

## Getting started with the X-NUCLEO-53L4A1 expansion board for STM32 Nucleo based on the VL53L4CD

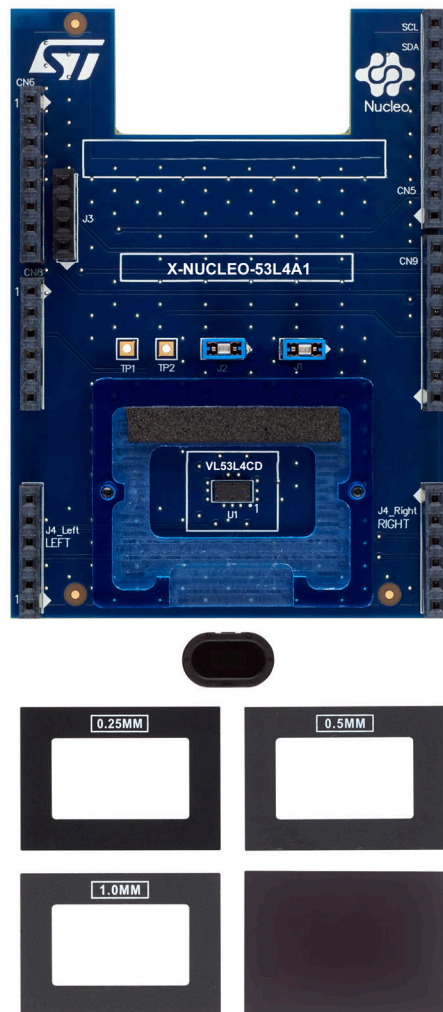
### Introduction

The X-NUCLEO-53L4A1 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 VL53L4CD Time-of-Flight high-accuracy proximity sensor.

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 VL53L4CD applications with Bluetooth or Wi-Fi interfaces.

**Figure 1. X-NUCLEO-53L4A1 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-53L4A1 expansion board. Failure to prevent electrostatic discharge could damage the device.

Figure 2. Electrostatic logo



#### 1.1.2 Laser safety considerations

The VL53L4CD contains a laser emitter and the corresponding drive circuitry.

The laser output is designed to remain within Class 1 laser safety limits under all reasonable foreseeable conditions, including single faults, in compliance with the IEC 60825-1:2014 (third edition).

The laser output remains within Class 1 limits as long as you use the STMicroelectronics recommended device settings and respect the operating conditions specified in the data sheet.

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

Figure 3. Class 1 laser product label



### 1.2 Features

- VL53L4CD Time-of-Flight high-accuracy proximity sensor
- Accurate absolute ranging distance, independent of the reflectance of the target
- 0.25, 0.5, and 1 mm spacers to simulate air gaps
- Two different cover glasses 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 Spacers and covers

The X-NUCLEO-53L4A1 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 VL53L4CD and the rectangular-shaped cover glass;
- an oval-shaped cover glass to simulate the integration of the VL53L4CD into the customer's final product;
- two six-pin headers that allow connecting the two breakout boards to the X-NUCLEO-53L4A1 expansion board.

**Attention:** The VL53L4CD is delivered with a liner to prevent potential foreign material from piercing the module holes during the assembly process. Remove this liner before use.

### 1.4 Ordering information

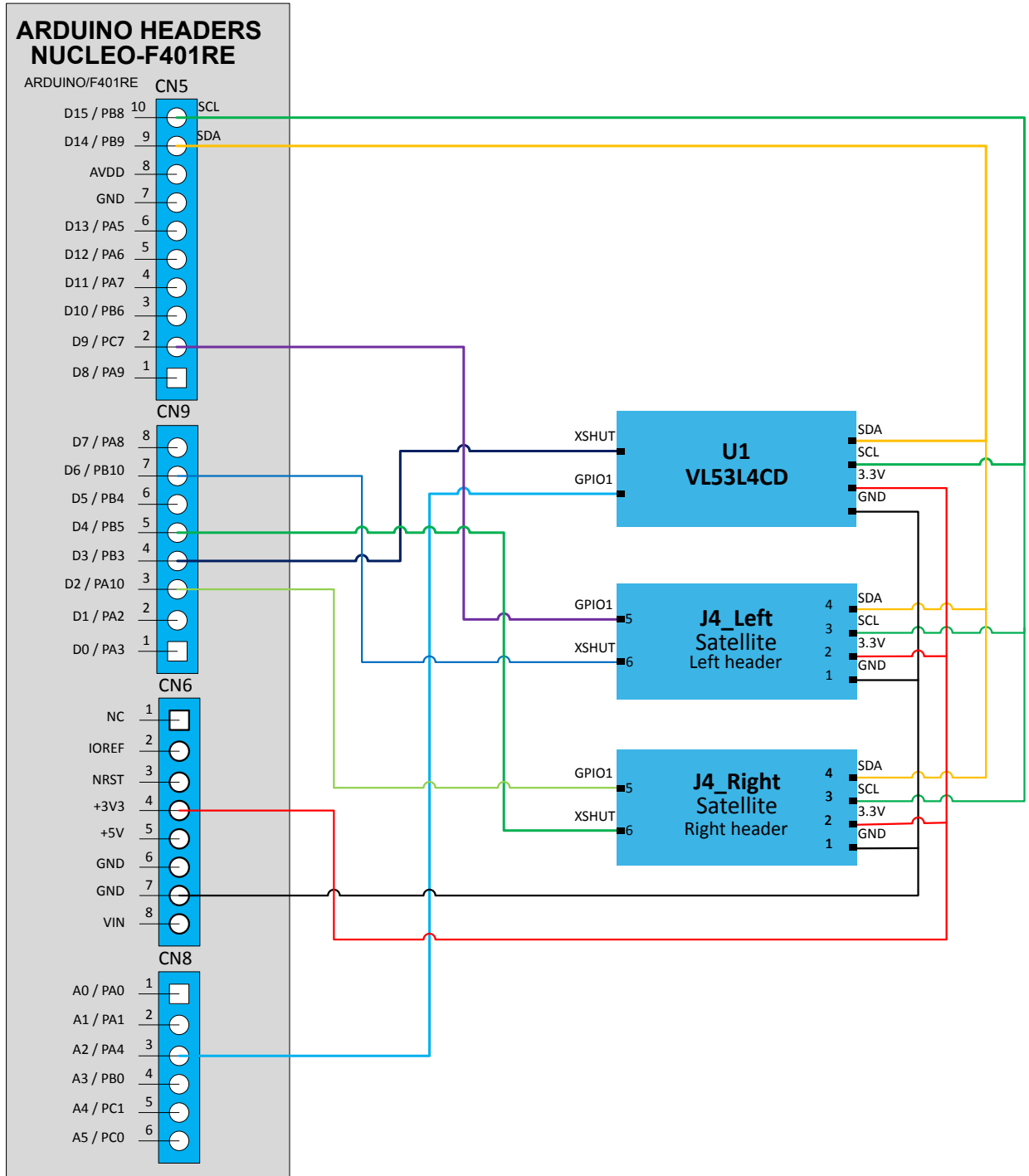
To order the Time-of-Flight high-accuracy proximity sensor expansion board based on the VL53L4CD, refer to the table below.

**Table 1. Ordering information**

Order code	PCB version	Core product
X-NUCLEO-53L4A1-	X\$NUCLEO-53L4A1-	VL53L4CD

## 1.5 Simplified schematic

Figure 4. X-NUCLEO-53L4A1 expansion board - simplified schematic



## 2 Using the expansion board

The X-NUCLEO-53L4A1 expansion board allows the user to test the VL53L4CD sensor functionality, to program it and to understand how to develop an application using this sensor.

The X-NUCLEO-53L4A1 integrates:

- the VL53L4CD sensor;
- Arduino UNO R3 connectors;
- Connectors for SATEL-VL53L4CD optional breakout boards;

*Important:* Program a microcontroller to control the VL53L4CD 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-53L4A1 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 4.

### 3 Breakout boards

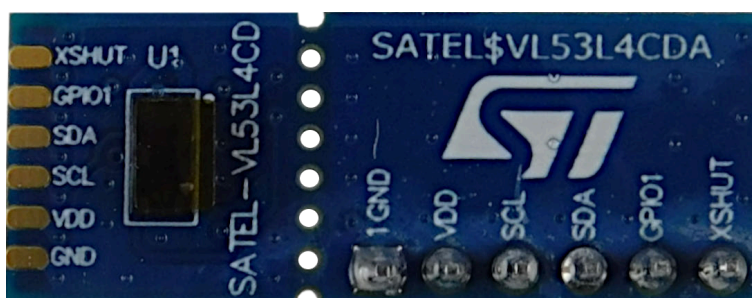
The X-NUCLEO-53L4A1 package does not include the VL53L4CD breakout boards.

You can purchase them in a pack of two PCBs as SATEL-VL53L4CD.

The X-NUCLEO-53L4A1 supplies the VL53L4CD breakout boards at 3.3 V (see Figure 4).

For mechanical integration purposes, it could be interesting to use the mini PCB by breaking the SATEL-VL53L4CD 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 5. SATEL-VL53L4CD



The SATEL-VL53L4CD boards can be directly plugged onto the X-NUCLEO-53L4A1 through the two 6-pin headers (see Figure 6).

As an alternative, they can be connected to the X-NUCLEO-53L4A1 by using the mini PCB through flying wires (see Figure 7).

Figure 6. SATEL-VL53L4CD breakout boards connected to the X-NUCLEO-53L4A1 expansion board

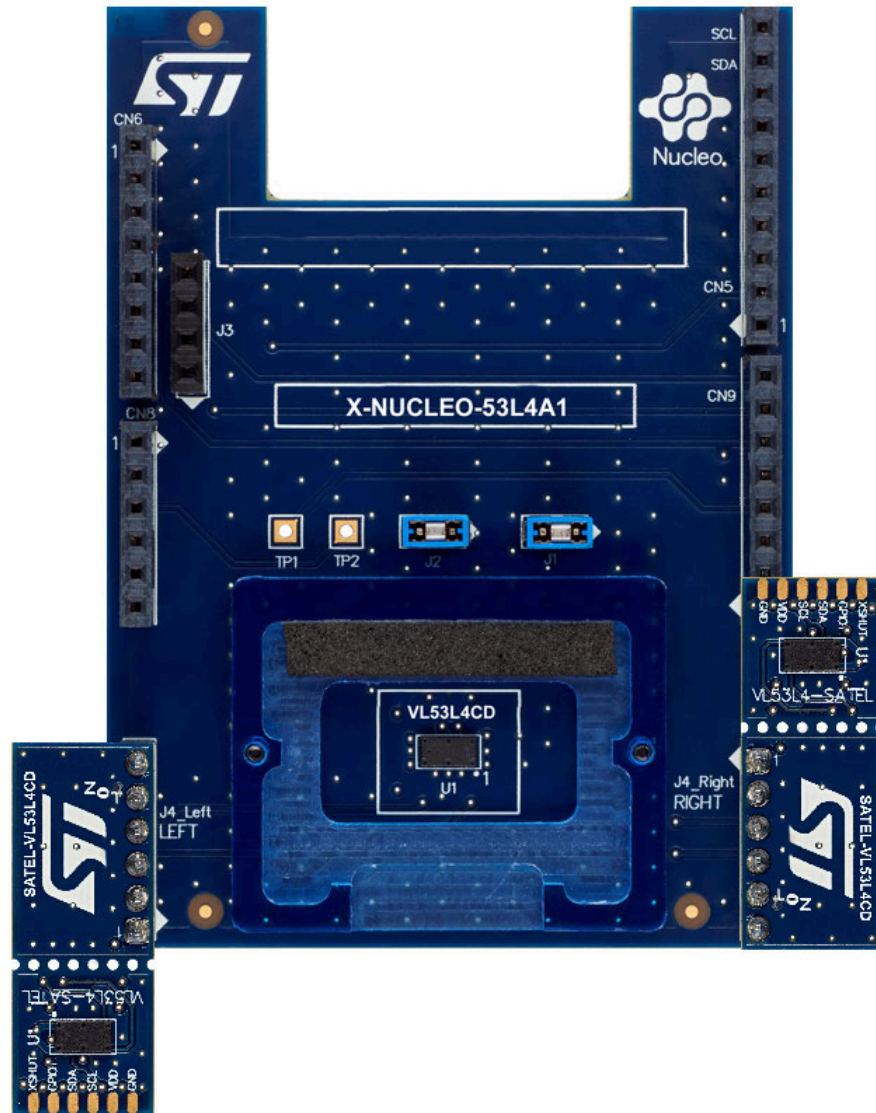
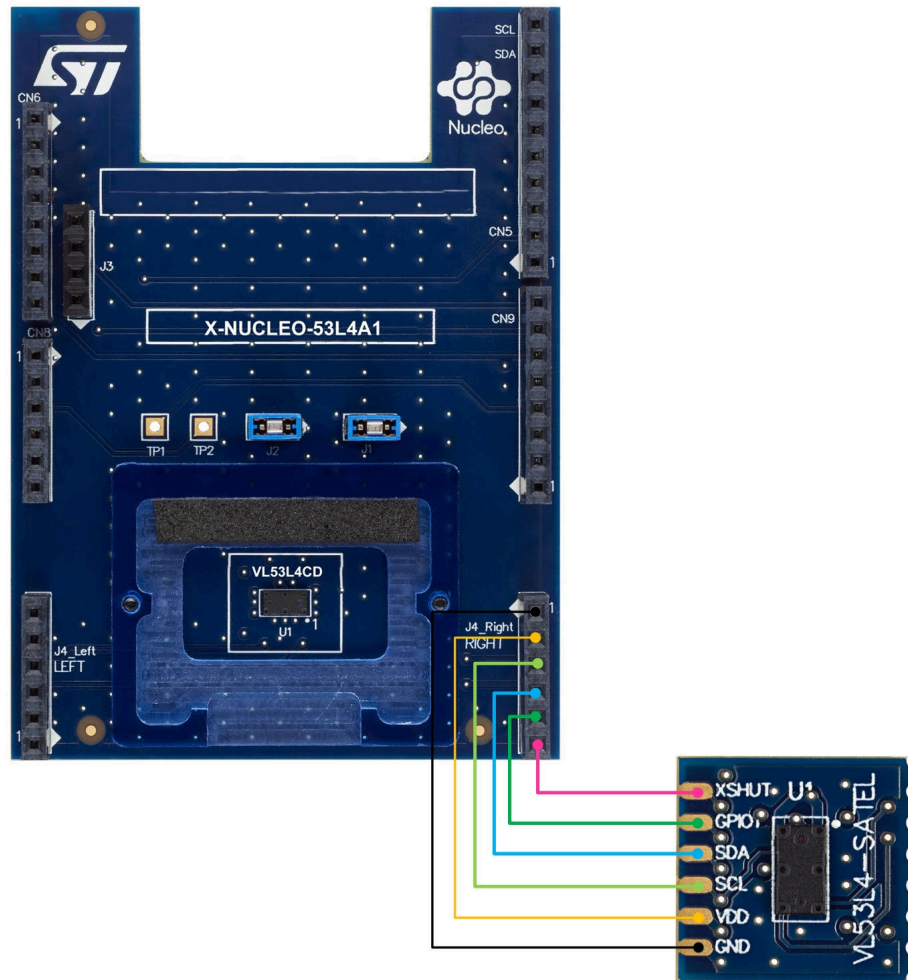


Figure 7. VL53L4CD mini PCB flying wire connection to the X-NUCLEO-53L4A1 expansion board





## 4 Graphical user interface (GUI) and programming example for the X-NUCLEO-53L4A1

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To evaluate the [VL53L4CD](#) device performance, use the related GUI or the [X-CUBE-TOF1](#).

The [X-NUCLEO-53L4A1](#) expansion board requires the [NUCLEO-F401RE](#) development board to use the GUI or run the ranging examples included in the [X-CUBE-TOF1](#).

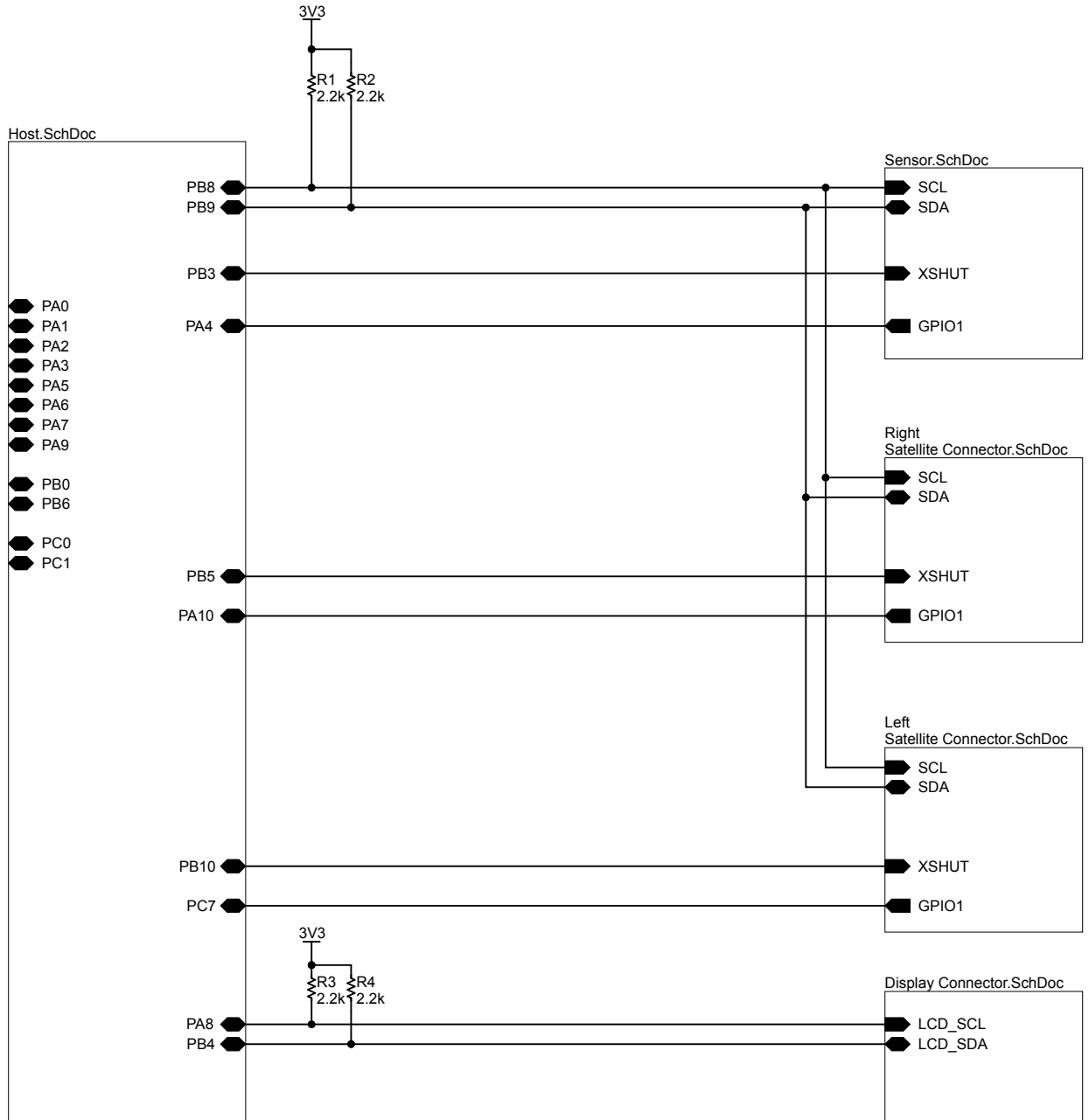
*Important:* *Despite the fact that the [X-NUCLEO-53L4A1](#) can be stacked on any [STM32 Nucleo](#) board equipped the [Arduino R3](#) connectors, the GUI is designed to work with the [NUCLEO-F401RE](#) only.*

Download the GUI (in the Tools and Software tab of the [X-NUCLEO-53L4A1](#) web page) or the [X-CUBE-TOF1](#) to evaluate the [VL53L4CD](#).

## 5 Schematic diagrams

Note: These schematic diagrams refer to the board latest version.

Figure 8. X-NUCLEO-53L4A1 circuit schematic (1 of 6)



Note: The display connector is an optional connector to connect an SSD1306 I2C OLED display to output the ranging data or other meaningful information if required. The related application note and example code will be available on [st.com](http://st.com).

Figure 9. X-NUCLEO-53L4A1 circuit schematic (2 of 6)

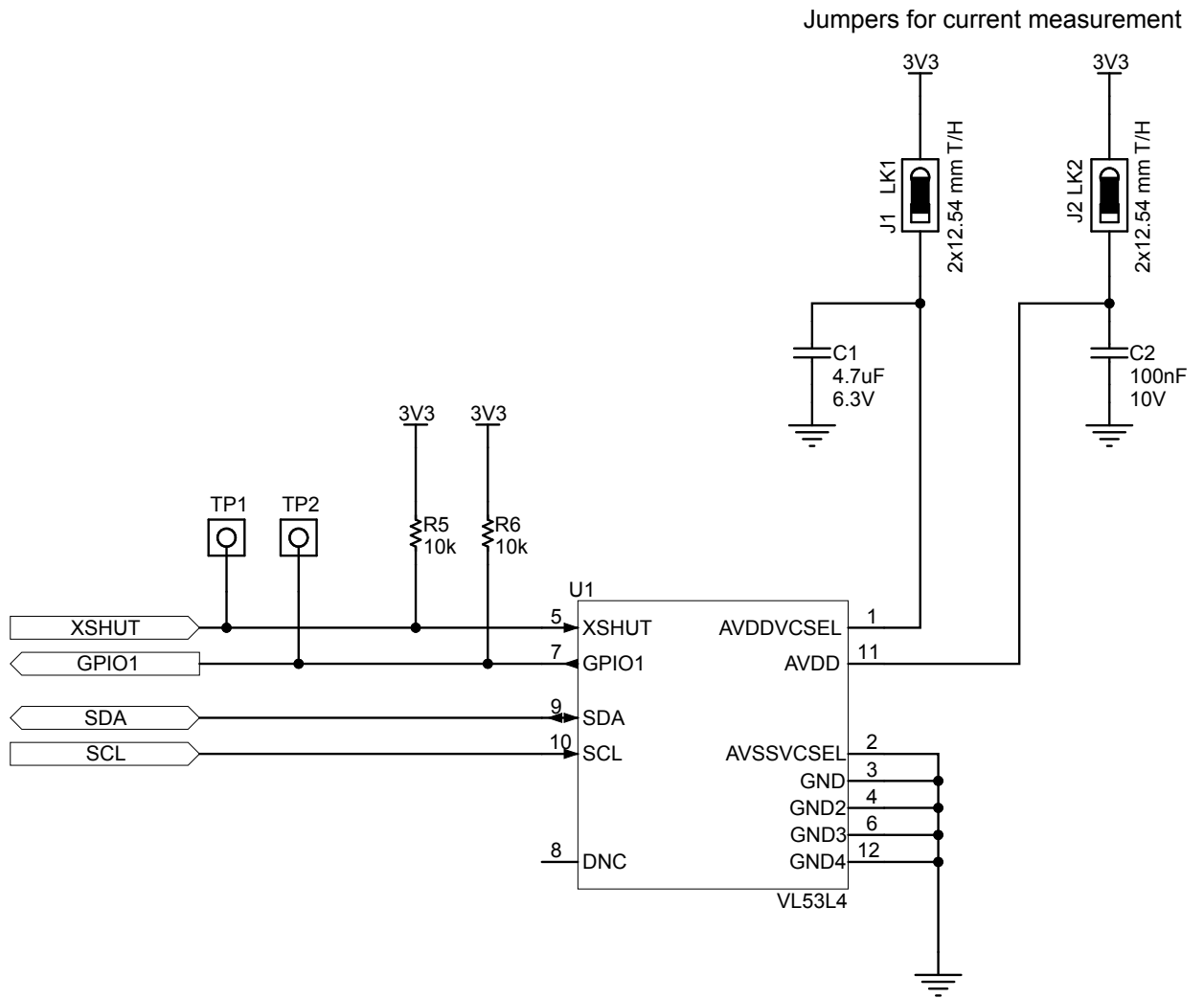


Figure 10. X-NUCLEO-53L4A1 circuit schematic (3 of 6)

STM32 Nucleo Arduino connectors

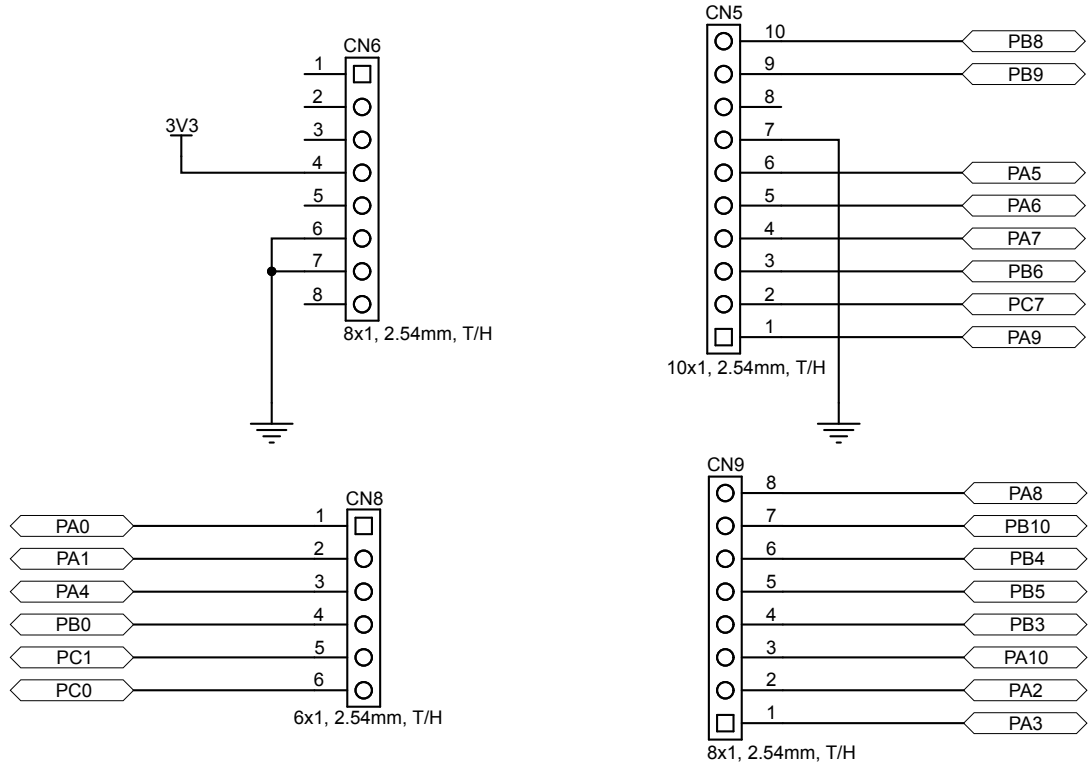


Figure 11. X-NUCLEO-53L4A1 circuit schematic (4 of 6)

Header for LCD

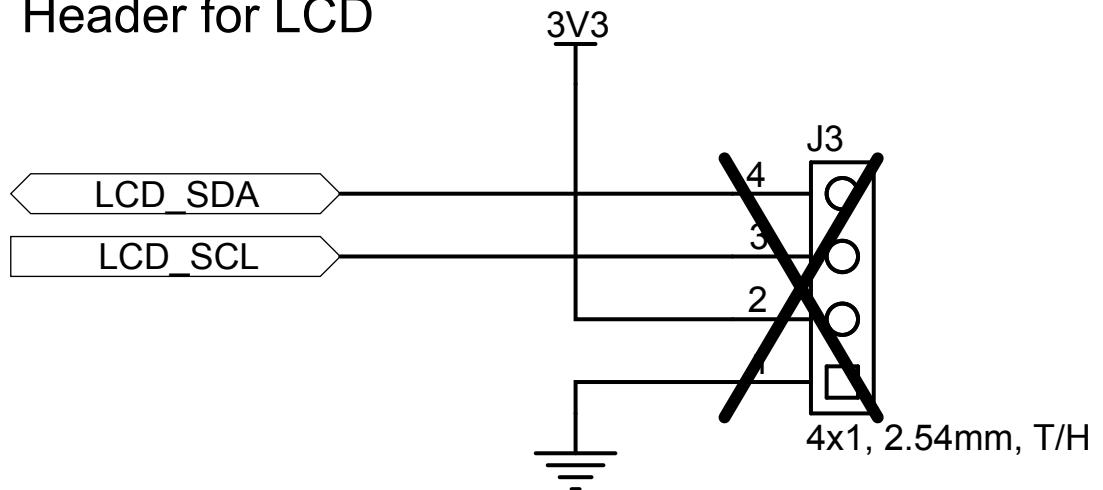


Figure 12. X-NUCLEO-53L4A1 circuit schematic (5 of 6)

### Header for satellite board

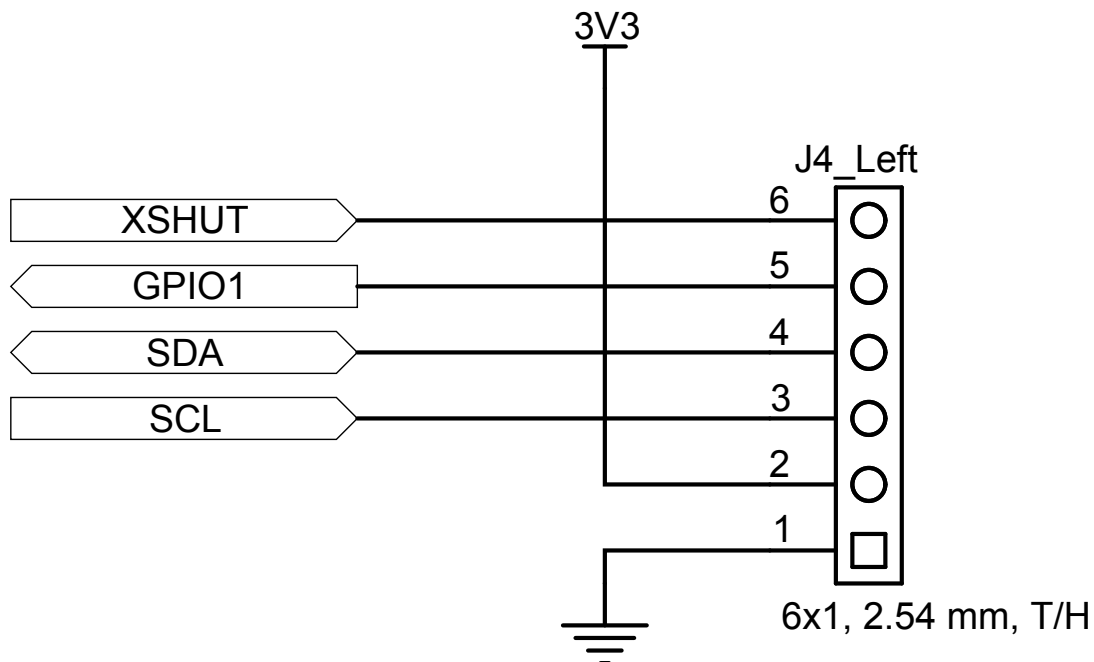
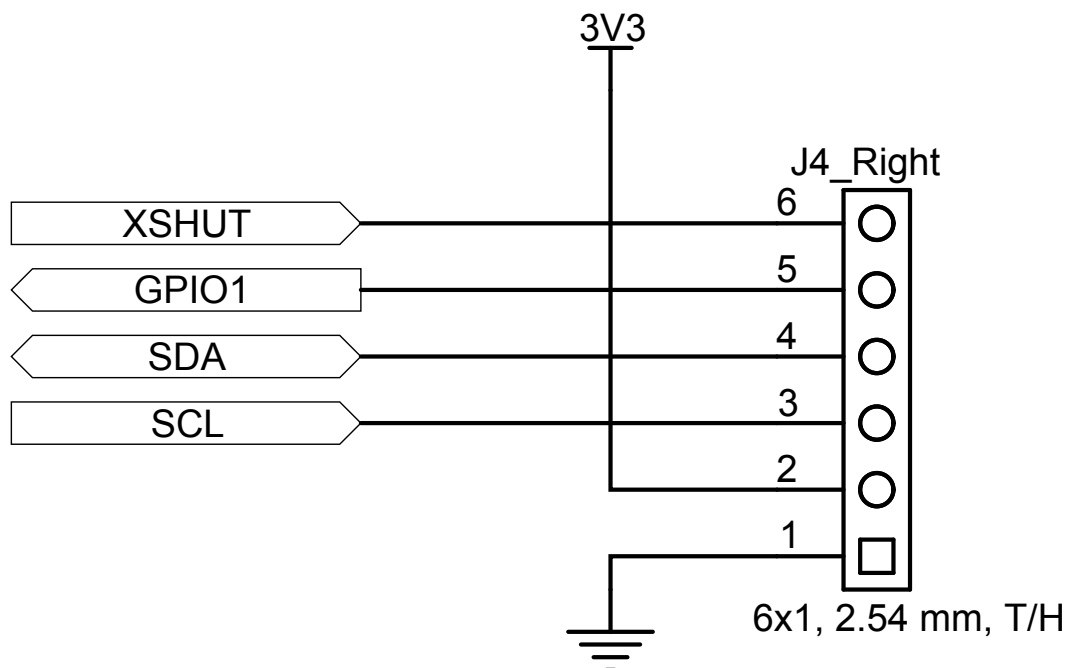


Figure 13. X-NUCLEO-53L4A1 circuit schematic (6 of 6)

### Header for satellite board



## 6 Bill of materials

Note: This BOM refers to the board latest version.

**Table 2. X-NUCLEO-53L4A1 bill of materials**

Item	Quantity	Reference	Part/value	Description	Manufacturer	Order code
1	0	J3	4-position, SNGL, 4x1, 2.54 mm, T/H	Connector header (not mounted)	Samtec	SSW-104-01-G-S
2	1	C1	4.7 $\mu$ F, 6.3 V, X5R, 0402	Ceramic capacitor	TDK	C1005X5R0J475K050BC
3	1	C2	100 nF, 10 V, X5R, 0201	Ceramic capacitor	Murata	GRM033R61A104KE15D
4	1	CN5	10-position, SNGL, 2.54 mm, T/H	Connector header	Samtec	SSQ-110-03-F-S
5	1	CN8	6-position, POS, SNGL, 2.54 mm, T/H	Connector header	Samtec	SSQ-106-03-F-S
6	1	U1	VL53L4CD	Time-of-Flight long ranging sensor with short distance capability	ST	<a href="#">VL53L4CD</a>
7	2	J1, J2	2-position, 2.54 mm, T/H, vertical	Connector headers	Harwin	M20-9990245
8	2	J4_Left, J4_Right	6-position, SNGL, 6x1, 2.54 mm, T/H	Connector headers	Samtec	SSW-106-01-G-S
9	2	CN6, CN9	8-position, SNGL, 2.54 mm, T/H	Connector headers	Samtec	SSQ-108-03-F-S
10	2	R5, R6	10 k, $\pm$ 1%, 1/16 W, 0402	Resistors	Stackpole Electronics	RMCF0402FT10K0
11	2	LK1, LK2	2.54 mm	Headers	Harwin	M7571-05
12	4	R1, R2, R3, R4	2.2 k, $\pm$ 1%, 1/16 W, 0402	Resistors	Stackpole Electronics	RMCF0402FT2K20
13	1	Glass piece	PMMA	Glass piece	Hornix	Custom
14	1	Spacer	Black, PVC, rigid, 0.25 mm	Thick spacer	STEP File	Custom
15	1	Spacer	Black, PVC, rigid, 0.5 mm	Thick spacer	STEP File	Custom
16	1	Spacer	Black, PVC, rigid, 1.0 mm	Thick spacer	STEP File	Custom
17	1	Foam piece	Polyurethane, foam flexible, 25 mm x 3 mm x 2.4 mm	Foam piece	STEP File	Custom
18	2	Tapping screw	Black steel, M 1.7 x 8.0 mm	Black cross, round-head, self-tapping screw	–	–
19	1	Glass holder	Epoxy 1mm	Cover glass holder	STEP File	Custom
20	1	Cover glass	PMMA	Oval cover glass	Hornix	Custom

## 7 Board versions

**Table 3. X-NUCLEO-53L4A1 versions**

PCB version	Schematic diagrams	Bill of materials
X\$NUCLEO-53L4A1- <sup>(1)</sup>	X\$NUCLEO-53L4A1- schematic diagrams	X\$NUCLEO-53L4A1-bill of materials

1. This code identifies the X-NUCLEO-53L4A1 expansion board first version. It is printed on the board PCB.

## 8 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.

The evaluation kit has been designed to comply with part 15 of the FCC Technical Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

Standard applied: FCC CFR 47 Part 15 Subpart B. Test method applied: ANSI C63.4 (2014).

### Formal Product Notice Required by Industry Canada Innovation, Science and Economic Development

#### Canada compliance:

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).

This device has been tested with Innovation, Science and Economic Development RSS standards. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Standard applied: ICES-003 Issue 7 (2020), Class B. Test method applied: ANSI C63.4 (2014).

Cet appareil a été testé pour les normes RSS d'Innovation, Science et Développement économique. L'utilisation est soumise aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences nuisibles, et (2) cet appareil doit accepter de recevoir tous les types d'interférence, y comprises les interférences susceptibles d'entraîner un fonctionnement indésirable.

Norme appliquée: NMB-003, 7e édition (2020), Classe B. Méthode d'essai appliquée: ANSI C63.4 (2014).

### Formal product notice required by EU

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Standards applied (Class B): IEC 61000-6-1:2016, IEC 61000-6-3:2020, EN 61000-6-1:2019, EN 61000-6-3:2021, CISPR 32:2015 + A1:2019, EN 55032:2015 + A1:2020, CISPR 35:2016, EN 55035:2017 + A11:2020, IEC 61000-3-2:2018 + A1:2020, EN 61000-3-2:2019, IEC 61000-3-3:2013 + A1:2017 + A2:2021, EN 61000-3-3:2013 + A1:2019



## Appendix A References

- [VL53L4CD data sheet: DS13812](#)
- [X-NUCLEO-53L4A1 data brief: DB4623](#)
- [X-CUBE-TOF1 data brief: DB4449](#)

## Revision history

**Table 4. Document revision history**

Date	Revision	Changes
16-Dec-2021	1	Initial release.
01-Mar-2022	2	Updated Section 1.2 Features.
01-Apr-2022	3	Added Section 1.4 Ordering information.
16-Jun-2022	4	Updated <a href="#">Figure 7</a> .

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