

BMP390

High-performance barometric pressure sensor

GENERAL DESCRIPTION

Bosch Sensortec is the market leader in barometric pressure sensors with more than one billion shipped products. The BMP390 is a very small, low-power and low-noise 24-bit absolute barometric pressure sensor. The digital, high-performance sensor is ideally suited for a wide range of altitude tracking applications. This new BMP390 pressure sensor offers outstanding design flexibility, providing a single package solution that customers can easily integrate into a multitude of existing and upcoming devices such as smartphones, GPS modules, wearables, hearables and drones.

BMP390 TARGET APPLICATIONS

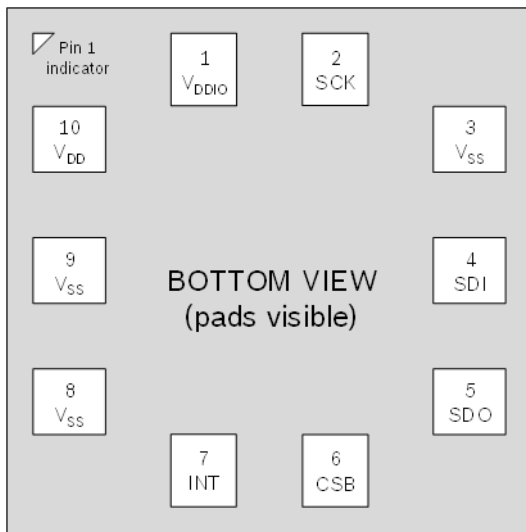
- ▶ Unprecedented precision to indoor navigation and localization applications, e.g. in smartphones for floor level detection in case of emergency calls (E-911)
- ▶ Enhancing GPS accuracy outdoors for improved navigation and localization
- ▶ Improved accuracy of calorie expenditure measurement in wearables, hearables and mobile devices
- ▶ Altitude stabilization in drones

The BMP390 is much more accurate than its predecessors, covering a wide measurement range from 300 hPa to 1250 hPa. This barometric pressure sensor exhibits an attractive price-performance ratio coupled with low power consumption. It is available in a compact 10-pin 2.0 x 2.0 x 0.75 mm³ LGA package with metal lid. The BMP390 is ideally suited for mobile applications that require very high performance and low power. The new interrupt functionality provides simple access to data and storage. Examples of interrupts that can be issued in a power efficient manner without using software algorithms include data ready interrupt, watermark interrupt (on byte level) or FIFO full interrupt.

BMP390 also includes a FIFO functionality. This greatly improves ease of use while helping to reduce power consumption of the overall device system during full operation. The integrated 512 byte FIFO buffer supports low power applications and prevents data loss in non-real-time systems.

TECHNICAL SPECIFICATIONS

BMP390 technical data	
Package dimensions	10-pin LGA with metal lid 2.0 x 2.0 x 0.75 mm ³
Operating range (full accuracy)	Pressure: 300 ... 1250 hPa
Supply voltage V_{DDIO}	1.2 V ... 3.6 V
Supply voltage V_{DD}	1.65 V ... 3.6 V
Interface	I ² C and SPI
Average typical current consumption (1 Hz data rate)	3.2 μ A at 1 Hz
Absolute accuracy P=300 hPa ... 1100 hPa (T=0 °C ... 65 °C)	± 0.50 hPa
Relative accuracy Pressure (typ.) p=700 hPa ... 1100 hPa (T=25 °C ... 40 °C)	± 0.03 hPa (equivalent to ± 25 cm)
RMS noise in pressure lowest bandwidth, highest resolution	0.02 Pa
Temperature coefficient offset (25 °C ... 40 °C at 900 Pa)	± 0.6 Pa/K
Long-term stability (12 months)	± 0.16 hPa
Solder drift	$< \pm 0.8$ hPa
Maximum sampling rate	200 Hz



Pin configuration

TECHNICAL SPECIFICATIONS

Pin	Name	Description
1	V _{DDIO}	Digital interface supply
2	SCK	Serial clock input
3	V _{SS}	Ground
4	SDI	Serial data input
5	SDO	Serial data output
6	CSB	Chip select
7	INT	INT output
8	V _{SS}	Ground
9	V _{SS}	Ground
10	V _{DD}	Analog supply

The sensor module is housed in an extremely compact 10-pin metal-lid LGA package with a footprint of only 2.0 mm x 2.0 mm and 0.75 mm package height. Its small dimensions and its very low power consumption of 3.2 μ A at 1Hz allow the implementation in battery driven devices.

The BMP390 is perfectly suited for applications like floor level detection as well as improved accuracy for calorie expenditure measurement in wearables and mobile devices. These applications are enabled by the sensor's excellent relative accuracy of ± 0.03 hPa, which is equivalent to ± 25 cm difference in altitude, and a temperature coefficient offset (TCO) of only 0.6 Pa/K. BMP390 is the successor of the widely implemented

BMP388 and achieves much higher performance in all applications requiring a precise air pressure measurement.

SENSOR OPERATION

The BMP390 features I²C and SPI (3-wire/4-wire) digital, serial interface. The sensor can be operated in three power modes: The sleep mode, the normal mode and the forced mode. In sleep mode, no measurements are performed. Normal mode comprises an automated perpetual cycling between an active measurement period and an inactive standby period. In forced mode, a single measurement is triggered. When the measurement is finished, the sensor returns to sleep mode.

A set of oversampling settings is available ranging from ultra-low power to highest resolution setting in order to adapt the sensor to the target application. The settings are predefined combinations of pressure measurement oversampling and temperature measurement oversampling which can be selected independently from 0 to 32 times oversampling:

- ▶ Temperature measurement
- ▶ Ultra-low power
- ▶ Low power
- ▶ Standard resolution
- ▶ High resolution
- ▶ Ultra-high resolution
- ▶ Highest resolution

BMP390 is equipped with a built-in IIR filter in order to minimize short-term disturbances in the output data caused by the slamming of a door or window. The filter coefficient ranges from 0 (off) to 128.

SYSTEM COMPATIBILITY

Bosch Sensortec designed the BMP390 for best possible fit into consumer electronics devices. Besides the ultra-small footprint and very low power consumption, the BMP390 has very wide ranges for V_{DD} and V_{DDIO} supply voltages.

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