BMM350

High-performance magnetometer

1 General description

The BMM350 is a very small, high-performance, and low-current 16-bit 3-axis magnetometer. The digital sensor is ideally suited for a wide range of consumer applications such as virtual, augmented, and mixed reality applications, head orientation, indoor navigation, magnetic compass, high-end gaming, and dead reckoning, for example in robotics applications. The sensor is based on Bosch's proprietary TMR technology. BMM350's features are carefully tuned and perfectly match the demanding requirements of all applications. The BMM350 magnetic sensor offers outstanding design flexibility, providing a single monolithic package solution. Customers can easily integrate this into a multitude of existing and upcoming devices such as smartphones, wearables, hearables, vehicles, drones, and GPS modules.

Compared to the predecessor BMM150, the BMM350 impresses with an outstanding performance. This is reflected in 3 times better sensitivity and a 20 times smaller power consumption. It can be programmed to optimize functionality, performance, and power consumption in customer specific applications. The BMM350 allows measurements of the magnetic field in three perpendicular axes with a magnetic field range of typical ± 2000 µT (x, y, z-axis). The low current consumption (200 µA @ 100 Hz in low power preset) and low noise (± 190 nTrms for x, y axis and ± 450 nTrms for z axis) makes it suitable for a multitude of target applications.

BMM350 TARGET APPLICATIONS

- Head orientation for 3D audio
- Indoor navigation, e.g., step counting in combination with accelerometer
- Reduced pixel latency in AR/VR applications
- Positioning and speed detection of vehicles or industrial machines

Together with the new pressure sensor series BMP58x and the Inertial Measurement Unit BMI270, the BMM350 is part of a comprehensive 10 DoF sensor solution from Bosch Sensortec, allowing for additional features like precise altitude measurement and accurate heading calculation.

2 Sensor features

The available communication interfaces are I3C or I2C. A data ready interrupt is signaling when new data is available, either via INT pin or via in-band-interrupt in I3C mode. If status polling is preferred, a "data ready" status register can be read out.

3 Technical specifications

BMM350 technical data	
Package dimensions	1.28 x 1.28 x 0.5 mm³ wafer level chip scale package (WLCSP)
Operating range	-40 to 85 °C
Supply voltage V_{DDIO} Supply voltage V_{DD}	1.72 ... 3.6 V 1.72 ... 1.98 V
Typical output noise rms 3dB BW = ODR/2	± 190 nTrms (x,y axis) and ± 450 nTrms (z axis)
Sensitivity Temperature Drift (typ.)	± -0.010 %/K
Average typical current consumption	200 µA @ 100 Hz in normal mode
Magnetic field range (all axes)	± 2000 µT
Zero-field offset drift after soldering (typ.)	± 25 µT
Sensitivity/gain error after soldering (typ.)	± 1 %
Interface	I2C and I3C
TCO error (typ.)	± 200 nT/K
Maximum sampling rate	400 Hz (normal mode)

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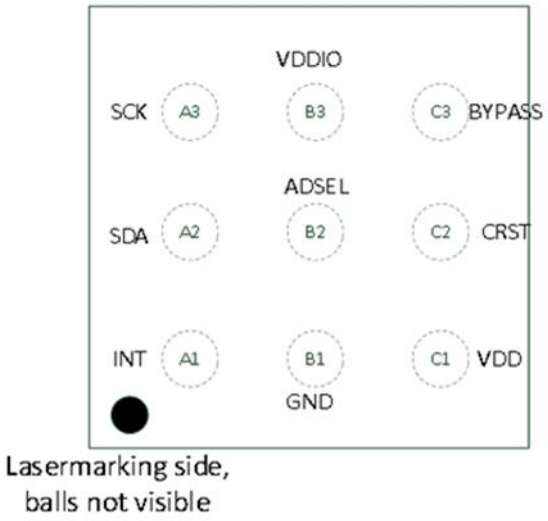
Pin configuration



Pin	Name	Description
C3	BYPASS	Connect to ground
C2	CRST	Connect to external 2.2 uF capacitor, low inductance
C1	VDD	Digital and analog supply, use decoupling capacitor
B3	VDDIO	IO supply, use decoupling capacitor
B2	ADSEL	The logic status of ADSEL defines the LSB to the I2C address. Connect ADSEL to GND or VDDIO
B1	GND	Analog, digital and IO ground
A3	SCK	I2C / I3C clock
A2	SDA	I2C / I3C data
A1	INT	Interrupt output

The sensor module is housed in a compact 9-pin wafer level chip scale package (WLCSP) with a footprint of only 1.28 x 1.28 m² and a sensor height of 0.5 mm. Its small dimensions and its low power consumption allow the implementation in battery driven devices. The emerging applications in wearables, industrial areas and home appliances require a low current consumption and a low total cost of ownership at the same time.

4 Sensor operation

The BMM350 knows two major modes of operation, “normal mode” and “forced mode”. The “suspend mode” brings the device into minimal power consumption, where settings are retained, and communication is possible while data conversions are stopped. A set of choices for the sensors output data rate and signal averaging is available ranging from ultra-low noise to low power setting to adapt the sensor to the target application trading noise versus power consumption.

BMM350 is equipped with an API function which helps setting the averaging/noise performance. The API checks for illegal combinations of settings and automatically chooses the setting with best noise performance.
The BMM350 has built-in-measures to recover from excessively strong magnetic fields (up to 400 mT) which would lead to a performance deterioration in competitor products. This feature is called “field shock recovery”. Fields of up to 100 times of the measurement range are tolerated without performance degradation.

5 System compatibility

The BMM350 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 BMM350 has a given range for VDD (1.72 V to 1.98 V) and VDDIO (1.72 V to 3.6 V) supply voltages.

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