HIGH-PERFORMANCE BAROMETRIC PRESSURE SENSOR BMP390

FOR SMARTPHONES, WEARABLES AND HEARABLES

BOSCH SENSORTEC

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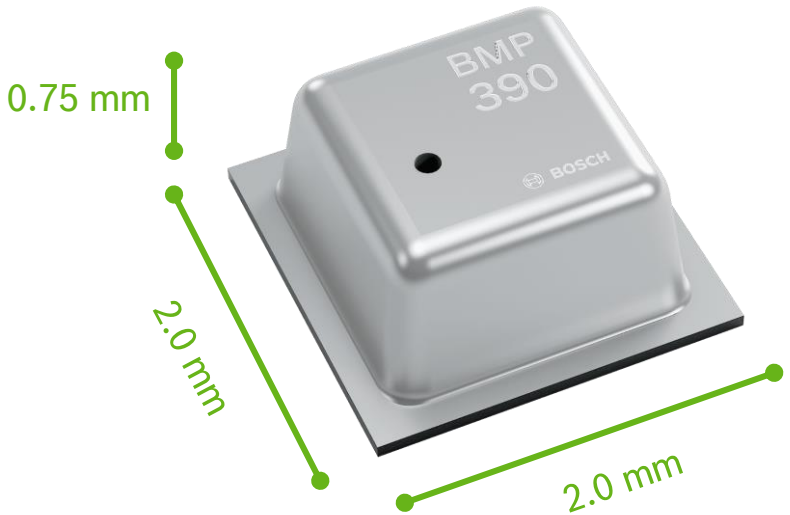
Barometric pressure sensor BMP390

High-performance pressure sensor for smartphones & wearables

- Best performance on the market due to unique accuracy and temperature stability
- Ideally suited for smartphones, hearables and wearables thanks to low package height
- Enables accurate indoor localization with smartphones in case of emergencies
- FCC estimates addition of vertical-specific information could save up to ten thousand lives per year



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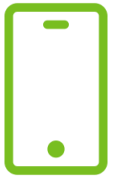
Devices and use cases

Target devices



Mobile devices:
smartphones and tablets

Wearable devices:
smartwatches and wristbands

Hearable devices:
earbuds and headphones

Use cases

Indoor localization and floor level detection (E911)

Enhanced GPS for improved outdoor navigation

Accurate fitness tracking and calorie expenditure estimation

Indoor navigation

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Invented for life
Indoor localization
Bosch Sensortec
Indoor localization with BMP390
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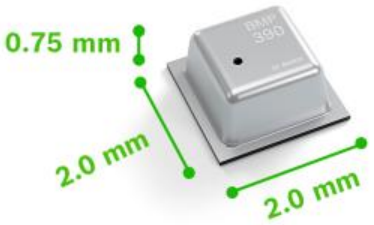
BMP390:
High-performance barometric pressure sensor for accurate altitude tracking applications such as enhanced emergency calls in smartphones



Indoor localization

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Indoor localization

The BMP390 is a high-performance barometric pressure sensor that is ideally suited for smartphones, hearables and wearables.

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Barometric pressure sensor BMP390
Indoor localization

Indoor localization

Problem

Rescue teams lack sufficient information about the caller's location, as calls are often made with smartphones from indoors, where traditional localization technologies do not work efficiently or fail completely (e.g. GPS).

Solution

- FCC requires wireless providers in the US to adopt a z-axis location accuracy metric of ±3 meters relative to the handset for 80 percent of indoor wireless 9-1-1 calls starting in 2021.
- Bosch and NextNav LLC, a 3D geolocation service provider, have created a solution that provides highly accurate z-axis capabilities indoors.
- Combining barometric pressure sensors inside smartphones with NextNav's Metropolitan Beacon System (MBS) z-axis service determines three-dimensional location and positioning for enhanced emergency calls (E911).

*Source: https://docs.fcc.gov/public/attachments/DOC-360516A1.pdf

The FCC estimates that the additional vertical information has the potential to save up to

10,000

lives per year just in the USA alone.*


Emergency room
Indoor localization
Did you know?
The Federal Communications Commission estimates that reducing response time by one minute has the potential to save up to 10,000 lives per year just in the USA alone.
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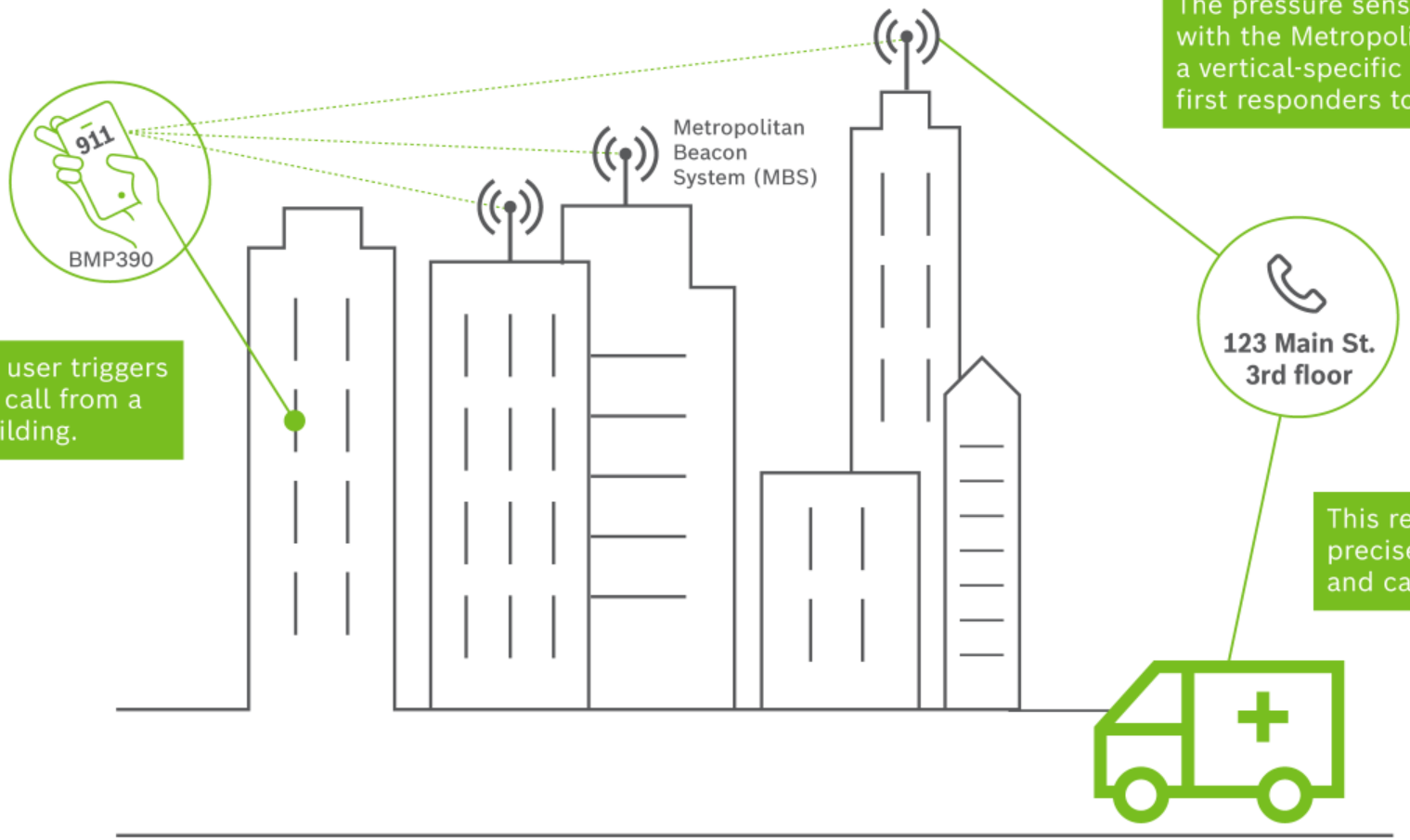
BMP390 enabling enhanced emergency calls

02

The pressure sensor BMP390 in combination with the Metropolitan Beacon System delivers a vertical-specific position, which enables first responders to determine the floor level.



01

A smartphone user triggers an emergency call from a multi-story building.

03

This reduces the time it takes to precisely locate an emergency call and can save thousands of lives.

Indoor localization

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Indoor localization

The BMP390 enables indoor localization for floor level detection in case of emergency calls, which helps to precisely locate a position within a mulity-story building.

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Barometric pressure sensor BMP390

The power of collaboration: Bosch and NextNav

Indoor localization

Picture: NextNav

- Bosch Sensortec and the startup NextNav work together since 2013.
- Together, they developed an innovative solution: a platform that localizes smartphones vertically and indoors by applying barometric pressure sensors and NextNav's MBS (Metropolitan Beacon System) technology.
- Rescue forces can identify the precise altitude position of people in buildings. This can save thousands of lives.
- NextNav and Bosch Sensortec are awarded with the "Open Bosch Award" for best startup collaboration.

"Innovation through collaboration is not only our history, it is also our future."

Dr. Michael Bolle, chief digital and technology officer at Bosch

Barometric pressure sensor BMP390

Location matters: accurate indoor localization with the BMP390

Watch the video to understand the benefits of BMP390 and how E911 works:

Bosch Sensortec YouTube channel

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Outdoor
navigation
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Barometric pressure sensor BMP390
Enhanced outdoor navigation

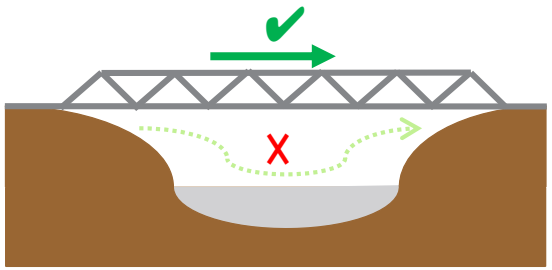
Outdoor navigation

Problem

Elevation services that use external databases are often inaccurate, as GPS and maps with height information follow the terrain and not necessarily the path the user took (e.g. in case of bridges).

Solution

Barometric pressure sensor enables altitude tracking to support accurate localization and navigation, e.g. in case of navigating through multi-level streets.



Information from GPS only: user goes through canyon

Information with BMP390: user takes bridge

The BMP390 can measure height changes below

10 cm

thanks to the improved resolution.

Fitness tracking

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Barometric pressure sensor BMP390
Fitness tracking

Fitness tracking

Problem

Standalone accelerometers estimate distances and cannot detect inclines or declines. This can result in wrong interpretation of data.

Solution

- Detecting inclines such as stairs and even small altitude changes, such as lifted weights during a fitness training session, increase the accuracy of fitness tracking.
- Enhancing GPS outdoors helps to calculate distances accurately.
- Hence, altitude tracking supports accurate fitness tracking, enabled by the barometric pressure sensors such as the BMP390.

A barometric pressure sensor such as the BMP390 helps to increase the precision of calorie tracking by up to

15%.*

*Souce: https://pdfs.semanticscholar.org/fecf/d7f13e68b3cd05a58d8fc92c4234844d8ad0.pdf

Indoor navigation

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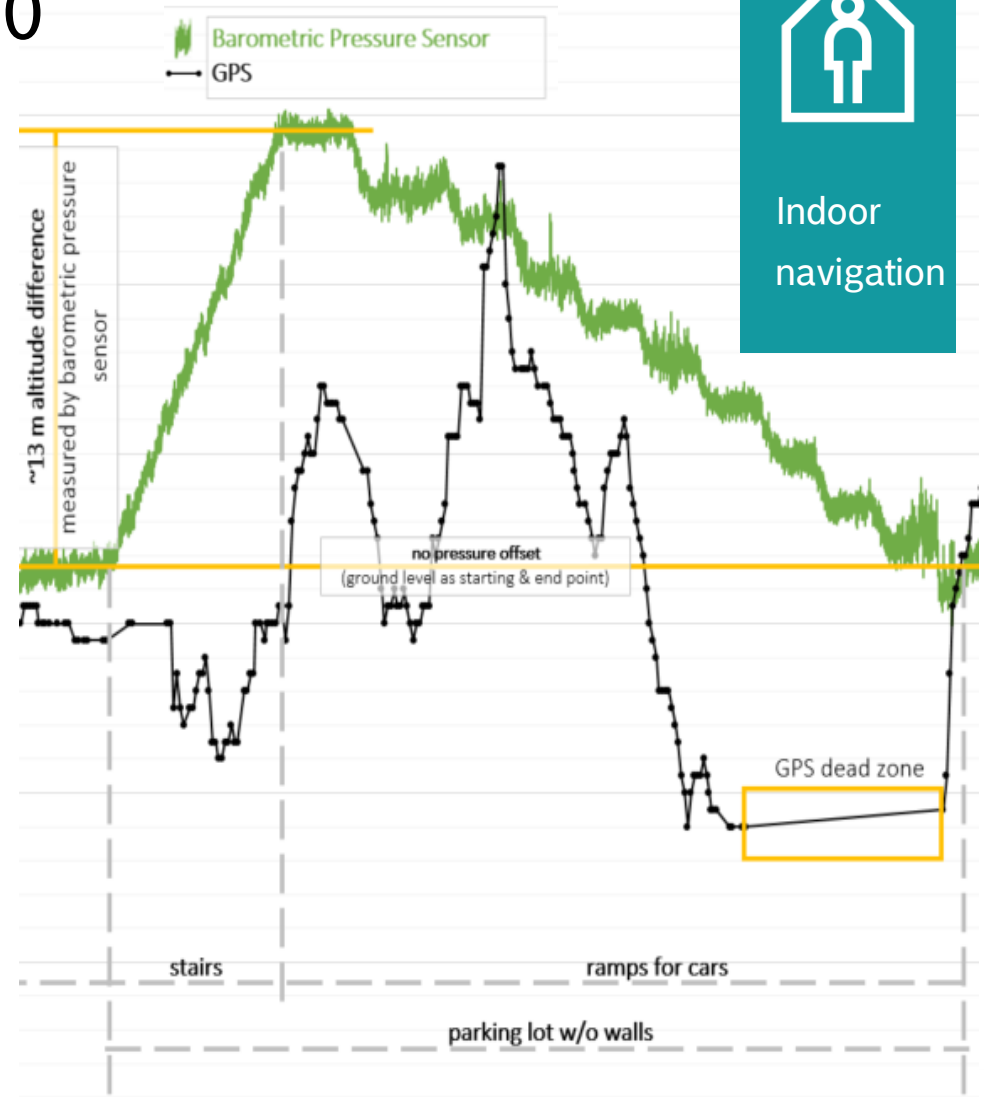
Barometric pressure sensor BMP390
Indoor navigation

Problem

GPS signals rarely make it through the thick walls of buildings. In these so-called GPS dead zones, the GPS signal is blocked and navigation information is not available. Also, GPS is not able to detect different floors.

Solution

- Floor level detection thanks to accurate altitude tracking, enabled by the BMP390.
- Horizontal navigation thanks to accurate position tracking, enabled by the BHI160BP.
- Pressure and motion sensors enable users to navigate inside buildings, e.g. airports or parking lots (see graphic).



Indoor navigation

Barometric pressure sensor BMP390

User benefits

Safety and peace of mind:
Accurate floor level detection helps first responders to more precisely pinpoint the location of an emergency call. This reduces response times and potentially saves thousands of lives per year.

Reliability:

Users can enjoy more reliable results of fitness activities such as exact calorie tracking and covered running or biking distance due to accurate altitude measurements.

Saving time:

Accurate indoor and outdoor navigation helps users to arrive punctually and hassle-free at their destination – saving valuable time, and energy.

Barometric pressure sensor BMP390

Manufacturer benefits

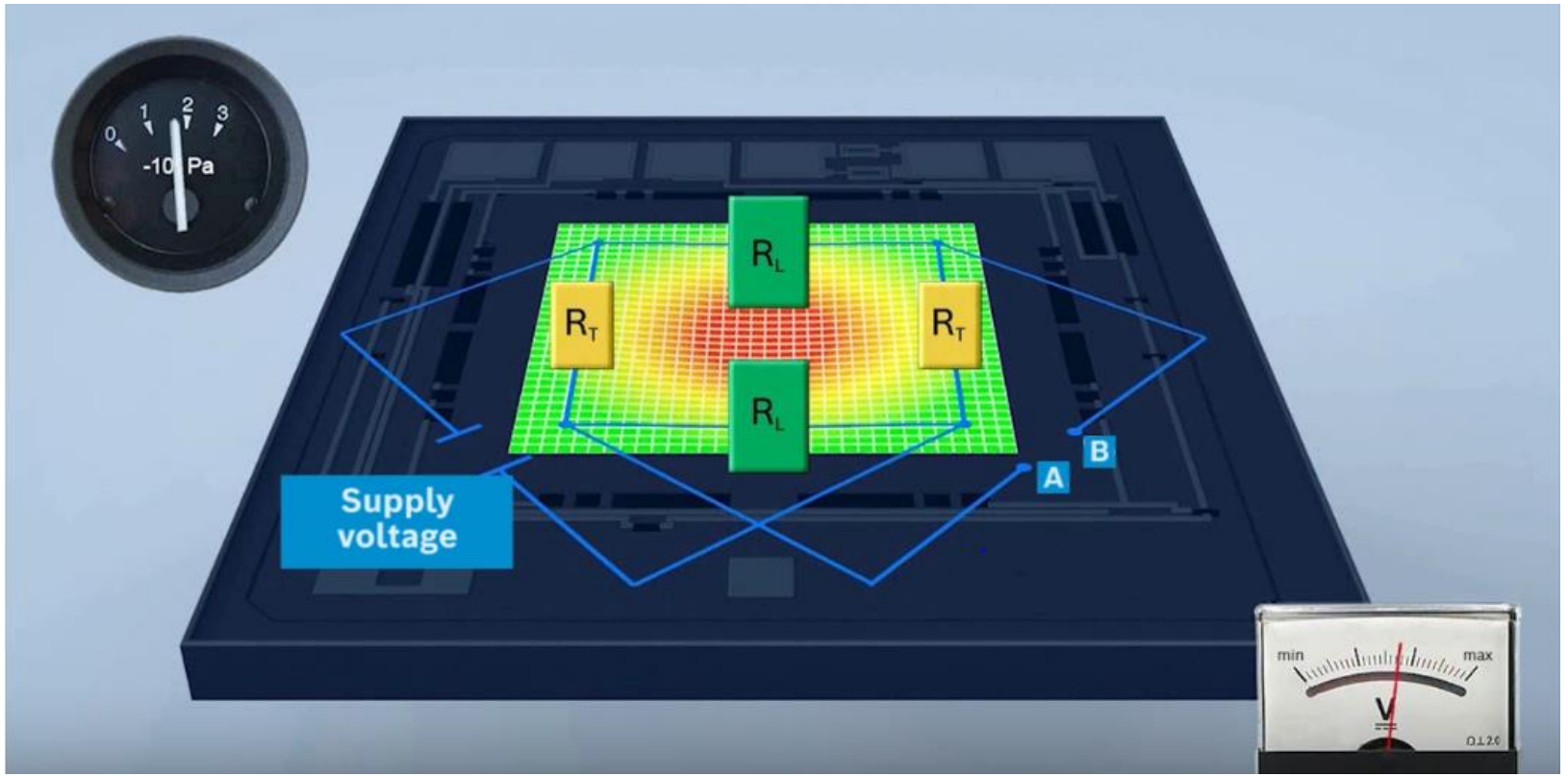
Helps meeting FCC regulation with BMP390: the order adopts a z-axis location accuracy metric of ±3 meters relative to the handset for 80 percent of indoor wireless 9-1-1 calls.

Easy to integrate into smartphones, wearables and hearables due to small size and low package height.

Reduced efforts for end-of-line calibration due to significantly improved absolute accuracy after soldering.

Barometric pressure sensor BMP390

Working principle of barometric pressure sensors



Watch the video to understand how barometric pressure sensors work:

Bosch Sensortec YouTube channel

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Barometric pressure sensor BMP390
Unmatched accuracy

Significant improvements in

- Temperature stability: average TCO of ±0.6 Pa/K
- Drift behavior: high long-term stability and low short- and long-term drift
- Noise: 0.9 Pa typical - 25 percent improved to predecessor BMP380

Best performance on the market due to unique accuracy.

More information: BMP390 product website 

The BMP390 is more than

50 %

more accurate than its predecessor.

The sensor's typical relative accuracy of

±0.03 hPa

is superior to any other comparable product on the market today.

Barometric pressure sensor BMP390
Technical features

Parameter	BMP390
Package dimensions	10-pin LGA with metal lid 2.0 x 2.0 x 0.75 mm³
Operating range (full accuracy)	Pressure: 300 … 1250 hPa
Supply voltage VDDIO Supply voltage VDD	1.2 V … 3.6 V 1.65 V … 3.6 V
Interface	I²C and SPI
Average typical current consumption (1 Hz data rate)	3.2 µA 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 (equivalent to ± 10 cm)
Temperature coefficient offset (25 °C … 40 °C at 900 Pa)	± 0.6 Pa/K
Long-term stability (12 months)	±0.16 hPa
Solder drift	<±0.8 hPa
Maximum sampling rate	200 Hz

Unless otherwise specified, all values are typical values @ Tc=25 °C.

Benefits of the BMP390 barometric pressure sensor:

- Accurate: measures altitude changes of ± 25 cm thanks to a relative accuracy of 3 Pa
- Small: ideally suited for smartphones, hearables and wearables
- Stable: average TCO of just ± 0.6 Pa/K and low noise of typical 0.9 Pa

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THANK YOU

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www.bosch-sensortec.com

https://community.bosch-sensortec.com

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