Quick Start Guide

Dual-channel high side driver expansion board based on VPS2535H for STM32 Nucleo

(X-NUCLEO-IPS02A1)

Version 1.0 (Sept. 2016)

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Quick Start Guide Contents

X-NUCLEO-IPS02A1: Dual-channel high side driver expansion board
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

Dual-channel high side driver expansion board

Hardware Overview

X-NUCLEO-IPS02A1 Hardware description

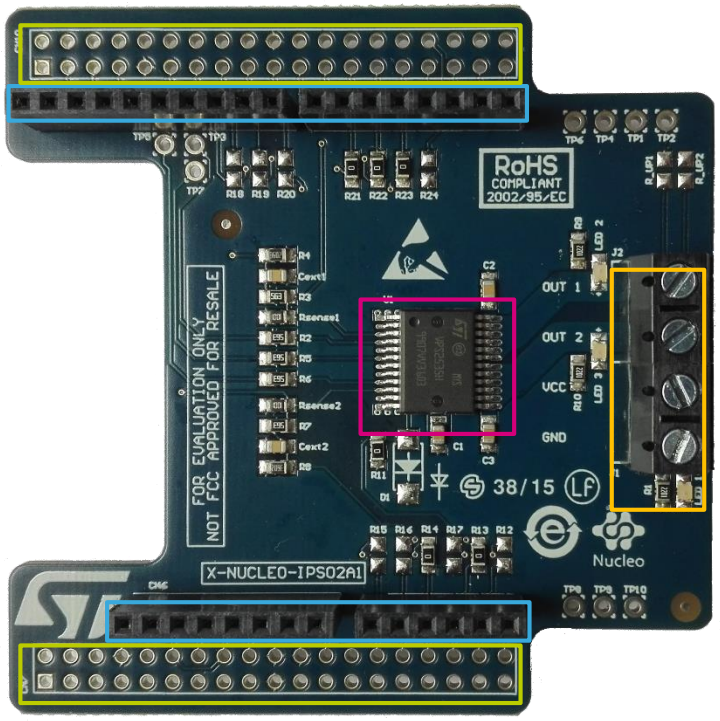
- The X-NUCLEO-IPS02A1 is a loads driver expansion board based on the VPS2535H, a double-channel high side driver. It provides an affordable and easy-to-use solution for driving all types of resistive, inductive and capacitive loads in your STM32 Nucleo project. The advanced current control of the VPS2535H and its extensive protection and diagnostic features, offer high levels of both performance and robustness.
- This expansion board is compatible with the Arduino UNO R3 connector and supports the addition of other STM32 expansion boards with a single STM32 Nucleo board.

Key features

- Operating voltage range V_{CC} from 8 to 36 V
- Current limitation (typ) I_{LIMH} 42 A
- $R_{DS(on)}$ 35 mΩ @ 25 C
- Standby current (max) I_{STBY} 2 µA
- Temperature range: -40°C ÷ 150°C
- Compatible with 3 V and 5V CMOS outputs
- Multisense analog feedback
- Fully protected device

Key Product on board

VPS2535H
Double channel high-side driver with analog current sense



VPS2535H

Arduino UNO R3 connector

ST morpho connector**

Supply and load connectors

Latest info available at www.st.com
X-NUCLEO-IPS02A1

** Connector for the STM32 Nucleo board

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Dual-channel high side driver expansion board

Software overview

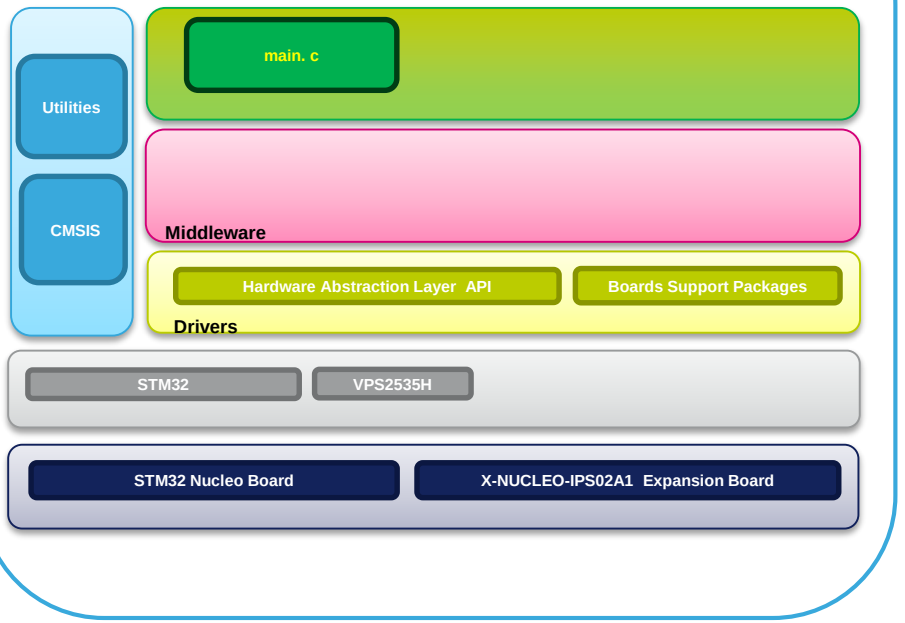
X-CUBE-IPS02 Software Description

- The X-CUBE-IPS02 is an expansion software package for STM32Cube, associated with the X-NUCLEO-IPS02A1 expansion board. It is compatible with the NUCLEO-F401RE and the NUCLEO-L053R8 development boards when they are equipped with one or more X-NUCLEO-IPS02A1 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 VPS2535H a double-channel high-side driver integrated in the X-NUCLEO-IPS02A1 expansion board
- Examples for controlling up to two load channels on a single STM32 Nucleo expansion boards
- 2 separated Load Current measurements
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Overall Software Architecture



Latest info available at www.st.com
X-CUBE-IPS02

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Quick Start Guide Contents

X-NUCLEO-IPS02A1: Dual-channel high side driver expansion board
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

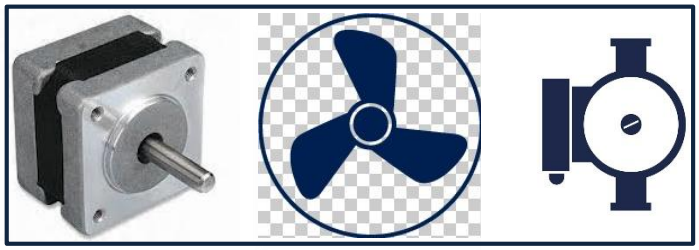
Setup & Demo Examples

HW prerequisites

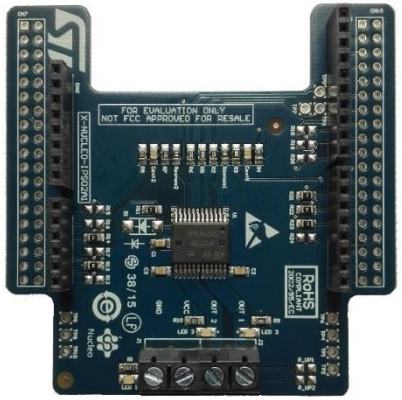
- 1x Dual-channel high side driver expansion board (**X-NUCLEO-IPS02A1**)
- 1x STM32 Nucleo development board (**NUCLEO-F401RE or NUCLEO-L053R8)**
- Up to two loads (motor, light bulbs, pumps, funs,…or just resistors)
- 1x Windows XP SP3,Vista, WIN7,WIN8 - Laptop/PC
- 1x USB type A to Mini-B USB cable
- 1x External DC power supply (*)

NUCLEO-F401RE
NUCLEO-L053R8

Mini USB Cable



Loads: motor, fun, pumps…



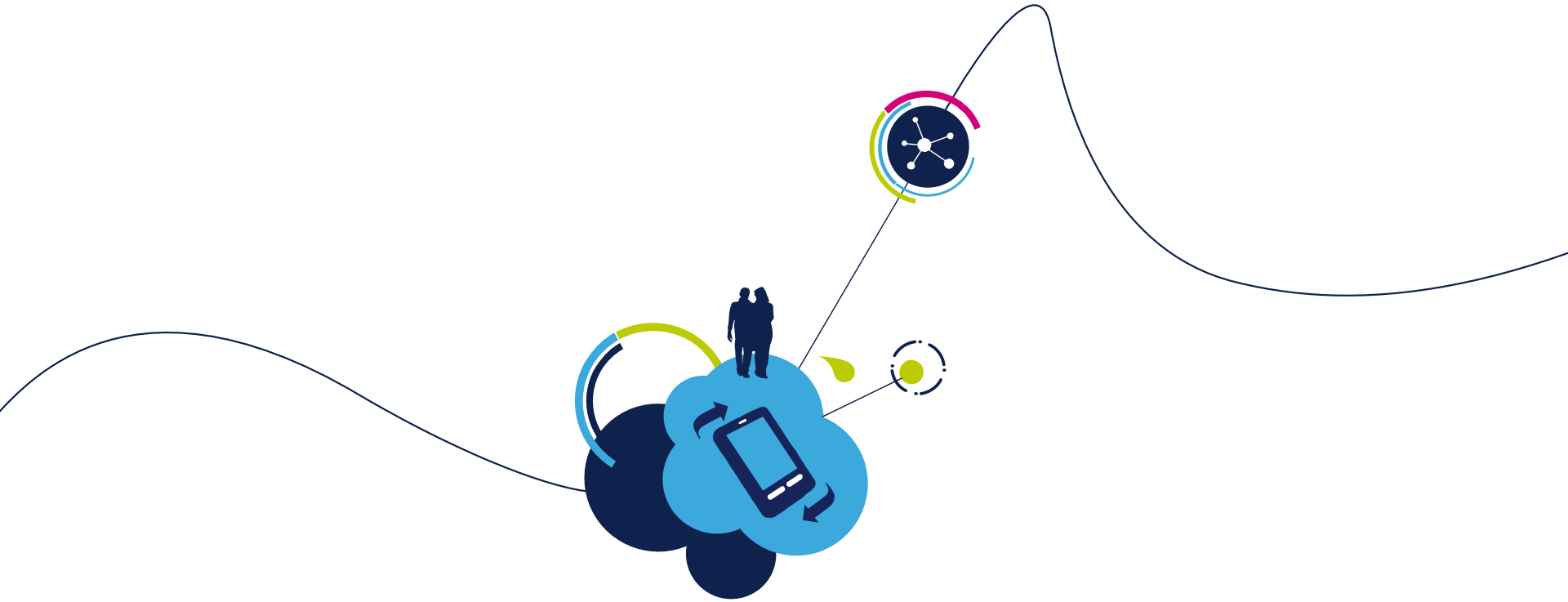
X-NUCLEO-IPS02A1

* Power supply compatible with loads and in the range of X-NUCLEO-IPS02A1 operating voltage

Setup & Demo Examples
SW prerequisites

- **STSW-LINK008 or STSW-LINK009:** ST-LINK/V2-1 USB driver

- A Windows PC with one of the supported development toolchain:
  - KEIL: MDK-ARM
  - IAR: EWARM
  - GCC-based IDEs (Atollic TrueStudio…)
- STM32Cube firmware for X-NUCLEO-IPS02A1 from IPS02A1 web page (firmware available in Tools and Software section)
- (optional) a terminal emulator, serial console (i.e. PuTTY, Termite) to get measured current values via USART



Configuration for driving 1 or 2 loads

X-CUBE-IPS02 in 7 steps (1/3)

Use of IPS02 demo with precompiled BIN fmw

X-CUBE-IPS021 v1.0.0 NUCLEO-F401RE or NUCLEO-L053R8

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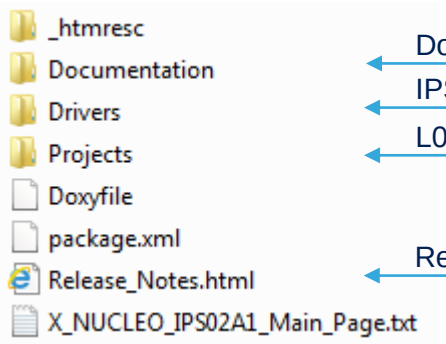
1 www.st.com/x-nucleo

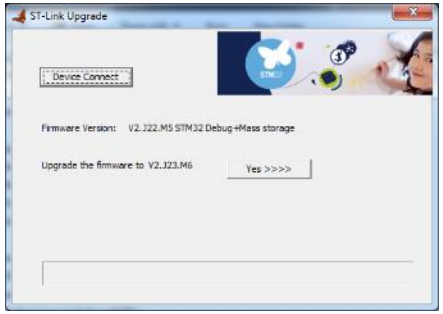
2 Select X-NUCLEO-IPS02A1

3 Download & unpack X-CUBE-IPS02

X-CUBE-IPS02 package structure



4 Download & install STM32 Nucleo ST-LINK/V2-1 USB driver stsw-link008



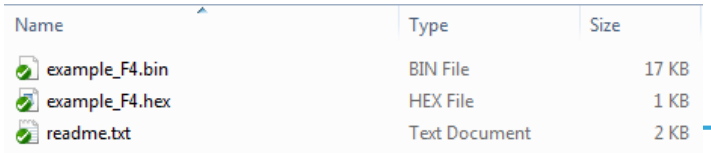
5 Download / Install / Run ST-Link FMW Upgrade Utility stsw-link007

X-CUBE-IPS02 in 7 steps (2/3)

Use of IPS02 demo with precompiled BIN firmware

X-CUBE-IPS02 v1.0.0 for NUCLEO-F401RE or NUCLEO-L053R8

\STM32CubeExpansion_IPS02_V1.0.0\Projects\STM32F4xx-Nucleo\Examples\Binary\example_F4.bin
\STM32CubeExpansion_IPS02_V1.0.0\Projects\STM32L0xx-Nucleo\Examples\Binary\example_L0.bin



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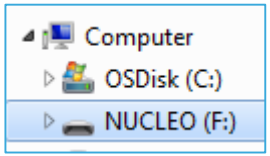
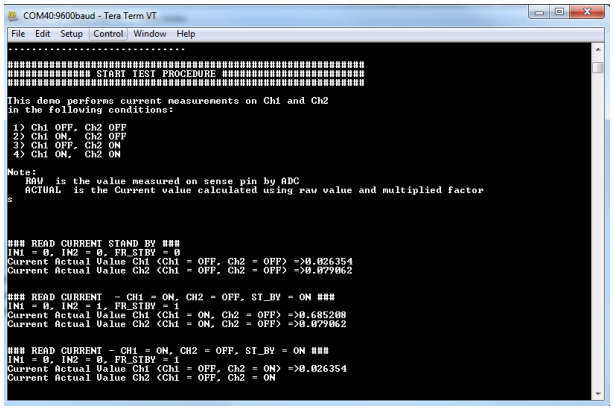


drag and drop
example_XX.bin for F4 or for L0
on STM32 Nucleo drive

Open Terminal and see current measurement



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…select the correct COM
Set the baud rate to 9600

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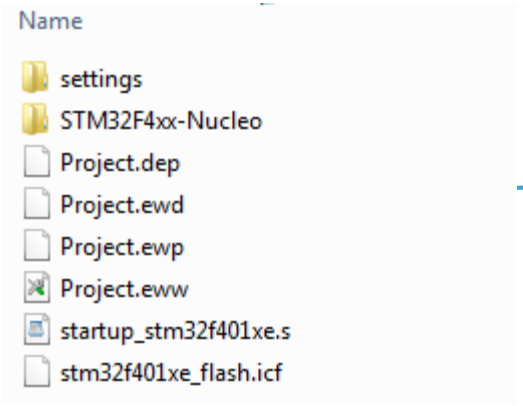
X-CUBE-IPS02 in 7 steps (3/3)

Use of IPS02 demo code using IAR

X-CUBE-IPS02 v1.0.0 for NUCLEO-F401RE or NUCLEO-L053R8

\STM32CubeExpansion_IPS02_V1.0.0\Projects\STM32F4xx-Nucleo\Examples\EWARM\Project.ewp
\STM32CubeExpansion_IPS02_V1.0.0\Projects\STM32L0xx-Nucleo\Examples\EWARM\Project.ewp



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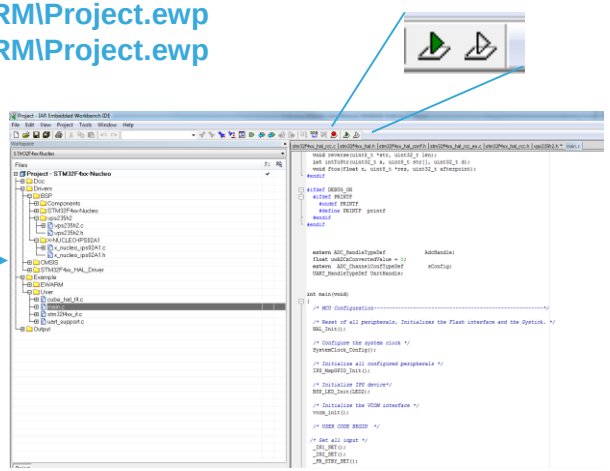
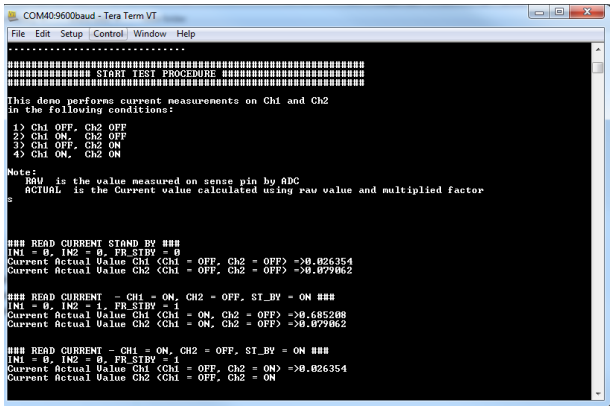
Open in IAR
Project.ewp for F4 or for L0
Build and download from IAR GUI



Open Terminal and see current measurement



7

…select the correct COM
Set the baud rate to 9600

Documents & related resources

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

X-NUCLEO-IPS02A1:

- Gerber files, BOM, and schematics
- **DB2943**: 24 V Intelligent power switch expansion board based on VPS2535H for STM32 Nucleo – **Databrief**
- **UM2078**: Getting started with the 24 V Intelligent Power Switch expansion board based on VPS2535H for STM32 Nucleo – **User manual**

X-CUBE-IPS02:

- **DB2986**: Intelligent Power Switch software for STM32, expansion for STM32Cube – **Databrief**
- **UM2105**: Getting started with X-CUBE-IPS02 Intelligent Power Switch software expansion for STM32Cube – **User manual**
- Software setup file

VPS2535H:

- **DS11478**: Product datasheet with details about default parameters - **datasheet**

Consult www.st.com for the complete list

Quick Start Guide Contents

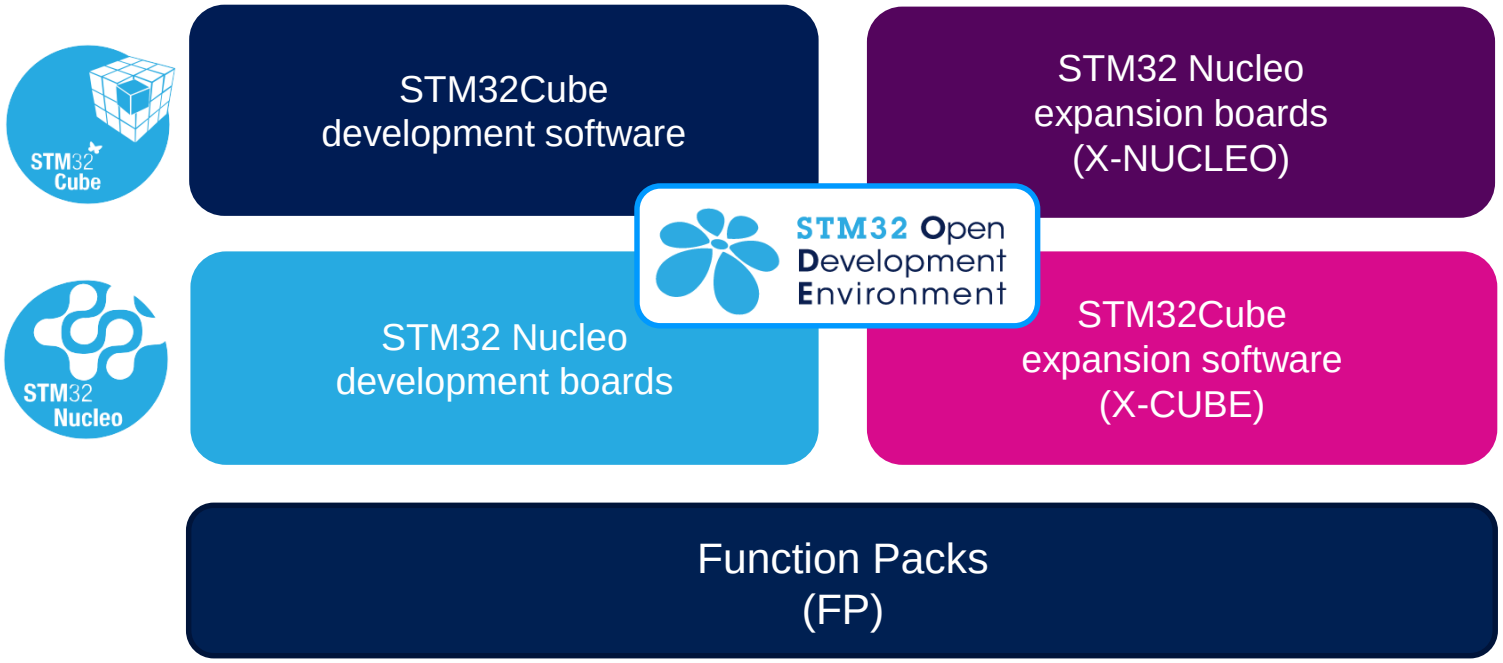
X-NUCLEO-IPS02A1: Dual-channel high side driver expansion board
Hardware and Software overview

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.



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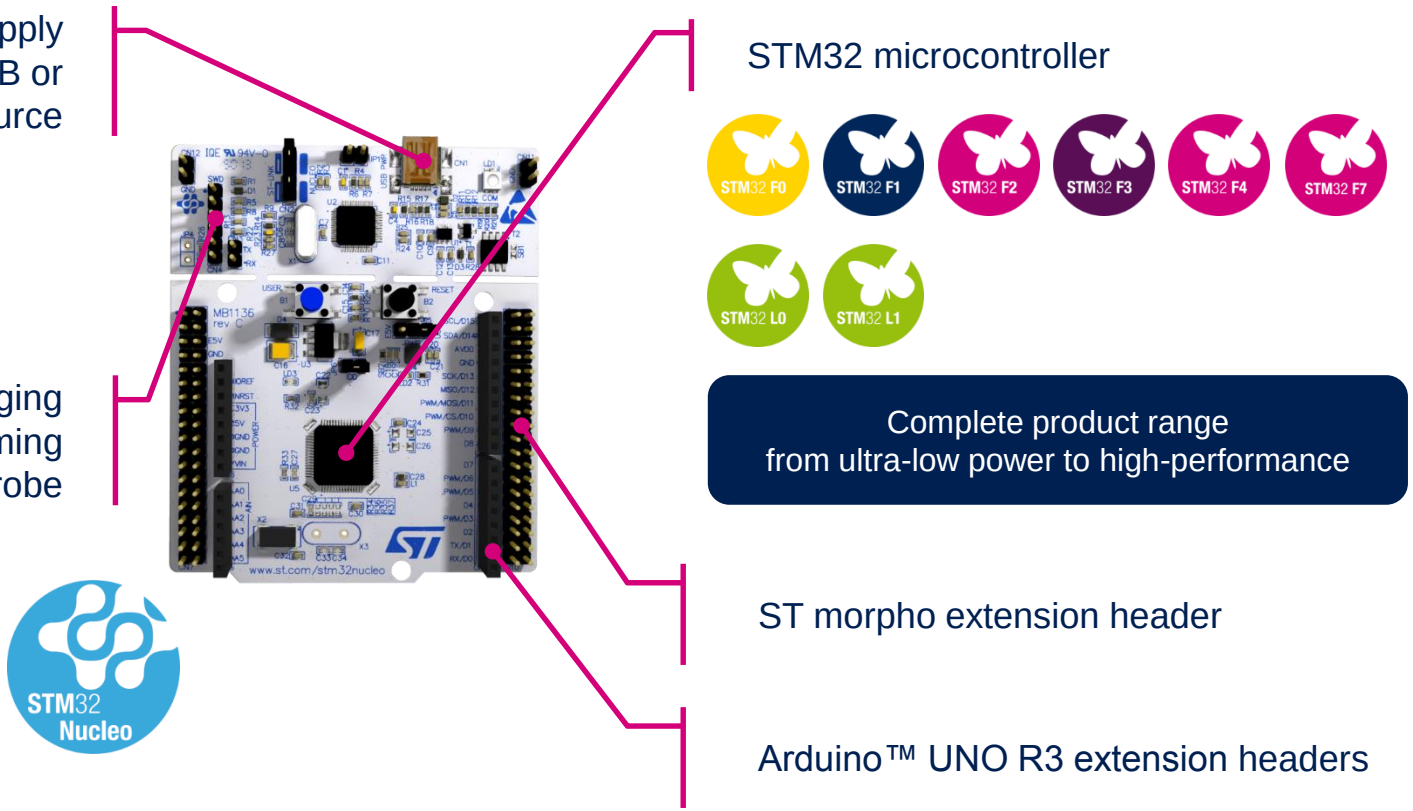
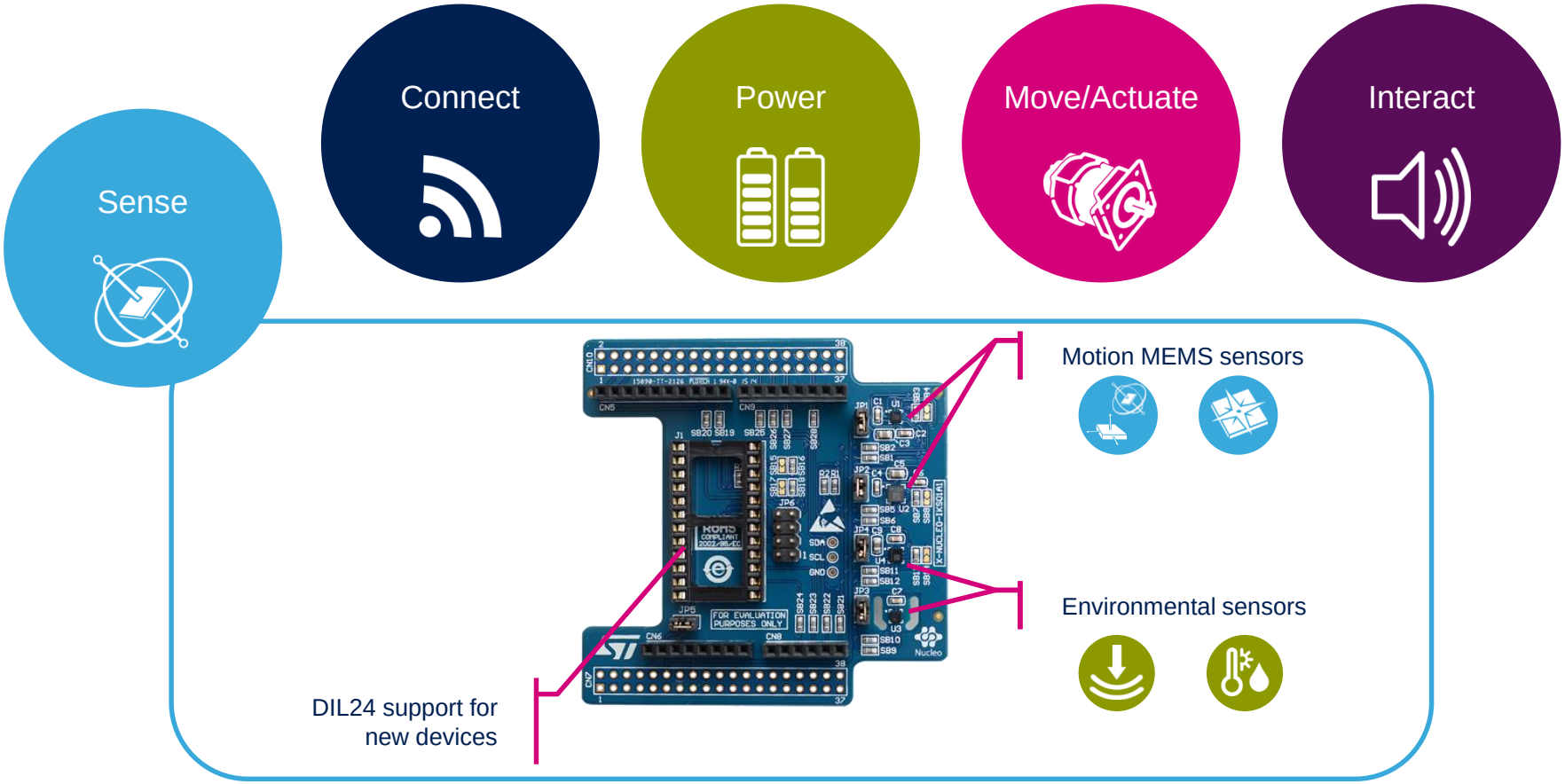
Development Boards (NUCLEO)

- 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.



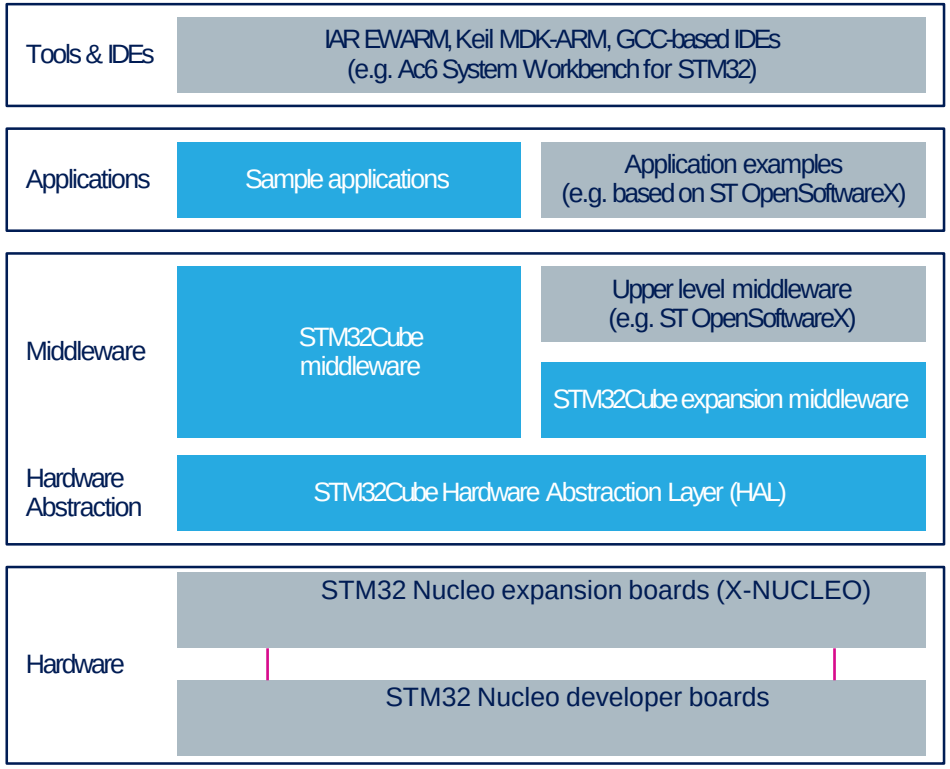
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

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, 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.

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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

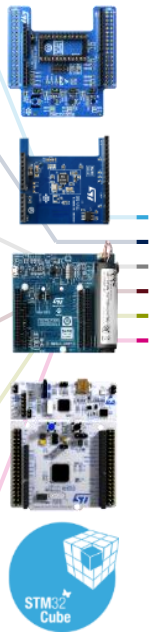
Energy management & battery

Power — POWER

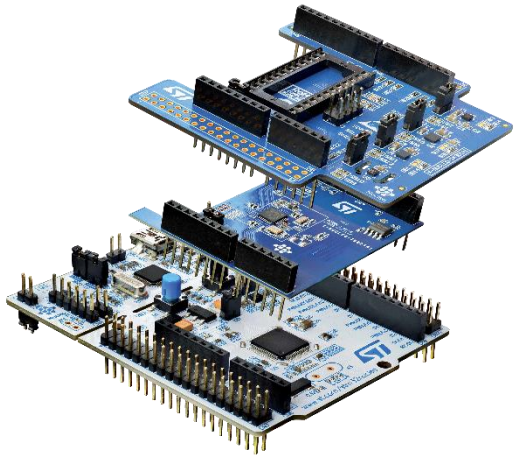
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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