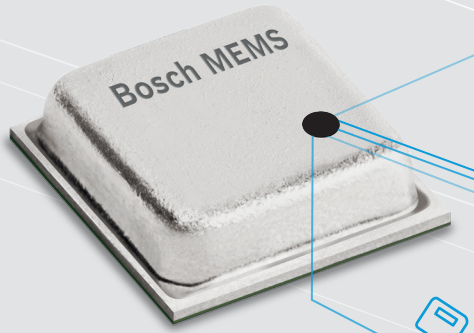


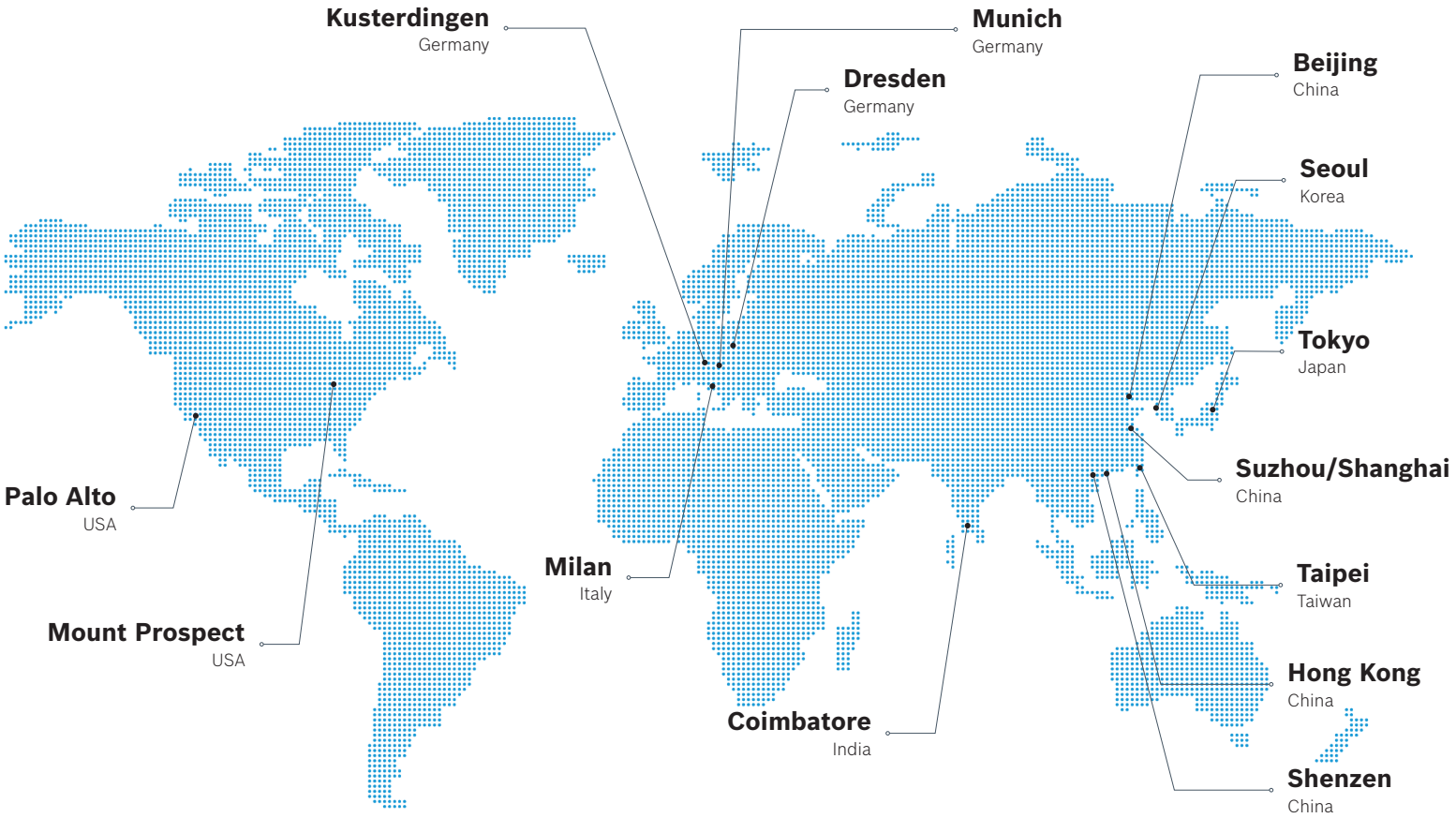
BOSCH SENSORTEC
MEMS SENSORS AND
SOLUTIONS

Sensing our world

PRODUCT OVERVIEW

BOSCH
Invented for life

Bosch Sensortec – Worldwide presence

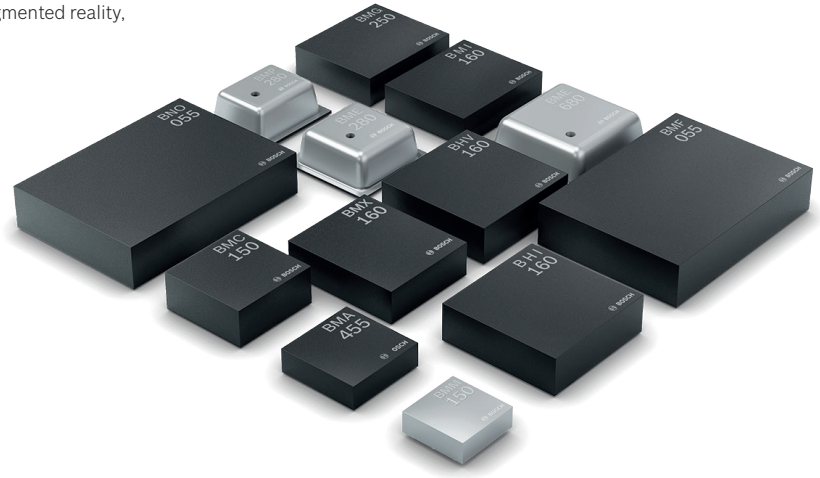


Bosch Sensortec – At the core of everyday life

Our **broad and unique** component, software and system offerings make us **your preferred partner**

Inertial Sensors

Bosch Sensortec's portfolio of motion sensors includes gesture and motion-based products. 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.



Smart Sensors

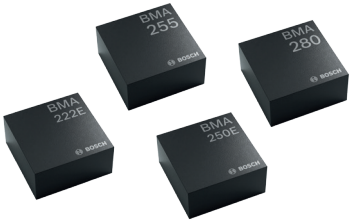
This product category contains the family of intelligent sensor hubs specifically designed for always-on sensor applications in smartphones, wearables and tracking devices. It offers you a flexible, low-power solution for motion sensing and sensor data processing. Additionally, the family of Application Specific Sensor Nodes (ASSNs) provides you an intelligent 9-axis "Absolute Orientation Sensor", including an accelerometer, gyroscope, magnetometer and a microcontroller running the BSX sensor fusion in a single package. ASSNs are designed as a turnkey solution for applications such as robotics, drones, virtual reality and other industrial applications.

Environmental Sensors

Bosch Sensortec's family of environmental sensors includes barometric pressure sensors, as well as integrated environmental sensors. These integrated environmental sensors combine barometric pressure, humidity and ambient air temperature sensing functions. Environmental sensors are ideally suited for sport & fitness monitoring, weather forecast, home automation control, Internet of Things, GPS-enhancement and indoor navigation.

Acceleration Sensors

The BMA is an advanced, ultra-small, triaxial, low-g acceleration sensor with digital interfaces, targeted for low-power applications. Featuring different digital resolutions (8 bit, 10 bit, 12 bit and 14 bit), the BMA family allows for very low-noise measurement of accelerations 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.



Product	Digital resolution	Range and sensitivity	Zero-g offset (typ.)	Noise density (typ.)	Bandwidths	Interfaces	Temperature range	Supply voltage	LGA package (mm^3)	Power
BMA222E	8 bit	±2 g: 64 LSB/g ±4 g: 32 LSB/g ±8 g: 16 LSB/g ±16 g: 8 LSB/g	±100 mg	600 µg/√Hz	8 Hz ... 1000 Hz	SPI & I^2C, 2 × digital interrupt pins	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.2 ... 3.6 V	2.0 × 2.0 × 0.95	Full operation 130 µA (@ 2 kHz data rate) Low-power mode 6.5 µA (@ 40 Hz data rate)
BMA250E	10 bit	±2 g: 256 LSB/g ±4 g: 128 LSB/g ±8 g: 64 LSB/g ±16 g: 32 LSB/g	±80 mg	400 µg/√Hz	8 Hz ... 1000 Hz	SPI & I^2C, 2 × digital interrupt pins	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.2 ... 3.6 V	2.0 × 2.0 × 0.95	Full operation 130 µA (@ 2 kHz data rate) Low-power mode 6.5 µA (@ 40 Hz data rate)
BMA255	12 bit	±2 g: 1024 LSB/g ±4 g: 512 LSB/g ±8 g: 256 LSB/g ±16 g: 128 LSB/g	±60 mg	150 µg/√Hz	8 Hz ... 1000 Hz	SPI & I^2C, 2 × digital interrupt pins	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.2 ... 3.6 V	2.0 × 2.0 × 0.95	Full operation 130 µA (@ 2 kHz data rate) Low-power mode 6.5 µA (@ 40 Hz data rate)
BMA280	14 bit	±2 g: 4096 LSB/g ±4 g: 2048 LSB/g ±8 g: 1024 LSB/g ±16 g: 512 LSB/g	±50 mg	120 µg/√Hz	8 Hz ... 500 Hz	SPI & I^2C, 2 × digital interrupt pins	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.2 ... 3.6 V	2.0 × 2.0 × 0.95	Full operation 130 µA (@ 2 kHz data rate) Low-power mode 6.5 µA (@ 40 Hz data rate)

Gyroscopes

The BMG is an ultra-small, digital 3-axis angular rate sensor with a measurement range up to 2000 °/s and a digital resolution of 16 bit. The BMG family allows low-noise measurement of angular rates in three perpendicular axes and is designed for use in smartphones, handhelds, computer peripherals, man-machine interfaces, virtual reality features, remote and game controllers.

Product	Digital reso-lution	Range and sensitivity	Zero-g offset (typ., over life-time)	Zero-rate offset over tempera-ture	Noise density (typ.)	Date rates (program-mable)	Interfaces	Tempera-ture range	Supply voltage	LGA package (mm³)	Power
BMG160	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131.2 LSB/°/s ±500 °/s: 65.5 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±1 °/s	0.015 °/s/K	0.014 °/s/√Hz	2000, 1000, 400, 200, 100 Hz	SPI, I²C, 2 × digital interrupts	–40 ... +85 °C	VDD: 2.4 ... 3.6 V VDDIO: 1.2 ... 3.6 V	3.0 × 3.0 × 0.95	Full operation: 5.0 mA Suspend mode: 5 µA
BMG250	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131.2 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±3 °/s	0.05 °/s/K	0.007 dps/√Hz	25 ... 3.200 Hz for UI IF 6.400 Hz for OIS/EIS IF	For primary UI IF: I²C up to 1 MHz 3w / 4w SPI 2 × digital interrupts for se-condary OIS/EIS IF: 3w SPI up to 10 MHz	–40 ... +85 °C	VDD: 1.7 ... 3.6 V VDDIO: 1.2 ... 3.6 V	2.5 × 3.0 × 0.8	Full operation: 850 µA Suspend mode: 3 µA

Geomagnetic Sensors

The BMM is a low-power and low-noise 3-axis digital geomagnetic sensor to be used in compass applications, which include virtual reality, gaming and navigation on devices such as smartphones, tablets and robotics requiring magnetic heading information.

Product	Digital resolution	Zero-B offset	Magnetic range (typ.)	Digital interfaces	Temperature range	Average current consumption	Package (mm³)	Supply voltage
BMM150	0.3 µT	±40 µT	±1300 µT (x,y-axis) ±2500 µT (z-axis)	I²C and SPI (2 interrupt pins)	–40 ... +85 °C	170 µA (low-power preset) 500 µA (normal mode)	CSWLP- (12 pin) 1.56 × 1.56 × 0.6	VDD: 1.62 ... 3.6 V VDDIO: 1.2 ... 3.6 V

eCompass

The BMC is an extremely small low-power and low-noise 6-axis digital compass. It measures the earth's geomagnetic field, as well as dynamic and static acceleration in all three dimensions and outputs tilt-compensated heading or orientation information. Due to its small package size and its advanced power management, the BMC is ideally suited for navigation applications or motion tracking in handheld devices like smartphones, tablets, notebooks, man-machine interfaces and game controllers.

Product	Acceleration				
	Digital resolution	Range	Sensitivity	Zero-g offset (typ.)	Noise density (typ.)
BMC150	12 bit	±2 g ±4 g ±8 g ±16 g	±4 %	±80 mg	150 µg/√Hz
BMC156	12 bit	±2 g ±4 g ±8 g ±16 g	±4 %	±80 mg	150 µg/√Hz

Product	Geomagnetic						
	Digital resolution	Range	Temperature range	Supply voltage	Digital inputs/outputs	Power consumption	LGA package (mm³)
BMC150	0.3 µT	±1300 µT (x-,y-axis) ±2500 µT (z-axis)	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.20 ... 3.6 V	I²C, SPI (3/4wire) 1 interrupt pin (accel) 1 data ready pin (magnet)	Full operation: 540 µA @10 Hz Low-power mode: 190 µA @10 Hz	2.2×2.2×0.95
BMC156	0.3 µT	±1300 µT (x-,y-axis) ±2500 µT (z-axis)	–40 ... +85 °C	VDD: 1.62 ... 3.6 V VDDIO: 1.20 ... 3.6 V	I²C, SPI (3/4wire) 1 interrupt pin (accel) 1 data ready pin (magnet)	Full operation: 540 µA @10 Hz Low-power mode: 190 µA @10 Hz	2.2×2.2×0.95

Inertial Measurement Units

The BMI allows very low-noise measurement of angular rates and accelerations in three perpendicular axes and thus senses tilt, motion, shock and vibration in smartphones, handheld devices, computer peripherals, man-machine interfaces, remote and game controllers.

Product	Acceleration			
	Digital resolution	Range and sensitivity	Zero-g offset (typ.)	Noise density (typ.)
BMI055	12 bit	±2 g: 1024 LSB/g ±4 g: 512 LSB/g ±8 g: 256 LSB/g ±16 g: 128 LSB/g	±70 mg	150 µg/√Hz
BMI160	16 bit	±2 g: 16384 LSB/g ±4 g: 8192 LSB/g ±8 g: 4096 LSB/g ±16 g: 2048 LSB/g	±40 mg	180 µg/√Hz

Product	Gyroscope								
	Digital resolution	Range and sensitivity	Zero-g offset (typ.)	Noise density (typ.)	Temperature range	Supply voltage	Digital inputs/ outputs	Power consumption	LGA package (mm^3)
BMI055	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131.2 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±1 °/s	0.014 °/s/√Hz	–40 ... +85 °C	VDD: 2.4 ... 3.6 V VDDIO: 1.2 ... 3.6 V	SPI, I^2C, 4 × digital interrupts	Full operation: 5.15 mA Suspend mode: 6 µA	3.0 × 4.5 × 0.95
BMI160	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131.2 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±10 °/s	0.007 °/s/√Hz	–40 ... +85 °C	VDD: 1.71 ... 3.6 V VDDIO: 1.2 ... 3.6 V	SPI, I^2C, 4 × digital interrupts	Full operation: 950 µA Suspend mode: 3 µA	2.5 × 3.0 × 0.8

Absolute Orientation Sensors

The BMX is a small, 9-axis sensor, consisting of a triaxial acceleration sensor, a triaxial gyroscope and a triaxial geomagnetic sensor. The BMX allows accurate measurement of angular rate and magnetic fields in three perpendicular axes within one device. With its ultra-small footprint, the BMX is unique in the class of low-noise 9-axis measurement units. The BMX is designed for motion detection applications, such as device orientation measurement, gaming, human machine interfaces, wearables, AR/VR and robotics.

Product	Acceleration				Gyroscope			
	Digital resolution	Range and sensitivity	Zero-g offset (typ.)	Noise density (typ.)	Digital resolution	Range and sensitivity	Zero-g offset (typ.)	Noise density (typ.)
BMX055	12 bit	±2 g: 1024 LSB/g ±4 g: 512 LSB/g ±8 g: 256 LSB/g ±16 g: 128 LSB/g	±70 mg	180 µg/√Hz	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131.2 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±1 °/s	0.008 °/s/√Hz
BMX160*	16 bit	±2 g: 16384 LSB/g ±4 g: 8192 LSB/g ±8 g: 4096 LSB/g ±16 g: 2048 LSB/g	±40 mg	180 µg/√Hz	16 bit	±125 °/s: 262.4 LSB/°/s ±250 °/s: 131 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s	±3 °/s	0.007 °/s/ √Hz

Product	Geomagnetic							
	Resolution	Range	Offset	Temperature range	Supply voltage	Digital inputs/ outputs	Power consumption	LGA package (mm³)
BMX055	0.3 µT	±1200 µT (x,y), ±2500 µT (z)	±40 µT	–40 ... +85 °C	VDD: 2.4 ... 3.6 V VDDIO: 1.2 ... 3.6 V	I²C/SPI interface	Full operation: Gyro. + Acc. + Geomag. 1585 µA Suspend mode: 7 µA	3.0×4.5×0.95
BMX160*	0.3 µT	±1300 µT (x,y axis), ±2500 µT (z axis)	±2 µT	–40 ... +85 °C	VDD: 1.71 ... 3.6 V VDDIO: 1.2 ... 3.6 V	I²C/SPI interface	Full operation: Gyro. + Acc. + Geomag. 1585 µA Suspend mode: 7 µA	2.5×3.0×0.95

* Product is coming soon. Data and specification are preliminary and subject to change without notice.

Application Specific Sensor Nodes (ASSNs)

The ASSN is a System-in Package (SiP) solution, integrating a triaxial 14 bit accelerometer, triaxial 16 bit gyroscope, a triaxial geomagnetic sensor and a 32 bit cortex M0+ microcontroller. The ASSNs are suitable for applications such as robotics, augmented and virtual reality, drones, gaming, as well as other industrial applications.

Product	Acceleration	Gyroscope	Geomagnetic	Hardware	Fusion SW	Power consumption	Interfaces	Voltage	Temperature range	Package size (mm³)
BMF055	14 bit	16 bit	±1300 µT (x,y-axis) ±2500 µT (z-axis)	ARM Cortex M0+	no		I²C UART HID-I2C	VDD 2.4 ... 3.6 V VDDIO: 1.7 ... 3.6 V	–40 ... +85 °C	3.8×5.2×1.13
BNO055	14 bit	16 bit	±1300 µT (x,y-axis) ±2500 µT (z-axis)	ARM Cortex M0+	yes	Suspend mode: 40 µA 9DOF @100Hz Output data rate: 12.3 mA	I²C UART HID-I2C	VDD 2.4 ... 3.6 V VDDIO: 1.7 ... 3.6 V	–40 ... +85 °C	3.8×5.2×1.13

Smart Hubs

The smart sensor hub is a small, low-power smart-hub with an integrated IMU and a triaxial accelerometer plus a programmable microcontroller containing pre-installed software and specific algorithms for activity recognition, it is specifically designed to enable always-on motion sensing. It perfectly matches the requirements of smartphones, wearables or any other application which demands highly accurate, real-time motion data at a very low-power consumption level.

Product	Acceleration	Gyro-scope	Geomagnetic	Integrated MCU	Integrated SW & Algos	Power consumption (including MCU)	Inter-faces	Supply voltage	Temperature range	Package size (mm³)
BHA250	14 bit	n/a	Ready for p&p hub-connectivity of BMM150, AK09911, AK09912, YAS532	32 bit floating-point ARC EM4 MCU running at 10 MHz. 96 kByte ROM 48 kByte RAM	BSX fusion Activity recognition Gesture recognition Step detector Step counter	Suspend mode: 11 µA Hub+Acc @100 Hz ODR: 430 µA	I²C up to 3.4 MBit/s 3×GPIO, 1×Host-INT	VDD: 1.71 ... 3.6 V VDDIO: 1.20 ... 3.6 V	–40 ... +85 °C	2.2×2.2 ×0.95
BHI160	16 bit	16 bit	Ready for p&p hub-connectivity of BMM150, AK09911, AK09912, YAS532	32 bit floating-point ARC EM4 MCU running at 10 MHz. 96 kByte ROM 48 kByte RAM	BSX fusion Activity recognition Gesture recognition Step detector Step counter	Suspend mode: 11 µA Hub+IMU @100 Hz ODR: 1.2 mA	I²C up to 3.4 MBit/s 3×GPIO, 1×Host-INT	VDD: 1.71 ... 3.6 V VDDIO: 1.20 ... 3.6 V	–40 ... +85 °C	3.0×3.0 ×0.95

Barometric Pressure Sensors

The BMP280 is an absolute barometric pressure sensor especially designed for mobile applications. The sensor module is housed in an extremely compact package. Its small dimensions and low-power consumption allow for the implementation in battery powered devices such as smartphones, GPS modules, wearables, drones and tracking systems.

Product	Operation range	Relative accuracy 300 ... 1050 hPa (Temperature = 0 ... +65 °C)	Absolute accuracy p = 950 ... 1050 hPa (+25 °C)	Power consumption	Supply voltage	Noise	Long term stability (1 yrs)	TCO	Interface	Package dimensions (mm³)
BMP280	0300 ... 1100 hPa	±0.12 hPa (±1 m)	±1 hPa (typical)	2.74 µA, typical (ultra-low power mode) sleep mode: 0.1 µA	VDDIO: 1.2 ... 3.6 V VDD: 1.71 ... 3.6 V	1.3 Pa	±1 hPa	±1.5 Pa/K	I²C and SPI	8-Pin LGA with metal 2.0 × 2.5 × 0.95

Integrated Environmental Units

The BME280 is an integrated environmental sensor developed specifically for mobile applications where size and low-power consumption are key design constraints. The unit combines individual high linearity, high accuracy sensors for pressure, humidity and temperature.

Product	Humidity				Pressure				Interface	Power	Package dimensions (mm³)
	Range	Response time (τ 63 %):	Accuracy tolerance	Hysteresis:	Range	RMS noise	TCO	Relative accuracy			
BME280	0 ... 100 % rH	1 s	±3 % relative humidity	≤2 % relative humidity	300 ... 1100 hPa	0.2 Pa (equiv. to 1.7 cm)	±1.5 Pa/K	±0.12 hPa (±1 m)	I²C and SPI	Sleep mode 0.1 µA −1.8 µA @ 1 Hz (H, T) −3.6 µA @ 1 Hz (H, P, T)	2.5 × 2.5 × 0.93

Bosch Sensortec GmbH
Headquarters

Gerhard-Kindler-Strasse 9
72770 Reutlingen, Germany
Telephone +49 7121 3535-900

www.bosch-sensortec.com
twitter.com/boschMEMS