

# BMI270

## Smart ultra-low power Inertial Measurement Unit (IMU)

### GENERAL DESCRIPTION

BMI270 is an ultra-low power IMU optimized for wearable applications. The IMU combines precise acceleration and angular rate measurement with intelligent on-chip motion-triggered interrupt features. The 6-axis sensor combines a 16-bit triaxial gyroscope and a 16-bit triaxial accelerometer in a compact 2.5 x 3.0 x 0.8 mm<sup>3</sup> LGA package.

### BMI270 TARGET APPLICATIONS

- ▶ Wearables
- ▶ Hearables
- ▶ Smart clothing
- ▶ Augmented / virtual reality (AR/VR)

### BMI270 TARGET DEVICES

- ▶ Fitness trackers, wristbands, smart watches
- ▶ Earbuds, ankle bands, neck bands
- ▶ Smart clothes
- ▶ Augmented and virtual reality glasses and controllers

### SENSOR FEATURES

BMI270 is a member of Bosch Sensortec's BMI260 family of IMUs, targeting fast and accurate inertial sensing in wearable applications. BMI270 features Bosch's automotive-proven gyroscope technology with an improved accelerometer. Significant improvements in BMI270 include, but are not restricted to, the overall accelerometer performance, i.e. an extremely low zero-g offset and sensitivity error, low temperature drifts, robustness over PCB strain and a low noise density.

BMI270 features the industry's first self-calibrating gyroscope using motionless CRT (Component Re-Trimming) functionality to compensate MEMS typical soldering drifts, ensuring post-soldering sensitivity errors down to  $\pm 0.4\%$ .

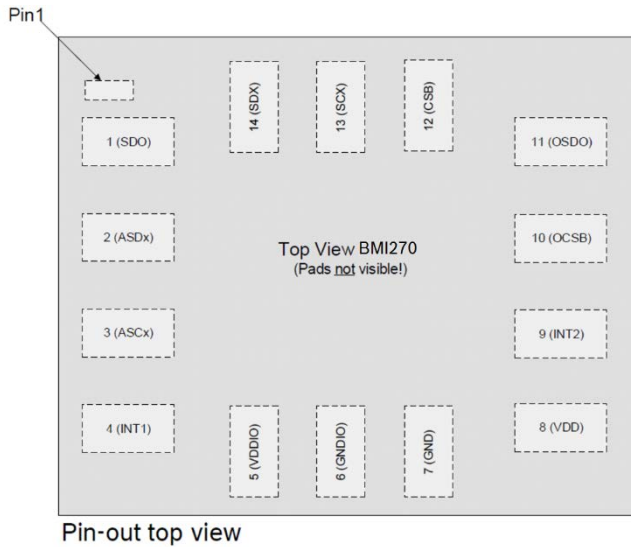
BMI270 includes intuitive gesture, context and activity recognition with an integrated plug-and-play step counter/detector, which is optimized for accurate step counting in wrist-worn devices. The IMU is also well suited for other types of

wearable devices, such as hearables, smart clothes, smart shoes, smart glasses and ankle bands.

### TECHNICAL SPECIFICATIONS (TYP)

BMI270 data	Accelerometer (A) Gyroscope (G)
Digital resolution	(A): 16-bit or 0.06 mg/LSB (G): 16-bit or 0.004 dps/LSB
Programmable measurement range and sensitivity	(A): $\pm 2$ g; 16384 LSB/g to (A): $\pm 16$ g; 2048 LSB/g  (G): $\pm 125$ dps; 262.1 LSB/dps to (G): $\pm 2000$ dps; 16.4 LSB/dps
Zero-g/Zero-rate offset	(A): $\pm 20$ mg (G): $\pm 0.5$ dps
Sensitivity Error	(A): $\pm 0.4\%$ (G): $\pm 0.4\%$ (with CRT)
Temperature range	-40 ... +85 °C
Temperature behaviour (TCO; TCS)	(A): $\pm 0.25$ mg/K; $\pm 0.004$ %/K (G): $\pm 0.02$ dps/K; $\pm 0.02$ %/K
Noise density	(A): 160 $\mu\text{g}/\sqrt{\text{Hz}}$ (G): 0.008 $\text{dps}/\sqrt{\text{Hz}}$
Offset vs PCB strain	(A): $\pm 0.01$ mg/ $\mu\epsilon$ (G): $\pm 1.5$ mdps/ $\mu\epsilon$
Filter BW (programmable)	(A): 5 Hz ... 684 Hz (G): 11 Hz ... 751 Hz
Output Data Rate (ODR)	(A): 12.5 Hz ... 1.6 kHz (G): 25 Hz ... 6.4 kHz
Digital inputs/outputs	2x SPI; 2x I2C; AUX I/F; OIS I/F 2x digital interrupts
Supply voltage	1.7 ... 3.6 V <sub>DD</sub> 1.2 ... 3.6 V <sub>DDIO</sub>
Current consumption	685 $\mu\text{A}$ at full ODR (aliasing-free)
Package size	2.5 x 3.0 x 0.8 mm <sup>3</sup> 14 pin LGA

## Pin configuration



## SYSTEM COMPATIBILITY

BMI270 is designed for best fit into modern embedded CE wearable/hearable devices and provides a primary digital interface (I<sup>2</sup>C and SPI) and a freely configurable secondary digital interface (I<sup>2</sup>C and SPI).

The smart IMU has a wide range for V<sub>DD</sub> and V<sub>DDIO</sub> supply voltages. The performance and current consumption are stable over the entire supply range. Typical current draw for BMI270's accelerometer and gyroscope at full ODR of 6.4 kHz is under 700 µA. By enabling high output data rates with low current consumption, wearable manufacturers can avoid an unpleasant aliasing effect – an effect that causes different signals to become indistinguishable when sampled at lower ODRs.

BMI270 is available in two application-specific versions: gesture and context & activity. The 'gesture' version includes flick in/out, arm up/down, and wrist tilt features. This version is designed for Wear OS by Google™<sup>1</sup> thus ensuring a user-friendly and feature-rich experience for end-users. The 'context and activity' version has advanced features for recognizing context activity and activity change, for example standing, walking and being in a vehicle (e.g. parking).

Bosch Sensortec's ultra-low power IMU BMI270 provides an intelligent power management system enabling motion-triggered always-on features to run inside the ultra-low power domain of the IMU. BMI270 significantly extends system battery life by handling multiple activity tracking, step counting and gesture recognition functions independently of the main system processor, without having to wake it up. These processor-independent functions include tasks such as sending an interrupt when a certain number of steps is reached, or geofencing to activate GPS when the user stands up and starts walking.

## Pin description

Pin No.	Name
1	SDO, Serial data output in SPI 4W
2	ASDx, Aux interface / OIS interface
3	ASCx, Aux interface / OIS interface
4	INT1, Interrupt Pin 1
5	VDDIO, Digital I/O supply voltage (1.2 ... 3.6V)
6	GNDIO, Ground for I/O
7	GND, Ground for digital and analog
8	VDD, Power supply analog and digital (1.71 ... 3.6V)
9	INT2, Interrupt Pin 2
10	OCSB, OIS interface
11	OSDO, OIS interface
12	CSB, Chip select for SPI mode
13	SCx, SPI/I <sup>2</sup> C serial clock (SCK/SCL)
14	SDx, Serial data I/O

BMI270 is pin-to-pin compatible with BMI160 and BMI260.

### Headquarters

Bosch Sensortec GmbH  
 Gerhard-Kindler-Straße 9  
 72770 Reutlingen · Germany  
 Telephone +49 7121 3535 900  
 Fax +49 7121 3535 909

[www.bosch-sensortec.com](http://www.bosch-sensortec.com)

<sup>1</sup> Wear OS by Google is a trademark of Google LLC.

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