

# BMP581

## 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 BMP581 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. The BMP581 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 IoT or industrial products, GPS modules, wearables, hearables and drones.

The BMP581 is much more accurate than its predecessors, covering a wide measurement range from 300 hPa to 1250 hPa. The BMP581 is perfectly suitable for high-performance applications like fitness measurements with  $\pm 6$  Pa. This is equivalent to  $\pm 50$  cm difference in altitude, and an offset temperature coefficient (TCO) of 0.5 Pa/K.

It is compatible for use with other Bosch Sensortec sensors, including the BMI270 for better performance, robustness and stability. The new BMP581 sensor with its small footprint offers outstanding design flexibility, providing a single package solution that is easy to integrate into other existing and upcoming devices for smartphones, home appliances and wearables.

This new barometric pressure sensor exhibits an attractive price-performance ratio coupled with low power consumption.

### BMP581 TARGET APPLICATIONS

- ▶ Fitness and well-being in wearables and hearables
- ▶ Localization applications, e.g. in products for floor level detection in case of emergency calls (E-911)
- ▶ Indoor navigation and enhanced GPS accuracy outdoors for improved navigation and localization
- ▶ Water level detection
- ▶ Fall down detection

### SENSOR FEATURES

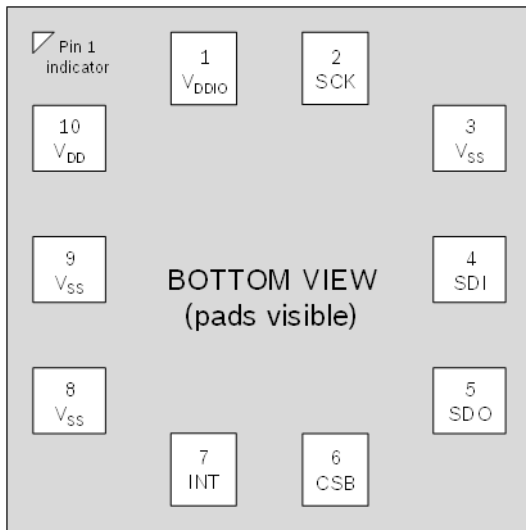
The new interrupt functionality provides simple access to data and storage. Examples of interrupts that can be used in a power efficient manner without using software algorithms include data ready interrupt, watermark interrupt (on byte level) or First In – First Out (FIFO) full interrupt.

BMP581 also includes a new 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

BMP581 Technical data	
Package dimensions	2.0 x 2.0 x 0.75 mm <sup>3</sup> metal lid LGA
Operating range (full accuracy)	Pressure: 300 ... 1250 hPa
Supply voltage V <sub>DDIO</sub>	1.2 V ... 3.6 V
Supply voltage V <sub>DD</sub>	1.65 V ... 3.6 V
Interface	I <sup>2</sup> C (up to 1.0 MHz), I <sup>3</sup> C, and SPI (3 and 4 wire, up to 10 MHz)
Average typical current consumption (1 Hz data rate)	1.3 $\mu$ A @ 1 Hz pressure and temperature, 0.5 $\mu$ A in deep standby mode
Absolute accuracy (typ.) P=300 hPa ... 1100 hPa (T=-5 °C ... 65 °C)	$\pm 30$ Pa
Relative accuracy Pressure (typ.) P=700 hPa ... 1100 hPa (T=15 °C ... 55 °C)	$\pm 6$ Pa, equiv. to $\pm 0.5$ m
Noise in pressure lowest bandwidth, highest resolution	0.08 Pa
Temperature coefficient offset (typ.) P=300 hPa ... 1100 hPa (T=-5 °C ... 65 °C)	$\pm 0.5$ Pa/K
Long-term drift (12 months)	$\pm 0.1$ hPa
Solder drift	0.3 hPa
Maximum sampling rate	480 Hz (continuous mode)

## Pin configuration



## Pin

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

The sensor module is housed in an extremely compact 10-pin metal-lid LGA package with a footprint of only 2.0 x 2.0 x 0.75 mm<sup>3</sup> package height. Its small dimensions and its lower power consumption of 1.3  $\mu$ A at 1 Hz allow the implementation in battery driven devices. The emerging applications in wearables, industrial areas and home appliances require a high relative accuracy and a low Total Cost of Ownership (TCO) at the same time.

The BMP581 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  $\pm 0.06$  hPa, which is equivalent to  $\pm 50$  cm difference in altitude, and a temperature coefficient offset (TCO) of only 0.5 Pa/K. for calorie consumption measurement accuracy in wearables as well.

## SENSOR OPERATION

BMP581 features an I<sup>2</sup>C, I<sup>3</sup>C and SPI (3-wire/4-wire) digital, serial interface.

The sensor operates in three power modes: sleep mode, normal mode and forced mode. In sleep mode, no measurements are being performed. The normal mode comprises an automated perpetual cycling between an active measurement period and an inactive standby period. In forced mode, a single measurement is being performed. 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. Pressure and temperature measurement oversampling 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

BMP581 is equipped with a built-in IIR filter in order to minimize short-term disturbances in the output data caused by for example the slamming of a door or window. The filter coefficient ranges from 0 (off) to 127.

## SYSTEM COMPATIBILITY

The BMP581 has been designed for the best possible fit into modern mobile consumer electronics devices. Besides the ultra-small footprint and very low power consumption, the BMP581 has very wide ranges for V<sub>DD</sub> and V<sub>DDIO</sub> supply voltages.

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