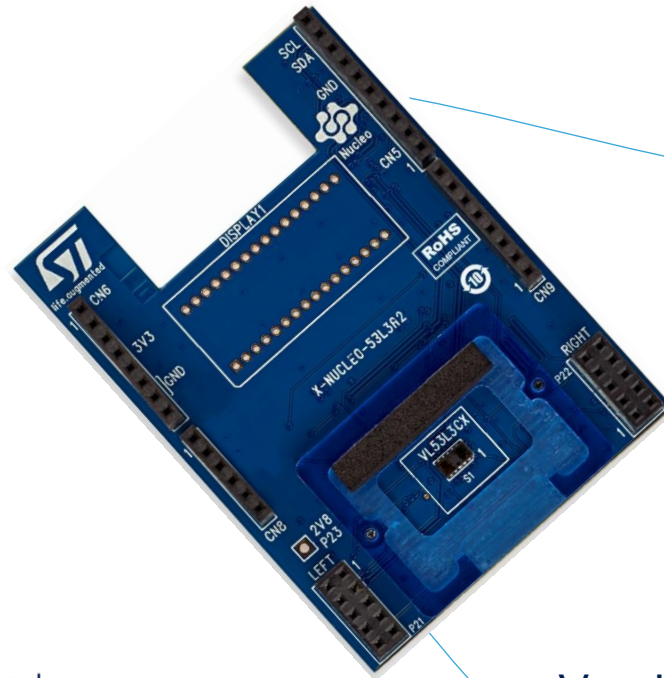
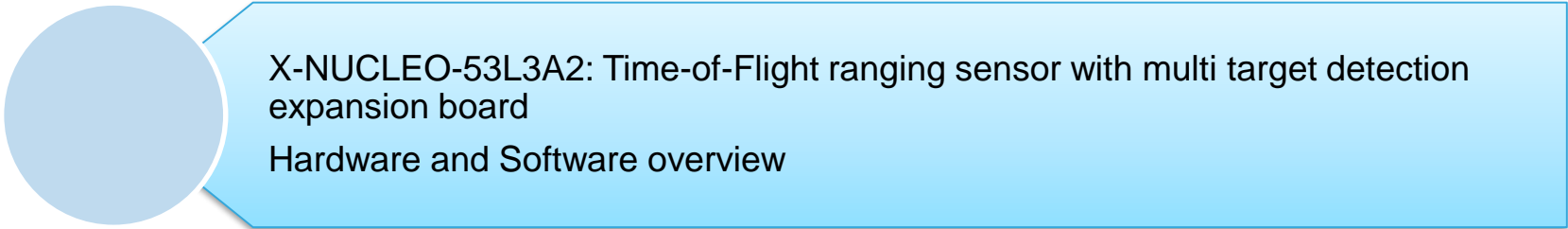


# Quick Start Guide

Time-of-Flight ranging sensor with multi target detection expansion board based on VL53L3CX for STM32 Nucleo (X-NUCLEO-53L3A2)





X-NUCLEO-53L3A2: Time-of-Flight ranging sensor with multi target detection expansion board  
Hardware and Software overview



Hardware & Software installation  
Documents & Related Resources



STM32 Open Development Environment: Overview

# ToF ranging sensor with multi target detection expansion board

## Hardware Overview (1/2)

3

### X-NUCLEO-53L3A2 Hardware Description

- The X-NUCLEO-53L3A2 is a ranging sensor with multi target detection evaluation and development board designed around the VL53L3CX sensor based on ST FlightSense™ Time-of-Flight technology.
- The VL53L3CX communicates with the STM32 Nucleo developer board host microcontroller through an I<sup>2</sup>C link available on the Arduino UNO R3 connector.

#### Key Products on board

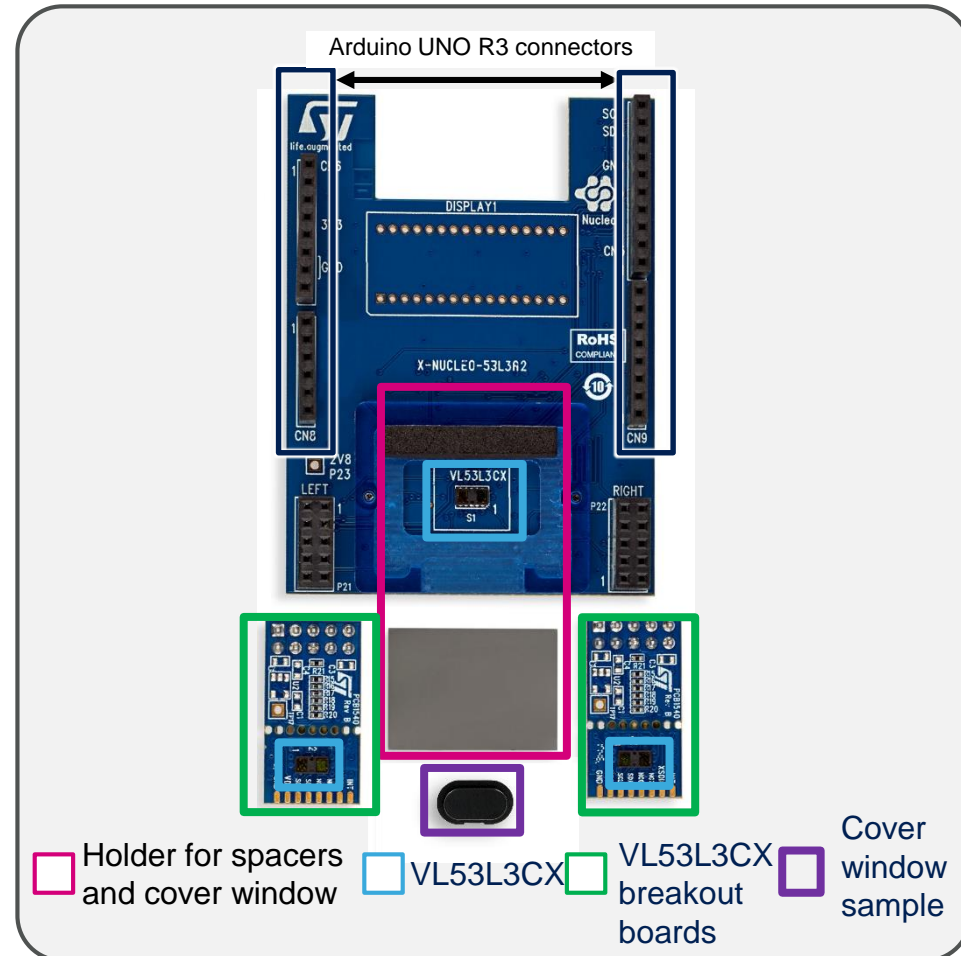
**VL53L3CX** ranging with multi target detection sensor module

**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 VL53L3CX

**2x VL53L3CX** breakout boards

Latest info available at [www.st.com](http://www.st.com)  
**X-NUCLEO-53L3A2**

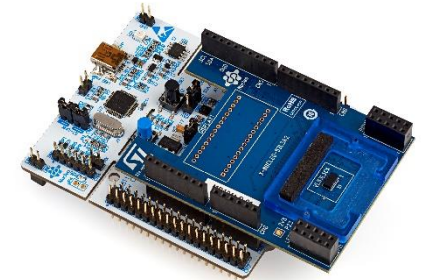
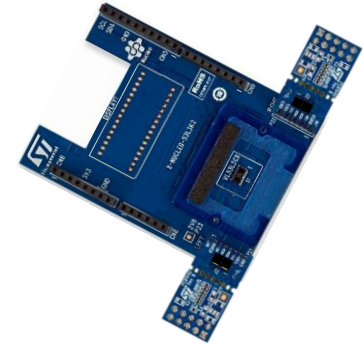


Order Code: **X-NUCLEO-53L3A2**

# ToF ranging sensor with multi target detection expansion board

## Hardware Overview (2/2)

- X-NUCLEO-53L3A2 expansion board
  - To help integrate multiple VL53L3CX devices in custom applications, up to 2 external VL53L3CX breakout boards can be connected to the expansion board.
  - The breakout boards are delivered with the **X-NUCLEO-53L3A2**.
- X-NUCLEO-53L3A2 is also available as a NUCLEO Pack (P-NUCLEO-53L3A2)
  - The X-NUCLEO-53L3A2 expansion board can also be ordered on [www.st.com](http://www.st.com) as part of a NUCLEO Pack with expansion board and STM32 NUCLEO board.
  - Order code: **P-NUCLEO-53L3A2**:  
X-NUCLEO-53L3A2 expansion board and NUCLEO-F401RE full features board.
- VL53L3CX breakout boards can also be ordered separately
  - Order code: **VL53L3CX-SATEL**  
Two breakout boards are included.



# Long distance ranging ToF sensor expansion board

## STM32Cube Software Overview

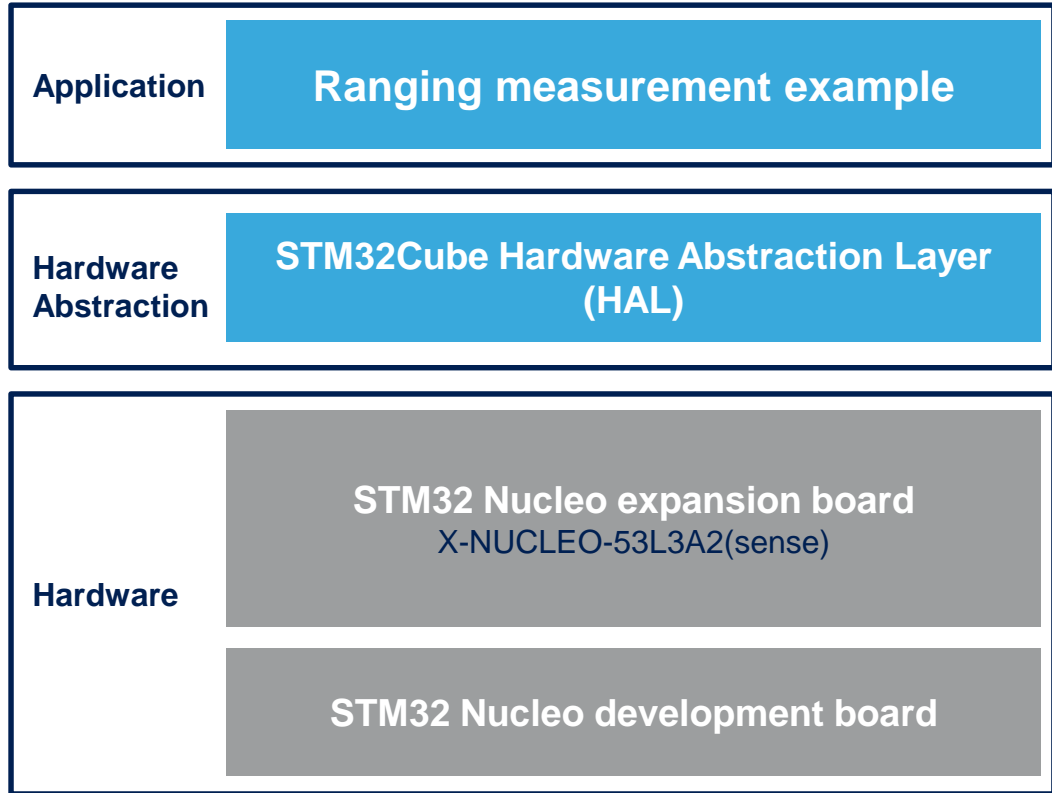
5

### X-CUBE-53L3A2 software description

- The X-CUBE-53L3A2 software package is an STM32Cube expansion for the X-NUCLEO-53L3A2 expansion board 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-53L3A2) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-L476RG).

### Key features

- Driver layer (VL53L3CX API) for complete management of the VL53L3CX ranging sensor integrated in the X-NUCLEO-53L3A2 expansion board.
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.
- Sample code for ranging measurement.

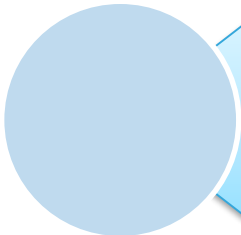


Latest SW available at [www.st.com](http://www.st.com)  
**X-CUBE-53L3A2**



X-NUCLEO-53L3A2: Time-of-Flight ranging sensor with multi target detection expansion board

Hardware and Software overview



Hardware & Software installation  
Documents & Related Resources



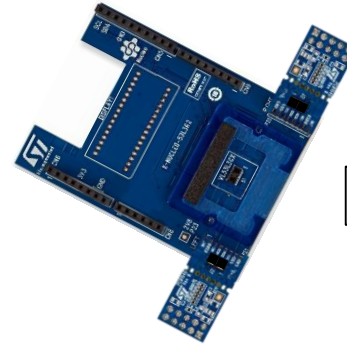
STM32 Open Development Environment: Overview

# Setup & Demo Examples

## HW prerequisites

7

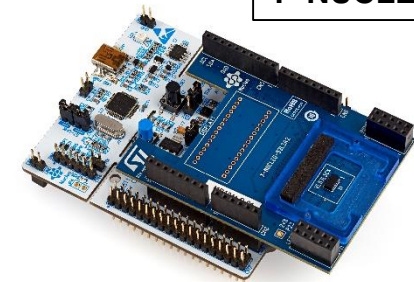
- 1x Ranging sensor expansion board based on VL53L3CX (**X-NUCLEO-53L3A2**).
- 1x STM32 Nucleo development board (**NUCLEO-F401RE** or **NUCLEO-L476RG**)
- 1x Laptop/PC with MS Windows
- 1x USB type A to Mini-B USB cable
- If you don't have an STM32 Nucleo development board, you can order a Nucleo pack (**P-NUCLEO-53L3A2**):
  - X-NUCLEO-53L3A2 expansion board and NUCLEO-F401RE full features board delivered together.



**X-NUCLEO-53L3A2**



**NUCLEO-F401RE**  
or  
**NUCLEO-L476RG**



**P-NUCLEO-53L3A2**

# Setup & Demo Examples

## SW prerequisites

- **STSW-IMG016:** P-NUCLEO-53L3A2 Graphical User Interface (GUI) on Windows 7 and 10
- **X-CUBE-53L3A2:** P-NUCLEO-53L3A2 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.

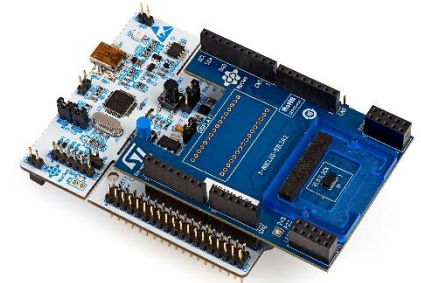
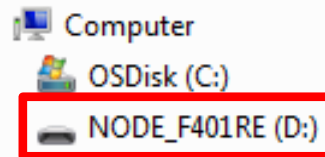


# Setup & Demo Examples

## NUCLEO Kit driver installation

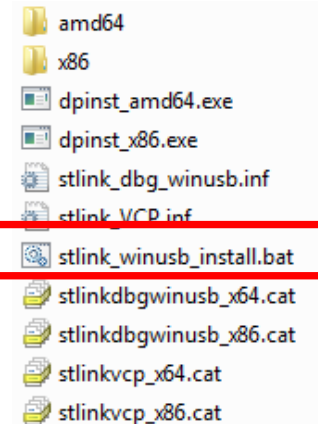
### 1. Connect the Nucleo pack to the PC through USB

- 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](http://www.st.com)
- Unzip, extract the docs, and install “stlink\_winusb\_install.bat”



### GUI is generally the first step to evaluate the device

- Perform HW installation and connect the VL53L3CX NUCLEO pack ( X-NUCLEO-53L3A2 expansion board + STM32 Nucleo board) to the PC
- Install the GUI SW for VL53L3CX Demo and configuration settings
  - Called **STSW-IMG016**, downloaded from [www.st.com](http://www.st.com)
  - Unzip, extract the docs, and install “**VL53L3CX\_setup.exe**”
  - **Run the installer with Admin privileges**

### The Graphical User Interface can:

- Perform calibration phases (offset and X-Talk with cover glass)
- Change key parameters of VL53L3CX
- Display real time main ranging data (distance, signal rate),
- Get data logging (.csv file)

# Setup & Demo Examples VL53L3CX GUI software installation

11



# X-CUBE-53L3A2 software installation

- Perform HW installation and connect the NUCLEO kit ( P-NUCLEO-53L3A2) to the PC
- Install the X-CUBE-53L3A2 SW package
  - Called **X-CUBE-53L3A2**, downloaded from [www.st.com](http://www.st.com)
  - Unzip, extract the docs, and the **X-CUBE-53L3A2** folder directory appears

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

- 
- The screenshot shows a directory tree for X-CUBE-53L3A2. Annotations with pink arrows point to specific folders and files:
- Generic Nucleo & SW installation guide (points to Documentation)
  - VL53L3CX API driver (points to Drivers)
  - There is the same folder for STM32L476RG-Nucleo (points to STM32F401RE-Nucleo)
  - VL53L3CX project examples for single sensor ranging:
    - pre-compiled binary files to evaluate the sensor
    - STM32 IDE with projects on STM32CubeIDE, Keil and IAR (points to SimpleRanging)

# VL53L3CX ranging ToF sensor expansion board

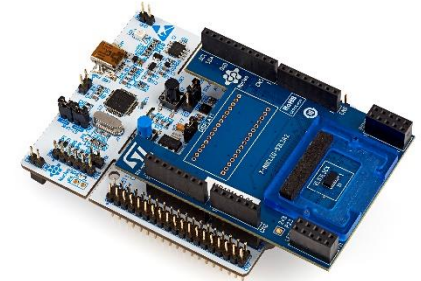
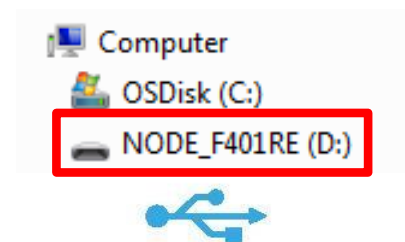
## Evaluation code example (.bin) using X-CUBE-53L3A2 and a NUCLEO Pack

- X-CUBE-53L3A2
      - \_htmresc
      - Documentation
      - Drivers
      - Projects
        - STM32F401RE-Nucleo
          - Examples
            - 53L3A2
              - SimpleRanging
                - Binary
                  - VL53L3CX\_SimpleRanging.bin
  - STM32L476RG-Nucleo
    - Examples
      - 53L3A2
        - SimpleRanging
          - Binary
            - VL53L3CX\_SimpleRanging\_L476.bin

Open: **UMxxxx** (Getting started with X-NUCLEO-53L3A2 ranging sensor with multi target detection expansion board based on VL53L3CX for STM32 Nucleo) and follow the instructions

Load STM32 firmware ( Binary code file )  
 VL53L3CX\_SimpleRanging.bin  
 Or  
 VL53L3CX\_SimpleRanging\_L476.bin

Drag and drop to



# VL53L3CX ranging ToF sensor expansion board

## Start programming with code examples using X-CUBE-53L3A2 and a NUCLEO Pack

- ▼ X-CUBE-53L3A2
  - \_htmresc
  - Documentation
  - > Drivers
  - ▼ Projects
    - ▼ STM32F401RE-Nucleo
      - ▼ Examples
      - ▼ 53L3A2
        - ▼ SimpleRanging
          - Binary
          - EWARM
            - Project.eww
          - MDK-ARM
            - VL53L3CX\_SimpleRanging.uvprojx
          - STM32CubeIDE
            - .project
  - ▼ STM32L476RG-Nucleo
    - ▼ Examples
    - ▼ 53L3A2

Open: **UMxxxx** (Getting started with X-NUCLEO-53L3A2 ranging sensor with multi target detection expansion board based on VL53L3CX 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

Go to <https://www.st.com/en/imaging-and-photonics-solutions/vl53l3cx>  
All documents are available in the **DESIGN** tab of the related products webpage

## VL53L3CX: Product Folder

- **DS13204**: Time-of-Flight ranging sensor with multi target detection - **data sheet**

## X-NUCLEO-53L1A1: Product Folder

- **DB4226**: ToF ranging sensor with multi target detection expansion board based on VL53L3CX for STM32 Nucleo – **data brief**
- **X-NUCLEO-53L3A2 Quick start guide** : Long distance ranging sensor expansion board - ( this document )
- **UMxxxx**: Getting started with X-NUCLEO-53L3A2 ranging sensor with multi target detection expansion board based on VL53L3CX for STM32 Nucleo - **user manual**

## P-NUCLEO-53L1A1: Product Folder

- **DB4199**: VL53L3CX nucleo pack with X-NUCLEO-53L3A2 expansion board and STM32F401RE nucleo board – **data brief**

## STSW-IMG016: Graphical User Interface (GUI) Folder

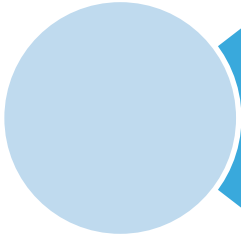
- **DB4198**: P-NUCLEO-53L3A2 pack graphical user interface (GUI) – **data brief**
- **Software setup file**

## STSW-IMG015: Application programming Interface (VL53L3CX software driver API) folder

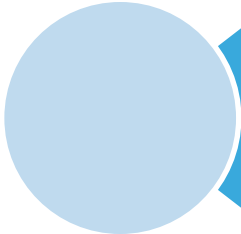
- **DB4134**: VL53L3CX ToF ranging sensor with multi target detection application programming interface (API) – **data brief**

## X-CUBE-53L3A2: Software package for STM32Cube

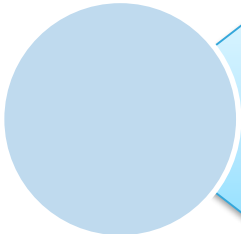
- **DB4193**: Time-of-Flight ranging sensor with multi target detection expansion of STM32Cube – **data brief**
- **User Manual** integrated to the zip
- **Software setup file**



X-NUCLEO-53L3A2: Time-of-Flight ranging sensor with multi target detection expansion board  
Hardware and Software overview



Setup & Demo Examples  
Documents & Related Resources



STM32 Open Development Environment: Overview

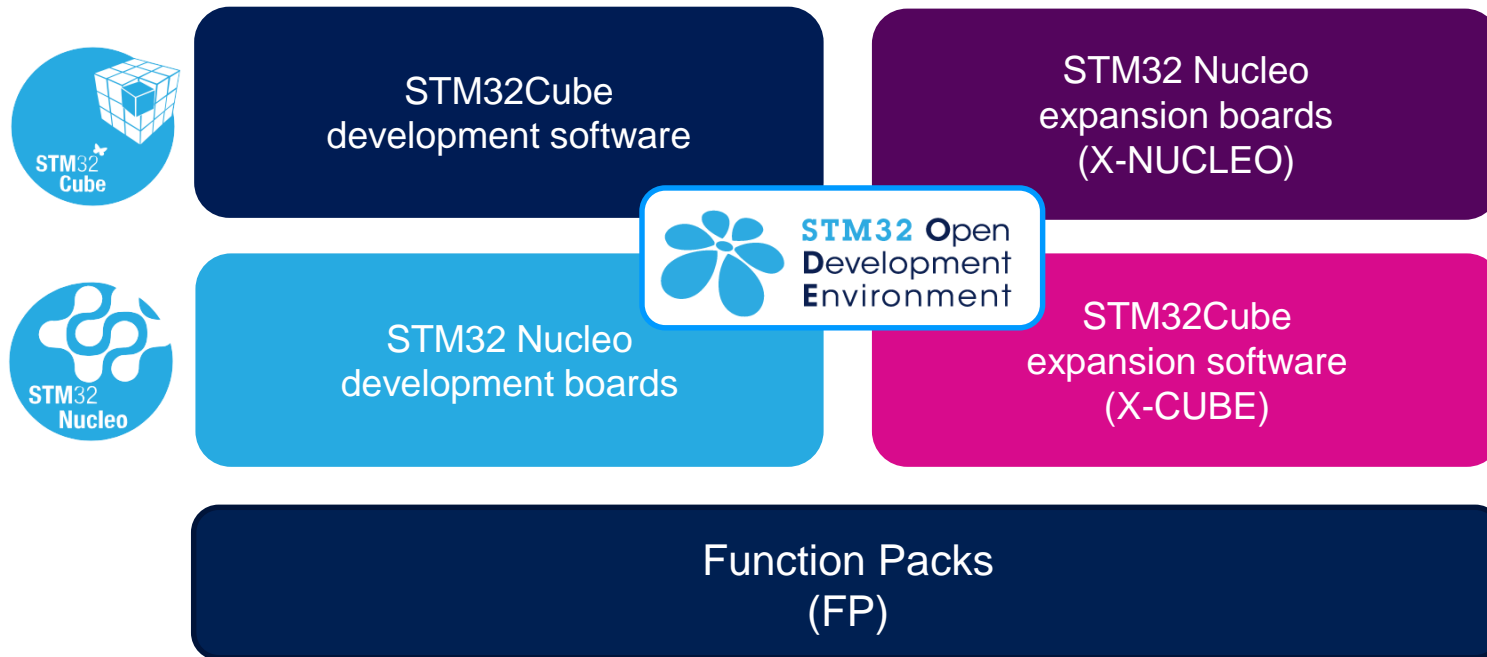


# STM32 Open Development Environment

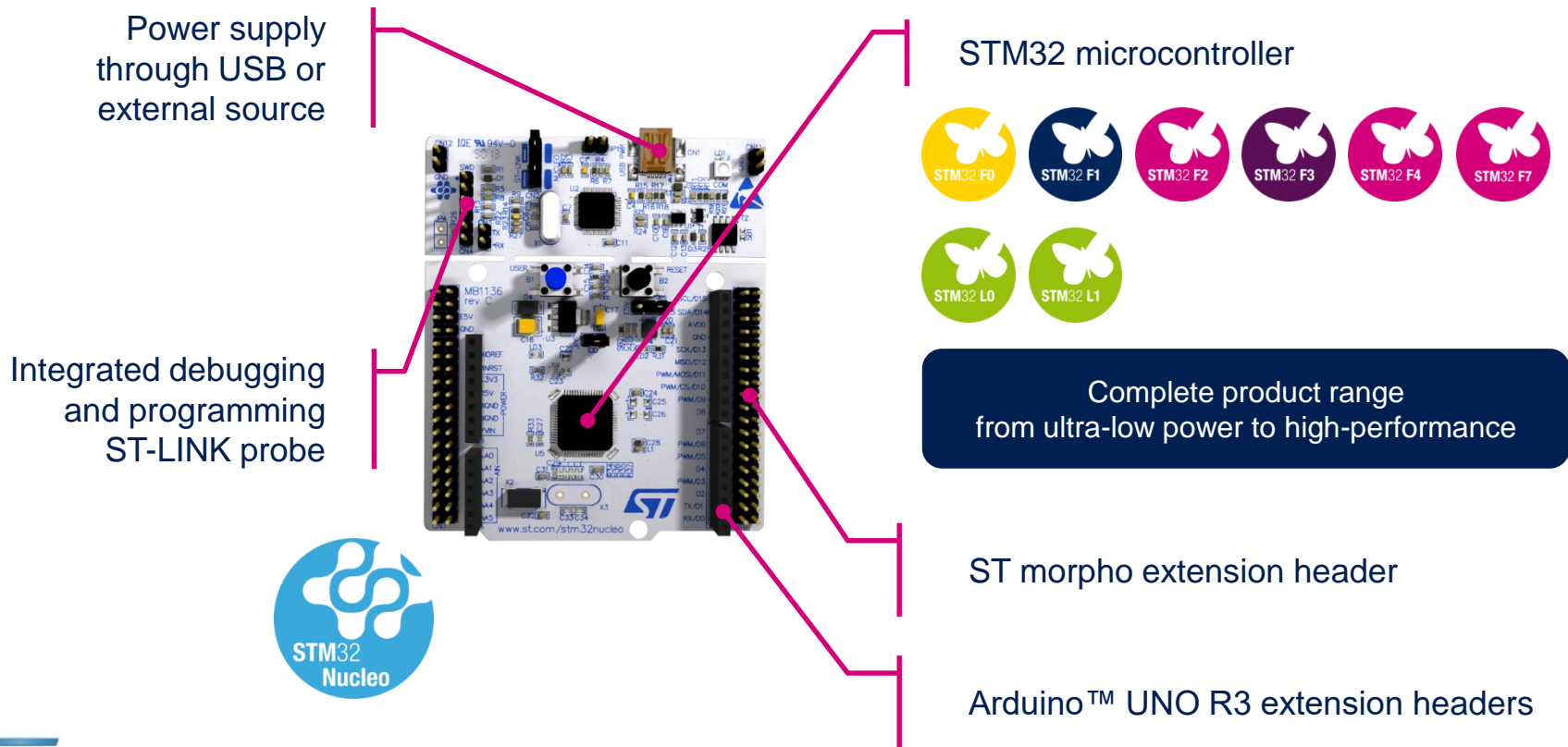
## Fast, affordable Prototyping and Development

17

- 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.

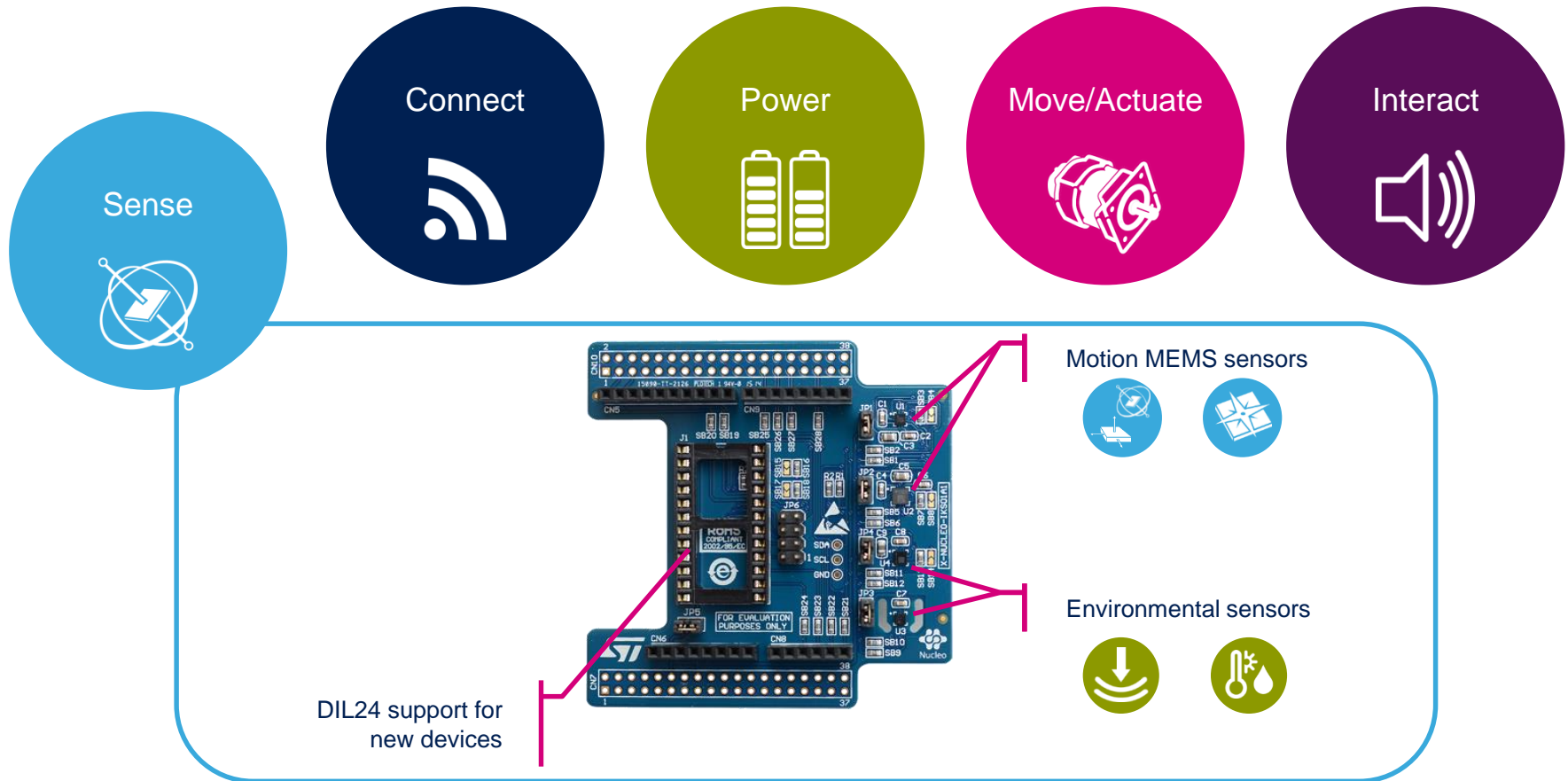


- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.



# 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)

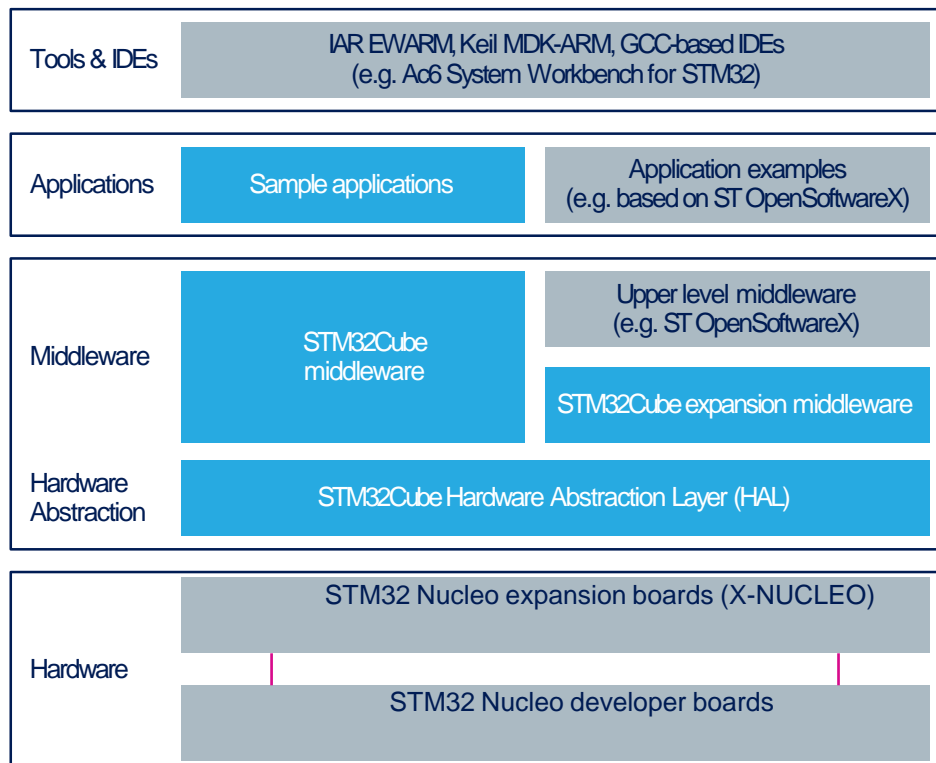
# STM32 Open Development Environment

## Software components

20

- **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](http://www.st.com/stm32cube)

[www.st.com/x-cube](http://www.st.com/x-cube)

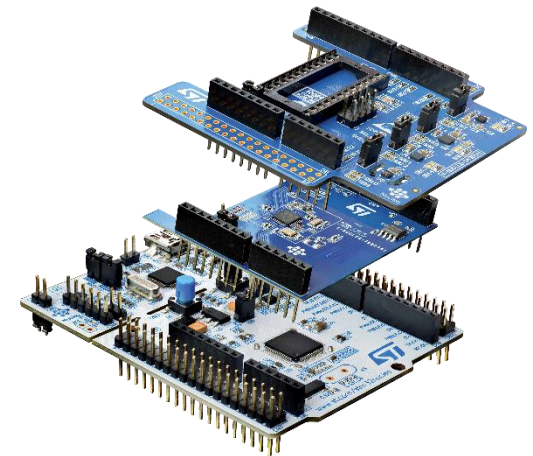
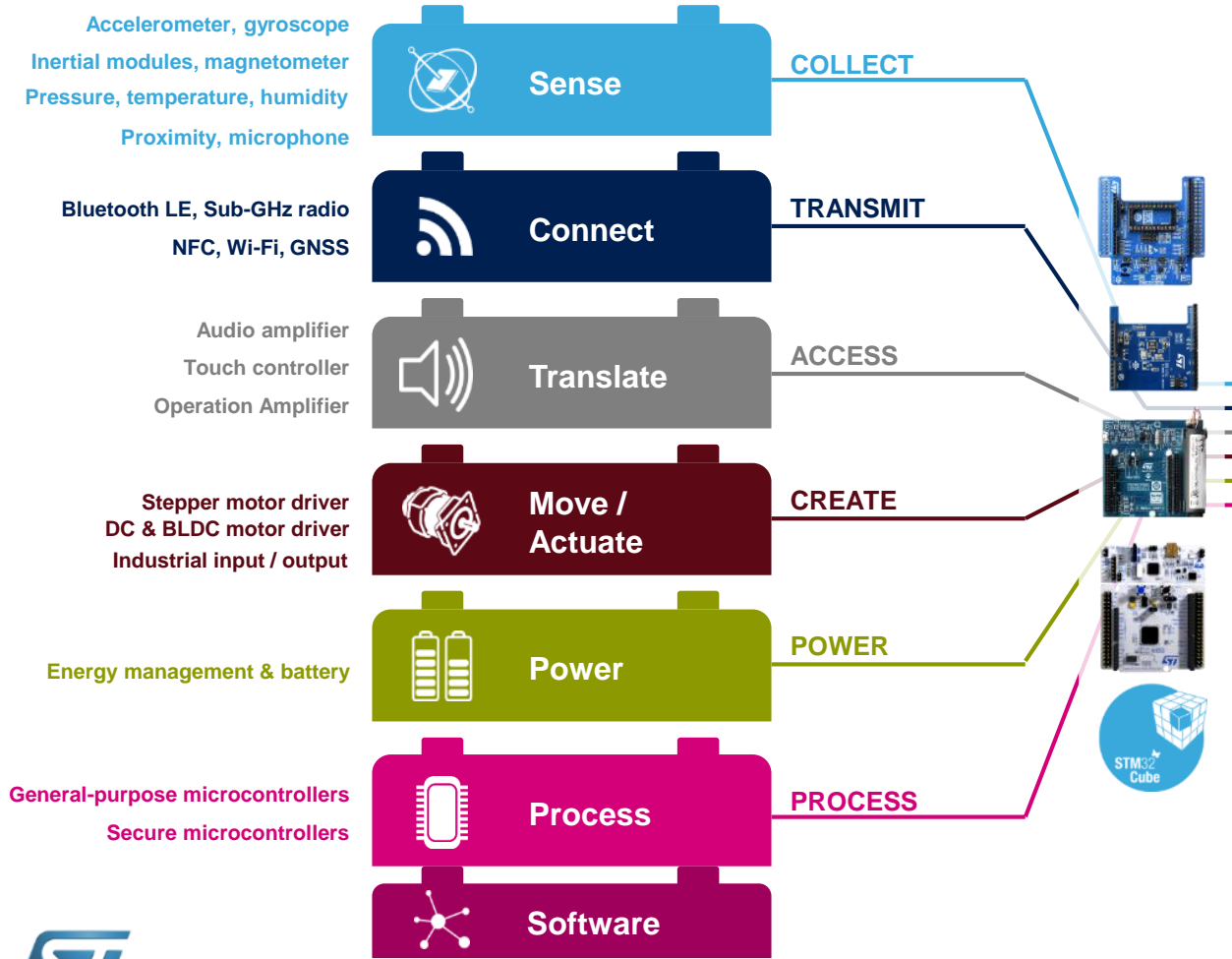
# STM32 Open Development Environment

## Building block approach

The building blocks

Your need

Our answer



[www.st.com/stm32code](http://www.st.com/stm32code)