MMA955xL Xtrinsic Intelligent Motion-Sensing Platforms

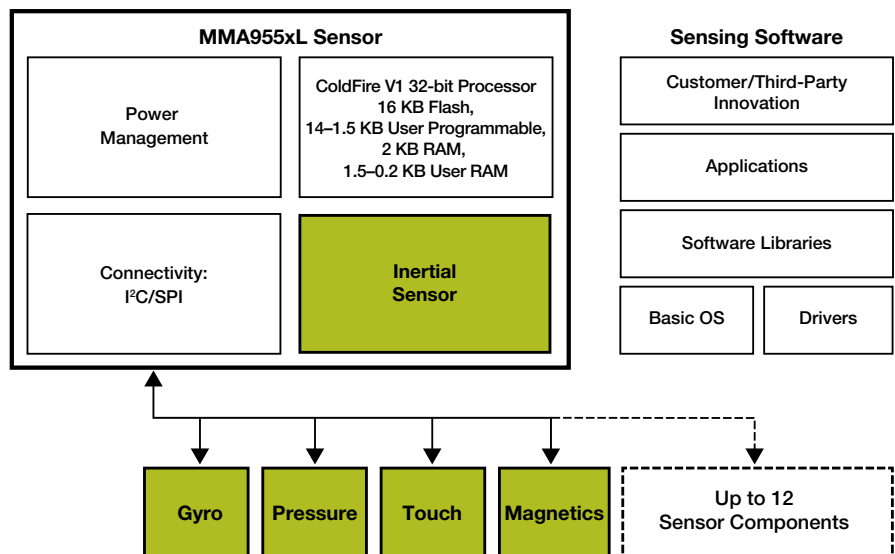## Typical Applications

- Pedometers
  - Step count
  - Distance
- Gaming and toys
  - Orientation detection (portrait/landscape)
  - Image stability
  - Tilt control enabled with higher resolution
  - Gesture recognition
  - Tap to control
  - Auto-wake/sleep for low power consumption
- Public transportation ticketing systems
- Activity monitoring in medical applications
- Security
  - Shock detection
  - Tilt
- Fleet monitoring, tracking
  - System auto wake-up on movement detection
  - Shock recording
  - Anti-theft
- Power tools and small appliances
  - Tilt
  - Safety shutoff
- E-Readers/tablets/laptops
  - Anti-theft
  - Freefall detection for hard disk drives
  - Orientation detection
  - Tap detection

Programmable Intelligence in Motion

Used in smartphones, e-readers, tablets and portable navigation devices, the Freescale MMA9550L Xtrinsic intelligent motion-sensing platform is an industry first with integration of an MEMS accelerometer, 32-bit embedded ColdFire MCU, flash memory and a dedicated architecture to manage other sensors. Freescale has now expanded the MMA9550L offering with other feature-rich devices, the MMA9551L, MMA9553L and MMA9559L to enable other applications such as gesture recognition, pedometer functionality and activity monitoring.

The MMA955xL family is comparable in size (3 x 3 mm) and power consumption to standard state-machine-based accelerometers. The devices can process sensor data locally, reducing communications required with the host 14-bit processor. Fewer computations done on the host and active power management of the host by the MMA955xL devices can reduce system power by up to 90 percent compared to systems in which "dumb sensors" are directly managed by the applications processor.

MMA955xL Xtrinsic Intelligent Motion-Sensing Platform Block Diagram

MMA955xL Sensor

Power Management

ColdFire V1 32-bit Processor
16 KB Flash,
14–1.5 KB User Programmable,
2 KB RAM,
1.5–0.2 KB User RAM

Connectivity:
I²C/SPI

Inertial Sensor

Sensing Software

Customer/Third-Party Innovation

Applications

Software Libraries

Basic OS | Drivers

Gyro | Pressure | Touch | Magnetics | Up to 12 Sensor Components

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The MMA955xL family can be programmed independent of the host operating system to create applications and services based on sensors. The devices also provide real-time sensor processing, more efficient data processing and re-use of IP software for shorter development time. In addition, sensor data aggregation can be achieved from third-party sensors, easing sensor implementation. With internal flash memory, the MMA955xL family can be re-programmed on the fly. New sensors for new applications are now possible based on programming the MMA955xL sensor hub with full customization for the end user and mobile device-level through software.

Up to twelve sensor inputs are easily consolidated by the MMA955xL motion-sensing platform which operates with a unique slave port that is configurable as either I^{2}C or SPI allowing calibration, compensation and sensor functions to be offloaded from the system application processor.

The MMA955xL family can be programmed and configured with CodeWarrior Development Studio software, which enables customers to quickly and easily shape next-generation applications that go beyond basic algorithms to exactly what they need.

Freescale offers a variety of firmware versions for the MMA955xL devices. The different versions of the device are identified by the fourth digit in the part number (for example MMA9559L). The only difference between the various device configurations is the firmware content that is loaded into the flash memory at the factory. The user can still add custom software using the remaining portion of flash memory. The MMA9550L, MMA9551L and MMA9553L devices can function immediately as they are. They have an internal command interpreter and applications scheduler and can interact directly with the user's host system.

Literature and Documentation

Document Number	Title
MMA955xL	MMA955xL Data Sheet
MMA9559LSWRM	MMA9559L Intelligent Motion-Sensing Platform Software Reference Manual
MMA955XLSWRM	MMA955xL Intelligent Motion-Sensing Platform Software Reference Manual
MMA955XLRM	MMA955XL Reference Manual
MMA955XLSTUG	MMA9550L and MMA9551L Sensor Toolboxes User Guide
Application Notes	
AN4446	Using MMA9550L to Detect High Point of a Vertical Trajectory
AN4315	Using the Freescale MMA9550L for High-Resolution Spectral Estimation of Vibration Data
AN4464	Digital Filtering with MMA955xL
AN4128	Installation of the MMA955xL CodeWarrior Service Pack
AN4129	Building Custom Applications on MMA9550L/MMA9551L

MMA955xL Xtrinsic Intelligent Motion-Sensing Platform Family

	MMA9550L	MMA9551L	MMA9553L	MMA9559L
Fast Speed	3.1 mA @ 8 MHz	3.1 mA @ 8 MHz	3.1 mA @ 8 MHz	3.1 mA @ 8 MHz
Standby	2 µA	2 µA	2 µA	2 µA
Accel. Measurement	143 µA @ 16 Hz	143 µA @ 16 Hz	165 µA @ 31 Hz	143 µA @ 16 Hz
ADC	10-, 12-, 14- and 16-bit	10-, 12-, 14- and 16-bit	10-, 12-, 14- and 16-bit	10-, 12-, 14- and 16-bit
Programmable	Single-wire background debug mode (BDM) pin interface	Single-wire background debug mode (BDM) pin interface	Single-wire background debug mode (BDM) pin interface	Single-wire background debug mode (BDM) pin interface
Key Elements	Infrastructure-only functions	Infrastructure + gestures	Infrastructure + pedometer	Lightweight infrastructure
User Flash	6.5 KB	4.5 KB	1.5 KB	14 KB
User RAM	576 B	452 B	164 B	1.5 KB
Development Tools	KITMMA9550LEVM	KITMMA9551LEVM	KITMMA9550LEVM with FW update	MMA9559LKUBE

The MMA9559L device provides the most flexibility and is for users who need to design their own control loop and system. The device must be programmed with custom user code.

Freescale: A Leader in Sensing Solutions

Expanding on more than 30 years of sensor innovation, Freescale 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.

For more information, visit freescale.com/sensingplatform