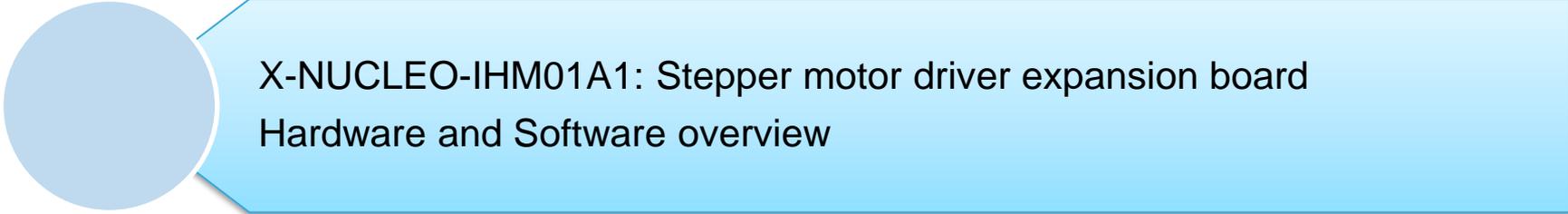


Quick Start Guide

Stepper motor driver expansion board based on L6474 for STM32 Nucleo
(X-NUCLEO-IHM01A1)



Quick Start Guide Contents



X-NUCLEO-IHM01A1: Stepper motor driver expansion board
Hardware and Software overview



Setup & Demo Examples
Documents & Related Resources



STM32 Open Development Environment: Overview

Stepper motor driver expansion board

Hardware overview

3

X-NUCLEO-IHM01A1 Hardware description

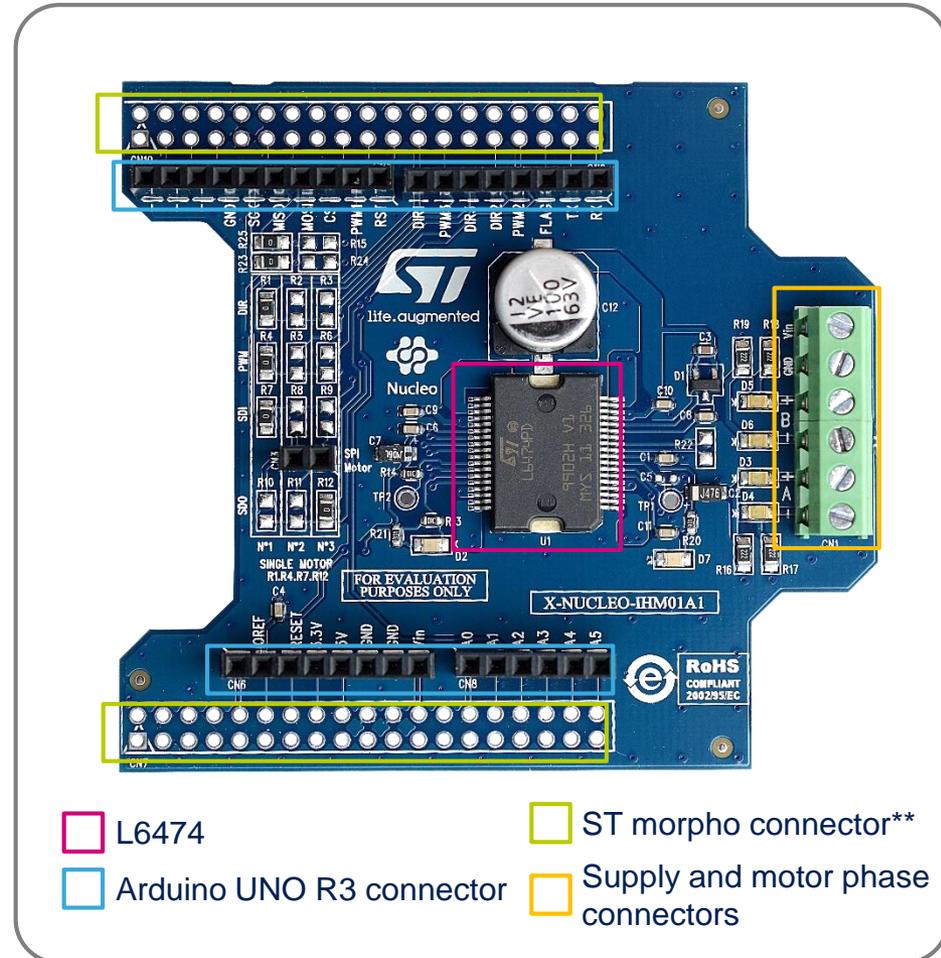
- The X-NUCLEO-IHM01A1 is a stepper motor driver expansion board based on the L6474. It provides an affordable and easy-to-use solution for driving a stepper motor in your STM32 Nucleo project. The advanced current control of the L6474 and a complete set of protection features offer high levels of both performance and robustness.
- The X-NUCLEO-IHM01A1 is compatible with the Arduino UNO R3 connector, and supports the addition of other boards which can be plugged to drive up to three stepper motors using a single STM32 Nucleo board.

Key features

- Voltage range from 8 V to 45 V
- Phase current up to 3 A_{RMS}
- Power OK and fault LEDs
- Advanced current control
- Fully protected power stage
- Up to 1/16 microstepping resolution
- RoHS compliant

Key Product on board

L6474
Fully integrated microstepping motor driver



Latest info available at www.st.com
X-NUCLEO-IHM01A1

** Connector for the STM32 Nucleo board

Stepper motor driver expansion board

Software overview

4

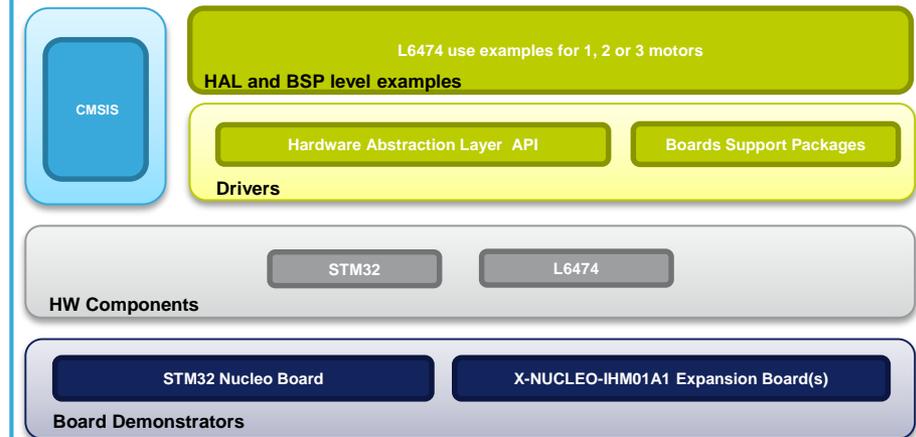
X-CUBE-SPN1 software description

- The X-CUBE-SPN1 is an expansion software package for STM32Cube, associated with the X-NUCLEO-IHM01A1 expansion board. It is compatible with the **NUCLEO-F401RE**, the **NUCLEO-F030R8**, the **NUCLEO-F334R8** and the **NUCLEO-L053R8** development boards when they are equipped with one or more (up to 3) X-NUCLEO-IHM01A1 boards.
- The source code of this package is based on STM32Cube to ease portability across different STM32 MCU families.

Key features

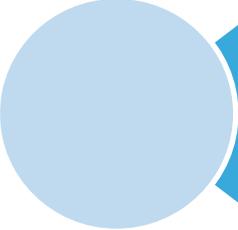
- Driver layer for complete management of the L6474 microstepping motor driver integrated in the X-NUCLEO-IHM01A1 expansion board
- Examples for controlling up to three stepper motors
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Overall system architecture

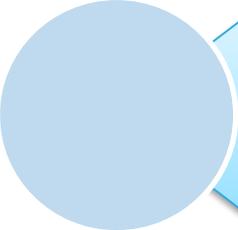


Latest info available at www.st.com
X-CUBE-SPN1

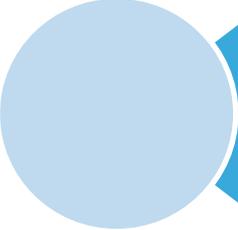
Quick Start Guide Contents



X-NUCLEO-IHM01A1: Stepper motor driver expansion board
Hardware and Software overview



Setup & Demo Examples
Documents & Related Resources



STM32 Open Development Environment: Overview

Setup & demo examples

Hardware prerequisites

6

Getting started with hardware

The X-NUCLEO-IHM01A1 expansion board is a stepper motor driver covering a wide range of applications.

The maximum ratings are:

- Power stage supply voltage (VS) from 8 V to 45 V
- Motor phase current up to 3 A_{RMS}

To start your project with the board:

1. Check the jumper position in accordance with your configuration (see Section 2 of UM1857).
2. Connect the board to the STM32 Nucleo board with the connector:
 - a. Arduino UNO R3 for the X-NUCLEO-IHM01A1
 - b. ST morpho for the X-NUCLEO-IHM01A

Up to three expansion boards can be stacked on the same STM32 Nucleo board, as described in Section 2.2 of UM1857.

1. Supply the board through pins 1 (VS) and 2 (ground) of the connector CN1.
2. The power OK (green) and fault (red) LEDs turn on.
3. Develop your application using the examples provided with the firmware library.

Selecting the chip select and clock lines of the SPI

The chip select and the clock lines of the SPI interface can be selected through dedicated resistors as indicated in Tables 3 and 5 of UM1857.

Multi-motor configuration

The expansion boards can be stacked on a single STM32 Nucleo board in order to drive up to three stepper motors (one for each motor). More in Section 2.2 of UM1857.

System requirements to drive up to 3 motors (1/2)

- 1 x STM32 Nucleo development board
(NUCLEO-F401RE or NUCLEO-F030R8 or NUCLEO-F334R8 or NUCLEO-L053R8)
- 1 to 3 x Stepper motor driver expansion board
(X-NUCLEO-IHM01A1)
- 1 to 3 x Stepper motors
- 1 x External DC power supply with two, four or six electric cables
- 1 x USB type A to Mini-B USB cable
- 1 x Windows 8/7 - Laptop/PC



NUCLEO-F401RE
NUCLEO-F030R8
NUCLEO-F334R8
NUCLEO-L053R8



Mini USB Cable



Stepper Motor

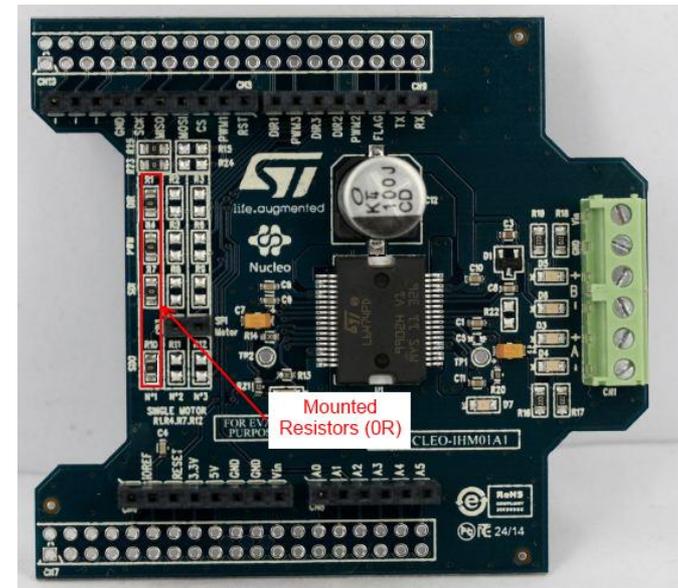


X-NUCLEO-IHM01A1

System requirements to drive up to 3 motors (2/3)

- The STM32 Nucleo has to be configured with the following jumper positions:
 - JP1 off
 - JP5 (PWR) on UV5 side
 - JP6 (IDD) on
- The X-NUCLEO-IHM01A1 expansion board for first motor must have:
 - Mounted resistors (0R) on R1, R4, R7 and 10
 - Unmounted resistors on R2, R3, R5, R6,R8, R9, R11 and R12

Resistor setup for first motor



System requirements to drive up to 3 motors (3/3)

- The X-NUCLEO-IHM01A1 expansion board for the second motor must have:
 - Mounted resistors (0R) on R2, R5, R8 and R11
 - Unmounted resistors on R1, R3, R4, R6,R7, R9, R10 and R12
- The X-NUCLEO-IHM01A1 expansion board for third motor must have:
 - Mounted resistors (0R) on R3, R6, R9 and R12
 - Unmounted resistors on R1, R2, R4, R5, R7, R8, R10 and R11

Resistor setup for second motor



Resistor setup for third motor

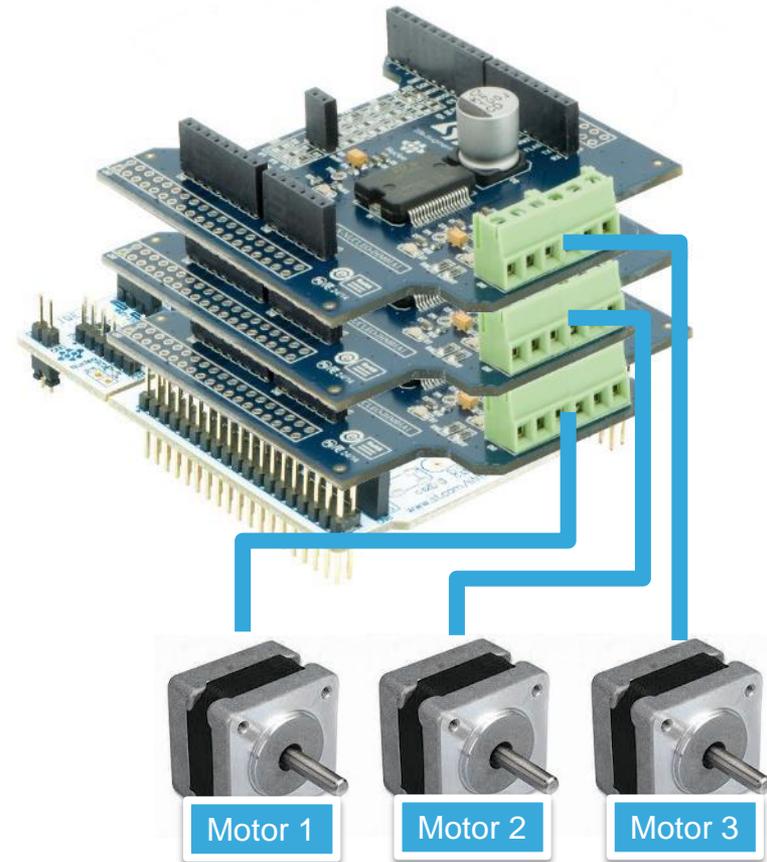


Setup & demo examples

System setup to drive up to 3 motors

10

- Plug the X-NUCLEO-IHM01A1 for the first motor on top of the STM32 Nucleo using the Arduino UNO R3 connectors
- Plug the X-NUCLEO-IHM01A1 for the second motor on top of the one for first motor
- Plug the X-NUCLEO-IHM01A1 for the third motor on top of the second one
- Connect the STM32 Nucleo board to a PC using the USB cable via USB connector CN1 to power the board
- Power on the X-NUCLEO-IHM01A1 expansion boards by connecting their VIN and GND connectors to the DC power supply. The DC supply must be set to deliver the correct voltage required by the stepper motors.
- Connect each stepper motor to the A+/- and B+/- bridge connectors of their dedicated X-NUCLEO-IHM01A1 board



Setup & Demo Examples

SW prerequisites

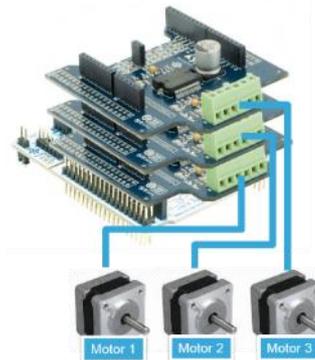
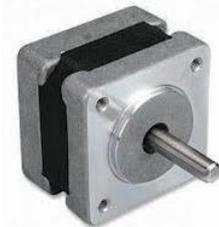
11

- **STSW-LINK008:** ST-LINK/V2-1 USB driver
- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade
- **X-CUBE-SPN1**
 - Copy the .zip file content into a folder on your PC. The package will contain source code example (Keil, IAR, System Workbench) based only on **NUCLEO-F401RE or NUCLEO-F030R8 or NUCLEO-F334R8 or NUCLEO-L053R8**
 - STM32Cube firmware for X-NUCLEO-IHM01A1 is available at www.st.com

Run the demo software to drive up to 3 motors

Once the system setup is ready:

- Open your preferred tool chain (MDK-ARM from Keil, EWARM from IAR, System Workbench for STM32...)
- Depending on your STM32 Nucleo board, open the software project from:
 - `\stm32_cube\Projects\Multi\Examples\MotionControl\NHM01A1_ExampleFor3Motors\YourToolChainName\STM32F401RE-Nucleo for Nucleo STM32F401`
 - `\stm32_cube\Projects\Multi\Examples\MotionControl\NHM01A1_ExampleFor3Motors\YourToolChainName\STM32F030R8-Nucleo for Nucleo STM32F030`
 - `\stm32_cube\Projects\Multi\Examples\MotionControl\NHM01A1_ExampleFor3Motors\YourToolChainName\STM32F334R8-Nucleo for Nucleo STM32F334`
 - `\stm32_cube\Projects\Multi\Examples\MotionControl\NHM01A1_ExampleFor3Motors\YourToolChainName\STM32L053R8-Nucleo for Nucleo STM32L053`
- In order to adapt the default parameters which are used by the L6474s depending of your stepper motor characteristics, open the file: `stm32_cube\Drivers\BSP\Components\l6474\l6474_target_config.h` and modify the parameters which are postfixed by “_DEVICE_0” for the first motor, postfixed by “_DEVICE_1” for the second motor and by “_DEVICE_2” for the third motor.
- Rebuild all files and load your image into the target memory.
- Run the example. The motors automatically start (see main.c for the detailed demo sequence).



Documents & related resources

All documents are available in the DESIGN tab of the related products webpage

X-NUCLEO-IHM01A1:

- Gerber files, BOM, and schematics
- **DB2360**: Stepper motor driver expansion board based on L6474 for STM32 Nucleo – **Data brief**
- **UM1857**: Getting started with the X-NUCLEO-IMH01A1, stepper motor driver expansion board based on L6474 for STM32 Nucleo – **User manual**

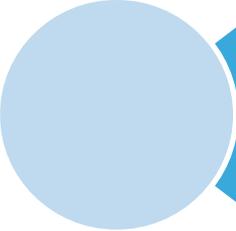
X-CUBE-SPN1:

- **DB2456**: Stepper motor driver software expansion for STM32Cube – **Data brief**
- **UM1848**: Getting started with X-CUBE-SPN1, stepper motor driver software expansion for STM32Cube – **User manual**
- Software setup file

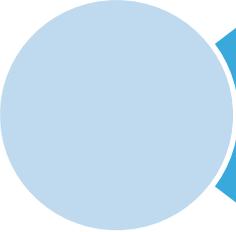
L6474:

- **DS8773**: Product datasheet with details about default parameters – **data sheet**

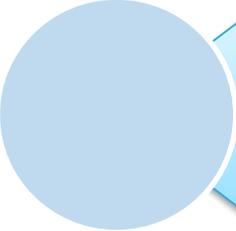
Quick Start Guide Contents



X-NUCLEO-IHM01A1: Stepper motor driver expansion board
Hardware and Software overview



Setup & Demo Examples
Documents & Related Resources

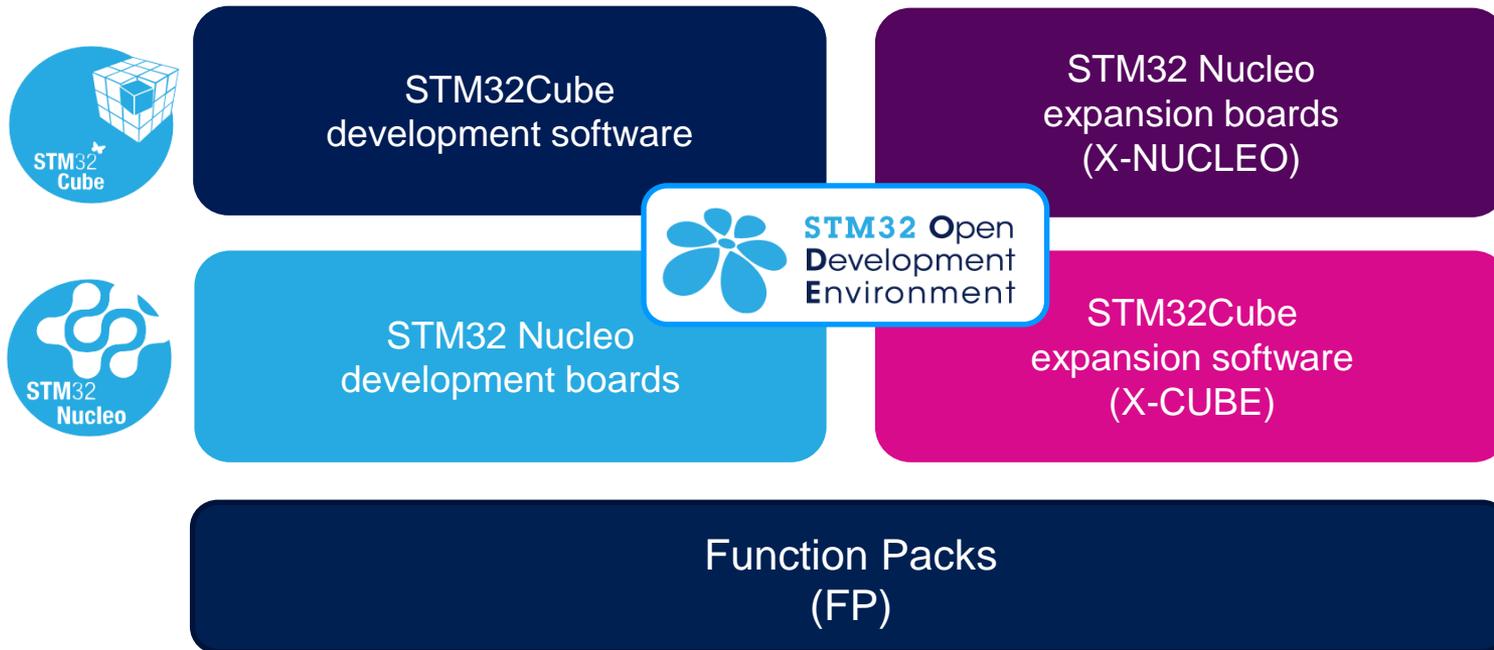


STM32 Open Development Environment: Overview

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.

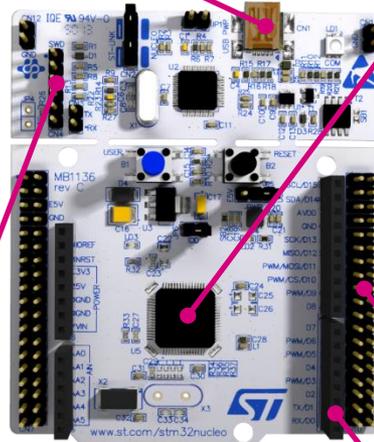


Development Boards (NUCLEO)

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

Power supply through USB or external source

Integrated debugging and programming ST-LINK probe



STM32 microcontroller



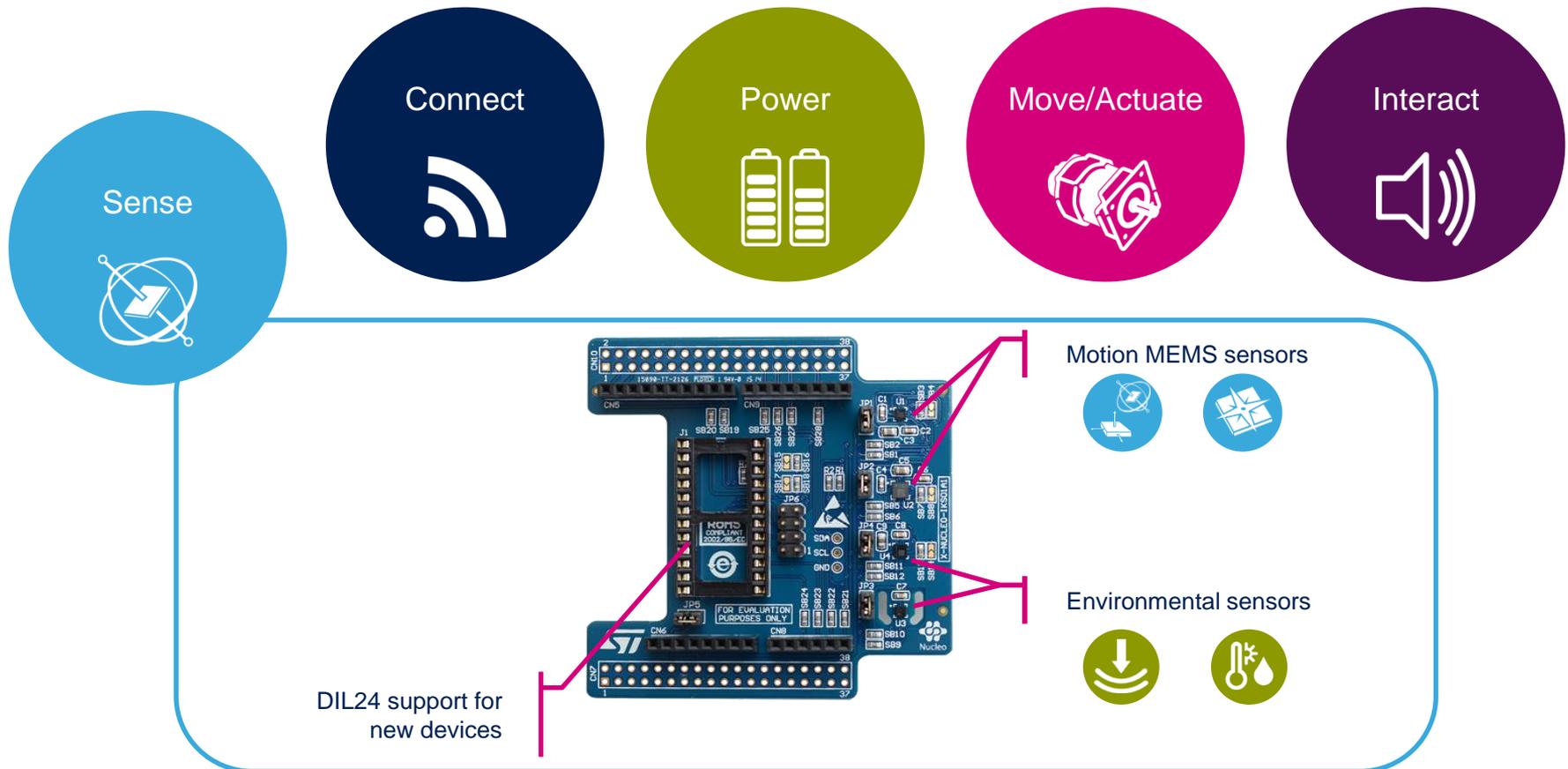
Complete product range from ultra-low power to high-performance

ST morpho extension header

Arduino™ UNO R3 extension headers

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.



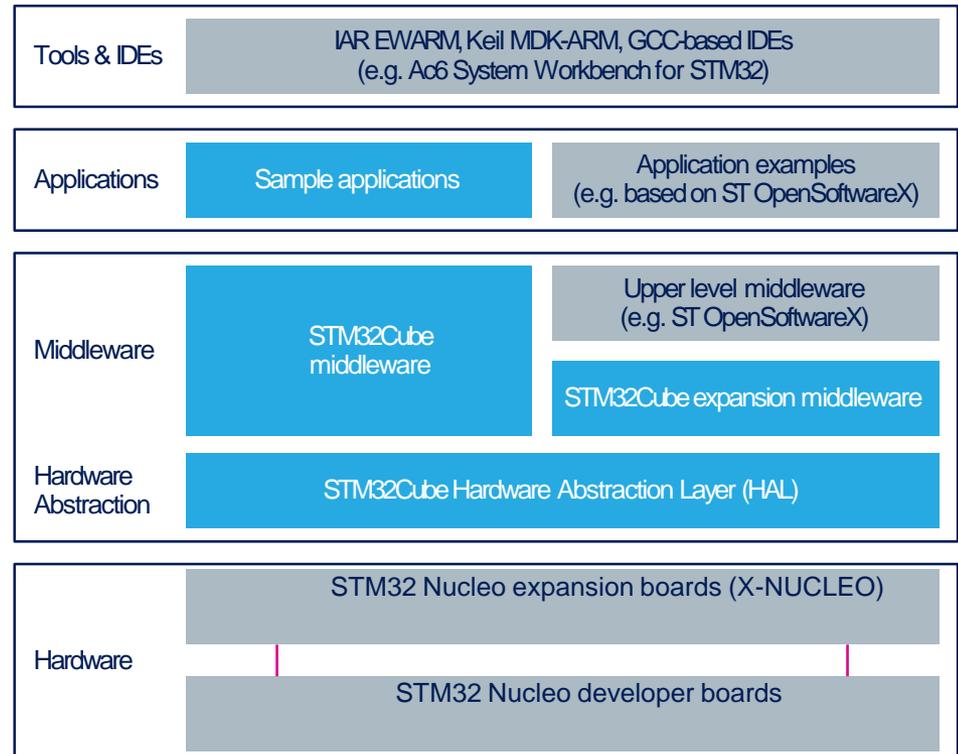
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

STM32 Open Development Environment

Software components

18

- **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, which 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.



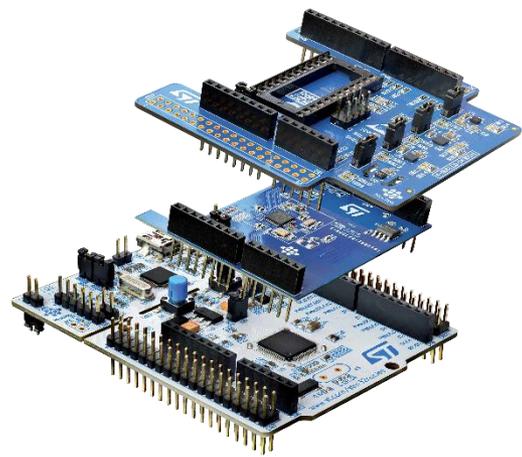
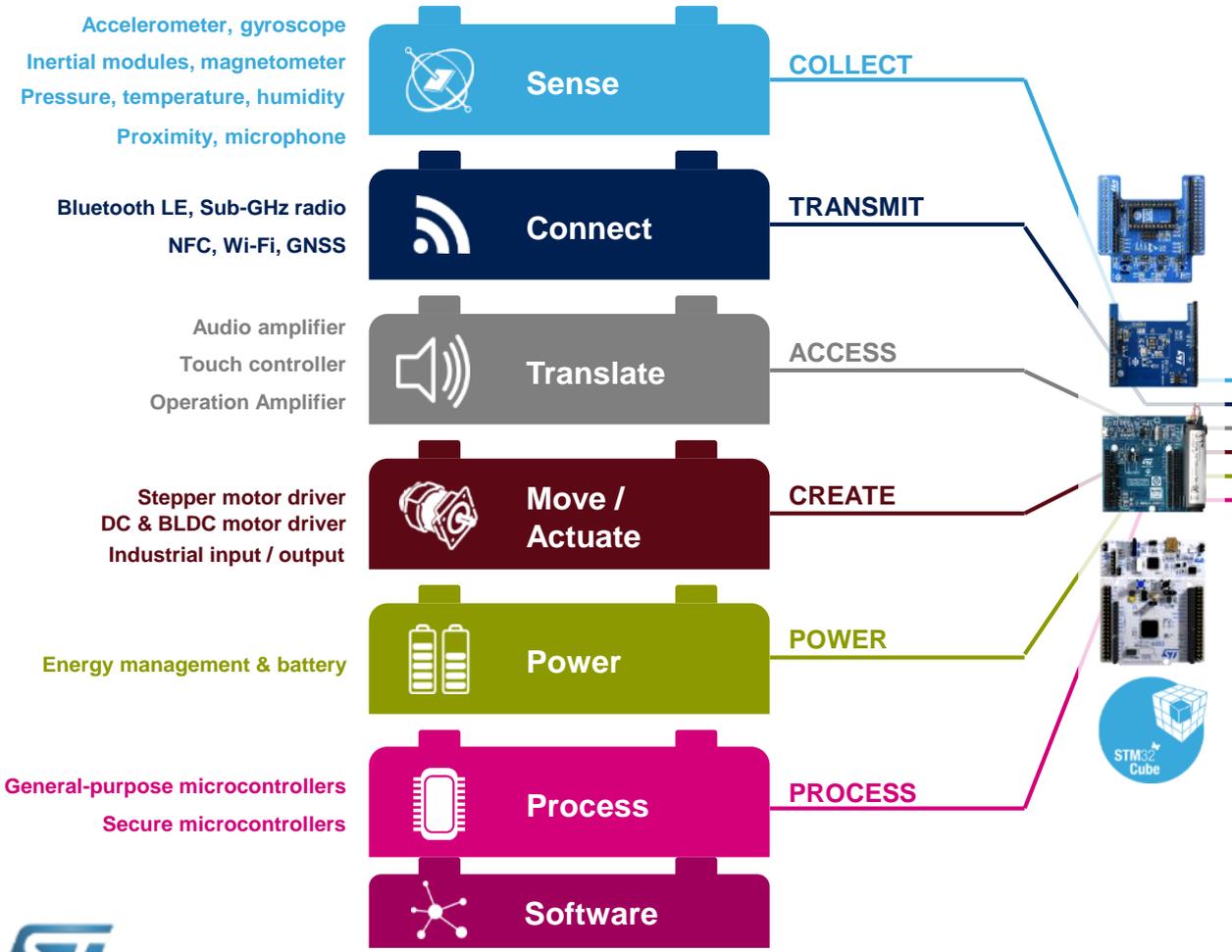
OPEN LICENSE MODELS: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

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STM32 Open Development Environment

Building block approach



www.st.com/stm32code

