

# How to generate single-tap and double-tap interrupts using BMI160 accelerometer

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## 1 Introduction

BMI160 IMU combo chip includes 16-bit 3-axis digital accelerometer (ACC) and 16-bit 3-axis gyroscope (GYR). Single-tap and double-tap interrupts are a built-in feature inside BMI160 accelerometer. It can be used to wake up a system in low power mode in order to save overall power consumption of the system. The working principle of single-tap and double-tap is described in BMI160 datasheet online at <https://ae-bst.resource.bosch.com/media/tech/media/datasheets/BST-BMI160-DS000-07.pdf> on page 28 Section 2.3.4.

After BMI160 is powered on, both accelerometer and gyroscope will be in suspend mode. Users need to write value of 0x12 to command register 0x7E to bring the accelerometer to low power mode (LPM) with default +/-2g full scale (FS) range and 100Hz output data rate (ODR). Then users can write value of 0x88 to register 0x40 for no average. At this time BMI160 accelerometer consumes about 45uA compared to normal mode of 180uA.

The single-tap interrupt will be generated when two of the following conditions are valid:

- The slope or differential acceleration exceeds the int\_tap\_th (tap threshold). Within the int\_tap\_shock amount of time, all other slope accelerations will be ignored
- After the tap\_shock amount of time, within the int\_tap\_quiet amount of time there are also no slope or differential acceleration exceeds the int\_tap\_th

The single-tap interrupt will be cleared automatically when the above conditions are no longer valid.

The double-tap interrupt will be generated when three of the following conditions are valid:

- The slope or differential acceleration exceeds the int\_tap\_th (tap threshold). Within the int\_tap\_shock amount of time, all other slope accelerations will be ignored
- After the tap\_shock amount of time, within the int\_tap\_quiet amount of time there are also no slope or differential acceleration exceeds the tap\_th
- Within int\_tap\_dur amount of time the second of single-tap event happened

The double-tap interrupt will be cleared automatically when the above conditions are no longer valid.

## 2 Sample code

Below is the pseudo code to initialize the BMI160 accelerometer for single-tap interrupt on INT1 pin and double-tap on INT2 pin. The settings can be fine-tuned to meet the requirements in different applications.

```
void init_BMI160_ACC(void)
{
    // basic configurations
    Write value of 0xB6 to register 0x7E;           // soft reset BMI160 to default settings. Both
                                                    // accelerometer and gyroscope are in suspend
                                                    // mode
    Delay 55ms;                                     // for BMI160 to stabilize
    Write value of 0x12 to register 0x7E;           // set the accelerometer to LPM mode
    Delay 5ms;                                       // for BMI160 accelerometer to stabilize
    Write value of 0x88 to register 0x40;           // set ODR to 100Hz with no average (45uA)

    // interrupt configuration
    Write value of 0xAA to register 0x53;           // set both INT1 pin and INT2 pin as output,
                                                    // active-high, push-pull
    Write value of 0x09 to register 0x54;           // temporarily latch the interrupt for 80ms
    Write value of 0x20 to register 0x55;           // route single-tap interrupt to INT1 pin
    Write value of 0x10 to register 0x57;           // route double-tap interrupt to INT2 pin

    // tap sensing configuration
    Write 0x04 to register 0x63;                     // default value for 50ms int_tap_shock,
                                                    // 30ms int_tap_quiet and 250ms int_tap_dur.
                                                    // (These durations can be fine-tuned)
    Write 0x0A to register 0x64;                     // default value for 625mg int_tap_th (can be
                                                    // fine-tuned)

    // enable single-tap and double-tap interrupt
    Write 0x30 to register 0x50;                     // enable single-tap and double-tap interrupt
}
}
```

### 3 Test results

Below is the screenshot of the Development Desktop software. The software works with the APP2.0 application base board that has the BMI160 shuttle board plugged in.

Figure 1 shows that the single-tap interrupts on INT1 pin and double-tap interrupts on INT2 pin are generated. The tap motion can come from any directions.

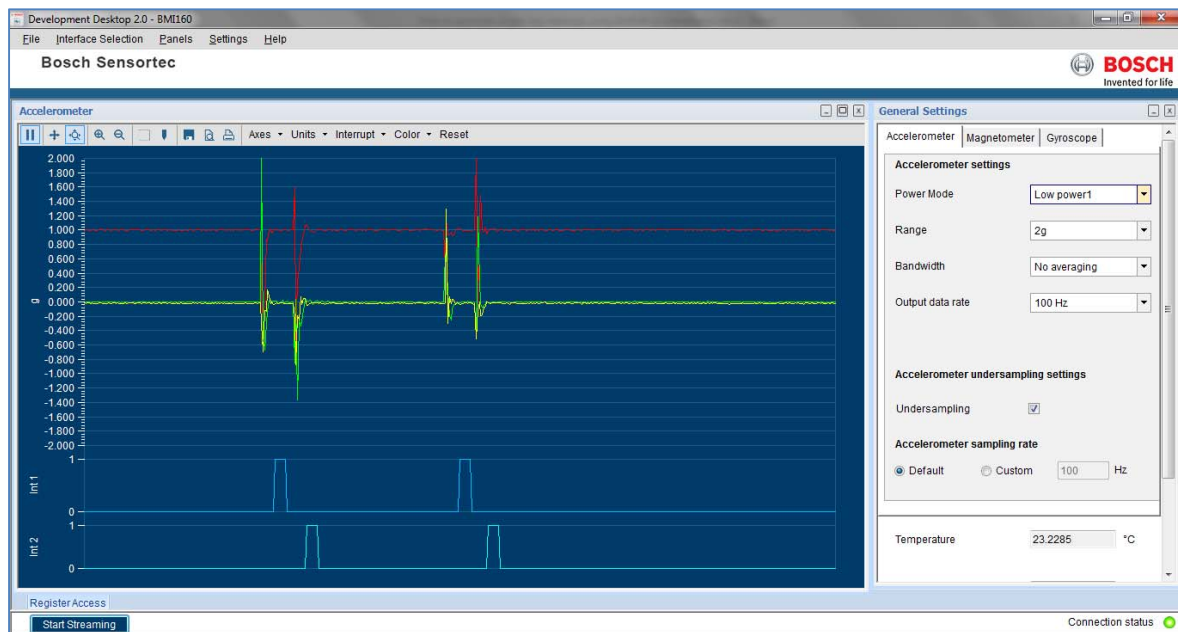


Figure 1: Single-tap and double-tap interrupts

## 4 Legal disclaimer

### 4.1 Engineering samples

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## 5 Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0		Document creation	August 22 <sup>nd</sup> , 2017

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