



Xtrinsic Accelerometers

# Xtrinsic Accelerometer MMA845xQ Family

Pin-compatible 14-, 12- and 10-bit accelerometers

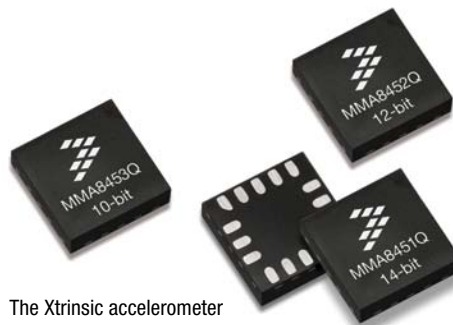
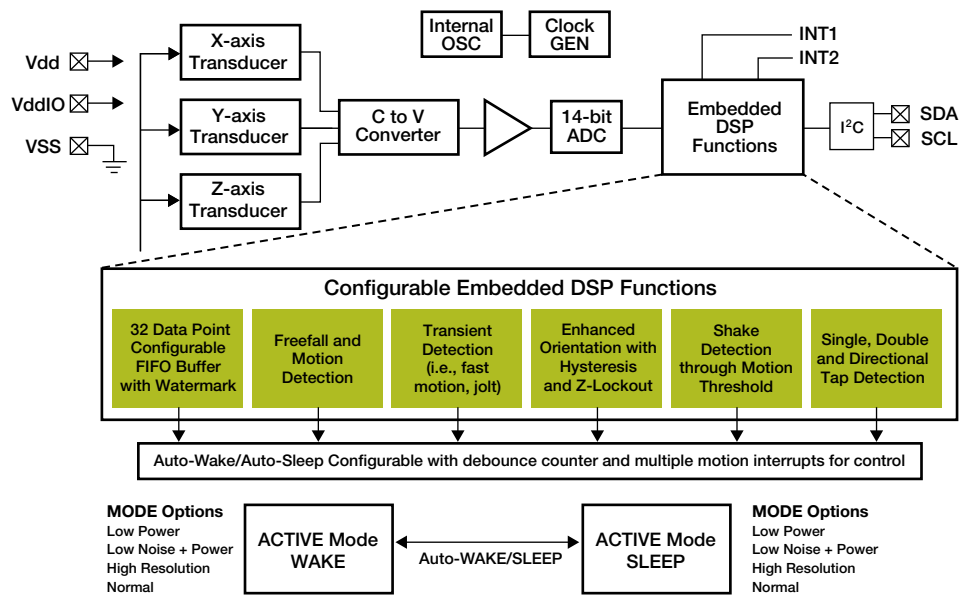


## Scalable Intelligence in Motion

Freescale's Xtrinsic accelerometer MMA845xQ family offers extremely low power and pin compatibility with a broad range of resolution (14-, 12- and 10-bit) and embedded features for configurable, accurate motion analysis. To operate with extremely low power, the MMA845xQ accelerometers have six user-configurable sample rates that can be set over a wide range of 1.5 to 800 Hz. The power scheme contains four different power modes from high resolution to low power, offering best-in-class savings in supply current and extremely high resolution for very small motion detection.

Pin to pin compatibility with register map alignment maximizes hardware re-use between 10-bit and 14-bit designs where there is zero development cost to migrate from 10-bit to 14-bit performance. The MMA845xQ accelerometers are feature-rich with a wide range of real-time motion detection such as orientation, directional shake and tap, jolt, freefall and pedometer applications. The MMA8451Q contains the 14/8-bit FIFO which holds up to 32 samples of either low pass filtered (LPF) or high pass filtered (HPF) data, depending on user selection. See the MMA845xQ accelerometer family comparison table for more details.

## MMA8451Q Block Diagram



The Xtrinsic accelerometer MMA845xQ family is hardware and software compatible.



## Typical Applications

- **Mobile phones/PMP/PDA/digital cameras**
  - Orientation detection (portrait/landscape)
  - Image stability
  - Tilt control enabled with higher resolution
  - Gesture dialing enhanced with HPF
  - 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**
  - Small motions detected with extremely high resolution
  - Tilt
- **Fleet monitoring, tracking**
  - Dead reckoning
  - System auto wake-up on movement detection
  - Shock recording
  - Anti-theft
  - Toll payment
- **Unbalance detection for washers**
- **Power tools and small appliances**
  - Tilt
  - Safety shutoff

Freescale is a leading provider of pressure, inertial and touch sensors and has offered MEMS-based sensors for over 30 years. Building on our heritage of sensor innovation, Freescale is proud to announce Xtrinsic sensing solutions that offer the right combination of intelligent integration, logic and customizable software to deliver smarter, more differentiated applications. Freescale sensors complement our broad portfolio of ZigBee® technology, microcontrollers, microprocessors, digital signal processors, analog ICs and development tools.

## Freescale Accelerometer Product Feature Comparison

| Features                  | MMA8450Q                | MMA8451Q                          | MMA8452Q                          | MMA8453Q                          | Benefits                                                     |
|---------------------------|-------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--------------------------------------------------------------|
| <b>Digital Capability</b> |                         |                                   |                                   |                                   |                                                              |
| Supply voltage            | 1.71–1.89               | 1.95–3.6                          | 1.95–3.6                          | 1.95–3.6                          | Wider supply voltage to support various applications         |
| Resolution                | 12-bit                  | 14-bit                            | 12-bit                            | 10-bit                            | Higher resolution for more precise applications              |
| Power consumption         | 27 $\mu$ A              | 6 $\mu$ A                         | 6 $\mu$ A                         | 6 $\mu$ A                         | Lower power for significant battery savings                  |
| Low noise (at 400 Hz ODR) | 375 $\mu$ g/ $\sqrt$ Hz | 99 $\mu$ g/ $\sqrt$ Hz            | 99 $\mu$ g/ $\sqrt$ Hz            | 99 $\mu$ g/ $\sqrt$ Hz            | Lower noise for more precise applications                    |
| Output data rate          | 1.563–400 Hz            | 1.563–800 Hz                      | 1.563–800 Hz                      | 1.563–800 Hz                      | Increased bandwidth to support various applications          |
| <b>Embedded Features</b>  |                         |                                   |                                   |                                   |                                                              |
| Freefall detection        | Yes                     | Yes                               | Yes                               | Yes                               | Fast UI response                                             |
| Orientation detection     | Yes                     | Yes                               | Yes                               | Yes                               | Fast UI response                                             |
| Embedded FIFO buffer      | Yes                     | Yes                               | No                                | No                                | Reduced I <sup>2</sup> C bus traffic<br>System power savings |
| Tap detect                | Tap/double tap          | Tap/double tap<br>Directional tap | Tap/double tap<br>Directional tap | Tap/double tap<br>Directional tap | Fast UI response<br>System power savings                     |
| Shake detect              | Shake                   | Shake<br>Directional shake        | Shake<br>Directional shake        | Shake<br>Directional shake        | Fast UI response<br>System power savings                     |
| High pass filtered data   | Yes                     | Yes                               | Yes                               | No                                | Reduced system cycle time                                    |
| Auto-wake/sleep           | Yes                     | Yes                               | Yes                               | Yes                               | System power savings                                         |

## Documentation

| Document Number                         | Description                                                                                            |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------|
| MMA8450Q/MMA8451Q/<br>MMA8452Q/MMA8453Q | Product Specification Data Sheets                                                                      |
| AN4068                                  | Embedded Orientation Detection Using the MMA8451, 2, 3Q                                                |
| AN4069                                  | Offset Calibration of the MMA8451, 2, 3Q                                                               |
| AN4070                                  | Motion and Freefall Detection Using the MMA8451, 2, 3Q                                                 |
| AN4071                                  | High Pass Filtered Data and Functions Using the MMA8451, 2, 3Q                                         |
| AN4072                                  | MMA8451, 2, 3Q Single/Double and Directional Tap Detection                                             |
| AN4073                                  | Using the 32 Sample First In, First Out (FIFO) in the MMA8451Q                                         |
| AN4074                                  | Auto-Wake/Sleep Using the MMA8451,2,3Q                                                                 |
| AN4075                                  | How Many Bits Are Enough? The Trade-off Between High Resolution and Low Power Using Oversampling Modes |
| AN4076                                  | Data Manipulation and Basic Settings of the MMA8451, 2, 3Q                                             |
| AN4077                                  | MMA8451, 2, 3Q Design Checklist and Board Mount Guidelines                                             |

## Development Tools

| Part Number    | Description                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LFSTBEB845x    | This LFSTBEB845x kit includes three accelerometer development boards that represent the MMA845xQ family. These boards connect to the LFSTBUSB communication board that is sold separately. |
| RDMMA845x      | The RDMMA845x bundled kit includes all three MMA845xQ accelerometer development boards as well as the accelerometer USB board.                                                             |
| LFSTBEB8450    | This LFSTBEB8450 accelerometer development board provides an evaluation platform for the MMA8450Q accelerometer and includes the QE8 MCU for data acquisition.                             |
| RD3924MMA8450Q | This Sensor Toolbox kit comes with the accelerometer MMA8450Q accelerometer development board and the USB board.                                                                           |

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