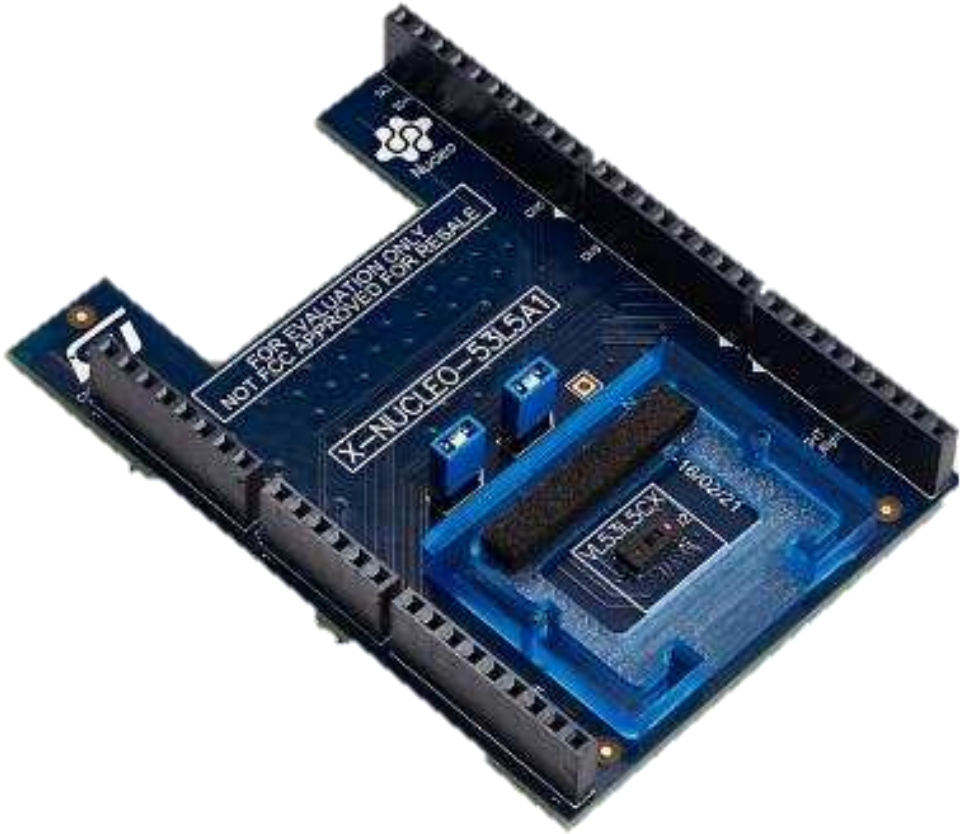

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Quick Start Guide

Time-of-Flight 8x8 multizone ranging sensor with wide field of view
expansion board based on VL53L5CX for STM32 Nucleo

Version 1.0 (June 16th, 2021)

Agenda

- # Hardware and Software overview
- # Documents & Related Resources
- # STM32 Open Development Environment: Overview

1- Hardware and Software overview

8x8 Multi-zone Time-of-Flight Sensor expansion board
Hardware Overview (1/2)

X-NUCLEO-53L5A1 Hardware Description

- The X-NUCLEO-53L5A1 is a Time-of-Flight 8x8 multizone ranging sensor with wide field of view and development board designed around the VL53L5CX sensor based on ST F**light**Sense™ patented technology
- The VL53L5CX communicates with the STM32 Nucleo developer board host microcontroller through an I²C link available on the Arduino UNO R3 connector.

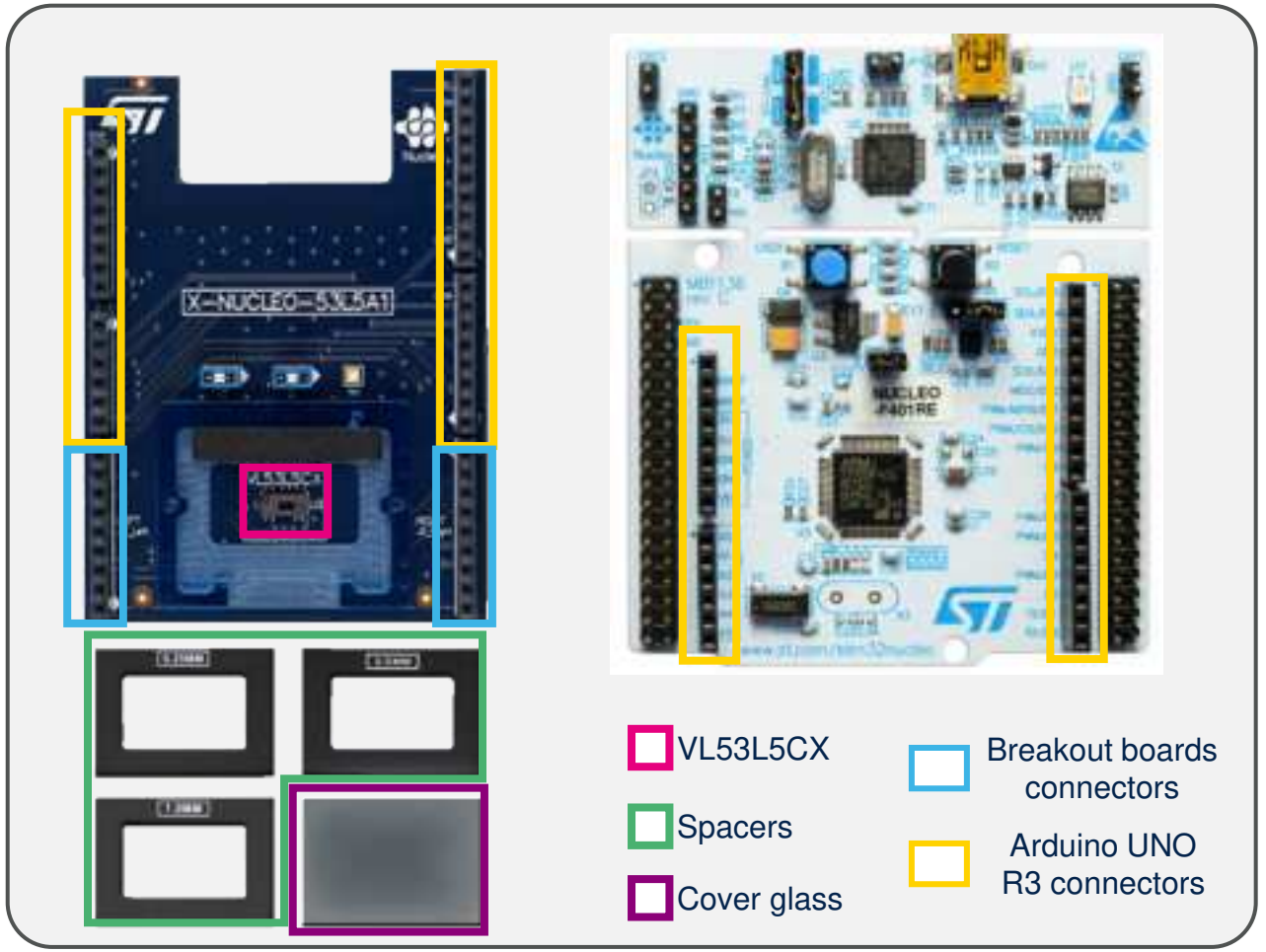
Key Products on board

VL53L5CX Time-of-Flight (ToF) 8x8 multizone ranging sensor with wide field of view

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

Breakout boards

VL53L5CX-SATEL breakout boards can be purchased separately



Order Code: **X-NUCLEO-53L5A1**

Latest info available at www.st.com
X-NUCLEO-53L5A1

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8x8 Multi-zone Time-of-Flight Sensor expansion board
Hardware Overview (2/2)

- X-NUCLEO-53L5A1 expansion board
  - VL53L5CX devices in custom applications can be integrated with expansion board, or external VL53L5CX breakout.
  - The breakout boards are delivered separately.
- X-NUCLEO-53L5A1 is also available as a NUCLEO Pack (P-NUCLEO-53L5A1)
  - The X-NUCLEO-53L5A1 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-53L5A1**:
    X-NUCLEO-53L5A1 expansion board and NUCLEO-F401RE full features board.
- VL53L5CX breakout boards can be ordered separately
  - Order code: **VL53L5CX-SATEL**
  - The pack carry **two** breakout boards

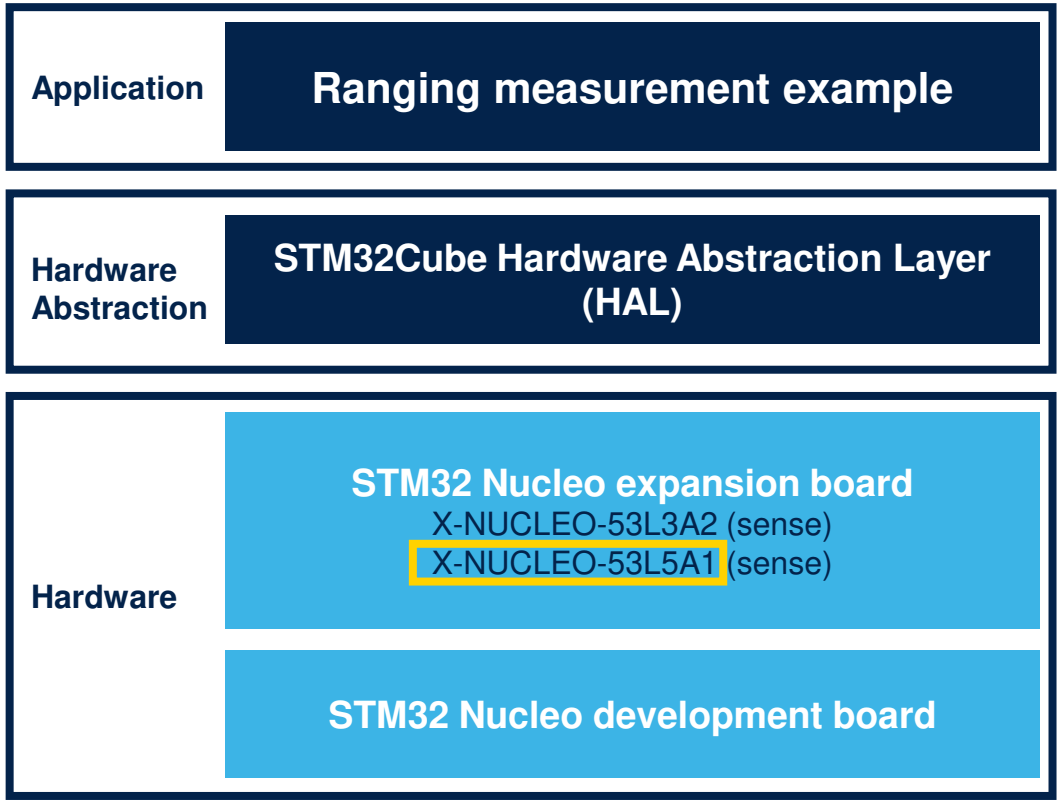
Time-of-Flight sensors Software Environment
STM32Cube Software Overview

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-53L5A1) 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-53L5A1) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG).

Key features

- Driver layer (VL53L5CX ULD) for complete management of the VL53L5CX 8x8 multi-zone ranging sensor integrated in the X-NUCLEO- 53L5A1 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

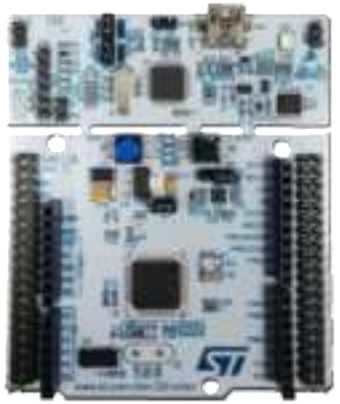
2- Setup & Demo Example

Setup & Demo Examples
HW prerequisites

- 1x Multi-zone ToF sensor expansion board based on VL53L5CX (**X-NUCLEO-53L5A1**).

X-NUCLEO-53L5A1

- 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-53L5A1)**:
  - X-NUCLEO-53L5A1 expansion board and NUCLEO-F401RE full features board delivered together.



NUCLEO-F401RE

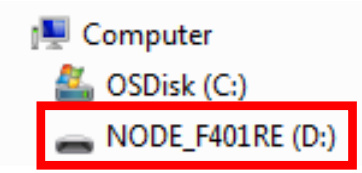
P-NUCLEO-53L5A1

Setup & Demo Examples
SW prerequisites

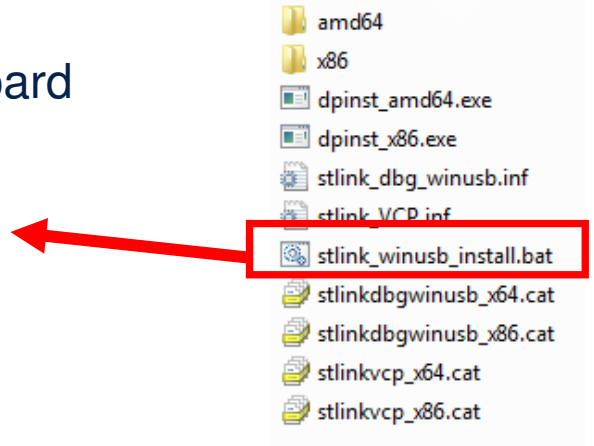
- **STSW-IMG023**: Ultra Lite Driver (ULD) for VL53L5CX
- **STSW-IMG024**: P-NUCLEO-53L5A1 Graphical User Interface (GUI) on Windows 7 and 10
- **STSW-IMG025**: Linux driver for VL53L5CX
- **X-CUBE-TOF1**: Time-of-Flight sensors software expansion for STM32Cube.
  - When you install the X-CUBE-TOF1 the installer install the directory containing the example projects here for instance :
    - C:\Users\john\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE-TOF1\2.0.0-B1\Projects\STM32F401RE-Nucleo\Examples\53L5A1\53L5A1_SimpleRanging.

Setup & Demo Examples
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"



=> VL53L5CX nucleo kit is ready for GUI installation

VL53L5CX GUI software installation

GUI is generally the first step to evaluate the device

- Perform HW installation and connect the VL53L5CX expansion board + Nucleo F401RE to the PC
- Install the GUI SW for VL53L5CX Demo and configuration settings
  - **STSW-IMG024**, downloaded from www.st.com
  - **Run the installer with Admin privileges**

The Graphical User Interface can:

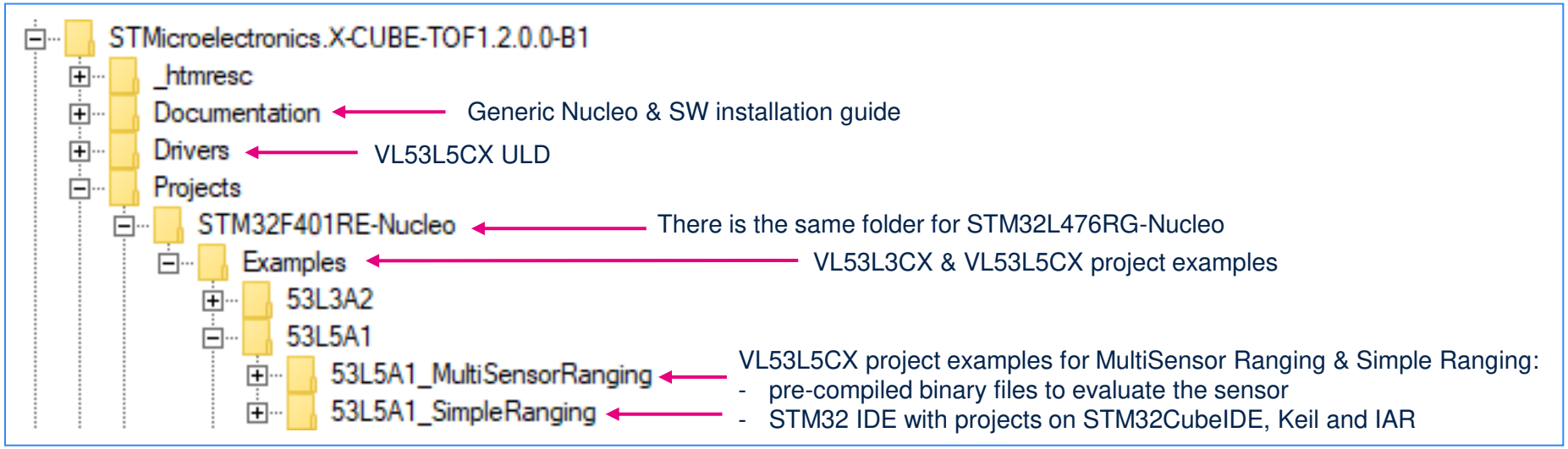
- Perform the Xtalk calibration and visualize calibration data
- Change key parameters of VL53L5CX
- Display real time mini-depth map data (distance, signal, ambient rate)
- Get data logging and replay a datalog (.csv file)

Setup & Demo Examples
VL53L5CX GUI software installation

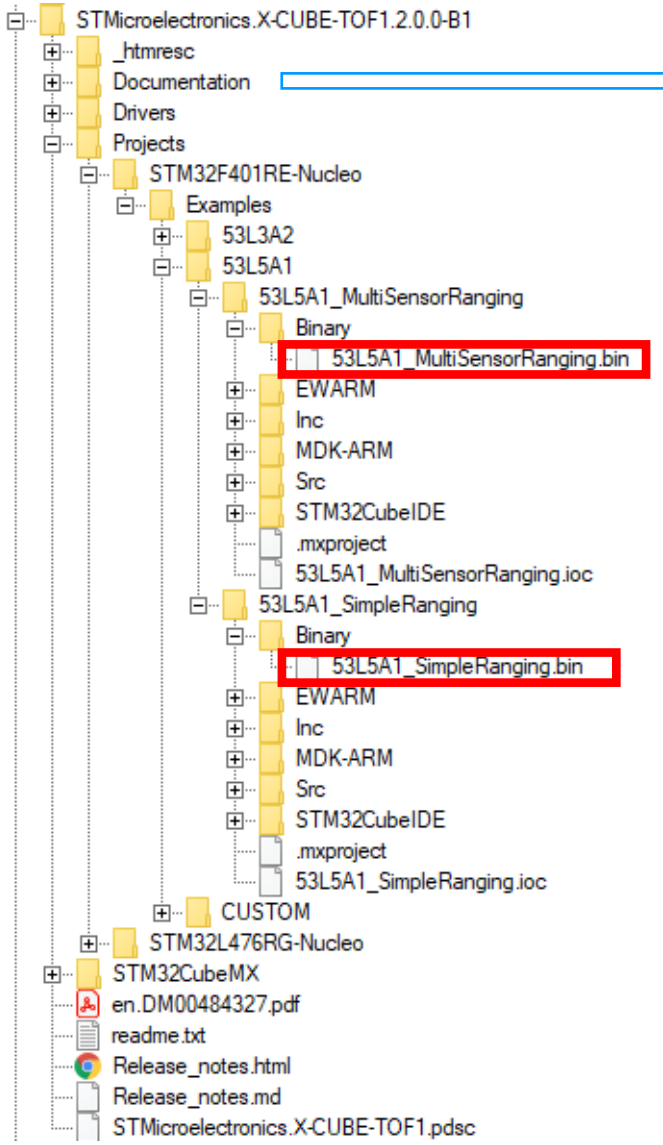
Setup & Demo Examples
X-CUBE-TOF1 software installation

- Perform HW installation and connect the NUCLEO kit (P-NUCLEO-53L5A1) to the PC
- Install the X-CUBE-TOF1 SW package
  - **X-CUBE-TOF1**, 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\john\STM32Cube\Repository\Packs\STMicroelectronics\X-CUBE-TOF1\2.0.0-B1\Projects\STM32F401RE-Nucleo\Examples\53L5A1\53L5A1_SimpleRanging

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

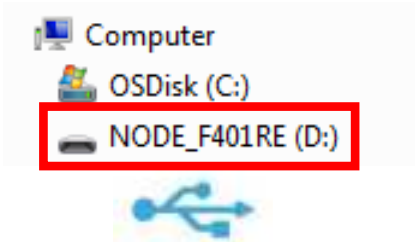


8x8 Multi-zone Time-of-Flight Sensor expansion board
Evaluation code example (.bin) using X-CUBE-TOF1 and a NUCLEO Pack

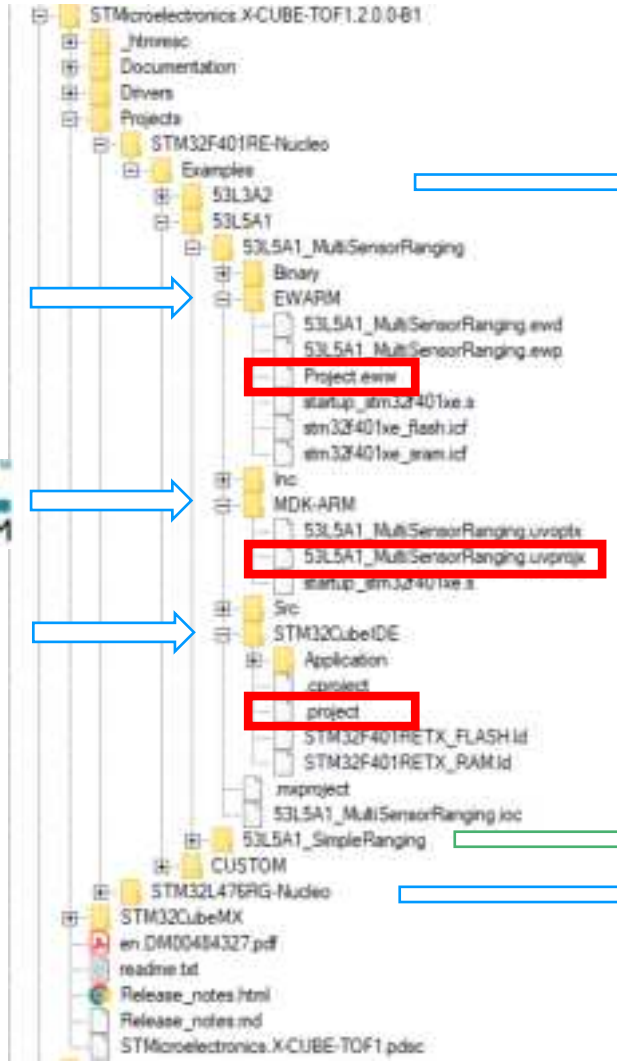


Open: **UM2853** (Getting started with the STMicroelectronics X-CUBE-TOF1, Time-of-Flight sensors, software package for STM32CubeMX) and follow the instructions

Drag and drop to



VL53L5CX 8x8 Multi-zone Time-of-Flight Sensor expansion board
Start programming with code examples using X-CUBE-TOF1 and a NUCLEO Pack



Open: **UM2853** (Getting started with the STMicroelectronics X-CUBE-TOF1, Time-of-Flight sensors, software package for STM32CubeMX) and **follow the instructions**

Open project example for
Multi Sensor ranging
And modify, build application SW

Same folders as above but for another project example

We find same folders and same files as above

3- Documents & Related Resources

Documents & Related Resources

Go to https://www.st.com/en/imaging-and-photonics-solutions/vl53l5cx
All documents are available in the Documentation tab of the related products webpage

VL53L5CX: Product Folder

- **DS13754**: Time-of-Flight 8x8 multizone ranging sensor with wide field of view - **data sheet**

X-NUCLEO-53L5A1: Product Folder

- **DB4505**: Time-of-Flight 8x8 multizone ranging sensor with wide field of view expansion board based on VL53L5CX for STM32 Nucleo – **data brief**
- **X-NUCLEO-53L5A1 Quick start guide :** Time-of-Flight 8x8 multizone ranging sensor with wide field of view - **this document**
- **UM2889:** Getting started with X-NUCLEO-53L5A1 Time-of-Flight 8x8 multi-zone ranging sensor with wide FoV based on the VL53L5CX for STM32 Nucleo - **user manual**

P-NUCLEO-53L5A1: Product Folder

- **DB4509**: VL53L5CX nucleo pack with X-NUCLEO-53L5A1 expansion board and STM32F401RE nucleo board– **data brief**

VL53L5CX-SATEL: Product Folder

- **DB4506** : VL53L5CX breakout board Time-of-Flight 8x8 multizone ranging sensor with wide field of view – **data brief**

STSW-IMG023: Ultra Lite Driver (ULD) for VL53L5CX folder

- **DB4499**: Ultra lite driver (ULD) application programming interface (API) for the VL53L5CX – **data brief**

STSW-IMG024: Graphical User Interface (GUI) Folder

- **DB4510**: P-NUCLEO-53L5A1 pack graphical user interface (GUI) – **data brief**
- **Software setup file**

X-CUBE-TOF1: Software package for STM32Cube

- **DB4449:** Time-of-Flight sensors software expansion for STM32Cube – **data brief**
- **UM2853:** Getting started with the STMicroelectronics X-CUBE-TOF1, Time-of-Flight sensors, software package for STM32CubeMX - **User Manual**
- **Software setup file**

4- STM32 Open Development Environment: Overview

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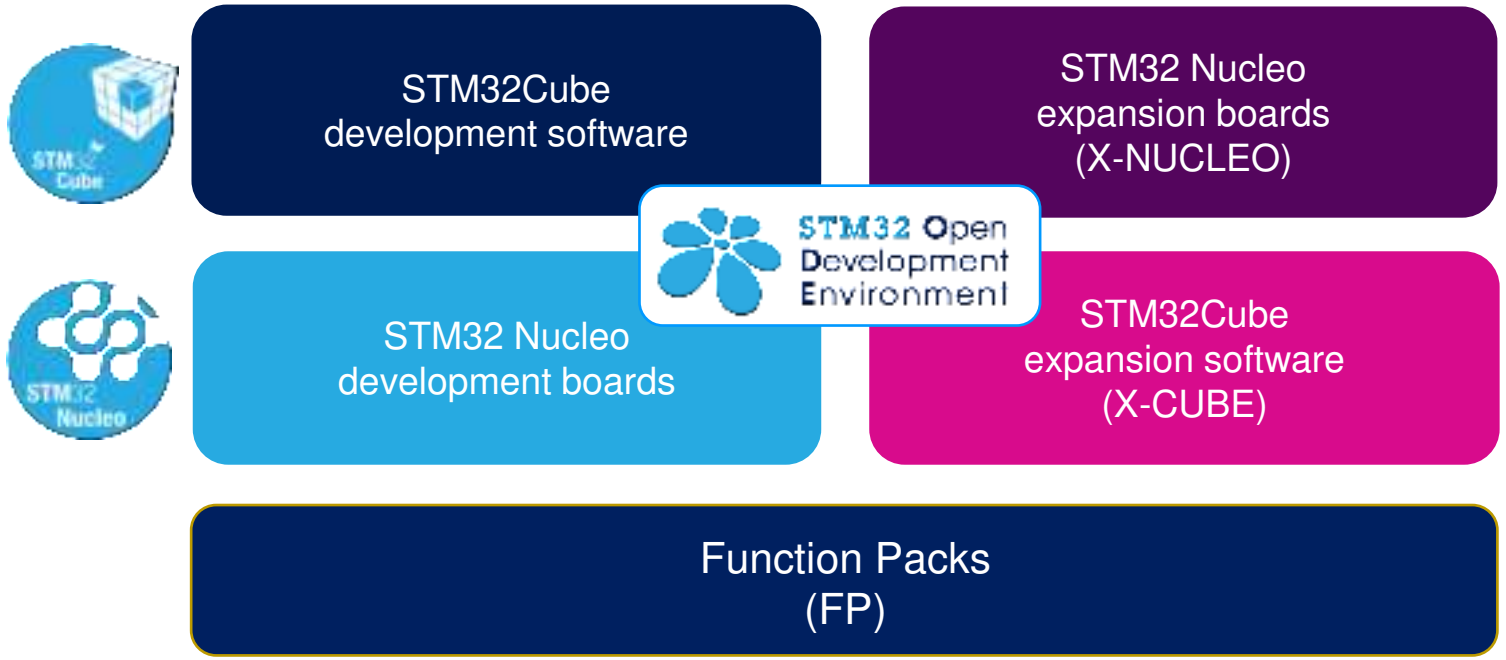
STM32 Open Development Environment
Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (STM32 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



For further information, please visit www.st.com/stm32ode

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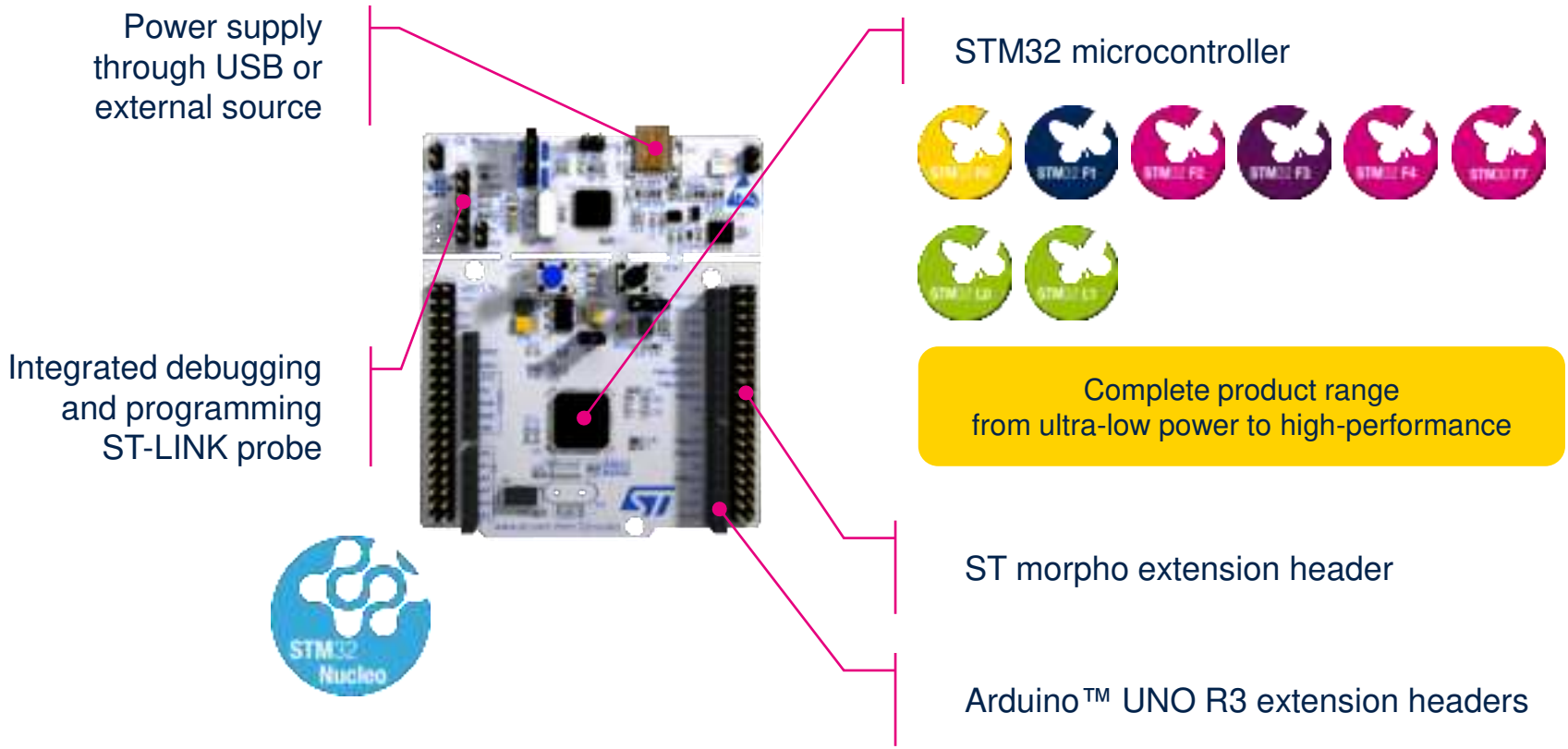
STM32 Nucleo
Development Boards (NUCLEO)

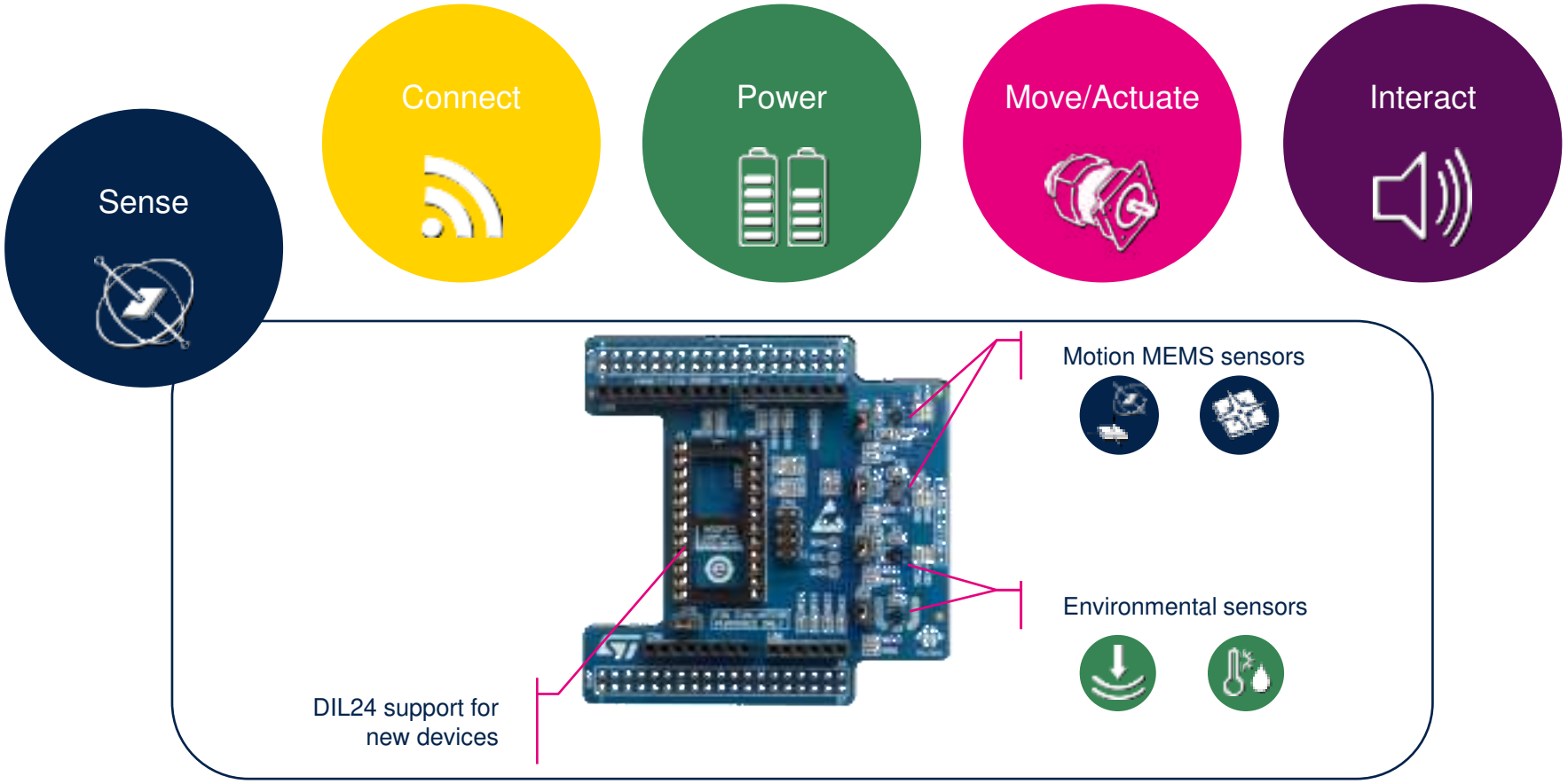
- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.



www.st.com/stm32nucleo

STM32 Nucleo
Expansion Boards (X-NUCLEO)

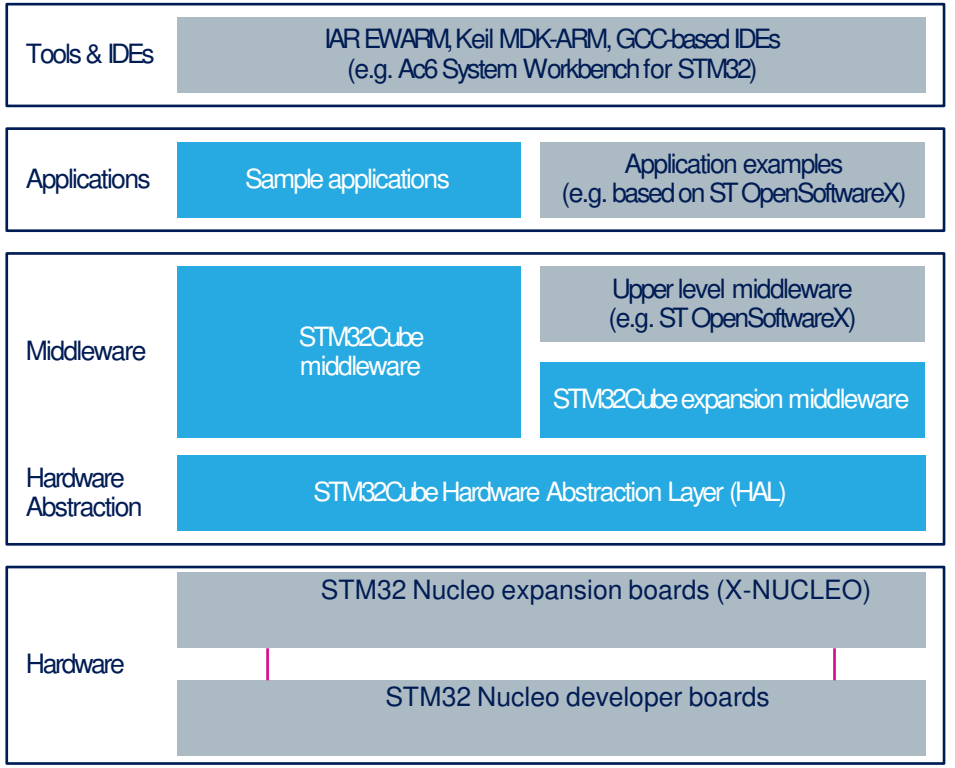
- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.



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.

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

Sense
Accelerometer, gyroscope
Inertial modules, magnetometer
Pressure, temperature, humidity
Time-of-Flight, microphone,
Ambient Light Sensor

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

Translate
Audio amplifier
Touch controller
Operation Amplifier

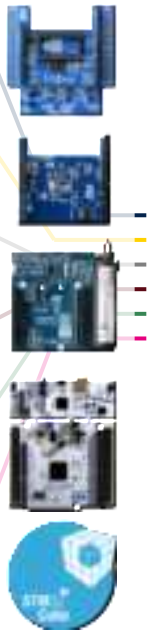
Move / Actuate
Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Power
Energy management & battery

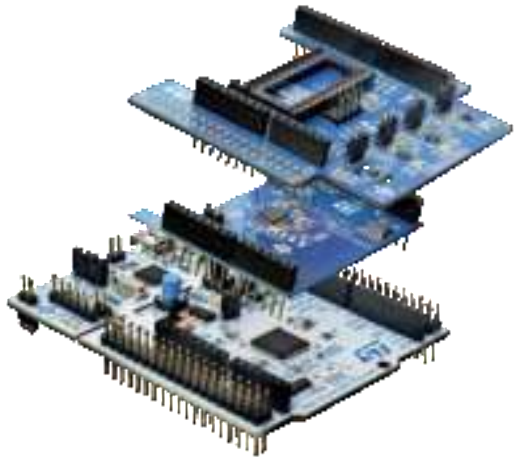
Process
General-purpose microcontrollers
Secure microcontrollers

Software

COLLECT
TRANSMIT
ACCESS
CREATE
POWER
PROCESS



STM32 Open Development Environment



www.st.com/stm32ode

Thank you

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