



Acceleration Sensors

# MMA8450Q

## Low-power, 12-bit, 3-axis accelerometer

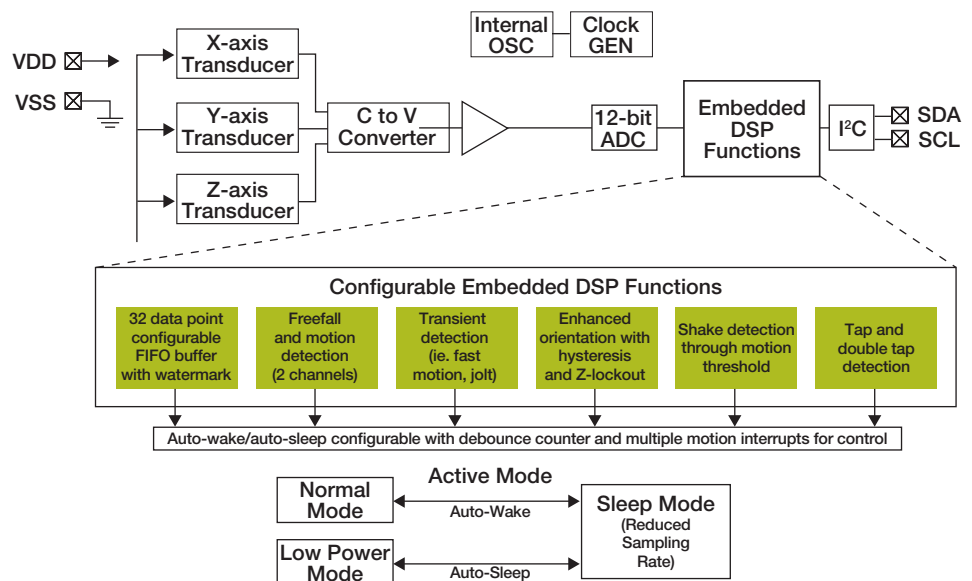


### Simplifying complexity

The Freescale MMA8450Q is a 12-bit, 3-axis, low g, I<sup>2</sup>C, digital capacitive acceleration sensor with power as low as 27 uA in active mode, contained in a small, low-profile 3 x 3 x 1 mm QFN package. The MMA8450Q next-generation motion sensing device provides 12-bit data with first in, first out (FIFO) to accomplish complex gesture recognition and position detection required for next-generation mobile applications that go beyond basic algorithms.

The MMA8450Q accelerometer provides increased embedded intelligence such as orientation, tap, double tap, jolt, freefall and shake detection. Utilizing the embedded functions in the MMA8450Q, customers can develop more robust applications such as position detection, 3-D gesture detection, pedometry and many other next-generation motion detection functions. The MMA8450Q has two programmable interrupt pins, making it possible to monitor two functions independently. There are eight interrupt sources that can be configured to use these two independent interrupt pins. To operate with

### MMA8450Q Block Diagram



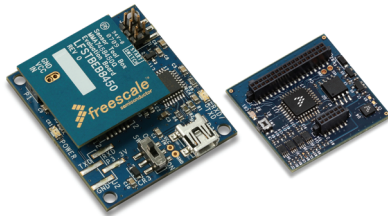
extremely low power, the MMA8450Q has six user configurable sample rates that can be set over a wide range of 1.5 to 400 samples per second where operating current is proportional

to the sample rate. The power scheme contains normal mode and low-power mode, allowing the customer to achieve optimal power consumption targets.



## Typical Applications

- Mobile phones/PMP/PDA/digital cameras
  - Orientation detection (portrait/landscape)
  - Image stability
  - Tilt control enabled with higher resolution
  - Gesture dialing enhanced with high pass filter
  - Tap to control
  - Auto wake/sleep for low power consumption
- Smartbooks/ereaders/netbooks/laptops
  - Anti-theft
  - Freefall detection for hard disk drives
  - Orientation detection
  - Tap detection
- Public transportation ticketing systems
- Activity monitoring in medical applications
- Security
  - Shock detection
  - Tilt
- Fleet monitoring, tracking
  - Dead reckoning
  - System auto wake-up on movement detection
  - Shock recording
  - Anti-theft
- Power tools and small appliances
  - Tilt
  - Safety shutoff



RD3924MMA8450Q

LFSTBEB8450

## Freescale Accelerometer Product Feature Comparison

| Feature                                    | MMA8450Q  | MMA7455L  | MMA7660FC  |
|--|---|---|--|
| <b>Digital Capability</b>                  |   |   |  |
| Digital resolution                         | 12-bit  | 10-bit  | 6-bit  |
| Digital output                             | I <sup>2</sup> C  | I <sup>2</sup> C, SPI   | I <sup>2</sup> C   |
| Current consumption                        | <ul style="list-style-type: none"> <li>• Shutdown: &lt; 1 uA</li> <li>• Standby: 4 uA</li> <li>• Normal mode: 42–250 uA</li> <li>• Low-power mode: 27–120 uA</li> </ul> | <ul style="list-style-type: none"> <li>• Shutdown: 2 uA</li> <li>• Standby: 10 uA</li> <li>• Normal mode: 400 uA</li> </ul> | <ul style="list-style-type: none"> <li>• Shutdown: 2 uA</li> <li>• Standby: 10 uA</li> <li>• Normal mode: 50–300 uA</li> </ul> |
| Programmable interrupt pins                | 2   | 2   | 1  |
| <b>Package</b>                             |   |   |  |
| Package type                               | 3 x 3 x 1 mm QFN  | 3 x 5 x 1 mm LGA  | 3 x 3 x 0.9 mm DFN   |
| <b>g-Cell or Sensing Cell</b>              |   |   |  |
| Dynamic range                              | 2g/4g/8g  | 2g/4g/8g  | 1.5g   |
| Axis                                       | 3-axis  | 3-axis  | 3-axis   |
| Drop shock                                 | 10,000g   | 10,000g   | 10,000g  |
| <b>Embedded Functions/Features</b>         |   |   |  |
| Selectable output data rate                | With reduced current specifications   | No reduced current specifications   | With reduced current specifications  |
| Freefall                                   | 2 channels programmable   | 2 channels programmable   | N/A  |
| Motion detection                           | 2 channels programmable   | 1 channel programmable  | 1 channel, fixed threshold   |
| Tap detection                              | 1 channel   | 2 channels  | 1 channel  |
| Transient detection                        | 1 channel   | N/A   | N/A  |
| Orientation (portrait/landscape) detection | <ul style="list-style-type: none"> <li>• Includes hysteresis compensation</li> <li>• Programmable trip points</li> <li>• Z-lockout</li> </ul>                           | N/A   | No hysteresis  |
| FIFO                                       | <ul style="list-style-type: none"> <li>• 12-bit data</li> <li>• 32 samples for each axis</li> </ul>   | N/A   | N/A  |
| Auto-wake/sleep                            | Configurable with up to 5 interrupts. Sleep counter configurable for up to 325 seconds  | N/A   | Configurable with up to 4 interrupts   |
| Self test                                  | Yes   | Yes   | I <sup>2</sup> C Test  |

## Development Tools

| Part Number    | Description   |
|----------------|---|
| LFSTBEB8450    | This LFSTBEB8450 accelerometer development board provides an evaluation platform for the MMA8450Q accelerometer and includes the QE8 MCU for data acquisition. This board can work with the LFSTBUSB communication board that is sold separately. |
| RD3924MMA8450Q | This Sensor Toolbox kit comes with the accelerometer LFSTBUSB development and the LFSTBUSB boards   |

Freescale is a leading provider of pressure, inertial and touch sensors and has offered MEMS-based sensors for over 30 years. The sensor ICs complement Freescale's broad portfolio of ZigBee® technology, microcontrollers, microprocessors, digital signal processors, analog ICs and development tools to offer system solutions to customers.

## Documentation

| Freescale Document Number | Description  |
|---------------------------|--|
| MMA8450Q                  | Product Specifications Data Sheet                                  |
| AN3915                    | Embedded Orientation Detection Using the MMA8450Q                  |
| AN3916                    | Offset Calibration of the MMA8450Q                                 |
| AN3917                    | Motion and Freefall Detection Using the MMA8450Q                   |
| AN3918                    | High Pass Filtered Data and Transient Detection Using the MMA8450Q |
| AN3919                    | MMA8450Q Single/Double and Directional Tap Detection               |
| AN3920                    | Using the 32 Sample First In, First Out (FIFO) in the MMA8450Q     |
| AN3921                    | Low-Power Modes and Auto-Wake/Sleep Using the MMA8450Q             |
| AN3922                    | Data Manipulation and Basic Settings of the MMA8450Q               |
| AN3923                    | MMA8450Q Design Checklist and Board Mounting Guidelines            |

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