

Bosch Sensortec

Quality, performance & prolonged
availability

Longevity Program for MEMS motions
and barometric pressure sensors

Agenda

1. Short introduction to Bosch Sensortec
2. Longevity Program
3. Longevity Products :
 - inertial measurement unit (IMU) – BMI090L
 - acceleration sensor – BMA490L
 - barometric pressure sensor – BMP390L
4. Questions & Answers

Introduction to Bosch Sensortec

Bosch is the #1 MEMS sensor supplier worldwide

Bosch Sensortec GmbH is a fully owned subsidiary of Robert Bosch GmbH that develops and markets a wide portfolio of MEMS sensors and solutions tailored for smartphones, tablets, wearable devices and IoT applications. Bosch has been both a pioneer and a global market leader in the MEMS sensor segment since 1995.

MEMS Pioneer

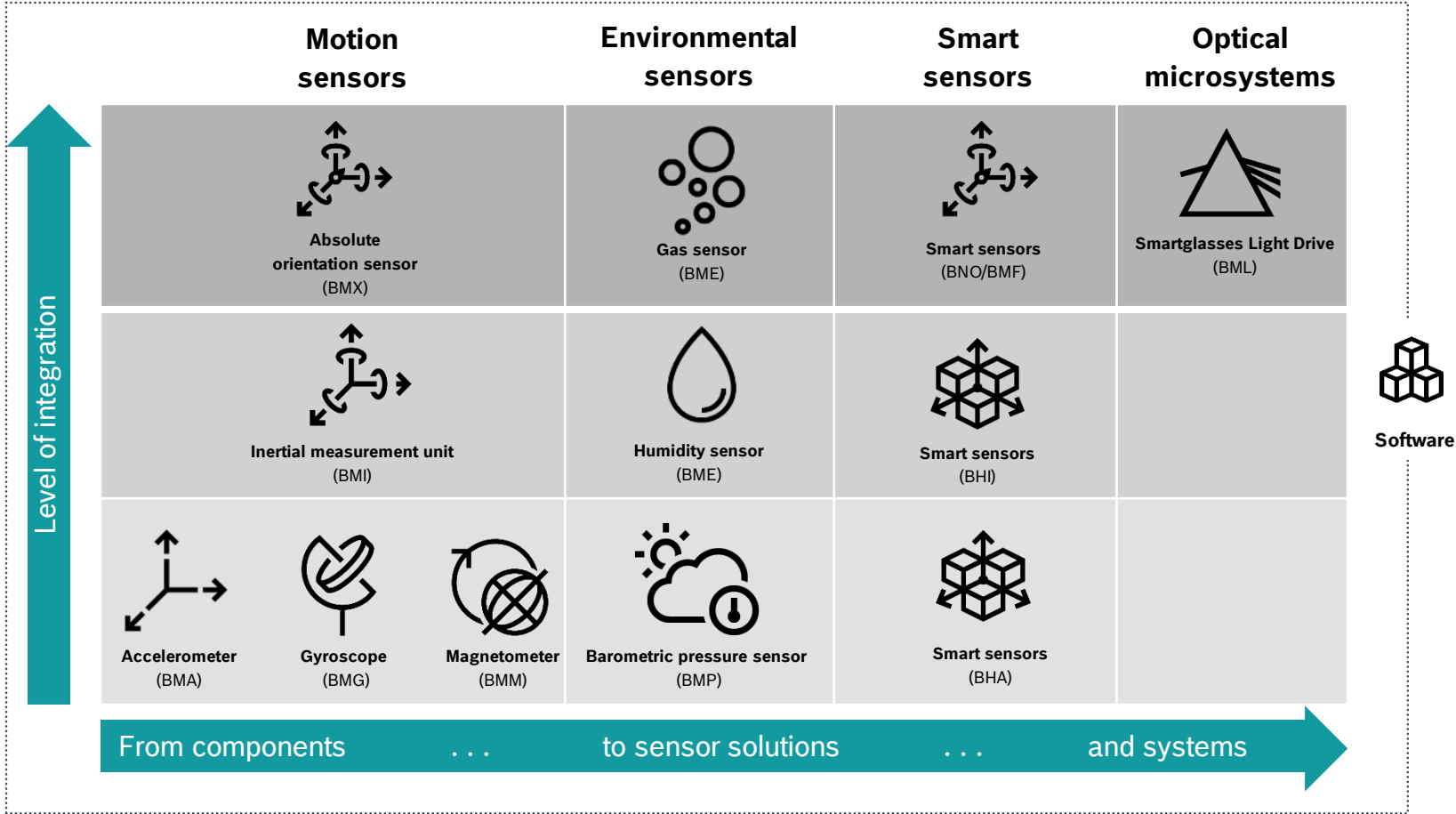
- ▶ Start of MEMS production in 1995
- ▶ Over 10 billion MEMS sensors produced
- ▶ 100% in-house from MEMS design to manufacturing

Value Proposition

- ▶ Technology leadership for MEMS solutions: Driving technology roadmaps with in-house technologies
- ▶ Global support & systems capabilities: Support beyond component supply (in hardware & software)
- ▶ Supply capability & reliability: Capacity, volumes of scale, proven processes, industry's best reliability

Bosch Sensortec

The leading provider of innovative sensing solutions



Please meet Shawn...

Manufacture #like a Bosch



<https://youtu.be/uaeADiepfXk>

Longevity program

Introduction & Benefits



Bosch Sensortec offers solutions to particularly serve industrial applications by providing products for a period of 10 years from release to market, including the notification period. Each product with an availability of 10 years is part of Bosch Sensortec's longevity program. All products that belong to this program are marked with an "L" at the end of each part number.

Customer benefits:



High degree of reliability and peace of mind due to prolonged availability



Improved device performance due to high-performance sensors specifically developed for industrial use cases



Increased flexibility in purchasing due to the availability of smaller reel sizes

A photograph of a modern industrial factory floor. Several yellow robotic arms are visible, some in the foreground and others in the background, working on assembly lines. The environment is filled with metal structures, pipes, and various industrial components. The lighting is bright and even.

BMI090L

High performance longevity IMU
optimized for demanding harsh
industrial and IoT applications

BMI090L

High-performance longevity IMU



Feature Description

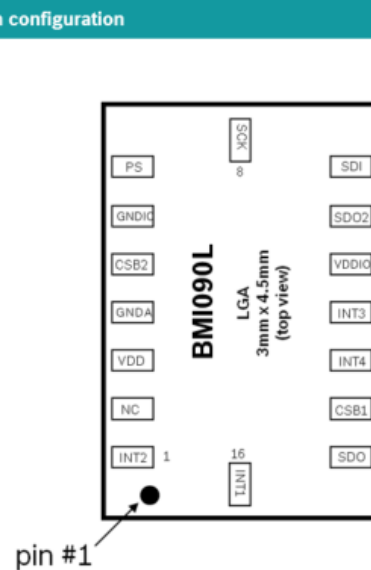
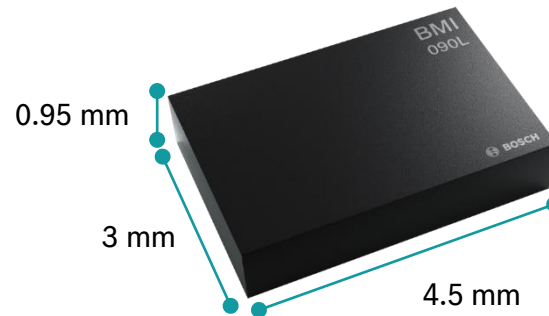
- ▶ High-performance longevity IMU for demanding harsh industrial and IoT applications
- ▶ Excellent vibration robustness, excellent temperature stability (low temperature coefficients), low bias instability & high-g accelerometer
- ▶ Longevity (extended availability) commitment up to 10 years, starting from product introduction, for long design- and production cycle applications

IMU USPs

- ▶ Lowest bias instability for currently available gyros in the market
- ▶ Built-in mechanical low-pass filter to improve vibration robustness
- ▶ Immunity against temperature fluctuations
- ▶ Industrial Interrupt Features including Any/No motion, High/Low g, Orientation 1kB FIFO and Data Sync

Technical data

BMI090L Technical Data		
Digital resolution	Accelerometer (A): 16-bit Gyroscope (G): 16-bit	
Resolution	(A): 0.09 mg (G): 0.004 °/s	
Measurement range and sensitivity (calibrated)	(A) ±3 g: 10920 LSB/g ±6 g: 5460 LSB/g ±12 g: 2730 LSB/g ±24 g: 1365 LSB/g	(G) ±125 °/s: 262.1 LSB/°/s ±250 °/s: 131.1 LSB/°/s ±500 °/s: 65.5 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s
Zero offset (typ. over lifetime)	(A): ± 20 mg (G): ± 1 °/s	
TCO	(A): ± 0.2 mg/K (G): ± 0.015 °/s/K	
Noise density (typ.)	(A): 190 µg/√Hz (G): 0.014 °/s/√Hz	
Bandwidths (progr.)	5 Hz ... 523 Hz	
Selectable output data rates	12.5 Hz ... 2 kHz	
Digital inputs/outputs	SPI, I²C 4 x digital interrupts	
Supply voltage (V _{DD})	2.4 ... 3.6 V	
I/O supply voltage (V _{DDIO})	1.2 ... 3.6 V	
Temperature range	-40 ... +85 °C	
Current consumption (full operation, A+G)	5.15 mA	
LGA package	3 x 4.5 x 0.95 mm³	



Pin description	
Pin No.	Name
1	INT2 (Accelerometer)
2	NC
3	V _{DD}
4	GNDA
5	CSB2 (Gyroscope)
6	GND _{IO}
7	PS
8	SCx
9	SDx
10	SDO2 (Gyroscope)
11	V _{DDIO}
12	INT3 (Gyroscope)
13	INT4 (Gyroscope)
14	CSB1 (Accelerometer)
15	SDO1 (Accelerometer)
16	INT1 (Accelerometer)

Note: BMI090L is pin-to-pin compatible with BMI088 and BMI055

BMI090L

High-performance longevity IMU

Typical markets

- ▶ Industrial IoT
- ▶ Industrial robots
- ▶ Precision agriculture (farming equipment)
- ▶ Drones
- ▶ White goods & appliances

Typical use cases

- ▶ Navigation & control
- ▶ Motion & position tracking
- ▶ Asset tracking



BMI090L blender demo

Temperature and vibration stability



<https://youtu.be/Qm783QSRrFo>



BMA490L

High performance longevity
accelerometer optimized for
demanding industrial and IoT
applications

BMA490L

High-performance longevity accelerometer



Feature description

- ▶ High-performance longevity acceleration sensor for demanding industrial and IoT applications
- ▶ Excellent temperature stability (low temperature drift), low noise and low offset
- ▶ Longevity (extended availability) commitment up to 10 years, starting from product introduction, for long design-cycle applications

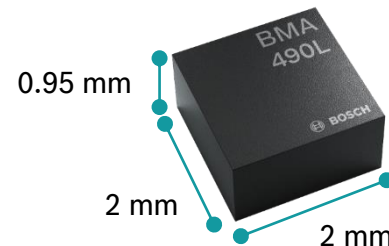
USPs

- ▶ Any-/no-motion, data ready interrupts
- ▶ Immunity against temperature fluctuations (low TCO/TCS)

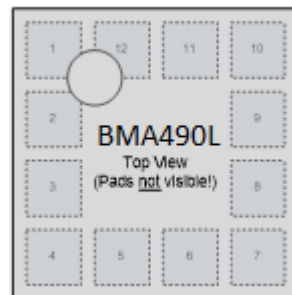
BMA490L

Technical Data

BMA490L Technical data	
Digital resolution	16 bit
Resolution (in $\pm 2g$ range)	0.06 mg
Measurement ranges (programmable)	$\pm 2g$; $\pm 4g$; $\pm 8g$; $\pm 16g$
Sensitivity (calibrated)	$\pm 2g$: 16384 LSB/g $\pm 4g$: 8192 LSB/g $\pm 8g$: 4096 LSB/g $\pm 16g$: 2048 LSB/g
Zero-g offset	± 20 mg
Output Noise density (typ.)	120 $\mu g/\sqrt{Hz}$
Output data rate (programmable)	1600 Hz ... 1.5 Hz
Digital inputs/outputs	SPI & I ² C, 2x digital interrupt pins
Supply voltage (V_{DD})	1.62 ... 3.6 V
I/O supply voltage (V_{DDIO})	1.2 ... 3.6 V
Temperature range	-40 ... +85 °C
Current consumption	
– full operation	150 μA
– low-power mode	14 μA (@ 50 Hz data rate)
FIFO data buffer	1 kB
LGA package	2 x 2 x 0.95 mm ³
Shock resistance	10,000 g x 200 μs



Pin configuration (top view)



Pin	Name	Description
1	SDO	SPI – Serial Data Out; I ² C - address select
2	SDx	Serial data I/O
3	V_{DDIO}	Power supply
4	ASDA	Serial data I/O – Secondary Interface
5	INT1	Interrupt pin
6	INT2	Interrupt pin
7	V_{DD}	Voltage supply
8	GND_{IO}	Ground
9	GND	Ground
10	CSB	SPI – Chip select
11	ASCL	Digital clock (in) – Secondary Interface
12	SCx	Digital clock (in)

BMA490L

High-performance longevity accelerometer

Typical markets

- ▶ Industrial IoT
- ▶ Logistics
- ▶ Agricultural and industrial robots
- ▶ White goods and home appliances
- ▶ Power tools

Typical use cases

- ▶ Power management
- ▶ Predictive maintenance
- ▶ Shock and tilt detection
- ▶ Vibration monitoring
- ▶ Orientation detection
- ▶ Asset tracking
- ▶ Device level detection



BMP390L

High performance longevity
barometric pressure sensor
optimized for demanding harsh
industrial and IoT applications



BMP390L

High-performance longevity barometric pressure sensor



Feature description

- ▶ High-performance longevity barometric pressure sensor for demanding industrial and IoT applications
- ▶ High accuracy, excellent temperature stability (low temperature drift), and low noise.
- ▶ Longevity (extended availability) commitment up to 10 years, starting from product introduction*, for long design-cycle applications

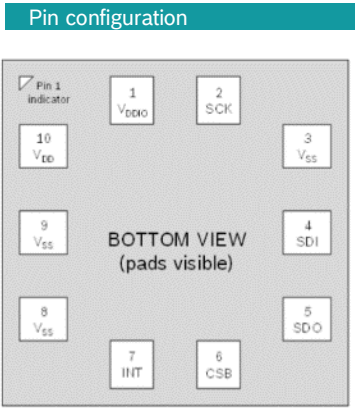
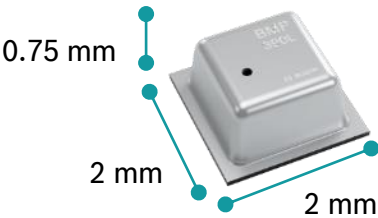
USPs

- ▶ Relative accuracy improved by 30 % compared to predecessor (BMP388)
- ▶ Lowest noise
- ▶ High temperature stability at whole temperature and pressure range
- ▶ High long-term stability → low short-term and long-term drift

BMP390L

Technical Data

BMP390L 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 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



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

BMP390L

High-performance longevity barometric pressure sensor

Typical markets

- ▶ Industrial IoT
- ▶ Logistics
- ▶ White goods and appliances
- ▶ Precision agriculture (farming equipment)
- ▶ Robots
- ▶ Drones

Applications

- ▶ Water-level detection
- ▶ Asset tracking
- ▶ Indoor & outdoor localization/navigation
- ▶ Airflow detection
- ▶ Clogging detection



BMP390L warehouse demo

Here comes Shawn again...



<https://youtu.be/PYs8CIWu43A>

BMP390L washing machine demo

Water level detection with a barometric pressure sensor



https://youtu.be/B_dqbdzvGzg

THANK YOU

<https://www.bosch-sensortec.com>

