

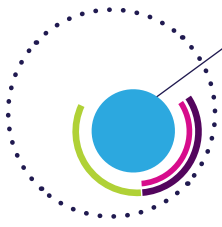


life.augmented

# Motion MEMS

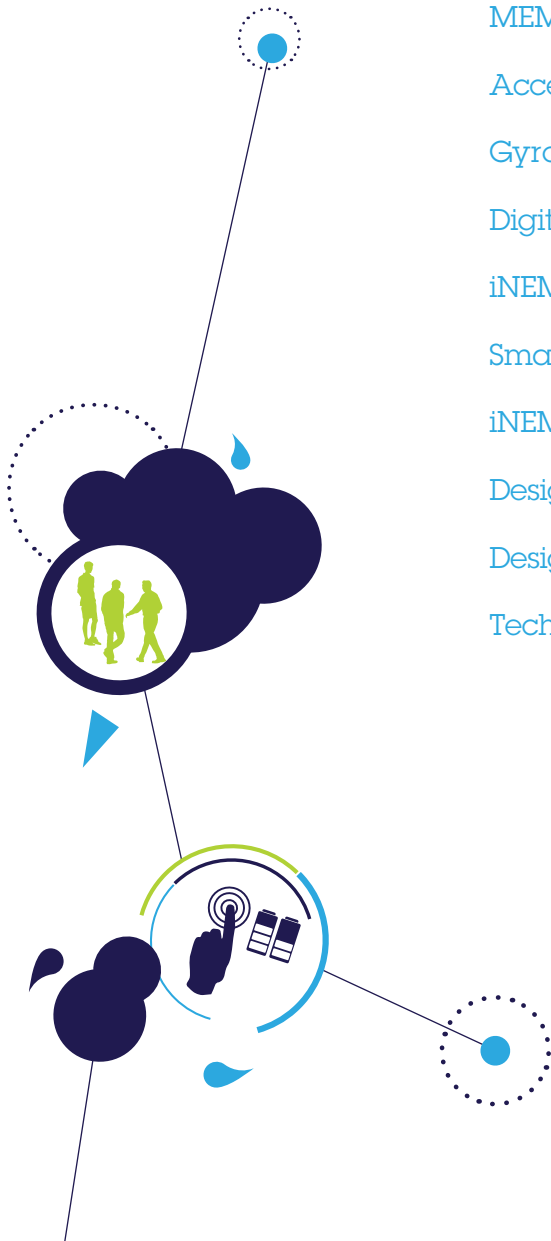
## Smart multi-axis solutions for enhanced user experience





# Content

The one-stop MEMS supplier .....	3
MEMS in your hand .....	4
MEMS in your training .....	5
MEMS in your home .....	6
MEMS in your car .....	7
MEMS at work .....	8
MEMS in health care .....	9
Accelerometers .....	10
Gyroscopes .....	12
Digital compasses .....	14
iNEMO inertial modules .....	15
Smart sensors .....	16
iNEMO fusion suite .....	18
Design support .....	19
Design a sensor subsystem .....	20
Technical Support .....	22





# The one-stop MEMS supplier



## For your MEMS needs, ST provides a complete solution

ST offers one of the industry's widest portfolios of MEMS motion sensors, including accelerometers, gyroscopes, digital compasses and inertial modules. With more than 3 billion micro-electromechanical sensors shipped already at the beginning of the year, ST leads the consumer and mobile MEMS market (source: IHS, MEMS Market Feb 2013). ST offers:

- A unique sensor portfolio, from discrete to fully-integrated solutions, to meet all design needs
- High-volume manufacturing capacity (more than 4 Mpieces/day) to provide cost-competitive solutions, fast time-to-market and security of supply
- High-performance sensor fusion to improve the accuracy of multi-axis sensor systems in order to enable new emerging and highly-demanding applications, such as indoor navigation and location-based services
- High-quality products, already tested in different application fields, including mobile, portable, gaming, consumer, automotive and health care segments (more than 3 billion pieces shipped worldwide)
- Multiple sites dedicated to MEMS foundry, assembly and testing lines, with full in-house dual sourcing, guaranteeing 100% security of supply

### COMPLETE SOLUTION

- Large sensor portfolio
- Integrated HW + SW solutions
- 100% security of supply
- Scalability of solutions
- Quality is a must for ST
- ST is MEMS market leader

ST's leadership continues with a strong commitment to sustainable technology, with our Sustainable Technology Program, delivering motion MEMS products with decreasing environmental impact, generation after generation, providing improved life quality by bringing environmental and social benefits to end users.



**SUSTAINABLE  
TECHNOLOGY**



# MEMS in your hand

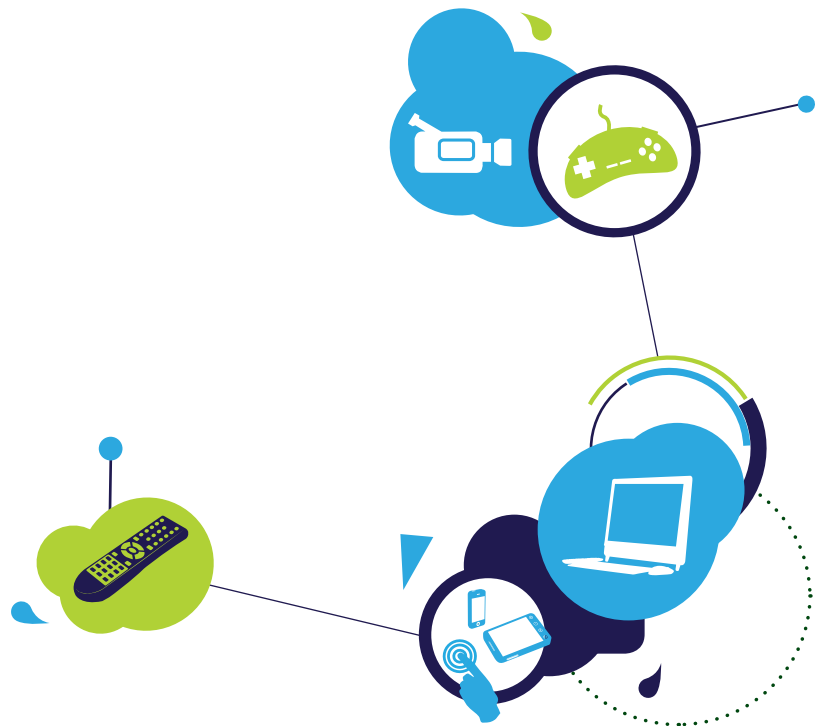


## All portable devices become easy-to-use and fun

4

### CONSUMER APPLIANCES

- Phones and tablets (AXL, GYRO, MAG, PS\*)
  - Motion tracking for gesture-based user interfaces
  - Electronic compasses
  - Location-based services
  - Heading and navigation
- Gaming devices (AXL, GYRO, MAG)
  - Accurate detection of orientation and angular rate
- Remote control (AXL, GYRO, MAG)
  - Gesture recognition and pointing (3D mouse)
- Notebooks and ultrabooks (AXL, GYRO, MAG)
  - Sensor hub
  - Hard-disk protection
  - Lid closure
  - Orientation
- Cameras (DSC/DVD) (AXL, GYRO)
  - OIS and user interfaces



\*  
AXL: accelerometer  
GYRO: gyroscope  
MAG: magnetometer  
PS: pressure sensor



# MEMS in your training



## Sensors for improving your fitness work out

### FITNESS AND WELLNESS APPLICATIONS

- Athlete performance monitoring
  - Movement recognition through shoes and wearable sensors (AXL, GYRO)
  - Golf and tennis swing detection (AXL, GYRO, MAG)
  - Body tracking recognition (AXL, GYRO, MAG)
- Watches and PND (AXL, GYRO, MAG, PS)  
Pedometers
  - Map orientation
  - Heading and navigation
  - Power saving using auto-wake up functionality
  - Gesture recognition
  - Taps (display activation)
- Treadmills and barbells (AXL)
  - Tilting angle, shock detection during steps





# MEMS in your home



## Devices offer enhanced user interfaces without increasing energy consumption

6

### HOME APPLIANCES

- Home alarm systems and car garages (AXL)
  - Vibration and shock detection
  - Detection of door open/close position
- White goods (AXL, GYRO, PS)
  - Control of rotation of the basket (washing machine)
  - Power consumption optimization
  - Vibration detection for noise reduction and maintenance
  - Door open/close position
  - Fluid column pressure measurement
- Electric, gas/water meters (AXL)
  - Tilting, vibration and shock detection
  - Anti-tamper





# MEMS in your car



## For safer cars and easier navigation

### AUTOMOTIVE

- Telematics
  - E-Calls (AXL)
  - Black boxes, crash detection (AXL)
  - Fleet tracking (AXL, GYRO)
  - Driver's behavior tracking (AXL, GYRO)
  - Key fobs (AXL)
- Security
  - Car alarms, anti-theft systems (AXL)
  - Tilt detection (AXL)
- Navigation
  - 3D navigation (AXL, GYRO, PS)
  - Dead reckoning (AXL, GYRO, PS)
- Safety
  - SRS with rollover detection (AXL, GYRO, PS)
  - Hill start assist, head Safety light leveling, assistance braking (AXL)
  - Vehicle dynamics, stability control (AXL, GYRO)
  - Electronic suspensions (AXL, GYRO)
  - Tyre pressure monitoring systems (AXL, PS)
  - Smart tyres (AXL, PS)





# MEMS at work



## For industrial applications

8

### INDUSTRIAL

- Robotics and automation (AXL, GYRO)
  - Inertial navigation, increase the accuracy of wheel encoder, self-balance robot
- Condition monitoring of industrial equipment and transportation (high g AXL)
  - Vibration and rotational speed monitoring
- Asset and parcel tracking and monitoring (high g AXL, GYRO)
  - Shock detection and logging
- Building and structure monitoring (AXL)
  - Vibration and tilt monitoring
- Seismic exploration and geophones (AXL)
  - Vibration monitoring
- Drills (AXL, GYRO)
  - Safety, detecting excessive rotation on the body of the drill if chuck gets stuck,
  - Tilt detection







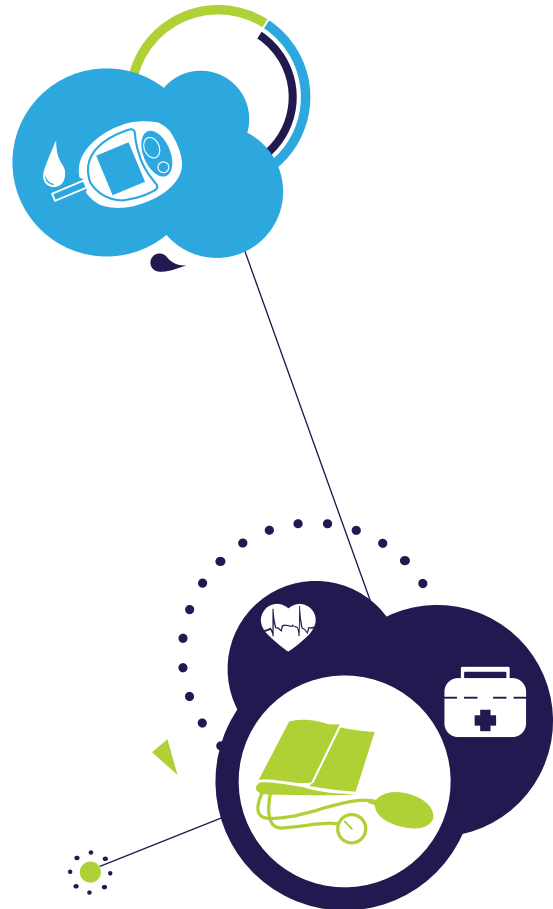
# MEMS in health care



## For advanced medical applications

### MEDICAL

- Implantable medical devices (AXL)
  - Pacemakers, defibrillators, neuro-stimulators
- Concussion detection in sports (high g AXL)
  - Helmets, patches, mouth guards
- Motion detection and body motion reconstruction (AXL, GYRO, MAG, PS)
  - Man down, rehabilitation and training, personal emergency response systems (PERS), improved straight line motion, tilt detection for safety
- Instrument guidance in surgery (AXL, GYRO)
- Health care and wheel chairs/ scooters (AXL, GYRO, PS)





# Accelerometers



## Smart motion features at ultra-low power consumption

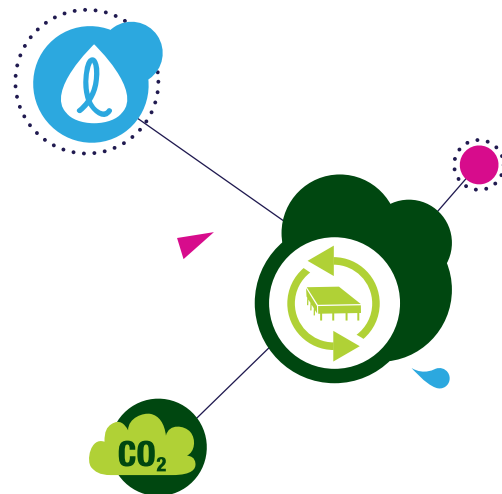
ST's state-of-the-art MEMS accelerometers include analog and digital sensors featuring up to  $\pm 400g$  acceleration full scale and from 1.71 to 3.6 V supply voltage. Accelerometers have advanced power-saving features that make them suitable for ultra-low-power applications. These features include low-power mode, auto wake-up function and a FIFO buffer that can be used to store data, thus reducing the host processor loading and system power consumption.

The small size and embedded features of ST's accelerometers make them an ideal choice for handheld portable applications and where long battery life is required.

10

### BENEFITS

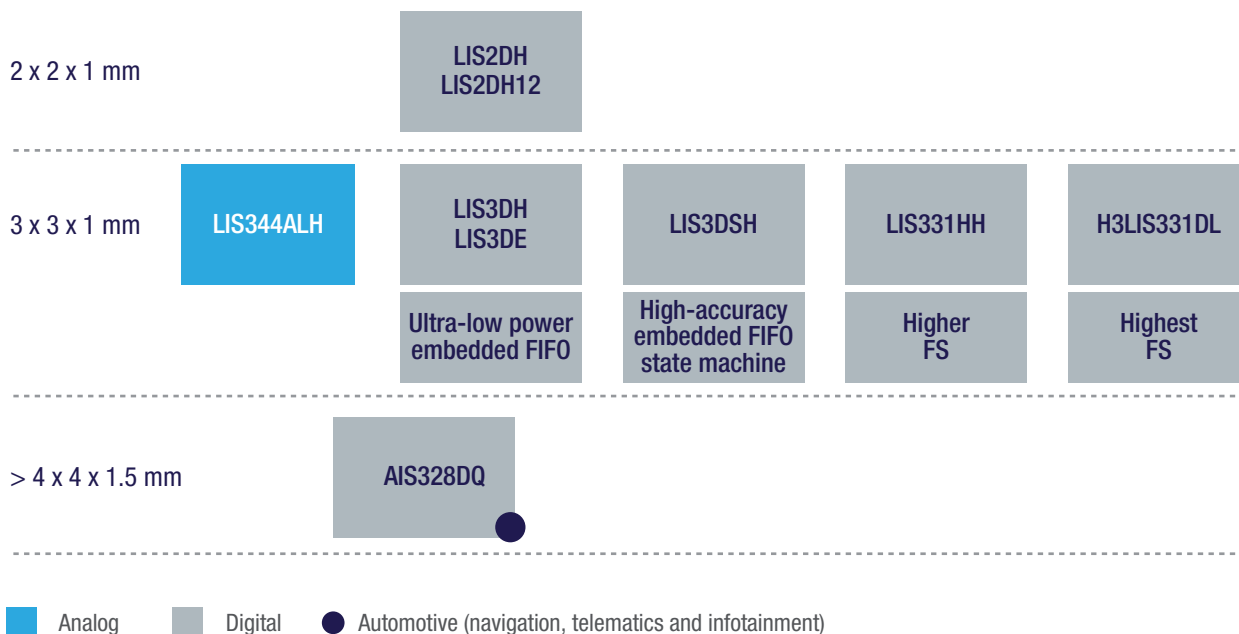
- High performances
- Small footprint for ultra-compact solutions
- Low power consumption and ultra-low-power operating modes that allow advanced power saving and smart sleep-to-wake-up functions
- Great and easy-to-use built-in features
- Embedded state machines enable custom motion recognition reducing system complexity



**SUSTAINABLE  
TECHNOLOGY**

**CO<sub>2</sub>** -42%  
-43%

## ACCELEROMETERS - RECOMMENDED PRODUCTS



## DEVICE SUMMARY

Part number	Package size (mm)	Full-scale typ (g)	Noise density ( $\mu\text{g}/\sqrt{\text{Hz}}$ )	Key features
LIS3DSH	3 x 3 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	150	16-bit, state machine, embedded FIFO
LIS3DE	3 x 3 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	220	8-bit, embedded FIFO
LIS3DH	3 x 3 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	220	12-bit, embedded FIFO
LIS2DH	2 x 2 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	220	12-bit, embedded FIFO
LIS2DE	2 x 2 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	220	8-bit, embedded FIFO
LIS2DH12	2 x 2 x 1	$\pm 2, \pm 4, \pm 8, \pm 16$	220	12-bit, embedded FIFO, board-compatible with compasses
LIS331HH	3 x 3 x 1	$\pm 6, \pm 12, \pm 24$	650	16-bit, up to $\pm 24\text{g}$ full scale
LIS331DLH	3 x 3 x 1	$\pm 2, \pm 4, \pm 8$	218	16-bit
LIS331DLM	3 x 3 x 1	$\pm 2, \pm 4, \pm 8$	-	8-bit
LIS331DL	3 x 3 x 1	$\pm 2, \pm 8$	-	8-bit
LIS33DE	3 x 3 x 1	$\pm 2, \pm 4, \pm 8$	-	8-bit
LIS332AR	3 x 3 x 1	$\pm 2$	100	Analog output
LIS332AX	3 x 3 x 1	$\pm 2$	100	Analog output
LIS302DL	3 x 5 x 0.9	$\pm 2, \pm 8$	-	8-bit
LIS35DE	3 x 5 x 0.9	$\pm 2, \pm 8$	-	8-bit
LIS344ALH	4 x 4 x 1.5	$\pm 2, \pm 6$	50	Analog output
LIS3LV02DL	4.4 x 7.5 x 1	$\pm 2, \pm 6$	-	16-bit
H3LIS331DL	3 x 3 x 1	$\pm 100, \pm 200, \pm 400$	15000	16-bit, up to $\pm 400\text{g}$ full scale, low power
AIS328DQ	4 x 4 x 1.8	$\pm 2, \pm 4, \pm 8$	218	16-bit, temperature range $-40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$
AIS326DQ	7 x 7 x 1.9	$\pm 2, \pm 6$	-	12-bit, temperature range $-40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$



# Gyroscoptes



## Superior accuracy and stability over time and temperature

ST's innovatively designed sensors with different combinations of analog and digital outputs provide high performances. Our gyroscopes offer superior stability over time and temperature, with a resolution lower than  $0.03 \text{ dps}/\sqrt{\text{Hz}}$  for zero-rate level. This guarantees the level of accuracy required by the most advanced motion-based applications.

These 3-axis gyroscopes have a single sensing structure for motion measurement along all three orthogonal axes, while other solutions on the market rely on two or three independent structures. ST's solution eliminates any interference between the axes that inherently degrades the output signal, thus increasing the accuracy and reliability of motion-controlled functionalities.

ST's gyroscopes measure angular rate with a large full-scale range to meet the requirements of different applications, ranging from gesture recognition and image stabilization, to indoor and personal navigation. ST's angular rate sensors are already used in mobile phones, tablets, 3D pointers, game consoles, digital cameras and many other devices.

12

### BENEFITS

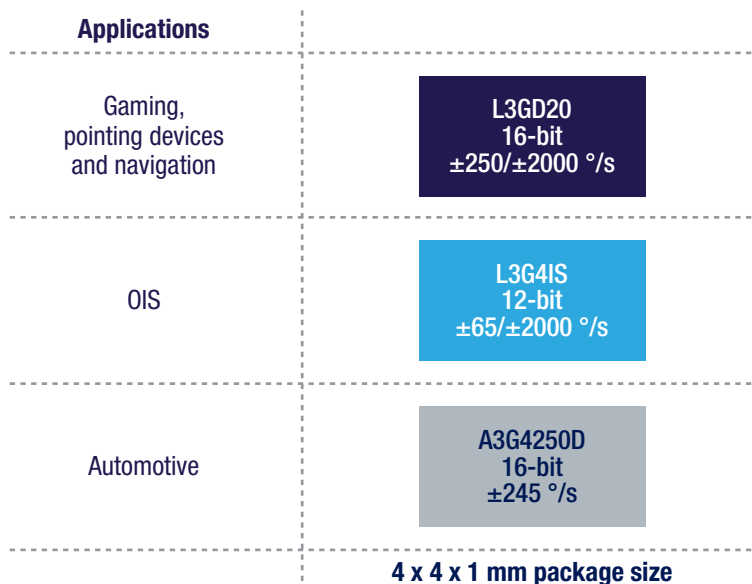
- Wide full-scale range (from  $\pm 65$  to  $\pm 2000 \text{ dps}$ ) for optical image stabilization and smart user interfaces
- High performance combined with low power consumption to address demanding applications and extend battery life
- Embedded FIFO for smart data storage and power saving
- Fast start-up for high responsiveness and system efficiency



**SUSTAINABLE  
TECHNOLOGY**

**CO<sub>2</sub>** -33%  
**l** -32%

### 3-AXIS DIGITAL GYROSCOPES - RECOMMENDED PRODUCTS



### DEVICE SUMMARY

Part number	Package size (mm)	Sensing axes	Full scale (dps)	Noise density (°/s/√Hz)	Key features
A3G4250D	4 x 4 x 1	yaw, pitch, roll	$\pm 245$	0.03	AEC-Q100 qualification
L3G4200D	4 x 4 x 1	yaw, pitch, roll	$\pm 2000$	0.03	Embedded FIFO
L3G4IS	4 x 4 x 1	yaw, pitch, roll	$\pm 65$ (OIS) $\pm 2000$ (UI)	0.008 (OIS) 0.015 (UI)	Dual-core: UI and OIS, embedded FIFO
L3GD20	4 x 4 x 1	yaw, pitch, roll	$\pm 2000$	0.03	Immunity to audio noise, embedded FIFO
L3GD20H	3 x 3 x 1	yaw, pitch, roll	$\pm 2000$	0.011	Embedded FIFO
L3G3250A	3 x 3.5 x 1	yaw, pitch, roll	$\pm 2000$	0.015	Analog output
L3G462A	4 x 4 x 1	yaw, pitch, roll	$\pm 625$	0.017	Analog output
LPR403AL	4 x 5 x 1	pitch, roll	$\pm 30/\pm 120$	0.01	Analog output
LPR410AL	4 x 5 x 1	pitch, roll	$\pm 100/\pm 400$	0.014	Analog output
LPR4150AL	4 x 5 x 1	pitch, roll	$\pm 1500/\pm 6000$	0.075	Analog output
LPR430AL	4 x 5 x 1	pitch, roll	$\pm 300/\pm 1200$	0.018	Analog output
LPR450AL	4 x 5 x 1	pitch, roll	$\pm 500/\pm 2000$	0.025	Analog output
LPY403AL	4 x 5 x 1	pitch, yaw	$\pm 30/\pm 120$	0.01	Analog output
LPY410AL	4 x 5 x 1	pitch, yaw	$\pm 100/\pm 400$	0.014	Analog output
LPY4150AL	4 x 5 x 1	pitch, yaw	$\pm 1500/\pm 6000$	0.075	Analog output
LPY430AL	4 x 5 x 1	pitch, yaw	$\pm 300/\pm 1200$	0.018	Analog output
LPY450AL	4 x 5 x 1	pitch, yaw	$\pm 500/\pm 2000$	0.025	Analog output
LY3100ALH	3 x 5 x 1	yaw	$\pm 1000$	0.016	Analog output
LY3200ALH	3 x 5 x 1	yaw	$\pm 2000$	0.074	Analog output
LY330ALH	3 x 5 x 1	yaw	$\pm 300$	0.014	Analog output



# Digital compasses



## Accurate compass heading in any conditions

ST's digital compasses include combo solutions, with accelerometer and magnetic sensor integrated in a single LGA package and standalone magnetometers, to give the possibility of designing a solution locating the magnetic sensor in the suitable position of the board.

Accurately detecting the direction and magnitude of external magnetic fields and using accelerometer measurements for tilt compensation, ST's digital compasses ensure very accurate compass heading even when the portable device is inclined.

ST's low-noise e-compasses offer better than 3 mgauss resolution and a wide range of full scales, all selectable by the user: up to  $\pm 16g$  full scale acceleration and up to  $\pm 16$  gauss magnetic field full scale. The compass family includes embedded self-test and smart power functionalities to minimize current consumption. The LSM303C and LSM303E compasses are board and software compatible with the latest generation of accelerometers, thus offering maximum design flexibility.

### DEVICE SUMMARY

Features	LIS3MDL	LSM303D	LSM303C	LSM303E
Acceleration full scale (g)	-	$\pm 2/\pm 4/\pm 6/\pm 8/\pm 16$	$\pm 2/\pm 4/\pm 8$	$\pm 2/\pm 4/\pm 8/\pm 16$
Acceleration noise density	-	150 $\mu g/\sqrt{Hz}$	150 $\mu g/\sqrt{Hz}$	220 $\mu g/\sqrt{Hz}$
Magnetic range (gauss)	$\pm 16$	$\pm 12$	$\pm 16$	$\pm 16$
Magnetometer noise density	3.5 mgauss (RMS)	5 mgauss (RMS)	3.5 mgauss (RMS)	3.5 mgauss (RMS)
Programmable interrupt generators	•	•	•	•
Digital interfaces	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C
Embedded FIFO	•	•	•	•
Embedded temp. sensor	•	•	•	•
Package size (mm)	2 x 2 x 1 LGA-12	3 x 3 x 1 LGA-16	2 x 2 x 1 LGA-12	2 x 2 x 1 LGA-12

### BENEFITS

- Superior sensing precision combined with low power consumption
- Extended magnetic-scale range
- Minimized measurement noise
- Very small package to address footprint reduction
- Temperature detection for advanced thermal drift compensation
- New possibilities for advanced navigation and location-based services in ever portable consumer devices



**SUSTAINABLE  
TECHNOLOGY**





# iNEMO inertial modules



## Single-chip solution featuring multiple DoFs

iNEMO inertial modules integrate complementary types of sensor to offer more compact, robust and easy-to-assemble solutions compared to discrete MEMS products. iNEMO solutions bring motion sensing systems to the level required for the most demanding applications, such as enhanced gesture recognition, gaming, augmented reality, indoor navigation and localization-based services.

### DEVICE SUMMARY

Features	LSM330DLC	LSM330D	LSM330	LSM9DS0
Acceleration full scale (g)	±2/±4/±8/±16	±2/±4/±8/±16	±2/±4/±6/±8/±16	±2/±4/±6/±8/±16
Acceleration noise density	220 µg/√Hz	220 µg/√Hz	150 µg/√Hz	150 µg/√Hz
Max gyroscope full scale (dps)	2000	2000	2000	2000
Gyroscope noise density	0.03 dps/√Hz	0.03 dps/√Hz	0.03 dps/√Hz	0.03 dps/√Hz
Magnetic range (gauss)	-	-	-	±12
Programmable interrupt generators	•	•	•	•
Digital interfaces	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C	SPI, I <sup>2</sup> C
Embedded FIFO	•	•	•	•
Embedded temperature sensor	•	•	•	•
Package size (mm)	4 x 5 x 1 LGA-28	3 x 5.5 x 1 LGA-28	3.5 x 3 x 1 LGA-24	4 x 4 x 1 LGA-24

### BENEFITS

- More sensors in a single package without compromising performances
- Smaller form factors
- Thermal and mechanical stability
- Software compatible with LIS3DH accelerometer and L3GD20 gyroscope
- Enhanced user experience and motion-sensing realism in mobile phones, gaming controls and other consumer electronics devices



**SUSTAINABLE TECHNOLOGY**





# Smart sensors



## LIS331EB accelerometer with embedded MCU

The LIS331EB smart sensor combines a high-precision 3-axis digital accelerometer and a microcontroller in a single 3 x 3 x 1 mm package. The microcontroller is an ultra-low-power ARM Cortex-M0 with 64-Kbyte Flash, 128-Kbyte RAM, embedded timers, 2x I<sup>2</sup>C (master/slave) and SPI (master/slave). Used as a sensor hub, the LIS331EB can process internally data sensed by other sensors, such as for example gyroscope, magnetometer, and pressure sensors, and fuse together all inputs with the iNEMO Engine software, providing the main system processor with quaternions.

16

### LIS331EB BENEFITS

- Highly-integrated solution that facilitates and minimizes the risk of interference between different sensors' measurements
- Small footprint guarantees PCB space saving
- Distributed system processor workload
- Avoids overheads on the communication lines
- Optimizes power consumption



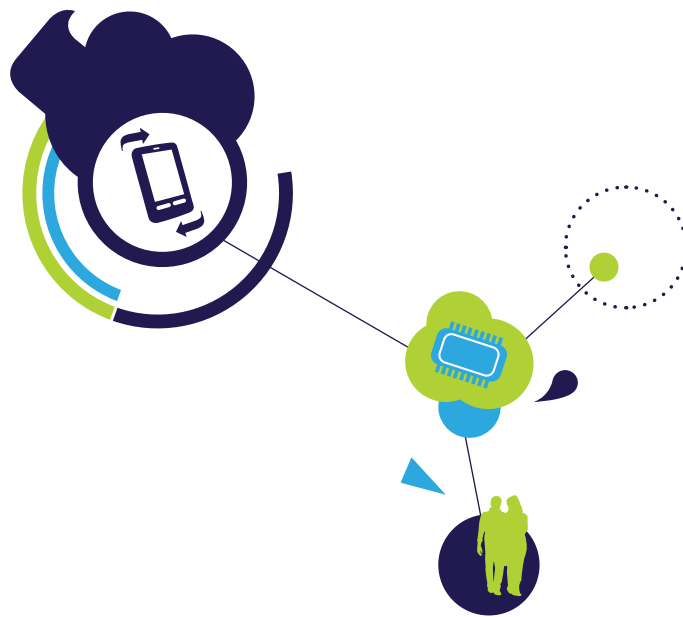
## INEMO-M1 system-on-board

INEMO-M1 integrates multiple sensors (accelerometers, gyroscopes and magnetometer) with all the features and the computational power of the STM32F103 32-bit MCU in a SMD module with very small form factor (13 x 13 x 2 mm<sup>3</sup>). First member of a system-on-board family of products that offer scalable computational and sensing features in the same footprint and pinout, INEMO-M1 may be used in combination with ST's sensor fusion software to seamlessly design high-performance 3D orientation and motion sensing applications.

An open architecture, where all the rich features, peripherals and communication interfaces of the MCU and all the sensors are completely accessible by the user's software, provides unlimited flexibility and greatly reduces the needs for additional external components to design a broad variety of applications in robotics, personal navigation, gaming and wearable sensors for healthcare, sports and fitness.

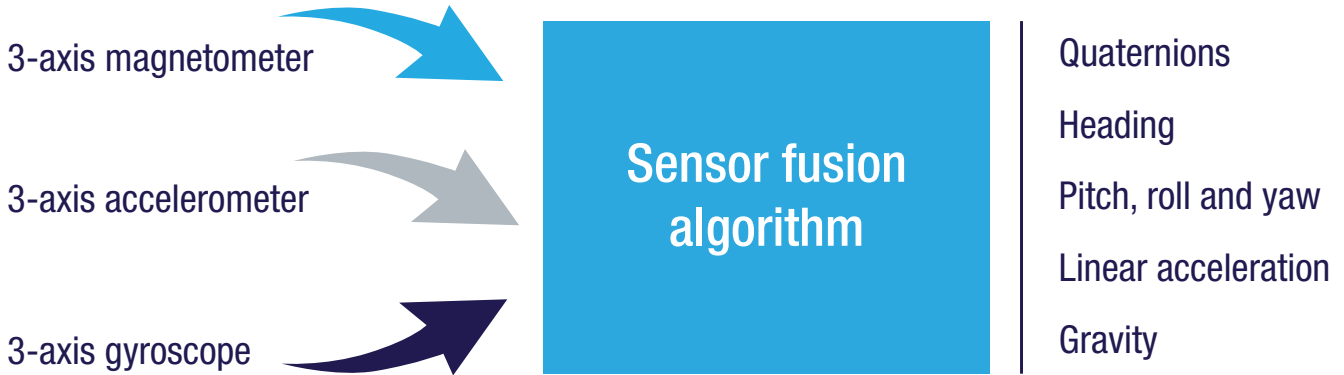
### INEMO-M1 BENEFITS

- Turnkey solution for easy and quick motion sensing application development
- Integrates 9 DoF sensors with a powerful ARM® Cortex™-M3 32-bit MCU, with 512-Kbyte Flash and 64-Kbyte SRAM
- Ultra-compact SMD module
- Complete software accessibility to the on-board microcontroller and sensors
- Sensor fusion software and firmware libraries available to ease and speed up creation of high-performance applications





# iNEMO fusion suite



## iNEMO engine features multi-sensor data fusion

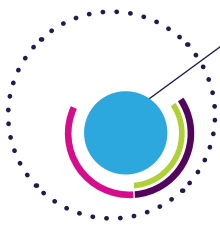
The iNEMO engine sensor fusion suite is a filtering and predictive software. It uses advanced algorithms to integrate outputs from multiple MEMS sensors in a smart way, independently of environmental conditions, to reach the best performance. Real-time motion-sensor data fusion is set to significantly improve the user experience, increasing accuracy, resolution, stability and response time in advanced motion-based applications in consumer, computer, industrial and medical fields. The iNEMO engine can be combined with ST's iNEMO inertial modules to create the industry's first complete and customizable hardware/software multi-axis MEMS sensor solutions for enhanced motion and accurate heading recognition. Equipment manufacturers across different market segments can now easily and quickly deploy robust and reliable high-performance motion detection systems with up to 10 degrees of freedom, comprising 3-axis sensing of linear, angular, and magnetic motion with barometer/altitude readings from a pressure sensor, enabling true augmented-reality applications.

### BENEFITS

- Absolute point tracking and motion tracking accuracy
- Immunity to magnetic interference for high performance in real-world conditions
- Few user-calibration interruptions, enabling innovative and longer game play
- Reliable compass heading for accurate navigation
- Accurate direction, enabling true augmented-reality applications

### PRODUCT SUMMARY

Software version	Description	Sensor fusion library code
<b>INEMO-ENG-M1L13</b>	LITE version for INEMO-M1: Based on the Kalman filter theory applied to MEMS sensors, the INEMO-M1 lite software library is a free source code that could be used for the STM32 and for customizable HW/SW solutions.	Source code
<b>iNEMOEngine_PW8</b>	PRO version: This firmware running on the STM32 manages sensors on Windows 8 using the standard human interface devices (HID) over USB/I <sup>2</sup> C. Allows sensor plug-and-play recognition and new application development using Windows 8 standard APIs. (compatible with Intel x86 and ARM processors)	Compiled code
<b>iNEMOEngine_PI3P platform independent</b>	PRO version: This firmware allows you to develop new custom applications running on the STM32 or to collect real-time sensor fusion data through Virtual COM from any platform (platform independent).	Compiled code
<b>iNEMOEngine_PAAP</b>	PRO version: This is a complete solution to support Android platforms by providing the hardware abstraction layer, sensor drivers and sensor fusion library.	Compiled code



# Design support

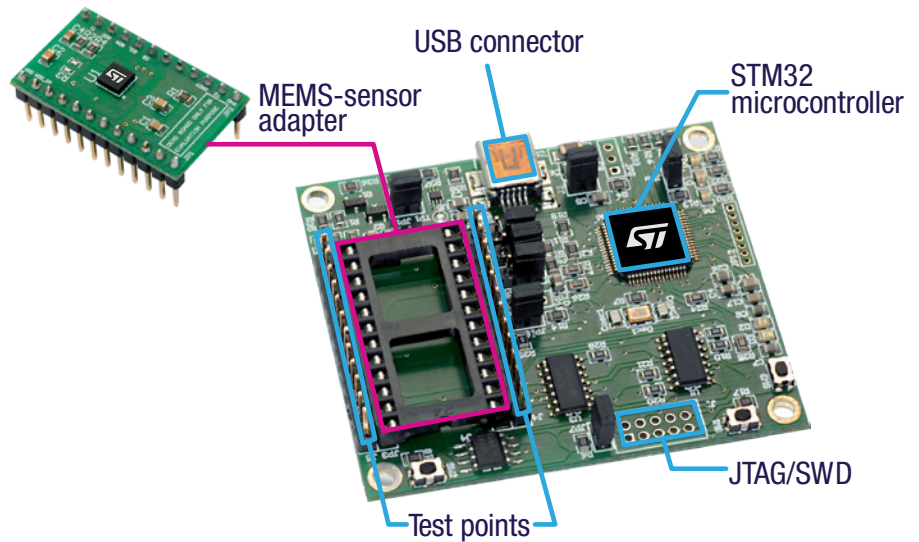
## We make our customers' ideas easy to design

STMicroelectronics offers a deep expertise in sensor integration and new application development and can assist customers in design-in. ST's evaluation kits and firmware allow a real-time evaluation of sensor performances in your applications.

### EVALUATION KIT

ST offers a complete evaluation kit including:

- A motherboard compatible with all of ST's MEMS adapters, based on a high-performance 32-bit microcontroller (order code: STEVAL-MKI109V2)
- A full set of MEMS sensor adapters, that are complementary to the motherboard and can mount all sensors
- An innovative graphic user interface for direct and real-time access to the sensor configuration registers.



## PRODUCT SUMMARY

Board	Description	Part Number
<b>Development kit</b>	Motherboard + adapter board: STEVAL-MKI119V1 kit includes STEVAL-MKI109V2 (motherboard) + STEVAL-MKI108V2 (9-axis module, L3GD20 and LSM303DLHC)	STEVAL-MKI119V1
<b>Motherboard</b>	ST MEMS motherboard is based on STM32F103 high-performance ARM 32-bit Cortex™-M3 MCU. Interfaces: USB connector, JTAG/SWD for debug. Ready to support iNEMOEngine. DFU compatible for USB microprocessor firmware update. Compatible with all of ST's MEMS adapters.	STEVAL-MKI109V2
<b>Adapter board</b>	For all standalone sensors and modules, an adapter board is designed to be plugged into the motherboard. The boards have a pinout to be plugged into a standard DIL24 socket. Complete list is available on ST's web site.	For example STEVAL-MKI108V2 (9-axis)
<b>Extender board</b>	The system is ready for any wireless extension and an external Bluetooth dongle is available.	STEVAL-MKI115V1
<b>Discovery-M1</b>	Evaluation board for INEMO-M1 that also includes a pressure sensor LPS331AP representing a complete 10-DoF open platform. USB and SWD connectors for debugging and programming.	STEVAL-MKI121V1



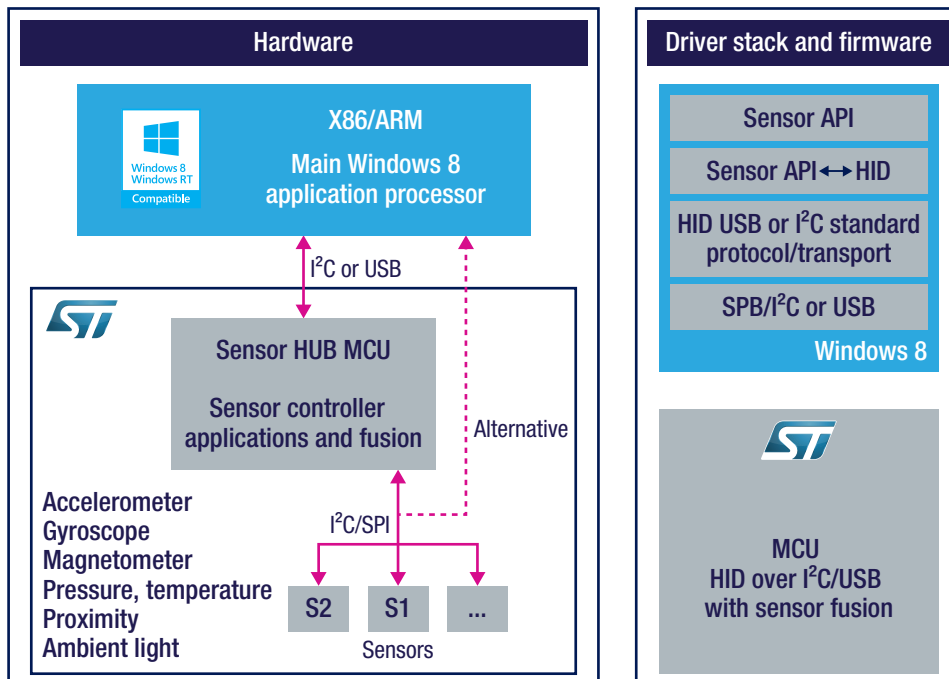
# Design a sensor subsystem

## Windows 8

Windows 8™ supports sensors through its sensor HID driver and sensor API class.

- ST offers a complete HW and SW solution to be used with Windows 8 with flexible combinations of multi-axis sensors, providing plug and play and turnkey solutions.
- The sensor systems can be combined either in a hardware solution, with an ARM® Cortex™-based STM32 MCU acting as a sensor hub processing the sensor signals, or in a software solution, without a sensor hub MCU with the sensor fusion being performed in the application processor of the Windows 8 device (this solution is available for Windows 7 also).
- The firmware supplied provides support for the HID protocol over I<sup>2</sup>C/USB and the iNEMO engine, using a smart fusion algorithm ensuring high-precision motion detection and sensor calibration.
- Additionally, the solution can optimize power consumption, executing tasks while the main host is busy or in sleep mode and performing wake up.

ST's evaluation platform, the STEVAL-MK1119V1, is available to kick-start your Windows 8 application design.



# Android

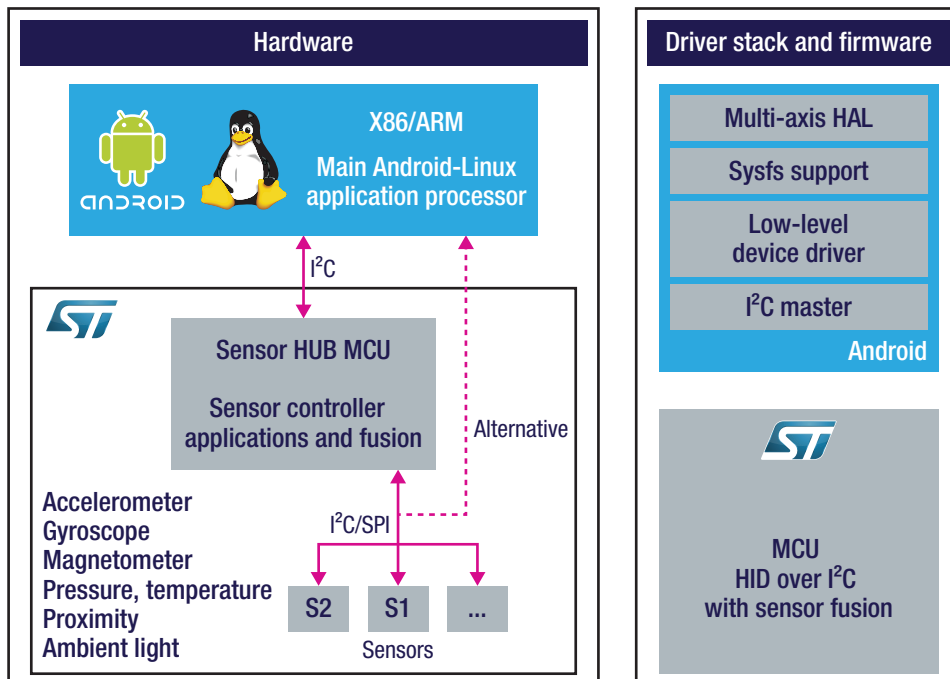
ST can support you in the design of an established solution where sensors are managed by the main host processor, providing:

- Sensor HAL for smart APIs, including added-value libraries for sensor fusion and magnetometer disturbance calibration
- Low-level Linux drivers to communicate with the sensors

We can also provide an innovative solution where the MCU sensor hub collects data from sensors and runs algorithms autonomously, maintaining high performances, in order to:

- Perform sensor fusion and magnetometer-disturbance calibration
- Execute dedicated real-time algorithms (such as a pedometer) when the main host is busy with other tasks
- Optimize power consumption, executing tasks while the main host is in sleep mode and performing wake up

To speed up Linux-Android projects, ST can support the PandaBoard development platform, providing sensor drivers, multi-axis HAL, added-value libraries (sensor fusion) and application demos. ST's PandaBoard solution is ready to support Android release 4.1 (Jelly Bean).





# Technical Support

---

## TECHNICAL DOCUMENTS

To see all technical documents and files for a specific product, go to [www.st.com/mems](http://www.st.com/mems) and select the product you are interested in through our product catalogue. Each part number has a corresponding web page where you can easily find all associated technical documents and resources.

## DEVELOPERS' LINKS

- To select an evaluation board: [www.st.com/mems-boards](http://www.st.com/mems-boards)
- To download drivers: [www.st.com/mems-drivers](http://www.st.com/mems-drivers)
- To download iNEMO engine: [www.st.com/inemo-engine](http://www.st.com/inemo-engine)
- To take part in our MEMS and Sensors forum: [www.st.com/memsdeveloper](http://www.st.com/memsdeveloper)

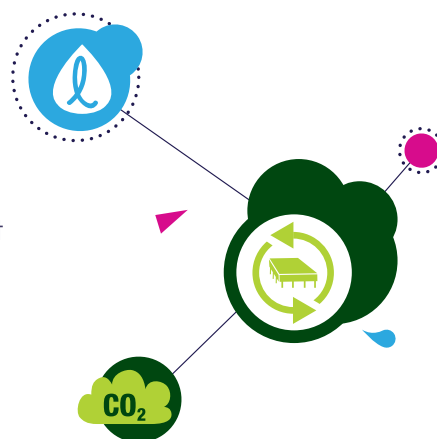
## ONLINE TECHNICAL SUPPORT

- For further information and software library support to develop your applications, contact us at [www.st.com/onlinesupport](http://www.st.com/onlinesupport)

## LOCAL SALES CONTACT

- For questions about product availability, pricing, where-to-buy, or other related issues, go to our sales support page at [www.st.com/questiontosales](http://www.st.com/questiontosales).







ST's Sustainable Technology Program provides a single, consistent framework for all the different programs that we implement to reduce the impact of our products on the environment and improve quality of life for the end user. The program includes three main domains:

- Compliance with legislation and with customers' requirements
- Eco-design to measure and take into account during the design phase the environmental impact of our products
- Responsible products which identify innovative products that provide clear environmental and social benefits to society

ST's motion MEMS products within sustainable technology

- All motion MEMS products are ECOPACK® compliant
- Improvements in our manufacturing technologies and product design have reduced our products' carbon footprint by up to 44% and water footprint up to 43%<sup>(1)</sup>
- Products identified as socially responsible:
  - H3LIS331DL is suited for concussion detection (3-STAR rating<sup>(2)</sup>)
  - AIS328DQ and A3G4250D are accelerometers and gyroscopes used for navigation and telematics (2-STAR rating<sup>(2)</sup>)
  - LIS2DH12, LSM303C, LSM303E are indicated for fitness monitoring applications (1-STAR rating<sup>(2)</sup>)

Product family	Carbon footprint evolution [%]	Water footprint evolution [%]
		
<b>Accelerometers</b>	-42	-43
<b>Gyroscopes</b>	-33	-32
<b>Digital compasses</b>	-44	-42
<b>Inertial modules</b>	-32	-33



(1) Screening LCA results for cradle-to-gate scope. Use phase is excluded. Values are reported as average for the whole product family in comparison to previous generation. For more information about eco-design, visit <http://www.st.com/eco-design>

(2) For more information about Star responsible product ratings, visit [http://www.st.com/responsible\\_products](http://www.st.com/responsible_products)