MEMS & Sensors

Sven Reinhardt

STMicroelectronics
• Introduction

• MEMS Applications & Market

• MEMS Products
  • Accelerometer & Gyroscope
  • Inertial Module & Digital Compass
  • INEMO
  • Environmental Sensors

• Markets targeted for you

• Tools & Evaluation Boards

• Conclusion and What is new for 2012
MEMS Market by Products

MEMS market share
All segments (extract)

ST Presence:
- Microphone: Since end of 2010
- Magnetometer: Since 2010
- DLP: New in 2012
- Gyroscope: Since 2009
- Pressure Sensor: New in 2012
- Accelerometer: Since 2006

* Magnetometer data source from Yole May 2011

Source: IHS iSuppli Corp. | Jan 2011
ST MEMS at a glance: Leadership through Innovation

Cumulative shipments more than 1.5 Billion Units

2011 key facts

- ST revenues* in 2011 >630M$; Reconfirming ST leadership as top MEMS supplier for consumer electronics and mobile handsets
- Growing faster than market
  ST # 1 Accelerometer and Gyroscopes
- ST delivering to the market 3Mpcs/day (@end 2011)
- > 500 patents on MEMS covering technology, manufacturing, design and applications
- Solutions (Hardware, Firmware & Software)

*Source: iSuppli, Yole Developpment
ST: the one-stop MEMS supplier

ST MEMS technology is at the heart of a fast growing family of sensors
ST MANAGES THE COMPLETE SUPPLY CHAIN
MEMS FAB: Dedicated FE + BE
ST Investing heavily in MEMS

Global & Outstanding Manufacturing Capability

Increase manufacturing capacity ... 3Mpcs/day (since end of 2011)
MEMS Accelerometers
Accelerometer Product Focus – LIS3DH

- 3-Axis Accelerometer
- Digital SPI/I2C output
- Able to measure accelerations with 4 selectable Full Scale: 2, 4, 8 and 16g
- High Resolution (up to 12 bit)
- Very low power consumption: 2µA in Low power mode (1Hz), 11µA in Normal mode (50Hz) and .5µA in Power down mode
- High Flexibility:
  - 8 ODR user selectable: 1/10/25/50/100/400/1600/5000 Hz
  - Bandwidth up to 2.5KHz
  - 32-level FIFO (for 16-bit data)
  - 3 ADC Inputs
  - Temperature sensor
  - Wide Power supply range 1.71 to 3.6V
  - Self test function
- Small size package 3x3x1 (in mm)

<$0.6 in quantities of 2Ku
Accelerometer Product Focus – LIS3DH

- Very low power consumption:

<table>
<thead>
<tr>
<th>ODR (Hz)</th>
<th>Normal mode (µA)</th>
<th>Low power mode (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDown</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>10</td>
<td>4</td>
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<td>400</td>
<td>73</td>
<td>36</td>
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<tr>
<td>1250</td>
<td>185</td>
<td>-</td>
</tr>
<tr>
<td>1600</td>
<td>-</td>
<td>99</td>
</tr>
<tr>
<td>5000</td>
<td>-</td>
<td>184</td>
</tr>
</tbody>
</table>
Embedded FIFO for smooth movement capture – LIS3DH

• OSs, Communication standards and architectural constraints may limit the maximum sensor access rate

• The availability of an embedded data buffer (FIFO) allows to manage high(er) sampling rate (smoother movement capture and advanced gesture recognition, ex. air writing) without sample loss while offloading I2C reads and reducing interrupt actions to the host

Without FIFO (data buffer)  With FIFO (data buffer)
Accelerometer – LIS3DSH

- 3-Axis Digital Accelerometer

- **Very High Resolution** (up to 14 bit) and low noise (150µg/νHz)

- 5 selectable Full Scale: 2, 4, 6, 8, 16g

- Anti-aliasing filter

- **2 programmable embedded finite-state machines**

- Low power consumption: 11µA in Active mode (3.1Hz) and 2µA in Power down mode

- **High Flexibility:**
  - ODR user selectable: from 3.1 to 1600 Hz
  - Bandwidth up to 800Hz
  - 32-level FIFO (for 16-bit data)
  - Wide Power supply range 1.71 to 3.6V
  - Self test function

- P2P compatible with LIS3DH*

$1.2 in quantities of 1Ku

Available in MM in Q3 2012

*no ADC
AIS328DQ: 3-axis digital Accelerometer for Automotive

- Product qualified, full Q100 qualification done
- 12 bit resolution, low power consumption (<10μA at 10Hz ODR)
- Stacked-die assembly in a small QFPN 4x4x1.8 24L package
- Target applications: security systems, inertial navigation, telematic boxes, intelligent power saving, motion activated functions, …
- AEC-Q100 - PPAP available

3.5$ in quantities of 3Ku
MEMS Gyroscopes
Accelerometer and Gyroscope

Accelerometer measure **linear accelerations**
Gyroscope measure **angular movement** (pitch, roll and yaw)

**Accelerometer and Newton**
\[ F = m \mathbf{a} \]

**Gyroscope and Coriolis**
\[ F = 2m \mathbf{v} \times \Omega \]

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MEMS accelerometer and gyroscope are combined into IMU (inertial measurement unit)
Gyroscope - Principle

- **Yaw** is rotation about the vertical axis (z-Axis)

- **Roll** is rotation around the longitudinal axis, (x-Axis)

- **Pitch** is rotation around the lateral or transverse axis, (y-Axis)
MEMS structure die of 3-axis digital gyroscopes
ASIC die of 3-axis digital gyroscopes
To take advantage of the Coriolis’ principle, a movable mass must be kept under continuous movement by means of electrostatic actuation on capacitive driving plates (drive circuitry). As soon as external angular rate is applied, the capacitive sensing interface reads the corresponding displacement of the movable mass.
Gyro product focus – L3GD20

• 3-Axis Gyroscope, Digital SPI/I2C output

• High precision, 16 bit resolution

• Able to measure rotations with 3 selectable Full Scale: 250 /s, 500 /s and 2000 /s

• Power down (5µA) and Sleep (2mA) modes

• Interruption and Data Ready output lines

• High performances:
  • Audio and mechanical noise immunity
  • High Resolution & High Thermal Stability
  • High Shock Survivability: 10000g for 0.1ms

• High number of embedded Features:
  • 4 Output Data Rates: 95, 190, 380, 760Hz
  • 8-bit temperature output, FIFO
  • Programmable Low and High pass filters
  • Self test function

<$2 in quantities of 2Ku
Gyro product focus – L3GD20

• 3-Axis Digital Gyroscope

• Combines high sensing resolution with outstanding immunity to audio noise and vibrations

• P2p adaptable and SW-compatible with the L3G4200D
A3G4250D: 3-axis digital Gyroscope for Automotive

A3G4250D
Automotive – 3 axes – Gyroscope – 4x4 LGA 16L– 250dps full scale – Digital Output

- Pin-to-pin compatibility with L3G4200D
- Low power consumption, 250dps full-scale
- Low noise and high-stability over temperature
- Target applications: vehicle tracking systems, rate activated functions, inertial navigation assistance, adaptive front beams, …
- AEC-Q100 - PPAP available

6$ in quantities of 1Ku
MEMS IMU (iNEMO - Inertial Movement Unit)
MEMS Module – iNEMO Inertial Module

LSM330DLC:

- MEMS Accelerometer + Gyroscope sensor
  - 3-axis accelerometer, 2 4 8 16g Full Scale
  - 3-axis gyroscope, 250 500 2000 dps Full Scale
  - SPI/I²C digital interface
  - Power-down mode
  - 4x Interrupt lines (2x gyro and 2x accel)
  - Small 4x5 package

- Targeted applications
  - 6-axis Smart remote control
  - Enhanced GPS navigation system
  - 6 Degrees of Freedom for Movement reconstruction, recognition and intelligent power saving

<2.4$ in quantities of 1Ku
Digital Compass
Digital Compass – LSM303DLHC

• MEMS Accelerometer + Magnetic sensor
  • 3-axis accelerometer: 2g/ 4g/ 8g/ 16g full scale
    • 12 bit resolution, 1mg/digit sensitivity
    • ODR up to 5KHz
  • 3-axis magnetic sensor: from 1.3 to 8.1 gauss full scale
    • 2mgauss resolution, 0.9mgauss (x,y) and 1mgauss (z) sensitivity
    • ODR up to 220Hz
• I²C digital interface
• 2.16 to 3.6 voltage range (1.8V I/Os),
• 110µA consumption, 1µA in Sleep mode (Accel is activated)
• Embedded FIFO and Temperature sensor
• 2 Interrupt lines, events detection

1.4$ in quantities of 2Ku
MEMS Environmental Sensors
Pressure Sensor
Pressure Sensor

Digital Barometer
- Highly precise pressure data at selectable output rate.
- Embedded compensation required zero data processing for the application.

Compact Device
- Innovative patented VENSEN technology to fabricate a monocrystalline silicon membrane over a sealed cavity.
- VENSEN technology enables to realize a very thin, robust and low cost sensing element.

Advanced Package
- Advanced packaging technology allows to realized a unique and very compact stacked solution.
Visualized LPS331AP

Cavity + ASIC with I2C/SPI interface =

Life, augmented
# LPS331AP 260 – 1260 mbar absolute digital output barometer

**LPS331AP**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>3x3x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>260-1260 mbar</td>
</tr>
<tr>
<td>Overpressure</td>
<td>&gt; 20 bar</td>
</tr>
<tr>
<td>ADC resolution</td>
<td>24 bits</td>
</tr>
<tr>
<td>Power consumption</td>
<td>45 µA (high res.)</td>
</tr>
<tr>
<td></td>
<td>@ 1Hz ODR</td>
</tr>
<tr>
<td>Pressure noise</td>
<td>0.020 mbar (rms)</td>
</tr>
<tr>
<td>Relative Accuracy</td>
<td>- Linear: ± 2 mbar (embedded)</td>
</tr>
<tr>
<td></td>
<td>- Quadratic: ± 1 mbar (external sw)</td>
</tr>
<tr>
<td>Max Data Rate/ODR</td>
<td>- High resolution mode: Selectable: 1Hz, 7Hz, 12.5Hz</td>
</tr>
<tr>
<td></td>
<td>- One shot (max conversion time) = 45 msec</td>
</tr>
</tbody>
</table>

## Digital features

- Compensation
  - Linear Embedded
  - Quadratic external SW
- Offset management
  - Autozero
  - One point calibration dedicated register

| 2.1$ in quantities of 1Ku |
LPS331AP - Target Application

- Altitude variation measurement with **High accuracy** and **low noise** make the LPS331AP suitable for altimeter, GPS, Weather station, … applications.
LPS331AP - floor detection

✓ Measured Pressure (mbar)

❖ LPS331AP output
  ▪ FROM 24th floor to B3

✓ Variance (mbar) - pressure value VS reference
LPS331AP – application note

• 2 are the main parameters for a pressure sensor:
  • Accuracy over temperature
  • Pressure noise

• LPS331AP typical values are:
  • Accuracy: 2 mbar between 0 C - 80 C
  • Pressure noise: 60ubar RMS

• STM developed SW algorithms and defined an final calibration procedure to improve the two main parameters.
  • Quadratic compensation for the accuracy
  • IIR filtering to reduce the noise

• We suggest to propose this SW algorithms to any customers based (compet also needs external SW for compensation and filtering)
LPS331AP - Embedded Compensation

- LPS331AP is calibrated at 3 different temperature
- The compensation algorithm uses the embedded temperature sensor
LPS331AP - Quadratic Compensation

- LPS331AP is calibrated at 3 different temperatures. Using the 3 calibration coefficients sets possible implement a quadratic temperature compensation improving the accuracy temperature.
LPS331AP - One point calibration dedicated register

- LPS331AP has a dedicated register to implement the one point calibration
  - Value stored in the register is add/subtracted to the pressure output
  - One point calibration is a procedure to remove the soldering shift to be implemented at the end of the customers production line

![Diagram showing the flow of data from Temperature, Pressure through AFE, ADC, Linear Temperature Compensation, and the use of register RIF_P and ONE_POINT to adjust PRESS_OUT.](image-url)
How to select MEMS for your application
MEMS Sensors: Different Sensors – Adding Features

**Gyroscope – L3GD20**
- Measures the angular rate (°/s)
- Mono-structure, High stability, compact

**Magnetometer – LSM303DLHC**
- Senses the magnetic field (gauss)
- Compact, SIP, Low consumption

**Accelerometer – LIS3DH**
- Senses the linear acceleration (m/s²), tilt, shocks, vibrations, linear displacement
- Low consumption, High Speed

**Pressure sensor – LPS331AP**
- Measures Abs atmospheric pressure (mbar)
- High resolution, High Speed
MEMS Accelerometer Usage

- User Interface
  - Image rotation, Portrait Landscape and Menu navigation
  - Game interaction (combined with Gyroscope and Magnetometer)
  - Power saving and Wake-up

- Free Fall Protection and shock detection
  - Material Warranty

- Context awareness
  - Sport (pedometer, Fitness,..)
  - People monitoring (combined with Gyroscope and Pressure sensor)

- Inclinometer, Angle measurement

- Vibration measurements
  - Seismology detection
  - Motor control

- Movement detection
  - Antitheft, Alarm

- ...

life: augmented
MEMS Sensors Usage

• Gyroscope usage:
  • Image Stabilization
    • Night camera
    • Optical Image Stability
  • Movement monitoring
  • Gesture recognition (combined with Accelerometer and Magnetometer)
  • Dead Reckoning (combined with Accelerometer)

• Pressure sensor usage:
  • Water level protection
  • Barometric applications (altimeter,…)
  • Free fall detection (combined with accelerometer)
  • …

• Magnetometer usage:
  • Magnetic Signature
  • E-compass applications (Location based services)
Markets targeted
MEMS Sensors – Applications

Image stabilization, Menu Navigation, Portrait / landscape, Shock monitoring, HDD protection, Noise cancellation

Gaming & Sport
Gesture recognition, Motion, Position sensing, Pedometer

Industrial & Medical
Tilt & Vibration Measurement, Alarm, People Monitoring

Automotive
Navigator system, Alarm, Active/passive safety, Headlight control, E-call, Hand-free kit

Robotics
Roll over detection, Motion & position sensing, IMU

Mobile, PDAs, MP4/MP3 Consumer
Image scrolling, Shock detection, Power Management, Pointing

MEMS Sensors
Focus on Industrial market

• Applications:
  • Machine control by Vibrations measurement and Tilt inclination (to adjust rotation speed, circuit breaker security, fault prediction),
    • For Washing machines, Domestic appliances (Robot), Turbines, Alternators, Wind mills,…
    • Outdoor power Tools (i.e. chain saw) or indoor tools (i.e. electronic screwdriver)
  • Maintenance management
  • Professional and domestic Alarms
  • Asset Tracking for shocks monitoring
  • Alarm and Anti Tamper function
  • Water Level Detection

• Key Products:
  • LIS3DH (LIS331DLH) Accelerometer
  • LPS331AP Pressure Sensor

• Targeted Customers:
  • Washing machine and Domestic appliances companies
  • Outdoor and Indoor tools manufacturers
  • Industrials (i.e. Lift) and maintenance equipment manufacturers
  • Alarms makers
  • High end protection Packaging companies
Focus on Portable Devices markets

• Applications:
  • Battery powered devices (Smart Power management)
  • Devices with screens (portrait / Landscape)
  • Dead Reckoning functions for fleet management and indoor services
  • Human interface management
  • Free fall and shocks monitoring
  • Electronic Compass

• Key Products:
  • LIS3DH Accelerometer
  • L3GD20 Gyroscope
  • LSM303DLHC Digital Compass
  • LPS331AP Pressure Sensor

• Targeted Customers:
  • Outdoor and Indoor GPS manufacturers
  • Companies targeted fleet management (cars, taxi, trucks)
  • Watch, altimeters and compass manufacturers
  • Mouse, pointer and remote control manufacturers
Focus on Medical, Fitness markets

• Applications:
  • Healthcare Applications for body fall, dead man function (reeducation, risky job, people fall alert) and reeducation analysis (people activity measurement)
  • E-Health

• Key Products:
  • LIS3DH Accelerometer
  • L3GD20 Gyroscope
  • LPS331AP Pressure Sensor
  • LSM303DLHC Digital Compass

• Targeted Customers:
  • Para Medical companies for people monitoring
Focus on Gaming & Sports markets

• Applications:
  • Movement recognition for sportsmen (golf/tennis clubs)
  • Sport & fitness training: step counter, force estimation, speed estimation, Pedometers, Watches
  • Movement recognition for Gaming
  • Inertial movement unit for Toys (plane, helicopter) and Robots

• Key Products:
  • LIS3DH Accelerometer
  • L3GD20 Gyroscope
  • LSM303DLHC Digital Compass
  • LPS331AP Pressure Sensor

• Targeted Customers:
  • Toys makers
  • Sport equipment manufacturers
Tools, SW & Evaluation Kits
STEVAL-MKI062V2 – iNEMO – 10-DOF

- 10-DegreesOfFreedom platform:
  - 3-Axis Accelerometer
  - 3-Axis Gyroscopes
  - 3-Axis Magnetometer
  - 1 Dimension of pressure information

- STLM75: temperature sensor with –55 to +125°C range and I²C
- MCU - STM32F103RE
MEMS support tools

eMotion: STEVAL-MKI109V2

STM32-based MEMS motherboard compatible with ST MEMS adapters

• **eMotion: Features and Description**
  - Compatible with Accelerometers, Gyro & e-Compass ST MEMS adapter boards
  - Includes a DIL24 socket for easy MEMS adapter connection
  - Controlled by the **STM32F103R8** ARM Cortex™-M3
  - 3 V on-board linear voltage regulator
  - DFU compatible for USB microprocessor firmware update
  - USB 2.0 full-speed compliant
  - Debugging connector for SWD/JTAG

- Software
- Application notes

Video
MEMS support tools

- Possible Daughter boards:
  - eMotion: STEVAL-MKI109V2
  - STM32-based MEMS motherboard compatible with ST MEMS adapters
  - High Runner
  - LIS3DH MKI105V1
  - LSM303DLHC MKI106V1
  - L3GD20 MKI107V2
  - And many others...
  - LSM303DLHC + L3GD20 MKI108V2
  - LPS331AP MKI120V1
MEMS support tools

- Magnetic field interference scanner:

  eMotion: STEVAL-MKI109

  + STEVAL-MKI114

  DIL24 adapter for eMotion

  Probe
Wireless Extension Boards for eMotion

- Cable replacement BT module for eMotion (STEVAL-MKI109)
- Fully compatible with Unico SW

STEVAL-MKI115
Adapter Evolution Toward 10 DOF

STEVAL-MKI105
STEVAL-MKI107
STEVAL-MKI108

Available soon…

NEW
Demonstration board SW for Gyroscope

Dedicated software is provided with the demonstration board to evaluate sensor functionality and to learn about all the possible configurations allowed.

Example for L3G4200D
iNEMO Sensor Fusion Engine API

- **Complete hardware and software solution**
  - High-performance Accelerometer, Gyroscope And Compass
  - Sensor fusion iNEMO™ Engine software library

- **Application:**
  - Localization-Based Services
  - Smart gaming
  - Enhanced user-interfaces
  - Gesture recognition
  - Pedestrian navigation
iNEMO Sensor Fusion Engine API

- The API compensates the non idealities of standalone sensors

- Filtering includes:
  - Magnetic distortions registered on the magnetometer
  - Dynamic distortion (hand jitter), measured by the accelerometer
  - Inherent drift of the Gyroscope

*Quaternion is a mathematic notation to define orientation and rotation for 3D objects in the space*
iNEMO Sensor Fusion Engine API

• 2 iNEMO Sensor Fusion versions available for ST MEMS devices

• LITE – Source files provided:
  • Version developed on, the STEVAL-MKI062V2 and its part numbers
  • STM32F103 MCU core

• PRO – Library is provided:
  • Android Version
    • ARM MCU core
  • Windows 8
    • STM32 MCU core
  • OS Platform independant
    • STM32 MCU core

• Submitted to License agreement - EUC
Key Messages & Conclusion
2 billion motion sensors already sold in the market

- Continuous challenges
  - MEMS Mechanical structure design:
    - Die shrink with superior or equal Mechanical properties
  - ASIC electronic design:
    - Reduce power consumption
    - Increase available features
- Technology & Packaging
  - Increase Manufacturing and Test equipments capacity
  - Develop new products and Modules (System in Package)

- Many applications & domains are still to investigate for MEMS
- ST is the company to provide you a complete set of sensors
Products focus for 2012

• **LIS3DH** 3-axis Digital **Accelerometer** (Also LIS331DLH)

• **L3GD20** 3-axis Digital **Gyroscope**

• **LSM330DLC** 6-axis **IMU** Digital **Accelerometer + Gyroscope**

• **LSM303DLHC** 6-axis **Accelerometer + Magnetometer** (Digital Compass)

• **LPS331AP** Absolute **Pressure Sensor**
What is new for 2012
2x2 Accelerometers - LIS2DM / 2DH

- Wide supply voltage, 1.71 to 3.6 V
- Independent IOs supply (1.8V) and supply voltage compatible
- Temperature sensor
- FIFO memory block
- Full-scale ranges of ±2g/±4g/±8g/±16g
- 4D/6D orientation detection
- Programmable interrupt signals that enable immediate notification of motion detection, click/double-click events, and other conditions

LIS2DH: 1.05$ in quantities of 1Ku
LIS2DM: 0.98$ in quantities of 1Ku

2x2x0.9 LGA-14
New generation gyroscope for UI&OIS

- DUAL CORE GYRO for OIS and UI application
- Independent power supply
- High full-scale required for UI
- 65dps and ultra low-noise for OIS
- Smart power management
- LGA package - 4x4x1mm

L3G4IS

3.9$ in quantities of 1Ku
L3G4IS- Dual-core 3x Digital Gyro for UI and OIS

Targeting User Interface and Optical Image Stabilization

High full-scale required for UI

Ultra low-noise & very high speed required for OIS

Smart power management and independent power supply

AVdd  HAVdd*

Digital I2C (250/500/2000 dps FS)

Digital SPI (65 dps FS)

*Presence of HAVdd enables OIS mode

2.5X noise reduction

10X noise reduction

10X speed increase

COMING SOON
Gyro – L3G3250A

- 3-Axis Analog Gyroscope
- Immune to audio noise and vibration
- 2 selectable **Full Scale**: ±625°/s and ±2500°/s
- Power down and Sleep modes
- **Self test** function
- Factory trimmed parameters
- **High Sensitivity**: 2mV/°/s @ 625°/s
- Embedded **Low** pass filter
- High Thermal Stability (0.08°/s/°C)
- High Shock Survivability: 10000g for 0.1ms
- Temperature range -40 to 85°C
- Power supply range: 2.4 to 3.6V
- Consumption: 6.3mA in normal, 2mA in Sleep and 5µA in power down mode
- **Small package** 3.5x3x1 LGA

* Available in H2 2012 for MM

3.95$ in quantities of 1Ku
MEMS Module – iNEMO Inertial Module

**LSM330D:**

- **MEMS Accelerometer + Gyroscope sensor**
  - 3-axis accelerometer, 2 4 8 16g Full Scale
  - 3-axis gyroscope, 250 500 2000 dps Full Scale
  - SPI/I²C digital interface
  - Power-down mode
  - 4x Interrupt lines (2x gyro and 2x accel)
  - External capacitor simplified
  - Small 3x5.5x1 package

- **Targeted applications**
  - 6-axis Smart remote control
  - Enhanced GPS navigation system
  - 6 Degrees of Freedom for Movement reconstruction, recognition and intelligent power saving

**COMING SOON**

**LSM330D**
MEMS IMU

* Available in Q3 2012 for MM

2.75$ in quantities of 1Ku
9-Axis iNEMO Module

- Compact design: 13 x 13 x 2 mm
- L3G4200D: 3-axis digital gyroscope
- LSM303DLHC: 6-axis geomagnetic module
- STM32F103REY: WLCSP package, ARM®-based 32-bit MCU
- LDS3985M33R: ultra low drop-low noise voltage regulator.
- Flexible interfaces: CAN, USART, SPI and I²C serial interfaces; full-speed USB 2.0
- Free ADC channels for external inputs
- iNEMO SW Fusion SW embedded as an option
Key products and highlights

**HT331 Humidity Sensor**

- Full molded package 3x3x1mm
- Digital out (I2C/SPI)
- Embedded temperature sensor
- Pin-to-Pin compatible
  - with LPS331AP pressure sensor
- Accuracy
  - +/-3%RH (between 20-80 %RH)

LGA16 pins
3x3x1mm

COMING SOON
Humidity Sensor - Applications

Weather station

Air conditioner
Environmental humidity feedback
(energy saving – comfort)

Dry air monitoring
(Skin care)

Dryer

Printer
Toner moisture control

HDD
Fly height feedback control

Windshield
Automatic defogger
For more information:

- Web site

www.st.com/mems