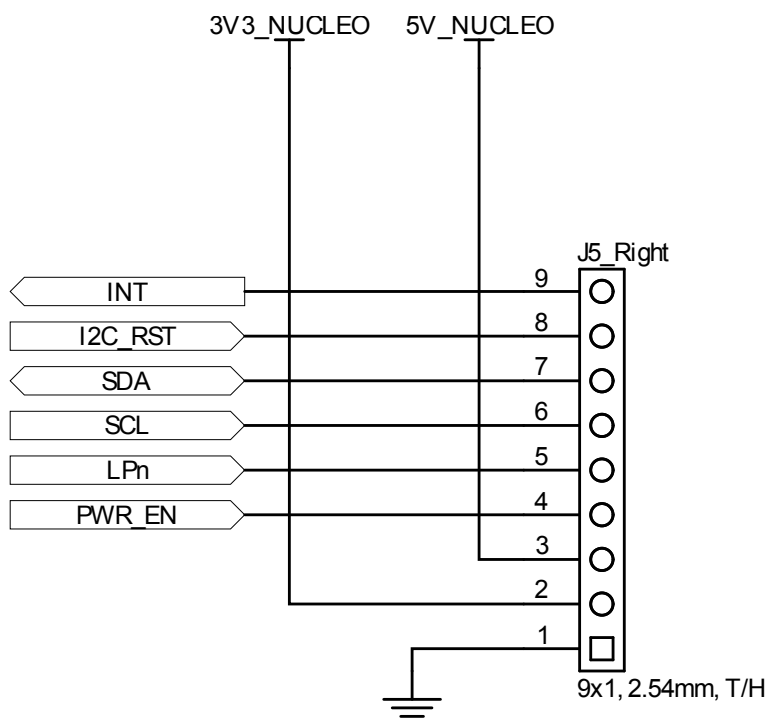


Figure 13. X-NUCLEO-53L7A1 circuit schematic (5 of 5)



6 Bill of materials

Table 2. X-NUCLEO-53L7A1 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	0	R3 Not Fitted	47k, 0201, 1/20 W	RES, 47k, 1%, 1/20W, 0201	Panasonic	ERJ1GNF4702C
2	1	C4 Fitted	100nF, 0201, 10 V	CAP, CER, 100nF, 10V, X5R, 0201	Murata	GRM033R61A104KE15D
3	1	C2 Fitted	1uF, 0201, 10 V	CAP, CER, 1uF, 10V, X5R, 0201	Samsung	CL03A105KP3NSNC
4	1	CN5 Fitted	-	CONN, HEADER, 10POS, SNGL, 2.54mm, T/H	Samtec	SSQ-110-03-F-S
5	1	CN8 Fitted	-	CONN, HEADER, 6POS, SNGL, 2.54mm, T/H	Samtec	SSQ-106-03-F-S
6	1	U2 Fitted	VL53L7CXV0GC/1	Time-of-Flight 8x8 multizone ranging sensor with wide field of v	ST	VL53L7CXV0GC/1
7	1	U1 Fitted	SOT-25	IC, REG, LDO, 3.3V, 0.7A, SOT25	Torex Semiconductor	XC6222D331MR-G
8	1	A1 Fitted		PCB X-NUCLEO-53L7A1	manufacturer	PCB4132B
9	2	C1, C3 Fitted	4.7uF, 0402, 6.3 V	CAP, CER, 4.7uF, 6.3V, X5R, 0402	TDK	C1005X5R0J475K050BC
10	2	J1, J2 Fitted		CONN, HEADER, 2POS, 2.54MM, T/H, VERT	Harwin	M20-9990245
11	2	J5_Left, J5_Right Fitted	-	CONN, HEADER, 9POS, SNGL, 2.54mm, T/H	Samtec	SSW-109-01-G-S
12	2	CN6, CN9 Fitted	-	CONN, HEADER, 8POS, SNGL, 2.54mm, T/H	Samtec	SSQ-108-03-F-S
13	2	R1, R2 Fitted	2.2k, 0402, 1/16 W	RES, 2.2k, 1%, 1/16W, 0402	Stackpole Electronics	RMCF0402FT2K20
14	2	LK1, LK2 Fitted	-	LINK, HEADER, 2.54MM	Harwin	M7571-05
15	4	R4, R5, R6, R7 Fitted	47k, 0201, 1/20 W	RES, 47k, 1%, 1/20W, 0201	Panasonic	ERJ1GNF4702C

7 Board versions

Table 3. X-NUCLEO-53L7A1 versions

PCB version	Schematic diagrams	Bill of materials
X\$NUCLEO-53L7A1A ⁽¹⁾	X\$NUCLEO-53L7A1A schematic diagrams	X\$NUCLEO-53L7A1A bill of materials

1. This code identifies the X-NUCLEO-53L7A1 expansion board first version. It is printed on the board PCB.

8 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 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 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).

Appendix A References

- [VL53L7CX data sheet](#)
- [X-NUCLEO-53L7A1 data brief: DB4808](#)
- [X-CUBE-TOF1 data brief: DB4449](#)

Revision history

Table 4. Document revision history

Date	Revision	Changes
13-Oct-2022	1	Initial release.
03-Mar-2023	2	Updated Section 3 Breakout boards and Section 1.1.2 Laser safety considerations .

Contents

1	Getting started	2
1.1	Safety considerations	2
1.1.1	Electrostatic precautions	2
1.1.2	Laser safety considerations	2
1.2	Features	2
1.3	VL53L7CX Time-of-Flight sensor characteristics	3
1.4	Spacers and covers	3
1.5	Ordering information	3
1.6	Simplified schematic	4
2	Using the expansion board	5
3	Breakout boards	6
4	Graphical user interface (GUI) and programming example for the X-NUCLEO-53L7A1	9
5	Schematic diagrams	10
6	Bill of materials	14
7	Board versions	15
8	Regulatory compliance information	16
Appendix A	References	17
	Revision history	18
	List of tables	20
	List of figures	21

List of tables

Table 1.	Ordering information.	3
Table 2.	X-NUCLEO-53L7A1 bill of materials.	14
Table 3.	X-NUCLEO-53L7A1 versions	15
Table 4.	Document revision history	18

List of figures

Figure 1.	X-NUCLEO-53L7A1 expansion board, spacers, cover glass holder, and oval cover glass.	1
Figure 2.	Electrostatic logo	2
Figure 3.	Class 1 laser product label	2
Figure 4.	Laser notice 56: applies to IEC 60825-1:2014.	2
Figure 5.	X-NUCLEO-53L7A1 expansion board - simplified schematic.	4
Figure 6.	SATEL-VL53L7CX	6
Figure 7.	SATEL-VL53L7CX breakout boards connected to the X-NUCLEO-53L7A1 expansion board	7
Figure 8.	VL53L7CX mini PCB flying wire connection to the X-NUCLEO-53L7A1 expansion board	8
Figure 9.	X-NUCLEO-53L7A1 circuit schematic (1 of 5).	10
Figure 10.	X-NUCLEO-53L7A1 circuit schematic (2 of 5).	11
Figure 11.	X-NUCLEO-53L7A1 circuit schematic (3 of 5).	12
Figure 12.	X-NUCLEO-53L7A1 circuit schematic (4 of 5).	13
Figure 13.	X-NUCLEO-53L7A1 circuit schematic (5 of 5).	13

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