BMA020
Digital, triaxal acceleration sensor

Bosch Sensortec

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General description

The BMA020 is a triaxial, low-g acceleration sensor with digital interfaces, aiming for low-power consumer market applications.

The BMA020 has been designed to match a multitude of hardware requirements. Key features like g-range and filtering characteristics are programmable by the customer. Since the sensor has a very small package and very low power consumption it is a perfect fit for mobile applications. The BMA020 can be customer programmed to further optimize functionality and performance in all consumer applications. Especially the very low stand-by current and fast wake-up time underline the suitability for state-of-the-art mobile low-power designs.

The BMA020 allows measurement of accelerations in 3 perpendicular axes. An evaluation circuitry converts the output of a three-channel micromechanical acceleration sensing structure that works according to the differential capacitance principle.

The base of Bosch Sensortec's micromachining technology has proven its capability in more than 100 million Bosch accelerometers and gyroscopes so far. Bosch Sensortec's modular design methodolgy provides a flexibility to react quickly to customer needs for additional sensor functionality in the future.

The BMA020 senses tilt, motion, shock and vibration in cell phones, handhelds, computer peripherals, man-machine interfaces, virtual reality features and game controllers.

BMA020 target applications

▶ Advanced power management for mobile devices
▶ Drop detection for warranty logging
▶ Menu scrolling, tip-tap function
▶ Display profile switching (portrait/landscape)
▶ Shock detection
▶ Gaming

Key features BMA020

▶ Switchable g-range and bandwidth
▶ Low-power consumption
▶ SPI (3-wire/4-wire) and I²C interfaces
▶ Programmable interrupt feature for mobile wake-up
▶ Ultra-low-power self-wake-up mode
▶ Self-test capability
▶ LGA package (3 mm x 3 mm x 0.9 mm)
▶ RoHS compliant

Technical data	BMA020
Sensitivity axes	x/y/z
Measurement range	±2g, ±4g, ±8g (switchable via SPI/I^2C)
Sensitivity (calibrated)	2g: 256LSB/g 4g: 128LSB/g 8g: 64LSB/g
Resolution	10bit → 4mg (±2g range)
Nonlinearity	±0.5% FS
Axes mixing	2%
Zero-g offset (calibrated)	±220mg
Zero-g offset temperature drift	1mg/K
Noise	0.5mg/√Hz
Bandwidth	25Hz ... 1500Hz (switchable via SPI/I²C)
Digital input / output	SPI & I²C, Interrupt pin
Supply voltage	2.0 ... 3.6V, 1.62 ... 3.6V IO
Current consumption	200µA
Idle current	1µA
Wake-up time	1ms
Temperature range	-40°C ... +85°C

Pin configuration for SPI interface (bottom view)
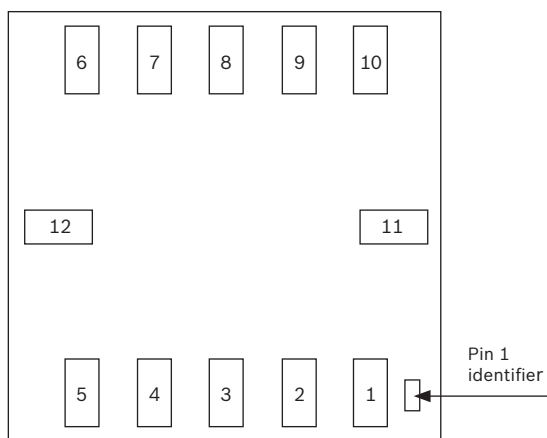
Pin No.	Name	Function
1	Reserved	Do not connect
2	VDD	Analog power supply
3	GND	Ground
4	INT	Interrupt
5	CSB	Chip select
6	SCK	Serial clock
7	SDO	Serial data output
8	SDI	Serial data in/out
9	VDDIO	Digital interface power supply
10	Reserved	Do not connect
11	Reserved	Do not connect
12	Reserved	Do not connect

Sensor operation

The function and performance of the BMA020 can be programmed to match customer specific applications by means of parameter and control settings. The BMA020 provides a digital 10bit output signal in SPI or I²C format. Via serial interface command the full measurement range can be chosen to ±2g, ±4g or ±8g. A second-order filter with a pole-frequency of 1500Hz is included to provide preconditioning of the measured acceleration signal. The maximum data conversion rate is 3KHz.

Additional digital filtering is possible to improve S/N ratio (down to 25Hz bandwidth). Typical noise level and quantization lead to a resolution of 4mg. The current consumption is typically 200µA. In addition there are several features implemented to support the host system in reducing power consumption.
Parallel to normal operation where acceleration values are provided to the output registers the BMA020 is capable to perform internal computations of the results. The customer is enabled to define specific criteria, e.g. high-g or low-g thresholds but also criteria for the recognition of smooth motion profiles. The sensor can inform the host system about the violation of one of these criteria via an interrupt pin. This feature can be used for many purposes, e.g. to wake-up the host system from a global sleep mode or to signalise a shock situation.

The BMA020 also features self-test capability, allowing to test the complete signal evaluation path including the micromachined sensor structure and the evaluation ASIC.

Bosch is the world market leader for acceleration sensors in automotive applications. The BMA020 offers this high experience and reliability for consumer applications. Bosch Sensortec is a subsidiary of Bosch that focuses on application and marketing of micromechanical components for the consumer electronics markets.

Please contact us for further details. We are happy to provide more information.

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