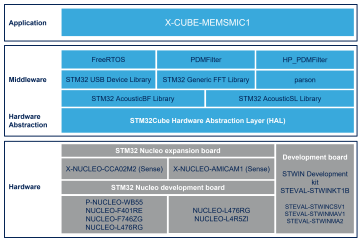
X-CUBE-MEMSMIC1

Data brief

Analog and digital MEMS microphone acquisition and processing software expansion for STM32Cube



Product summary	
Analog and digital MEMS microphones acquisition and processing software expansion for STM32Cube	X-CUBE-MEMSMIC1
MEMS audio sensor omnidirectional stereo digital microphone	MP34DT06J
Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo	X-NUCLEO-CCA02M2
Analog MEMS microphone expansion board based on MP23ABS1 for STM32 Nucleo	X-NUCLEO-AMICAM1
High performance MEMS audio sensor single ended analog bottom-port microphone	MP23ABS1
Applications	Condition Monitoring/ Predictive Maintenance Remote Controls Sound Sensing

Features

- Complete middleware to build applications using MEMS digital microphones (MP34DT06J, IMP34DT05 and MP23DB01HP when using the STEVAL-MIC006V1 coupon board) and analog microphones (MP23ABS1 and IMP23ABSU)
- Easy portability across different MCU families thanks to STM32Cube
- Audio input class USB driver to allow the recognition of the device as a standard USB microphone and enable audio streaming
- PC-based streaming using third-party standard audio editors
- Free, user-friendly license terms
- Microphone acquisition sample implementation available on the X-NUCLEO-CCA02M2 expansion board when connected to a P-NUCLEO-WB55, NUCLEO-F401RE, NUCLEO-L476RG or NUCLEO-F746ZG development board
- High performance microphone acquisition and streaming via USB available on the X-NUCLEO-CCA02M2 expansion board when connected to a STEVAL-MIC006V1 microphone coupon board and a P-NUCLEO-WB55, a NUCLEO-F401RE or NUCLEO-F746ZG development board
- Microphone acquisition sample implementation available on the X-NUCLEO-AMICAM1 expansion board when connected to a NUCLEO-L476RG or NUCLEO-L4R5ZI
- Microphone acquisition sample implementation available on the STEVAL-STWINKT1B (and STEVAL-STWINKT1) evaluation kit and STEVAL-STWINMAV1 and STEVAL-STWINMA2 microphone array expansion boards
- Advanced processing applications based on ST acoustic libraries for NUCLEO-F401RE, NUCLEO-L4R5ZI development board and STEVAL-STWINKT1B (and STEVAL-STWINKT1) development kit, including AcousticBF (real-time beamforming) sample and AcousticSL (real-time sound source localization) sample
- Ultrasound FFT analysis demonstration available on the STEVAL-STWINKT1B (and STEVAL-STWINKT1) and on the X-NUCLEO-AMICAM1 expansion board when connected to a NUCLEO-L476RG or NUCLEO-L4R5ZI

Description

X-CUBE-MEMSMIC1 is an expansion software package for STM32Cube.

The software runs on the STM32 and includes drivers and middleware for audio data acquisition from MEMS digital microphones (MP34DT06J, IMP34DT05 and MP23DB01HP) and analog microphones (MP23ABS1 and IMP23ABSU), and USB streaming of the recorded signals.

The package also includes an example of ultrasound condition monitoring (UltrasoundFFT) that calculates the FFT of the analog microphone signal and streams the result to a PC GUI via USB. The microphone sampling rate is set by default to 192 kHz whereas the microphone bandwidth is up to 80 kHz.

The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers and comes with examples showing X-NUCLEO-CCA02M2 capabilities when connected to a P-NUCLEO-WB55, NUCLEO-F401RE, NUCLEO-L476RG or NUCLEO-F746ZG board and X-NUCLEO-AMICAM1 capabilities when connected to a NUCLEO-L476RG or NUCLEO-L4R5ZI.

X-CUBE-MEMSMIC1 also includes demonstrations for STEVAL-STWINKT1B (and STEVAL-STWINKT1) SensorTile Wireless Industrial Node (STWIN) development kit.

The software is available also on GitHub, where the users can signal bugs and propose new ideas through [**Issues**] and [**Pull Requests**] tabs.

1 Detailed description

1.1 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- STM32CubeMX configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- STM32CubeIDE integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- STM32CubeProgrammer programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools (STM32CubeMonRF, STM32CubeMonUCPD, STM32CubeMonPwr) to help developers customize their applications in real-time
- STM32Cube MCU and MPU packages specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- STM32Cube expansion packages for application-oriented solutions.

1.2 How does this software complement STM32Cube?

The proposed software is based on the STM32CubeHAL, the hardware abstraction layer for the STM32 microcontroller.

The package extends STM32Cube by providing a board support package (BSP) for the MEMS microphones expansion board and some middleware components for PDM to PCM conversion and USB communication with a PC.

The drivers abstract low-level details of the hardware and allow the middleware components and applications to access audio data in a hardware-independent manner.

The package also includes a sample application that developers can use to start experimenting with the code. The sample application was developed to enable device recognition as a standard multichannel USB microphone and audio streaming on a PC. For this purpose, a Windows PC utility is needed (not included in the package) in order to record and save the audio stream. Any freeware or commercial audio recording software can be used.

Revision history

Table 1. **Document revision history**

Date	Version	Changes
21-May-2015	1	Initial release.
27-Jan-2016	2	Updated cover page Features Updated cover page Description
29-Jan-2016	3	Updated cover page image
11-Jul-2016	4	Updated cover page Features Updated cover page Description
09-May-2017	5	Updated cover page image and features.
18-Apr-2018	6	Updated cover image. Removed references to NUCLEO-F072RB and NUCLEO-L053R8 boards.
04-Jun-2019	7	Added P-NUCLEO-WB55 compatibility information.
02-Dec-2019	8	Updated cover page image and product summary table. Updated Section 1.1 What is STM32Cube?. Added MP34DT06J microphone and X-NUCLEO-CCA02M2 expansion board compatibility information.
08-Jan-2020	9	Updated title. Added MP23ABS1 microphone and X-NUCLEO-AMICAM1 expansion board compatibility information.
19-Mar-2020	10	Updated cover page image, features, description and product summary table.
03-Jul-2020	11	Updated cover page features.
21-Dec-2020	12	Updated cover page image, features and description.
26-Oct-2021	13	Updated cover page image.
11-Nov-2022	14	Updated cover page features and description.
20-Sep-2023	15	Updated cover image and features in cover page.