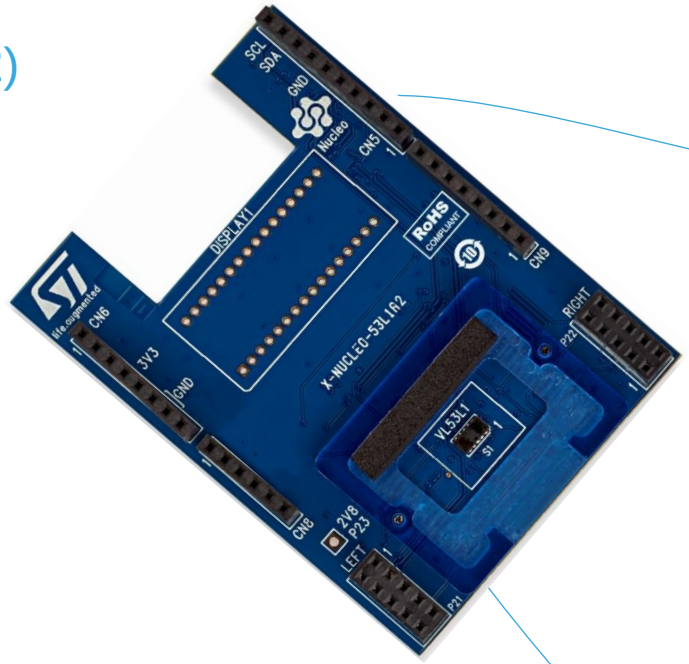
Quick Start Guide

Time-of-Flight ranging sensor with advanced multi-zone and multi-object detection expansion board based on VL53L1 for STM32 Nucleo
(X-NUCLEO-53L1A2)



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Version (May 5, 2020)

Quick Start Guide Contents

Long distance ranging ToF sensor expansion board
Hardware Overview (1/2)

X-NUCLEO-53L1A2 Hardware Description

- The X-NUCLEO-53L1A2 is an evaluation and development board designed with the VL53L1 ranging sensor with advanced multi-zone and multi-object detection based on ST F**light**Sense™ Time-of-Flight technology.
- The VL53L1 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

VL53L1 long distance ranging and gesture detection sensor module

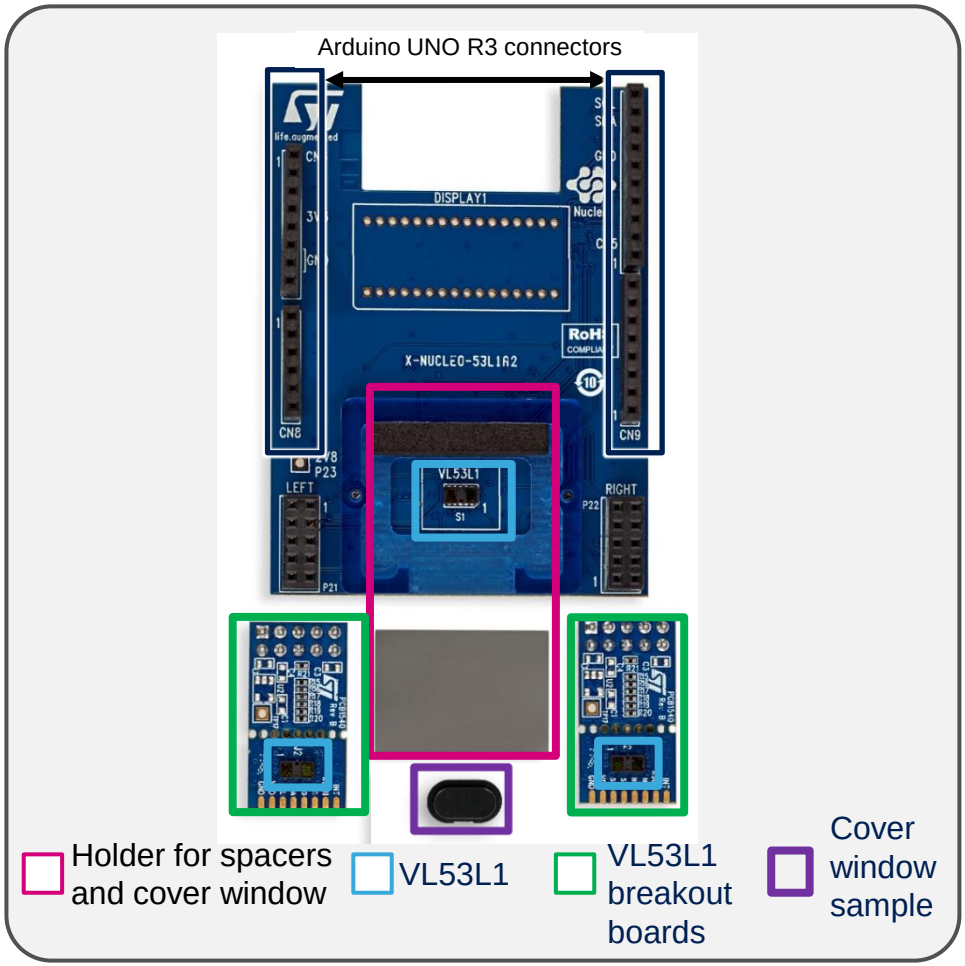
0.25, 0.5 and 1mm spacers to simulate air gaps, with the cover glass

Cover window (made by Hornix) sample with low cross-talk ready to use / clipable on VL53L1

2x VL53L1 breakout boards

Latest info available at www.st.com
X-NUCLEO-53L1A2

Remove the protective film on the VL53L1 sensor



Order Code: **X-NUCLEO-53L1A2**

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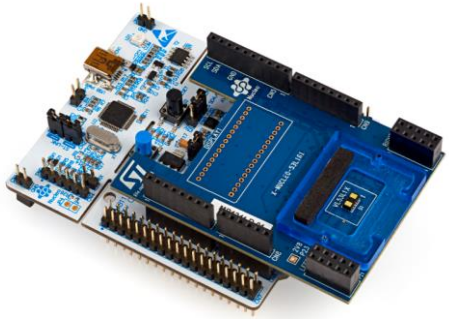
Long distance ranging ToF sensor expansion board
Hardware Overview (2/2)

Remove the protective film on the VL53L1 sensor

- X-NUCLEO-53L1A2 expansion board
  - To help integrate multiple VL53L1 devices in custom applications, up to 2 external VL53L1 breakout boards can be connected to the expansion board.
  - The breakout boards are delivered with the **X-NUCLEO-53L1A2**.

- X-NUCLEO-53L1A2 is also available as a NUCLEO Pack (P-NUCLEO-53L1A2)
  - The X-NUCLEO-53L1A2 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-53L1A2**:
    X-NUCLEO-53L1A2 expansion board and NUCLEO-F401RE full features board.

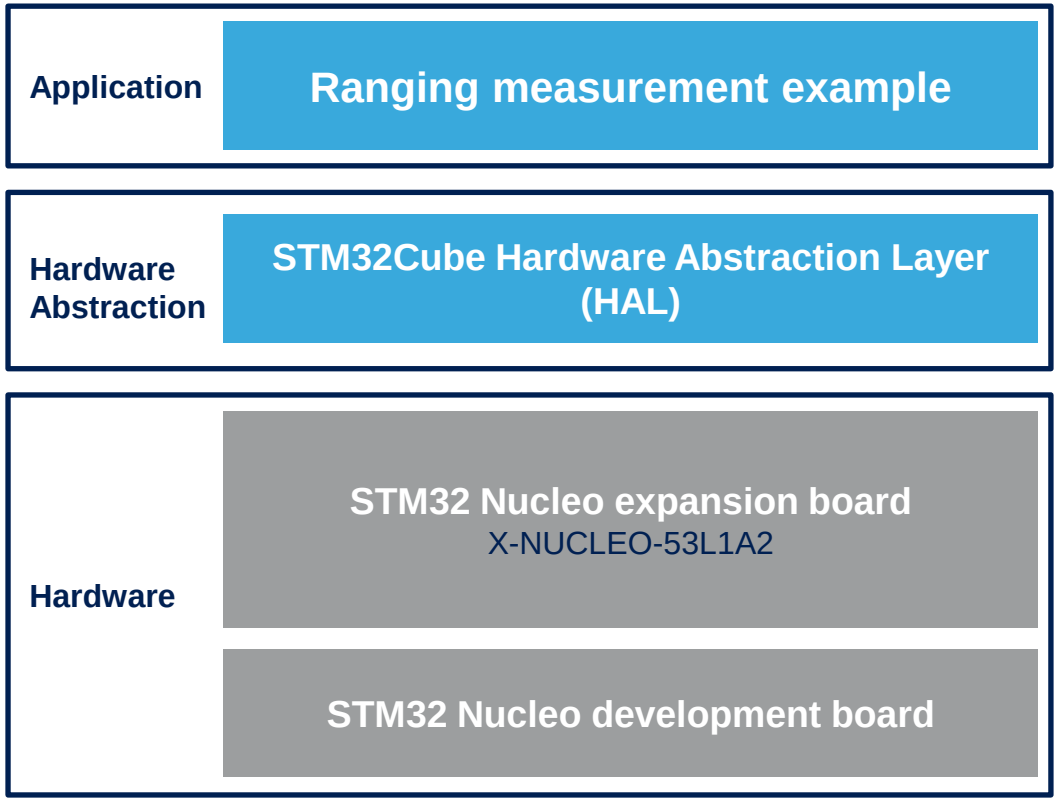


- VL53L1 breakout boards can also be ordered separately
  - Order code: **VL53L1-SATEL**
    Two breakout boards are included.

Long distance ranging ToF sensor expansion board
STM32Cube Software Overview

X-CUBE-53L1A2 software description

- The X-CUBE-53L1A2 software package is an STM32Cube expansion for the X-NUCLEO-53L1A2 expansion board for STM32. The source code is based on STM32Cube to ease portability and code sharing across different STM32 MCU families. An sample implementation is available for the STM32 Nucleo ranging sensor expansion board (X-NUCLEO-53L1A2) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG).



Key features

- Driver layer (VL53L1 API) for complete management of the VL53L1 ranging sensor integrated in the X-NUCLEO-53L1A2 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-53L1A2

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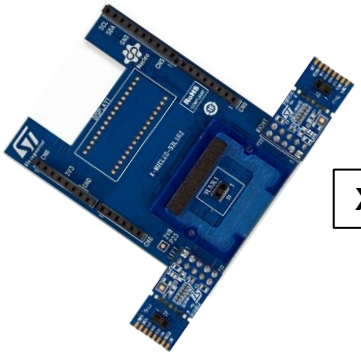
Quick Start Guide Contents

Setup & Demo Examples
HW prerequisites

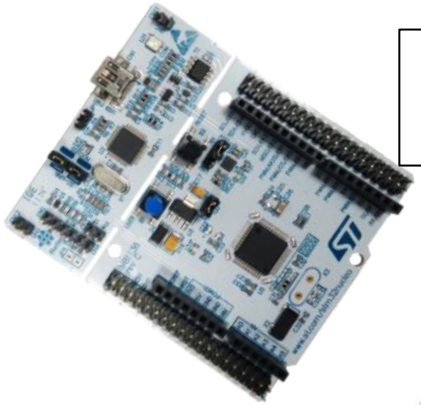
- 1x Ranging sensor expansion board based on VL53L1 (**X-NUCLEO-53L1A2**).



Remove the protective film on the VL53L1 sensor

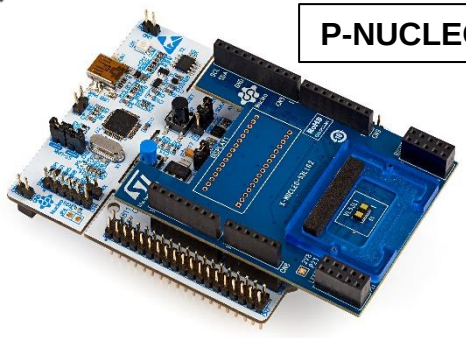
X-NUCLEO-53L1A2

- 1x STM32 Nucleo development board (**NUCLEO-F401RE** or **NUCLEO-L476RG**)
- 1x Laptop/PC with MS Windows
- 1x USB type A to Mini-B USB cable



NUCLEO-F401RE or NUCLEO-L476RG

P-NUCLEO-53L1A2



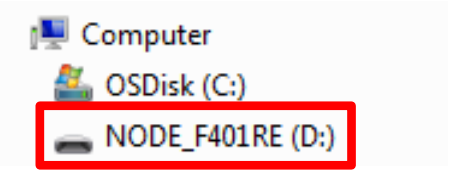
- If you don't have an STM32 Nucleo development board, you can order a Nucleo pack (**P-NUCLEO-53L1A2)**:
  - X-NUCLEO-53L1A2 expansion board and NUCLEO-F401RE full features board delivered together.

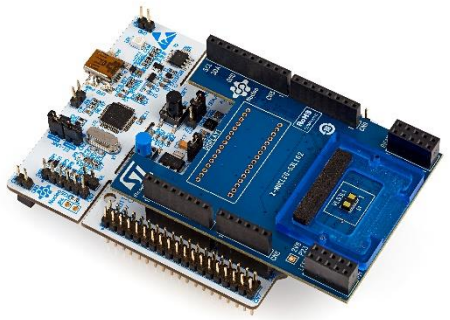
SW prerequisites

- **STSW-IMG019**: VL53L1 ranging sensor with advanced multi-zone and multi-object detection application programming interface (API)
- **STSW-IMG020**: P-NUCLEO-53L1A2 Graphical User Interface (GUI) on Windows 7 and 10
- **X-CUBE-53L1A2**: P-NUCLEO-53L1A2 software expansion. Copy the .zip file content into a folder on your PC; the package will contain the API software driver, a simple ranging source code example (Keil, IAR, STM32CubeIDE) based on NUCLEO-F401RE or NUCLEO-L476RG for STM32Cube, and all the necessary documentation.

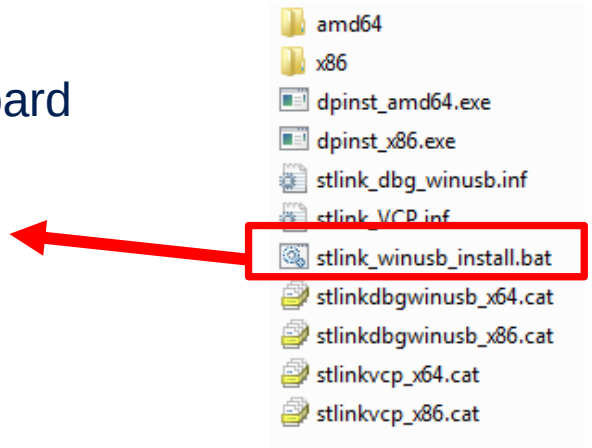
NUCLEO Kit driver installation

1. Connect the Nucleo pack 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
   - Called **STSW-LINK009**, downloaded from www.st.com
   - Unzip, extract the docs, and install “stlink_winusb_install.bat”



=> VL53L1 NUCLEO Kit is ready for GUI installation

VL53L1 GUI software installation

GUI is generally the first step to evaluate the device

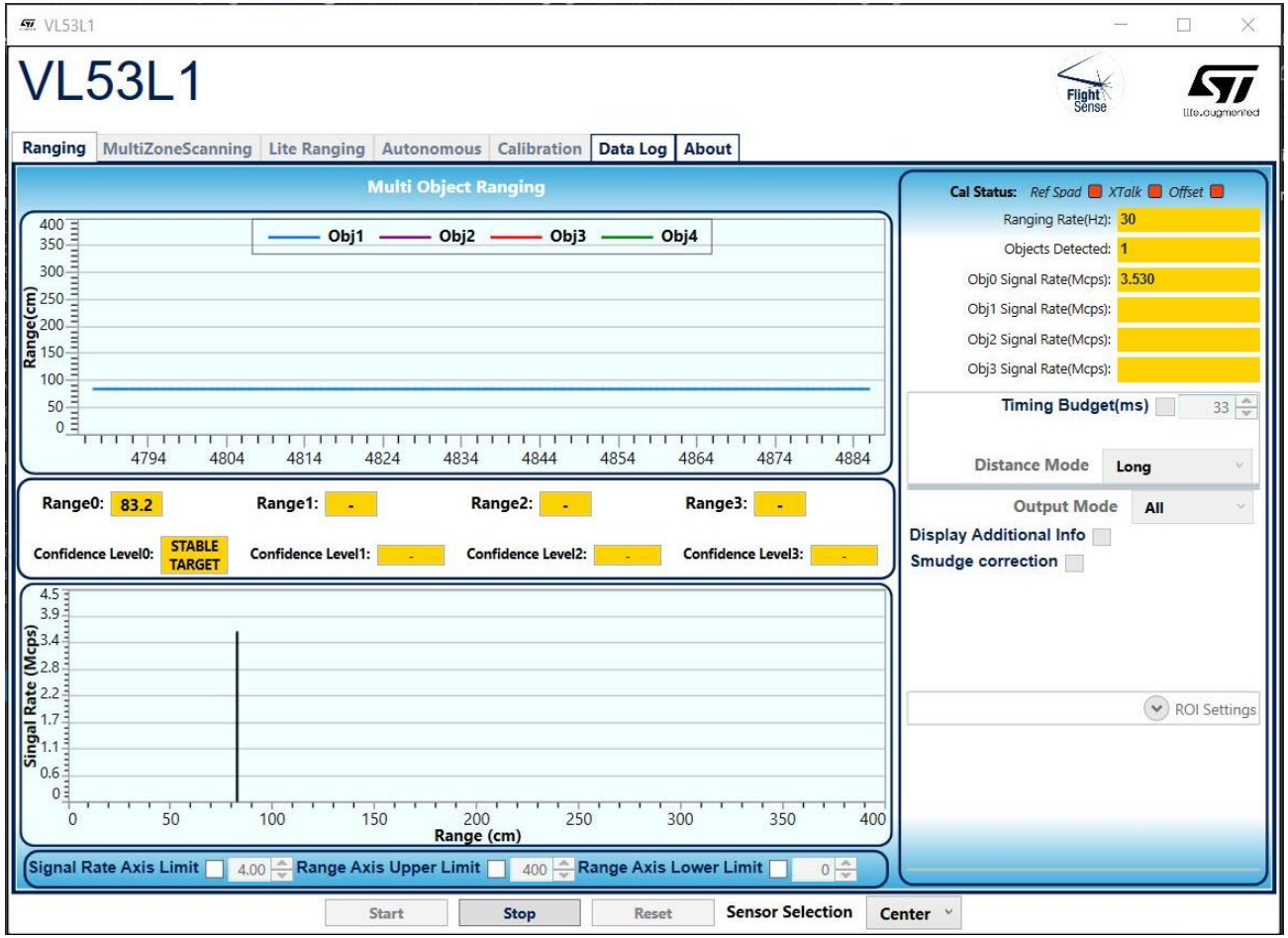
- Perform HW installation and connect the VL53L1 NUCLEO pack (X-NUCLEO-53L1A2 expansion board + STM32 Nucleo board) to the PC
- Install the GUI SW for VL53L1 Demo and configuration settings
  - Called **STSW-IMG020**, downloaded from www.st.com
  - Unzip, extract the docs, and install "**VL53L1_setup.exe**"
  - Run the installer with Admin privileges or change default installation directory

The Graphical User Interface can:

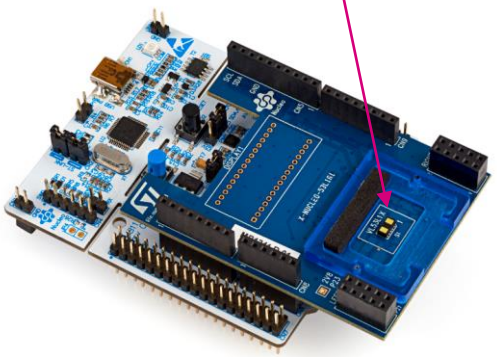
- Perform calibration phases (offset and Crosstalk with cover glass)
- Change key parameters of VL53L1
- Display real time key ranging data (distance, signal rate),
- Get data logging (.csv file)

Setup & Demo Examples

VL53L1 GUI software installation



Remove the protective film on the VL53L1 sensor

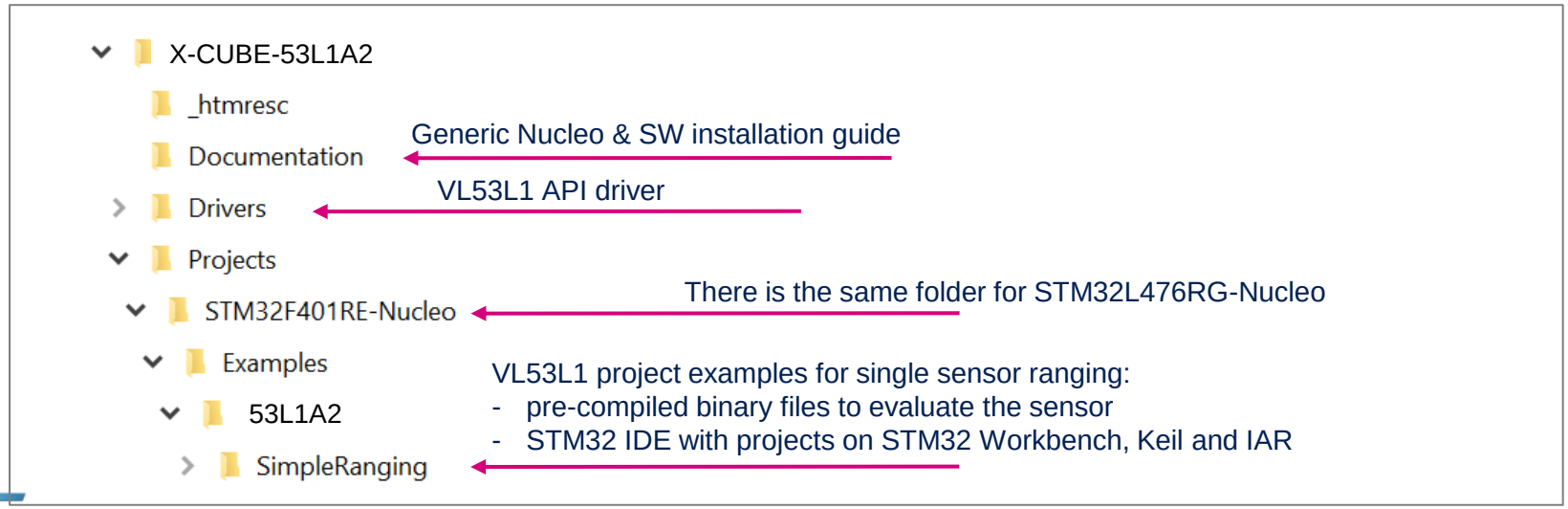


X-CUBE-53L1A2 software installation

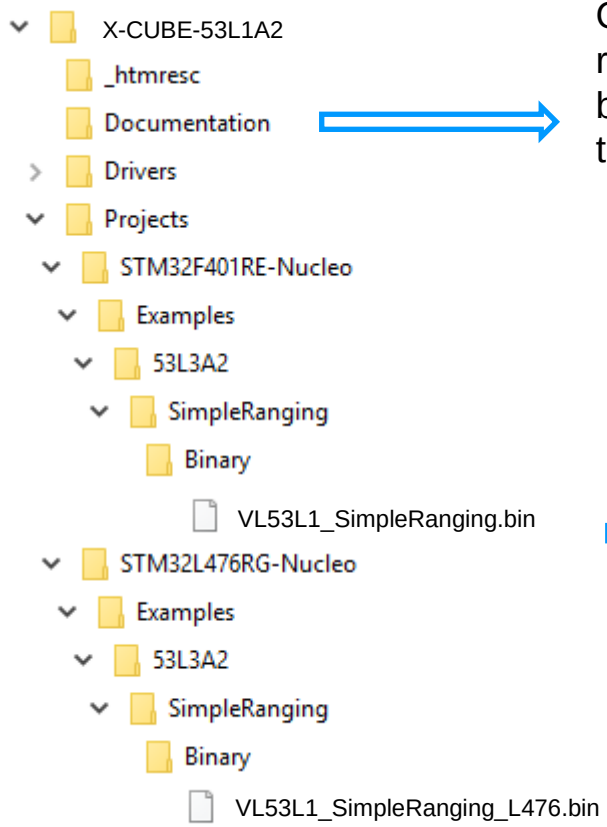
- Perform HW installation and connect the NUCLEO kit (P-NUCLEO-53L1A2) to the PC

- Install the X-CUBE-53L1A2 SW package
  - Called **X-CUBE-53L1A2**, downloaded from www.st.com
  - Unzip, extract the docs, and the **X-CUBE-53L1A2** folder directory appears

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

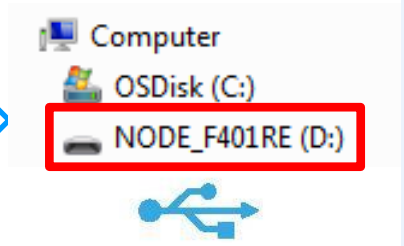


VL53L1 ranging ToF sensor expansion board
Evaluation code example (.bin) using X-CUBE-53L1A2 and a NUCLEO Pack

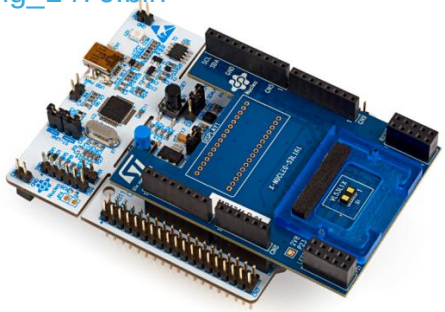


Open: **UMxxxx** (Getting started with X-NUCLEO-53L1A2 ranging sensor with multi target detection expansion board based on VL53L1 for STM32 Nucleo) and follow the instructions

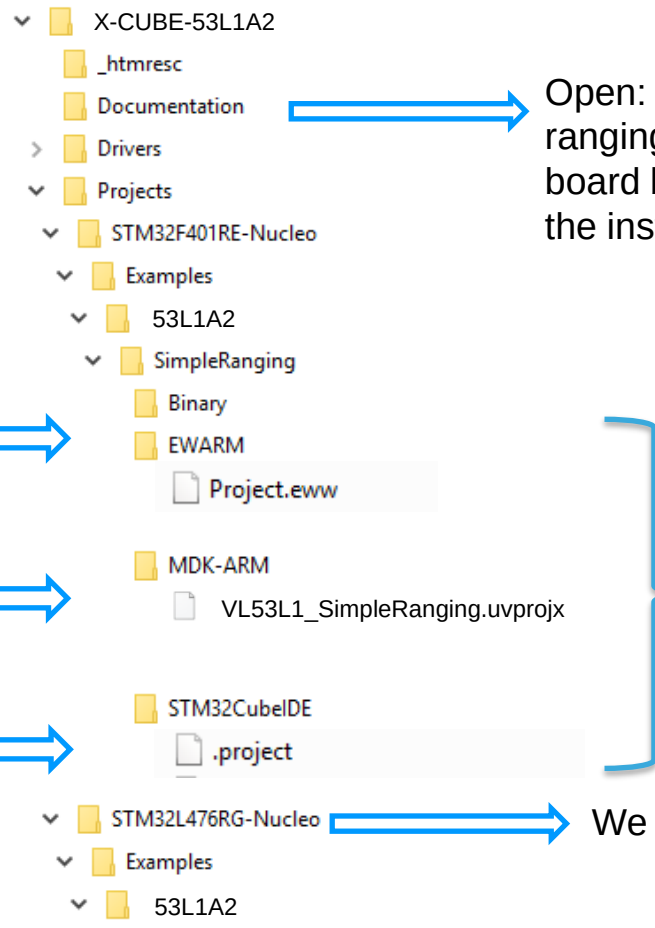
Load STM32 firmware (Binary code file)
VL53L1_SimpleRanging.bin
Or
VL53L1_SimpleRanging_L476.bin



Drag and drop to



VL53L1 ranging ToF sensor expansion board
Start programming with code examples using X-CUBE-53L1A2 and a NUCLEO Pack



Open: **UMxxxx** (Getting started with X-NUCLEO-53L1A2 ranging sensor with multi target detection expansion board based on VL53L1 for STM32 Nucleo) and follow the instructions

Open project example for
Single sensor ranging measurement
And
Modify, build application SW

We find same folders and same files as above

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Documents & Related Resources

Go to https://www.st.com/en/imaging-and-photonics-solutions/vl53l1
All documents are available in the DESIGN tab of the related products webpage

VL53L1: Product Folder

- **DS11786**: New generation Time-of-Flight ranging sensor with advanced multi-zone and multi-object detection- **data sheet**

X-NUCLEO-53L1A2: Product Folder

- **DBxxxx**: – **data brief**
- **X-NUCLEO-53L1A2 Quick start guide :** Time-of-Flight ranging sensor with advanced multi-zone and multi-object detection expansion board based on VL53L1 for STM32 Nucleo **–** (this document)
- **UMxxxx:** Getting started with X-NUCLEO-53L1A2 ranging sensor with multi target detection expansion board based on VL53L1 for STM32 Nucleo - **user manual**

P-NUCLEO-53L1A2: Product Folder

- **DBxxxx**: – **data brief**

STSW-IMG020: Graphical User Interface (GUI) Folder

- **DB4253**: P-NUCLEO-53L1A2 pack graphical user interface (GUI) – **data brief**

STSW-IMG019: Application programming Interface (VL53L1 software driver API) folder

- **DB4208**: VL53L1 Time-of-Flight ranging sensor with programmable field of view and multiobject detection application programming interface (API) – **data brief**

X-CUBE-53L1A2: Software package for STM32Cube

- **DB4252 :** Time-of-Flight ranging sensor with programmable field of view and multi object detection software expansion of STM32Cube – **data brief**

Quick Start Guide Contents

X-NUCLEO-53L1A2: Time-of-Flight ranging sensor with advanced multi-zone and multi-object detection expansion board

Hardware and Software overview

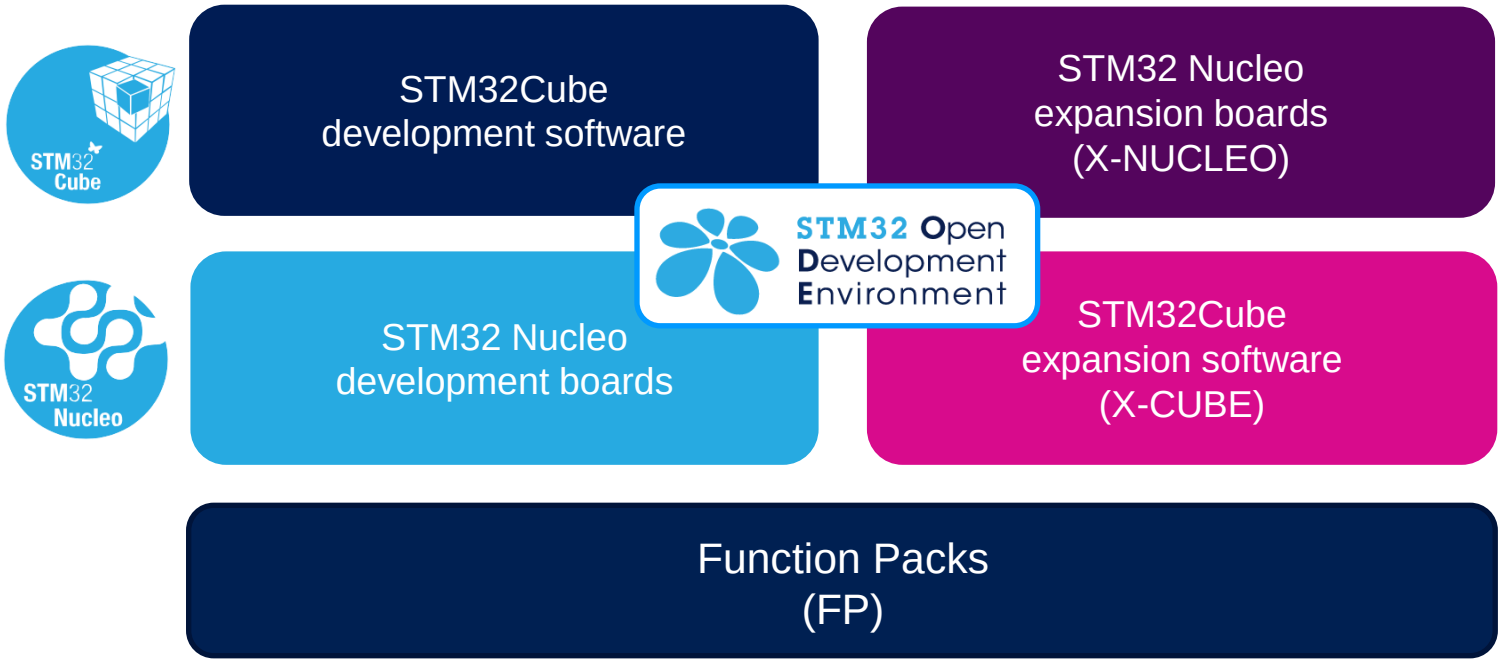
Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

STM32 Open Development Environment
Fast, affordable Prototyping and Development

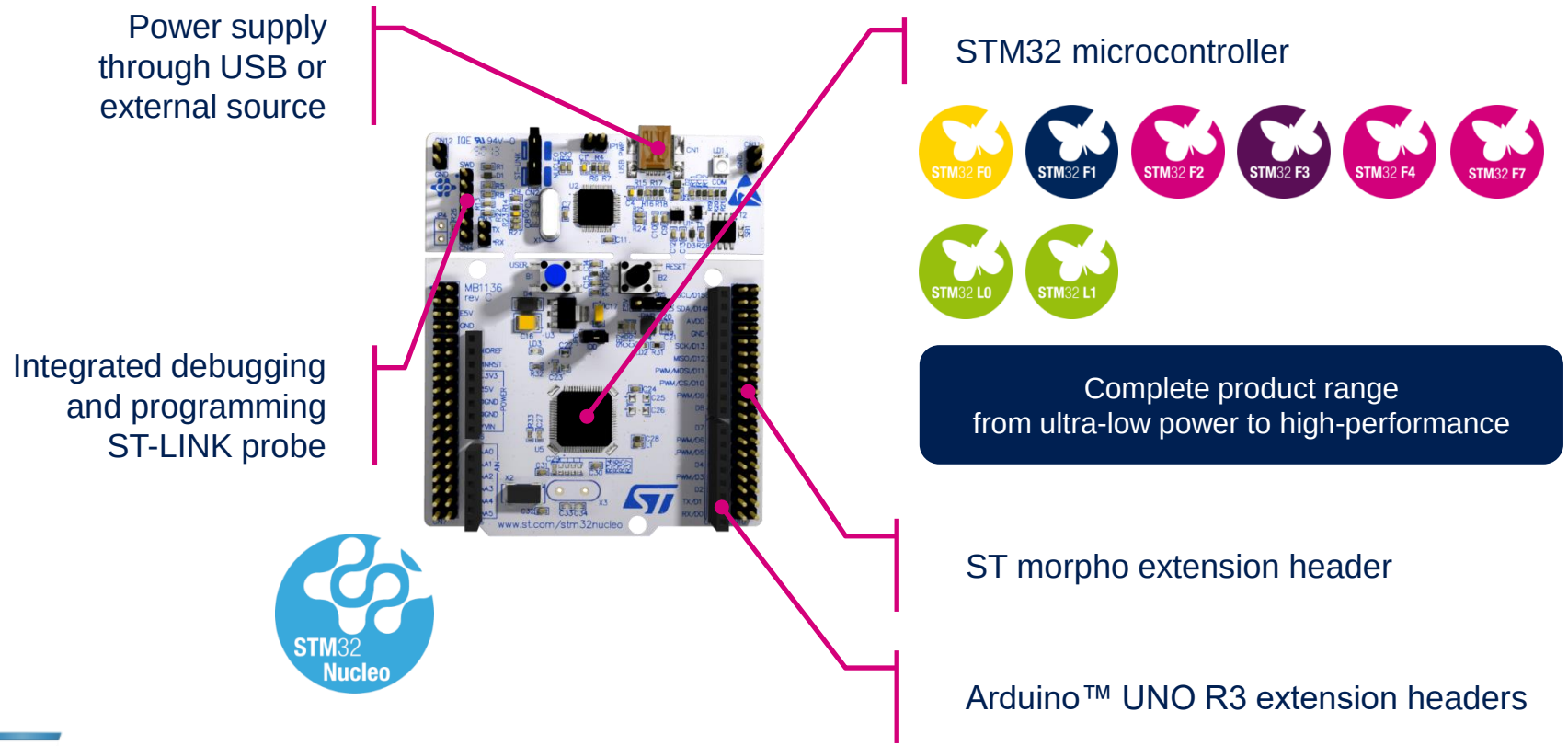
- The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.



www.st.com/stm32ode

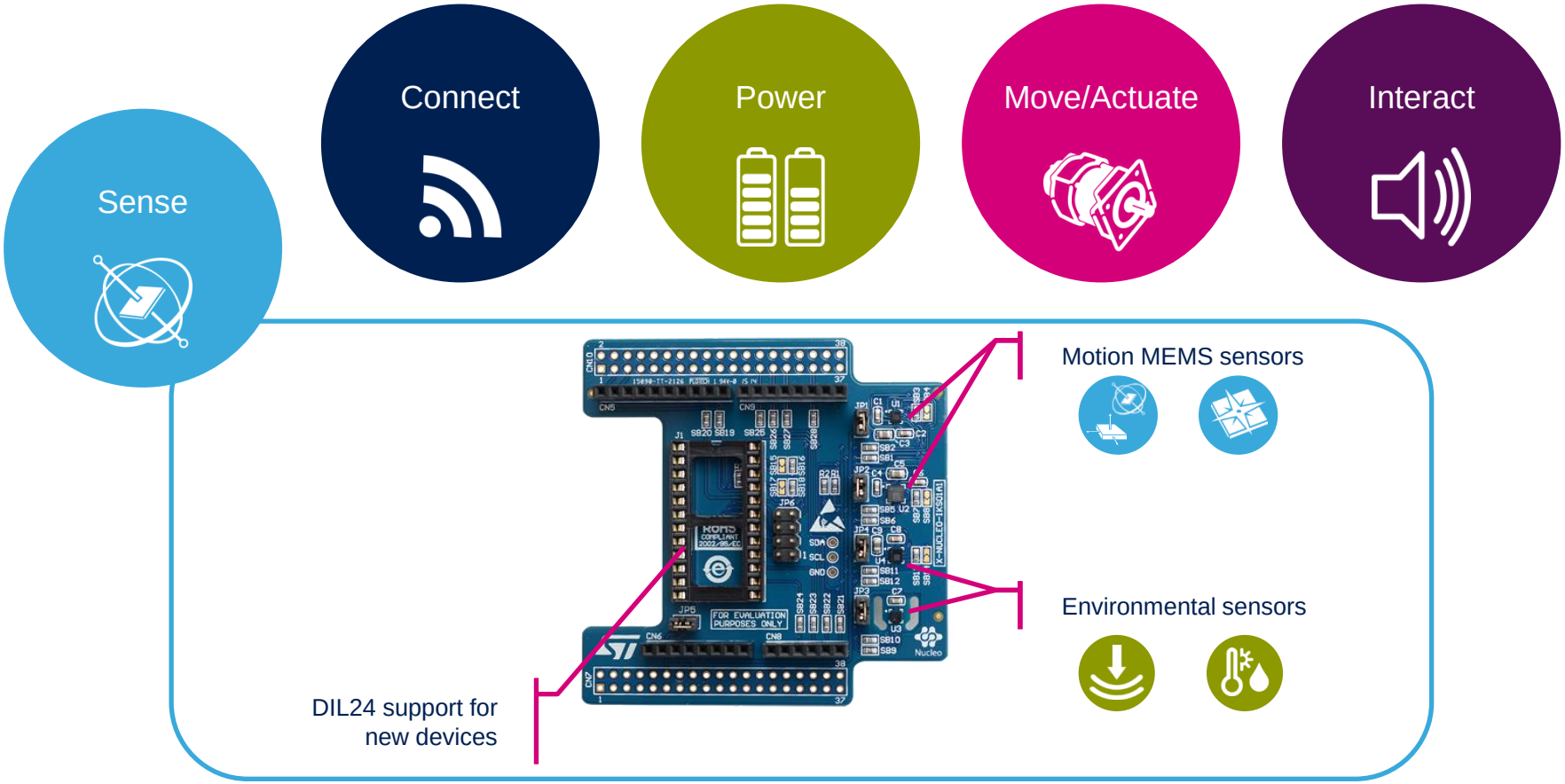
Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.



Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.



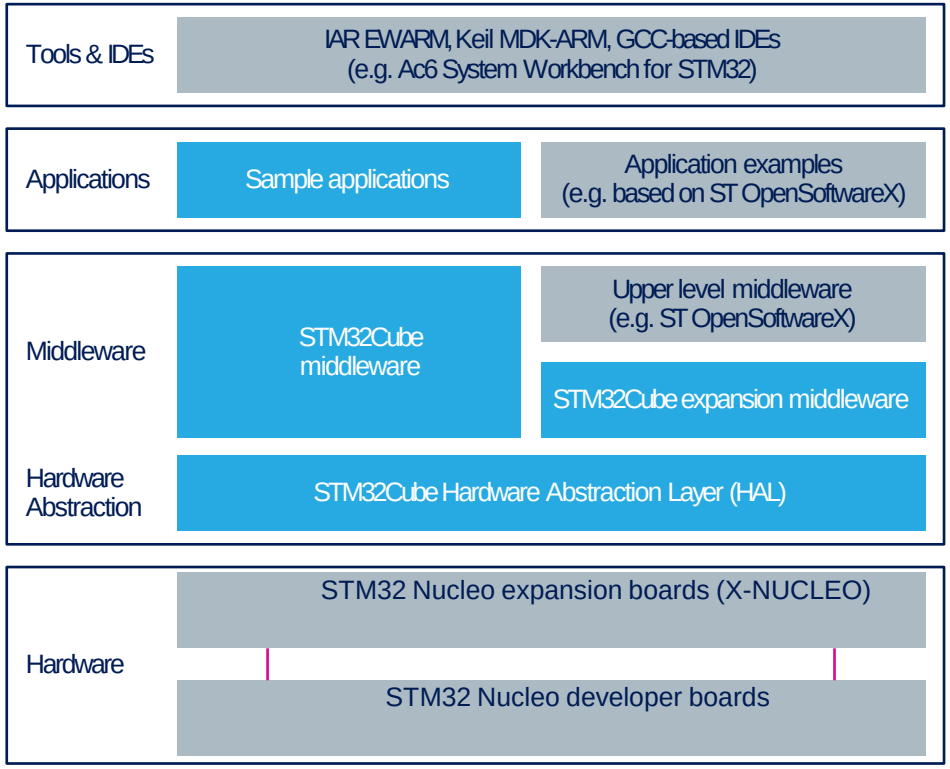
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

STM32 Open Development Environment

Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.



- **Compatibility with multiple Development Environments -** The STM32 Open Development Environment is compatible with a number of IDEs, including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors; they are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

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OPEN LICENSE MODELS: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

www.st.com/stm32cube

www.st.com/x-cube

STM32 Open Development Environment

Building block approach

The building blocks	Your need	Our answer

Accelerometer, gyroscope
Inertial modules, magnetometer
Pressure, temperature, humidity
Proximity, microphone

Sense — COLLECT

Bluetooth LE, Sub-GHz radio
NFC, Wi-Fi, GNSS

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Move / Actuate — CREATE

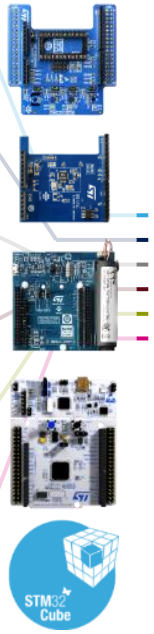
Energy management & battery

Power — POWER

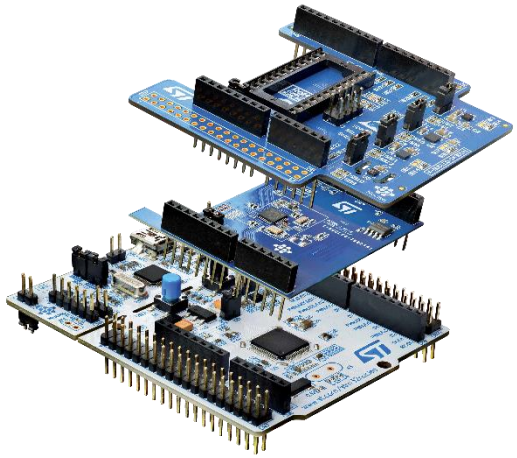
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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