

# BMC156

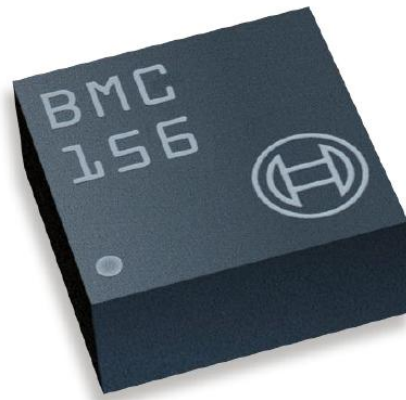
## Pin Compatible Design with BMA2x2

Bosch Sensortec



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### **BMC156: Application Note - Pin Compatible Design with BMA2x2**

Document revision 1.1

Document release date 06 August 2014

Document number BST-BMC156-AN000-01

Technical reference code(s) 0 273 141 193

Notes Data in this document are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product's appearance.

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## 1. About this application note

This document provides recommendations for BMC156 pin compatible hardware design with BMA2x2.

### 1.1 Who should read this document

Purpose of this document is to help developers to understand and implement the compatible PCB design of BMC156 with BMA2x2. Also in chapter 3 we give a guide for PCB layout to avoid the disturbance from on-board hard-iron, soft-iron and fluctuate current.

### 1.2 Glossary

Magnetic sensor

Sensor which can measure magnetic field.

Accelerometer

Sensor which can measure acceleration.

Hard-iron

Hard magnet will give a offset to sensor, there is no distortion, only offset in magnetic sensor X,Y,Z axis. It can be compensated by calibration algorithm

Soft-Iron

Soft magnetic materials will 'bent' the field line, the direction is changed from large-scale geomagnetic field direction. Normally this materials are anisotropic, it is difficult to be compensated. Normally we use "Soft-Iron compensation matrix" to correct the distortion.

## 2. Pin-out and package of BMC156 and BMA2x2

BMC156 and BMA2x2 are pin-compatible expect the following difference: BMA2x2 has two interrupt, INT1 and INT2 for accelerator part, BMC156 has only INT2 for accelerator. User can remap the internal interrupt engine to external interrupt pin (INT2 in register map).

### 2.1 Pin-out

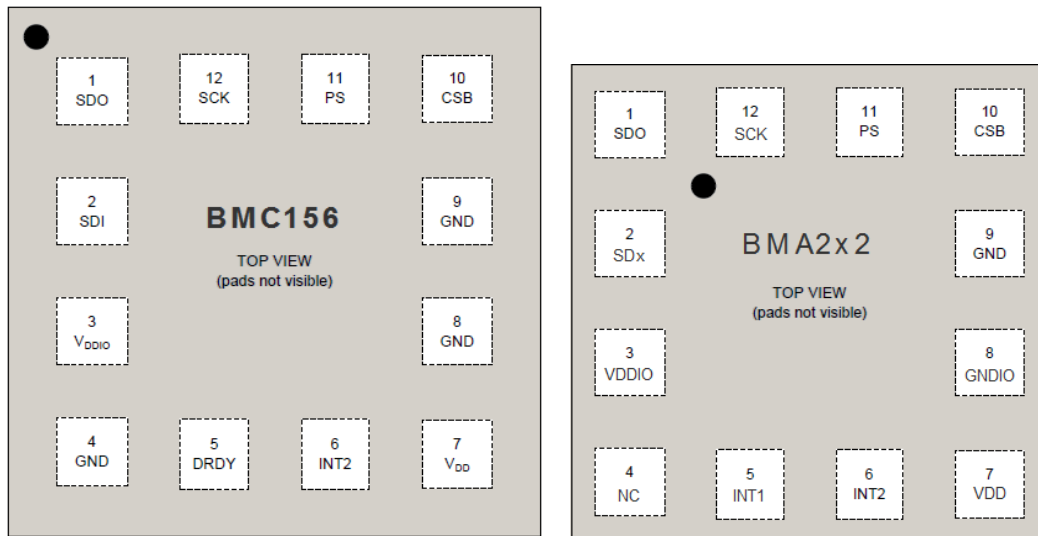


Figure1. BMC156 and BMA2x2 Pin-out

## 2.2 Pin Description

Table1. BMC156 Pin Description

Pin	Name	I/O Type	Sensor	Description	Connect To		
					SPI4W	SPI3W	I2C
1	SDO	OUT	Mag+Acc	SPI:Data out	SDO/MISO	DNC (float)	GND for Default Address
2	SDI	IN/OUT	Mag+Acc	SPI:Data in I2C:Data	SDI/MOSI	SDA	SDA
3	VDDIO	SUPPLY	Mag+Acc	I/O Voltage	VDDIO		
4	GND <sup>1</sup>	IN	Mag	Ground	GND		
5	DRDY	OUT	Mag	Data Ready	DRDY Output or DNC		
6	INT2	OUT	Acc	Interrupt Output #2	INT2 Output or DNC if unused		
7	VDD	SUPPLY	Mag+Acc	Supply Voltage	VDD		
8	GNDIO	SUPPLY	Mag	Ground	GND		
9	GND	SUPPLY	Mag+Acc	Ground	GND		
10	CSB	IN	Mag+Acc	Chip Select	CSB	CSB	DNC(float) or VDDIO
11	PS	IN	Mag+Acc	Protocol Select	GND	GND	VDDIO
12	SCK	IN	Mag+Acc	Serial Clock	SCK	SCK	SCL

<sup>1</sup> GND connection is recommended but not required (alternative: do not connect)

Table 2: BMC156 BMA2x2 pin comparison

Pin	Name		I/O Type		Description	
	BMC156	BMA2x2	BMC156	BMA2x2	BMC156	BMA2x2
1	SDO	SDO	OUT	OUT	SPI:Data Out I2C:Address Selection	SPI:Data Out I2C:Address Selection
2	SDI	SDX	IN/OUT	IN/OUT	SPI:Data in I2C:Data	SPI:Data In I2C:Data
3	VDDIO	VDDIO	SUPPLY	SUPPLY	I/O Voltage	I/O Voltage
4	GND <sup>2</sup>	NC	IN	--	Ground	Connect to GND
5	<b>DRDY</b>	<b>INT1</b>	<b>OUT</b>	<b>OUT</b>	<b>Mag Data Ready</b>	<b>Acc Interrupt #1</b>
6	INT2	INT2	OUT	OUT	Acc Interrupt #2	Acc Interrupt #2
7	VDD	VDD	SUPPLY	SUPPLY	Supply Voltage	Supply Voltage
8	GNDIO	GNDIO	SUPPLY	SUPPLY	Ground	Ground
9	GND	GND	SUPPLY	SUPPLY	Ground	Ground
10	CSB	CSB	IN	IN	SPI:Chip Selection	SPI:Chip Selection
11	PS	PS	IN	IN	Protocol Selection	Protocol Selection
12	SCK	SCx	IN	IN	SPI:Serial Clock I2C:Serial Clock	SPI:Serial Clock I2C:Serial Clock

<sup>2</sup> GND connection is recommended but not required (alternative: do not connect)

### 2.3 Package

Please note that comparing with BMA2x2, BMC156 footprint has 100um overhang in each side.

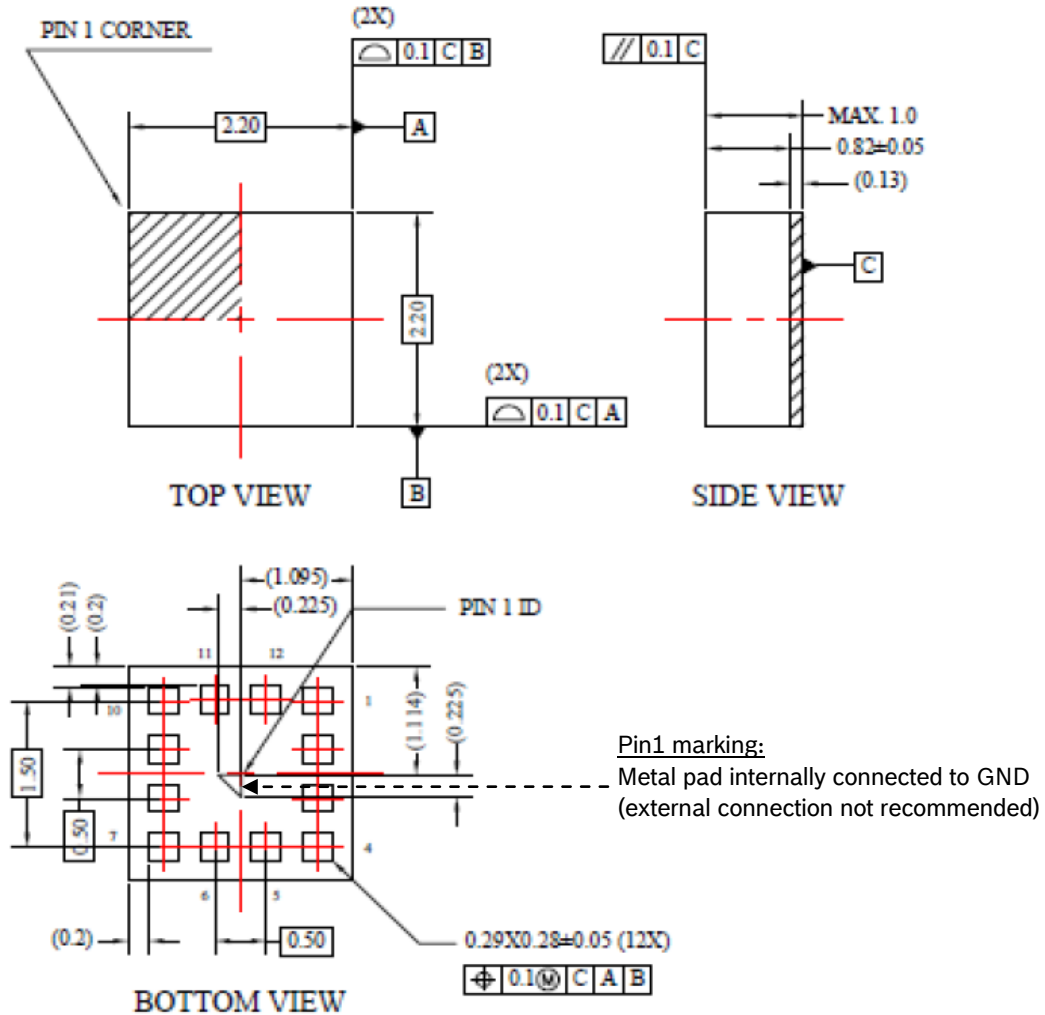


Figure 2: BMC156 package dimension

### 3. Pin Compatible of BMC156 and BMA2X2

#### 3.1 4-wire SPI connection compatible design

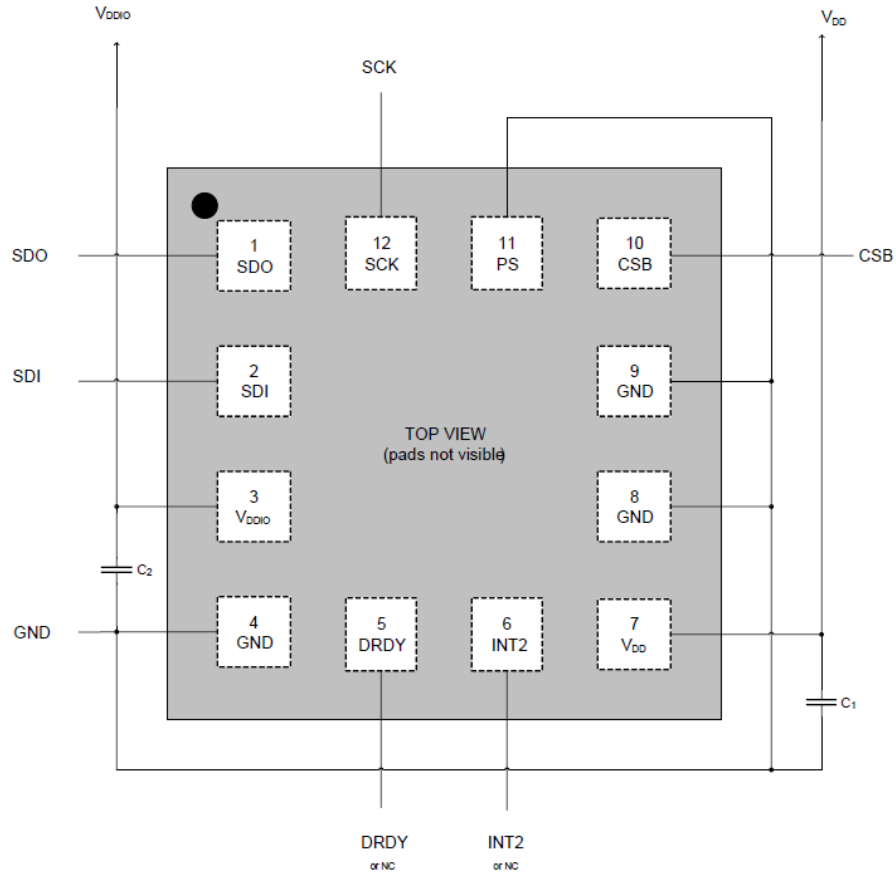


Figure 3: 4-wire SPI connection (C1=C2=100nF)

Note: The connection diagram is based on BMC156 pin definition.



### 3.2 3-wire SPI connection compatible design

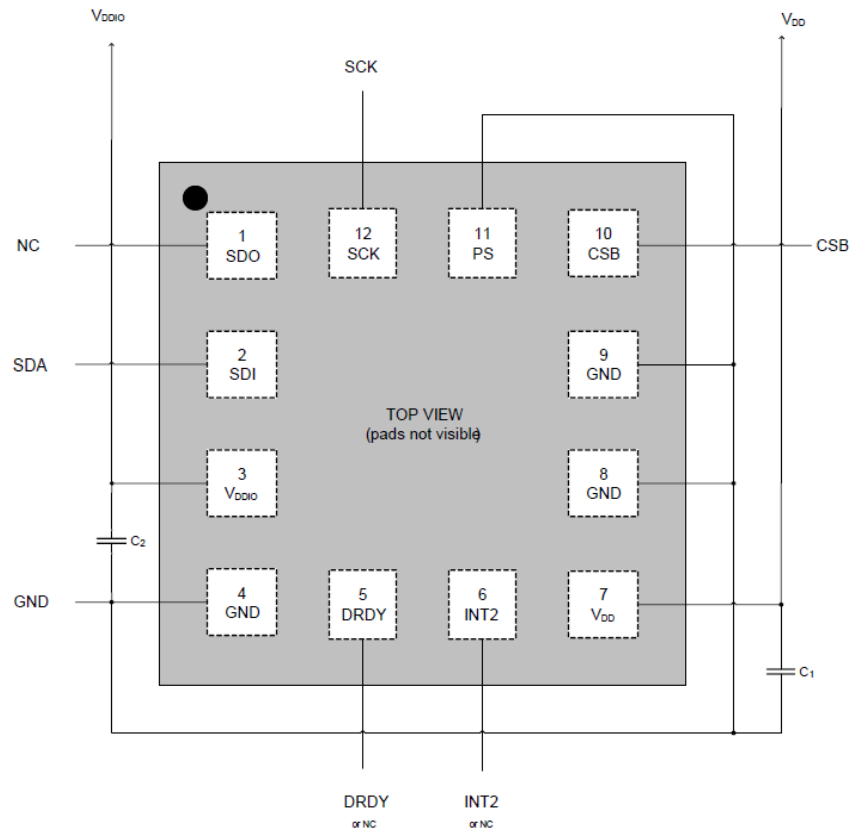


Figure 4. 3-wire SPI connection (C1=C2=100nF)

Note: The connection diagram is based on BMC156 pin definition.

### 3.3 I2C connection compatible design

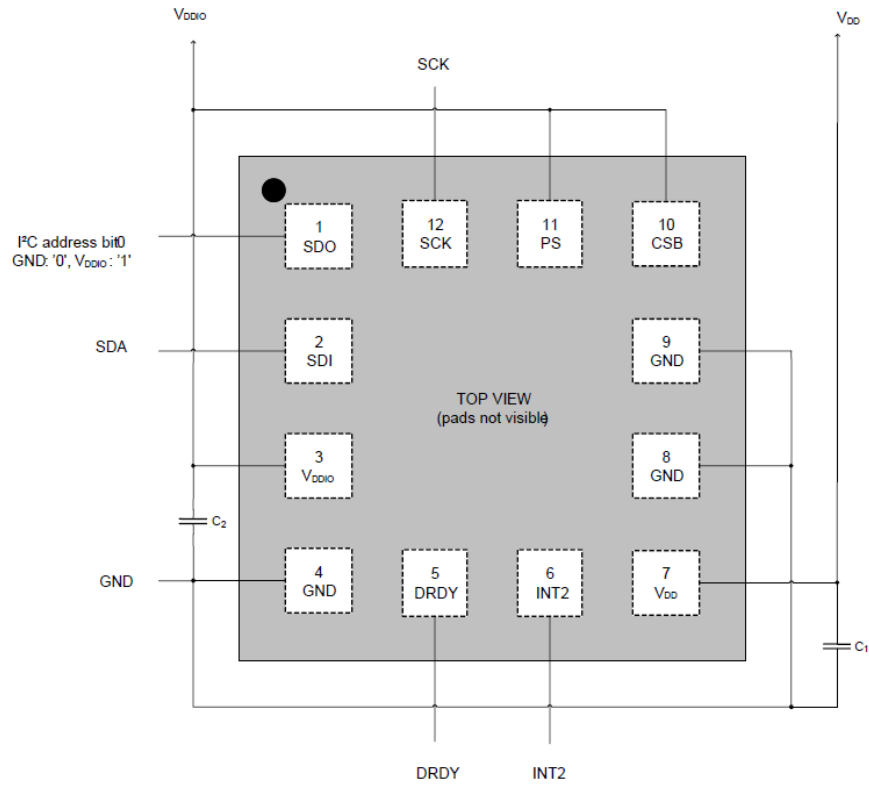


Figure 5. I2C connection (C1=C2=100nF)

Note: The connection diagram is based on BMC156 pin definition.

### 3.4 PCB Landing pattern recommendation

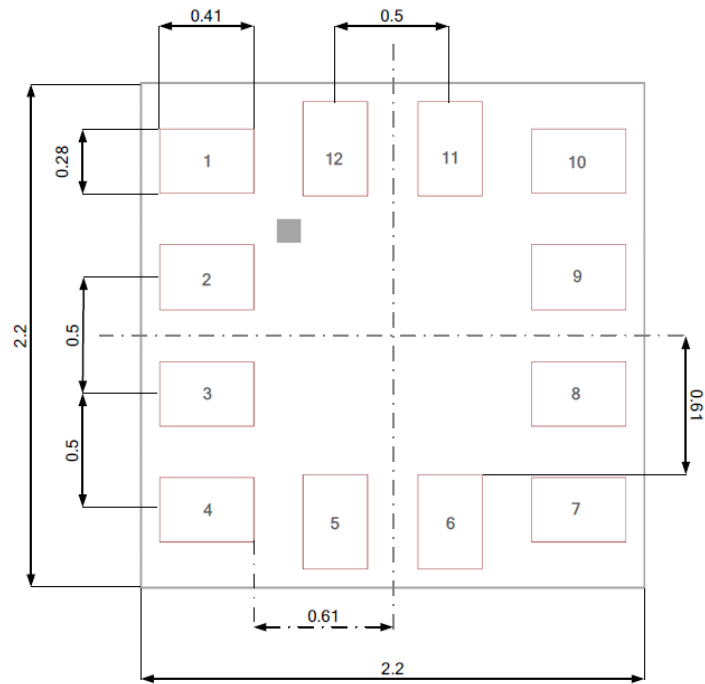


Figure 6: Landing pattern compatible design

*Note: Compare with BMA2x2, BMC156 footprint has 100um overhang in each side.*

### 3.5 PCB placement consideration

BMC156 has magnetic sensor part, in order to achieve optimum compass performance; several rules need to be kept to avoid the disturbances such as:

- a. On-board hard magnetic offsets
- b. Pay attention to temperature effect
- c. On-board current-induced fields
- d. On-board or external shielding
- e. On-board soft magnetic effects

For more detail guidance please refer to application note BST-MCS-AN002-02(“BMC Electronic Compass Geomagnetic sensor PCB placement guideline”).

## 4. Legal disclaimer

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## 5. Document history and modifications

Rev. No	Chapter	Description of modification/changes	Date
1.0		Document creation	14 May 2014
1.1	2.1	Figure 1: Size comparison improved	06 Aug 2014
	2.2	PIN#4: GND recommended but not required	
	2.3	Pin1 marking, metal pad: external connection not recommended	

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Document number: BST-BMC156-AN000-00  
Revision\_1.1\_082014