Bosch Sensortec sensing solutions

Product overview

Content

Bosch Sensortec

At the core of your everyday life

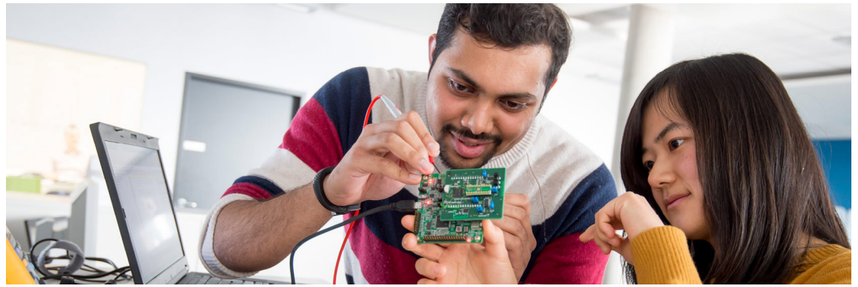
Bosch Sensortec GmbH, a fully owned subsidiary of Robert Bosch GmbH, develops and markets a wide portfolio of microelectromechanical systems (MEMS) sensors and solutions tailored for smartphones, tablets, wearables and hearables, AR/VR devices, drones, robots, smart home and IoT (Internet of Things) applications. The product portfolio includes 3-axis accelerometers, gyroscopes and magnetometers, integrated 6- and 9-axis sensors, smart sensors, barometric pressure sensors, humidity sensors, gas sensors, optical microsystems and comprehensive software. Since its foundation in 2005, Bosch Sensortec has emerged as the MEMS technology leader in the markets it addresses. Bosch has been both a pioneer and one of the leading providers in the MEMS sensor segment since 1995 and has, to date, sold more than 23 billion MEMS sensors.

Motion sensors

Smart sensor systems

Environmental sensors

Software and tools



Display solutions*

Acoustic microsystems*

* These products are not yet in distribution.

Application		Accelerometers					IMUs			Pressure sensors			
		BMA580	BMA550	BMA530	BMA456	BMA400	BMI323	BMI270	BMI088	BMP585	BMP581	BMP390	BMP384
Wearables	Fitness trackers	●		○	●	○	●	○		○	○		○
	Smart watches	●		○	●	●		○		○	○		○
	Hearables	○	○	●	○	●	●	○		○	○	●	○
	Other wearables	●		○	●	○	●	○		○	○	●	○
VR/AR	VR/AR glasses		○					●		●	○	●	○
	VR remote control						●	●		○	●	●	○
Smart home	Env. monitoring	●		●	●	○						●	
	Security	●		●	●	○	●			●	●	●	
	Appliances	●		●	●		●		○	○	○	○	
Robots	Drones								○	●	○		○
	CE robots (home)						●		○	●	●	○	○
Industrial	Telematics								○			●	○
	Asset tracking	●	●	●	●	○			●	○	○	○	○
	Predictive maintenance	●	●	●	●	●			●			●	○
Other CE	Remote control	●		○	●	○	○					●	
	Camera							○				●	
	Toys	●		○	●	●	○		●		●		

● Recommendation from Bosch Sensortec ● Also can be used

Application		Magnetometer	Smart sensor systems			Sensor node	Humidity & gas sensors				Particulate matter sensors
		BMM350	BHI380	BHI360	BHI-260AP	BNO055	BME690	BME688	BME680	BME280	BMV080
Wearables	Fitness trackers	○	●	○	○		●				
	Smart watches	○	○	●	○		●	○	●	●	
	Hearables	○	●	○	○		●				
	Other wearables	○	●	○	○		●	○	●	●	○
VR/AR	VR/AR glasses	○	○	●	●	●	●	●	●	●	●
	VR remote control	●	●	●	●						
Smart home	Env. monitoring						○	○	○	●	○
	Security	●		●				○	○	○	●
	Appliances		●	●			○	○	○	●	○
Robots	Drones	○					●	●			
	CE robots (home)	○	○	●		○	●	○	●	●	●
Industrial	Telematics	○									○
	Asset tracking	●	○				●	○		●	●
	Predictive maintenance	●	●	○		●		○	●	○	●
Other CE	Remote control		●	●	●						●
	Camera	○	●	●		●					
	Toys	●	●	●	●			●	●	●	

● Recommendation from Bosch Sensortec ● Also can be used

MOTION

Motion sensors

Our portfolio of motion sensors includes products for motion, orientation and gesture detection. Motion sensors are designed for several consumer electronics and IoT applications in the field of smartphones, wearables, smart home, drones, toys, virtual and augmented reality, gaming, as well as industrial applications.

Accelerometers

The BMAs are advanced, ultra-small, triaxial, low-g acceleration sensors with digital interfaces (SPI, I²C, interrupt pins) targeted for low-power applications. Featuring different digital resolutions (12-16 bit), the BMA family allows for very low noise measurement of accelerations (range programmable from 2...16 g) in three perpendicular axes and thus senses tilt, motion, shock and vibration in smartphones, man machine interfaces, wearables, smart home, as well as industrial applications.

The BMA family has 1 kB FIFO and integrates embedded intelligence which enables precise low current step counting and a multitude of other always-on features. BMA456 fits into wearable or hearable devices - depending on the feature set.

Product	Package	Description	Key performance parameters	Current consumption	Noise	Offset	TCO
BMA580	WLCSP 1.2 x 0.8 x 0.55 mm³	Smallest accelerometer on the market with unique voice activity detection and advanced feature set for hearable devices	• Different power modes and automatic power mode switching • Integrated voice activity detection	High performance: 135 µA Low power: 19.5 µA at 100Hz	120 µg/√Hz	±50 mg	±0.2 mg/K
BMA550 Not available in distribution*	WLCSP 2 x 2 x 0.6 mm³	High bandwidth accelerometer with integrated features for hearable applications	• Smart voice enhancement • Integrated functionalities like voice activity detection	Low noise: 290 µA Low power: 104 µA			
BMA530	WLCSP 1.2 x 0.8 x 0.55 mm³	Smallest accelerometer on the market with advanced feature set for wearables and toys	• Different power modes and automatic power mode switching • Integrated functionalities like step counter and generic interrupts	High performance: 135 µA Low power: 19.5 µA at 100Hz	120 µg/√Hz	±75 mg	±0.5 mg/K
BMA456	LGA 2.0 x 2.0 x 0.65 mm³	High performance accelerometer with integrated features for hearable and wearable applications and reduced height	• Low noise, low offset and low TCO • 16 Bit • Application specific feature sets can be programmed (hearables feature set, wearables feature set)	High performance: 150 µA Normal mode: 14 µA at 50 Hz	120 µg/√Hz	±20 mg	±0.35 mg/K
BMA400	LGA 2.0 x 2.0 x 0.95 mm³	Ultra-low power accelerometer with integrated features for Internet of Things (IoT), smart home, wearables and hearables	• Self wake-up/sleep (sleep mode: 160 nA) • No duty-cycling and max. performance at lowest current consumption • Programmable interrupts (generic interrupts) • Low current step counter and tap feature	High performance: 14.5 µA Low power: 0.85 µA	X,Y: 180 µg/√Hz Z: 240 µg/√Hz	±50 mg	±1 mg/K

* If you are interested in these sensors, please get in touch with us.

Magnetometer

The high-performance magnetometer BMM350 enables tracking of head movements and thus 3D audio for a personalized sound experience. In the AR/VR area it can take up the struggle against motion sickness with the reduction of pixel latency. The magnetometer can be used in wearables and hearables, smartphones and tablets, AR and VR, and various vehicles.

Product	Package	Description	Key performance parameters	Current consumption	Noise	Offset	Sensitivity
BMM350	WLCSP 1.28 x 1.28 x 0.5 mm³	• Newest generation low-power magnetometer • TMR magnetometer also for hearable and wearable applications	• Unique field shock recovery feature (400 mT) • High-performance and ultra-low noise due to innovative TMR technology • Very low current consumption	Low power preset: 130 µA Normal mode: 200 µA	± 190 (x/y axis) and ± 450 nT (z axis) (RMS noise)	± 2 µT (software calibrated)	0.08 µT/LSB

Inertial Measurement Units

Bosch Sensortec optimizes its IMUs (Inertial Measurement Units) for advanced smartphones, wearables, AR and VR, drones, gaming and robot applications. They are designed to provide maximum flexibility to customers. An IMU combines a gyroscope with an accelerometer in one system-in-package (SiP). It enables for example real-time motion detection, indoor navigation, gesture and activity recognition as well as optical image stabilization (OIS).

Product	Package	Description	Key performance parameters	Current consumption	Noise	Offset	TCO
BMI330	LGA 2.5 x 3.0 x 0.83 mm³	• Extended temperature range up to 105°C • Low power consumption and configurable power modes for continuous use	• Integrated feature set enables easy implementation • Temperature range: -40 ... +105 °C • Low-noise gyroscope	High performance mode, A+G: 790 µA	(A): 180 µg/√Hz (G): 0.007 dps/√Hz	(A): ± 50 mg (G): ± 1 °/s	(A): ± 0.3 mg/K (G): ± 0.01 °/s/K (-10°C to +85°C) ± 0.02 °/s/K (-40°C to <-10°C and from >85°C to 105°C)
BMI323	LGA 2.5 x 3.0 x 0.83 mm³	• Newest member of Bosch's next-generation IMUs • Easy-to-use standard IMU • I3C, I2C, SPI Interface	• Motionless Component Retrimming (CRT) for gyroscope calibration • Low-noise gyroscope • Integrated features	High performance mode, A+G: 790 µA	(A): 180 µg/√Hz (G): 0.007 dps/√Hz	(A): ± 50 mg (G): ± 1 °/s	(A): ± 0.3 mg/K (G): ± 0.04°/s/K
BMI270	LGA 2.5 x 3.0 x 0.83 mm³	• Very low power, smart features • Optimized for e.g. hearable and wearable applications	• Motionless Component Retrimming (CRT) for gyroscope calibration • High-performance accelerometer (low offset, TCO, TCS) • Features: context & activity / gesture recognition	Full operation: 685 µA	(A): 160 µg/√Hz (G): 0.007 dps/√Hz	(A): ± 20 mg (G): ± 0.5 °/s	(A): ± 0.25 mg/K (G): ± 0.015 °/s/K
BMI088	LGA 3.0 x 4.5 x 0.95 mm³	• High-performance IMU featuring vibration robustness • Optimized for drones and robots	• High-g accelerometer (up to ±24 g) • Low sensitivity errors (over lifetime) • Extremely low gyro bias instability (< 2°/h)	Full operation: 5.15 mA	(A): 190 µg/√Hz (z) / 160 µg/√Hz (x,y) (G): 0.014 dps/√Hz	(A): ± 20 mg (G): ± 1°/s	(A): ± 0.2 mg/K (G): ± 0.015 °/s/K

Smart sensor systems

We offer a wide range of smart sensor systems for low-power, always-on sensor applications in smartphones, wearables, and tracking devices. It offers you flexible, low-power solutions for motion sensing and sensor data processing.

Sensor node

The BNO055 is a smart sensor implementing an intelligent 9-axis absolute orientation sensor, which includes sensors and sensor fusion in a single package. This smart sensor is significantly smaller than comparable solutions.

Product	Package	Description	Key performance parameters	Integrated MCU	Embedded software*	Interfaces	Current consumption
BNO055	3.8 x 5.2 x 1.13 mm^3	Smart sensor system with integrated 9-axis (accelerometer, gyroscope, magnetometer) MEMS sensor, and MCU with sensor fusion software in a single package	• High bias stability gyroscope • Integrated sensor fusion software	32 bit cortex M0+ microcontroller	BSX 3.0 full fusion	I^2C, UART, HID-I^2C	Suspend mode: 40 µA 9DOF at 100 Hz ODR: 12.3 mA

Programmable and AI sensor systems

Meet our programmable and AI sensor systems, which include a customer programmable 32-bit microcontroller and an IMU. This allows an even more versatile sensor application such as head orientation for 3D audio, step counting or activity recognition in smartphones, wearables, hearables, and other mobile devices. The extended software of the PRO versions additionally enable PDR navigation, swim analytics and self-learning AI fitness tracking.

Product	Package	Description	Key performance parameters	Integrated MCU	Embedded software	Interfaces	Current consumption
BHI260AP	4.1 x 3.6 x 0.8 mm³	Smart sensor system that includes multiple software functionalities, a 32-bit customer programmable microcontroller and a 6-axis IMU, all in one package.	• Self-learning AI function • Programmability	32 bit floating-point ARC EM4 CPU running at 20 MHz OR 50 MHz (up to 3.6 CoreMark/MHz) with 256 kByte SRAM, 144 kByte ROM	Self-learning AI software for fitness tracking, swim analytics, pedestrian dead reckoning, relative & absolute orientation	Host interface configurable as SPI or I²C, 2 master interfaces (1 selectable SPI/I²C and 1 I²C), Up to 12 GPIOs	Self-learning AI function (25Hz): 249 µA Self-learning AI function (50Hz): 386 µA Standby current: 8 µA
BHI360	3.0 x 2.5 x 0.95 mm³	Highly integrated, ultra-low power, smart 6-axis IMU consistiong of a 32-bit programmable microcontroller, an additional ultra-low power microprocessor, including pre-installed sensor fusion software and algorithms in a single package.	• IMU footprint (2.5 x 3 mm) • Low power MCU (ARC EM4 at 20/50 MHz) • Integrated sensor fusion software • Open programmable platform	• 32 bit floating-point ARC EM4 CPU running at 20 MHz OR 50 MHz (up to 3.6 CoreMark/MHz) with 256 kByte SRAM, 144 kByte ROM • Integrated ultra-low power MCU (Bosch Sensortec Core) optimized for always on algorithms	• BSX fusion algorithm (up to 800Hz) and low power features (e.g. activity & recognition, step detector & counter) • Custom programmable MCU	Host interface configurable as SPI or I²C, 2 master interfaces (1 selectable SPI/I²C and 1 I²C), Up to 12 GPIOs	6DoF Fusion at 100 Hz ODR: 700 µA 6DoF Fusion at 50 Hz ODR: <600 µA Activity recognition: 50 µA
BHI380 Not available in distribution*	2.5x3.6x0.95 mm³	Self-learning AI smart sensor with integrated IMU that includes a larger set of integrated application specific algorithms and is highly integrated, ultra-low power, smart 6-axis IMU consisting of a 32-bit programmable microcontroller.	• Self-learning AI function • Programmability • Pedestrian dead reckoning (PDR) algorithm	• 32 bit floating-point ARC EM4 CPU running at 20 MHz OR 50 MHz (up to 3.6 CoreMark/MHz) with 256 kByte SRAM, 144 kByte ROM • Integrated ultra-low power MCU (Bosch Sensortec Core) optimized for always on algorithms	• Self-learning AI software suitable for a wide variety of fitness tracking and custom motion patterns • Dedicated solution for tracking swimming performance in smart watch • Dedicated solution for pedestrian dead reckoning (PDR) for indoor and outdoor positioning	• Host interface configurable as SPI or I2C • 2 secondary master interfaces (one I2C interface, and one selectable SPI or I2C) • Up to 14 GPIOs	Fuser2 (running CoreMark) • Long Run mode (20 MHz) 950 µA • Turbo mode (50 MHz) 2.8 µA Sensor Fusion (Hub + IMU) operation (calculating Game Rotation Vector) •800 Hz ODR 1.2 mA •100 Hz ODR 1.0 mA Standby current: 8 µA

* If you are interested in these sensors, please get in touch with us.

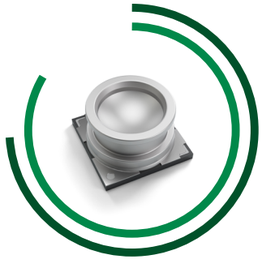
ENVIRONMENTAL

Environmental sensors

Our environmental sensor portfolio includes barometric pressure sensors as well as integrated environmental sensors. These integrated environmental sensors combine barometric pressure, relative humidity, gas and ambient temperature sensing functions. Environmental sensors are ideally suited for indoor air quality measurement, sport & fitness monitoring, weather forecast, home automation control, Internet of Things, GPS-enhancement and indoor navigation.

Barometric pressure sensors

Bosch Sensortec's barometric pressure sensors enable a variety of smartphones, wearables and smart home applications. Our very small and low-power barometric pressure sensors stabilize the altitude of drones, enable accurate indoor navigation and improve precise calorie and distance counting in wearables. The pressure sensors work with the piezoresistive or the capacitive principle. For all BMPs, the operation range is between 300 and 1250 hPa, VDDIO is 1.2...3.6 V and VDD is 1.65...3.6 V. The interfaces are I2C, I3C, and SPI.



Product	Package	Description	Key performance parameters	Supply current	Accuracy	TCO
BMP585	LGA 3.25 x 3.25 x 1.86 mm³	Robust and high-performance barometric pressure sensor	• Highest robustness against liquids, particles, dust etc. • High performance due to lowest noise and power consumption	1.3 µA at 1 Hz pressure and temperature	Relative accuracy of typ. ± 6 Pa at 700...1100 hPa ...15...55 °C) Absolute accuracy of typ. ± 50Pa at 300...1100 hPa ...-.5...65 °C)	typ. ± 0.5 Pa/K (5...65 °C at 300...1100 hPa)
BMP581	LGA 2.0 x 2.0 x 0.75 mm³	Ultra high performance & accurate barometric pressure sensor	• Highest performence due to lowest noise and power consumption • Extreme accuracy at smallest size	1.3 uA at 1 Hz pressure and temperature	Relative accuracy of typ. ± 6 Pa at 700...1100 hPa ...15...55 °C) Absolute accuracy of typ. ± 30Pa at 300...1100 hPa ...-.5...65 °C)	typ. ± 0.5 Pa/K (5...65 °C at 300...1100 hPa)
BMP390	LGA 2.0 x 2.0 x 0.8 mm³	Ultra-high performance barometric pressure sensor	• Outstanding temperature stability • Low noise and drift • High absolute and relative accuracy	3.2 µA at 1 Hz pressure and temperature	Relative accuracy of typ. ± 3 Pa at 700...1100 hPa, 25...40 °C Absolute accuracy of typ. ± 50 Pa at 300...1100 hPa, -0...+65 °C)	typ. ± 0.6 Pa/K (25...40 °C at 900 hPa)
BMP384	LGA 2.0 x 2.0 x 1.0 mm³	Robust & high performance barometric pressure sensor	• Resistant against liquids, particles, dust etc. • Highest resolution mode at lowest bandwidth 0.016 Pa • Embedded temperature compensation • Embedded FIFO and interrupt	3.4 µA at 1 Hz pressure and temperature	(Relative accuracy of typ. ± 9 Pa at 700...1100 hPa, 25...40 °C Absolute accuracy of typ. ± 50 Pa at 300...1100 hPa, 0...+65 °C)	yp. ± 1.0 Pa/K (25...40 °C at 900 hPa)

Humidity sensor

The BME280 is a humidity sensor measuring relative humidity, barometric pressure and ambient temperature in one metal-lid package. The BME280 is developed specifically for mobile applications and wearables where size and low power consumption are key design parameters.
For BME280, VDDIO is 1.2...3.6 V and VDD is 1.71...3.6 V. The interfaces are I²C and SPI.

Product	Package	Description	Key performance parameters	Supply current	Accuracy	Measurement range
BME280	LGA 2.5 x 2.5 x 0.93 mm³	Combined absolute pressure (p), ambient humidity (h) and temperature (T) sensor	• Fast response time for humidity (tau63 = 1 s) • High accuracy for T, p and rH over wide temperature and pressure range • High long-term stability	0.1 µA in sleep mode 1.8 µA at 1 Hz (h,T) 2.8 µA at 1 Hz (p, T) 3.6 µA at 1 Hz (h, p, T)	±3 % relative humidity ±1.0 absolute accuracy pressure (300...1100 hPa, 0...65 °C) ±0.5 at 25 °C for T	T: -40...85 °C p: 300...1100 hPa h: 0...100%

Gas sensors

The BME680, BME688 and BME690 are 4-in-1 environmental sensors combining barometric pressure, ambient temperature, relative humidity and gas measurement in one small package. They detect a broad range of gases including Volatile Organic Compounds (VOC) for air quality monitoring in smart homes to improve health and well-being.

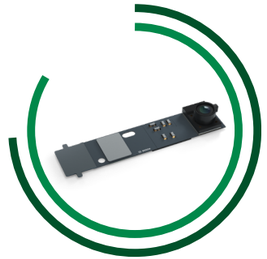
The BME690 is the latest-generation gas sensor for the monitoring of gases, temperature, pressure and humidity, coupled with innovative artificial intelligence (AI) capabilities. The BME690 is further developed on Bosch Sensortec's BME688 and BME680 sensors, building on this time-proven platform.

For all BME680, BME688 and BME690, VDDIO is 1.2...3.6 V and VDD is 1.71...3.6 V. The interfaces are I^2C and SPI.

Product	Package	Description	Key performance parameters	Supply current	Accuracy	Measurement range
BME680	LGA 3.0 x 3.0 x 0.93 mm³	Combined gas (VOCs), absolute pressure (p), ambient humidity (h) and temperature (T) sensor	• 4-in-1: All environmental parameters in one device • BME680/688 Software (BSEC) suite provides many air quality outputs with compensation and simplifies gas sensor integration in devices • Application specific operation modes with current consumption down to 90 µA	0.15 µA in sleep mode 3.7 µA at 1 Hz (h,p,T) 0.09-12 mA for h,p,T, gas depending on operation mode	±15% ±15 IAQ s2s deviation ±3 % relative humidity ±0.6 hPa absolute accuracy pressure (300...1100 hPa, 0...65 °C) ±0.5 at 25 °C for T	0...500 IAQ (equivalent to 0.2...20 mg/m³ TVOC levels) T: -40...85 °C p: 300...1100 hPa h: 0...100%
BME688	LGA 3.0 x 3.0 x 0.93 mm³	The same descriptions apply as for BME680 + Suitable for the detection of various additional gases (VSCs, carbon monoxide, hydrogen, etc.) + Differentiation between multiple gases + Artificial Intelligence	The same descriptions apply as for BME680 + BME AI-Studio tool enables customers to train the BME688 gas scanner on their specific application, like in home appliances, IoT products or smart home + BME688 development kit allows for testing and developing use cases based on temperature, humidity, barometric pressure and gas sensing	The same descriptions apply as for BME680 + 3.96 mA in standard gas scan mode (configuarable in AI-Studio between 0.1 - 12 mA)	±15% ±15 IAQ s2s deviation ±3 % relative humidity ±0.6 hPa absolute accuracy pressure (300...1100 hPa, 0..65°C) ±0.5°C absolute accuracy temperature (0...65°C)	0...500 IAQ (equivalent to 0.2...20 mg/m³ TVOC levels) T: -40...85 °C p: 300...1100 hPa h: 0...100%
BME690	LGA 3.0 x 3.0 x 0.93 mm³	The same descriptions apply as for BME688 + Suitable for high condensation applications	The same performance parameters apply as for BME688 + Align to WELL/RESET standards + Reduced power consumption for IAQ mode + BME690 shuttle board compatible to App board 3.1 for Proof of Concept and use case development	0.15 µA in sleep mode 0.05-12mA for p/h/T/gas depending on operation modes	±15% ±15 IAQ s2s deviation ±3% relative humidity ±0.6 hPa absolute accuracy pressure (300...1100 hPa, 0..65°C) ±0.5°C absolute accuracy temperature (0...65°C)	0...500 IAQ T: -40...85°C rH: 0...100% P: 300...1100 hPa

Particulate matter sensor

The BMV080 is the world's smallest PM (PM1, PM2.5 PM10) air quality sensor. It is a natural fit for ultra-compact Internet of Things (IoT) devices such as air quality monitors, smart thermostats, HVAC & air ventilation systems, smart air purifiers, and wearables to monitor local PM concentration in real-time to provide actionable data.



Product	Package	Description	Key performance parameters	Supply current	Accuracy	Measurement range
BMV080	4.4 x 3.0 x 3.0 mm³	World's smallest PM (PM1, PM2.5 PM10) air quality sensor	• Ultra-compact IoT devices • Maintenance-Free operations • Real-time monitoring because of ultra-compact lasers with integrated photodiodes	Typical peak current at 1 Hz ODR: <68 mA Sleep current: <30µA	Precision (typ.) ±10 µg/m³ @ 0 to 100 µg/m³ ±10% of measured value @ 101 to 1000 µg/m³	(operating) T: -10 to +40 °C (storage) T: -10 to +80 °C

OPTICAL

Display solutions

Bosch Sensortec´s optical microsystems provide complete, ready-to-use solutions based on microoptoelectromechanical systems (MOEMS). The MOEMS sensors enables always-in focus projection and flexible virtual touchscreens on every surface. The systems combine all hardware components as well as algorithms to integrate into customer devices as a standalone or an embedded solution.*

* These products are not yet in distribution.

ACOUSTIC

Acoustic microsystems

The internet of tomorrow will be mobile and audio based. TWS (true wireless system) earphones and other hearable devices are becoming key interfaces for the voice-controlled internet. Moving from typing and reading to speaking and listening will make our everyday lives easier - when communicating, navigating or researching. At the same time, the demands on sound quality are increasing. Our µSpeakers have what it takes in the rapidly evolving world of smart in-ear devices.*

* These products are not yet in distribution.

SOFTWARE & TOOLS

Software & tools

Bosch Sensortec provides you with intelligent software and helpful tools for more comfortable, customizable solutions: The Bosch Sensortec sensor fusion software is a complete 9-axis fusion solution. The software combines the measurements from 3-axis gyroscope, 3-axis geomagnetic sensor and a 3-axis accelerometer, to provide a robust absolute orientation vector. The sensor fusion software provides orientation information in form of quaternion or Euler angles. The algorithm fuses the sensor raw data in an intelligent way to improve each sensors output.

BSX lite/BSX

Bosch Sensortec's sensor fusion software BSX is a complete 9-axis fusion solution which combines the measurements from 3-axis gyroscope, 3-axis geomagnetic sensor and a 3-axis accelerometer to provide a robust absolute orientation vector. BSX features support for wide variety of applications including smartphones, wrist wearables, drones, home robots such as vacuum cleaners, AR/VR head mounted devices and gaming controllers. These virtual sensors are highly flexible and hence can be configured according to system architecture and target use case.
The BSXlite software is a feature reduced version of Bosch Sensortec's sensor fusion software. BSXlite provides dynamic and accurate orientation of the target platform. It is typically used to provide enhanced user experience for gaming, navigation systems, dead reckoning etc. BSXlite is available for download (after accepting the license agreements), and for the BSX full version software, please contact Bosch Sensortec directly.

Product	Key features									
	Axis remapping	Offset correction	Soft Iron Correction	Acceler-ometer calibration	Magnetometer calibration	Magnetic disortion check	Gyroscope calibration	9-axis orientation processing	Compass orienta-tion processing	Data fusion models
BSXlite (as web-download)	x	√	x	x	Classic: based on figure-of-eight motion	Basic	√	Basic	Basic (tilt compen-sation)	9-axis
BSX (full library) in BHI/BNO055	√	√	√	√	Classic advanced (fast calibration)	Advanced	√	Advanced	Advanced (adaptive filtering, tilt com-pensation)	9-axis & 6-axis (IMU, M4G, eCompass)

Product	Outputs									
	Acceleration	Magneto-meter	Gyroscope	Virtual gyro-scope (M4G)	Quater-nions	Orientation	Rotation matrix	Heading accuracy	Linear acceleration	Gravity
BSXlite (as web-download)	Raw	Raw, corrected	Raw, corrected	x	√	√ (unfiltered)	x	√	x	x
BSX (full library) in BHI/NO055	√	√	√	√	√	√	√	√	√	√

Product	Outputs			Output date rates (ODR)		
	Gestures	Step counter and step detector	Significant motion	Accelerometer	Magnetometer	Gyroscope
BSXlite (as web-download)	x	x (in BMI160 Hardware)	x (in BMI160 Hardware)	100 Hz	25 Hz	100 Hz
BSX (full library) in BHI/BNO055	√	√	√	Multiple data rates	Multiple data rates	Multiple data rates

Smart Connected Sensors - SCS

Smart Connected Sensors is the platform for full-body motion tracking that combines qualitative and quantitative movement feedback to provide guidance on physical performance. Usable for a wide range of use cases, from fitness and rehabilitation to gaming and AR/VR applications, it can assist you improving your movement results for a higher level of fun, health and experience.

Product	Key features		
	Hardware	Wearable reference design	Features & software
SCS	• BHI380: Ulrta-low power IMU-based smart sensor platform enabling multi-device sensor fusion: ARC EM4 CPU 8up to 3.6 CoreMark/MHz) • BMM350: Newest generation low-power magnetometer • BMP581: High performance barometric pressure sensor	• Small form factor wearable housing: 36 x 22.2 x 10 mm² • BHI380 sensor with possibility to add additional capabilities magnetometer (BMM350) to enable 9DoF and pressure sensor (BMP581) to enable accurate relative vertical distance measurement • BLE 5.3 for low power connectivity • External flash memory for logging and FW storage • Certified for all regions • Smart power management for long battery life up to 40 h • All hardware design files (PCB * housing) provided for reference	• Multi-device sensor fusion of up to 8 sensor nodes • Time-synchronization throughout entire network for all sensor nodes irrespective individual clocks • Time synchronization with 1 ms accuracy over 24 h, coming with minimal bandwidth, minimal power consumption and minimal memory overhead • Multi-device activity recognition and feedback using up to 8 sensor nodes simultaneously, easily scalable by custom gestures and patterns • Full body avatar based on 6 DoF inertial live data combining sensors of up to 8 sensor nodes • Joint-Angle information for complete body analysis • Raw sensor data stream via BLE with up to 50 Hz and up to 8 sensor nodes simultaneously • System coming with multiple easy-to-implement applica-tions based on body area networks

BME680/688 software (BSEC)

The Bosch Sensortec Environmental Cluster library (BSEC) provides higher-level signal processing and fusion for the BME680 and BME688. The library receives compensated sensor values from the sensor API.

The BSEC library is running on the device microcontroller to operate the BME680/BME688, to analyze the sensor data and to calculate all sensor outputs like ambient humidity, index for air quality or gas scan results. Additionally, the BME688 software can be configured by config strings generated by BME AI-Studio. Both BME680 and BME688 software offer a complete, easy to integrate software fusion solution out of one hand and thus eliminate the need for own fusion software development.

The BME AI-Studio software enables sensor configuration, data analysis & labelling, training and optimization of application-specific solutions. The software is designed very user-friendly and supports with a comprehensive documentation.

Product	Operating system	Key features	Operation modes	Software outputs	Link to website
BSEC library for BME680	Cortex-ARM, Cortex-A, AVR, ESP, MSP, Android, IAR, Rasperry Pi (+more on demand)	• Calculation of ambient air temperature, relative humidity, barometric pressure and index for air quality outside the device	• ULP mode (3.3 mHz) quick-ULP (0.33 Hz / 3.3 mHz) • LP mode (0.33 Hz) • HP mode (1 Hz)	Raw & compensated outputs for temperature, pressure, humidity and gas, IAQ, CO2-eq (ppm), bVOC-eq (ppm), gas (%), accuracy & stabilization status	
BSEC library for BME688	Same as above	• Same as above • Operate gas scan mode & AI-based model to directly output scan results • Can be configured with config string from BME AI-Studio	Same as above + gas scan mode (1/10.8 s in standard mode)	Same as above + gas scan results (%), intensity	
BME AI-Studio	Windows, Mac, and Linux	• Sensor configuration, data analysis & labelling, training and optimization of application-specific solutions • Comprehensive documentation	Gas scan mode can be defined & optimized on specific application	BSEC 2 .x config string to configure devices with trained AI model	

Application board 3.1

The application board 3.1 is a versatile and sensor independent development platform, enabling a fast and easy experience with Bosch Sensortec's sensors. As shuttle boards 3.0, a wide variety of Bosch Sensortec's sensors can be plugged into the application board's shuttle board socket. The combination of the application board 3.1 and shuttle board 3.0 can be used to evaluate the sensors and build prototypes to test use cases.

Application board 3.0

Our application board 3.0 is a versatile and sensor independent development platform, enabling a fast and easy experience with our sensors. The combination of the application board 3.0 and shuttle board 3.0 can be used to evaluate the sensors and build prototypes to test use cases. The application board is a closed system that can be used to configure sensor parameters and to plot and log the resulting sensor readings by means of PC based software (Desktop Development) and COINES.

The application boards can be used together with Bosch Sensortec the development desktop software, they allow to configure all sensor parameters and read-out, display and capture the data on the attached PC.

Development desktop software 2.1

The development desktop software 2.1 user interface offers the possibility to configure sensor parameters of the Bosch Sensortec sensors and allows for data logging of the measured sensor signals. Its user interface displays the sensor signals and sensor interrupt signals in various graphical formats.

COINES

COINES ("COmmunication with INertial and Environmental Sensors") is a software package that provides a low-level interface to Bosch Sensortec's application board 3.X. The COINES library package contains the source code of sample applications and SensorAPI. The software can be used to see how to use the SensorAPI in an embedded and native environment and allows convenient prototyping and data logging. COINES is intended for experienced embedded software developers with good knowledge of the programming language C and the appropriate build tools. The user can access Bosch Sensortec's MEMS sensors through a C interface and modify, compile and run the sample applications. COINES can be used with the SensorAPI of the sensor. The SensorAPI is available at https://github.com/BoschSensortec.

Source code of sample applications and SensorAPI are provided with the COINES library as a package. The user can modify, compile and run the sample applications.

Arduino Nicla Sense ME

The versatile Arduino Nicla Sense ME featuring Bosch Sensortec sensors is a robust development board that enables users to develop smart sensing applications. Embedded in the Arduino-ecosystem, the tool comes with a simple and clear programming structure that is easy-to-use for enthusiasts, yet flexible enough for advanced users. The unique combination of highly integrated sensors on the board, including 9DoF smart motion and 4DoF environmental sensors with AI capabilities, allow a broad range of applications to address the different segments of the IoT market. The tool is ultra-compact, power-saving and suitable for rapid prototyping and deployment.

Bosch Sensortec Community

Foster and accelerate innovative IoT applications

Bosch Sensortec offers an ideation community to customers, partners, developers and makers to learn about sensing solutions and to accelerate the development of innovative IoT applications. The Bosch Sensortec Community provides useful information, best practice advice and allows developers to share their experience with others

MEMS sensors forum

The forum is intended for developers, customers, partners and makers using Bosch Sensortec's sensing solutions. Ask your questions, share your ideas, and exchange with experts.

Knowledge base

The knowledge base is intended for developers, customers, partners and makers using Bosch Sensortec's sensing solutions.

Join our Bosch Sensortec Community now!

Discuss, share and learn about sensor solutions by Bosch Sensortec.

LET’S GET IN TOUCH

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Version 17.0 | Published in February 2025