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STM32
Open Development Environment

ECOSYSTEM

Fast, affordable Prototyping and Development

The STM32 Open Development Environment (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.

The STM32 ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a wide range of development environments including STM32CubeIDE, IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs, with the possibility to integrate the various components such as STM32CubeMX, STM32CubeProgrammer or STM32CubeMonitor.

FIND OUT MORE

http://www.st.com/stm32ode

ALL THAT YOU NEED

The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

Choose the appropriate STM32 Nucleo development board (NUCLEO) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need.

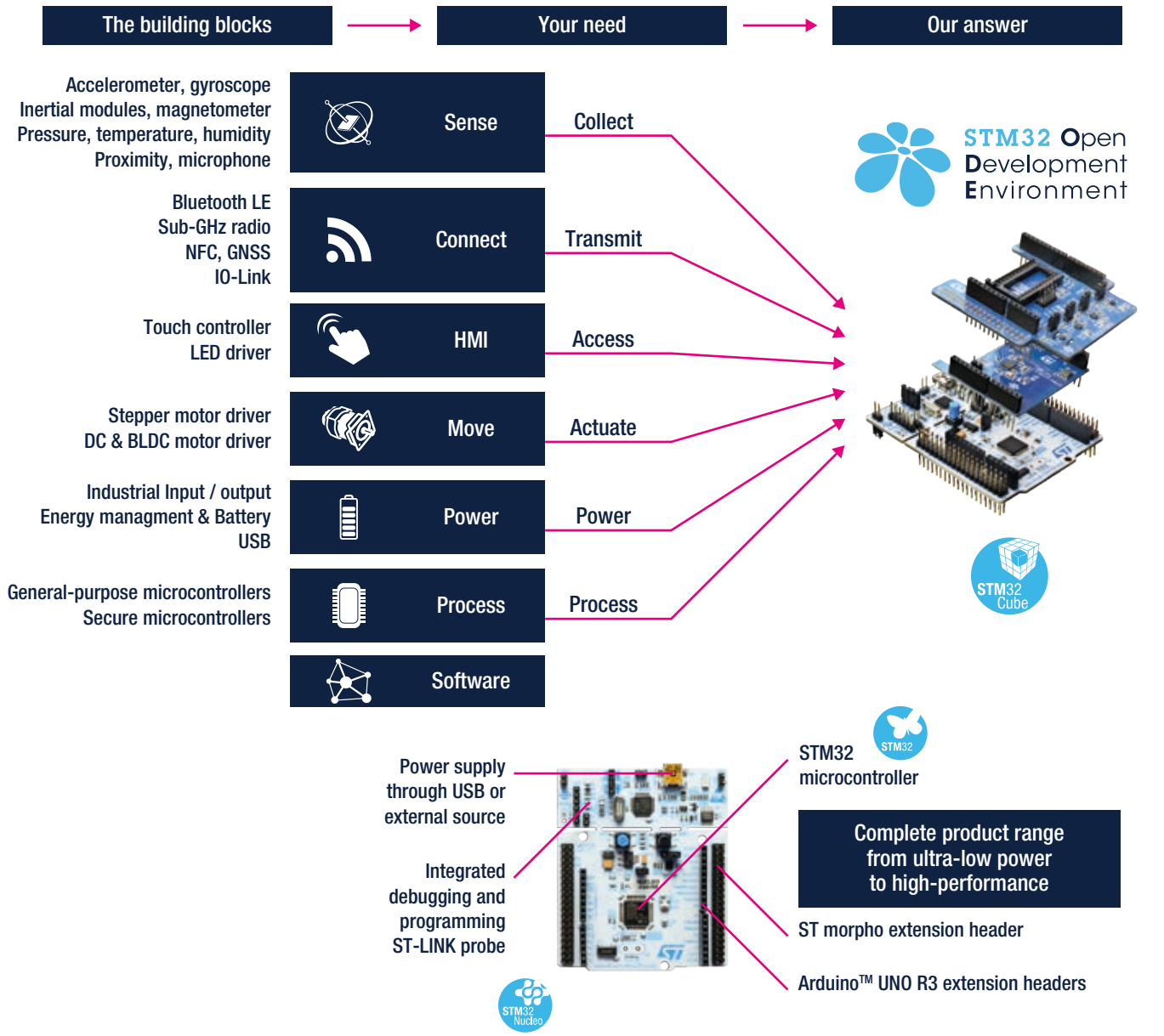
Select your development environment (IAR EWARM, Keil MDK, and GCC-based IDEs) and use the free STM32Cube tools and software such as STM32CubeMX, STM32CubeProgrammer, STM32CubeMonitor or STM32CubeIDE.

Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.

Compile your design program for the STM32 Nucleo development board.

Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in an end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.



ECOSYSTEM

The STM32 Open Development Environment consists of a set of stackable boards and a modular open software environment designed around the STM32 microcontroller family.

A wide variety of STM32 MCU Nucleo Boards, coupled with one or more Expansion Boards (X-Nucleo), through a Hardware Abstraction Layers API and a Middleware and interacting with cloud services, mobile apps and PC Software, let the user exploit its own application use case. Function Pack with applications examples are provided to facilitate the development and testing of use cases.

In addition, dedicated solution boards, integrating application functionalities and form factor expectation, are available.

The software layers used by the application software to access and use the expansion boards are:

STM32Cube HAL layer: consists of simple, generic and multi-instance APIs (application programming interfaces) which interact with the upper layer applications, libraries and stacks. These generic and extension APIs are based on a common framework so that overlying layers like middleware can function without requiring specific microcontroller unit (MCU) hardware information. This structure improves library code reusability and guarantees easy portability across other devices.

Board support package (BSP) layer: provides software support for the STM32 Nucleo board peripherals, excluding the MCU. These specific APIs provide a programming interface for certain board specific peripherals like LEDs, user buttons, etc., and can also be used to fetch individual board version information. It also provides support for initializing, configuring and reading data.

PC Software

Cloud Service

Mobile App

Product evaluation example

Function Pack with application examples

Middleware

Drivers and Hardware Abstraction Layer API

Hardware code optimized

Nucleo & X-Nucleo Boards

64 **STM32 Nucleo development boards**
Covering the broad portfolio of STM32 MCU families

73 **STM32 Nucleo expansion boards**
Offering peripheral functions

Solution Boards

11 **System boards**
Exploiting application functionalities and their form factor

X-NUCLEO BOARDS

Sharing Arduino™ connectors and ST morpho headers, STM32 Nucleo boards can easily be extended with a large number of expansion boards available from ST and from third parties. Stack as many boards as you need to create the functionality required. Each board is provided with dedicated X-Cube driver library.
In some cases all in one comprehensive packs including a Nucleo and an expansion board are provided as P-Nucleo to easy the boards association of dedicated solutions.

Category	Part Number	Specifications
Sense / Proximity	X-NUCLEO-6180A1	Expansion board based on VL6180V1 FightSense Proximity sensor up to 62cm equipped with 3 breakout boards (VL6180-SATEL)
	P-NUCLEO-6180A1	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-6180A1 expansion board
	X-NUCLEO-6180XA1	Expansion board based on VL6180X FlightSense™, Time-of-Flight proximity to above 10 cm, gesture and Ambient Light Sensor
	X-NUCLEO-6283A1	Expansion board providing a complete evaluation kit allowing anyone to learn, evaluate and develop their applications using the VD6283, a 6-channel ambient light sensor (ALS) color sensor with advanced light flicker frequency extraction
	P-NUCLEO-6283A1	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-6283A1 expansion board
	X-NUCLEO-53L0A1	Expansion board based on VL53L0CX FightSense Ranging sensor up to 2 meters and gesture detection sensor module
	P-NUCLEO-53L0A1	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-53L0A1 expansion board
	X-NUCLEO-53L1A1	Expansion board based on VL53L1CX FightSense Long Distance sensor up to 4 meters
	P-NUCLEO-53L1A1	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-53L0A1 expansion board
	X-NUCLEO-53L1A2	Expansion board based on VL53L1CB FightSense Long Distance + Multi target detection sensor up to 4 meters and field of view (FoV) programming
	P-NUCLEO-53L1A2	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-53L1A2 expansion board
	X-NUCLEO-53L3A2	Expansion board based on VL53L3CX FightSense Proximity +Multi target detection up to 3 meters
	P-NUCLEO-53L3A2	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-53L3A2 expansion board
	X-NUCLEO-53L5A1	Expansion board based on VL53L5CX Time-of-Flight 8x8 multizone ranging sensor with wide field of view. It provides accurate ranging up to 400 cm and can work at fast speeds (60 Hz), . Multizone distance measurements are possible up to 8x8 zones with a wide 63 ° diagonal FoV which can be reduced by software. Thanks to ST Histogram patented algorithms, the VL53L5CX is able to detect different objects within the FoV. The Histogram also provides immunity to cover glass crosstalk beyond 60 cm
	P-NUCLEO-53L5A1	NUCLEO pack build on NUCLEO-F401RE and X-NUCLEO-53L5A1expansion board
Sense / motion and env	X-NUCLEO-IKS01A3	Motion MEMS and environmental sensor expansion board for the STM32 Nucleo, LSM6DSO MEMS 3D accelerometer + 3D gyroscope, LIS2MDL MEMS 3D magnetometer, LIS2DW12 MEMS 3D accelerometer, LPS22HH MEMS pressure sensor, HTS221 capacitive digital relative humidity and temperature, STTS751 Temperature sensor
	X-NUCLEO-IKS02A1	Industrial motion MEMS sensor expansion board, ISM330DHCX MEMS 3D accelerometer + 3D gyroscope, IIS2MDC MEMS 3D magnetometer, IIS2DLPC MEMS 3D accelerometer low power, IMP34DT05 MEMS digital omnidirectional microphone
	X-NUCLEO-IKS01A2	Motion MEMS and environmental sensor expansion board for the STM32 Nucleo, LSM6DSL MEMS 3D accelerometer + 3D gyroscope, LSM303AGR MEMS 3D accelerometer + MEMS3D magnetometer, LPS22HB MEMS pressure sensor, HTS221 capacitive digital relative humidity and temperature
Sense / Audio & Mics	X-NUCLEO-AMICAM1	Expansion board allowing synchronized acquisition and streaming of up 3 on-board MP23ABS1 analog MEMS microphones at a maximum sampling rate of 192 KHz. External microphone coupon board STEVAL-MIC004V1 allows acquisition from four microphones. Synchronized acquisition and streaming of up to 4 microphones
	X-NUCLEO-CCA02M2	Expansion board embedding two MP34DT06J microphones. 6 slots to plug in digital microphone coupon boards such as STEVAL-MIC001V1, STEVAL-MIC002V1 and STEVAL-MIC003V1. Synchronized acquisition and streaming of up to 4 microphones
Sense / gas	P-NUCLEO-IKA02A1	Evaluation pack build on NUCLEO-L053R8 and providing a reference design for various gas electrochemical sensors like CO, SO2, NO and CL2. Specifically, the P-NUCLEO-IKA02A1 evaluation pack features a Carbon monoxide sensor Figaro TGS5141, a STLM20 temperature sensor and two TSU111 operational amplifiers providing signal conditioning.

Category	Part Number	Specifications
Connect / BLE	X-NUCLEO-BNRG2A1	Expansion board that features the Bluetooth® v5.0 compliant and FCC certified BlueNRG-M2SP application processor module based on the ST BlueNRG-2 System-on-Chip
	X-NUCLEO-IDB05A2	Expansion board based on the BlueNRG-M0 BLE network processor module
Connect / GNSS	X-NUCLEO-GNSS1A1	Expansion board based on the Teseo-LIV3F tiny GNSS module
Connect / Sub 1GHz	X-NUCLEO-S2868A2	Expansion board based on the S2-LP narrow band ultra-low power sub-1 GHz transceiver operating in the 868 MHz ISM frequency band (Europe).
	X-NUCLEO-S2915A1	Expansion board based on the S2-LP narrow band ultra-low power sub-1 GHz transceiver operating in the 915 MHz ISM frequency band (Australia and North America)
	X-NUCLEO-IDS01A4	Expansion board based on the SPSGRF-868 operating in the 868 MHz ISM band (Europe) and is ETSI certified
	X-NUCLEO-IDS01A5	Expansion board based on the SPSGRF-915 operating in the 915 MHz ISM band (Australia and North America) and is FCC certified (FCC ID: S9NSPSGRF) and IC certified (IC:8976C-SPSGRF)
Connect / NFC	X-NUCLEO-NFC01A1	Expansion board based on the M24SR64-Y device, a ISO14443-A 106-kbps dynamic Type IV NFC/RFID tag IC with a dual interface 64 Kbit EEPROM memory that also features an I^2C interface supporting 1 MHz protocol, preformatted for NFC transactions, and which can be protected by a unique and flexible 128-bit password scheme
	X-NUCLEO-NFC03A1	Expansion board based on the CR95HF/ ST25R95-VMD5T NFC card reader/writer and Card Emulation device, ISO14443-A/B and ISO15693 compliant, 230mW
	X-NUCLEO-NFC04A1	Expansion board based on the ST25DV04K device, a ISO15693 up to 53kbps dynamic NFC Type V/RFID tag IC with a dual interface 4 Kbits EEPROM that also features an I^2C interface supporting 1 MHz protocol, 64-bit password scheme
	X-NUCLEO-NFC05A1	Expansion board based on the ST25R3911B IC NFC card reader/writer device, ISO14443-A/B, ISO15693 and ISO18092 compliant, 1.4W
	X-NUCLEO-NFC06A1	Expansion board is based on the ST25R3916 IC NFC card reader/writer device, ISO14443-A/B, ISO15693 and ISO18092 compliant, 1.6W
Connect / Power Line	X-NUCLEO-PLM01A1	Expansion board based on the ST7580 FSK, PSK multi-mode power line networking system-on-chip
Connect / Industrial Link	X-NUCLEO-IOD02A1	Expansion board for STM32 Nucleo is based on the L6364Q dual channel SIO and IO-Link PHY device transceiver embedding 50 mA 3.3 V and 5.0 V voltage regulators, DC-DC converter and M-sequence management for the development of industrial sensor applications
	P-NUCLEO-IOD01A1	Nucleo pack composed of the NUCLEO-L073RZ development board, the STEVAL-IOD003V1 evaluation board and the X-NUCLEO-IKS01A2 expansion board. The STEVAL-IOD003V1 offers an IO-Link device PHY layer (L6362A) while the NUCLEO-L073RZ runs the IO-Link stack v1.1.3 included in the STSW-IOD01 (developed by and property of TEConcept Gmbh) and the firmware controlling the X-NUCLEO-IKS01A2 sensors
	P-NUCLEO-IOD02A1	Nucleo pack composed of the X-NUCLEO-IOD02A1 and X-NUCLEO-IKS02A1 expansion boards stacked on the NUCLEO-L452RE development board
	P-NUCLEO-IOM01M1	Nucleo pack for IO-Link master with IO-Link v1.1 PHY and stack build on NUCLEO-F446RE board and STEVAL-IOM001V1. The STEVAL-IOM001V1 is a single IO-Link master PHY layer (L6360) while the NUCLEO- F446RE runs an IO-Link stack rev 1.1
Power / In Out	X-NUCLEO-OUT01A1	Industrial Digital output expansion board based on ISO8200BQ galvanic isolated octal high-side smart power solid state-relay with SPI interface enabling industrial programmable logic controller (PLC) capabilities. Operating voltage from 10.5 V to 33 V, maximum operating output current per channel IOUT = 700 mA
	X-NUCLEO-OUT02A1	Industrial digital output expansion board based on the ISO8200AQ galvanic isolated octal high-side smart power solid state-relay. 10.5 to 33 V operating voltage range, 0.7A current per channel
	X-NUCLEO-OUT08A1	Industrial digital output expansion board featuring the safe driving and smart diagnostic capabilities of the IPS160HF single high-side switch allowing to evaluate a dual channel digital output module with 2 A (typ.) capability each, or a 2 A (typ.) single channel safety digital output module. Operation up to 60V
	X-NUCLEO-OUT10A1	Industrial digital output expansion board featuring the safe driving and smart diagnostic capabilities of the IPS160HF single high-side switch allowing to evaluate a dual channel digital output module with 0,5 A (typ.) capability each, or a 0,5 A (typ.) single channel safety digital output module. Operation up to 60V

Category	Part Number	Specifications
Power / In Out	X-NUCLEO-PLC01A1	Industrial input/output expansion board with a PLC (programmable logic controller) designed around 8x output VNI8200XP (solid state relay) and 8x input CLT01-38SQ7 (octal digital termination array)
	X-NUCLEO-CCA01M1	Expansion board based on the STA350BW Sound Terminal® 2.1-channel high-efficiency digital audio output system
Power / USB PD	X-NUCLEO-USBPDM1	Expansion board for evaluating USB Type-C Power Delivery in Sink mode based on TCPP01-M12. It is compliant with USB Type-C Rev 1.2 and Power Delivery 3.0 with 100 W PPS support, as well as USB-IF certified (Test ID certification: 3036)
	X-NUCLEO-SNK1M1	USB-C PD Sink expansion board based on our TCPP01-M12 Type-C port protection IC, includes USB 2.0 data and example code compliant with all STM32 Nucleo-64 platform
	X-NUCLEO-DRP1M1	Expansion board allows evaluating the features of TCPP03-M20 and the USB Type-C™ features and protections required for VBUS and CC lines suitable for dual role power (DRP) applications. The expansion board can be stacked on top of any STM32 Nucleo-64 with Power Delivery (UCPD) peripheral embedded in their microcontrollers
HMI	X-NUCLEO-GFX01M1	Expansion board to add graphic user interface (GUI) capability. It features a 2.2" SPI QVGA TFT display as well as a 64-Mbit SPI NOR Flash memory for storing graphic images, texts and texture. The expansion board also offers a joystick for GUI navigation
	X-NUCLEO-LED16A1	Expansion board designed to provide an application for the 16 channel LED driver LED1642GW. Multiple drivers can also be cascaded by coupling X-NUCLEO-LED16A1 expansion boards
	X-NUCLEO-LED61A1	DC-DC LED driver expansion board designed to provide a sample application for the compact LED driver based on LED6001. The expansion board is equipped with a single-channel, constant-current LED driver for boost or SEPIC topologies
	X-NUCLEO-LED12A1	Expansion board featuring four LED1202 devices that can drive up to 48 LEDs. The LED1202 is a 12-channel low quiescent current LED driver, which guarantees 5 V output driving capability. Each channel is able to provide up to 20 mA with a headroom voltage of 350 mV (typ.) only. The output current can be adjusted separately for each channel through an 8-bit analog and 12-bit digital dimming control
Other / Safe	X-NUCLEO-SAFEA1	Expansion board is based on the STSAFE-A110 secure element that acts as a secure element providing authentication and secure data management services to a local or remote host. It allows to evaluate its authentication and data management services connected to a local or remote host. Can be used in IoT (Internet of things) devices, smart-home, smart-city and industrial applications, consumer electronics devices, consumables and accessories
Other / EEPROM	X-NUCLEO-EEPRMA1	Expansion board based on M24xx I^2C and M95xx SPI EEPROM. Up to 1-Mbit serial I^2C bus embedded EEPROM, up to 1-Mbit SPI bus embedded EEPROM with highspeed clock
	X-NUCLEO-EEPRMA2	Expansion board based on M24xx I^2C and M95xx SPI EEPROM. Up to 1-Mbit serial I^2C bus embedded EEPROM, up to 4-Mbit SPI bus embedded EEPROM
Move / Stepper motors	X-NUCLEO-IHM01A1	Stepper motor driver expansion board based on L6474 micro-stepping motor driver; 16usteps. Operative range: 8–45 VDC, up to 3 Arms
	X-NUCLEO-IHM02A1	Two axis stepper motor driver expansion board based on two L6470s, a fully-integrated micro stepping motor driver; 128usteps. Operative range: 8–45 VDC, up to 3 Arms
	X-NUCLEO-IHM03A1	High power stepper motor driver expansion board based on powerSTEP01 driver for high current bipolar steppers; 128 usteps. Operative range: 10.5–85 VDC, up to 10 Arms
	X-NUCLEO-IHM05A1	Bipolar stepper motor driver expansion board based on L6208 driver for bipolar stepper motors. Operative range: 8–50 VDC, up to 2.8 Arms
	X-NUCLEO-IHM06A1	Low voltage stepper motor driver expansion board based on the STSPIN220, very compact 256usteps capable ultra low-power microstepping driver. Operative range: 1.8–10 VDC, up to 1.3 Arms
	X-NUCLEO-IHM14A1	Stepper motor driver expansion board based on STSPIN820, cost optimized 256usteps capable and compact microstepping driver. Operative range: 7–45 VDC, up to 1.5 Arms
Move / Brushed DC motors	X-NUCLEO-IHM04A1	Dual brushed DC motor driver expansion board based on L6206, versatile general purpose dual full bridge driver for dual bipolar DC or quad unipolar DC motors. Thanks to the parallel operation, it can be easily converted to a single brushed DC driver with double current capability. Operative range: 8–50 VDC, 2.8 Arms (5.6 Arms in parallel mode, single driver)
	X-NUCLEO-IHM12A1	Low voltage dual brushed DC motor driver expansion board based on STSPIN240, very compact and ultra low-power dual brushed DC motor driver. Operative range: 1.8–10 VDC, up to 1.3 Arms

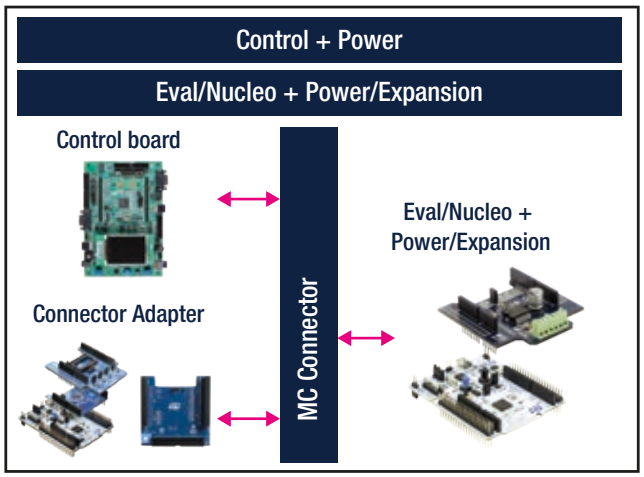
Category	Part Number	Specifications
Move / Brushed DC motors	X-NUCLEO-IHM13A1	Low voltage brushed DC motor driver based on the STSPIN250, very compact and ultra low-power single brushed DC motor driver. Operative range: 1.8– 0 VDC, up to 2.6 Arms
	X-NUCLEO-IHM15A1	Dual brushed DC motor driver expansion board based on STSPIN840, cost optimized, compact dual brushed DC motor driver able to drive 2 bi-directional brushed DC motors simultaneously. Thanks to the parallel operation, it can be easily converted to a single brushed DC driver with double current capability. Operative range: 7–45 VDC, up to 1.5 Arms (3 Arms in parallel mode, single driver)
Move / Brushless DC motors	X-NUCLEO-IHM07M1	Three-phase brushless DC motor driver expansion board based on L6230, versatile fully integrated driver for three-phase brushless DC motors driver. Operative range: 8–48 VDC, 1.4 Arms
	X-NUCLEO-IHM08M1	Low-Voltage BLDC motor driver expansion board based 3x L6398 a high voltage single-chip half bridge gate drivers and on 6x STL220N6F7 STripFET™ F7 Power MOSFET three-phase brushless DC motors driver in single shunt and 3 shunt topology. The L6398 gate driver plus STL220N6F7 Power MOSFET combination forms the high current power platform for the BLDC motor. Operative range: 10–48 VDC, 15 Arms
	X-NUCLEO-IHM11M1	Low voltage three-phase brushless DC motor driver expansion board based on STSPIN230, very compact and ultra low-power triple half-bridge motor driver for BLDC motors; 6 INx driving mode. Operative range: 1.8–10 VDC, up to 1.3 Arms
	X-NUCLEO-IHM16M1	Three-phase brushless DC motor driver expansion board based on STSPIN830, cost optimized, compact three-phase and three-sense BLDC motors driver. Operative range: 7–45 VDC, up to 1.5 Arms
	X-NUCLEO-IHM17M1	Low voltage three-phase brushless DC motor driver expansion board based on STSPIN233, very compact and ultra low-power three phase and three sense motor driver; 3 INx driving mode. Operative range: 1.8–10 VDC, up to 1.3 A_{rms}
	P-NUCLEO-IHM002	Nucleo pack build on NUCLEO-F302R8, X-NUCLEO-IHM07M1 and a Bull-Running model BR2804-1700 kV motor with power supply
	P-NUCLEO-IHM03	Nucleo pack build on NUCLEO-G431RB, X-NUCLEO-IHM16M1 and a Gimbal motor GBM2804H-100T with power supply
Interface	X-NUCLEO-STM0DA1	Expansion board which provides an easy way to expand the STM32 Nucleo board with the STMod+ connector
	X-NUCLEO-IHM09M1	Motor control connector expansion board to evaluate motor control solutions for three-phase motors with an external ST motor control power board, thanks to ST morpho and 34-pin motor control connector, allowing to extend the STM32ODE motor control support to high voltage STEVAL and EVAL Brushless Motors boards.

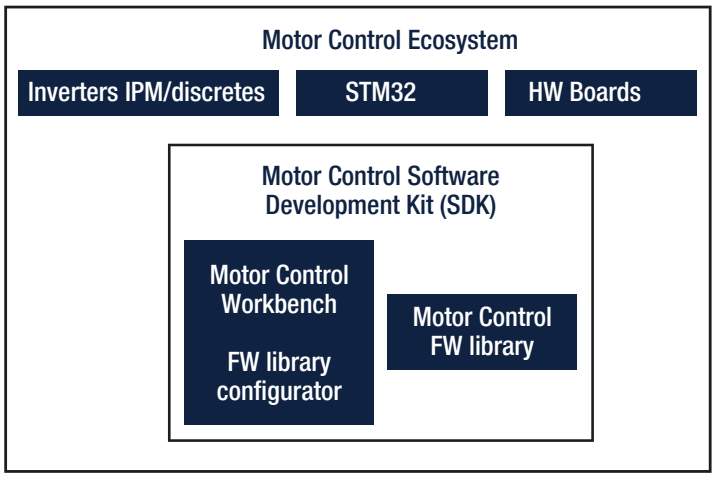
STM32ODE MOTOR CONTROL ECOSYSTEM

ST proposes a wide range of evaluation boards for comprehensive evaluation of ST's products and solutions while reducing your development time. In particular, all of ST's microcontroller evaluation boards have ST's standard MC connector on-board allowing the use of the board in conjunction with any of the power stage evaluation boards.

STM32 MC SDK (motor control software development kit) firmware (X-CUBE-MCSDK) includes the permanent-magnet synchronous motor (PMSM) firmware library and the STM32 Motor Control Workbench to configure the firmware library parameters through its graphical user interface.

STM32 Motor Control Workbench is PC software that reduces the design effort and time needed for the firmware configuration: The user generates a project file through the GUI, and initializes the library according to the application needs. Some of the variables of the algorithm being used can be monitored and changed in real time.





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https://www.st.com/content/st_com/en/stm32-motor-control-ecosystem.html

SOLUTION BOARDS

Solution boards to meet customer expectation in term of form factor. Their functionality is identical to stacking a STM32 Nucleo board with more X-Nucleo expansion boards but integrated in a compact form factor.

Category	Part Number	Specifications
LoRa® IoT tracker	STEVAL-STRKT01	LoRa® IoT tracker designed and optimized to implement the latest technologies in IoT tracker applications such as asset, people and animal tracking as well as fleet management. STM32L072CZ embedded in the CMWX1ZZABZ-091 LoRa® module (by Murata), geofence and data logging from Teseo-LIV3F GNSS module, ultra-low-power high-performance three-axis linear accelerometer (LIS2DW12), and environmental (capacitive digital sensor for relative humidity and temperature HTS221 and LPS22HB ultra-compact piezo-resistive absolute pressure sensor) sensors.
NFC Dynamic Tag sensor node	STEVAL-SMARTAG1	This smart and flexible NFC Tracker evaluation board with sensors includes a comprehensive software library and a sample application to monitor and log sensor data over NFC from an Android or iOS device. STM32L031K6, ST25DV64K dynamic NFC tag solution based on 64K-bit (8K-Byte) EEPROM, LIS2DW12 ultra-low-power high-performance three-axis linear accelerometer, LPS22HB ultra-compact piezo-resistive absolute pressure sensor which functions as a digital output barometer, HTS221 capacitive digital sensor for relative humidity and temperature, STLQ015 low drop linear regulator power management, CR2032 Battery powered (not included).
Predictive maintenance kit	STEVAL-BFA001V2B	An industrial reference design kit designed for condition monitoring (CM) and predictive maintenance (PdM). STM32F469AI, iNEMO 6DoF (ISM330DLC), Absolute digital pressure sensor (LPS22HB), Relative humidity and temperature sensors (HTS221), Digital microphone sensors (MP34DT05-A), IO-Link PHY device (L6362A), EEPROM (M95M01-DF) for data storage, Step-down switching regulator and LDO regulator (L6984 and LDK220).
STWIN SensorTile Wireless Industrial Node	STEVAL-STWINKT1B	The STWIN SensorTile wireless industrial node is a development kit and reference design that simplifies prototyping and testing of advanced industrial IoT applications such as condition monitoring and predictive maintenance. STM32L4R9, Wide range of industrial IoT sensors: ultra-wide bandwidth (up to 6 kHz), low-noise, 3-axis digital vibration sensor (IIS3DWB), 3D accelerometer + 3D Gyro iNEMO inertial measurement unit (ISM330DHCX) with machine learning core, ultra-low-power high performance MEMS motion sensor (IIS2DH), ultra-low-power 3-axis magnetometer (IIS2MDC), digital absolute pressure sensor (LPS22HH), relative humidity and temperature sensor (HTS221), low-voltage digital local temperature sensor (STTS751), industrial grade digital MEMS microphone (IMP34DT05), wideband analog MEMS microphone (MP23ABS1), Micro SD Card slot for standalone data logging applications, Wireless BLE4.2 (on-board) and Wi-Fi (with STEVAL-STWINWFV1 expansion board), and wired RS485 and USB OTG connectivity, Li-Po battery 480 mAh, STLINK-V3MINI debugger with programming cable, Plastic box. Easy-to-use STE BLE Sensor app with immediate functionality for the following motion and environmental sensor applications: Pedometer optimized for belt positioning, Baby crying detection with Cloud AI learning, Barometer / environmental monitoring, Vehicle / goods tracking, Vibration monitoring / training, Compass and inclinometer, Human Activity recognition, Sensor data logger. Expert Mode functionality: The STE BLE Sensor app can help you develop your own app or customize an existing one, which you can then upload and run on the SensorTile.box device. Pro Mode functionality: SensorTile.box is fully compatible with the STM32 Open Development Environment (STM32 ODE) for developers to customize the SensorTile.box firmware
SensorTile.box	STEVAL-MKSBOX1V1	SensorTile.box is a ready-to-use box kit with wireless IoT and wearable sensor platform to help you use and develop apps based on remote motion and environmental sensor data, regardless of your level of expertise. STM32L4R9, Digital temperature sensor (STTS751), 6-axis inertial measurement unit (LSM6DSOX), 3-axis accelerometers (LIS2DW12 and LIS3DHH), 3-axis magnetometer (LIS2MDL), Altimeter / pressure sensor (LPS22HH), Microphone / audio sensor (MP23ABS1) Humidity sensor (HTS221), Bluetooth Smart connectivity v4.2 (SPBTLE-1S).

SOLUTION BOARDS

STEVAL-STRKT01

STEVAL-SMARTAG1

SSTEVAL-BFA001V2B

STEVAL-STWINKT1B

STEVAL-MKSBOX1V1

DEVELOPMENT PLATFORMS

Tiny boards to accelerate the solution development.

Category	Part Number	Specifications
SensorTile	STEVAL-STLKT01V1	Highly integrated development kit that can be plugged into form-factor prototypes, adding sensing and connectivity capabilities to new designs through a smart hub solution. STM32L476JGY microcontroller, 3D digital accelerometer and a 3D digital gyroscope LSM6DSM, MEMS 3D accelerometer + MEMS3D magnetometer LSM303AGR, ultra-compact piezoresistive absolute pressure sensor LPS22HB, Digital microphone sensors MP34DT05-A, Bluetooth low energy connectivity BlueNRG-MS. The kit includes SensorTile module, SensorTile Cradle expansion board equipped with audio DAC, USB port, STM32 Nucleo, Arduino UNO R3 and SWD connector, SensorTile Cradle with battery charger, humidity and temperature sensor, SD memory card slot, USB port and breakaway SWD connector, 100 mAh Li-Ion battery Plastic box, SWD programming cable
BlueCoin	STEVAL-BCNKT01V1	Integrated development and prototyping platform for augmented acoustic and motion sensing for IoT applications builds on the listening and balancing capabilities of the human ear. STM32F446 microcontroller, 3D digital accelerometer and a 3D digital gyroscope LSM6DSM, MEMS 3D accelerometer + MEMS3D magnetometer LSM303AGR, ultra-compact piezoresistive absolute pressure sensor LPS22HB, 4x MP34DT06J microphones, Bluetooth low energy connectivity BlueNRG-MS, linear battery charger STBC03JR. The kit includes BlueCoin module, CoinStation board, BlueCoin Cradle, 130 mAh Li-Po battery, Plastic box for housing the BlueCoin cradle and the battery, SWD programming cable

DISCOVERY BOARDS

All-in-One IoT development platform.

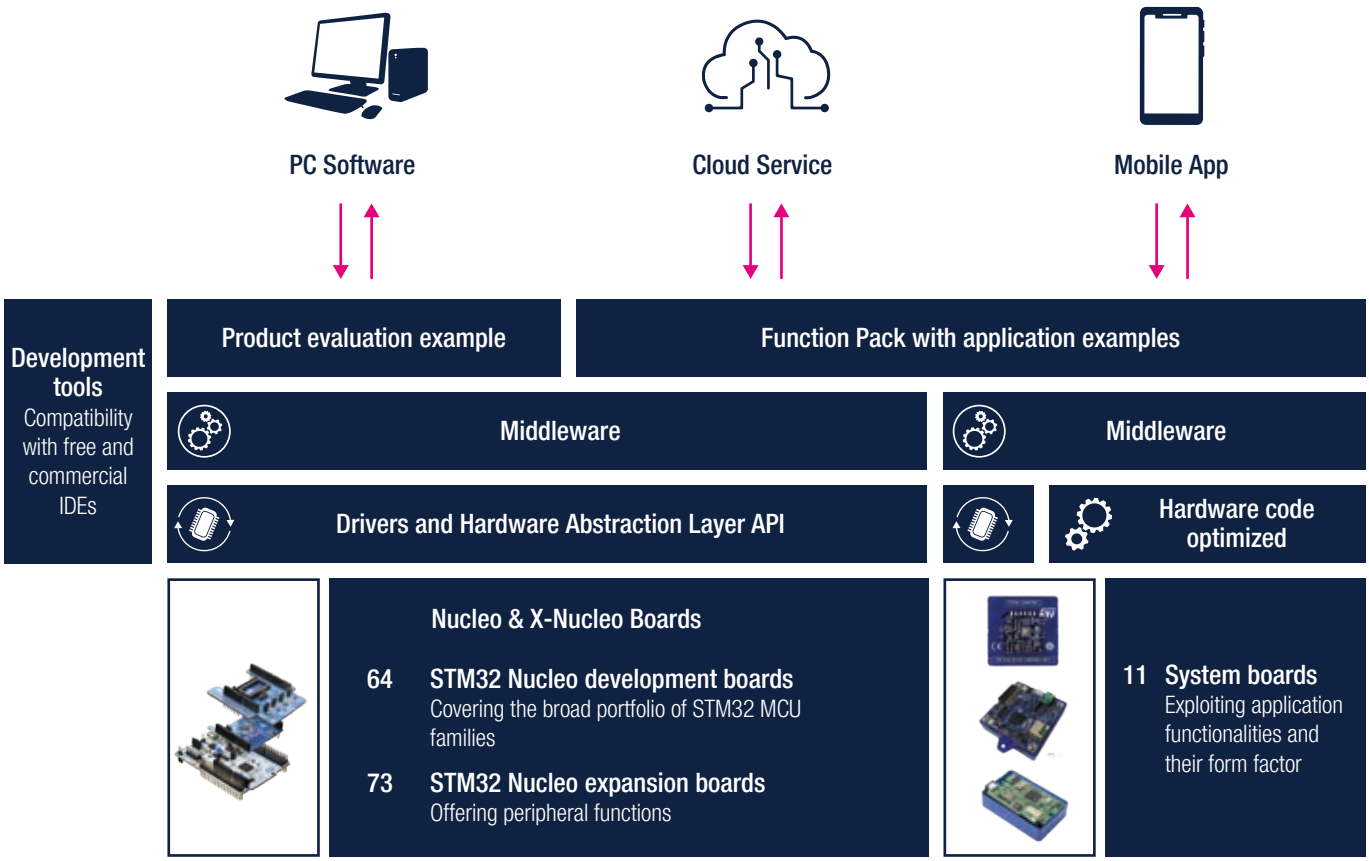
Category	Part Number	Specifications
Discovery kit IoT node, low-power wireless, BLE, NFC, SubGHz, Wi-Fi	B-L475E-IOT01A	Discovery kit for IoT node allows users to develop applications with direct connection to cloud servers. STM32L4 , 64-Mbit Quad-SPI (Macronix) Flash memory, Bluetooth® V4.1 module (SPBTLE-RF), Sub-GHz (868 MHz or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915), 802.11 b/g/n compliant Wi-Fi® module from Inventek Systems (ISM43362-M3G-L44), Dynamic NFC tag based on M24SR with its printed NFC antenna, 2 digital omnidirectional microphones (MP34DT01), Capacitive digital sensor for relative humidity and temperature (HTS221), High-performance 3-axis magnetometer (LIS3MDL), 3D accelerometer and 3D gyroscope (LSM6DSL), absolute digital output barometer (LPS22HB), Time-of-Flight and gesture-detection sensor (VL53L0X)
Discovery kit LoRa, Sigfox, low-power wireless	B-L072Z-LRWAN1	Discovery kit to learn and develop solutions based on LoRa®, Sigfox™, and FSK/OOK technologies. Features the all-in-one CMWX1ZZABZ-091 open module by Murata, powered by STM32L0 MCU & SX1276 transceiver
Discovery kit with STM32L496AG MCU	32L496GDISCOVERY	Complete development platform for STM32L4 MCU. Easy prototyping of applications, including audio and graphics, with state-of-the-art energy efficiency. On-board ST-LINK/V2-1 debugger provides out-of-the-box loading and debugging capabilities. Supported in STM32ODE only in the configuration P-L496G-CELL02. Equipped with 1.54 inch 240 x 240 pixel-TFT color LCD with parallel interface, SAI Audio CODEC with a stereo headset jack and analog microphone input, Stereo digital MEMS microphones, microSD™ card connector (card included), Camera 8 bit-connector, STMod+ and PMOD connectors, 8 Mbit-PSRAM, IDD measurement, 64 Mbit-Quad-SPI Flash 8 LEDs, Reset push button, 4 direction-joystick with selection
LTE Cellular to Cloud Pack	P-L496G-CELL02	Discovery pack for LTE IoT cellular to cloud (STM32-C2C/LTE IoT). A turnkey development platform for cellular and cloud technology-based solutions. The pack is composed of an STM32L496AGI6-based low-power discovery mother board with preloaded firmware, and an STMod+ cellular expansion board with antenna. Equipped with Switchable SIM interface, eSIM and MicroSIM, SAI Audio CODEC, ST-MEMS digital microphones, 8-Mbit PSRAM, 2 user LEDs, 1 user and 1 reset push-buttons, 4-direction joystick with selection button

FUNCTION PACKS

A Function Pack is a pre-integrated application SW package including a set of key building blocks used in most popular application domains such as Cloud, Wearables, IoT, Home and Building Automation.

Each Function Pack package is associated to two or more X-NUCLEO boards. For example the FP-IND-PREDMNT1 runs on the X-NUCLEO-BNRG2A1, X-NUCLEO-CCA02M2 and X-NUCLEO-IKS01A3. But it can also run on solution boards STEVAL-STWINKT1B or STEVAL-BFA001V2B

All Function Pack come with pre-built projects with following IDEs: IAR, Keil, SW4STM32, STM32CubeIDE*, and binaries that can be run out of the box.



Category	Part Number	Specifications	Associated PN
AI	FP-AI-NANOEDG1	Implementation and development of condition monitoring applications designed with the NanoEdge™ AI Studio solution from Cartesiam (a member of the ST Partner program).	Nanoedge AI™
	FP-AI-SENSING1	The package enables advanced applications such as human activity recognition or audio scene classification, on the basis of outputs generated by neural networks (NN). The NN are implemented by a multi-network library supporting both floating and fixed point arithmetics, generated by the X-CUBE-AI extension for STM32CubeMX tool	X-NUCLEO-IKS01A2 X-NUCLEO-CCA02M2 B-L475E-IOT01A STEVAL-STLKT01V1 STEVAL-MKSBOX1V1 STBLESensor
	FP-AI-VISION1	Examples of computer vision applications based on Convolutional Neural Network (CNN)	STM32H747I-DISCO
	FP-AI-CTXAWARE1	Ultra-low power context awareness with distributed artificial intelligence (AI): acoustic analysis with NN on MCU and motion analysis with ML on IMU	STEVAL-MKSBOX1V1 STBLESensor
	FP-AI-MONITOR1	Artificial intelligence (AI) monitoring application based on a wide range of sensors. It covers the entire design of the Machine Learning cycle from the data set acquisition to the integration on a physical node	

* starting from Q3/2019 for all the new firmware packages

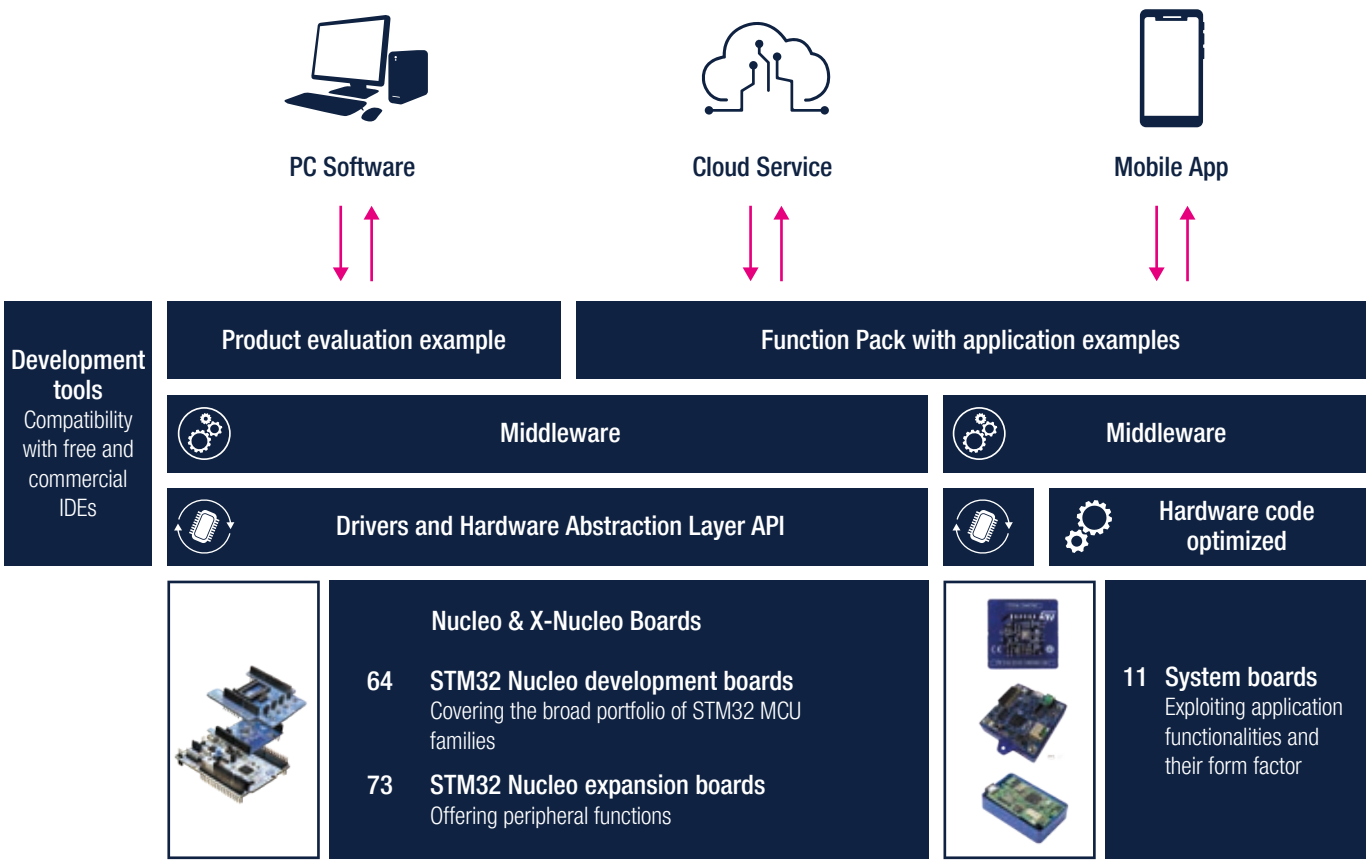
Category	Part Number	Specifications	Associated PN
AI	FP-AI-FACEREC	Software for face recognition application on the STM32H7 microcontroller and STM32MP1 microprocessor	
	FP-AI-PREDMNT2	Programs the STEVAL-STWINKT1B as an IoT Edge node, connected to the cloud, able to acquire sensor data, process them and send the results to the DSH-PREDMNT cloud dashboard. It includes dedicated algorithms for advanced time and frequency domain signal processing and analysis of 3D digital accelerometers with flat bandwidth up to 6 kHz	STEVAL-STWINKT1B STEVAL-STWINWFV1 STBLESensor DSH-PREDMNT NanoEdgeAIStudio AWS IoT Core
Asset Tracking	FP-ATR-LORA1	Read data from environmental and motion sensors, retrieve geo-position from GNSS and send collected data via LoRaWAN connectivity	X-NUCLEO-GNSS1A1 X-NUCLEO-IKS01A2 STEVAL-STRKT01 B-L072Z-LRWAN1 DSH-ASSETRACKING
	FP-ATR-SIGFOX1	Read data from environmental and GNSS sensors and send collected data via Sigfox connectivity	X-NUCLEO-IKS01A3 X-NUCLEO-IKS01A2 X-NUCLEO-GNSS1A1 X-NUCLEO-S2868A2 X-NUCLEO-S2915A1 DSH-ASSETRACKING
	FP-ATR-BLE1	Asset tracking using BLE connectivity for SensorTile.box wireless multi sensor development kit	STEVAL-MKSBOX1V1 STAssetTracking DSH-ASSETRACKING
	FP-ATR-LTE1	Asset tracking with LTE connectivity, GNSS and MEMS sensors	X-NUCLEO-GNSS1A1 X-NUCLEO-IKS01A3 P-L496G-CELL02 DSH-ASSETRACKING
Audio Proc.	FP-AUD-BVLINK1	Performs voice streaming over Bluetooth low energy in a half-duplex configuration	X-NUCLEO-CCA02M2 STEVAL-BCNKT01V1 STEVAL-STLKT01V1
	FP-AUD-BVLINK2	Performs voice streaming over BLE in a full-duplex configuration using the advanced Opus compression algorithm	STEVAL-BCNKT01V1 STEVAL-STLKT01V1 STBLESensor
	FP-AUD-BVLINKWB1	Full-duplex voice streaming or stereo music streaming over BLE using the advanced Opus compression algorithm	X-NUCLEO-CCA02M2 STBLESensor
	FP-AUD-SMARTMIC1	This software package implements a complete application targeting advanced processing for MEMS microphone arrays, including digital MEMS microphone acquisition, beamforming, source localization and acoustic echo cancellation. The processed audio is sent to a USB host and a loudspeaker connected to the relevant expansion boards	X-NUCLEO-CCA01M1 X-NUCLEO-CCA02M2 STEVAL-BCNKT01V1
	FP-AUD-AEC1	Features an example fully focused on acoustic echo cancellation and provides an implementation of a USB smart speaker use case with microphone	NUCLEO-F446RE NUCLEO-F746ZG X-NUCLEO-CCA01M1 X-NUCLEO-CCA02M2
Local and Cloud Conn.	FP-CLD-AWS1	Safely connect your IoT node to Amazon AWS IoT service, transmit sensor data and receive commands from AWS-based cloud applications	X-NUCLEO-IKS01A3 B-L475E-IOT01A
	FP-CLD-AZURE1	Safely connect a IoT node to Microsoft Azure service, transmit sensor data and receive commands from Azure cloud applications	B-L475E-IOT01A STEVAL-STWINKT1B
	FP-CLD-WATSON1	Connect an IoT to IBM Watson service, transmit sensor data and receive commands from remote applications	B-L475E-IOT01A
Network	FP-NET-6LPETH1	Connect your IoT node in a 6LoWPAN wireless sensor network to the Internet via an Ethernet network	X-NUCLEO-IDS01A4 X-NUCLEO-IDS01A5
	FP-NET-6LPWIFI1	Connect your IoT node in a 6LoWPAN wireless sensor network to the Internet via a Wi-Fi network	X-NUCLEO-IKS01A2 B-L475E-IOT01A
	FP-NET-BLESTAR1	Connect your IoT node in a BLE sensor network to the Internet via a Wi-Fi network	B-L475E-IOT01A STBLEStarNet
Industrial	FP-IND-IODSNS1	Enable IO-Link communication between P-NUCLEO-IOD02A1 kit and an IO-Link master through the L6364Q transceiver mounted on the X-NUCLEO-IOD02A1	NUCLEO-L452RE P-NUCLEO-IOD02A1 X-NUCLEO-IKS02A1 X-NUCLEO-IOD02A1

Category	Part Number	Specifications	Associated PN
Industrial	FP-IND-PREDMNT1	Dedicated algorithms for advanced time and frequency domain signal processing and analysis of 3D digital accelerometers with flat bandwidth up to 5 kHz	X-NUCLEO-BNRG2A1 X-NUCLEO-CCA02M2 X-NUCLEO-IKS01A2 X-NUCLEO-IKS01A3 STEVAL-STWINKT1B STEVAL-BFA001V2B DSH-PREDMNT STBLESensor
Sensing	FP-SNS-AGNSS1	Connect your IoT node to a cellular network and enable Assisted-GNSS applications	P-L496G-CELL02 X-NUCLEO-GNSS1A1
	FP-SNS-IOTA1	Enable IOTA DLT functions on an IoT sensor node with cellular connectivity implementing and demonstrating IOTA DLT use cases for the STM32 MCUs	X-NUCLEO-IKS01A3 P-L496G-CELL02
	FP-SNS-DATALOG1	High Speed Datalog application which provides a comprehensive solution to save data from any combination of sensors and microphones configured up to the maximum sampling rate. Sensor data can be stored onto a micro SD card (Secure Digital High Capacity - SDHC) formatted with the FAT32 file system, or streamed to a PC via USB (WinUSB class) using the companion host software (cli_example) provided for Windows and Linux.	STEVAL-STWINKT1B STBLESensor
	FP-SNS-BLEMESH1	Connect an IoT node with BLE Mesh connectivity and sensor model	X-NUCLEO-IKS01A2 X-NUCLEO-BNRG2A1 X-NUCLEO-IDB05A2 ST BLE Mesh
	FP-SNS-ALLMEMS1	Connect your IoT node to a smartphone via BLE and use a suitable Android™ or iOS™ application, like the STBLESensor app, to view real-time environmental sensor data, motion sensor data, digital microphone levels and battery level	X-NUCLEO-BNRG2A1 X-NUCLEO-CCA02M2 X-NUCLEO-IKS01A2 X-NUCLEO-IKS01A3 STEVAL-BCNKT01V1 STEVAL-STLKT01V1 STEVAL-MKSBOX1V1 STBLESensor
	FP-SNS-ALLMEMS2	Connect an ultra-low power IoT node with BLE connectivity, digital microphone, environmental and motion sensors	X-NUCLEO-BNRG2A1 X-NUCLEO-CCA02M2 X-NUCLEO-IKS01A2 X-NUCLEO-IKS01A3 STEVAL-BCNKT01V1 STEVAL-STLKT01V1 STEVAL-MKSBOX1V1 STBLESensor
	FP-SNS-FLIGHT1	IoT node with NFC, BLE connectivity and environmental, motion and time-of-flight sensors. Connect to a smartphone via BLE and uses a suitable Android™ or iOS™ application like the STBLESensor app to view real-time object distance data read by the time-of-flight sensor.	X-NUCLEO-53L1A2 X-NUCLEO-IDB05A2 X-NUCLEO-NFC04A1 STEVAL-BCNKT01V1 STBLESensor
	FP-SNS-MOTENV1	Connect your IoT node to a smartphone via BLE and uses a suitable Android™ or iOS™ application, such as the STBLESensor app, to view real-time motion and environmental (such as temperature, relative humidity, carbon monoxide) sensor data	P-NUCLEO-IKA02A1 X-NUCLEO-IDB05A2 X-NUCLEO-IKS01A2 X-NUCLEO-IKS01A3 STBLESensor
	FP-SNS-MOTENVWB1	Connect your IoT node to a smartphone via Bluetooth Low Energy (BLE) and use a suitable Android or iOS application such as the STBLESensor app to view real-time motion and environmental (temperature, relative humidity, carbon monoxide) sensor data. Includes all the necessary drivers to recognize the devices on the STM32WB55 Nucleo development board (P-NUCLEO-WB55)	X-NUCLEO-IKS01A3 P-NUCLEO-WB55
	FP-SNS-SMARTAG1	Read the motion and environmental sensor data on your IoT node via an NFC enabled reader such as a mobile phone or a tablet. The package supports energy harvesting (enabled by NFC) and battery operated use cases.	X-NUCLEO-IKS01A2 X-NUCLEO-IKS01A3 X-NUCLEO-NFC04A1 STEVAL-SMARTAG1 DSH-ASSETRACKING

Category	Part Number	Specifications	Associated PN
Sensing	FP-SNS-STBOX1	For the Pro Mode of the SensorTile.box wireless multi sensor development kit. The package includes pressure, relative humidity, temperature, accelerometer, gyroscope and magnetometer sensors, as well as an analog microphone and the Bluetooth low energy system-on-chip application processor.	STEVAL-MKSBOX1V1 STBLESensor
	FP-SNS-6LPNODE1	Connect your IoT node to a 6LoWPAN Wireless Sensor Network and expose the sensor and actuator resources using standard application layer protocols	X-NUCLEO-IDS01A4 X-NUCLEO-IDS01A5 X-NUCLEO-IKS01A2 X-NUCLEO-6180XA1

CLOUD AND APPS

Support for the main Cloud SDKs and Android and iOS mobile apps complete the software portfolio, extending the possibility to interact and control the boards and the associated function packs through a web dashboard or a mobile app.



Category	Part Number	Specifications	Associated PN
WEB App	DSH-ASSETRACKING	Cloud based dashboard application powered by Amazon Web Services (AWS). It provides a highly functional and intuitive interface tailored for the collection, visualization and analysis of asset tracking position as well as data from motion and environmental sensors such as temperature, humidity and pressure	FP-ATR-BLE1 FP-ATR-LORA1 FP-ATR-LTE1 FP-ATR-SIGFOX1 FP-SNS-SMARTAG1
	DSH-PREDMNT	Predictive Maintenance Dashboard is a cloud application based on AWS services	STEVAL-STWINKT1B FP-IND-PREDMNT1

Category	Part Number	Specifications	Associated PN
Mobile App	STAssetTracking	Remotely configure a Sigfox or BLE asset tracking node from a compatible mobile device with Bluetooth connectivity. It provides the functionality to enable data logging for specific sensors and set threshold triggers to start and stop logging activity.	FP-ATR-LTE1 FP-ATR-SIGFOX1
	STBLESensor	Android and iOS application to shows the data exported by a BLE device using the BlueST protocol	X-NUCLEO-53L1A2 STEVAL-BCNKT01V1 STEVAL-STLKT01V1 FP-AI-SENSING1 FP-AUD-BVLINK2 FP-AUD-BVLINKWB1 FP-IND-PREDMNT1 FP-SNS-ALLMEMS1 FP-SNS-ALLMEMS2 FP-SNS-FLIGHT1 FP-SNS-MOTENV1 FP-SNS-MOTENVWB1 FP-SNS-STBOX1
	STBLEStarNet	Android and iOS application which allows viewing the data exported by a BLE gateway connected to a network of devices. The app connects to a star network master node and displays data sent by the slave nodes. For each slave node in the network, the app shows a set of sensor data (e.g. temperature, pressure and humidity) measured by the slave and read by the master node.	FP-NET-BLESTAR1
	ST BLE Mesh	STBLEMesh application for Android and iOS allows you to create your own Bluetooth® Mesh Profile compliant mobile Apps. The App can be used for provisioning, configuring and controlling multiple Bluetooth® Mesh Profile compliant devices in a BLE Mesh network for Internet of Things (IoT) solutions.	FP-SNS-BLEMESH1 X-CUBE-BLEMESH1
	STNFCSensor	Shows the data exported by sensor nodes via the NFC protocol. It allows you to configure and read data from any system running the FP-SNS-SMARTAG1 function pack (for example, the STEVAL-SMARTAG1 evaluation board).	STEVAL-SMARTAG1
	STBLEToolbox	The ST BLE Toolbox is a user-friendly application to interact and debug ST Bluetooth Low Energy (BLE) devices. Upon launch, the app scans for BLE devices. For each device found it is possible to display advertisements and connect to it. The key features are: Discovery peripherals, Show output of standard profile, Show peripheral services and characteristics, Perform Read, write and notification interactions with peripherals, Collect Cloud based Analytics on Azure App Center, Bond device	STEVAL-SMARTAG1

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