How to test BMA456MM any-motion and no-motion interrupt

Bosch Sensortec

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1 Introduction

BMA456 is a high performance 16‑bit accelerometer and has 3 variants. "BMA456H" is for hearables that supports triple‑tap interrupt, "BMA456W" is for wearables that supports step counting, while "BMA456MM" is for mass market as replacement of BMA253 that supports any‑motion/no‑motion interrupt. After BMA456 is powered on users can choose which config file to download to BMA456 and then BMA456 will become one of the 3 variants.

Currently the new application board 3.0 (APP3.0 board) is available at https://www.futureelectronics.com/p/development-tools--development-tool-hardware/application-board-3-0-bosch-sensortec-5147870. It has ublox module NINA‑B302 installed. The ublox module has Nordic nRF52840 BLE embedded. Different sensor shuttle board 3.0 can be plugged onto APP3.0 board and users can connect APP3.0 board to PC through a USB cable and then use DD2.1 GUI SW to evaluate sensor(s) or log sensor data into a file. Users can also download COINES SW at https://www.bosch-sensortec.com/software-tools/tools/coines/ and then install it on PC. Then users can perform low level C code modification and then compiling the code to evaluate sensor(s).

This technical document presents how to use COINES SW to test BMA456MM any‑motion and no‑motion interrupt.

2 Hardware setup

The hardware includes one APP3.0 base board, one BMA400 shuttle board 3.0 as an example and a battery pack shown in Figure 1. BMA400 shuttle board 3.0 can be replaced by BMA456 shuttle 3.0 that is available to purchase at https://www.digikey.com/en/products/detail/bosch-sensortec/SHUTTLE-BOARD-3-0-BMA456/14617514.
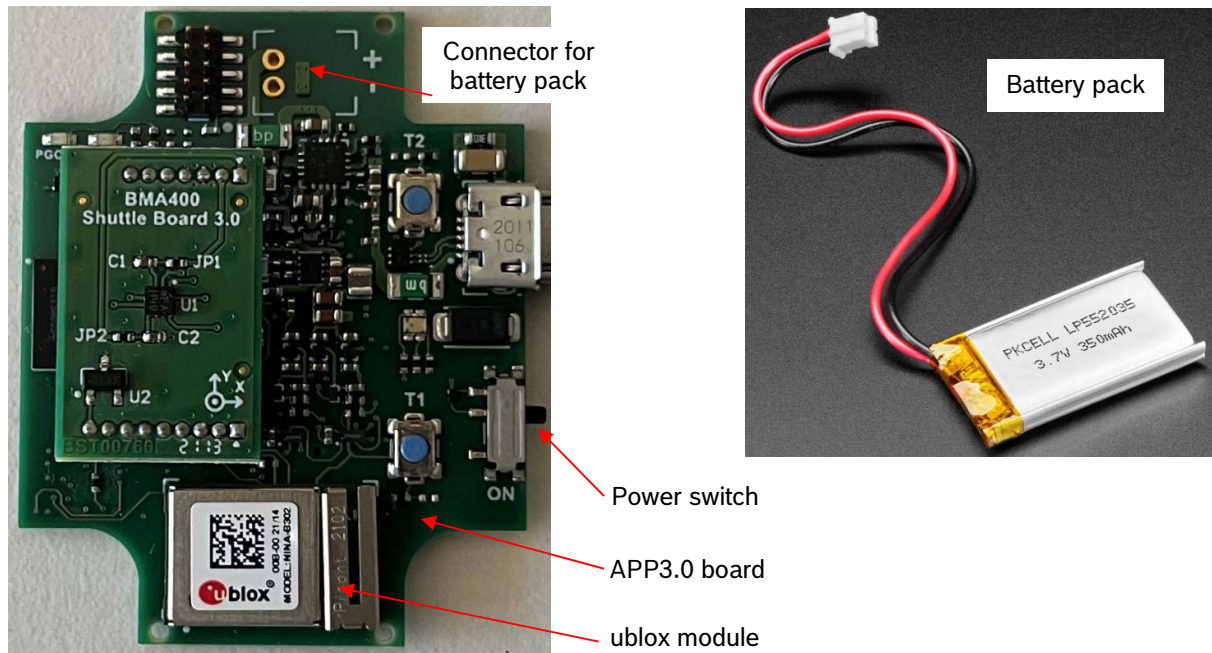

Figure 1 Hardware setup

The male connector for battery pack is available at https://www.digikey.com/en/products/detail/molex/0532540270/1952198. Users can buy it and then solder it on APP3.0 board.

The battery pack for APP3.0 board can be purchased at https://www.adafruit.com/product/2750. Users can then attach the battery pack to the bottom side of APP3.0 board for example with a piece of double stick tape. Then users can plug the battery pack female connector to the above male connector on the APP3.0 board.
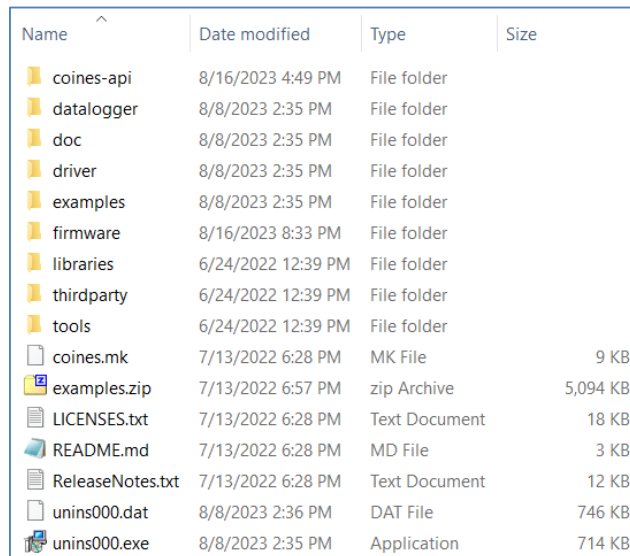
3 Getting started

The following is step-by-step instructions about how to test BMA456 any-motion and no-motion interrupt.

3.1 Download and install COINES SW

COINES v2.8.8 SW can be downloaded online at https://www.bosch-sensortec.com/media/boschsensortec/downloads/software/communication_with_inertial_and_environmental_sensors_coines/v2_8/coines_external_v2-8_rc_installer.zip. Users can unzip this file and then double click "COINES_External_V2.8_RC.exe" to install the COINES SW. After installation users are able to find the folder C:/Windows/COINES/v2.8.8 as shown in Figure 2.

COINES ("COmmunication with INertial and Environmental Sensors") provides a low-level interface to APP3.0 board and each sensor shuttle board 3.0. Users can access MEMS sensors through a C interface. COINES can be used with the SensorAPI of the sensor. The SensorAPI is available at https://github.com/BoschSensortec. Source code of sample applications and SensorAPI are provided with the COINES library as a package. Users can modify, compile and run the sample applications.

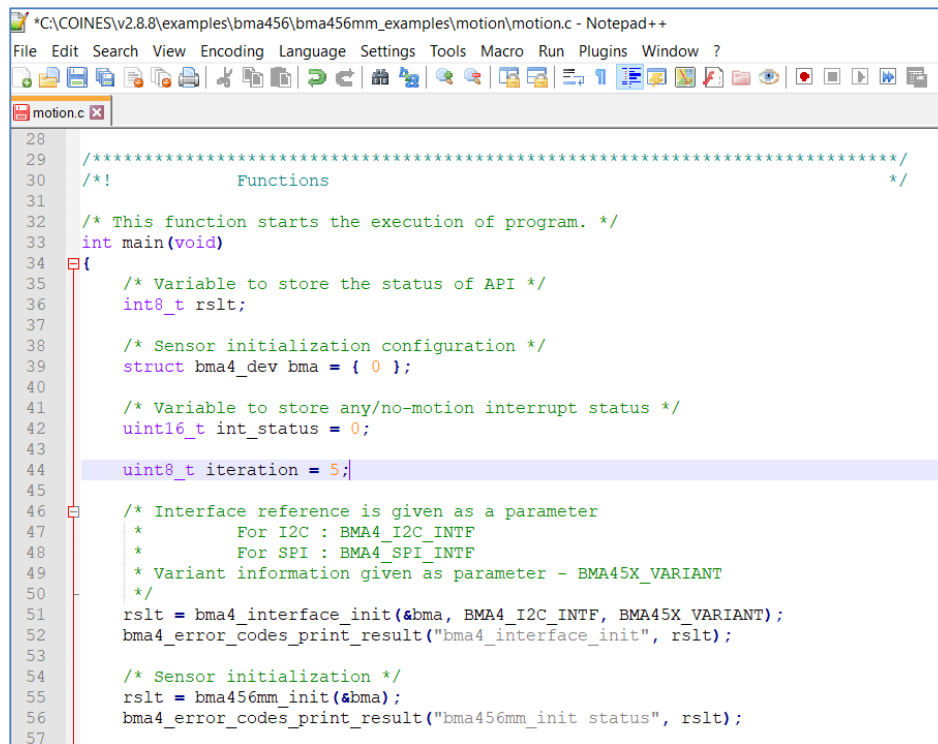| Name	Date modified	Type	Size
coines-api	8/16/2023 4:49 PM	File folder	
datalogger	8/8/2023 2:35 PM	File folder	
doc	8/8/2023 2:35 PM	File folder	
driver	8/8/2023 2:35 PM	File folder	
examples	8/8/2023 2:35 PM	File folder	
firmware	8/16/2023 8:33 PM	File folder	
libraries	6/24/2022 12:39 PM	File folder	
thirdparty	6/24/2022 12:39 PM	File folder	
tools	6/24/2022 12:39 PM	File folder	
coines.mk	7/13/2022 6:28 PM	MK File	9 KB
examples.zip	7/13/2022 6:57 PM	zip Archive	5,094 KB
LICENSES.txt	7/13/2022 6:28 PM	Text Document	18 KB
README.md	7/13/2022 6:28 PM	MD File	3 KB
ReleaseNotes.txt	7/13/2022 6:28 PM	Text Document	12 KB
unins000.dat	8/8/2023 2:36 PM	DAT File	746 KB
unins000.exe	8/8/2023 2:35 PM	Application	714 KB

Figure 2 COINES folder

The subfolder of "examples" contains subfolders of each sensor that have C source code for evaluation.

3.2 Download and install TDM-GCC compiler

Go to https://github.com/jmeubank/tdm-gcc/releases/download/v10.3.0-tdm64-2/tdm64-gcc-10.3.0-2.exe to download TDM-GCC compiler version 10.3.0 and then install it on PC.

3.3 Test BMA456

- Connect APP3.0 board to PC through a USB cable. BMA456 shuttle board 3.0 is plugged onto APP3.0 bard.

- Switch on the power switch of APP3.0 board. The LED close to the USB connector on APP3.0 board will light up with red color.

- Go to folder C:\COINES\v2.8.8\examples\bma456\bma456mm_examples\motion in Windows File Explorer.

- Use Notepad++ SW to open "motion.c" file and change the iteration from default 20 to 5 as shown in Figure 3. Then save the file.


```c
28
29   /***************************************************************************/
30   /*!          Functions                                                  */
31
32   /* This function starts the execution of program. */
33   int main(void)
34   {
35       /* Variable to store the status of API */
36       int8_t rslt;
37
38       /* Sensor initialization configuration */
39       struct bma4_dev bma = { 0 };
40
41       /* Variable to store any/no-motion interrupt status */
42       uint16_t int_status = 0;
43
44       uint8_t iteration = 5;
45
46       /* Interface reference is given as a parameter
47        *          For I2C : BMA4_I2C_INTF
48        *          For SPI : BMA4_SPI_INTF
49        * Variant information given as parameter - BMA45X_VARIANT
50        */
51       rslt = bma4_interface_init(&bma, BMA4_I2C_INTF, BMA45X_VARIANT);
52       bma4_error_codes_print_result("bma4_interface_init", rslt);
53
54       /* Sensor initialization */
55       rslt = bma456mm_init(&bma);
56       bma4_error_codes_print_result("bma456mm_init status", rslt);
57
```

Figure 3 Modify code in COINES example C file

- Then press and hold "Shift" key on the keyboard and then right click the mouse. Select "Open PowerShell window here" as shown in Figure 4.
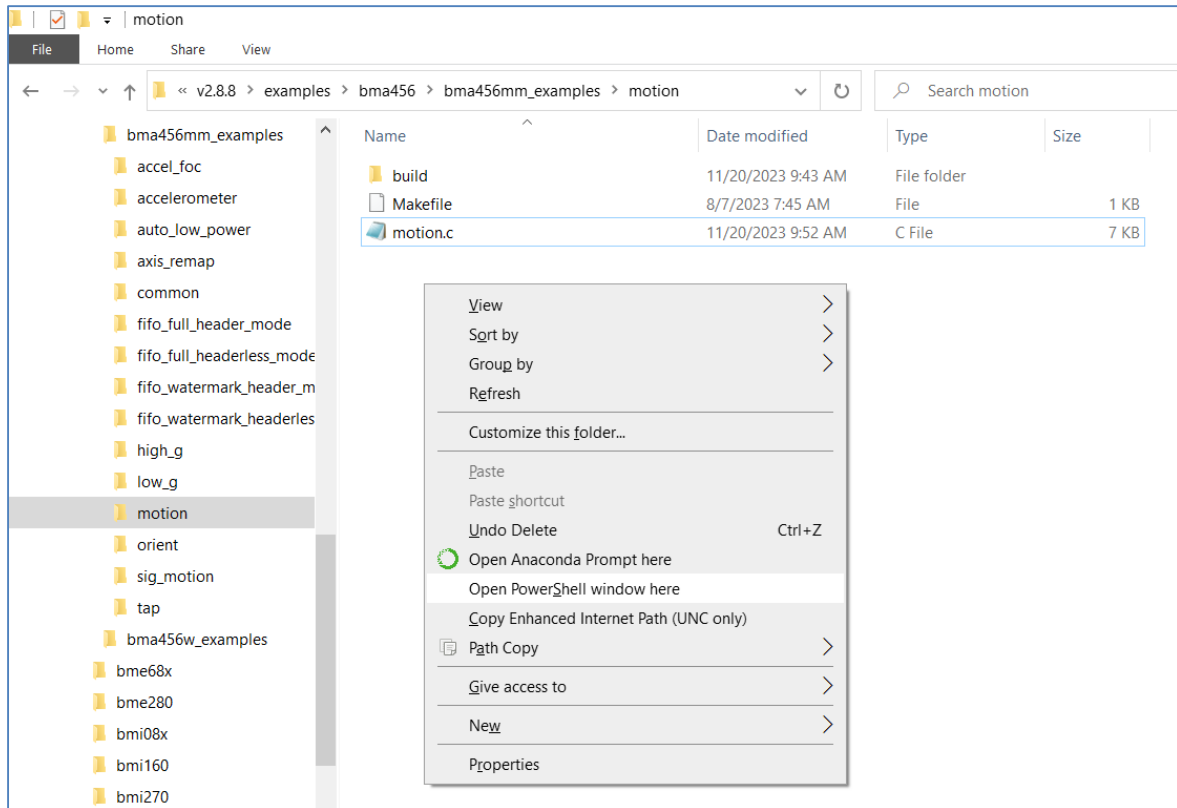
Figure 4 Open PowerShell window

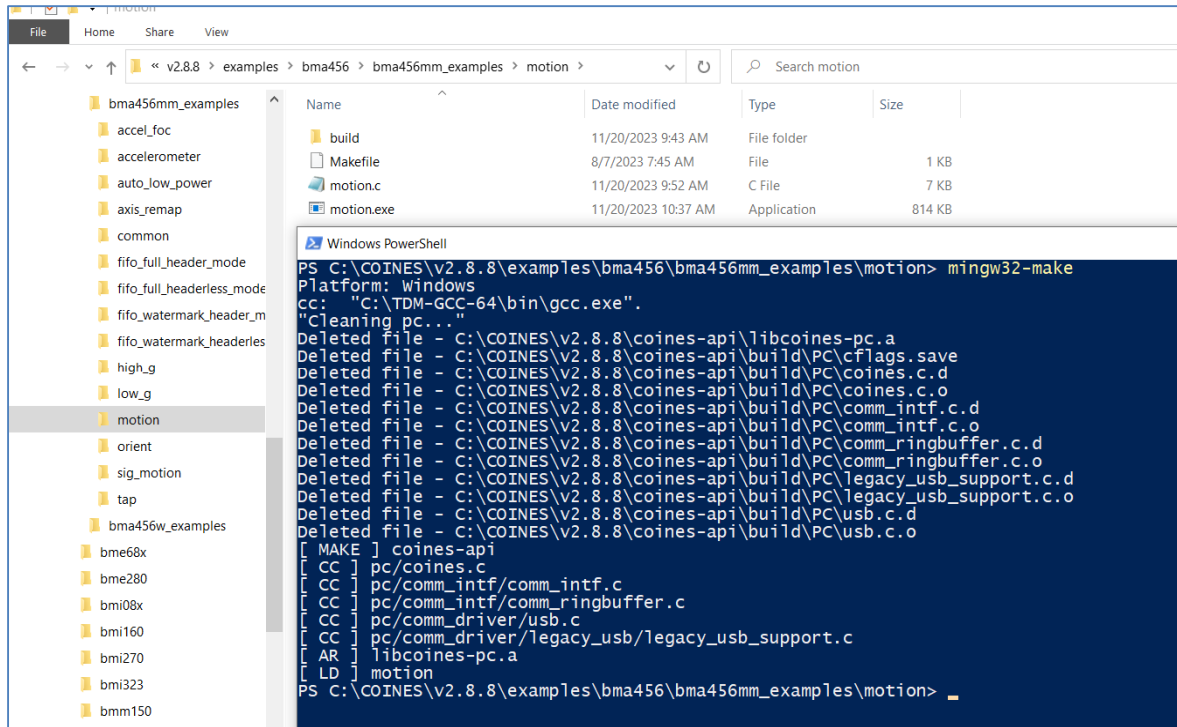- Type mingw32-make and then press Enter key. The "motion.exe" file will be generated as shown in Figure 5.

Figure 5 The EXE file is generated

- Type .\motion.exe and then press Enter key. Leave the APP3.0 base board and BMA456 shuttle board stationary. After a short while, "No-motion interrupt occurred" will be shown in Figure 6 below to indicate that no-motion interrupt event has happened 5 times.
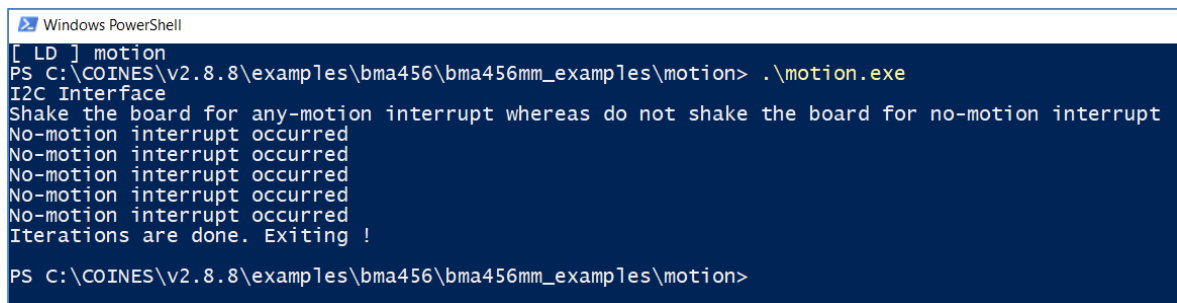

Figure 6 BMA456 no-motion interrupt event

- Type .\motion.exe and then press Enter key again. Shake the APP3.0 base board and BMA456 shuttle board continuously for about 30 seconds until the following Figure 7 shows up. "Any-motion interrupt occurred" repeated 5 times meaning that any-motion interrupt event has happened 5 times.

Figure 7 BMA456 any-motion interrupt event

- Done.

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5   Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0		Document creation	November 20th, 2023

Bosch Sensortec GmbH
Gerhard-Kindler-Strasse 8
72770 Reutlingen / Germany

Contact@bosch-sensortec.com
www.bosch-sensortec.com

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