BME680
Integrated Environmental Unit

GENERAL DESCRIPTION

The BME680 is an integrated environmental sensor developed specifically for mobile applications and wearables where size and low power consumption are key requirements. Expanding Bosch Sensortec's existing family of environmental sensors, the BME680 integrates for the first time individual high linearity and high accuracy sensors for gas, pressure, humidity and temperature.

It consists of an 8-pin metal-lid 3.0 x 3.0 x 0.95 mm^3 LGA package which is designed for optimized consumption depending on the specific operating mode, long term stability, and high EMC robustness.

The gas sensor within the BME680 can detect a broad range of gases to measure indoor air quality for personal well being. Gases that can be detected by the BME680 include: Volatile Organic Compounds (VOC) from paints (such as formaldehyde), lacquers, paint strippers, cleaning supplies, furnishings, office equipment, glues, adhesives and alcohol.

The humidity sensor features a best-in-class response time supporting performance requirements for emerging applications such as context awareness, and high accuracy over a wide temperature range.

The pressure sensor is an absolute barometric pressure sensor featuring exceptionally high accuracy and resolution at very low noise.

The integrated temperature sensor has been optimized for very low noise and high resolution. It is primarily used for temperature compensation of the gas, pressure and humidity sensors, and can also be used for estimating ambient temperature.

The BME680 supports a full suite of operating modes which provides huge flexibility in optimizing the device for power consumption, resolution and filter performance.

Emerging applications such as home automation, indoor navigation, personalized weather stations and innovative sport and fitness tools require a gas sensor with quick response time, a pressure sensor with high relative accuracy and a low TCO, in combination with fast response, high accuracy, relative humidity and ambient temperature measurements. The BME680 is ideally suited for such barometer applications as the device features excellent relative accuracy of ±0.12 hPa (equivalent to ±1 m difference in altitude) and an offset temperature coefficient (TCO) of only 1.5 Pa/K (equivalent to 12.6 cm/K).

BME680 APPLICATIONS AND USE CASES

- ▶ Indoor air quality measurement
- ▶ Personalized weather station
- ▶ Context awareness, e.g. skin moisture detection, room change detection
- ▶ Fitness monitoring/well-being
  - − Warning regarding dryness or high temperatures
  - − Measurement of volume and air flow
- ▶ Home automation control (e.g. HVAC)
- ▶ GPS enhancement (e.g. time-to-first-fix improvement, dead reckoning, slope detection)
- ▶ Indoor navigation (change of floor detection, elevator detection)
- ▶ Altitude tracking and calories expenditure for sports activities

SENSOR OPERATION

The BME680 supports I^{2}C and SPI (3-wire/4-wire) digital, serial interfaces.

The sensor can be operated in three power modes: sleep mode, normal mode and forced mode.

In normal mode, the sensor automatically cycles between a measurement and a standby period. This mode is recommended when using BME680's 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.

In order to tailor data rate, noise, response time and current consumption to the needs of the user; a variety of oversampling modes, filter modes and data rates can be selected. By applying several short term disturbance filter settings, the sensor can be programmed in a very flexible way in order to adapt to application and power management requirements.

To simplify the design-in phase, default settings optimized for several example applications such as weather monitoring, elevator/staircase detection, drop detection or indoor-navigation are provided.
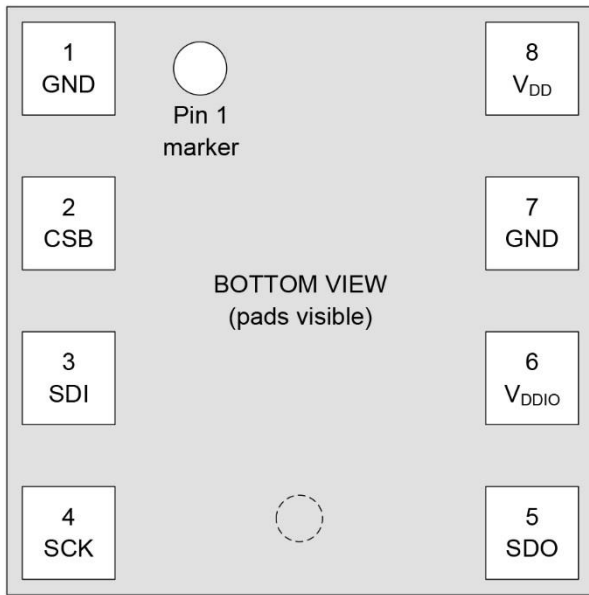
Pin configuration (bottom view)

SOFTWARE

The BME680 comes fully calibrated for all sensor components. For pressure calculation, Bosch Sensortec's Altitude Content Provider ACP2.0 software is available as a software package for BME680. It calculates the altitude with best possible accuracy. The ACP2.0 software uses the sea-level pressure to calculate the altitude, compensating for the non-sphericality of the earth by geoid correction, and compares its altitude with current altitude given by the GPS module, if available.

SYSTEM COMPATIBILITY

The BME680 has been designed for best possible fit into modern mobile consumer electronics devices. Besides the small footprint and low power consumption, the BME680 has very wide ranges for V_{DD} and V_{DDIO} supply voltages.
Bosch is the world market leader in MEMS sensors. The BME680 from Bosch Sensortec combines extensive experience with reliability for consumer applications.

TECHNICAL SPECIFICATIONS

Pin		
Pin	Name	Description
1	GND	Ground
2	CSB	Chip select
3	SDI	Serial data input
4	SCK	Serial clock input
5	SDO	Serial data output
6	V_{DDIO}	Digital/Interface supply
7	GND	Ground
8	V_{DD}	Analog supply

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公司名: 深圳市工采网络科技有限公司   地址: 广东省深圳市南山区高新南一道中国科技开发院3号楼16层
电话: + 86-755-83289036   传真: + 86-755-83289052   邮箱: sales@isweek.cn