BMX160

9-axis Absolute Orientation Sensor

GENERAL DESCRIPTION

The BMX160 is a very small low power, low noise absolute orientation sensor designed for use in wearable devices like smart watches or augmented reality glasses. It comprises a 3-axis accelerometer, gyroscope and geomagnetic sensor in a single package. Its current consumption is typically 1580 µA, enabling always-on applications in battery driven devices. The BMX160 is available in a compact 14-pin 2.5 x 3.0 x 0.95 mm³ LGA package.

BMX160 TARGET APPLICATIONS

- Augmented reality and immersive gaming
- 3D scanning and indoor mapping
- Indoor navigation and pedestrian dead-reckoning, step counting
- Wearable accessories requiring small footprint and high performance
- 9-axis sensor fusion, air mouse applications
- Optical image stabilization

BMX160 TARGET DEVICES

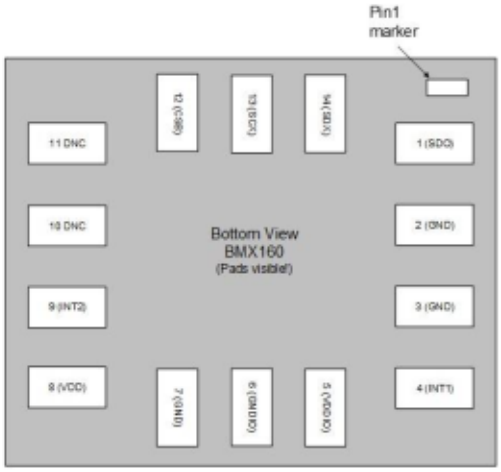
- Smart watches, wearable fitness trackers, augmented reality glasses
- Mobile phones and tablet PCs
- Game controllers and smart remote controls
- Toys, e.g. quatrocopters

SENSOR FEATURES

Due to the built-in hardware synchronization of the inertial sensor data and geomagnetic sensor data, the BMX160 is ideally suited for augmented reality, immersive gaming, and navigation applications that require highly accurate, low power and low latency 9-axis sensor data fusion. The BMX160 provides high precision sensor data together with an accurate time stamp generated by a real-time clock. The BMX160 features an on-chip interrupt engine which provides motion-based context awareness as always-on background functions.

TECHNICAL SPECIFICATIONS

BMX160 Technical data	
Package dimension (mm³)	2.5 x 3.0 x 0.95
Temperature ranges	-40 °C ... +85 °C
Supply voltage (V_{DDIO}) Supply voltage (V_{DD})	1.2 V ... 3.6 V 1.71 V ... 3.6 V
Typ. current consumption Gyro full operation Gyro + Acc. + Geomag. Geomag. @full operation Acc. @full operation Suspend mode Significant motion Step detector	 850 µA 1585 µA 660 µA 180 µA 5 µA 30 µA 30 µA
Sensitivity	(A) ±2 g: 16384 LSB/g ±4 g: 8192 LSB/g ±8 g: 4096 LSB/g ±16 g: 2048 LSB/g (G) ~~(B)~~ ±125 °/s: 262.4 LSB/°/s ±250 °/s: 131 LSB/°/s ±500 °/s: 65.6 LSB/°/s ±1000 °/s: 32.8 LSB/°/s ±2000 °/s: 16.4 LSB/°/s
Device resolution	(M): 0.3 µT
TCS (typ.)	(A): ±0.03 %/K (M): ±0.01 %/K (G): ±0.02 %/K
Non-linearity (typ.)	(A): ±0.5 % FS (G): ±0.1 % FS (M): ±1 % FSmax
Offset (typ.)	(A): ±40 mg (G): ±3 °/s (M): ±40 µT
TCO (typ.)	(A): ±1.0 mg/K (G): ±0.05 /s/K
Noise density (typ.)	(A): ±180 µg/ √Hz (M): ±0.3 µT (G): 0.008 °/s/ √Hz
FIFO size	1024 byte



Pin out

TECHNICAL SPECIFICATIONS

Pin

Pin	Name	Description
1	SDO	Serial data output in SPI Address select in I^2C mode
2	GND	Ground for digital and analog
3	GND	Ground for digital and analog
4	INT	Interrupt pin1
5	V_{OUT}	Digital I/O supply voltage (1.2…3.6 V)
6	GNDIO	Ground for I/O
7	GND	Ground for digital & analog
8	VDD	Power supply analog & digital domain (1.71 – 3.6 V)
9	INT 2	Interrupt pin 2
10	–	Do not connect
11	–	Do not connect
12	CSB	Chip select for SPI mode/ Protocol select pin
13	SCx	SCK: SPI clock SCL: I^2C clock SDA serial data I/O in I^2C
14	SDX	MOSI serial data input in SPI 4W SISO serial data I/O in SPI 3W

Examples of interrupts that can be issued, in a power efficient manner, without using extensive software algorithms are: any-or no-motion detection, tap or double tap sensing, orientation detection, free-fall or shock events.
The smart built-in power management unit (PMU) can be configured, for example, to further lower the power consumption by automatically sending the gyroscope into fast start-up mode and waking it again based on the any-motion interrupt of the accelerometer. By allowing the host to sleep longer, the PMU significantly contributes to power saving on system level.

SYSTEM COMPATABILITY

With a footprint of only 2.5 x 3.0 mm^2 and a package height of only 0.95 mm, the BMX160 can easily be designed into devices with miniaturized PCBs.
The BMX160 has been designed for always-on, 9-axis applications in wearable devices such as smart watches and head mounted devices, mobile phones, tablets, remote controls, game controllers, and toys such as quatrocopters.
BMX160 is footprint and register compatible to BMI160. This way it allows easy upgrade from the 6-axes intertial measurement unit to the 9-axes absolute orientation sensor.

The integrated 1024 byte FIFO buffer supports low power applications and prevents data loss in non-real-time systems. The intelligent FIFO architecture allows dynamic reallocation of FIFO space for accelerometer, gyroscope and geomagnetic sensor. In a typical 9-DoF application – including the geomagnetic sensor – this is sufficient for approx. 0.5 s. Accel and Gyro 16 bit, Accel 2 g to 16 g range.
The BMX160 is fully Android Marshmallow compliant, and in the implementation of the Significant Motion and Step Detector interrupts, each of which consumes less than 30 µA.
The BMX160 offers a wide V_{DD} voltage range from 1.71 V to 3.6 V and a V_{DDIO} range from 1.2 V to 3.6 V, allowing the BMX160 to be powered at 1.8 V for both V_{DD} and V_{DDIO}.

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