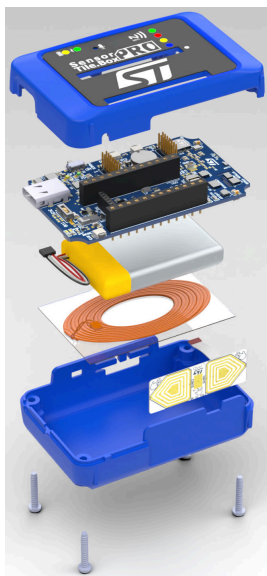## SensorTile.box PRO with multi-sensors and wireless connectivity for any intelligent IoT node



### Features

**Key solution advantages**

- All-in-one sensor node, which fits into the palm of your hand (40x63 mm) for any IoT applications
- Ready-to-go development kit
- Ultra-low-power with FPU Arm-Cortex-M33 with TrustZone® microcontroller (STM32U585AI)
- microSD™ card slot for standalone data logging applications
- On-board Bluetooth® Low Energy 5.2 (STM32WB07) and NFC tag (ST25DV04K)
- High precision sensors to gather high-quality data:
  – Low-voltage local digital temperature sensor (STTS22H)
  – Six-axis inertial measurement unit (LSM6DSV16X)
  – Three-axis low-power accelerometer (LIS2DU12)
  – 3-axis magnetometer (LIS2MDL)
  – Pressure sensor (LPS22DF)
  – Digital microphone/audio sensor (MP23DB01HP)
- User interface:
  – Hardware power switch
  – Green and orange system LED to display the power supply state
  – 4 programmable status LEDs (green, red, orange, blue)
  – 2 programmable push-buttons
  – Audio buzzer
  – Reset button
  – Qvar with electrodes for user interface experience
  – Interface J-Link/SWD debug-probe
  – Interface for extension board
  – Socket for DIL24 sensor adapters
- Power and charging options: USB Type-C® charging and connecting, 5 W wireless charging and rechargeable long-life 480 mAh battery
- Develop apps quickly regardless of your level of expertise:
  – **Entry mode**: wide range of default IoT and wearable applications
  – **Expert mode**: create your own app in a simple graphic environment
  – **Pro mode**: develop code in an intuitive way using STM32 Open Development Environment (ODE) and ST function pack libraries
- STBLESensor app on the smartphone (both on the Google Play and Apple Store) allows you to immediately connect to the box kit (the required PIN for pairing with the app is 123456)
- Windows, LINUX, and MacOS ST software compatibility
- Firmware over-the-air (FOTA) upgrade
- Certifications: CE, FCC, UKCA, IC

| Product summary | |
|---|---|
| SensorTile.box PRO with multi-sensors and wireless connectivity | STEVAL-MKBOXPRO |
| Low-voltage, ultra-low-power, temperature sensor | STTS22H |
| Ultra-low-power with FPU Arm Cortex-M33 MCU | STM32U585AI |
| MEMS digital output motion sensor | LIS2DU12 |
| iNEMO 3D accelerometer and 3D gyroscope | LSM6DSV16X |
| Magnetic sensor 3-axis magnetometer | LIS2MDL |
| Applications | IoT applications |

## Description

The STEVAL-MKBOXPRO (SensorTile.box PRO) is the new ready-to-use programmable wireless box kit for developing any IoT application based on remote data gathering and evaluation, exploit the full kit potential by leveraging both motion and environmental data sensing, along with a digital microphone, and enhance the connectivity and smartness of whatever environment you find yourself into.

You can entirely enjoy the SensorTile.box PRO experience regardless of your level of expertise, the box kit could be exploited according to three different modalities:

**Entry mode**: run a wide range of already embedded IoT applications on your box.

You can download the free STBLESensor App on your smartphone and immediately begin commanding the board with any of the following applications that have been specifically designed to work with the board sensors:

1) Motion: Compass, Free-fall detection, Level, Pedometer, Sensor-fusion - Quaternion

2) Environmental: Barometer

3) Log: Data recorder

4) AI and MLC: Baby crying detector, Human activity recognition

5) User interface: Qtouch

6) Connectivity: NFC Tag

**Expert mode**: build custom applications through the STBLESensor App by selecting specific input data and operating parameters from corresponding available in-box sensors, functions to assess/compute those data, and output types that you need, while leveraging on the available powerful algorithms.

**Pro mode**: develop quickly your own tailored IoT application taking advantage of STM32 open development environment (ODE) and ST function pack libraries, including sensing AI function pack with neural network libraries, without the need to perform any coding activity.

The SensorTile.box PRO board fits into a small plastic box with a long-life 480mAh rechargeable battery, for the first time leveraging also on a wireless charger and a programmable NFC tag. The board can be easily connected via Bluetooth to the ST BLE Sensor app on your smartphone, from which the box kit can be enjoyed in Entry and Expert mode. In Pro mode, professional users can exploit the firmware programming and debugging interface in the STM32 ODE for developing their firmware from scratch.

# 1 Solution overview

**Figure 1.** Solution block diagram
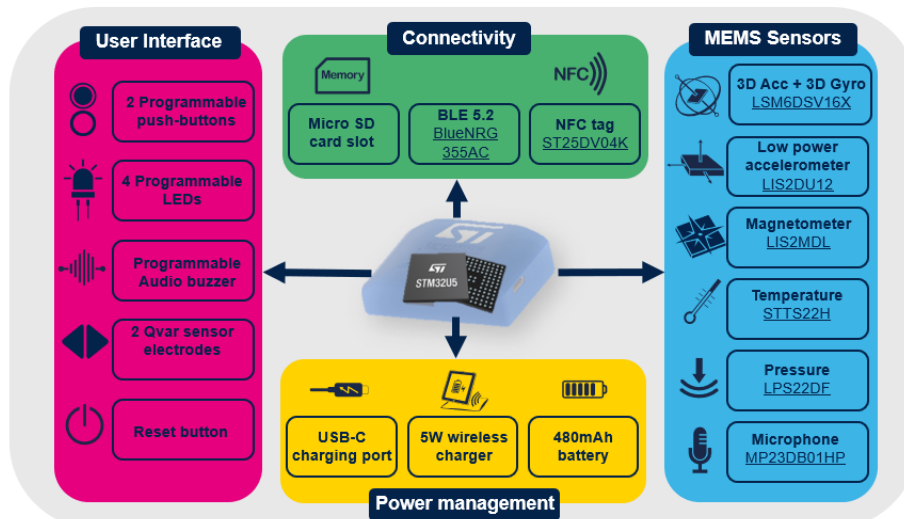


The STEVAL-MKBOXPRO solution enables the user to collect environmental and motion data through a wide range of intelligent, low-power MEMS sensors and to process them thanks to the STM32U585AI microcontroller.

Connectivity is guaranteed by a ST Bluetooth® Low Energy module for wireless communication with a BLE-enabled smartphone, an NFC module to enable near-field applications and a microSD™ card slot for data-logging.

The box kit is equipped with a long-life 480mAh rechargeable battery, a USB Type-C® battery charging interface, and is compatible with a new 5W wireless charging option.

User experience is enhanced by a new user interface composed of two programmable push-buttons, four programmable LEDs, a programmable audio buzzer, one battery status LED, a reset button, and Qvar sensor electrodes.

The small compact box and long-life battery, together with the enhanced user interface and connectivity, make the kit suitable for testing wearable and remote monitoring/tracking for IoT applications while relying on high-quality data gathered.

# 2 Board versions

**Table 1. STEVAL-MKBOXPRO versions**

| PCB version | Schematic diagrams | Bill of materials |
|---|---|---|
| STEVAL$MKBOXPROA | STEVAL$MKBOXPROA schematic diagrams | STEVAL$MKBOXPROA bill of materials |
| STEVAL$MKBOXPROB | STEVAL$MKBOXPROB schematic diagrams | STEVAL$MKBOXPROB bill of materials |
| STEVAL$MKBOXPROC | STEVAL$MKBOXPROC schematic diagrams | STEVAL$MKBOXPROC bill of materials |

There are available three revisions of STEVAL-MKBOXPRO, first host two different near field communication ICs, and specifically U17 has been replaced from revision A to revision B: ST25DV04K-IER8C3 to ST25DV04KC-IE8C3, meanwhile third version BlueNRG-LP is replaced by STM32WB07.

This modification is completely transparent in the firmware and mobile app software packages; they manage both the ICs and automatically set the code for the installed NFC.

For sake of clarity, the two revisions can be distinguished by the label on back and its FG code:

- STEVAL$MKBOXPROA for revision A of the board, hosting ST25DV04K-IER8C3.
- STEVAL$MKBOXPROB for revision B of the board, hosting ST25DV04KC-IE8C3.
- STEVAL$MKBOXPROC for revision C of the board, hosting STM32WB07.

**Figure 2. Label visible on back of the box**

# Revision history

**Table 2.** Document revision history

| Date | Revision | Changes |
|---|---|---|
| 10-Mar-2023 | 1 | Initial release. |
| 04-Sep-2024 | 2 | Updated features in cover page.<br>Added Section 2: Board versions. |
| 02-Sep-2025 | 3 | Updated Features, Section 1: Solution overview and Section 2: Board versions. |

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