NXP

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Sensors

Xtrinsic Accelerometers

Xtrinsic Accelerometer MMA845xQ Family

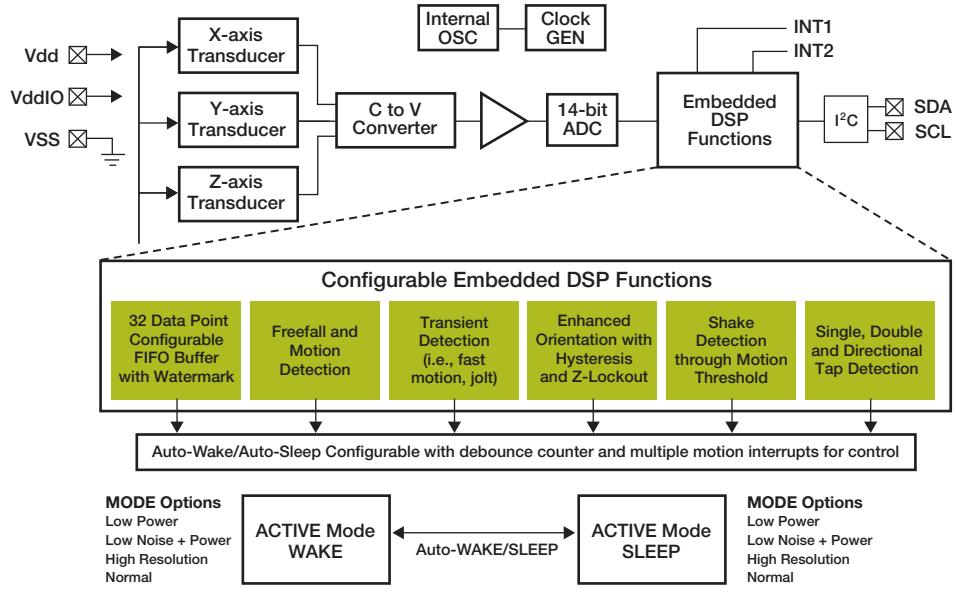## Pin-compatible 14-, 12- and 10-bit accelerometers

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

Target 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

Energy Efficient Solutions ™
by Freescale

Freescale: A Leader in Sensing Solutions

Expanding on more than 30-years of sensor innovation, our Xtrinsic sensing solutions are designed with the right combination of high-performance sensing capability, processing capacity and customizable software to help deliver smart, differentiated sensing applications. With Xtrinsic sensing solutions, our vision is to offer a diverse and differentiated product portfolio to meet the expanding needs of the automotive, consumer and industrial segments. Xtrinsic solutions offer ideal blends of functionality and intelligence designed to help our customers differentiate and win in highly competitive markets.

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.

The Xtrinsic accelerometer MMA845xQ family is hardware and software compatible.

Freescale Accelerometer Product Feature Comparison

Features	MMA8450Q	MMA8451Q	MMA8452Q	MMA8453Q	Benefits
Digital Capability					
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 uA	6 uA	6 uA	6 uA	Lower power for significant battery savings
Low noise (at 400 Hz ODR)	375 µg/√Hz	99 µg/√Hz	99 µg/√Hz	99 µg/√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
Embedded Features					
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 I²C bus traffic System power savings
Tap detect	Tap/double tap	Tap/double tap Directional tap	Tap/double tap Directional tap	Tap/double tap Directional tap	Fast UI response System power savings
Shake detect	Shake	Shake Directional shake	Shake Directional shake	Shake Directional shake	Fast UI response 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/ 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

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