BOSCH

BMA250E
Digital, triaxial acceleration sensor

GENERAL DESCRIPTION

The BMA250E is an advanced, ultra-small, triaxial, low-g acceleration sensor with digital interfaces, aiming for low-power consumer electronics applications. Featuring 10 bit digital resolution, the BMA250E allows low-noise measurement of accelerations in 3 perpendicular axes and thus senses tilt, motion, shock and vibration in cellular phones, handhelds, computer peripherals, man-machine interfaces, virtual reality features and game controllers.

BMA250E TARGET APPLICATIONS

▶ Display profile switching (portrait/landscape, face-up/face-down switching)
▶ Flat detection
▶ Tap / double tap sensing
▶ Menu scrolling
▶ Gaming
▶ Advanced power management for mobile devices
▶ Shock and free-fall detection
▶ Step-counting
▶ Tilt compensation for electronic compass

SENSOR FEATURES

With its ultra-small footprint of only 2 mm x 2 mm the BMA250E is unique in the class of low-noise, 10 bit digital acceleration sensors. On top, the BMA250E integrates a multitude of features that facilitate its use especially in the area of motion detection applications, such as device orientation detection, gaming, HMI and menu browser control. Featuring a full operation current consumption of only 130 μA the BMA250E is ideally suited for mobile consumer electronic devices. In low-power mode operation the current consumption can be even further reduced by more than one order of magnitude. The BMA250E is highly configurable in order to give the designer full flexibility when integrating the sensor into the system.
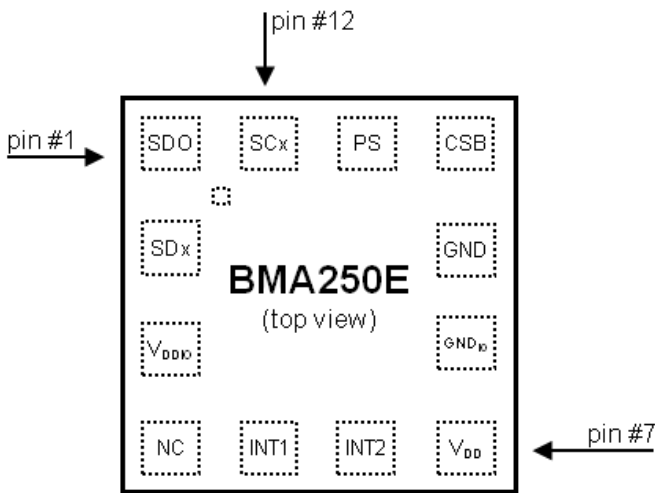
TECHNICAL SPECIFICATIONS

BMA250E Technical data	
Digital resolution	10 bit
Resolution (in ±2g range)	3.9 mg
Measurement ranges (programmable)	±2 g; ±4 g; ±8 g; ±16 g
Sensitivity (calibrated)	±2 g: 256 LSB/g ±4 g: 128 LSB/g ±8 g: 64 LSB/g ±16 g: 32 LSB/g
Zero-g offset (typ., over life-time)	±80 mg
Noise density (typ.)	400 μg/√Hz
Bandwiths (programmable)	1000 Hz … 8 Hz
Digital inputs/outputs	SPI & I^{2}C, 2x digital interrupt pins
Supply voltage (V_{DD})	1.62 … 3.6 V
I/0 supply voltage (V_{DDIO})	1.2 … 3.6 V
Temperature range	-40 … +85 °C
Current consumption – full operation – low-power mode	130 μA (@ 2 kHz data rate) 6.5 μA (@ 40 Hz data rate)
FIFO data buffer	32 sample depth (for each axis)
LGA package	2 x 2 x 0.95 mm^3
Shock resistance	10,000 g x 200 μs

SENSOR OPERATION

The BMA250E supports two modes of operation:
1) Standard data polling mode: Acceleration data is directly read-out via the sensor's digital interface and computed by a system μController, application processor or a base-band processor.
2) Interrupt engine mode: Acceleration data is computed already within the BMA250E by the integrated, programmable interrupt engine.

Pin configuration (top view)

TECHNICAL SPECIFICATIONS

Pin		
Pin	Name	Description
1	SDO	SPI: serial data output in SPI 4-wire mode I²C: I²C address select
2	SDx	SPI: SDI serial data input in SPI 4-wire mode SPI: SDA serial data I/O in SPI 3-wire mode I²C: SDA serial data line
3	V_{DDIO}	Voltage supply for I/Os
4	NC	Not connected
5	INT1	Interrupt output #1
6	INT2	Interrupt output #2
7	V_{DD}	Voltage supply
8	GND_{IO}	Ground for I/O
9	GND	Ground
10	CSB	Chip select for SPI
11	PS	Protocol select: SPI: GND I²C: V_{DDIO}
12	SCx	SCK: SPI clock SCL: I²C clock

The BMA250E features I²C and SPI (3-wire/4-wire) digital, serial interfaces. Sensor parameters, like g-ranges or low-pass filter settings, and also all interrupt engine settings can be easily programmed via the digital interfaces.

INTEGRATED INTERRUPT ENGINE

One of the key elements of the BMA250E is the enhanced intelligent interrupt engine that gives the hard and software designer full control. Various motion detection scenarios can be identified by the BMA250E and signaled to the system via two interrupt pins. The interrupt sources can be freely mapped to either of the two interrupt pins.

The following motion detection use case scenarios are supported by the BMA250E interrupt engine:

▶ Data-ready (e.g. for processor synchronization)
▶ Any-motion (slope) detection (e.g. for wake-up)
▶ Tap sensing (e.g. for tap-sensitive UI control)
▶ Orientation change recognition (e.g. for portrait/landscape switching)
▶ Flat detection (e.g. for position sensitive switching)
▶ Low-g / high-g detection (e.g. for shock and free-fall detection)
▶ No-motion (e.g. for power saving)

Interrupt parameters (e. g. switching angles and hysteresis settings for orientation change) can be configured by the designer and thus perfectly support the integration of the BMA250E into the user's system environment.

SYSTEM COMPATIBILITY

The BMA250E has been designed for best possible fit into modern mobile consumer electronics devices. Besides the ultra-small footprint and lowest power consumption, the BMA250E has very wide ranges for V_{DD} and V_{DDIO} supply voltages. The BMA250E also includes a FIFO buffer with 32 samples depth for each acceleration axis. An integrated self-test feature facilitates overall system reliability.