BMA456MM Feature Set
Application Note

Application Note – BMA456MM Feature Set

Document revision	0.1
Document release date	July 2021
Document number	BST-BMA456-AN001-01
Document valid for	BMA456
Notes	Data and descriptions 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 appearance. The technical details and legal disclaimer of the respective product data sheet apply.

Index of Contents

1. Feature set 5

1.1. Interrupt Features 5

Global Configuration 5

Axes remapping for interrupt features 6

2. Features Description 7

2.1. Any Motion detection 7

2.2. No Motion Detection: 8

2.3. Significant Motion 10

2.4. Orientation Recognition 11

2.5. High-g Detection 16

2.6. Low-g (Freefall) Detection 18

2.7. Auto low power 19

Auto sleep mode 19

Auto wake mode 19

2.8. Multi-tap detection 21

3. Register Description 23

3.1. Register Map 23

3.1.1 Register (0x00) CHIP_ID 31

3.1.2 Register (0x02) ERR_REG 31

3.1.3 Register (0x03) STATUS 32

3.1.4 Register (0x0A) DATA_0 32

3.1.5 Register (0x0B) DATA_1 32

3.1.6 Register (0x0C) DATA_2 33

3.1.7 Register (0x0D) DATA_3 33

3.1.8 Register (0x0E) DATA_4 33

3.1.9 Register (0x0F) DATA_5 34

3.1.10 Register (0x10) DATA_6 34

3.1.11 Register (0x11) DATA_7 35

3.1.12 Register (0x12) DATA_8 35
3.1.13 Register (0x13) DATA_9 35
3.1.14 Register (0x14) DATA_10 36
3.1.15 Register (0x15) DATA_11 36
3.1.16 Register (0x16) DATA_12 36
3.1.17 Register (0x17) DATA_13 37
3.1.18 Register (0x18) SENSORTIME_0 37
3.1.19 Register (0x19) SENSORTIME_1 37
3.1.20 Register (0x1A) SENSORTIME_2 38
3.1.21 Register (0x1B) EVENT 38
3.1.22 Register (0x1C) INT_STATUS_0 38
3.1.23 Register (0x1D) INT_STATUS_1 39
3.1.24 Register (0x1E) ORIENT_OUTPUT 39
3.1.25 Register (0x1F) HIGH_G_OUTPUT 40
3.1.26 Register (0x20) MULTITAP_OUTPUT 40
3.1.27 Register (0x22) TEMPERATURE 41
3.1.28 Register (0x24) FIFO_LENGTH_0 41
3.1.29 Register (0x25) FIFO_LENGTH_1 42
3.1.30 Register (0x26) FIFO_DATA 42
3.1.31 Register (0x2A) INTERNAL_STATUS 42
3.1.32 Register (0x40) ACC_CONF 43
3.1.33 Register (0x41) ACC_RANGE 44
3.1.34 Register (0x44) AUX_CONF 45
3.1.35 Register (0x45) FIFO_DOWNS 46
3.1.36 Register (0x46) FIFO_WTM_0 46
3.1.37 Register (0x47) FIFO_WTM_1 47
3.1.38 Register (0x48) FIFO_CONFIG_0 47
3.1.39 Register (0x49) FIFO_CONFIG_1 48
3.1.40 Register (0x4B) AUX_DEV_ID 49
3.1.41 Register (0x4C) AUX_IF_CONF 49
3.1.42 Register (0x4D) AUX_RD_ADDR 50
3.1.43 Register (0x4E) AUX_WR_ADDR 50

3.1.44 Register (0x4F) AUX_WR_DATA 50
3.1.45 Register (0x53) INT1_IO_CTRL 51
3.1.46 Register (0x54) INT2_IO_CTRL 52
3.1.47 Register (0x55) INT_LATCH 53
3.1.48 Register (0x56) INT1_MAP 53
3.1.49 Register (0x57) INT2_MAP 54
3.1.50 Register (0x58) INT_MAP_DATA 54
3.1.51 Register (0x59) INIT_CTRL 55
3.1.52 <Register (0x5E) FEATURES_IN 55
3.1.53 Register (0x5F) INTERNAL_ERROR 64
3.1.54 Register (0x6A) NVM_CONF 64
3.1.55 Register (0x6B) IF_CONF 65
3.1.56 Register (0x6D) ACC_SELF_TEST 65
3.1.57 Register (0x70) NV_CONF 66
3.1.58 Register (0x71) OFFSET_0 67
3.1.59 Register (0x72) OFFSET_1 67
3.1.60 Register (0x73) OFFSET_2 69
3.1.61 Register (0x7C) PWR_CONF 69
3.1.62 Register (0x7D) PWR_CTRL 69
3.1.63 Register (0x7E) CMD 70

4. Document history and modification 71

1. Feature set

This application note describes the feature set for the firmware version BMA456MM[1] which can be applied for multiple use-cases. The BMA456MM firmware version supports the following features: Any-motion, No-motion, Significant-motion, Orientation, High-g, Low-g, Multi-tap detection and Auto-sleep/ wakeup.
For complete details regarding BMA456 specifications (e.g. pin-out, power modes, interrupt pin configuration, temperature sensor, sensor Time, FIFO), digital interfaces (primary/secondary), landing pattern, HSMI and firmware image refer the following link:
https://www.bosch-sensortec.com/products/motion-sensors/accelerometers/bma456.html
https://github.com/BoschSensortec

1.1. Interrupt Features

Global Configuration

The configuration of the interrupt feature set is described in the register FEATURES_IN.
In order to reconfigure the features, the user must perform a burst read of the whole content from the register FEATURES_IN, followed by a modification of the content, and finally a burst write of the modified content to the register FEATURES_IN. The content of the successive bytes read or written in burst mode correspond to the each bytes described in FEATURES_IN.

Ensure that the sensor is initialized before the feature configuration is performed (see datasheet chapter 4.2 Device Initialization)

The output of the interrupt features can be read from the status registers listed below.

Feature	Output Status
Any motion	INT_STATUS_0.any_motion_out
No motion	INT_STATUS_0.no_motion_out
Significant motion	INT_STATUS_0.sig_motion_out
Orientation	INT_STATUS_0.orientation_out
High g	INT_STATUS_0.high_g_out
Low g	INT_STATUS_0.low_g_out
Multi tap	INT_STATUS_0.tap_out
Error interrupt	INT_STATUS_0. error_int_out

Table 1: Interrupt status register overview

The error interrupt signals indicate that the sensor has been stopped after a fatal error. In this condition the device re-initialization must be done for proper functioning of the sensor.

The BMA456 supports features processing in both power modes: high performance and low power. In addition BMA456 supports automated power modes and also conditional power mode switching. The features have as input data the acceleration samples, which between 50Hz and 200Hz in low power mode.

Minimum Bandwidth Settings
If performance mode is enabled (ACC_CONF.acc_perf_mode is 0b1, device is in continuous mode), then the features are functioning properly, regardless to the ODR and the Bandwidth that the Host would set.

[1] MM – Mass Market

If Performance Mode is disabled (ACC_CONF.acc_perf_mode is 0b0) (device is in non-continuous mode), then the minimum ODR setting must comply with the following restrictions:

- The ODR must be set to minimum 50 Hz for the most features except multi-tap and high G detection
- The ODR must be set to minimum 200 Hz for the use of multi-tap and high G detection

If the minimum requirements are not met, then the corresponding error flag from the register INTERNAL_STATUS is set.

Axes remapping for interrupt features

If the sensor orientation, when integrated into the customer devices, is different from described in chapter 'sensing axis orientation', the sensor axis/axes must be remapped to use the integrated features properly.
Axes remapping register allows the host to freely map individual axis to the coordinate system of the used platform. Individual axis can be mapped to any other defined axis. The sign value of the axis can also be configured. For example x axis can be mapped to –x axis, +y axis, - y axis, +z axis or –z axis. Similarly other axes can also be configured depending on the customer use case.

Note:
The axis remapping does apply only to the data fetched into the features. The DATA_0 to DATA_13 registers are not affected and should be accordingly remapped on the driver level if needed.

Configuration settings:

1. FEATURES_IN.axes_remapping.map_x_axis - describes which axis shall be mapped to x axis.
2. FEATURES_IN.axes_remapping.map_x_axis_sign – describes whether the mapped axis shall be inverted or not to be inverted.
3. FEATURES_IN.axes_remapping.map_y_axis – describes which axis shall be mapped to y axis.
4. FEATURES_IN.axes_remapping.map_y_axis_sign – describes whether the mapped axis shall be inverted or not to be inverted.
5. FEATURES_IN.axes_remapping.map_z_axis –describes which axis shall be mapped to z axis.
6. FEATURES_IN.axes_remapping.map_z_axis_sign – describes whether the mapped axis shall be inverted or not to be inverted.

2. Features Description

2.1. Any Motion detection

Any-motion detection uses the slope between current input and reference acceleration samples to detect the motion status of the device. Feature can be enabled by setting at least one of the following: FEATURES_IN.ANYMO_2.x_en, FEATURES_IN.ANYMO_2.y_en, FEATURES_IN.ANYMO_2.z_en, respectively for each axis.

Any-motion provides an interrupt when the absolute value of the slope exceeds the configurable FEATURES_IN.ANYMO_1.threshold for consecutive FEATURES_IN.ANYMO_2.duration samples for at-least one of the enabled sensing axis.

Any motion interrupt behaviour is configured using FEATURES_IN.ANYMO_1.int_bhvr. When the bit is set (single_shot) it generates an interrupt for every valid condition and when it is cleared (multi_int) it generates an interrupt as long as the condition is valid.

Reference acceleration sample is updated only when an any-motion interrupt is triggered. The interrupt status is reset as soon as the slope falls below the set FEATURES_IN.ANYMO_1.threshold value. The signals and timings relevant to the any-motion interrupt functionality are depicted in the figure below:

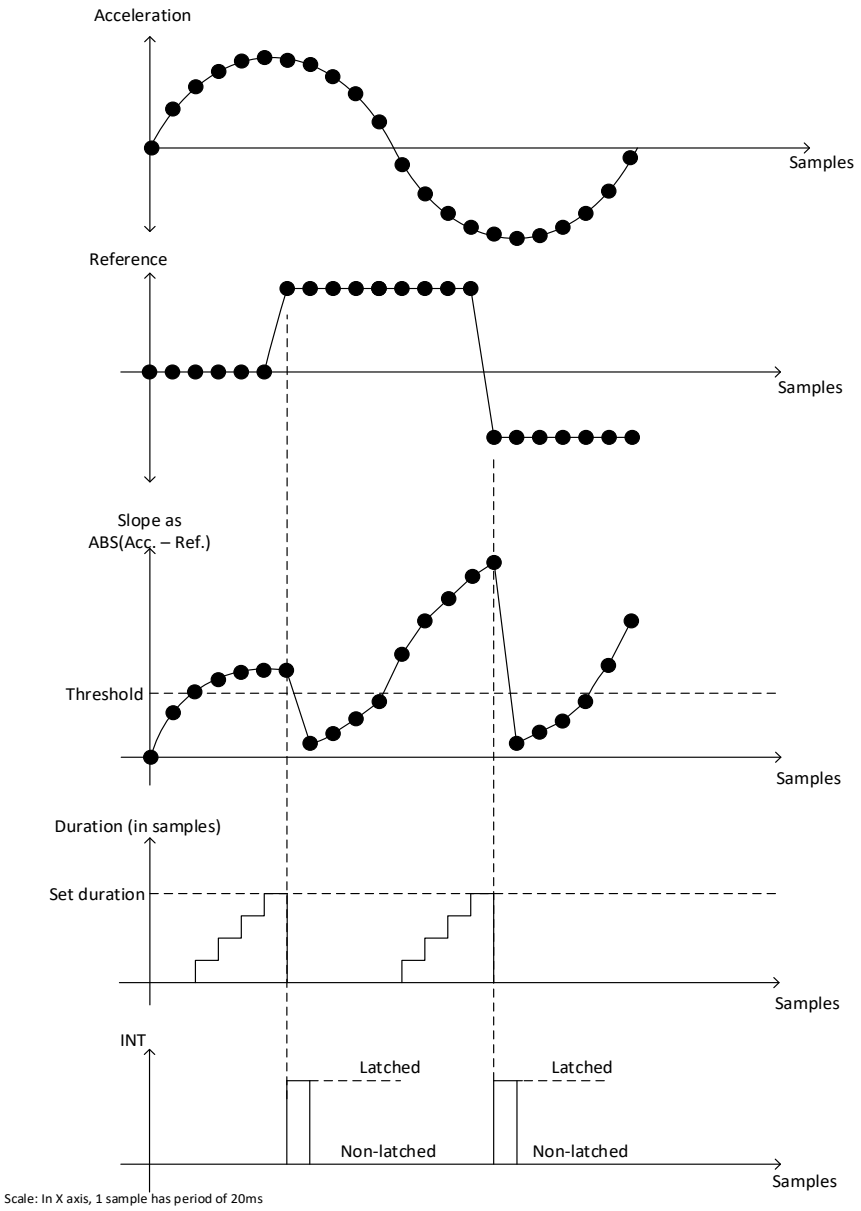


Figure 1: Signal and timing diagram for any-motion interrupt detection

Configuration settings:

1. FEATURES_IN.ANYMO_1.threshold – the slope threshold.
2. FEATURES_IN.ANYMO_1.int_bhvr – the interrupt behavior is configured
3. FEATURES_IN.ANYMO_2.duration – the number of consecutive data points for which the threshold condition must be respected, for interrupt assertion.
4. FEATURES_IN.ANYMO_2.x_en – indicates if this feature is enabled for x axis
5. FEATURES_IN.ANYMO_2.y_en – indicates if this feature is enabled for y axis
6. FEATURES_IN.ANYMO_2.z_en –indicates if this feature is enabled for z axis

2.2. No Motion Detection

No-motion detection uses the slope between two consecutive acceleration signal samples to detect static state of the device. Feature can be enabled by setting at least one of the following flags: FEATURES_IN.NOMO_2.x_en, FEATURES_IN.NOMO_2.y_en and FEATURES_IN.NOMO_2.z_en, respectively for each axis.

No-motion interrupt is triggered when the slope on all enabled sensing axis remains smaller than the configurable FEATURES_IN.NOMO_1.threshold for the duration configured by FEATURES_IN.NOMO_2.duration. No-motion interrupt is cleared as soon as the acceleration slope exceeds the set threshold. The signals and timings relevant to the no-motion interrupt functionality are depicted in the figure below.

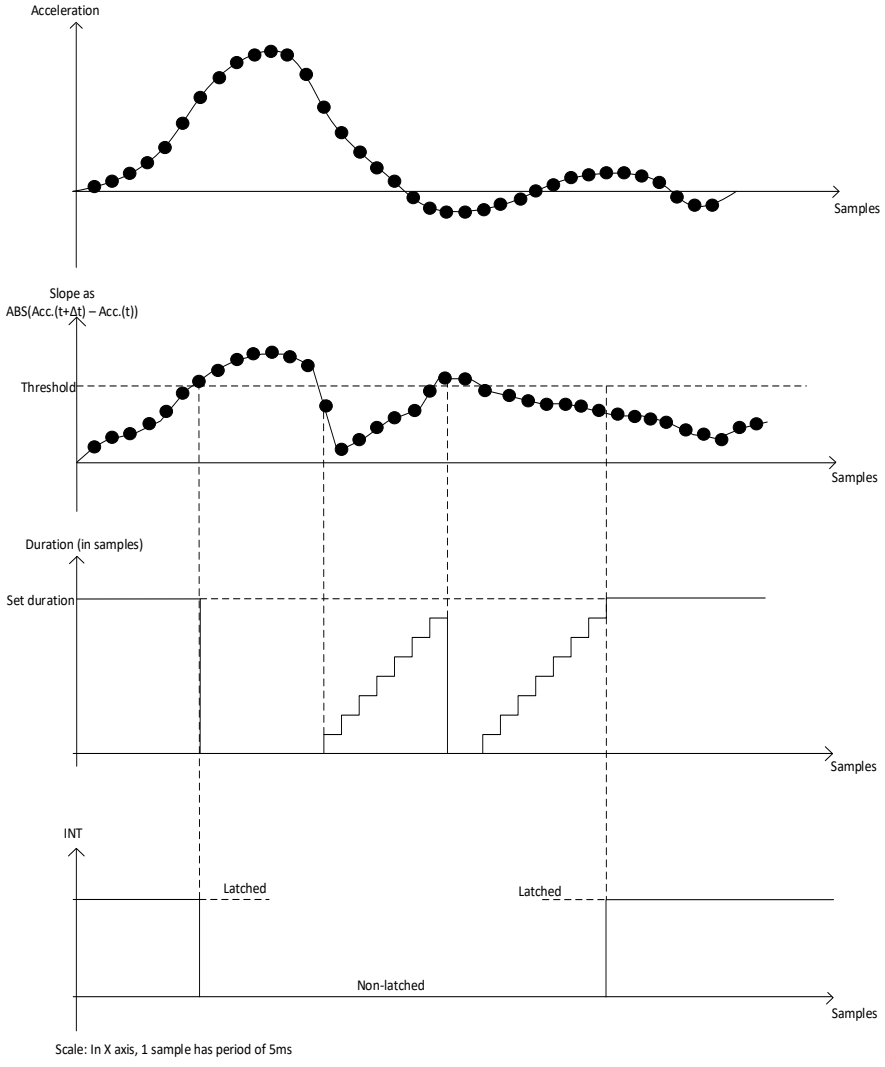


Figure 2: Signal and timing diagram for no-motion interrupt detection

Register FEATURES_IN.NOMO_2.duration defines the number of consecutive data points for which the slope of enabled axis must be smaller than the threshold for an interrupt to be asserted. No motion interrupt behaviour is configured using FEATURES_IN.NOMO_1.int_bhvr. When the bit is set (single_shot) it generates an interrupt for every valid condition and when it is cleared (multi_int) it generates an interrupt as long as the condition is valid.

Configuration settings:

1. FEATURES_IN.NOMO_1.threshold – the slope threshold.
2. FEATURES_IN.NOMO_1.int_bhvr – the interrupt behavior is configured
3. FEATURES_IN.NOMO_2.duration – the number of consecutive data points for which the threshold condition must be respected, for interrupt assertion.
4. FEATURES_IN.NOMO_2.x_en – indicates if this feature is enabled for x axis
5. FEATURES_IN.NOMO_2.y_en – indicates if this feature is enabled for y axis
6. FEATURES_IN.NOMO_2.z_en –indicates if this feature is enabled for z axis

2.3. Significant Motion

The significant motion interrupt implements the interrupt required for motion detection in Android 4.3 and higher: https://source.android.com/devices/sensors/sensor-types.html#significant_motion.

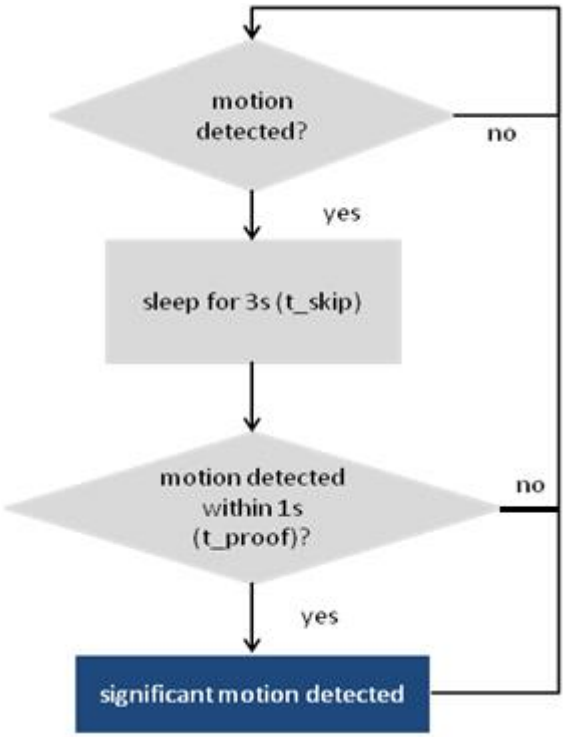
A significant motion is a motion due to a change in the user location.
Examples of such significant motions are walking or biking, sitting in a moving car, coach or train, etc. Examples of situations that should not trigger significant motion include phone in pocket and person is not moving, phone is on a table and the table shakes a bit due to nearby traffic or washing machine.

The algorithm uses acceleration and performs the following steps to detect a significant motion:

1. Look for movement – is the slope (difference between two consecutive accelerations) over a FEATURES_IN.SIGMO_1.threshold.
2. [Movement detected] Sleep for a time interval, specified in FEATURES_IN.SIGMO_2.skip_time.
3. Look for movement. Either option a or option b will happen:
   a. FEATURES_IN.SIGMO_3.proof_time has passed without movement. Go back to 1.
   b. Movement detected - Report that a significant movement has been found and wake up the application processor.

Both FEATURES_IN.SIGMO_2.skip_time and FEATURES_IN.SIGMO_3.proof_time is expressed in number of 50Hz samples, that need to be skipped and the motion is checked for re-detection.

The following block diagram illustrates the algorithm:



Configuration settings:

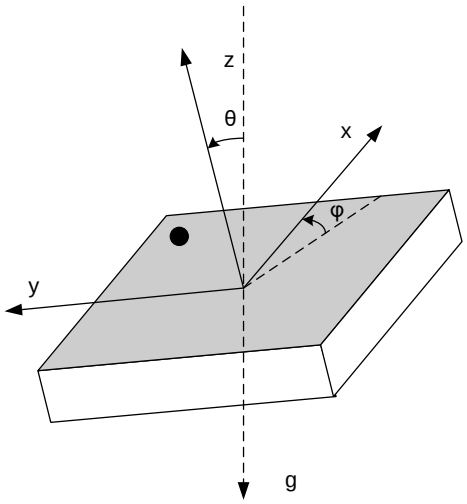
1. FEATURES_IN.SIGMO_1.threshold – the acceleration-slope threshold above which the significant motion is detected.
2. FEATURES_IN.SIGMO_2.skip_time – the duration for skip time in 20ms intervals.
3. FEATURES_IN.SIGMO_3.proof_time – the duration for proof time in 20ms intervals
4. FEATURES_IN.SIGMO_2.enable – indicates if this feature is enabled or not.

2.4. Orientation Recognition

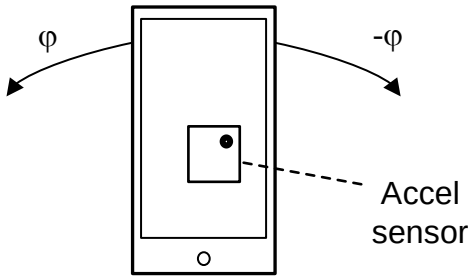
Working principle

The orientation recognition feature detects the change in the sensor orientation with respect to the gravitational field vector g. It performs two types of detection: portrait/landscape detection (portrait upright, landscape left, portrait upside down, and landscape right) and face upside/downside detection. Only when the portrait/landscape detection has been enabled, the face upside/downside detection can be enabled/disabled through FEATURES_IN.ORIENT_1.ud_en.

The sensor orientation is defined by the angle φ and θ. φ is the rotation angle around the stationary z axis, corresponding to the portrait/landscape detection. θ is the rotation angle around the stationary y axis, corresponding to the face upside/downside detection.



Definition of Coordinate System with Respect to Pin 1 Marker



$\theta = 90°$, $\varphi = 270°$

Looking at the Phone from the Front in Portrait Upright Mode

Therefore, the measured acceleration vector components are calculated as follows:

$$acc_x = 1g \cdot \sin\theta \cdot \cos\varphi \qquad (1)$$

$$acc_y = -1g \cdot \sin\theta \cdot \sin\varphi \quad (2)$$

$$acc_z = 1g \cdot \cos\theta \quad (3)$$

(2)/(1): $\frac{acc_y}{acc_x} = -\tan\varphi$

Following figure shows the typical switching conditions among the four different orientations in symmetrical mode i.e. without hysteresis, as well as the position of the device and phone:

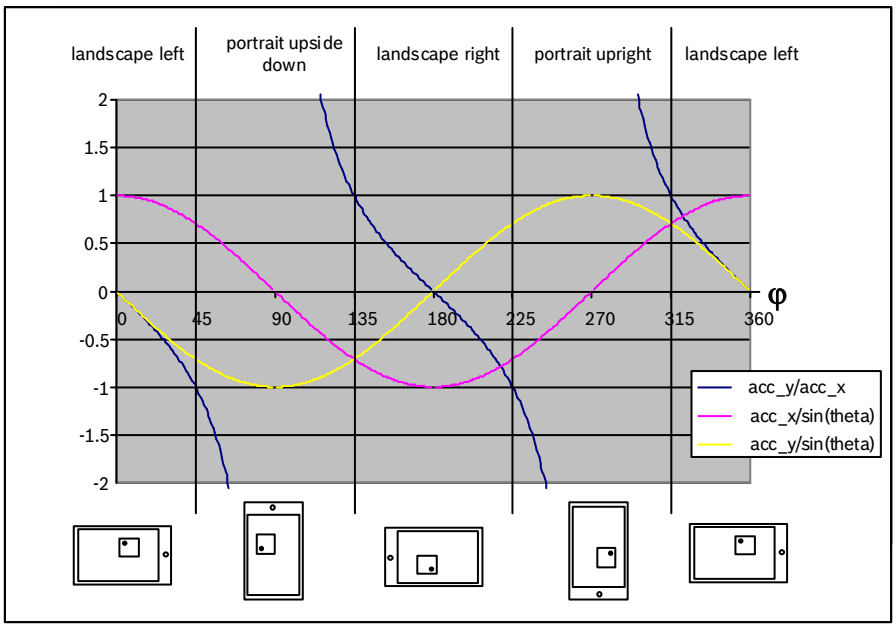


Figure 3: Typical Orientation Switching Conditions Without Hysteresis

Portrait/landscape detection mode

There are three orientation calculation modes for the portrait/landscape detection: symmetrical, high asymmetrical and low asymmetrical. The mode can be configured in the register FEATURES_IN.ORIENT_1.mode as follows:

Portrait/Landscape Mode

Value	Orientation Mode
0b00	Symmetrical
0b01	High asymmetrical
0b10	Low asymmetrical
0b11	Symmetrical

Portrait/landscape detection output in different modes

When the portrait/landscape detection is enabled in FEATURES_IN.ORIENT_1.enable, the detection outputs are updated in the Bit 1 and Bit 0 of FEATURES_IN.ORIENT_OUTPUT.orientation_out.
The change of orientation and the trigger of the interrupt is stated in INT_STATUS_0.orientation_out.

The hysteresis for the portrait/landscape detection can be configured in FEATURES_IN.ORIENT_2.hysteresis, which contains 11 valid bits (unsigned) with a range of 1g. So, one LSB stands for $1/2^{11}$ g (≈ 0.49 mg). The default hysteresis value is 128 = 0.0625 g.

The following tables show the portrait/landscape detection outputs in different modes, where "hy" stands for the configured hysteresis value, and "hy°" stands for the according value in degree.

Portrait/Landscape Output with Hysteresis in Symmetrical Mode

Orientation_out [1:0]	Name	Angle	Condition
00	Portrait upright	225°+hy° < φ < 315°-hy°	|acc_y|>|acc_x|+hy && acc_y≥0
01	Landscape left	315°+hy° < φ < 45°-hy°	|acc_y|<|acc_x|-hy && acc_x≥0
10	Portrait upside down	45°+hy° < φ < 135°-hy°	|acc_y|>|acc_x|+hy && acc_y<0
11	Landscape right	135°+hy° < φ < 225°-hy°	|acc_y|<|acc_x|-hy && acc_x<0

Portrait/Landscape Output with Hysteresis in High Asymmetrical Mode

Orientation_out [1:0]	Name	Angle	Condition
00	Portrait upright	243°+hy° < φ <297°-hy°	|acc_y|>2*|acc_x|+hy && acc_y≥0
01	Landscape left	297°+hy° < φ <63°-hy°	|acc_y|<2*(|acc_x|-hy) && acc_x≥0
10	Portrait upside down	63°+hy° < φ <117°-hy°	|acc_y|>2*|acc_x|+hy && acc_y<0
11	Landscape right	117°+hy° < φ <243°-hy°	|acc_y|<2*(|acc_x|-hy) && acc_x<0

Portrait/Landscape Output with Hysteresis in Low Asymmetrical Mode

Orientation_out [1:0]	Name	Angle	Condition
00	Portrait upright	207°+hy° < φ <333°-hy°	|acc_y|>|acc_x|/2+hy && acc_y≥0
01	Landscape left	333°+hy° < φ <27°-hy°	|acc_y|<(|acc_x|-hy)/2 && acc_x≥0
10	Portrait upside down	27°+hy° < φ <153°-hy°	|acc_y|>|acc_x|/2+hy && acc_y<0
11	Landscape right	153°+hy° < φ <207°-hy°	|acc_y|<(|acc_x|-hy)/2 && acc_x<0

Face upside/downside detection

With the orientation detection feature enabled, the face upside/downside detection can be enabled/disabled by setting FEATURES_IN.ORIENT_1.ud_en to 1/0, and the output is indicated in Bit 2 of FEATURES_IN.ORIENT_OUTPUT.orientation_faceup_down.

In order to avoid unwanted generation of the orientation interrupt in a nearly flat position (z ~ 0, sign change due to small movements or noise), the hysteresis for the face upside/downside detection is always applied and fixed to 11.5°, which is ~ 200 mg.

Face Upside/Downside Output with Hysteresis

Orientation_out [2]	Name	Angle	Condition
0	Upside	281.5°< θ <78.5°	acc_z>200mg (|acc_z|>200mg and acc_z≥0)
1	Downside	101.5°< θ <258°	acc_z<-200mg (|acc_z|>200mg and acc_z<0)

If neither of the conditions is satisfied, the output will keep the previous result.

Blocking mode

The orientation detection can be blocked by setting FEATURES_IN.orientation.settings_1.blocking. See following table for details.

Orientation Blocking

Value	Blocking Conditions
0b00	Interrupt blocking is disabled
0b01	Interrupt is blocked if the device is close to the horizontal position (blocking_theta) or acceleration of any axis > 1.5g
0b10	Interrupt is blocked if the device is close to the horizontal position (blocking_theta) or acceleration of any axis > 1.5g or slope > 0.2g
0b11	Interrupt is blocked if the device is close to the horizontal position (blocking_theta) or acceleration of any axis > 1.5g or slope > 0.4g or another orientation change within 100 ms (5 samples @50Hz)

In blocking mode 3 (0b11), 100 ms interrupt blocking is enabled. In order to trigger the interrupt, the orientation remains the same (stable) until the timer runs out of 100 ms. The timer starts to count when the orientation changes between two consecutive samples. If the orientation changes while the timer is counting, the timer will be restarted.

The *blocking_theta* is defined by the following equation:

$$\left|\tan blocking\_Angle\right| = \frac{\sqrt{blocking\_theta}}{8}$$

The parameter *blocking_theta* of the above given equation stands for the contents of FEATURES_IN.ORIENT_1.theta. It is possible to define a blocking angle between 0° and 44.8°. The blocking angles are valid only for a device at rest; they can be different if the device is moved.

For different acceleration range settings, the internal blocking algorithm automatically saturates the acceleration values before further processing.

Example:
To get a blocking angle of 19°, the parameter *blocking_theta* is determined in the following way: (8 * tan(19°))² = 7.588, therefore, the *blocking_theta* numeric value = 8dec = 001000b must be chosen.

Examples of Blocking_Angle Settings

Blocking_theta numeric value	Blocking Angle (degree)
0	0.0
1	7.1
2	10.0
5	15.6
8	19.5
14	25.1
22	30.4
33	35.7
45	40.0
63	44.8

Configuration parameters

- FEATURES_IN.ORIENT_1.enable – for enabling/disabling the orientation recognition feature.
- FEATURES_IN.ORIENT_1.ud_en – for enabling/disabling face upside/downside detection, with portrait/landscape detection already enabled.
- FEATURES_IN.ORIENT_1.mode – for setting the mode to enable: symmetrical, high asymmetrical, or low asymmetrical.
- FEATURES_IN.ORIENT_1.blocking – for setting blocking mode.
- FEATURES_IN.ORIENT_1.theta – for setting the coded value (blocking_theta) of the threshold angle with horizontal position used in blocking mode; theta = 64 * (tan (angle) ^ 2).
- FEATURES_IN.ORIENT_2.hysteresis – for setting the acceleration hysteresis for orientation detection.

Output register

The orientation values are stored in the output register FEATURES_IN.ORIENT_OUTPUT.orientation_out (3 bits).

- Bit 2 represents face upside (value 0) or face downside (value 1), only when FEATURES_IN.ORIENT_1.ud_en is enabled.
- Bit 0 - 1 have the values:
    1. ORIENTATION_PORTRAIT_UPRIGHT = 0,
    2. ORIENTATION_LANDSCAPE_LEFT = 1,
    3. ORIENTATION_PORTRAIT_UPSIDE_DOWN = 2,
    4. ORIENTATION_LANDSCAPE_RIGHT = 3

2.5. High-g Detection

This interrupt is enabled by setting enable flag FEATURES_IN.HI_G_2.enable along with at least one axis.

The interrupt is asserted if the absolute value of acceleration data of at least one enabled axis exceeds the programmed FEATURES_IN.HI_G_1.threshold and the sign of the value does not change for a minimum FEATURES_IN.HI_G_3.duration.

The interrupt condition is cleared when the absolute value of acceleration data of all selected axes falls below the FEATURES_IN.HI_G_1.threshold minus the FEATURES_IN.HI_G_2.hysteresis or if the sign of the acceleration value changes.

If any device axis is parallel to the gravitational vector, then that axis will report ±1g as output. In this case, it is recommended to have (*threshold - hysteresis*) greater than 1g. If (*threshold - hysteresis*) is less than 1g then after high-g interrupt is triggered, the interrupt will not get cleared if anyone axis is parallel to the gravitational vector since that axis will already be at 1g.

The X, Y and Z axes are enabled with the FEATURES_IN.HI_G_2.en_x, FEATURES_IN.HI_G_2.en_y, and FEATURES_IN.HI_G_2.en_z respectively.When the high-g interrupt is triggered, the signals of the axis that has triggered the interrupt (*first_x*, *first_y*, *first_z*) and the motion direction (*sign*) are set.

Configuration settings

1. FEATURES_IN.HI_G_3.duration – the duration in 200 Hz samples (5ms) for which the threshold has to be exceeded.
2. FEATURES_IN.HI_G_2.hysteresis – the detection hysteresis.
3. FEATURES_IN.HI_G_2.en_x – select the feature for x axis
4. FEATURES_IN.HI_G_2.en_y – select the feature for y axis
5. FEATURES_IN.HI_G_2.en_z – select the feature for z axis
6. FEATURES_IN.HI_G_2.enable – enable the feature
7. FEATURES_IN.HI_G_1.threshold – the detection threshold.

Output

1. High g output is packed only in FEATURE page as shown in below,
2. detect_x - bit 0 , this is set if high-g was detected on x axis
3. detect_y - bit 1, this is set if high-g was detected on y axis
4. detect_z - bit 2, this is set if high-g was detected on z axis
5. detect_sign - bit 3, this reflects the sign of the acceleration for which the high-g was detected; 1 – negative, 0 – positive.

The output of the features are provided via the HIGH_G_OUTPUT registers. The outputs are updated whenever a new event triggered, e.g. for the high g interrupt the axes information is only updated when then high g event condition is satisfied. This avoids that the feature output is gone, when the host is late reading it.

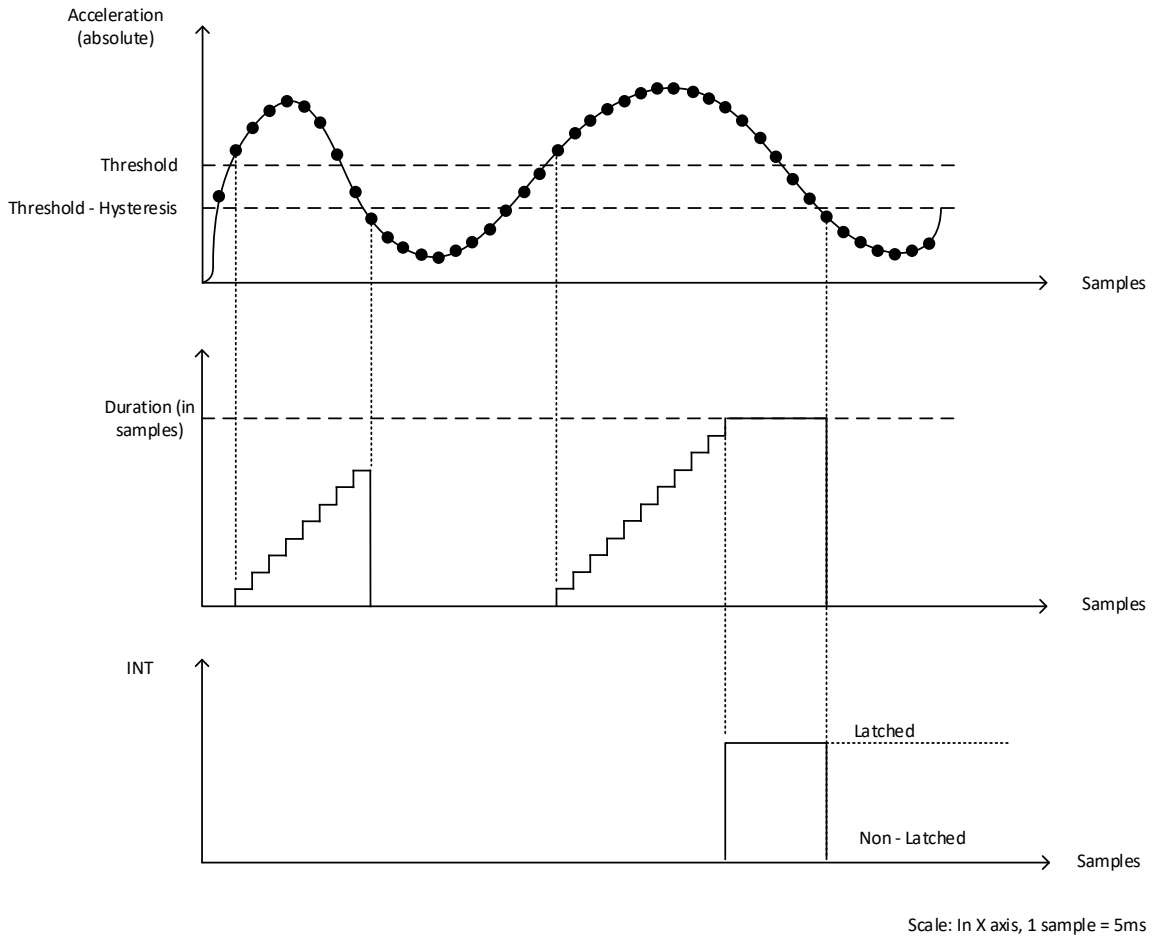


Figure 4: High G detection

2.6. Low-g (Freefall) Detection

For freefall detection, the absolute values of the acceleration data of all axis is observed. The vector length of all accelerations, sqrt(acc_x^2 + acc_y^2 + acc_z^2), is compared with the FEATURES_IN.LO_G_1.threshold.

The interrupt will be generated when the acceleration is smaller than threshold for some minimum number of samples (FEATURES_IN.LO_G_3.duration). The interrupt is reset when the acceleration is above the Threshold + Hysteresis value.

Configuration settings

1. FEATURES_IN.LO_G_1.threshold – the detection threshold. For better performance, the recommended range is 0 to 1g.
2. FEATURES_IN.LO_G_2.hysteresis – the detection hysteresis. For better performance, the recommended range is 0 to 0.5g.
3. FEATURES_IN.LO_G_3.duration – the duration in 50 Hz samples (20ms) for which the threshold has to be exceeded.
4. FEATURES_IN.LO_G_2.enable – indicates if this feature is enabled or not.

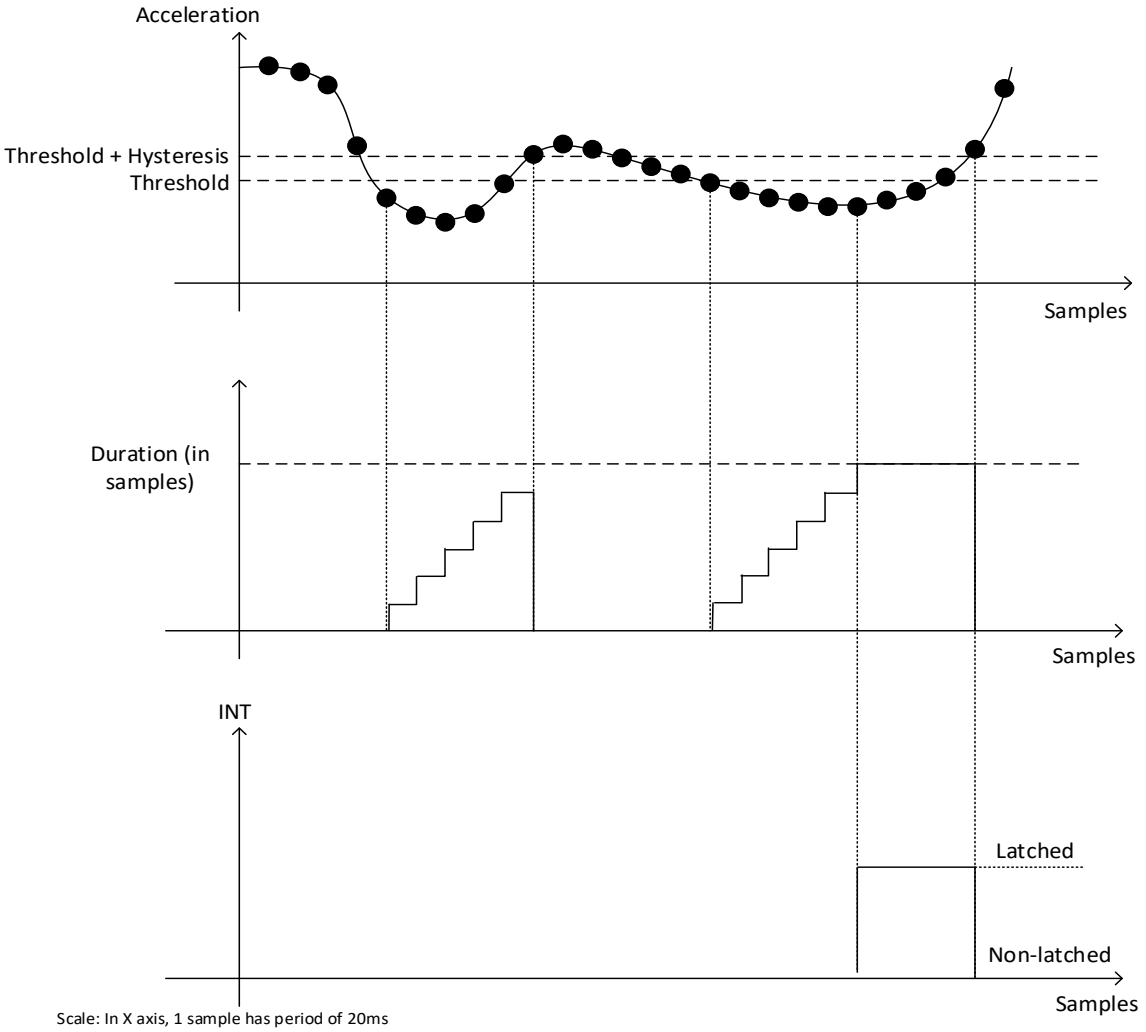


Figure 5: Low G detection

2.7. Auto low power

Auto low power feature is used for the advanced power saving operation of the sensor. The power modes of the sensor are switched automatically on the no-motion and any-motion conditions. The auto low power feature is enabled by setting bit FEATURES_IN.settings.alp_en to 0b1. Set FEATURES_IN.settings.alp_en to 0b0, disables auto low power feature, where power consumption of the sensor is not automatically controlled.
In case auto low power feature is enabled, the sensor operates in two power modes:

- auto sleep mode (power consumption of the sensor typ. <10uA)
- auto wake mode (power consumption of the sensor typ. <60uA, depends on the enabled features)

Auto sleep mode

Auto sleep mode is lowest current consumption power mode at which the acceleration measurement and feature processing is active. In auto sleep mode only any-motion and no-motion features can be processed. The any-motion and no-motion features must be enabled in the FEATURES_IN register. In auto low power mode the acceleration measurement data rate can be configured by setting FEATURES_IN.settings.lp_odr. The data rates in auto low power can be selected from 1.5625Hz to 12.5Hz. The any-motion condition is used to put the sensor auto sleep mode into auto wake mode.

Auto wake mode

In auto wake mode all enabled features are processed (e.g. any-motion, no-motion and tap detection) and sensor is operated in the low power mode according to settings in ACC_CONF. The features must be enabled in the respective registers.

FEATURES_IN.settings.pwr_mgt can be used for auto-configuration of the sensor settings required for feature processing ACC_CONF. If FEATURES_IN.settings.pwr_mgt is set to 0b0, ACC_CONF is not automatically optimized based on feature set, host need to configure the sensor properly. If FEATURES_IN.settings.pwr_mgt is set to 0b1, ACC_CONF is automatically optimized based on the enabled feature set. In automated mode (pwr_mgt = 1) following data rates are used:

- 50Hz data rate is used for processing of any-motion, no-motion detection features
- 200Hz data rate is used if tap detection feature is active

Mode transition happens from auto wake mode to auto sleep mode, either when no-motion is detected and/or any motion is not detected for specific duration.
If FEATURES_IN.settings.no_motion bit is set to 0b1, no motion is used as a condition to enter to auto sleep mode.
If FEATURES_IN.settings.time_out is set to 0b1, any motion should not be detected for specific duration as mentioned in FEATURES_IN.settings.time_out_duration is used as a condition to enter to auto sleep mode.

Configuration settings

- FEATURES_IN.settings.alp_en – enables the feature.
- FEATURES_IN.settings.no_motion – enter auto sleep mode, when no-motion interrupt condition is detected.
- FEATURES_IN.settings.time_out – enter to auto sleep, when any motion is not detected for time_out_dur period.
- FEATURES_IN.settings.time_out_duration – duration to enter to auto sleep, when any motion event is not detected.
- FEATURES_IN.settings.lp_odr – data rate configuration for auto sleep mode.
- FEATURES_IN.settings.pwr_mgt – power management.

Notes:

- host shall not change the ACC_CONF when FEATURES_IN.settings.alp_en is set to 0b1.
- In case of no-Motion being set as condition for auto wake to auto sleep (FEATURES_IN.settings.no_motion), the no-motion feature must be enabled in FEATURES_IN register. Failure to enable the no-motion feature will lead to no transition from auto wake to auto sleep mode

2.8. Multi-tap detection

Tap gestures are generally used for user interaction with the device. Especially, in the small form factor devices without display or not directly observable by user such as hearables, tap detection can be used natural way to control the device. In addition, integrated tap detection feature allows to save significantly power consumption of the system / device by using low power integrated tap sensing feature.

The multi-tap detection feature supports detection of the single tap, double tap and triple tap gesture event. The timings diagram of the acceleration signals and according tap detection parameters are shown in the figure below.

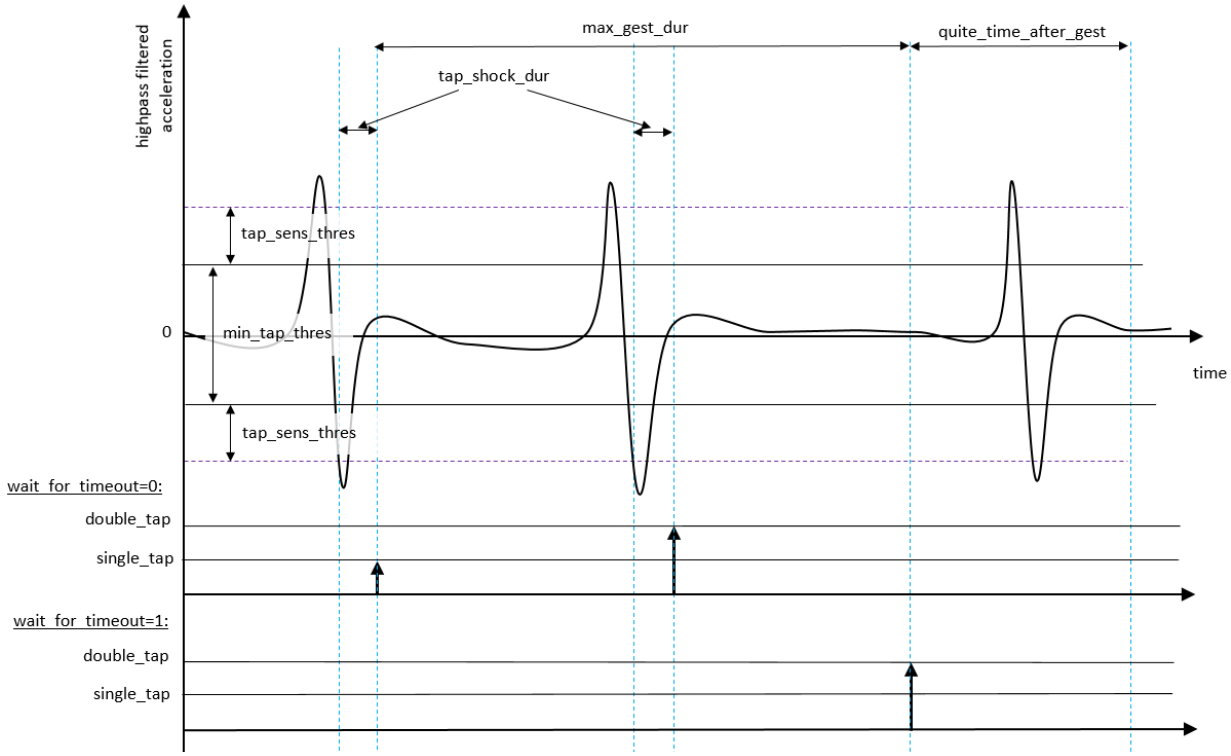


Figure 6: Timing diagram of the multi-tap detection feature (as an example of double tap)

The multi-tap detection feature supports only detection of taps along one of the sensing axis of the accelerometer. The axis of tap-detection can be selected using the FEATURES_IN.TAP_7.axis_sel configuration parameter. In case the device coordinate system and the sensor coordinate system are different, the required axis remapping needs to be configured (see chapter axis-remapping).

The tap detection feature evaluates continuously the acceleration signals, especially the timings of the tap events. After the first-tap has been detected, the next tap should be performed within the configurable time duration set by FEATURES_IN.TAP_3.max_gest_dur. Once the tap interrupt is triggered, the corresponding status bits FEATURES_IN.MULTITAP_OUTPUT.s_tap, FEATURES_IN.MULTITAP_OUTPUT.d_tap and FEATURES_IN.MULTITAP_OUTPUT.t_tap shall be read from register.

Configuration settings

- FEATURES_IN.TAP_1. s_tap_en – Enable the detection of single-tap gesture
- FEATURES_IN.TAP_1. d_tap_en – Enable the detection of double-tap gesture
- FEATURES_IN.TAP_1. t_tap_en – Enable the detection of triple-tap gesture
- FEATURES_IN.TAP_2.tap_sens_thres - scaling factor of additional threshold increment for detection of positive and negative peak of a tap. Default value = 9, Recommended range = 0 to 15.

Resolution of each LSB of scaling factor in terms of filtered acceleration signal magnitude is 78.125 mg.

- FEATURES_IN.TAP_3.max_gest_dur - maximum duration after the first tap within which the second and/or third tap have to be performed for being detected as double-tap or triple-tap. Default value = 130 (650 ms), Resolution = 5 ms, Recommended range = 250 to 1000 ms.
- FEATURES_IN.TAP_4.tap_shock_dur - settling time of high frequency acceleration signal components after tap. Default value = 6 (30 ms), Resolution = 5 ms, Recommended range = 20 to 100 ms.
- FEATURES_IN.TAP_5.quite_time_after_gest - minimum quite time between the two gesture detection. Default value = 80 (400 ms), Resolution = 5 ms, Recommended range = 250 to 500 ms.
- FEATURES_IN.TAP_6.wait_for_timeout - wait for the duration set by FEATURES_IN.TAP_3.max_gest_dur after the first tap and report the tap-gesture based on number of taps detected. Default value = 0 (disabled). Allowed values = 0 / 1 (disabled / enabled).
- FEATURES_IN.TAP_7.axis_sel - selection of axis from 3D-acceleration signal vector for tap detection. Default value = 2 (z-axis). Other supported values 0 (x-axis) and 1 (y-axis). Any other selection leads to usage of default value.

Known limitations:

- Single tap can be sensitive to touch, pick-up and knock gestures due to similarity of the acceleration signals.

3. Register Description

3.1. Register Map

read/write	read only	write only	reserved

Corresponding to BMA456MM_image.tbin version 1.0, register map version 1.0

Register Address	Register Name	Default Value	7	6	5	4	3	2	1	0
0x7E	CMD	0x00	cmd							
0x7D	PWR_CTRL	0x00	reserved					acc_en	reserved	aux_en
0x7C	PWR_CONF	0x03	reserved						fifo_self_wakeup	adv_power_save
0x7B	-	-	reserved							
...	-	-	reserved							
0x74	-	-	reserved							
0x73	OFFSET_2	0x00	off_acc_z							
0x72	OFFSET_1	0x00	off_acc_y							
0x71	OFFSET_0	0x00	off_acc_x							
0x70	NV_CONF	0x00	reserved				acc_off_en	i2c_wdt_en	i2c_wdt_sel	spi_en
0x6F	-	-	reserved							
0x6E	-	-	reserved							
0x6D	ACC_SELF_TEST	0x00	reserved				acc_self_test_amp	acc_self_test_sign	reserved	acc_self_test_en
0x6C	-	-	reserved							
0x6B	IF_CONF	0x00	reserved			if_mode	reserved			spi3
0x6A	NVM_CONF	0x00	reserved						nvm_prog_en	reserved
0x69	-	-	reserved							
...	-	-	reserved							
0x60	-	-	reserved							
0x5F	INTERNAL_ERROR	0x00	reserved					int_err_2	int_err_1	reserved
0x5E	FEATURES_IN	0x00	features_in							
0x5D	-	-	reserved							
...	-	-	reserved							
0x5A	-	-	reserved							

0x59	INIT_CTRL	0x90	init_ctrl						
0x58	INT_MAP_DATA	0x00	reserved	int2_drdy	int2_fwm	int2_ffull	reserved	int1_drdy	int1_fwm	int1_ffull
0x57	INT2_MAP	0x00	error_int_out	no_motion_out	any_motion_out	sig_motion_out	high_g_out	low_g_out	orientation_out	tap_out
0x56	INT1_MAP	0x00	error_int_out	no_motion_out	any_motion_out	sig_motion_out	high_g_out	low_g_out	orientation_out	tap_out
0x55	INT_LATCH	0x00	reserved							int_latch
0x54	INT2_IO_CTRL	0x00	reserved			input_en	output_en	od	lvl	edge_ctrl
0x53	INT1_IO_CTRL	0x00	reserved			input_en	output_en	od	lvl	edge_ctrl
0x52	-	-	reserved							
...	-	-	reserved							
0x50	-	-	reserved							
0x4F	AUX_WR_DATA	0x02	write_data							
0x4E	AUX_WR_ADDR	0x4C	write_addr							
0x4D	AUX_RD_ADDR	0x42	read_addr							
0x4C	AUX_IF_CONF	0x83	aux_manual_en	reserved					aux_rd_burst	
0x4B	AUX_DEV_ID	0x20	i2c_device_addr							reserved
0x4A	-	-	reserved							
0x49	FIFO_CONFIG_1	0x10	reserved	fifo_acc_en	fifo_aux_en	fifo_header_en	fifo_tag_int1_en	fifo_tag_int2_en	reserved	
0x48	FIFO_CONFIG_0	0x02	reserved						fifo_time_en	fifo_stop_on_full
0x47	FIFO_WTM_1	0x02	reserved			fifo_water_mark_12_8				
0x46	FIFO_WTM_0	0x00	fifo_water_mark_7_0							
0x45	FIFO_DOWNS	0x80	acc_fifo_filt_data	acc_fifo_downs			reserved			
0x44	AUX_CONF	0x46	aux_offset				aux_odr			
0x43	-	-	reserved							
0x42	-	-	reserved							
0x41	ACC_RANGE	0x01	reserved						acc_range	

0x40	ACC_CONF	0xA8	acc_perf_mode	acc_bwp			acc_odr	
0x3F	-	-	reserved					
...	-	-	reserved					
0x2B	-	-	reserved					
0x2A	INTERNAL_STATUS	0x00	odr_high_error	odr_50Hz_error	axes_remap_error	alp_state	message	
0x29	-	-	reserved					
...	-	-	reserved					
0x27	-	-	reserved					
0x26	FIFO_DATA	0x00	fifo_data					
0x25	FIFO_LENGTH_1	0x00	reserved	fifo_byte_counter_13_8				
0x24	FIFO_LENGTH_0	0x00	fifo_byte_counter_7_0					
0x23	-	-	reserved					
0x22	TEMPERATURE	0x00	temperature					
0x21	-	-	reserved					
0x20	MULTITAP_OUTPUT	0x00	reserved				t_tap	d_tap	s_tap
0x1F	HIGH_G_OUTPUT	0x00	reserved			detect_sign	detect_z	detect_y	detect_x
0x1E	ORIENT_OUTPUT	0x00	reserved				orientation_face up_down	orientation_out	
0x1D	INT_STATUS_1	0x00	acc_drdy_int	reserved	aux_drdy_int	reserved		fwm_int	ffull_int
0x1C	INT_STATUS_0	0x00	error_int_out	no_motion_out	any_motion_out	sig_motion_out	high_g_out	low_g_out	orientation_out	tap_out
0x1B	EVENT	0x01	reserved						por_detected
0x1A	SENSORTIME_2	0x00	sensor_time_23_16						
0x19	SENSORTIME_1	0x00	sensor_time_15_8						
0x18	SENSORTIME_0	0x00	sensor_time_7_0						

0x17	DATA_13	0x00	acc_z_15_8							
0x16	DATA_12	0x00	acc_z_7_0							
0x15	DATA_11	0x00	acc_y_15_8							
0x14	DATA_10	0x00	acc_y_7_0							
0x13	DATA_9	0x00	acc_x_15_8							
0x12	DATA_8	0x00	acc_x_7_0							
0x11	DATA_7	0x00	aux_r_15_8							
0x10	DATA_6	0x00	aux_r_7_0							
0x0F	DATA_5	0x00	aux_z_15_8							
0x0E	DATA_4	0x00	aux_z_7_0							
0x0D	DATA_3	0x00	aux_y_15_8							
0x0C	DATA_2	0x00	aux_y_7_0							
0x0B	DATA_1	0x00	aux_x_15_8							
0x0A	DATA_0	0x00	aux_x_7_0							
0x09	-	-	reserved							
...	-	-	reserved							
0x04	-	-	reserved							
0x03	STATUS	0x10	drdy_acc	reserved	drdy_aux	cmd_rdy	reserved	aux_man_op	reserved	
0x02	ERR_REG	0x00	aux_err	fifo_err	reserved	error_code			cmd_err	fatal_err
0x01	-	-	reserved							
0x00	CHIP_ID	0x16	chip_id							

FEATURES_IN

Register Address	**Register Name**	**Default Value**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0x5E: 0x3D	general_settings.axes_remapping[1]	0x00	reserved							map_z_axis_sign
0x5E: 0x3C	general_settings.axes_remapping[0]	0x88	map_z_axis		map_y_axis_sign	map_y_axis		map_x_axis_sign	map_x_axis	
0x5E: 0x3B	general_settings.Reserved[1]	0x00	Reserved							

0x5E: 0x3A	general_settings.Reserved[0]	0x00	Reserved					
0x5E: 0x39	sig_motion.SIGMO_3[1]	0x00	reserved					
0x5E: 0x38	sig_motion.SIGMO_3[0]	0x32	reserved	proof_time				
0x5E: 0x37	sig_motion.SIGMO_2[1]	0x00	reserved				enable	skip_time
0x5E: 0x36	sig_motion.SIGMO_2[0]	0x96	skip_time					
0x5E: 0x35	sig_motion.SIGMO_1[1]	0x01	reserved	threshold				
0x5E: 0x34	sig_motion.SIGMO_1[0]	0x33	threshold					
0x5E: 0x33	high_g.HI_G_3[1]	0x00	reserved				duration	
0x5E: 0x32	high_g.HI_G_3[0]	0x04	duration					
0x5E: 0x31	high_g.HI_G_2[1]	0x71	enable	en_z	en_y	en_x	hysteresis	
0x5E: 0x30	high_g.HI_G_2[0]	0x00	hysteresis					
0x5E: 0x2F	high_g.HI_G_1[1]	0x0C	reserved	threshold				
0x5E: 0x2E	high_g.HI_G_1[0]	0x00	threshold					
0x5E: 0x2D	auto_low_power.settings[1]	0x41	pwr_mgt	lp_odr		alp_en	time_out_dur	

0x5E: 0x2C	auto_low_power.settings[0]	0x91	time_out_dur	time_out	no_motion
0x5E: 0x2B	multi-tap.reserved[1]	0x00	reserved		
0x5E: 0x2A	multi-tap.reserved[0]	0x00	reserved		
0x5E: 0x29	multi-tap.reserved[1]	0x00	reserved		
0x5E: 0x28	multi-tap.reserved[0]	0x03	reserved		
0x5E: 0x27	multi-tap.TAP_7[1]	0x00	reserved		
0x5E: 0x26	multi-tap.TAP_7[0]	0x02	reserved	axis_sel	
0x5E: 0x25	multi-tap.reserved[1]	0x04	reserved		
0x5E: 0x24	multi-tap.reserved[0]	0x4C	reserved		
0x5E: 0x23	multi-tap.TAP_6[1]	0x00	wait_for_timeout		
0x5E: 0x22	multi-tap.TAP_6[0]	0x00	wait_for_timeout		
0x5E: 0x21	multi-tap.TAP_5[1]	0x00	quite_time_after_gest		
0x5E: 0x20	multi-tap.TAP_5[0]	0x50	quite_time_after_gest		
0x5E: 0x1F	multi-tap.reserved[1]	0x00	reserved		
0x5E: 0x1E	multi-tap.reserved[0]	0x08	reserved		
0x5E: 0x1D	multi-tap.TAP_4[1]	0x00	tap_shock_dur		

0x5E: 0x1C	multi-tap.TAP_4[0]	0x06	tap_shock_dur				
0x5E: 0x1B	multi-tap.reserved[1]	0x00	reserved				
0x5E: 0x1A	multi-tap.reserved[0]	0x06	reserved				
0x5E: 0x19	multi-tap.TAP_3[1]	0x00	max_gest_dur				
0x5E: 0x18	multi-tap.TAP_3[0]	0x82	max_gest_dur				
0x5E: 0x17	multi-tap.TAP_2[1]	0x00	tap_sens_thres				
0x5E: 0x16	multi-tap.TAP_2[0]	0x09	tap_sens_thres				
0x5E: 0x15	multi-tap.reserved[1]	0x00	reserved				
0x5E: 0x14	multi-tap.reserved[0]	0x06	reserved				
0x5E: 0x13	multi-tap.TAP_1[1]	0x00	reserved				
0x5E: 0x12	multi-tap.TAP_1[0]	0x00	reserved	avg2_en	t_tap_en	d_tap_en	s_tap_en
0x5E: 0x11	low_g.LO_G_3[1]	0x30	Reserved	duration			
0x5E: 0x10	low_g.LO_G_3[0]	0x00	duration				
0x5E: 0x0F	low_g.LO_G_2[1]	0x01	reserved	enable	hysteresis		
0x5E: 0x0E	low_g.LO_G_2[0]	0x00	hysteresis				
0x5E: 0x0D	low_g.LO_G_1[1]	0x02	reserved	threshold			

0x5E: 0x0C	low_g.LO_G_1[0]	0x00	threshold					
0x5E: 0x0B	orientation.ORIENT_2[1]	0x00	reserved				hysteresis	
0x5E: 0x0A	orientation.ORIENT_2[0]	0x80	hysteresis					
0x5E: 0x09	orientation.ORIENT_1[1]	0x0A	reserved				theta	
0x5E: 0x08	orientation.ORIENT_1[0]	0x30	theta		blocking		mode	ud_en	enable
0x5E: 0x07	no_motion.NOMO_2[1]	0x00	z_en	y_en	x_en	duration		
0x5E: 0x06	no_motion.NOMO_2[0]	0x64	duration					
0x5E: 0x05	no_motion.NOMO_1[1]	0x00	reserved				int_bhvr	threshold
0x5E: 0x04	no_motion.NOMO_1[0]	0xCC	threshold					
0x5E: 0x03	any_motion.ANYMO_2[1]	0x00	z_en	y_en	x_en	duration		
0x5E: 0x02	any_motion.ANYMO_2[0]	0x05	duration					
0x5E: 0x01	any_motion.ANYMO_1[1]	0x00	reserved			slope	int_bhvr	threshold
0x5E: 0x00	any_motion.ANYMO_1[0]	0xCC	threshold					

3.1.1 Register (0x00) CHIP_ID

DESCRIPTION: Chip identification code
RESET: 0x16
DEFINITION (Go to register map):

Name	**Register (0x00) CHIP_ID**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	1
Content	chip_id			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	1	1	0
Content	chip_id			

chip_id: Chip identification code for BMA456.

3.1.2 Register (0x02) ERR_REG

DESCRIPTION: Reports sensor error conditions
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x02) ERR_REG**			
Bit	7	6	5	4
Read/Write	R	R	n/a	R
Reset Value	0	0	0	0
Content	aux_err	fifo_err	reserved	error_code
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	error_code		cmd_err	fatal_err

fatal_err: Fatal Error, chip is not in operational state (Boot-, power-system). This flag will be reset only by power-on-reset or softreset.
cmd_err: Command execution failed.
error_code: Error codes for persistent errors

error_code		
0x00	no_error	no error is reported
0x01	acc_err	error in Register ACC_CONF

fifo_err: Error in FIFO detected: Input data was discarded in stream mode. This flag will be reset when read.
aux_err: Error in I2C-Master detected. This flag will be reset when read.

3.1.3 Register (0x03) STATUS

DESCRIPTION: Sensor status flags
RESET: 0x10
DEFINITION (Go to register map):

Name	**Register (0x03) STATUS**			
Bit	7	6	5	4
Read/Write	R	n/a	R	R
Reset Value	0	0	0	1
Content	drdy_acc	reserved	drdy_aux	cmd_rdy
Bit	3	2	1	0
Read/Write	n/a	R	n/a	n/a
Reset Value	0	0	0	0
Content	reserved	aux_man_op	reserved	

aux_man_op: ‘1’(‘0’) indicate a (no) manual auxiliary interface operation is ongoing.
cmd_rdy: CMD decoder status. `0´ -> Command in progress `1´ -> Command decoder is ready to accept a new command
drdy_aux: Data ready for auxiliary sensor. It gets reset when one auxiliary DATA register is read out
drdy_acc: Data ready for accelerometer. It gets reset when one accelerometer DATA register is read out

3.1.4 Register (0x0A) DATA_0

DESCRIPTION: AUX_X(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0A) DATA_0**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_x_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_x_7_0			

3.1.5 Register (0x0B) DATA_1

DESCRIPTION: AUX_X(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0B) DATA_1**			
Bit	7	6	5	4

Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_x_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_x_15_8			

3.1.6 Register (0x0C) DATA_2

DESCRIPTION: AUX_Y(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0C) DATA_2**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_y_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_y_7_0			

3.1.7 Register (0x0D) DATA_3

DESCRIPTION: AUX_Y(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0D) DATA_3**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_y_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_y_15_8			

3.1.8 Register (0x0E) DATA_4

DESCRIPTION: AUX_Z(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0E) DATA_4**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_z_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_z_7_0			

3.1.9 Register (0x0F) DATA_5

DESCRIPTION: AUX_Z(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x0F) DATA_5**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_z_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_z_15_8			

3.1.10 Register (0x10) DATA_6

DESCRIPTION: AUX_R(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x10) DATA_6**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_r_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_r_7_0			

3.1.11 Register (0x11) DATA_7

DESCRIPTION: AUX_R(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x11) DATA_7**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_r_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	aux_r_15_8			

3.1.12 Register (0x12) DATA_8

DESCRIPTION: ACC_X(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x12) DATA_8**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_x_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_x_7_0			

3.1.13 Register (0x13) DATA_9

DESCRIPTION: ACC_X(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x13) DATA_9**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_x_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_x_15_8			

3.1.14 Register (0x14) DATA_10

DESCRIPTION: ACC_Y(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x14) DATA_10**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_y_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_y_7_0			

3.1.15 Register (0x15) DATA_11

DESCRIPTION: ACC_Y(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x15) DATA_11**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_y_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_y_15_8			

3.1.16 Register (0x16) DATA_12

DESCRIPTION: ACC_Z(LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x16) DATA_12**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_z_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_z_7_0			

3.1.17 Register (0x17) DATA_13

DESCRIPTION: ACC_Z(MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x17) DATA_13**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_z_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	acc_z_15_8			

3.1.18 Register (0x18) SENSORTIME_0

DESCRIPTION: Sensor time <7:0>
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x18) SENSORTIME_0**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_7_0			

sensor_time_7_0: Sensor time <7:0> in units of 39.0625 us.

3.1.19 Register (0x19) SENSORTIME_1

DESCRIPTION: Sensor time <15:8>
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x19) SENSORTIME_1**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_15_8			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_15_8			

sensor_time_15_8: Sensor time <15:8> in units of 10 ms.

3.1.20 Register (0x1A) SENSORTIME_2

DESCRIPTION: Sensor time <23:16>
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x1A) SENSORTIME_2**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_23_16			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	sensor_time_23_16			

sensor_time_23_16: Sensor time <23:16> in units of 2.56 s.

3.1.21 Register (0x1B) EVENT

DESCRIPTION: Sensor status flags
RESET: 0x01
DEFINITION (Go to register map):

Name	**Register (0x1B) EVENT**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	n/a	n/a	R
Reset Value	0	0	0	1
Content	reserved			por_detected

por_detected: '1' after device power up or softreset. Clear-on-read

3.1.22 Register (0x1C) INT_STATUS_0

DESCRIPTION: Interrupt/Feature status. This register will be cleared on read.
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x1C) INT_STATUS_0**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	error_int_out	no_motion_out	any_motion_out	sig_motion_out
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	high_g_out	low_g_out	orientation_out	tap_out

tap_out: Tap detector output
orientation_out: Orientation output
low_g_out: Low-g detection output
high_g_out: High_g detection out
sig_motion_out: Sigmotion output
any_motion_out: Any-motion detection output
no_motion_out: No-motion detection output
error_int_out: Error interrupt output

3.1.23 Register (0x1D) INT_STATUS_1

DESCRIPTION: Interrupt Status. This register will be cleared on read.
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x1D) INT_STATUS_1**			
Bit	7	6	5	4
Read/Write	R	n/a	R	n/a
Reset Value	0	0	0	0
Content	acc_drdy_int	reserved	aux_drdy_int	reserved
Bit	3	2	1	0
Read/Write	n/a	n/a	R	R
Reset Value	0	0	0	0
Content	reserved		fwm_int	ffull_int

ffull_int: FIFO Full Interrupt
fwm_int: FIFO Watermark Interrupt
aux_drdy_int: Auxiliary sensor data ready interrupt
acc_drdy_int: Accelerometer data ready interrupt

3.1.24 Register (0x1E) ORIENT_OUTPUT

DESCRIPTION: Orientation detection output
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x1E) ORIENT_OUTPUT**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	reserved	orientation_faceup_down	orientation_out	

orientation_out: Orientation detection output bits

orientation_out		
0x00	portrait_upright	Orientation portrait upright
0x01	landscape_left	Orientation landscape left
0x02	portrait_upside_down	Orientation portrait upside down
0x03	landscape_right	Orientation landscape right

orientation_faceup_down: Output value of face down face up orientation (only if ud_en is enabled). Value after device initialization is 0b0 i.e. face up

orientation_faceup_down		
0x00	face_up	Face up orientation
0x01	face_down	Face down orientation

reserved: reserved

3.1.25 Register (0x1F) HIGH_G_OUTPUT

DESCRIPTION: Describes high_g output
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x1F) HIGH_G_OUTPUT**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	detect_sign	detect_z	detect_y	detect_x

detect_x: High-g was detected on X-axis
detect_y: High-g was detected on Y-axis
detect_z: High-g was detected on Z-axis
detect_sign: Axis direction for which the high-g was detected. 1 for negative axis, 0 for positive axis.
reserved: reserved

3.1.26 Register (0x20) MULTITAP_OUTPUT

DESCRIPTION: Describes Multitap Output
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x20) MULTITAP_OUTPUT**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0

Content	reserved			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	reserved	t_tap	d_tap	s_tap

s_tap: Single tap detected
d_tap: Double tap detected
t_tap: Triple tap detected
reserved: reserved

3.1.27 Register (0x22) TEMPERATURE

DESCRIPTION: Contains the temperature value of the sensor
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x22) TEMPERATURE**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	temperature			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	temperature			

temperature: Temperature value in two's complement representation in units of 1 Kelvin: 0x00 corresponds to 23 degree Celsius.

3.1.28 Register (0x24) FIFO_LENGTH_0

DESCRIPTION: FIFO byte count register (LSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x24) FIFO_LENGTH_0**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	fifo_byte_counter_7_0			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	fifo_byte_counter_7_0			

fifo_byte_counter_7_0: Current fill level of FIFO buffer.

3.1.29 Register (0x25) FIFO_LENGTH_1

DESCRIPTION: FIFO byte count register (MSB)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x25) FIFO_LENGTH_1**			
Bit	7	6	5	4
Read/Write	n/a	n/a	R	R
Reset Value	0	0	0	0
Content	reserved		fifo_byte_counter_13_8	
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	fifo_byte_counter_13_8			

fifo_byte_counter_13_8: FIFO byte counter bits 13..8

3.1.30 Register (0x26) FIFO_DATA

DESCRIPTION: FIFO data output register
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x26) FIFO_DATA**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	fifo_data			
Bit	3	2	1	0
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	fifo_data			

fifo_data: FIFO read data, for burst read.

3.1.31 Register (0x2A) INTERNAL_STATUS

DESCRIPTION: Error bits and message indicating internal status
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x2A) INTERNAL_STATUS**			
Bit	7	6	5	4
Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	odr_high_error	odr_50Hz_error	axes_remap_error	alp_state
Bit	3	2	1	0

Read/Write	R	R	R	R
Reset Value	0	0	0	0
Content	message			

message: Internal Status Message

message		
0x00	not_init	ASIC is not initialized
0x01	init_ok	ASIC initialized
0x02	init_err	Initialization error
0x03	drv_err	Invalid driver
0x04	sns_stop	Sensor stopped

alp_state: Indicates the current state of auto low power mode

alp_state		
0x00	auto_wake	Wake state, where all enabled features shall be processed
0x01	auto_sleep	Sleep state, where any motion and no motion shall be processed

axes_remap_error: Incorrect axes remapping. X,Y,Z axes must be mapped to exclusively separate axes i.e. they cannot be mapped to same axes.
odr_50Hz_error: The minimum bandwidth conditions are not respected for the features which require 50Hz data
odr_high_error: The minimum bandwidth conditions are not respected for the features which require 200Hz data

3.1.32 Register (0x40) ACC_CONF

DESCRIPTION: Sets the output data rate, the bandwidth, and the performance mode of the acceleration sensor
RESET: 0xA8
DEFINITION (Go to register map):

Name	**Register (0x40) ACC_CONF**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	1	0	1	0
Content	acc_perf_mode	acc_bwp		
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	1	0	0	0
Content	acc_odr			

acc_odr: ODR in Hz. The output data rate is independent of the power mode setting for the sensor, but not all settings are supported in all power modes.

acc_odr		
0x00	reserved	Reserved
0x01	odr_0p78	25/32
0x02	odr_1p5	25/16
0x03	odr_3p1	25/8

0x04	odr_6p25	25/4
0x05	odr_12p5	25/2
0x06	odr_25	25
0x07	odr_50	50
0x08	odr_100	100
0x09	odr_200	200
0x0a	odr_400	400
0x0b	odr_800	800
0x0c	odr_1k6	1600
0x0d	odr_3k2	Reserved
0x0e	odr_6k4	Reserved
0x0f	odr_12k8	Reserved

acc_bwp: Bandwidth parameter, determines filter configuration (acc_perf_mode=1) and averaging for undersampling mode (acc_perf_mode=0)

acc_bwp		
0x00	osr4_avg1	acc_perf_mode = 1 -> OSR4 mode; acc_perf_mode = 0 -> no averaging
0x01	osr2_avg2	acc_perf_mode = 1 -> OSR2 mode; acc_perf_mode = 0 -> average 2 samples
0x02	norm_avg4	acc_perf_mode = 1 -> normal mode; acc_perf_mode = 0 -> average 4 samples
0x03	cic_avg8	acc_perf_mode = 1 -> Reserved; acc_perf_mode = 0 -> average 8 samples
0x04	res_avg16	acc_perf_mode = 1 -> Reserved; acc_perf_mode = 0 -> average 16 samples
0x05	res_avg32	acc_perf_mode = 1 -> Reserved; acc_perf_mode = 0 -> average 32 samples
0x06	res_avg64	acc_perf_mode = 1 -> Reserved; acc_perf_mode = 0 -> average 64 samples
0x07	res_avg128	acc_perf_mode = 1 -> Reserved; acc_perf_mode = 0 -> average 128 samples

acc_perf_mode: Select accelerometer filter performance mode:

acc_perf_mode		
0x00	cic_avg	averaging mode.
0x01	cont	continuous filter function.

3.1.33 Register (0x41) ACC_RANGE

DESCRIPTION: Selection of the Accelerometer g-range
RESET: 0x01
DEFINITION (Go to register map):

Name	**Register (0x41) ACC_RANGE**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			

Bit	3	2	1	0
Read/Write	n/a	n/a	RW	RW
Reset Value	0	0	0	1
Content	reserved		acc_range	

acc_range: Accelerometer g-range

acc_range		
0x00	range_2g	+/-2g
0x01	range_4g	+/-4g
0x02	range_8g	+/-8g
0x03	range_16g	+/-16g

3.1.34 Register (0x44) AUX_CONF

DESCRIPTION: Sets the output data rate of the Auxiliary interface
RESET: 0x46
DEFINITION (Go to register map):

Name	**Register (0x44) AUX_CONF**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	1	0	0
Content	aux_offset			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	1	1	0
Content	aux_odr			

aux_odr: Select the poll rate for the sensor attached to the Auxiliary interface.

aux_odr		
0x00	reserved	Reserved
0x01	odr_0p78	25/32
0x02	odr_1p5	25/16
0x03	odr_3p1	25/8
0x04	odr_6p25	25/4
0x05	odr_12p5	25/2
0x06	odr_25	25
0x07	odr_50	50
0x08	odr_100	100
0x09	odr_200	200
0x0a	odr_400	400
0x0b	odr_800	800
0x0c	odr_1k6	Reserved
0x0d	odr_3k2	Reserved
0x0e	odr_6k4	Reserved
0x0f	odr_12k8	Reserved

aux_offset: trigger-readout offset in units of 2.5 ms. If set to zero, the offset is maximum, i.e. after readout a trigger is issued immediately.

3.1.35 Register (0x45) FIFO_DOWNS

DESCRIPTION: Configure Accelerometer downsampling rates for FIFO
RESET: 0x80
DEFINITION (Go to register map):

Name	**Register (0x45) FIFO_DOWNS**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	1	0	0	0
Content	acc_fifo_filt_data	acc_fifo_downs		
Bit	3	2	1	0
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			

acc_fifo_downs: Downsampling for accelerometer data (2**acc_fifo_downs)
acc_fifo_filt_data: selects filtered or unfiltered Accelerometer data for fifo

acc_fifo_filt_data		
0x00	unfiltered	Unfiltered data
0x01	filtered	Filtered data

3.1.36 Register (0x46) FIFO_WTM_0

DESCRIPTION: FIFO Watermark level LSB
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x46) FIFO_WTM_0**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	fifo_water_mark_7_0			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	fifo_water_mark_7_0			

3.1.37 Register (0x47) FIFO_WTM_1

DESCRIPTION: FIFO Watermark level MSB
RESET: 0x02
DEFINITION (Go to register map):

Name	**Register (0x47) FIFO_WTM_1**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			fifo_water_mark_12_8
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	1	0
Content	fifo_water_mark_12_8			

3.1.38 Register (0x48) FIFO_CONFIG_0

DESCRIPTION: FIFO frame content configuration
RESET: 0x02
DEFINITION (Go to register map):

Name	**Register (0x48) FIFO_CONFIG_0**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	n/a	RW	RW
Reset Value	0	0	1	0
Content	reserved		fifo_time_en	fifo_stop_on_full

fifo_stop_on_full: Stop writing samples into FIFO when FIFO is full.

fifo_stop_on_full		
0x00	disable	do not stop writing to FIFO when full
0x01	enable	Stop writing into FIFO when full.

fifo_time_en: Return sensortime frame after the last valid data frame.

fifo_time_en		
0x00	disable	do not return sensortime frame
0x01	enable	return sensortime frame

3.1.39 Register (0x49) FIFO_CONFIG_1

DESCRIPTION: FIFO frame content configuration
RESET: 0x10
DEFINITION (Go to register map):

Name	**Register (0x49) FIFO_CONFIG_1**			
Bit	7	6	5	4
Read/Write	n/a	RW	RW	RW
Reset Value	0	0	0	1
Content	reserved	fifo_acc_en	fifo_aux_en	fifo_header_en
Bit	3	2	1	0
Read/Write	RW	RW	n/a	n/a
Reset Value	0	0	0	0
Content	fifo_tag_int1_en	fifo_tag_int2_en	reserved	

fifo_tag_int2_en: FIFO interrupt 2 tag enable

fifo_tag_int2_en		
0x00	disable	disable tag
0x01	enable	enable tag

fifo_tag_int1_en: FIFO interrupt 1 tag enable

fifo_tag_int1_en		
0x00	disable	disable tag
0x01	enable	enable tag

fifo_header_en: FIFO frame header enable

fifo_header_en		
0x00	disable	no header is stored (output data rate of all enabled sensors need to be identical)
0x01	enable	header is stored

fifo_aux_en: Store Auxiliary data in FIFO (all 3 axes)

fifo_aux_en		
0x00	disable	no Auxiliary data is stored
0x01	enable	Auxiliary data is stored

fifo_acc_en: Store Accelerometer data in FIFO (all 3 axes)

fifo_acc_en		
0x00	disable	no Accelerometer data is stored
0x01	enable	Accelerometer data is stored

3.1.40 Register (0x4B) AUX_DEV_ID

DESCRIPTION: Auxiliary interface slave device id
RESET: 0x20
DEFINITION (Go to register map):

Name	**Register (0x4B) AUX_DEV_ID**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	1	0
Content	i2c_device_addr			
Bit	3	2	1	0
Read/Write	RW	RW	RW	n/a
Reset Value	0	0	0	0
Content	i2c_device_addr			reserved

i2c_device_addr: I2C device address of Auxiliary slave

3.1.41 Register (0x4C) AUX_IF_CONF

DESCRIPTION: Auxiliary interface configuration
RESET: 0x83
DEFINITION (Go to register map):

Name	**Register (0x4C) AUX_IF_CONF**			
Bit	7	6	5	4
Read/Write	RW	n/a	n/a	n/a
Reset Value	1	0	0	0
Content	aux_manual_en	reserved		
Bit	3	2	1	0
Read/Write	n/a	n/a	RW	RW
Reset Value	0	0	1	1
Content	reserved		aux_rd_burst	

aux_rd_burst: Burst data length (1,2,6,8 byte)

aux_rd_burst		
0x00	BL1	Burst length 1
0x01	BL2	Burst length 2
0x02	BL6	Burst length 6
0x03	BL8	Burst length 8

aux_manual_en: Enable auxiliary interface manual mode.

aux_manual_en		
0x00	disable	Data mode
0x01	enable	Setup mode

3.1.42 Register (0x4D) AUX_RD_ADDR

DESCRIPTION: Auxiliary interface read register address
RESET: 0x42
DEFINITION (Go to register map):

Name	**Register (0x4D) AUX_RD_ADDR**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	1	0	0
Content	read_addr			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	1	0
Content	read_addr			

read_addr: Address to read

3.1.43 Register (0x4E) AUX_WR_ADDR

DESCRIPTION: Auxiliary interface write register address
RESET: 0x4C
DEFINITION (Go to register map):

Name	**Register (0x4E) AUX_WR_ADDR**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	1	0	0
Content	write_addr			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	1	1	0	0
Content	write_addr			

write_addr: Address to write

3.1.44 Register (0x4F) AUX_WR_DATA

DESCRIPTION: Auxiliary interface write data
RESET: 0x02
DEFINITION (Go to register map):

Name	**Register (0x4F) AUX_WR_DATA**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	write_data			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW

Reset Value	0	0	1	0
Content	write_data			

write_data: Data to write

3.1.45 Register (0x53) INT1_IO_CTRL

DESCRIPTION: Configure the electrical behaviour of the interrupt pins
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x53) INT1_IO_CTRL**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			input_en
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	output_en	od	lvl	edge_ctrl

edge_ctrl: Configure trigger condition of INT1 pin (input)

edge_ctrl		
0x00	level_tr	Level
0x01	edge_tr	Edge

lvl: Configure output level of INT1 pin

lvl		
0x00	active_low	active low
0x01	active_high	active high

od: Configure output behaviour of INT1 pin to open drain.

od		
0x00	push_pull	push-pull
0x01	open_drain	open drain

output_en: Output enable for INT1 pin

output_en		
0x00	off	Output disabled
0x01	on	Output enabled

input_en: Input enable for INT1 pin

input_en		
0x00	off	Input disabled
0x01	on	Input enabled

3.1.46 Register (0x54) INT2_IO_CTRL

DESCRIPTION: Configure the electrical behaviour of the interrupt pins
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x54) INT2_IO_CTRL**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			input_en
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	output_en	od	lvl	edge_ctrl

edge_ctrl: Configure trigger condition of INT2 pin (input)

edge_ctrl		
0x00	level_tr	Level
0x01	edge_tr	Edge

lvl: Configure level of INT2 pin

lvl		
0x00	active_low	active low
0x01	active_high	active high

od: Configure output behaviour of INT2 pin to open drain.

od		
0x00	push_pull	push-pull
0x01	open_drain	open drain

output_en: Output enable for INT2 pin

output_en		
0x00	off	Output disabled
0x01	on	Output enabled

input_en: Input enable for INT2 pin

input_en		
0x00	off	Input disabled
0x01	on	Input enabled

3.1.47 Register (0x55) INT_LATCH

DESCRIPTION: Configure interrupt modes
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x55) INT_LATCH**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			int_latch

int_latch: Latched/non-latched/ modes

int_latch		
0x00	none	non latched
0x01	permanent	latched

3.1.48 Register (0x56) INT1_MAP

DESCRIPTION: Interrupt/Feature mapping on INT1
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x56) INT1_MAP**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	error_int_out	no_motion_out	any_motion_out	sig_motion_out
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	high_g_out	low_g_out	orientation_out	tap_out

tap_out: Tap detector output
orientation_out: Orientation output
low_g_out: Low-g detection output
high_g_out: High_g detection out
sig_motion_out: Sigmotion output
any_motion_out: Any-motion detection output
no_motion_out: No-motion detection output
error_int_out: Error interrupt output

3.1.49 Register (0x57) INT2_MAP

DESCRIPTION: Interrupt/Feature mapping on INT2
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x57) INT2_MAP**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	error_int_out	no_motion_out	any_motion_out	sig_motion_out
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	high_g_out	low_g_out	orientation_out	tap_out

tap_out: Tap detector output
orientation_out: Orientation output
low_g_out: Low-g detection output
high_g_out: High_g detection out
sig_motion_out: Sigmotion output
any_motion_out: Any-motion detection output
no_motion_out: No-motion detection output
error_int_out: Error interrupt output

3.1.50 Register (0x58) INT_MAP_DATA

DESCRIPTION: Interrupt mapping hardware interrupts
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x58) INT_MAP_DATA**			
Bit	7	6	5	4
Read/Write	n/a	RW	RW	RW
Reset Value	0	0	0	0
Content	reserved	int2_drdy	int2_fwm	int2_ffull
Bit	3	2	1	0
Read/Write	n/a	RW	RW	RW
Reset Value	0	0	0	0
Content	reserved	int1_drdy	int1_fwm	int1_ffull

int1_ffull: FIFO Full interrupt mapped to INT1
int1_fwm: FIFO Watermark interrupt mapped to INT1
int1_drdy: Data Ready interrupt mapped to INT1
int2_ffull: FIFO Full interrupt mapped to INT2
int2_fwm: FIFO Watermark interrupt mapped to INT2
int2_drdy: Data Ready interrupt mapped to INT2

3.1.51 Register (0x59) INIT_CTRL

DESCRIPTION: Start initialization
RESET: 0x90
DEFINITION (Go to register map):

Name	**Register (0x59) INIT_CTRL**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	1	0	0	1
Content	init_ctrl			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	init_ctrl			

init_ctrl: Start initialization

3.1.52 <Register (0x5E) FEATURES_IN

DESCRIPTION: Feature configuration read/write port
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x5E) FEATURES_IN**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	features_in			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	features_in			

features_in: Feature configuration read/write data

Address	**Bit**	**Name**	**Description**	**Reset**	**Access**
any_motion					
0x5E: 0x00		ANYMO_1	Configurations for any-motion detection - Part 1	0x00CC	
	10...0	threshold	Threshold for acceleration signal slope to detect any-motion event. Range is 0 to 1g. Resolution is 0.4883mg. Default value is 100mg.	0xCC	RW
	11	int_bhvr	Defines any motion interrupt behaviour	0x0	RW

			Value **Name** **Description** 0x00 multi_int Generates interrupt as long as condition is valid 0x01 single_shot Generate one interrupt for every valid condition		
	12	slope	Configuration for acceleration slope computation **Value** **Name** **Description** 0x00 non-consecutive Computes the slope between acceleration vector at last event detection to current. 0x01 consecutive Computes the slope between consecutive acceleration vector samples	0x0	RW
0x5E: 0x02		ANYMO_2	Any-motion detection general configuration flags - part 2	0x0005	
	12...0	duration	Defines the number of consecutive data points for which the threshold condition must be respected for interrupt assertion. It is expressed in 50 Hz samples (20 ms). Range is 0 to 163sec. Default value is 5=100ms.	0x5	RW
	13	x_en	Enables the feature on a per-axis basis	0x0	RW
	14	y_en	Enables the feature on a per-axis basis	0x0	RW
	15	z_en	Enables the feature on a per-axis basis	0x0	RW

no_motion					
0x5E: 0x04		NOMO_1	Configurations for no-motion detection - Part 1	0x00CC	
	10...0	threshold	Threshold for acceleration signal slope to detect no-motion event. Range is 0 to 1g. Resolution is 0.4883mg. Default value is 100mg.	0xCC	RW
	11	int_bhvr	Defines no motion interrupt behaviour **Value** **Name** **Description** 0x00 multi_int Generates interrupt as long as condition is valid 0x01 single_shot Generate one interrupt for every valid condition	0x0	RW
0x5E: 0x06		NOMO_2	No-motion detection general configuration flags - part 2	0x0064	
	12...0	duration	Defines the number of consecutive data points for which the threshold condition must be respected for interrupt assertion. It is expressed in 50 Hz samples (20 ms). Range is 0 to 163sec. Default value is 100=2000ms.	0x64	RW
	13	x_en	Enables the feature on a per-axis basis	0x0	RW
	14	y_en	Enables the feature on a per-axis basis	0x0	RW
	15	z_en	Enables the feature on a per-axis basis	0x0	RW
orientation					
0x5E: 0x08		ORIENT_1	Orientation general configuration flags	0x0A30	
	0	enable	Enables the feature	0x0	RW
	1	ud_en	Enables face upside/downside detection if set to 1	0x0	RW
	3...2	mode	Sets the mode: symmetrical (values 0 or 3), high	0x0	RW

			asymmetrical (value 1) or low asymmetrical (value 2).		
	5...4	blocking	Sets the blocking mode. Default value is 3, the most restrictive blocking mode.	0x3	RW
	11...6	theta	Coded value of the threshold angle with horizontal used in blocking modes, theta = 64 * (tan(angle)^2). Default value is 40 which is equivalent to 38 degrees angle.	0x28	RW
0x5E: 0x0A		ORIENT_2	Acceleration hysteresis	0x0080	
	10...0	hysteresis	Acceleration hysteresis for orientation detection. Range is 0 to 1g. Default value is 0x80 = 0.0625g.	0x80	RW
low_g					
0x5E: 0x0C		LO_G_1	The acceleration threshold below which the low_g motion is signaled.	0x0200	
	14...0	threshold	Threshold value for low-g feature. Range is 0 to 1g. Default value is 512 = 0.25g.	0x200	RW
0x5E: 0x0E		LO_G_2	Enable flag and hysteresis configuration	0x0100	
	11...0	hysteresis	Hysteresis value for low_g feature. Range is 0 to 0.5g. Default value is 256 = 0.125g.	0x100	RW
	12	enable	Enables the feature	0x0	RW
0x5E: 0x10		LO_G_3	Output configuration and duration interval	0x3000	
	11...0	duration	Duration in 50 Hz samples (20 msec) for which the threshold has to be exceeded. Range is 0 to 82 sec. Default value is 0 = 0 ms.	0x0	RW
	15...12	Reserved	Reserved	0x3	R
multi-tap					
0x5E: 0x12		TAP_1	Configurations general Settings	0x0000	
	0	s_tap_en	Enables single tap feature	0x0	RW
	1	d_tap_en	Enables double tap feature	0x0	RW
	2	t_tap_en	Enables triple tap feature	0x0	RW
	3	avg2_en	Enables averaging2 for tap feature	0x0	RW

0x5E: 0x14		reserved	Configurations for tap detector - Part 1	0x0006	
	15...0	reserved	Reserved	0x6	RW
0x5E: 0x16		TAP_2	Configurations for tap detector - Part 2	0x0009	
	15...0	tap_sens_thres	Configures detection sensitivity by a Scaling factor of additional threshold increment for detection of positive and negative peak of a tap. Default value = 9, Recommended range = 0 to 15. Resolution of each LSB of scaling factor in terms of filtered acceleration signal magnitude is 78.125 mg.	0x9	RW
0x5E: 0x18		TAP_3	Configurations for tap detector - Part 3	0x0082	
	15...0	max_gest_dur	Maximum duration after the first tap within which the second and/or third tap have to be performed for being detected as double-tap or triple-tap. Default value = 130 (650 ms), Resolution = 5 ms, Recommended range = 250 to 1000 ms.	0x82	RW
0x5E: 0x1A		reserved	Configurations for tap detector - Part 4	0x0006	
	15...0	reserved	Reserved	0x6	RW
0x5E: 0x1C		TAP_4	Configurations for tap detector - Part 5	0x0006	
	15...0	tap_shock_dur	Settling time of high frequency acceleration signal components after tap. Default value = 6 (30 ms), Resolution = 5 ms, Recommended range = 20 to 100 ms.	0x6	RW
0x5E: 0x1E		reserved	Configurations for tap detector - Part 6	0x0008	
	15...0	reserved	Reserved	0x8	RW
0x5E: 0x20		TAP_5	Configurations for tap detector - Part 7	0x0050	
	15...0	quite_time_after_gest	Minimum quite time between the two gesture detection. Default value = 80 (400 ms), Resolution = 5 ms, Recommended range = 250 to 500 ms.	0x50	RW
0x5E: 0x22		TAP_6	Configurations for tap detector - Part 8	0x0000	

	15...0	wait_for_timeout	Wait for the duration set by max_gest_dur after the first tap and report the tap-gesture based on number of taps detected. Default value = 0 (disabled). Allowed values = 0 / 1 (disabled / enabled).	0x0	RW
0x5E: 0x24		reserved	Configurations for tap detector - Part 9	0x044C	
	15...0	reserved	Reserved	0x44C	RW
0x5E: 0x26		TAP_7	Configurations for tap detector - Part 10	0x0002	
	1...0	axis_sel	Selection of axis from 3D-acceleration signal vector for tap detection. Default value = 2 (z-axis). Other supported values 0 (x-axis) and 1 (y-axis). Any other selection leads to usage of default value **Value** **Name** **Description** 0x00 x-axis Use x-axis for tap detection 0x01 y-axis Use y-axis for tap detection 0x02 z-axis Use z-axis for tap detection 0x03 reserved Reserved	0x2	RW
0x5E: 0x28		reserved	Configurations for tap detector - Part 11	0x0003	
	15...0	reserved	Reserved	0x3	RW
0x5E: 0x2A		reserved	Configurations for tap detector - Part 12	0x0000	
	15...0	reserved	Reserved	0x0	RW
auto_low_power					
0x5E: 0x2C		settings	Auto low power feature settings	0x4191	
	0	no_motion	Enter to auto sleep, when no motion is detected	0x1	RW
	1	time_out	Enter to auto sleep, when any motion is not detected for time_out_dur period	0x0	RW
	11...2	time_out_dur	Duration to enter to auto sleep, when any motion event is not	0x64	RW

			detected. Range 0 to 20480ms. Resolution is 20 ms. Default value is 2000 ms.		
	12	alp_en	Enables auto low power feature	0x0	RW
	14...13	lp_odr	ODR for low power mode **Value** **Name** **Description** 0x00 odr_1p5 25/16 Hz 0x01 odr_3p1 25/8 Hz 0x02 odr_6p25 25/4 Hz 0x03 odr_12p5 25/2 Hz	0x2	RW
	15	pwr_mgt	Power management **Value** **Name** **Description** 0x00 disable Disable feature optimized acc_conf. Uses host desired configuration. 0x01 enable Enable feature optimized acc_conf	0x0	RW
high_g					
0x5E: 0x2E		HI_G_1	The acceleration threshold above which the high_g motion is signaled.	0x0C00	
	14...0	threshold	The acceleration threshold above which the high_g motion is signaled15 bit, signed integer (valid values 0...32767) holding the threshold in 5.11 g format. Default is 3072 = 1.5 g. Range is 0 to 16g.	0xC00	RW
0x5E: 0x30		HI_G_2	Enable flags and hysteresis configuration	0x7100	
	11...0	hysteresis	Hysteresis value for high_g feature. Range is 0 to 2g. Default value is 256 = 125mg.	0x100	RW
	12	en_x	Enables the feature on a per-axis basis	0x1	RW
	13	en_y	Enables the feature on a per-axis basis	0x1	RW
	14	en_z	Enables the feature on a per-axis basis	0x1	RW

	15	enable	Enables the feature	0x0	RW
0x5E: 0x32		HI_G_3	Duration interval	0x0004	
	11...0	duration	12 bit signed character (valid values 0...4095) holding the duration in 200 Hz samples (5 ms) for which the threshold has to be exceeded; default value 4 = 20 msec. Range is 0 to 20sec.	0x4	RW
sig_motion					
0x5E: 0x34		SIGMO_1	Significant motion detection general configuration flags - part 1	0x0133	
	14...0	threshold	Slope threshold value for this feature above which the significant motion is detected. Range is 0 to 16g. Default is 307 = 150mg.	0x133	RW
0x5E: 0x36		SIGMO_2	Significant motion detection general configuration flags - part 2	0x0096	
	8...0	skip_time	Defines the number of consecutive data points for which the feature remains in sleep mode after the first significant motion detection. The feature checks for significant motion detection again after this sleep duration. It is expressed in 50 Hz samples (20 ms). Range is 0 to 10sec. Default is 150 = 3sec.	0x96	RW
	9	enable	Enables the feature	0x0	RW
0x5E: 0x38		SIGMO_3	Significant motion detection general configuration flags - part 3	0x0032	
	6...0	proof_time	Defines duration of certain number of consecutive data points after sleep time. The second significant motion must be detected within this duration for the interrupt to get triggered. Range is 0 to 2.5sec. Default value is 50 = 1sec.	0x32	RW
general_settings					

0x5E: 0x3A		Reserved	Reserved	0x0000	
	15...0	Reserved	Reserved	0x0	R
0x5E: 0x3C		axes_remapping	Describes axes remapping	0x0088	
	1...0	map_x_axis	Map the x axis to desired axis **Value** **Name** **Description** 0x00 x axis Map to x-axis 0x01 y axis Map to y-axis 0x02 z axis Map to z-axis 0x03 reserved Map to x-axis	0x0	RW
	2	map_x_axis_sign	Map the x axis sign to the desired one **Value** **Name** **Description** 0x00 not_invert Clear this bit to not invert the x axis 0x01 inverted Set this bit to invert the x axis	0x0	RW
	4...3	map_y_axis	Map the y axis to desired axis **Value** **Name** **Description** 0x00 x axis Map to x-axis 0x01 y axis Map to y-axis 0x02 z axis Map to z-axis 0x03 reserved Map to y-axis	0x1	RW
	5	map_y_axis_sign	Map the y axis sign to the desired one **Value** **Name** **Description** 0x00 not_invert Clear this bit to not invert the y axis 0x01 inverted Set this bit to invert the y axis	0x0	RW
	7...6	map_z_axis	Map the z axis to desired axis	0x2	RW

			Value **Name** **Description** 0x00 x axis Map to x-axis 0x01 y axis Map to y-axis 0x02 z axis Map to z-axis 0x03 reserved Map to z-axis		
	8	map_z_axis_sign	Map the z axis sign to the desired one **Value** **Name** **Description** 0x00 not_invert Clear this bit to not invert the z axis 0x01 inverted Set this bit to invert the z axis	0x0	RW

3.1.53 Register (0x5F) INTERNAL_ERROR

DESCRIPTION: Internal error flags. Value of all reserved bits should be ignored.
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x5F) INTERNAL_ERROR**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	R	R	n/a
Reset Value	0	0	0	0
Content	reserved	int_err_2	int_err_1	reserved

int_err_1: Internal error flag - long processing time, processing halted
int_err_2: Internal error flag - fatal error, processing halted

3.1.54 Register (0x6A) NVM_CONF

DESCRIPTION: NVM controller mode (Prog/Erase or Read only)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x6A) NVM_CONF**

Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	n/a	RW	n/a
Reset Value	0	0	0	0
Content	reserved		nvm_prog_en	reserved

nvm_prog_en: Enable NVM programming

nvm_prog_en		
0x00	disable	disable
0x01	enable	enable

3.1.55 Register (0x6B) IF_CONF

DESCRIPTION: Serial interface settings
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x6B) IF_CONF**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			if_mode
Bit	3	2	1	0
Read/Write	n/a	n/a	n/a	RW
Reset Value	0	0	0	0
Content	reserved			spi3

spi3: Configure SPI Interface Mode for primary interface

spi3		
0x00	spi4	SPI 4-wire mode
0x01	spi3	SPI 3-wire mode

if_mode: Auxiliary interface configuration

if_mode		
0x00	p_auto_s_off	Auxiliary interface:off
0x01	p_auto_s_mag	Auxilary interface:Magnetometer

3.1.56 Register (0x6D) ACC_SELF_TEST

DESCRIPTION: Settings for the sensor self-test configuration and trigger
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x6D) ACC_SELF_TEST**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	RW	RW	n/a	RW
Reset Value	0	0	0	0
Content	acc_self_test_amp	acc_self_test_sign	reserved	acc_self_test_en

acc_self_test_en: Enable accelerometer self-test

acc_self_test_en		
0x00	disabled	disabled
0x01	enabled	enabled

acc_self_test_sign: select sign of self-test excitation as

acc_self_test_sign		
0x00	negative	negative
0x01	positive	positive

acc_self_test_amp: select amplitude of the selftest deflection:

acc_self_test_amp		
0x00	low	low
0x01	high	high

3.1.57 Register (0x70) NV_CONF

DESCRIPTION: NVM backed configuration bits.
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x70) NV_CONF**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	acc_off_en	i2c_wdt_en	i2c_wdt_sel	spi_en

spi_en: disable the I2C and enable SPI for the primary interface, when it is in autoconfig mode

spi_en		
0x00	disabled	I2C enabled
0x01	enabled	I2C disabled

i2c_wdt_sel: Select timer period for I2C Watchdog

i2c_wdt_sel		
0x00	wdt_short	I2C watchdog timeout after 1.25 ms
0x01	wdt_long	I2C watchdog timeout after 40 ms

i2c_wdt_en: I2C Watchdog at the SDA pin in I2C interface mode

i2c_wdt_en		
0x00	Disable	Disable I2C watchdog
0x01	Enable	Enable I2C watchdog

acc_off_en: Add the offset defined in the off_acc_[xyz] OFFSET register to filtered and unfiltered Accelerometer data

acc_off_en		
0x00	disabled	Disabled
0x01	enabled	Enabled

3.1.58 Register (0x71) OFFSET_0

DESCRIPTION: Offset compensation for Accelerometer X-axis (NVM backed)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x71) OFFSET_0**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_x			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_x			

off_acc_x: Accelerometer offset compensation (X-axis).

3.1.59 Register (0x72) OFFSET_1

DESCRIPTION: Offset compensation for Accelerometer Y-axis (NVM backed)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x72) OFFSET_1**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_y			
Bit	3	2	1	0

Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_y			

off_acc_y: Accelerometer offset compensation (Y-axis).

3.1.60 Register (0x73) OFFSET_2

DESCRIPTION: Offset compensation for Accelerometer Z-axis (NVM backed)
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x73) OFFSET_2**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_z			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	off_acc_z			

off_acc_z: Accelerometer offset compensation (Z-axis).

3.1.61 Register (0x7C) PWR_CONF

DESCRIPTION: Power mode configuration register
RESET: 0x03
DEFINITION (Go to register map):

Name	**Register (0x7C) PWR_CONF**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	n/a	RW	RW
Reset Value	0	0	1	1
Content	reserved		fifo_self_wakeup	adv_power_save

adv_power_save		
0x00	aps_off	advanced power save disabled (fast clk always enabled).
0x01	aps_on	advanced power mode enabled (slow clk is active when no measurement is ongoing.)

fifo_self_wakeup		
0x00	fsw_off	FIFO read disabled in advanced power saving mode.
0x01	fsw_on	FIFO read enabled after interrupt in advanced power saving mode.

3.1.62 Register (0x7D) PWR_CTRL

DESCRIPTION: Sensor enable register
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x7D) PWR_CTRL**			
Bit	7	6	5	4
Read/Write	n/a	n/a	n/a	n/a
Reset Value	0	0	0	0
Content	reserved			
Bit	3	2	1	0
Read/Write	n/a	RW	n/a	RW
Reset Value	0	0	0	0
Content	reserved	acc_en	reserved	aux_en

aux_en		
0x00	mag_off	Disables the auxiliary sensor.
0x01	mag_on	Enables the auxiliary sensor.

acc_en		
0x00	acc_off	Disables the Accelerometer.
0x01	acc_on	Enables the Accelerometer.

3.1.63 Register (0x7E) CMD

DESCRIPTION: Command Register
RESET: 0x00
DEFINITION (Go to register map):

Name	**Register (0x7E) CMD**			
Bit	7	6	5	4
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	cmd			
Bit	3	2	1	0
Read/Write	RW	RW	RW	RW
Reset Value	0	0	0	0
Content	cmd			

cmd: Available commands (Note: Register will always read as 0x00):

cmd		
0xa0	nvm_prog	Writes the NVM backed registers into NVM
0xb0	fifo_flush	Clears all data in the FIFO, does not change FIFO_CONFIG and FIFO_DOWNS registers
0xb6	softreset	Triggers a reset, all user configuration settings are overwritten with their default state

4. Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0		Document creation	July 2021

Bosch Sensortec GmbH
Gerhard-Kindler-Straße 9
72770 Reutlingen / Germany

contact@bosch-sensortec.com
www.bosch-sensortec.com

Document number: BST-BMA456-AN001-01
Revision_1.0_072021