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Quick Start Guide

High accuracy proximity sensor with extended temperature capability expansion board based on VL53L4ED for STM32 Nucleo

March 2024

STM32 Open Development Environment

Quick Start Guide Contents

VL53L4ED – ToF high accuracy proximity and extended temperature range sensor
Hardware Overview (1/2)

X-NUCLEO-53L4A3 Hardware Description

- The X-NUCLEO-53L4A3 is development board designed around the VL53L4ED ToF high accuracy proximity and extended temperature range sensor based on ST F**light**Sense™ patented technology
- The VL53L4ED communicates with the STM32 Nucleo developer board host microcontroller through an I^2C link available on the Arduino UNO R3 connector.

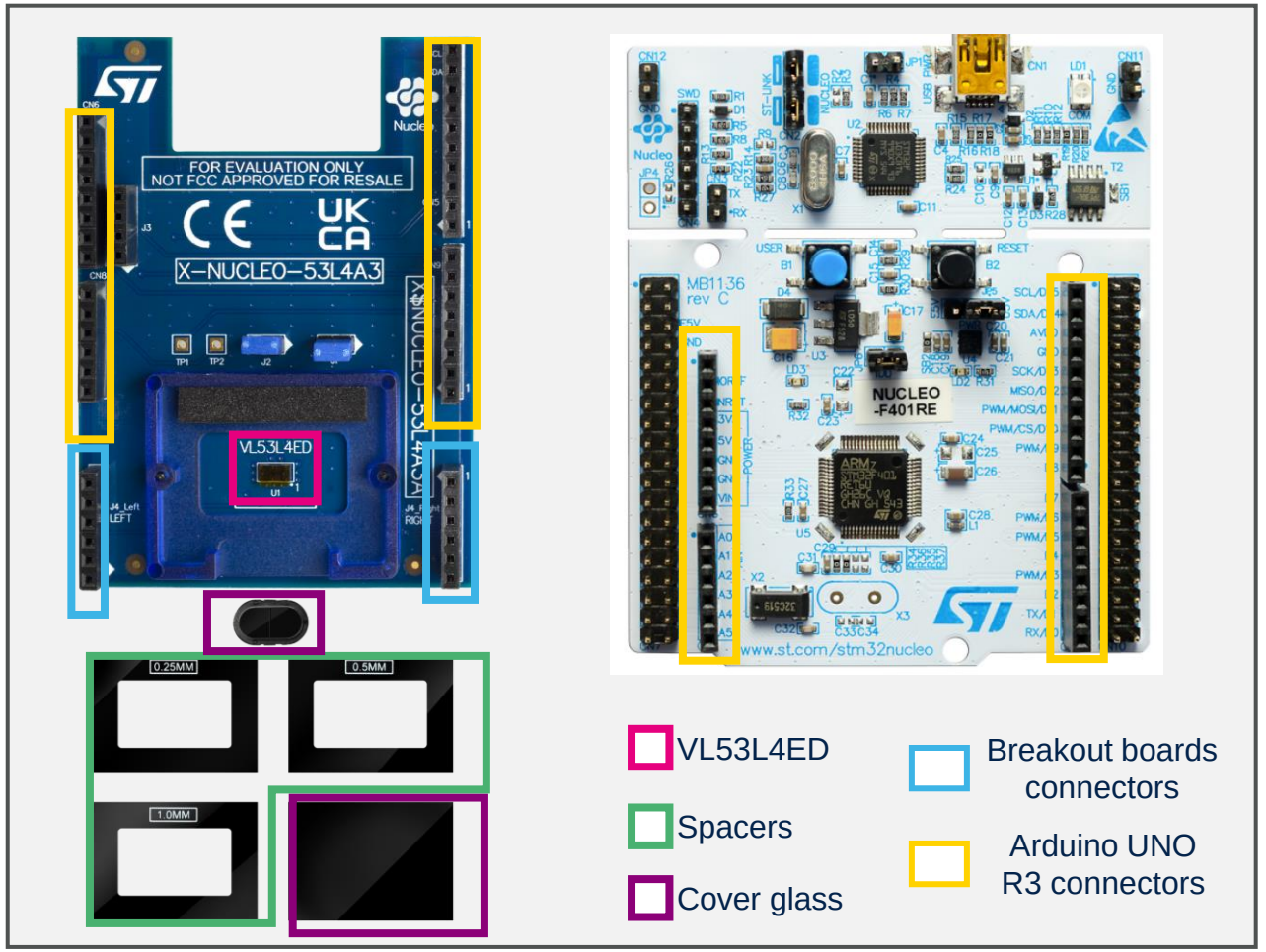
Key Products on board

VL53L4ED ToF high accuracy proximity and extended temperature range sensor

0.25, 0.5 and 1mm spacers to simulate air gaps, with the cover glasses

Breakout boards

SATEL-VL53L4ED breakout boards can be purchased separately

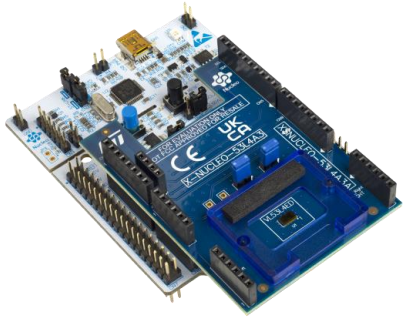


Order Code: **X-NUCLEO-53L4A3**

Latest info available at www.st.com
X-NUCLEO-53L4A3

VL53L4ED – ToF high accuracy proximity and extended temperature range sensor
Hardware Overview (2/2)

- X-NUCLEO-53L4A3 expansion board
  - VL53L4ED devices in custom applications can be integrated with expansion board, or external VL53L4ED breakout.
  - The breakout boards are delivered separately.
- X-NUCLEO-53L4A3 is also available as a NUCLEO Pack (P-NUCLEO-53L4A3)
  - The X-NUCLEO-53L4E3 expansion board can also be ordered on www.st.com as part of a NUCLEO Pack with expansion board and STM32 NUCLEO board.
  - Order code: **P-NUCLEO-53L4A3**:
    X-NUCLEO-53L4A3 expansion board and NUCLEO-F401RE full features board.
- VL53L4ED breakout boards can be ordered separately
  - Order code: **SATEL-VL53L4ED**
  - The pack carry **two** breakout boards



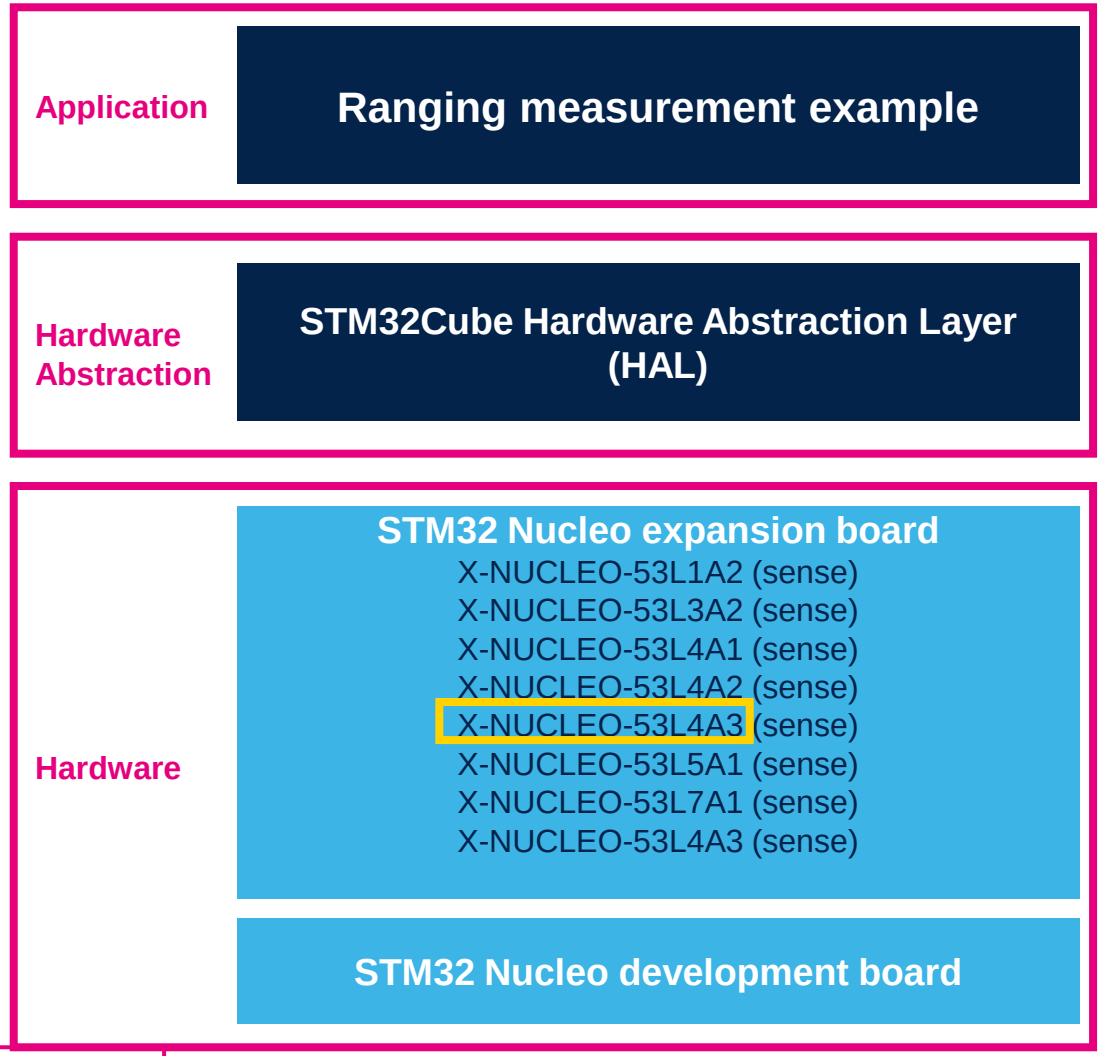
Time-of-Flight sensors Software Environment
STM32Cube Software Overview

X-CUBE-TOF1 software description

- The X-CUBE-TOF1 software package is a STM32Cube expansion for the expansion boards of the Time-of-Flight product family (including the X-NUCLEO-53L4A3) for STM32. The source code is based on STM32Cube to ease portability and code sharing across different STM32 MCU families. A sample implementation is available for the STM32 Nucleo ranging sensor expansion board (X-NUCLEO-53L4A3) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG).

Key features

- Driver layer (VL53L4ED ULD) for complete management of the VL53L4ED sensor integrated in the X-NUCLEO-53L4A3 expansion board.
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.
- Sample code for ranging measurement.



Latest SW available at www.st.com
X-CUBE-TOF1

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Hardware Overview

Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Setup & Demo Examples
HW prerequisites

- 1x High accuracy ToF sensor expansion board based on VL53L4ED (**X-NUCLEO-53L4A3**).
- 1x STM32 Nucleo development board (**NUCLEO-F401RE for example**)
- 1x Laptop/PC with Windows
- 1x USB type A to Mini-B USB cable
- If you don’t have an STM32 Nucleo development board, you can order a Nucleo pack (**P-NUCLEO-53L4A3)**:
  - X-NUCLEO-53L4A3 expansion board and NUCLEO-F401RE full features board delivered together.

X-NUCLEO-53L4A3

NUCLEO-F401RE

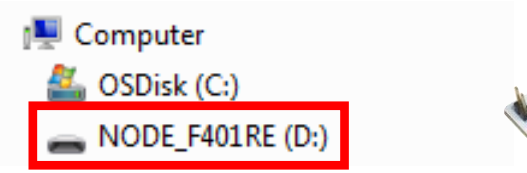
P-NUCLEO-53L4A3

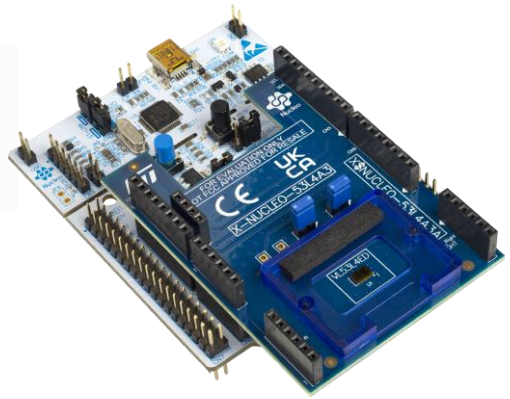
Setup & Demo Examples
SW prerequisites

- **STSW-IMG044**: Ultra Lite Driver (ULD) for VL53L4ED
- **STSW-IMG045**: Graphical User Interface (GUI) on Windows 7 and 10
- **STSW-IMG046** : Linux driver for VL53L4ED
- **X-CUBE-TOF1**: Time-of-Flight sensors software expansion for STM32Cube.
  - When you install the X-CUBE-TOF1 the installer install also the directory containing the example projects here for instance :
    - C:\Users\<*user_name*>\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE-TOF1\<*version of the X-Cube-TOF1*>\Projects\NUCLEO-F401RE\Examples\53L4A3\53L4A3_SimpleRanging.

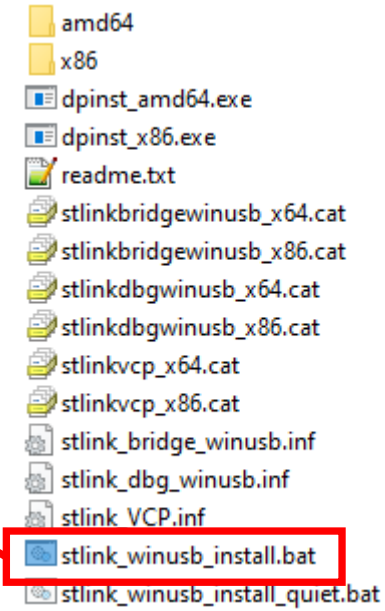
Setup & Demo Examples
NUCLEO Kit driver installation

1. Connect the P-NUCLEO to the PC through USB
   - Wait for the board to be recognized; the drivers are installed automatically)
   - If Windows cannot install automatically the STLINK driver, please follow step 2





2. Install the PC USB port driver to detect the Nucleo board
   - Download **STSW-LINK009** from www.st.com
   - Unzip and double click on “stlink_winusb_install.bat” to install the driver



VL53L4ED GUI software installation

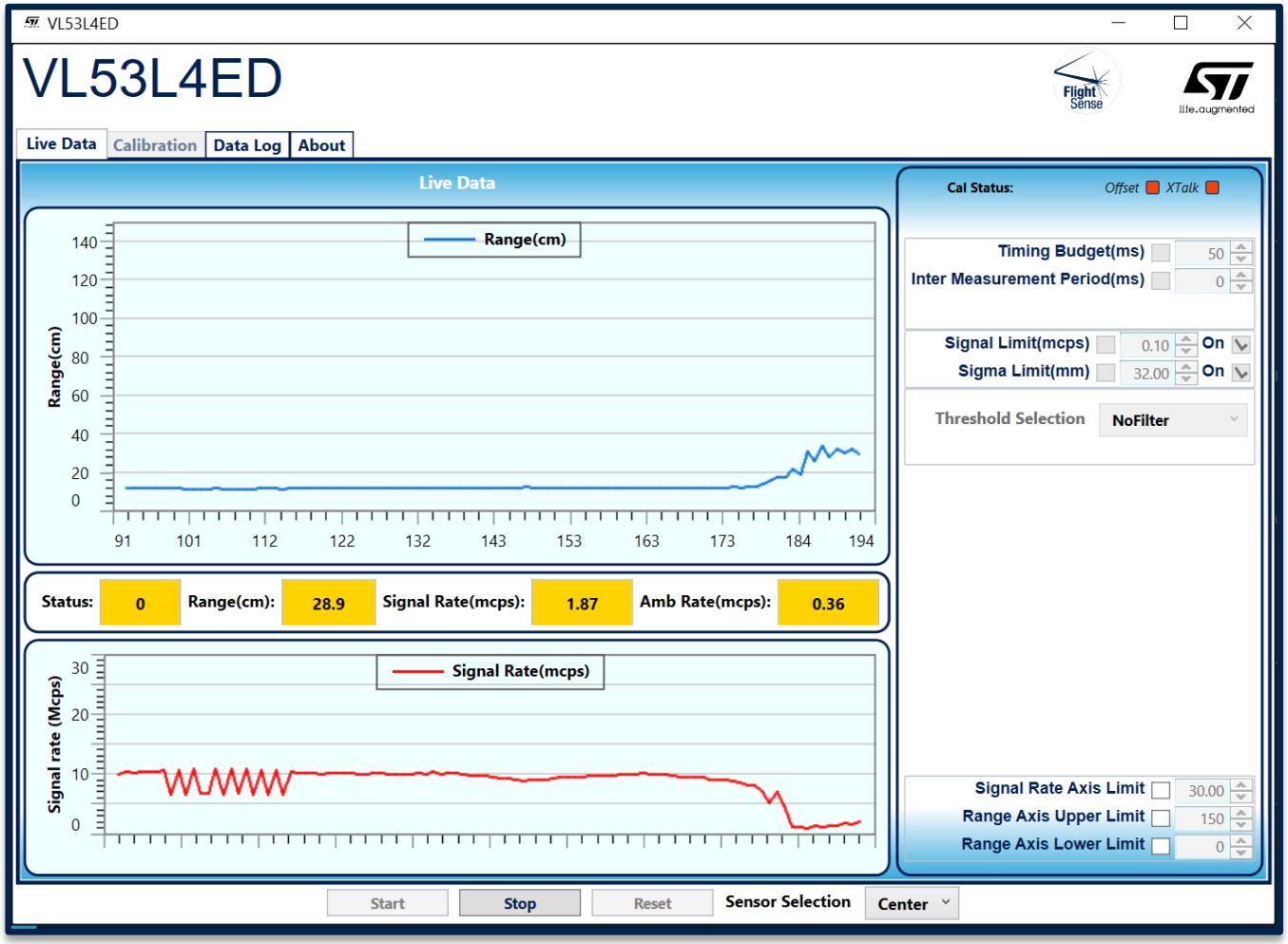
GUI is generally the first and easy tool to evaluate the device

- Perform HW installation and connect the X-NUCLEO-53L4A3 expansion board + Nucleo F401RE to the PC
- Install the GUI SW for VL53L4ED Demo and configuration settings
  - **STSW-IMG045**, downloaded from www.st.com
  - **Run the installer with Admin privileges**

The Graphical User Interface can:

- Perform the offset and Xtalk calibration and visualize calibration data
- Change key parameters of VL53L4ED
- Display real time the data (distance, signal, ambient rate)
- Get data logging and replay a datalog (.csv file)

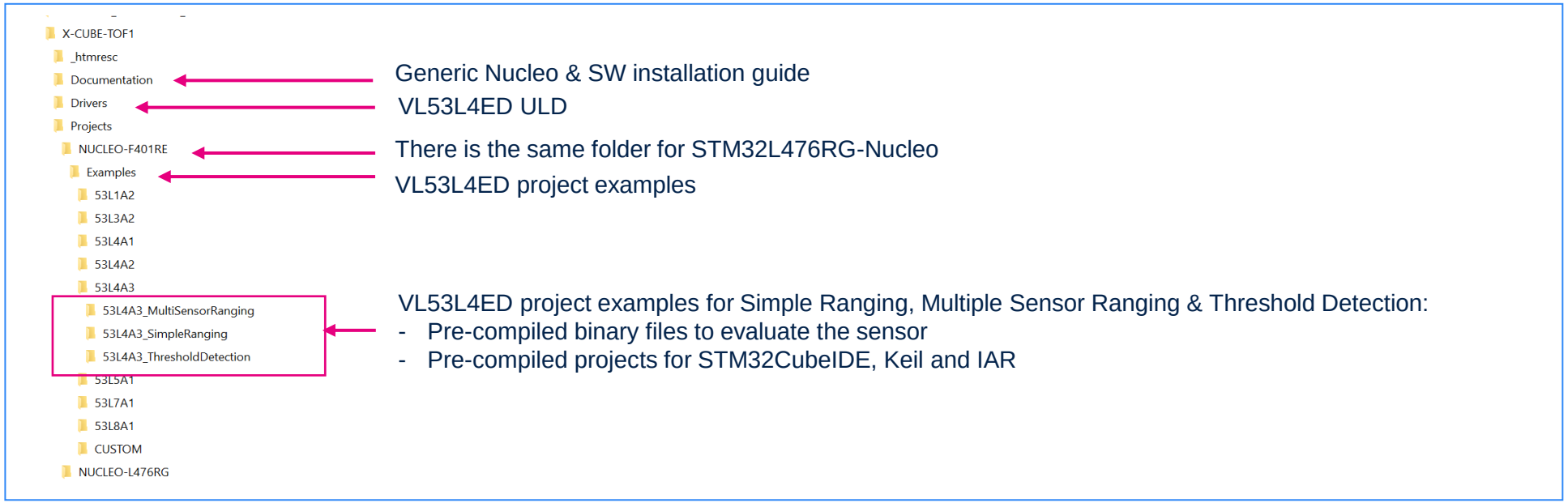
Setup & Demo Examples
VL53L4ED GUI software installation



Setup & Demo Examples
X-CUBE-TOF1 software installation

- Perform HW installation and connect the NUCLEO kit (P-NUCLEO-53L4A3) to the PC
- Install the X-CUBE-TOF1 SW package
  - **X-CUBE-TOF1 rev 3.4.0 or newer**, downloaded from www.st.com
  - The X-CUBE-TOF1 is installed through STM32CubeMx, manage software installation section.
  - Once the X-CUBE-TOF1 is installed. Go to
    - C:\Users\<*user_name*>\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE-TOF1\<*version of the X-Cube-TOF1*>\Projects\NUCLEO-F401RE\Examples\53L4A3\53L4A3_SimpleRanging

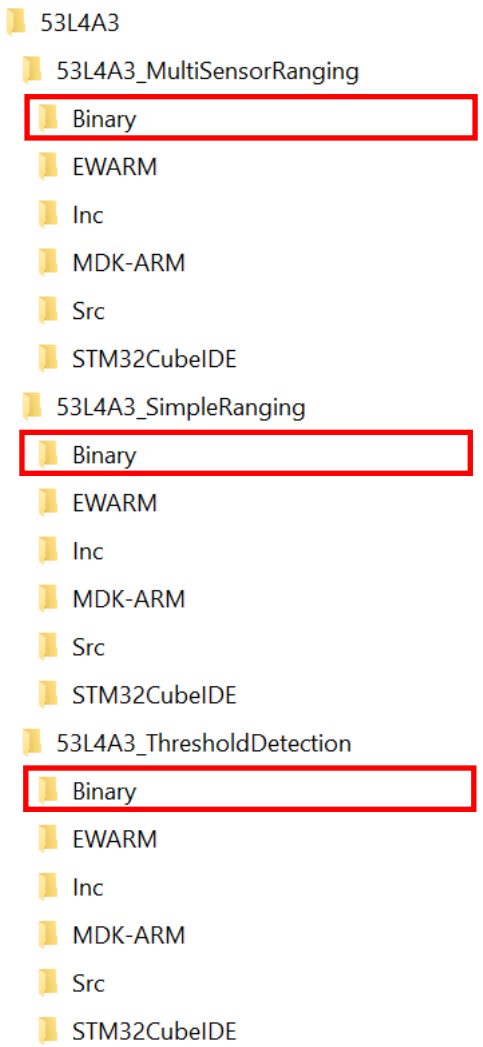
X-CUBE software package contents: API SW + SW examples



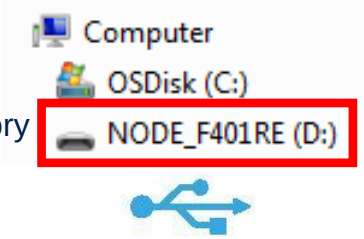
VL53L4ED – ToF high accuracy proximity and extended temperature range sensor

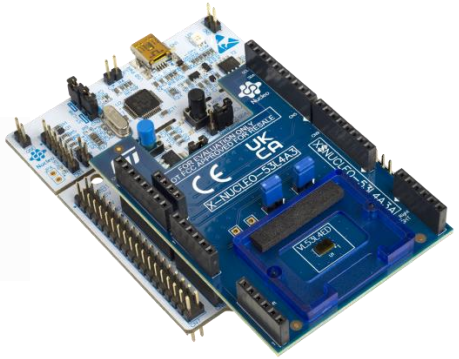
Evaluation code example (.bin) using X-CUBE-TOF1 and a NUCLEO Pack

Follow the instructions from the **UM3108** (How to use the VL53L4ED with STMicroelectronics' X-CUBE-TOF1 Time-of-Flight sensor software packages for STM32CubeMX) that can be found on st.com



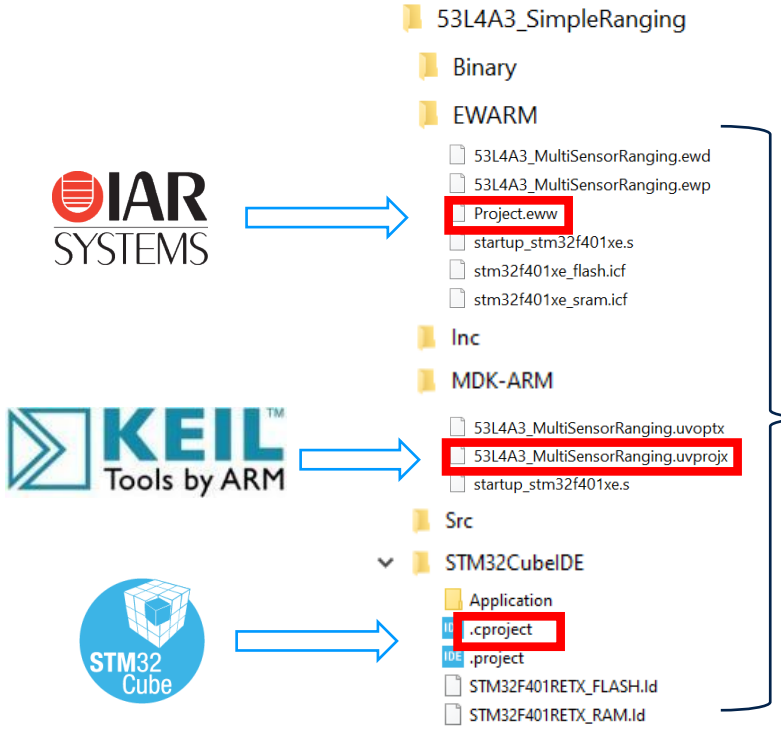
Drag and drop .bin files from the directory to





VL53L4ED – ToF high accuracy proximity and extended temperature range sensor
Start programming with code examples using X-CUBE-TOF1 and a NUCLEO Pack

Follow the instructions from the **UM3108** (How to use the VL53L4ED with STMicroelectronics' X-CUBE-TOF1 Time-of-Flight sensor software packages for STM32CubeMX) that can be found on st.com



Open project example for Simple Ranging
And modify, build application SW

- Same folders exist for Multiple sensors ranging and Threshold Detection projects
- Same folders exist for L476RG board

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STM32 Open Development Environment: Overview

Documents & Related Resources

Go to https://www.st.com/en/imaging-and-photonics-solutions/VL53L4ED
All documents are available in the Documentation tab of the related products webpage

VL53L4ED : Product Folder

- **DS14256**: Time-of-Flight high accuracy proximity sensor with extended temperature capability - **data sheet**
- **DB5003:** Time-of-Flight high-accuracy proximity sensor expansion board based on the VL53L4ED for STM32 Nucleo – **data brief**

X-NUCLEO-53L4A3: Product Folder

- **DB5074**: High accuracy proximity sensor with extended temperature capability expansion board based on VL53L4ED for STM32 Nucleo – **data brief**
- **UM3222:** Getting started with the X-NUCLEO-53L4A3 expansion board for STM32 Nucleo based on the VL53L4ED - **user manual**

P-NUCLEO-53L4A3: Product Folder

- **DB5122**: VL53L4ED Nucleo pack with X-NUCLEO-53L4A3 expansion board and STM32F401RE Nucleo board– **data brief**
- **UM3222:** Getting started with the X-NUCLEO-53L4A3 expansion board for STM32 Nucleo based on the VL53L4ED - **user manual**

SATEL-VL53L4ED: Product Folder

- **DB5080**: VL53L4ED breakout board High accuracy proximity sensor with extended temperature capability – **data brief**

STSW-IMG044: Ultra Lite Driver (ULD) for VL53L4ED folder

- **DB5182**: Ultra lite driver (ULD) application programming interface (API) for the VL53L4ED – **data brief**

STSW-IMG045: Graphical User Interface (GUI) Folder

- **DB5183**: P-NUCLEO-53L4A3 pack graphical user interface (GUI) – **data brief**

X-CUBE-TOF1: Software package for STM32Cube

- **DB4449:** Time-of-Flight sensors software expansion for STM32Cube – **data brief**
- **UM3108:** Getting started with the STMicroelectronics X-CUBE-TOF1, Time-of-Flight sensors, software package for STM32CubeMX - **user manual**

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STM32 Open Development Environment: Overview

STM32 ODE Ecosystem

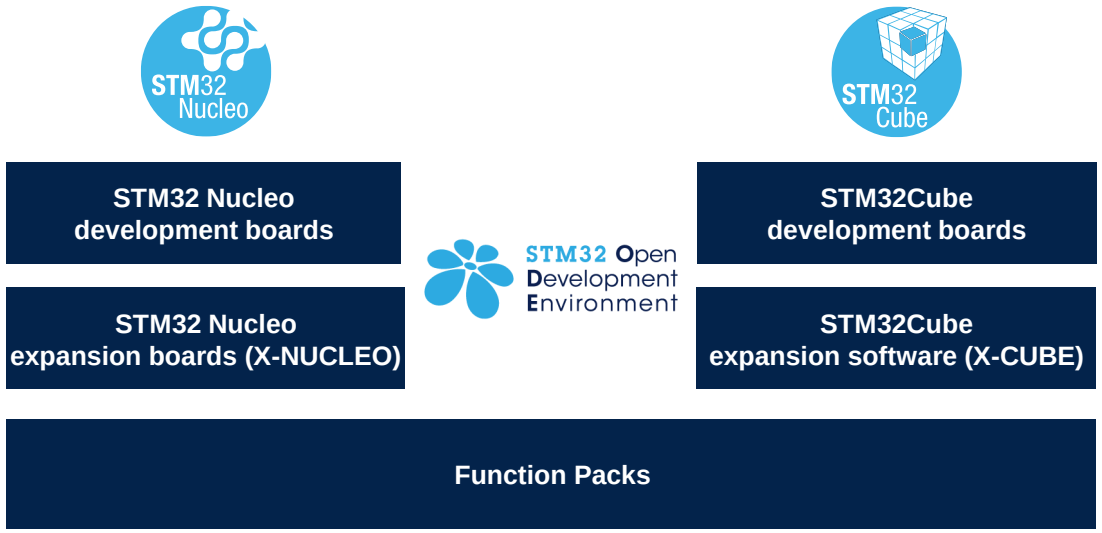
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (ODE) is an **open**, **flexible**, **easy** and **affordable** way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

The STM32 ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a wide range of development environments including STM32CubeIDE, IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs, with the possibility to integrate the various components such as STM32CubeMX, STM32CubeProgrammer or STM32CubeMonitor.



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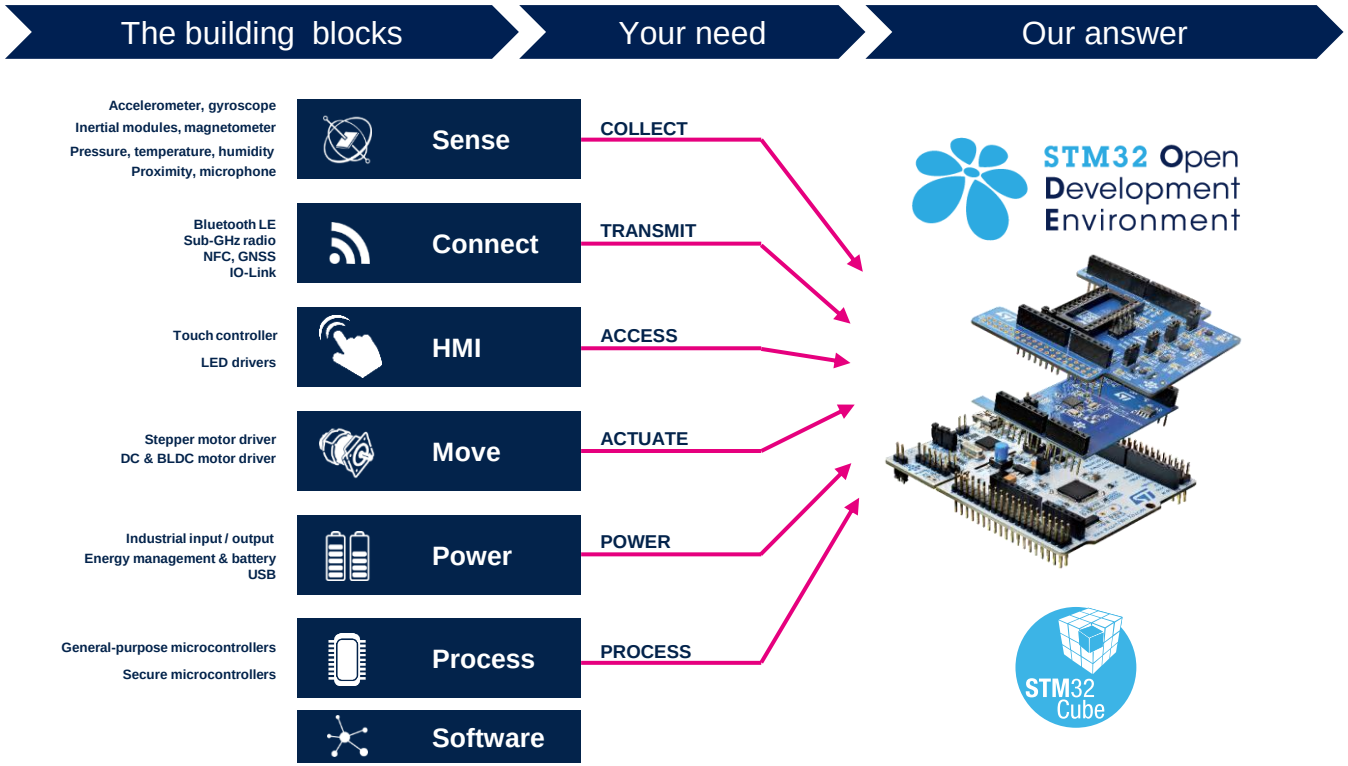
STM32 Open Development Environment: all that you need

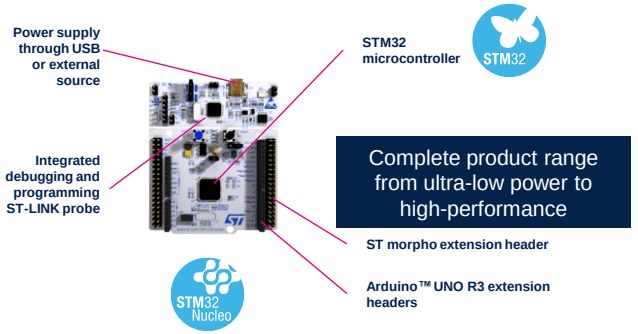
The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

- Choose the appropriate STM32 Nucleo development board (NUCLEO) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need.
- Select your development environment (IAR EWARM, Keil MDK and GCC/LLVM-based IDEs) and use the free STM32Cube tools and software such as STM32CubeMX, STM32CubeProgrammer, STM32CubeMonitor or STM32CubeIDE.
- Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.
- Compile your design and upload it to the STM32 Nucleo development board.
- Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in an end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.





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