ST MEMS Sensor at a glance

- Broadest MEMS Sensor portfolio in the industry
- # 1 in MEMS Sensors for Consumer and Mobile
- Fastest growing MEMS company in Automotive
- Over 13 billion MEMS sensors shipped
- Proven manufacturing technology
- Partnership with OEM’S in product development
- Expertise in multi-axis sensor integration
- Expanding in automotive and industrial market segment
- Developing new sensors and wafer foundry business

- Five major Front End Factories: AGM, AG8, Crolles, AMK, TSMC
- Five major Back End Factories: Malta, Calamba + Subcon (AMKOR / UTAC / ASE).
20 Years of MEMS Sensors & Actuators

ST Innovations

SENSING

Accelerometer  Gyroscope  Inertial module  Pressure sensor  Microphone  Magnetometer  UV sensor  Humidity sensor  GAS & VOC

ACTUATING

Fluidic Micro actuators  Piezo actuators  Micro Mirrors

ST Strenghts

ST’S MARKET-PROVEN MANUFACTURING TECHNOLOGY  HIGH-VOLUME MANUFACTURING CAPABILITY  EXPERTISE IN MULTI-AXIS SENSOR INTEGRATION  PARTNERSHIP WITH OEMS IN PRODUCT DEVELOPMENT
Applications served by ST MEMS

- **Mobile Phone**
- **Internet of Things**
- **Wearable Technology**
- **Automotive**
  - No Safety
  - Passive Safety
  - Active Safety
- **Medical**
- **Industrial High End Industrial**
NEW TOP SELLING MEMS Products

- Accelerometer: LIS2DW12
  - 2x2x0.7 mm
  - 12 to 14bit resolution
  - Noise level flex
  - <<1µA in LP MODE
  - Low Power
  - Ultra Low Noise A+G
  - Embedded Algo

- 6-axis IMU: LSM6DSL
  - 2.5x3x0.86 mm
  - AMR, 50Ga FS
  - 3mGa noise
  - Offset cancellation

- Magnetometer: LIS2MDL
  - 2x2x0.7 mm
  - 1st 6-axis IMU with 10 years committed
  - Ultra Low Power

- Indus IMU: ISM330DLC
  - 2.5x3x0.86 mm
  - Waterproof Apps
  - Low noise
  - Temp compensated
  - SENS ±1dB

- Pressure: LPS33HW
  - 3.3x3.3x2.9 mm

- Microphone: MP23AB01DH
  - 3.35x2.5x0.98 mm
  - Differential, Analog
  - 135dB AOP, 65dB SNR

MARKET POSITION

- Lower POWER
- Lower NOISE & Higher ACCURACY
- High level of FLEXIBILITY and EASY integration
- SOFTWARE & TOOLS available
Motion MEMS
• Main Features
  • 3-Axis Digital SPI/I2C Accelerometer from ±2 to ±16g
  • Very low power:
    • 6µA/11µA in LPM/HRM (@50Hz)
    • 2µA in HRM (@1Hz)
  • Embedded features (Filters, FIFO, Temperature sensor, Self-Test)
  • 2x2 LGA-12, 0.5mm pitch

• LIS2DH12
  • Up to 12 bit resolution for Performance and Embedded Functionalities. LPM & HRM available

• LIS2DE12:
  • 8 bit resolution for Low Power and Cost effective. LPM available

Free-fall interrupt

Key Features
8 and 12-bit Resolution
P2P and Cost effective
Very low power
LIS2DW12:
Ultra Low Power

- 3-Axis Digital SPI/I2C Accelerometer from ±2 to ±16 g
- From 12 to 14 bit resolution, **Low Power** and **High Performance** Modes, low noise enabled fct
- ODR: single shot and from 1.6 to 1.6KHz, FIFO, Temperature sensor, Self-Test

**Ultra Low Power:**

- 0.38µA in **Low Power Mode** @1.6Hz
- 3µA in **Low Power Mode** @50Hz
- 90 / 120µA in HPM @1.6KHz
- 50nA in PD
- Power supply 1.62 – 3.6V
- 2x2x0.7mm, P2P with rest of the family

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**Key Features**

Combine **VERY low NOISE** & **VERY low POWER**
<table>
<thead>
<tr>
<th></th>
<th>LIS2DW12</th>
<th>LIS2DS12</th>
<th>LIS2HH12</th>
<th>LIS2DH12</th>
<th>LIS2DE12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package (mm)</td>
<td>2x2x0.7</td>
<td>2x2x0.86</td>
<td>2x2x1</td>
<td>2x2x1</td>
<td>2x2x1</td>
</tr>
<tr>
<td></td>
<td>LGA-12</td>
<td>LGA-12</td>
<td>LGA-12</td>
<td>LGA-12</td>
<td>LGA-12</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 modes: Low power (12 bit), 4x High res (14 bit)</td>
<td>3 modes: Low power (10 bit), Normal (12 bit), High res (14 bit)</td>
<td>3 modes: Low power (8 bit), Normal (10 bit), High res (16 bit)</td>
<td>3 modes: Low power (8 bit), Normal (10 bit), High res (12 bit)</td>
<td>1 mode: Low power (8 bit)</td>
</tr>
<tr>
<td>Sensitivity (mg)</td>
<td>0.244</td>
<td>0.244</td>
<td>0.061</td>
<td>1</td>
<td>15.6</td>
</tr>
<tr>
<td>Noise Density (±2g, 100Hz)</td>
<td>90μg/sqrt(Hz)</td>
<td>120μg/sqrt(Hz)</td>
<td>140μg/sqrt(Hz)</td>
<td>750μg/sqrt(Hz)</td>
<td>1315μg/sqrt(Hz)</td>
</tr>
<tr>
<td>Power cons. in PD</td>
<td>0.05</td>
<td>0.38</td>
<td>0.7</td>
<td>5μA / -110μA @ 50Hz</td>
<td>0.5</td>
</tr>
<tr>
<td>Low Power Mode</td>
<td>@1.6Hz, 3 / 16</td>
<td>@1Hz, 8 @50Hz, 150 from 12.5 up to 6.4kHz</td>
<td>2.5 @1Hz, 8 @50Hz, 150 from 12.5 up to 6.4kHz</td>
<td>2 @1Hz, 6 @50Hz, 11 @50Hz</td>
<td>2 @1Hz, 6 @50Hz no normal mode</td>
</tr>
<tr>
<td>Normal Mode (μA)</td>
<td>0.38 @1.6Hz, 3 / 16</td>
<td>0.05 @50Hz</td>
<td>0.7 @1Hz, 8 @50Hz, 150 from 12.5 up to 6.4kHz</td>
<td>5μA / -110μA @ 50Hz</td>
<td>0.5 @1Hz, 6 @50Hz no normal mode</td>
</tr>
<tr>
<td>0g level offset accuracy (Typ)</td>
<td>±20 mg</td>
<td>±30 mg</td>
<td>±30 mg</td>
<td>±40 mg</td>
<td>±100 mg</td>
</tr>
<tr>
<td>0g level change vs. Temp</td>
<td>±0.2 mg/°C</td>
<td>±0.3 mg/°C</td>
<td>±0.25 mg/°C</td>
<td>±0.5 mg/°C</td>
<td>±0.5 mg/°C</td>
</tr>
<tr>
<td>ODR</td>
<td>One shot, 1.6Hz-1.6kHz</td>
<td>1 Hz – 6.4kHz</td>
<td>10Hz-800Hz (HR)</td>
<td>1Hz-5.376 kHz (Low power), 1Hz-1.344 kHz (Normal, HR)</td>
<td>1Hz-5.376 kHz (Low power)</td>
</tr>
<tr>
<td>BW</td>
<td>Up to ODR/2</td>
<td>Up to ODR/2</td>
<td>Up to ODR/2</td>
<td>ODR/2 (LPM and NM), ODR/9 (HR)</td>
<td>ODR/2 (Low power)</td>
</tr>
<tr>
<td>FIFO</td>
<td>32-level</td>
<td>256 level FIFO (14b), 768 level (if XL module)</td>
<td>32-level</td>
<td>32-level (10bit)</td>
<td>32-level (10bit)</td>
</tr>
<tr>
<td>Self-test / Temp sensor</td>
<td>Yes / Yes (1 digit/°C)</td>
<td>Yes / Yes</td>
<td>Yes / 11bit resolution (8 digit/°C)</td>
<td>Yes / Yes</td>
<td>Yes / Yes</td>
</tr>
<tr>
<td>Power supply</td>
<td>1.62 to 3.6 V</td>
<td>1.62 to 1.98 V</td>
<td>1.71 to 3.6 V</td>
<td>1.71 to 3.6 V</td>
<td>1.71 to 3.6 V</td>
</tr>
</tbody>
</table>
High Performance Inclinometer: LIS3DHH

- 16bit accelerometer
- Supply voltage 1.7 to 3.6V
- Full -Scale +/-2.5g
- Zero-g noise density : 45μg/√Hz (Max)
- High Stability
  - Zero-g level change vs. temperature < 0.4mg/°C
  - Sensitivity change vs. temperature < 2%
- Embedded FIFO 32 Levels
- SPI 4-Wire digital output Interface
- Embedded temperature sensor (12-bit data output)
- Ceramic cavity LGA16 5x5x1.7mm

ST it is also SPECIFIC device

Key Features
- Ultra High Resolution
- Temperature behavior
3-axis Low-power High-G Axel

H3LIS100DL, H3LIS200DL and H3LIS331DL

Features

- **3 axis, High-g Full Scale (100g/200g/400g)**
- Low power consumption - 300 µA in Active mode - 10µA in low-power mode
- Programmable interrupt
- Package LGA, 3x3x1 mm³, 16 Leads

Benefits

- Enabler for a broad range of application
- Ideal for battery operated applications
- Enables system level power consumption reduction
- Small footprint and pin to pin compatible with all the H3LISxxxDL devices

Applications

- Ideal for all space and power-constrained applications requiring precise shock detection
- Concussion detection and monitoring in impact sports
- Car black box (for insurance purpose)
- Augmented sports
- Shock detection in tools, equipment, portable instrument and for asset tracking
- Vibration monitoring for equipment condition monitoring
Magnetometer:

to detect magnet and rotation

• To detect **Earth Magnetic field** for Compass

• Movement and **Rotation** measurement

• **Anti-tamper** in case of high magnet field

• Companion for **9-axis** high accuracy movement recognition

  • Heading = angle between Xb axis and Magnetic North

  • Earth’s magnetic field H has a horizontal component

  • If sensor is horizontal, magnetometer senses Xh and Yh components of H projected on axis;

  • Heading = $\arctan(Yh / Xh)$
AMR Magnetometer & Digital Compass
LIS2MDL & LSM303AH/LSM303AGR

**LIS2MDL**
(standalone LSM303AH magnetometer)

- 3-axis digital magnetometer:
  - ±50Ga FS (module)
  - Resolution 3mGa RMS
  - ODR on single mode operation (<10Hz ODR) and from 10 to 100Hz (150Hz in LPM)
  - Self-test embedded
- Embedded magnetic **Offset cancellation** enabling no offset thermal drift
- Power consumption (@ODR=20Hz):
  - 200µA in High resolution
  - 50µA in Low power & 2µA in Power down

**Key Features**
- Standard 2x2 pinout
- Self test & High field behavior
- Flexibility in resolution vs. consumption

**LSM303AH / LSM303AGR**

- 3-axis accelerometer: up to ±16g full-scale,
  - LIS2DS12 based (LSM303AH)
  - LIS2DH12 based (LSM303AGR)
- 3-axis magnetic sensor: ± 50Ga FS
  - Resolution down to 3mGa RMS
  - 10, 20, 50, 100Hz ODR
  - Embedded temperature sensor
  - Embedded **Self test** for A and M
  - Embedded magnetic Offset cancellation
    - No offset thermal drift
- LGA-12, 2x2, P2P compatible with LSM303C, LIS2MDL, LIS2DH12/DE12, LIS2DS12, LIS2DW12

**Key Features**
- High Full Scale Magnetometer
- Flexibility resolution vs. power consumption
- Magnetic offset cancellation embedded
**Magnetometer and e-Compass**

**eCompass**
- **LSM303C**
  - 2.0x2.0x1 mm
  - Dynamic Range: ± 18G
  - Noise RMS [HP] = 3.5mG
  - IddXL = 180 µA
  - An = 150 µg/√Hz
  - Based on LIS2HH12

- **LSM303AGR**
  - 2.0x2.0x1 mm
  - Dynamic Range: ± 50G
  - Mag Noise RMS [HP] = 3mG
  - An = 750 µg/√Hz
  - Low Power Combo
  - High Performance Mag
  - Based on LIS2DH12

- **LSM303AH**
  - 2.0x2.0x1 mm
  - Dynamic Range: ± 50G
  - Mag Noise RMS [HP] = 3mG
  - An = 120 µg/√Hz
  - High Performance eCompass
  - Based on LIS2DS12
  - Pedo: WeChat compliant
  - SMD, Step counter

- **LIS2MDL**
  - 2.0x2.0x0.7 mm
  - Imag = 200µA @ 20 Hz
  - Dynamic Range: ± 50G
  - Noise RMS [i-P] = 3.0mG
  - High Performance Mag
  - Board compatible with LSM303AH/AGR

**Pedometer**
- **IMAG** = 200µA @ 20 Hz
- Dynamic Range: ± 50G
- Noise RMS [i-P] = 3.0mG
- High Performance Mag
- Board compatible with LSM303AH/AGR
- Pedo: WeChat compliant
- SMD, Step counter
6-axis IMU: LSM6DSL*  

**Low-Power: DIVIDED by2**

**Always-on experience:**
- \(0.29\) mA in combo low power mode
- \(0.48\) mA in combo normal mode
- \(0.65\) mA in combo high-performance mode
- \(4.5\mu A\) in Accelerometer only mode

- Ultra now noise gyro: \(4\text{mdps}/\sqrt{\text{Hz}}^*\)
- \(\pm 2/\pm 4/\pm 8/\pm 16 \text{ g Axl Full scale}\)
- \(\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000 \text{ dps Gyro full scale}\)
- FIFO up to 4 Kbyte for dynamic data batching
- Accelerometer and Gyro ODR up to 6.66kHz
- I2C/SPI data synchronization feature
- Hard, soft ironing for external magnetic sensor corrections
- Digital function (Pedo, Tilt, StepMvtDetec)
- Sensor hub

*LMS6DSM is a LSM6DSL for OIS and very low noise*
LSM6DSO* & LSM6DSR*

**PERFORMANCE and FEATURES**

- A: ±2/±4/±8/±16 g full scale
- G: ±125/±250/±500/±1000/±2000 dps full scale
- Accuracy: 3.8mdps/√Hz (G), 70μg/√Hz (A) noise level
- 0.55mA current consumption in HP combo
  -15% vs. LSM6DSL @ same performance
- New ultra low power mode: 15uA Axl only

**FEATURES embedded @ silicon level**

- Finite State Machine recognize custom motion patterns from A + G and external sensor to generate interrupts
- Smart FIFO up to 9KB to store
  - Gyroscope, Accelerometer, External sensors (up to 4), Step counter, Timestamp, Temperature
- New and High performance Pedometer 2.0
  - Improved filtering capabilities
  - Advanced configurable parameters

**POWER CONSUMPTION and FEATURES**

- **LSM6DSO**
- A: ±2/±4/±8/±16 g full scale
- G: ±125/±250/±500/±1000/±2000 dps full scale
- Accuracy: 3.8mdps/√Hz (G), 70μg/√Hz (A) noise level
- 0.55mA current consumption in HP combo
  -15% vs. LSM6DSL @ same performance
- New ultra low power mode: 15uA Axl only

- **LSM6DSR**
- A: ±2/±4/±8/±16 g full scale
- G Full Scale up to 4000dps
- High Accuracy: high stability over temp and time

P2P with LSM6DSL, SW compatible with LSM6DSx

*Target delivery plan: ES now, MP in Q2*
Industrial, Medical

&

Automotive Motion

MEMS
ST MEMS Longevity Program
10 years longevity commitment

ST is focused on markets requiring long lifecycles

- Industrial
- Appliances
- Building automation
- Medical
- Defense
- Navigation

ST Longevity Program Benefits

- 10-YEAR LONGEVITY FROM PRODUCT INTRODUCTION DATE
- DESIGN AND MANUFACTURING FOR HIGHER ROBUSTNESS & PERFORMANCES
- CALIBRATION & TESTING FOR HIGHER ACCURACY & QUALITY
- EXTENDED TEMPERATURE RANGE AND ENDURANCE TO SHOCK AND VIBRATION
Industrial 10 Years Longevity Roadmap

**Axel**
- **IIS2DH 2x2 LGA 12**
  - Compact, 3-axis digital
  - Low Power axel
  - FS ±2/±4/±8/±16g

- **IIS328DQ 4x4 QFN 24**
  - High performance, 3-axis digital
  - Extended temperature range axel
  - FS ±2/±4/±8g

**Gyro**
- **I3G4250D 4x4 LGA 16**
  - High performance, 3-axis digital
  - Gyroscope
  - FS ±245/±500/±2000 dps

**IMU**
- **ISM330DLC 2.5x3 LGA 14**
  - First 6-axis IMU on the market with 10y committed longevity
  - Ultra low power, smart features
  - 3-axis axel FS ±2/±4/±8/±16 g
  - 3-axis gyro FS ±125 -> ±2000 dps

- **IIS2MDC 2x2 LGA 12**
  - Stand alone, 3-axis digital magnetometer
  - FS ±50Ga

- **ISM303DAC 2x2 LGA 12**
  - First eCompass on the market with 10y committed longevity
  - 3-axis magnetometer FS ±50Ga
  - 3-axis axel FS ±16g

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2015 - 2018
### 6-axis IMU for Industry 4.0
**ISM330DLC**

#### Features
- 10 years longevity commitment
- 3-axis axel: ±2/±4/±8/±16 g full-scale
- 3-axis gyro: ±125/±245/±500/±1000/±2000 dps FS
- Ultra Low noise, wide bandwidth, high-stability
- Dedicated, independent and optimized signal processing path for stabilization control loop
- Ultra low power, Large FIFO, smart features (Interrupts, Sensor Hub)
- Package LGA 14-lead, 2.5x3x0.83mm

#### Benefits
- Continuity and stability of component supply
- Flexibility to cover a broad range of applications
- High accuracy for demanding applications
- Ultra low power and smart features enable battery operated applications in industrial domain
- Very compact size

#### Applications
- Industrial IoT and connected devices
- Antenna, platform, optical image and lens stabilization
- Appliances, Robotics and Drones
- Navigational systems & Telematics
- Vibration monitoring and compensation
Digital Magnetometer for Industry 4.0
IIS2MDC

Benefits
- Continuity and stability of the component supply
- High dynamic range and high resolution magnetic sensing
- Ultra low power and small size
- High reliability thanks to the 3-axial sensing element in a single die
- Almost immune from Magnetic offset thanks to AMR technology and the embedded reading algorithm

Features
- 10 years longevity commitment
- AMR (Anisotropic Magneto Resistance) Technology
- 3-axis, single-die magnetic transducer
- ±50 Gauss Full Scale
- Ultra Low noise: 3 mG RMS (Hires mode)
- Ultra low Magnetic offset (< ±60 mG)
- Embedded Magnetic offset compensation vs Temp.
- Ultra Low Power (down to 25µA@10Hz ODR)
- Digital features: Interrupts & Hard Iron Compensation
- Embedded Self Test and Temperature Sensor
- Package LGA 12-lead, 2x2x0.7mm³

Applications
- Anti-tampering in smart meters
- Positional and distance sensor
- Compass for Inertial Measurement Unit (IMU)
- Presence detection, magnetic switch
- Variable magnetic field monitoring

Available NOW
Digital eCompass for Industry 4.0
ISM303DAC

Benefits
• Continuity and stability of the component supply
• Integrated high-performance 3-axis magnetic sensor with an high performance 3-axis accelerometer
• Versatile device: possible to dynamically switch between High resolution/High frequency and Low Power modes
• Low power and small size
• Monolithic AMR magnetic sensor for high reliability, high resolution and stability
• Embedded Magnetic offset compensation

Features
• 10 years longevity commitment
• 3-axis, AMR magnetic sensor. ±50 Gauss full scale
• 3-axis axel: ±2/±4/±8/±16 g full-scale
• Multiple Operating modes: Low power/High resolution/High speed
• Ultra Low noise: Mag 3 mG RMS ; Axel 120 µg/√Hz
• Low Power (down to 32µA@10Hz ODR - combo)
• High ODR and wide bandwidth
• Digital features: FIFO, Interrupts
• Embedded Self Test both for Axel & Mag
• Embedded Temperature Sensor
• Package LGA 12-lead, 2x2x1mm3

Applications
• Dual mode, Anti-tampering in smart meters
• Antenna pointing
• Motion tracking
• Robotics and Appliances
• Positioning and Navigation systems
Automotive Accelerometers

**AIS328DQ**

Automotive Inertial Sensor – 3 axes – 2/4/8g full scale – Digital Output – QFPN package

- 12 bit resolution, low power consumption (<10µA at 10Hz ODR)
- AEC-Q100 - PPAP available
- Temperature Extended range: -40° to 105°C
- QFPN 4x4x1.8 24L package

**AIS3624DQ**

Automotive Inertial Sensor – 3 axes – 6/12/24g full scale – Digital Output – QFPN package

- 12 bit resolution, low power consumption (<10µA at 10Hz ODR)
- AEC-Q100 - PPAP available
- Temperature Extended range: -40° to 105°C
- QFPN 4x4x1.8 24L package, P2p with AIS328DQ

Key features

AEC-Q100, Flexible FS -40 to 105°C
Automotive Gyroscope

**A3G4250D**

- **Automotive – 3 axes – Gyroscope – 4x4 LGA 16L– ±245dps full scale – Digital Output**
  - ±245dps full-scale
  - 16-bit rate value data output
  - Integrated low and high-pass filters with user selectable bandwidth
  - Ultra-stable over temperature and time
  - AEC-Q100
  - Temperature range: -40° to 85°C
  - LGA-16 4x4x1.1 mm³

**Key features**
- AEC-Q100, 245dps
- ULTRA STABLE
Accelerometer for medical application: MIS2DH

- Dynamically user selectable FS: ±2g/±4g/±8g/±16g
- I2C/SPI digital output interface
- Output data rate: from 1Hz up to 5kHz
- 3 Operative modes: low power(8bits) / normal mode(10bits) / high resolution(12 bits)
- Ultra low power consumption: down to 2uA in low power mode and 0.5uA in power down
- Smart power saving features: sleep to wake-up/return to sleep
- Embedded FIFO: 32 levels – 4 different operating modes
- Programmable interrupt signals for 4D/6D orientation, motion detection, free-fall and other conditions
- Embedded Self-Test functionality & Temperature Sensor
- LGA -12L 2x2x1 mm3
- Activity Monitoring and posture detection in Implantable for applications (FDA Class III) like pacemaker, neurostimulator
Environmental Sensors
Why Environmental Sensors:

• Pressure sensor (mbar)
  • LPS22HB / LPS33HW are barometric sensors with high accuracy pressure measurement, low power consumption and water resistant / proof Applications
  • Pressure sensor can be used for absolute pressure monitoring, altimeter: It complete a IMU solution to detect floor level changes in outdoor navigation
  • Applications: Weather station, Smart Watch/Glasses, Altimeter, Vacuum Cleaner, Metering compensation

• Humidity sensor (% RH range)
  • HTS221 is humidity sensor with temperature sensor embedded
  • Humidity sensor help to improve air quality or prevent electronics from water exposure
  • Applications: Weather station, Smart home, Smart Watch/Glasses, Home Appliances

• Temperature sensor (°C)
  • STTS751 can be used if humidity or pressure sensors is not required
LPS22HB, LPS225HB(1), LPS22HD(1): High Accuracy Barometric Sensor

Low noise, High accuracy, Reduced current consumption & High stability vs Temperature

• Key parameters

• 260 to 1260 mbar absolute pressure (2bar Max)
• Pressure noise: down to 20µbar & 7.5µbar (LPF)
• ODR from 1 to 75Hz, one shot
• Low power consumption: 12µA (low noise) to 3µA (low power) @1Hz
• Embedded Temperature compensation
• 32 samples Embedded FIFO for Pressure and Temperature
• SPI and I²C interfaces
• 2x2x0.76 mm package, 6 holes with 20µm diameter to avoid contamination

• LPS225HB: 2x2.5x0.8mm Package Version
• LPS22HD: one shot mode enabling 200Hz ODR

(1) LPS225HB / LPS22HD are not Mass Market Products
Pressure Sensor for Water Proof App’s:

**LPS33HW**

Water proof up to 10 ATM (100meters)

Key Features:
- 260 to 1260 mbar absolute pressure (2bar max)
- ±2.5hPa Abs Accuracy (±1 hPa after OPC), ±0.1hPa Rel. Accuracy
- RMS noise: 0.8Pa
- Low power consumption: 15µA (HPM), 4µA (LPM) @1Hz
- 1µA in Power Down mode
- ODR from 1 Hz to 75 Hz
- Embedded FIFO, Embedded temperature compensation
- SPI and I²C interfaces
- Harsh Environment compatible:
  - High robustness with full Metal LID, Ceramic substrate
  - Automotive gel targeting Gas meter conditions

For Swim user case in swimming pool & Sea
- Chlorine, Bromine mixed water test
- Salt water test
- Over Pressure Test (up to 10Bar / up to 24hr)

Corrosion Test for industrial
- n-Pentane Chemical liquid

CCLGA - 10L
3.3x3.3x2.9 mm
Humidity Sensor
HTS221

• Features:
  • Humidity (0 to 100% RH) and temperature (-40 to 120 °C) sensor
  • Humidity Accuracy (20%RH to 80%RH):
    • HTS221 ±3.5%RH
  • Low Power Consumption: 2 µA @ 1Hz ODR
  • SPI and I²C interfaces
  • Self-Test
  • Supply voltage: 1.7 to 3.6 V

Key Features
±3.5%RH Accuracy
2x2 Package
Low Power

\[ C_{\text{sense}} = C_0 + S \cdot \%rH \]
Microphones
Analog & Digital Microphones

Roadmap Evolution

**MP23AB01DH**
- 3.35x2.5x0.98 mm
- Differential
- Top Port
- SNR 61dB
- AOP 120dB
- SENS ±3dB

**MP23ABS1**
- 3.5x2.65x0.98 mm
- Bottom Port
- SNR 64dB
- AOP 132dB
- SENS ±1dB

**MP34DT01-M**
- 3x4x1 mm
- Top Port
- SNR 61dB
- AOP 120dB
- SENS ±3dB

**MP34DT05-A**
- 3x4x1 mm
- Top Port
- SNR 64dB
- AOP 122.5dB
- SENS ±1dB

**MP23DB01HP**
- 3.5x2.65x0.98 mm
- Bottom Port
- SNR 64dB
- AOP 135dB
- SENS ±1dB

*: Not yet available for MM

2016
2017
2018

gildas.henriet@st.com – EMEA – Sensors Presentation
Bottom Port, Analog Differential microphone: **MP23AB01DH**

- **Bottom Port, Analog Differential microphone:**
  - **High AOP (135dB)** for better sound fidelity
  - Better signal integrity thanks to the fully differential output
  - **Narrow Sensitivity:** +/- 1dB
  - Ultra-flat bandwidth for noise canceling application

### Parameter | MP23AB01DH
--- | ---
Supply voltage [V] | Min 2.3, Typ 3.6
Current consumption [μA] @2.7V | 220
SNR[dB] (20Hz-20kHz, A-Weighted) | 65
Roll-off [Hz] | 35
THD [%] @120dBSP | 2
A0P [10% THD] | 135
PSR (217Hz Sine wave, 100mVpp) | -100
Output | **Analog Differential**

---

Key Features
- Analog Differential
- 65dB SNR, SENS ±1dB

**Package Dim**

<table>
<thead>
<tr>
<th>Port Hole</th>
<th>3.35x2.5x0.98mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Port Hole</strong></td>
<td>0.35mm</td>
</tr>
</tbody>
</table>

---

**Frequency response**
Analog bottom port single ended microphone: MP23ABS1*

- Analog bottom port single ended microphone with 64dB SNR (Typ.)
- Low distortion, 132dB AOP
- Low power
- Ultra flat frequency response: roll off @ 15Hz
- DS and Samples available, coupon board in September

CONFIDENTIAL

*Mass Market available in Q1 2018
TOP PORT:

- **MP34DT01-M**\(^{(1)}\) - 61dB SNR, 120dB AOP, Metallic package
- **MP34DT05-A**\(^{(2)}\) – 64dB SNR, 122.5dB AOP, LGA package

- PDM output
- High Acoustic Overload Point
- Sensitivity = -26dBV ±3dB
- Omni-directional sensitivity
- Dimension (mm): 3 x 4 x 1
- Supply voltage Vcc = 1.6V – 3.6V
- Supply current Idd = 650μA

\(^{(1)}\)Replacement product for MP45DT02-M
\(^{(2)}\)MP34DT05-A replace MP34DT04-C1 and MP34DT05
Tools, SW & Evaluation Kits
Nucleo / X-Nucleo: Stackable solution

Flexible board power supply: through USB or external source

Integrated ST-Link/V2-1: mass storage device flash programming

2 push buttons, 2 color Leds

Arduino extension connectors: easy access to add-ons

One STM32 MCU flavor with 64 pins

Morpho extension headers: direct access to all MCU I/Os

STM32 Nucleo features
STM32 X-Nucleo boards allow to add a function to STM32 Nucleo boards

It is stacked on the STM32 Nucleo

(*) thanks to the electrical compatibility it can be used as a shield for Arduino UNO R3 or similar
Key products on board

**LSM6DSM**: MEMS 3D accelerometer (±2/±4/±8/±16 g) + 3D gyroscope (±245/±500/±2000 dps) with OIS

**LSM303AGR**: MEMS 3D magnetometer (±50 gauss) + 3D accelerometer (±2/±4/±8 g /±16 g)

**LPS22HB**: MEMS pressure sensor, 260-1260 hPa absolute digital output barometer

**BLUENRG-MS**: BLE Network processor

**BALF-NRG-01D3**: 50 Ohm / Conjugate match to BlueNRG Balun

**MP34DT04**: Digital MEMS microphone

**STM32L4**: Microcontroller

100 mAh Li-ion battery included

**Info available at STEVAL-STLKT01V1**

**SensorTile + Eval kit**

Order code: **STEVAL-STLKT01V1**

Module only: **STEVAL-STLCS02V1** (available NOW)
Available now:

STEVAL-BCNKT01V1

Order code: STEVAL-BCNKT01V1
• STEVAL-BLUEMIC-1
  • SPBTLE-1S: BlueNRG-1 Module
  • MP34DT04-C1: Digital MEMS Microphone
  • LSM6DSL: iNemo inertial Module (3D accelerometer and 3D gyroscope)
  • Battery connector and battery charger
  • USB and SWD connectors

• BlueNRG-1 single chip solution for processing and communication
  • 8 or 16 KHz audio compressed with ADPCM
  • Audio and inertial data streaming via Bluetooth Low Energy link

Order code: STEVAL-BLUEMIC-1
Available on: STEVAL-BLUEMIC-1
**Unicleo:** SW solution for evaluation

**X-CUBE-MEMS-XT1**
software expansion for STM32Cube

- Based on X-NUCLEO-IKS01A2
- Display data from connected sensors in various views (time plot, scatter plot, 3D plot)
- Save data to TSV or CSV files
- Configurable output data rate and full scale
- Direct read from and write to sensor registers
FP-SNS-ALLMEMS1:

**HW + FW* + Appli**

**Application**
- BLE
- USB Device
- Audio PCM to PCM
- MotionFX/ACGRAFR
- AcousticSL/BE
- BlueVoiceAPCM

**Middleware**
- STM32Cube Hardware Abstraction Layer (HAL)

**Hardware**
- STM32 Nucleo expansion boards
  - X-NUCLEO-DSP01BA1 (Groved)
  - X-NUCLEO-IKS01A1
  - X-NUCLEO-IKS01A2 (Sense)
  - X-NUCLEO-CGA02M1 (Microphone)
- STM32 Nucleo development board
  - STEVAL evaluation board

*Available for F401, L476, F446

---

**SensorTile**
- 13.5 mm
- Antenna Clearance Area
- MP34DT04
- STM32L476
- LSM6DSM
- LSM303AGR
- LPS22HB

**BlueCoin**
- 13.5 mm
- 2.5 mm
- 5 x LEDS
- BALF-NRG-01D3
- LPS22HB
- LSM303AGR
- BlueNRG-MS

**BlueMS**

FP-SNS-ALLMEMS1, pack usable for the 3 HW platforms
X-CUBE-MEMS1
MEMS Sensors SW libraries

X-CUBE-MEMS1: complete environment with drivers, set of libraries and processing algorithms for MEMS Sensors (MOTION & ENVIRONMENTAL)

• **Sensor Fusion:** MotionFX

• **Device Orientation:** MotionTL (tilt measurement), MotionEC (E-Compass library)

• **Man activity tracking:**
  - MotionPM (Pedometer), MotionPW (Pedometer for Wrist), MotionFA (fitness activity), MotionFD (fall detection), MotionSD (standing, sitting)
  - MotionAR (Activity recognition for belt and pocket), MotionAW (Activity recognition for Wrist), MotionGR (Gesture Recognition), MotionPE (Pose estimation), MotionID (Motion Intensity), MotionCP (Carry position of an object), MotionAT (Active Time)

• **Calibration:**
  - MotionAC (Accelerometer Calibration), MotionGC (Gyroscope Calibration), MotionMC (Magnetometer Calibration)

+18 libraries available
FP-AUD-SMARTMIC1

**HW + FW** + Appli

**Appli**
(iOS, Android)

**FW**

**HW**

FP-AUD-SMARTMIC1, Pack usable for the 2 HW platforms

*Available for F446*

BlueCoin

BlueMS & Audacity Application

dB noise

Sense

BeamForming

Source Localization

AEC

gildas.henriet@st.com – EMEA – Sensors Presentation
X-CUBE-MEMSMIC1: complete environment with set of libraries and processing algorithms for audio capturing systems based on digital MEMS microphones

- PDM to PCM conversion library
  - Converts digital MEMS microphones PDM signal to the PCM format.

- dBNoise, Sound pressure level (dB)
  - Provide Ambient Sound Pressure level in dB

Open.Audio is now part of X-CUBE-MEMSMIC1

Available on line: X-CUBE-MEMSMIC1
• **AcousticBF: BEAMFORMING**
  • Uses signals from 2 MEMS microphones to create a virtual directional microphone

• **AcousticSL: SOUND SOURCE LOCALIZATION**
  • Uses a MEMS microphones array to estimate the direction of the audio signal

• **AcousticEC: Acoustic Echo Cancelation**
  • Cleans microphone input from loudspeakers to avoid echo

• **Active Noise Cancelation (BF+SL)**
  • To remove the environmental noise by focusing on the sound source.

Open.Audio is now part of X-CUBE-MEMSMIC1
ST custom SOFTWARE: Tilt / Inclination measurement

- **Application**
  - Alarm (car, home)
  - Digital Inclinometer for moving machines, airplanes, construction machines
  - Consumer devices, camera (virtual horizon)

- **How to validate:**
  - **AN3182** for guidance
  - X-Nucleo HW (using embedded LSM6DS0 accelerometer)
  - SW for test & validation (includes sensor calibration (Offset, Gain));
  - IAR project including source code.

- **Result:**
  - **0.2° tilt accuracy with LSM6DS0 accelerometer** (with calibration procedure)

- **How to get SW:**
  - Yr ST Contact or gildas.henriet@st.com

---

<table>
<thead>
<tr>
<th>Tilt Error [°]</th>
<th>Uncalibrated</th>
<th>Calibrated - Offset &amp; Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pitch</td>
<td>Roll</td>
</tr>
<tr>
<td>Min</td>
<td>-0.87</td>
<td>-0.05</td>
</tr>
<tr>
<td>Max</td>
<td>0.3</td>
<td>1.07</td>
</tr>
<tr>
<td>Max-Min</td>
<td>1.17</td>
<td>1.12</td>
</tr>
</tbody>
</table>
• Application
  • Appliance real time monitoring
    • White goods low speed motor, Washing machine drum balance,
    • Robot,
    • Slow movement (doors, windows)
  • Industrial monitoring for preventive maintenance
    • Compressor, geared motors, windmill
    • Elevator, …

• How to validate:
  • Sound And Vibration Analysis Toolkit:
    • Accelerometer **IKS01A2** + according DIL adapter
  • FFT SW for Time to Frequency domain transform for local alerts/limits

<table>
<thead>
<tr>
<th>Appliance</th>
<th>BW (Max ODR/2)</th>
<th>Industrial</th>
<th>BW (Max ODR/2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIS2DH12</td>
<td>2.56 kHz (8-bit) / 672 Hz (10-bit)</td>
<td>H3LIS331DL</td>
<td>500 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-up to 400g</td>
<td></td>
</tr>
<tr>
<td>LIS2HH12</td>
<td>400 Hz (14-bit)</td>
<td>IIS328DQ</td>
<td>500 Hz / 105°C</td>
</tr>
<tr>
<td>LSM6DS3</td>
<td>3.3 kHz (14-bit)</td>
<td>IIS2DH</td>
<td>2.56 kHz (8-bit) / 672 Hz (10-bit)</td>
</tr>
<tr>
<td>LIS2DS12</td>
<td>3.2 kHz (12-bit)</td>
<td>LIS2DS12</td>
<td>3.2 kHz (12-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IIS3DWB</td>
<td>5 kHz / 105°C</td>
</tr>
</tbody>
</table>

• How to get SW:
  • Yr ST Contact or **gildas.henriet@st.com**
ST custom SOFTWARE: UnderPressure / OverPressure

• Application
  • Vacuum Cleaner
  • Water level Detection

• How to validate:
  • Nucleo for HW, LPS25HB
  • IAR project for SW

• Result:
  • Ready to use solution
  • Under and Over Pressures measurable, Customized Threshold

• How to get SW:
  • Your ST Contact or gildas.henriet@st.com
Conditions to use ST SW libraries
(binary provided)

• STM32 is used:
  • Simplified process for SW library usage
  • No paperwork
  • License provided by server
    (if Software License Agreement accepted)

• No STM32 used:
  • Request to sent to ST (me)
  • LUA* preparation
  • LUA* signature from customer
  • SW reception

Valid for:
X-CUBE-BLE1, X-CUBE-MEMS1, X-CUBE-MEMSMIC1, X-CUBE-SUBG1, FP-SNS-MOTENV1, FP-SNS-ALLMEMS1, FP-SNS-FLIGHT1, FP-AUD-BVLINK1, FP-SNS-SMARTMIC1

*LUA License User Agreement
## HW resources for ST libraries

<table>
<thead>
<tr>
<th>Description</th>
<th>Sensors used</th>
<th>Library</th>
<th>ROM* (KB)</th>
<th>RAM* (KB)</th>
<th>ODR (Hz)</th>
<th>ARM Cortex core supported</th>
<th>CPU recommended</th>
<th>CPU Clock** M4 / M3 [MHz]</th>
<th>MIPS*** M4 / M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 &amp; 9-axis Sensor Fusion (quaternions, Euler angles, linear acceleration, gravity vector, heading)</td>
<td>A, G, (M optional)</td>
<td>MotionFX</td>
<td>45</td>
<td>8</td>
<td>100</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>1.66 / 1.13***</td>
<td>2.07 / 1.42****</td>
</tr>
<tr>
<td>Pedometer (number of steps and cadence)</td>
<td>A</td>
<td>MotionPM</td>
<td>7.9</td>
<td>3.7</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.86 / 1.05</td>
<td>1.08 / 1.31</td>
</tr>
<tr>
<td>Pedometer for wrist (number of steps and cadence)</td>
<td>A</td>
<td>MotionPW</td>
<td>3.1</td>
<td>1.9</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.21 / 0.58</td>
<td>0.26 / 0.72</td>
</tr>
<tr>
<td>Fitness Activity for wrist (number of steps and cadence)</td>
<td>A, P</td>
<td>MotionFA</td>
<td>11.9</td>
<td>8.6</td>
<td>25</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.24 / 0.78</td>
<td>0.30 / 0.97</td>
</tr>
<tr>
<td>Activity Recognition (stationary, walking, fast walking, jogging, biking, driving)</td>
<td>A</td>
<td>MotionAR</td>
<td>7.2</td>
<td>1.6</td>
<td>16</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.23 / 0.87</td>
<td>0.29 / 1.09</td>
</tr>
<tr>
<td>Activity Recognition for wrist (stationary, standing, sitting, lying, walking, fast walking, jogging, biking)</td>
<td>A</td>
<td>MotionAW</td>
<td>8.2</td>
<td>4.7</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.16 / 0.70</td>
<td>0.20 / 0.88</td>
</tr>
<tr>
<td>Gesture Recognition (pick up, glance, wake up)</td>
<td>A</td>
<td>MotionGR</td>
<td>12</td>
<td>3</td>
<td>16</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.12 / 0.23</td>
<td>0.15 / 0.29</td>
</tr>
<tr>
<td>Pose Estimation for wrist (sitting, standing and lying down)</td>
<td>A</td>
<td>MotionPE</td>
<td>11</td>
<td>3</td>
<td>16</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.04 / 0.02</td>
<td>0.004 / 0.02</td>
</tr>
<tr>
<td>Intensity Detection for wrist (on desk, hand on bed/couch/cushion, light movements, biking, typing/writing, high intensity typing/slow walking, washing hands/walking, fast walking/jogging, running/brushing teeth, springing)</td>
<td>A</td>
<td>MotionID</td>
<td>5.6</td>
<td>12</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.38 / 0.48</td>
<td>0.47 / 0.60</td>
</tr>
<tr>
<td>Carry Position (on desk, in hand, near head, shirt pocket, trouser pocket, arm swing, jacket pocket)</td>
<td>A</td>
<td>MotionCP</td>
<td>5.6</td>
<td>12</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.67 / 1.26</td>
<td>0.84 / 1.57</td>
</tr>
<tr>
<td>E-Compass (device orientation (quaternions, Euler angles), device rotation (virtual gyroscope functionality), gravity vector and linear acceleration)</td>
<td>M, A</td>
<td>MotionEC</td>
<td>3</td>
<td>0.1</td>
<td>100</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.44 / 0.60</td>
<td>0.54 / 0.75</td>
</tr>
<tr>
<td>Fall Detection (man fall occurrence)</td>
<td>A, P</td>
<td>MotionFD</td>
<td>2.4</td>
<td>3.4</td>
<td>25</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.09 / 0.19</td>
<td>0.11 / 0.24</td>
</tr>
<tr>
<td>Standing vs Sitting Desk Detection (sitting at the desk, standing desk position)</td>
<td>A, P</td>
<td>MotoSD</td>
<td>2.4</td>
<td>3.4</td>
<td>25</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.09 / 0.19</td>
<td>0.11 / 0.24</td>
</tr>
<tr>
<td>Tilt Sensing (tilt angles)</td>
<td>A</td>
<td>MotionTL</td>
<td>3.7</td>
<td>1.1</td>
<td>25</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.49 / 0.61</td>
<td>0.61 / 0.76</td>
</tr>
<tr>
<td>Active Time (active seconds)</td>
<td>A</td>
<td>MotionAT</td>
<td>16.5</td>
<td>5.6</td>
<td>50</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.12 / 0.35</td>
<td>0.15 / 0.44</td>
</tr>
<tr>
<td>Real-time Accelerometer Calibration (offsets and scale factor coefficients)</td>
<td>A</td>
<td>MotionAC</td>
<td>14</td>
<td>2</td>
<td>20 to 100</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.09 / 0.48</td>
<td>0.11 / 0.60</td>
</tr>
<tr>
<td>Real-time Gyroscope Calibration (offsets)</td>
<td>A, G</td>
<td>MotionGC</td>
<td>1.6</td>
<td>0.2</td>
<td>25 to 200</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.04 / 0.26</td>
<td>0.05 / 0.33</td>
</tr>
<tr>
<td>Real-time Magnetometer Calibration (Hard iron offsets &amp; scale factor coefs)</td>
<td>M</td>
<td>MotionMC</td>
<td>20</td>
<td>3</td>
<td>&lt;100</td>
<td>M3 and M4</td>
<td>STM32F4 / L4</td>
<td>0.05 / 0.19</td>
<td>0.06 / 0.23</td>
</tr>
<tr>
<td>Real-time adaptive beamforming</td>
<td>2 Dig. Mic</td>
<td>AcousticBF</td>
<td>41.7</td>
<td>41.5(1)</td>
<td>65(1)</td>
<td>M4 and M7</td>
<td>STM32F4/7</td>
<td>8.8 to 65.28(1)</td>
<td>11 to 81.6(1)</td>
</tr>
<tr>
<td>Real-time source localization</td>
<td>2-4 Dig Mic</td>
<td>AcousticSL</td>
<td>38</td>
<td>27.1(1)</td>
<td>80(1)</td>
<td>M4 and M7</td>
<td>STM32F4/7</td>
<td>1.6 to 79.04(1)</td>
<td>1 to 98.8(1)</td>
</tr>
<tr>
<td>Real-time Echo Cancellation</td>
<td>1 Dig Mic</td>
<td>AcousticEC</td>
<td>32.5</td>
<td>54(1)</td>
<td>72(1)</td>
<td>M4 and M7</td>
<td>STM32F4/7</td>
<td>27.2 to 71.1(1)</td>
<td>34 to 88.8(1)</td>
</tr>
</tbody>
</table>

* Real size might differ for different IDEs (toolchain)  
** CPU clock used by the algorithm, mean value calculate from results for IAR EWARM 7.80.4  
*** MIPS = CPU clock * 1.25MHz/DMIPS (see datasheet for STM32F401 or STM32L476)  
**** For Cortex-M3 the parameter modx is set to 4  
(1) Those are maximum values : could be less depending on microphones inter-distance, input format (PDM or PCM), and the selected level of the audio processing.
Key Messages & Conclusion
Flexible and independent Manufacturing
Installed Capacity >5 Mpcs/day

- France (Crolles, Rousset)
- Italy (Agrate, Catania)
- Malta
- Thailand
- Philippines
- Singapore

Accelerometers, Gyroscopes, Compasses, Microphones and Pressure Sensors

Front-End
Back-End
ST Sensors Support for you

Easy-to-use, Customer-oriented

- Technical Training & Seminar
- Distributor Support DFAE
- Datasheet, AN, TN
- Schematic, BOM, Gerber
- X-Nucleo Boards IKS01A2, CCA02M1
- Low Level Driver, Software examples
- Android, iOS, Applications
- Website st.com
- Video & e-presentation
- Forums & e2e
- ST FAE, ams-support@st.com
- Newsletter

Website st.com

Distributor Support DFAE

Datasheet, AN, TN

Schematic, BOM, Gerber

X-Nucleo Boards IKS01A2, CCA02M1

Low Level Driver, Software examples

Android, iOS, Applications

Video & e-presentation

Forums & e2e

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Newsletter
TOP SELLING MEMS Products

- 3-axis Digital AXL: **LIS2DE12** / **LIS2DH12** / **LIS2DW12**
- 3-axis Digital High-g AXL (up to 400g): **H3LIS100DL** / **H3LIS200DL** / **H3LIS331DL**
- 3-axis Magnetometer and 6-Axis e-Compass: **LSM303AGR** / **LSM303AH** / **LIS2MDL**
- 6-axis iNEMO IMU: **LSM6DSL**
- Industrial Sensors (10Years longevity committed): **IIS328DQ** / **I3G4250D** / **IIS2DH** / **ISM330DLC** / **ISM330DLC** / **ISM303DAC** / **IIS2MDC**
- Automotive Sensors: **AIS328DQ** / **AIS3624DQ** / **A3G4250D**
- Environmental Sensors: **LPS22HB** / **LPS33HW** / **HTS221**
- Microphones: **MP23AB01DH** / **MP34DT01-M** / **MP34DT05-A**

**New PRODUCTS**

*to be promoted when available*
Takeaway: Why Choose ST?

Our Strengths

- ST’s Market-Proven Manufacturing Technology
- High-Volume Manufacturing Capability
- Expertise in Multi-Axis Sensor Integration
- Partnership with OEMs in Product Development

Paving the Future with Unique Assets and Focused Market Leadership
For more information on sensors: **www.st.com/sensors**

For EMEA – a dedicated team

**Product Marketing:**
gildas.henriet@st.com

**Technical support (excl. mic):**
amssupport-emea@st.com

**Technical support (mic):**
RF-support-emea@st.com