

# BMA455

## Intelligent, triaxial acceleration sensor

### GENERAL DESCRIPTION

The BMA455 is an ultra-small, triaxial, low-g high performance acceleration sensor with digital interfaces, aiming for low-power and demanding consumer electronics applications. Featuring 16 bit digital resolution and embedded intelligence, the BMA455 allows low-noise measurement of accelerations in 3 perpendicular axes and thus senses significant motion, tilt and enables plug 'n' play step counting at low current consumption in smart phones without an additional sensor hub. Furthermore the device is optimized to fulfill Android low power accelerometer requirements. The superior temperature behaviour of BMA455 facilitates accurate measurements over changing temperature. The reduced height of only 0.65 mm is beneficial for low profile smart phones.

### BMA455 TARGET APPLICATIONS

- ▶ Step counting
- ▶ Significant motion
- ▶ Tilt detection
- ▶ Low power user interaction
- ▶ Advanced gesture recognition
- ▶ Activity recognition/tracking
- ▶ Advanced power management for mobile devices
- ▶ Shock and freefall detection
- ▶ Tilt compensation for electronic compass
- ▶ Spirit leveling / Virtual horizon

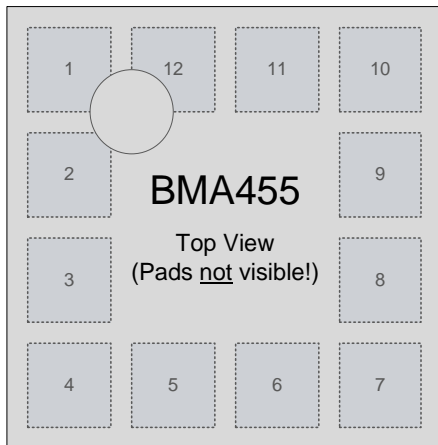
### SENSOR FEATURES

With its embedded intelligence BMA455 is unique in the class of consumer grade accelerometers for smart phones, wearable devices and toys and gadgets. The embedded intelligence enables low current step-counting at 25  $\mu\text{A}$ . On top, the BMA455 integrates a multitude of other features (e.g. tilt, significant motion etc.) that facilitate its use especially in the area of Android based smart phones, to fulfill the newest Android M accelerometer requirements. Featuring a high performance measurement mode with low pass filters and a current consumption of only 150  $\mu\text{A}$  the BMA455 is robust to vibrations

and aliasing. In low-power mode operation the current consumption can be even further reduced by more than one order of magnitude. This fulfills the current consumption requirements for always-on applications. The BMA455 is highly configurable in order to give the designer full flexibility when integrating the sensor into the system.

### TECHNICAL SPECIFICATIONS

BMA455 Technical data	
Digital resolution	16 bit
Resolution (in $\pm 2\text{g}$ range)	0.06 mg
Measurement ranges (programmable)	$\pm 2\text{ g}$ ; $\pm 4\text{ g}$ ; $\pm 8\text{ g}$ ; $\pm 16\text{ g}$
Sensitivity (calibrated)	$\pm 2\text{ g}$ : 16384 LSB/g
	$\pm 4\text{ g}$ : 8192 LSB/g
	$\pm 8\text{ g}$ : 4096 LSB/g
	$\pm 16\text{ g}$ : 2048 LSB/g
Zero-g offset (typ., over life-time)	$\pm 20\text{ mg}$
Noise density (typ.)	120 $\mu\text{g}/\sqrt{\text{Hz}}$
Output data rate (programmable)	1600 Hz ... 1.5 Hz
Digital inputs/outputs	SPI & I <sup>2</sup> C, 2x digital interrupt pins
Supply voltage ( $V_{\text{DD}}$ )	1.62 ... 3.6 V
I/O supply voltage ( $V_{\text{DDIO}}$ )	1.2 ... 3.6 V
Temperature range	-40 ... +85 °C
Current consumption	– full operation 150 $\mu\text{A}$
	– low-power mode 13 $\mu\text{A}$ (@ 50 Hz data rate)
Large FIFO data buffer	1 kb
LGA package	2 x 2 x 0.65 mm <sup>3</sup>
Shock resistance	10,000 g x 200 $\mu\text{s}$



Pin configuration (top view)

## TECHNICAL SPECIFICATIONS

Pin	Name	Description
1	SDO	SPI: serial data out I <sup>2</sup> C: I <sup>2</sup> C address select
2	SDx	Serial data I/O
3	V <sub>DDIO</sub>	Power supply
4	ASDA	Serial data I/O – Secondary Interface
5	INT1	Interrupt pin
6	INT2	Interrupt pin
7	V <sub>DD</sub>	Power supply
8	GND <sub>IO</sub>	Ground
9	GND	Ground
10	CSB	Chip select for SPI
11	ASCL	Digital clock (in) – Secondary Interface
12	SCx	Digital clock (in)

## SENSOR OPERATION

The BMA455 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  $\mu$ Controller, application processor or a baseband processor. An integrated FIFO with 1 kB of size can be used optionally to reduce overall system current consumption.

2) Plug 'n' play intelligence operation: Acceleration data is computed already within the BMA455. The embedded intelligence of the sensor can trigger an interrupt at certain selectable events which can be mapped to the selectable interrupt pins. In addition to the electrical interrupt, the status of the events and the counted steps are stored in the register map and can be read out easily.

Embedded intelligence:

- ▶ Step detector / Step counting
- ▶ Significant motion
- ▶ Tilt detection
- ▶ Wake-up, Glance, Pick-up

Feature parameters can be configured by the designer and thus perfectly support the adoption to the required use case and system design.

## SYSTEM COMPATIBILITY

The BMA455 has been designed for best possible fit into modern mobile consumer electronics and IoT devices. Besides the very low height and lowest power consumption, the BMA455 has very wide ranges for V<sub>DD</sub> and V<sub>DDIO</sub> supply voltages. The BMA455 features I<sup>2</sup>C and SPI (3-wire/4-wire) digital, serial interfaces. The availability of a separate I<sup>2</sup>C interface enables the connection of an external magnetometer (BMM150 recommended) and the synchronization of the acceleration and the magnetometer data in the FIFO of the BMA455. This reduces the complexity of sensor data fusion and improves its precision as well. BMA455 is designed for plug 'n' play functionality and ease-of-use in various system designs with demanding performance requirements.

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