

BMP280

Digital, barometric pressure sensor

Bosch Sensortec



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General description

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 its low power consumption allow for the implementation in battery driven devices such as mobile phones, GPS modules or watches.

As its predecessor BMP180, the BMP280 is based on Bosch's proven piezo-resistive pressure sensor technology featuring high accuracy and linearity as well as long term stability and high EMC robustness.

Numerous device operation options offer highest flexibility to optimize the device regarding power consumption, resolution and filter performance. A tested set of default settings for example use case is provided to the developer in order to make design-in as easy as possible.

Technology and specification

The sensor module is housed in an extremely compact 8-pin metal-lid LGA package with a footprint of only $2.0 \times 2.5 \text{ mm}^2$ and 0.95 mm package height. Its small dimensions and its low power consumption of $2.74 \mu\text{A}$ @1Hz allow the implementation in battery driven devices.

The emerging applications of in-door navigation, health care as well as GPS refinement require a high relative accuracy and a low TCO at the same time.

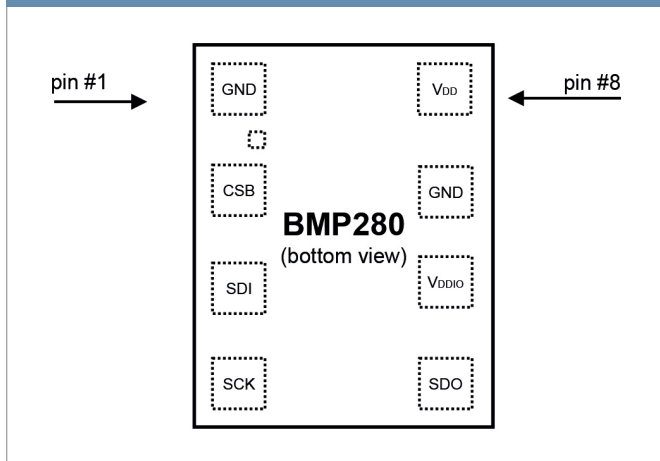
The BMP280 is perfectly suitable for applications like floor level detection since the sensors features excellent relative accuracy of $\pm 0.12 \text{ hPa}$, which is equivalent to $\pm 1 \text{ m}$ difference in altitude, and an offset temperature coefficient (TCO) of only 1.5 Pa/K (equivalent to 12.6 cm/K). As the successor of the widely implemented BMP180, which initially enabled barometric pressure measurement in high volumes in mobile handsets in 2011, BMP280 achieves high performance in all applications requiring a precise pressure measurement. At the same time BMP280 features more application flexibility, new filter modes and SPI interface besides the shrinkage of footprint by 63% with respect to BMP180.

Technical data	BMP280 (prelim.)
Package dimensions	8-Pin LGA with metal $2.0 \times 2.5 \times 0.95 \text{ mm}^3$
Operation range (full accuracy)	Pressure: 300...1100 hPa Temperature: 0...+65°C
Supply voltage V_{DDIO}	1.2 ... 3.6V
Supply voltage V_{DD}	1.71 ... 3.6V
Interface	I ² C and SPI
Average current consumption (typ.) (1Hz data refresh rate)	$2.74 \mu\text{A}$ (ultra-low power mode)
Average current consumption in sleep mode	$0.1 \mu\text{A}$
Average measurement time	5.5msec (ultra-low power preset)
Resolution of data	Pressure: 0.18 Pa (equiv. to <10 cm) Temperature: 0.01 K
Absolute accuracy $p=950 \dots 1100 \text{ hPa}$ ($T=0 \dots +65^\circ\text{C}$)	$\sim \pm 1 \text{ hPa}$
Relative accuracy pressure (typ.) $p=950 \dots 1050 \text{ hPa}$ (+25°C)	$\pm 0.12 \text{ hPa}$ (equiv. to $\pm 1 \text{ m}$)
Temperature coefficient offset (+25°...+40°C @900hPa)	1.5 Pa/K (equiv. to 12.6 cm/K)

BMP280 target applications

- ▶ Enhancement of GPS navigation (e.g. time-to-first-fix improvement, dead-reckoning, slope detection)
- ▶ Indoor navigation (floor detection, elevator detection)
- ▶ Outdoor navigation, leisure and sports applications
- ▶ Weather forecast
- ▶ Health care applications (e.g. spirometry)
- ▶ Vertical velocity indication (e.g. rise/sink speed)

Pin configuration and dimensions (bottom)



Sensor operation

The BMP280 features I²C and SPI (3-wire/4-wire) digital, serial interfaces.

The sensor can be operated in two power modes: The normal mode and the forced mode. In normal mode the sensor automatically cycles between a measurement and a standby period. This mode is recommended when using BMP280 built-in IIR filter when short-term disturbances (e.g. blowing into the sensor) need to be filtered. In forced mode the sensor performs a single measurement on request and returns to sleep mode afterwards. This mode is recommended for applications which require low sampling rate or host-based synchronization.

Internal oversampling rates for pressure and temperature measurement can be selected independently between 1, 2, 4, 8 and 16 times oversampling. In combination with several short term disturbance filter settings, sensor can be programmed in a very flexible way in order to adapt to application and power management requirements.

For easy design-in default settings are provided to the developer, which are optimized to several example use-cases for barometric pressure sensors like weather monitoring, elevator / stair case detection, drop detection or indoor-navigation.

Pin No.	Name	Function
1	GND	Ground
2	CSB	Chip select
3	SDI	Serial data
4	SCK	Serial clock input
5	SDO	Serial data output
6	V _{DDIO}	Digital Interface supply
7	GND	Ground
8	V _{DD}	Analogue supply

Software

The Altitude Content Provider ACP2.0 software is available as software package for BMP280 in order to calculate the altitude with best possible accuracy. The ACP2.0 uses the sea level pressure to calculate the altitude, compensating for the non-sphericallity of the earth by geoid correction and compares its altitude with current altitude given by the GPS module, if available.

System compatibility

The BMP280 has been designed for best possible fit into modern mobile consumer electronics devices.

Besides the ultra-small footprint and very low power consumption, the BMP280 has very wide ranges for V_{DD} and V_{DDIO} supply voltages.

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