ST Sensors:

Main trends and new products

EMEA - MEMS Product Marketing
Focus applications and macro trends in Industry 4.0

Predictive Maintenance

Asset Tracking

Inclination and health structural monitoring

Sensors Nodes for Environmental monitoring

Audio (noise, voice and ultrasound)

Artificial Intelligence

and Cloud integration
Artificial Intelligence and Smart Edge
Artificial Intelligence @ the deep edge inside ST Sensors enables Distributed Artificial Intelligence

- Responsiveness
- Bandwidth
- Privacy
- Security
- Energy Saving
LSM6DSO/X Sensors with MLC & Improved Performance

**Improved accuracy, optimized system power**

- **High accuracy**
  - Noise: Gyro 3.8 mdp/s/√Hz
  - Accelerometer 70 µg/√Hz

- **Low current consumption**
  - 0.55 mA HP combo
  - -15% vs. LSM6DSL/M gen.

- **New Ultra low power accelerometer only mode**
  - 9.5 µA @ 52 Hz ODR
  - 14uA @100Hz ODR

**LSM6DSO/X**

- **Accelerometer**
  - FSM
  - Interrupt
  - FIFO
  - Pedometer

- **Gyroscope**
  - Sensor Hub

- **Machine learning code**
  - Optical stabilization core

- **Accelerometer + Gyroscope**

**Finite State Machine & Machine Learning Core**

**New standard protocol**

- I²C / I³C / SPI

**Sensor HUB**

- & compressed 9kB FIFO

**Embedded Pedometer 2.x**

- WeChat Compliant
- OIS Stabilization Core

2.5x3x0.86 mm

Life augmented
ST sensors with machine learning embedded
Marked with X at the end of the part number

**Consumer**

- LSM6DSO/32/X
- LSM6DSRX
- Activity recognition
- Gym activity recognition
- Airplane Mode detection

**Industrial & Medical**

- ISM330DHCX and IIS2ICLX(*)
- Moving/Still
- Structural Health Monitoring
- Motion Intensity Detection

**Automotive**

- ASM330LHHX (coming soon)
- Vehicle Stationary/Moving
- Vehicle driving detection
- Driver quality Monitoring

(*) high performance inclinometer <0.5° accuracy over temp & time

User daily context

Asset Tracking and IOT context

Vehicle/Driver context

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Sophisticated movement detection
More intelligence examples
with embedded Machine Learning Core

Get inspired by MLC examples!

Personal Electronics
- Activity recognition
- Gym activity recognition
- Head gestures
- Sleep monitoring
- Yoga pose recognition
- Man Down

Industrial & IoT
- Motion intensity
- Orientation detection
- Vibration monitoring
- Tilt angle
- Drilling machine (under preparation)

Automotive and Asset tracking
- Vehicle stationary motion detection
- Boats tracker
- Airplane mode detection

MLC examples are available online at dedicated GitHub project for Machine Learning Core
• **Implementation details**
  - STWIN board attached to a drilling equipment sensing movements / vibration (AXL, IMU)
  - Programmable embedded decision tree detects different drill operations / screwing

• **Benefits in real application**
  - Auto adjust of drill setup based on current utilization of the tool
  - Better user experience (no need to readjust drill manually)
  - Power consumption optimization - longer battery life

Classes/Classification:

- Idle
- Drilling
- Tightening screw
- Loosening screw

Other equipment: electric saws, cutters, screwdrivers, wrenches, grinders, …
Accuracy and embedded digital capabilities to detect positions and movements (i.e. moving up and down). DEMO: IIS2ICLX with STM32 Nucleo board and Unicleo GUI (CES 2021)
Recognition of boxing specific movements

A low powered wearable is trained to individual users' habits and capabilities using ST’s Machine Learning Core. Machine Learning Core in SensorTile.box inside sport wearable

MLC able to recognize a punch in a boxing environment by using ST MLC capabilities

13 uA – current consumption for this algorithm with MLC
Definition of the classes to be recognized: running, walking, car, ... Capture data ...

1. User defines Classes to be recognized
2. Collect data Logs for each class and label data
3. Select Features that best characterize the identified classes
4. Machine Learning tools generate program for LSM6DSOX based on Logs and Features
5. Run the application
Machine Learning process with ST tools
Rapid prototyping environment

1. Capture data
2. Label data & extract features
3. Build decision tree
4. Embed decision tree
5. Process new data

- **Unico GUI** → PC tool for MLC development
- **AlgoBuilder** → PC tool for graphical development of algorithms
- **Unicleo-GUI** → PC tool for STM32 Nucleo with MEMS expansion board
- **ST BLE Sensor** → Mobile App for SensorTile.box

*Alternatively other external tools: Weka, RapidMiner, MATLAB, Python*
Inside SensorTile.box

Sensing, processing and connectivity

- Micro USB connector
- BLE module
- STM32L4+ MCU
- Motion sensors: IMU, Inclinometer and low power Accelerometer, Magnetometer
- 500 mA-h Li-Po battery
- microSD card socket (below battery)
- STLink V3 connector
- Environmental sensors: Altimeter / Pressure, Accurate Temperature, Humidity sensor, Analog wide-band Microphone
- Analog wide-band Microphone
## Machine learning accuracy

### Accuracy and Low current consumption

Confusion Matrix of Activity Recognition in LSM6DSOX

<table>
<thead>
<tr>
<th>Detected as</th>
<th>Stationary</th>
<th>Walking</th>
<th>Fast Walking</th>
<th>Jogging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary</td>
<td>99.1%</td>
<td>0.9%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Walking</td>
<td>0.0%</td>
<td>99.4%</td>
<td>0.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Fast Walking</td>
<td>0.0%</td>
<td>3.7%</td>
<td>95.9%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Jogging</td>
<td>0.0%</td>
<td>0.6%</td>
<td>0.7%</td>
<td>98.5%</td>
</tr>
</tbody>
</table>
and Current consumption improvement
Very low power Internet of Things (IoT) applications

Only 4uA additional current consumption to run Activity Recognition in MLC

- Activity recognition library (MotionAR) running in Software
- Activity recognition algorithm running inside MLC

<table>
<thead>
<tr>
<th>LSM6DSOX Sensor</th>
<th>Sensor Current consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors</td>
<td>15 μA</td>
</tr>
<tr>
<td>MLC – not used</td>
<td>0 μA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MCU</th>
<th>Wake-up rate</th>
<th>MCU Current consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32F401RE</td>
<td>1/16 = 63ms</td>
<td>91 μA</td>
</tr>
<tr>
<td>STM32L152RE</td>
<td>1/16 = 63ms</td>
<td>82 μA</td>
</tr>
<tr>
<td>STM32L476RG</td>
<td>1/16 = 63ms</td>
<td>51 μA</td>
</tr>
</tbody>
</table>

STM32F401RE
1 s 9.27 μA
30 s 3.02 μA
100 s 2.8 μA

STM32L152RE
1 s 3.24 μA
30 s 1.46 μA
100 s 1.4 μA

STM32L476RG
1 s 2.8 μA
30 s 0.65 μA
100 s 0.59 μA

Only 4uA additional current consumption to run Activity Recognition in MLC

Running on: [μA]
- Cortex-M4 low power
- STM32L476RG 51
- MLC on LSM6DSOX 5

Additional Current Consumption required to run the application

MCU
- STM32F401RE
- STM32L152RE
- STM32L476RG
Asset tracking categories
Emerging applications

**Logistics:**
- Supply Chain Quality Control, from manufacturing to end user.
- Transportation and Storage Handling monitor (object dropping, vibration etc...)

**Things tracking**
Find your things/location tracking

**Animal tracking**
Activity, Temperature, location data monitoring

**People tracking**
Smart band for concerts/entrance/payment/ amusement parks/cruise ships

**Retails**
Storage/Shelf life, Temperature & Humidity, beacons

**Perishable Goods:**
Exp. date alert, Shelf/Storage Life Calculation/Condition of goods

**Smart Packaging:**
Temperature, Vibration Use, ID

Discover ST’s range of asset tracking solutions
Asset Tracking

ST Main Components

**STM32**
- Computation by STM32 Family

**BLE**
- Bluetooth Low Energy Connectivity to gateway/tablet

**Sub-1GHz**
- Long Range Connectivity to base stations/Sigfox

**NFC**
- Short Range Connectivity To handheld devices

**Battery**
- DCDC, LDO, Battery Charger, Fuel Gauge…

**Accelerometer**
- Vibration
- Orientation
- Free Fall detection
- Shocks (high-g)

**Temperature sensor**
- Shipping Environment
- Goods Status

**Pressure sensor**
- Take off and landing detection
- Seal detection

**Analog**
- Including Signal Conditioning, Protections, …
The LIS2DTW12 delivers the same high performances as the LIS2DW12. Differently from the LIS2DW12 the LIS2DTW12 is factory calibrated to ensure a narrower accuracy relieving the customer from the need of a costly calibration along the manufacturing line.

**Fan Condition Monitoring**

**THE CASE**
Servers run multiple fans to ensure the proper temperature operating conditions. When a fan wears out the server has to be stopped with the consequent machine down cost.

**THE NEED**
Anticipating the failure by monitoring both the fan vibrations and the air flow temperature is key to reduce the machine down time.

**THE PERFECT FIT**
LIS2DTW12

**Asset Trackers**

**THE CASE**
Delivery services monitor the parcel to ensure no high-g shock or thermal shock occurred to the goods in package.

**THE NEED**
An integrated low power solution (axl + temperature sensor) is the ideal solution to contain the application BOM and size

**THE PERFECT FIT**
LIS2DTW12
Asset Tracking

READY Solutions

Outdoor Real-Time Monitoring
Containers, livestock monitoring, e-bike,
Fleet management, pet, tools management

Industrial Logistic
Pallets, racks, indoor / outdoor location

Good Guarantee
Cold chain, food, medical, smart parcels

Disposable
Letters, packages, parcels

Asset Tracking

STEVAL-STRKT01
B-L072Z-LRWAN1
X-NUCLEO-GNSS1A1
X-NUCLEO-IKS01A2
FP-ATR-LORA1*
Cayenne/TagoIO*
DSH-ASSETTRACKING*

STEVAL-SMARTAG1
NUCLEO-L053R8+
X-NUCLEO-NFC04A1+
X-NUCLEO-IKS01A2
FP-SNS-SMARTAG1*
ST NFC Sensor*
DSH-ASSETTRACKING*

STEVAL-MKSBOX1V1
FP-ATR-BLE1*
ST Asset Tracking*
DSH-ASSETTRACKING*

NUCLEO-F401RE
P-L496G-CELL02 LTE
FP-ATR-TOMTOM1*
FP-ATR-LTE1*
DSH-ASSETTRACKING*

NUCLEO-L053R8
/L476RG
X-NUCLEO-S2868
X-NUCLEO-IKS01A3
X-NUCLEO-GNSS1
FP-ATR-SIGFOX1*
ST Asset Tracking*
DSH-ASSETTRACKING*

Cayenne/TagoIO*

*iOS/Android App, *Firmware, * Dashboard

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End-to-end Architecture

An unique dashboard collecting data on AWS independently from the used technology to contact the nodes.
Asset tracking demonstration with STM32 MCU-based solutions, including NFC, Bluetooth®, Low Energy and LPWAN with SigFox and LoRa®, GNSS for positioning, environmental and motion sensors with Machine Learning.

- Ready solution for: NFC, Bluetooth® Low Energy, LoRa®, SigFox with cloud AWS or Tago-Io dashboard
- Wide range of asset-tracking solutions with GNSS positioning, geo-fencing, and LPWAN connectivity
- IMU with Machine Learning Core for Asset Tracking using SensorTile.box
- ST Parts: ST25DV, STM32WB, BlueNRG-2, STM32L0 LoRa® module, S2-LP, LSM6DSOX, LPS22HH, LIS2DW12, STTS751, LIS2MDL, STTS22H, HTS221, TESEO-LIV3
Predictive Maintenance
MEMS for Vibration Analysis

Sensors and defects over bandwidth

Use cases

Acoustic

- IMP23ABSU
- IMP34DT05
- IIS3DWB
- ISM330DHCX
- IIS2DLPC /IIS2DH

Inertial

- Unbalance
- Looseness
- Misalignment
- Roller Bearings
- Gearing
- Cavitation
- Bearings
- Gear boxes
- Lubrication
- Fan bearings
- Venting occlusion
- Cooling failure

Unbalance Looseness Misalignment

Roller Bearings Gearing Cavitation

Bearings Gear boxes Lubrication

Fan bearings Venting occlusion Cooling failure

Use cases

Mechanical Vibration / Sound analysis (1 ÷ 10KHz)

Ultrasound analysis

kHz

2 5 10 >50

STM32

Bearing Looseness

Misalignment

Structural Looseness

Unbalance

NEW!
## IIS3DWB

**Ultra Wide Bandwidth, Low Noise 3-Axes Digital Accelerometer for Vibration Monitoring**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. of axis</td>
<td>3-axis</td>
</tr>
<tr>
<td>Full Scale [g]</td>
<td>±2/±4/±8/±16</td>
</tr>
<tr>
<td>Output i/f</td>
<td>Digital: SPI</td>
</tr>
<tr>
<td>Bandwidth (-3dB) [kHz]</td>
<td>6.3</td>
</tr>
<tr>
<td>ODR [kHz]</td>
<td>26.7</td>
</tr>
<tr>
<td>Noise Density [µg/√Hz]</td>
<td>75 (60 in single axis mode)</td>
</tr>
<tr>
<td>Current Consumption [mA]</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Features**
- FIFO (3kbyte)
- Programmable HP Filter
- Interrupts
- Temp. Sensor
- Embedded Self Test

**Operating Temp [°C]**
- -40 ; +105

**Operating Voltage [V]**
- 2.1 ± 3.6

**Package [mm³]**
- LGA 2.5x3x0.83 14Lead

Pin2pin compatible with ISM330x/LSM6DSx devices

IIS3DWB Key Performance Indicators for condition monitoring

#1 KPI Filtering chain and Low noise levels
- MEMS → Analog Front-end
- ADC
- Low Pass Filter (LPF1)
- Composite Filter

Frequency response determined by CAD simulation – at the output of LPF1

#2 KPI
Wide & Flat measurement bandwidth 6.3kHz

#3 KPI
Attenuation >70 dB in the stop band.
Very low folding of spectrum inside signal bandwidth,
No aliasing

<table>
<thead>
<tr>
<th>KPI</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>75</td>
<td>110</td>
</tr>
<tr>
<td>Y-axis</td>
<td>75</td>
<td>110</td>
</tr>
<tr>
<td>Z-axis</td>
<td>110</td>
<td>190</td>
</tr>
<tr>
<td>X-axis</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Y-axis</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Z-axis</td>
<td>80</td>
<td>130</td>
</tr>
</tbody>
</table>

#4 KPI
Stable thermal behavior over extended temperature range
IIS3DWB details and repeatability

- >6 kHz Bandwidth (@ –3dB)
- Frequency response with Flat Pass Band, Steep roll-off (>90dB/dec), high Stop Band attenuation (>70dB)
- Low Noise
STEVAL-STWINKT1B

- **Best-in-class Industrial Grade Sensors**
- Multiple algorithms running on the STM32L4+
- Secure Connection and Authentication with STSAFE-110
- Out-of-the-box BLE Connectivity
- Connectivity and sensor expansions support
- Smart Power to increase battery life (Li-Po battery, USB or ext. 5V)

- **FP-IND-PREDMNT1** IoT sensor node for condition monitoring
- **FP-CLD-AZURE1** connect an IoT sensor node to Microsoft Azure
- **FP-SNS-DATALOG1** High speed Datalog
- **FP-AI-NANOEDG1** AI Condition monitoring application

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### Diagram ICs and STM32CUBE Function Packs

- **STM32L4R9ZIJ6** Microcontroller Ultra Low Power Cortex-M4F@120MHz
- **LDK130** Low Noise LDO
- **ST1PS01EJR** step-down switching regulator
- **STBC02** Li-ion freese battery charger
- **STR485LV** RS485 Interface
- **BlueNRG-M2SA** BLE Application Processor Module
- **STSAFE-A110** Secure Element
- **IIS3DWB** 3D Accelerometer
- **IIS2DH** 3D Accelerometer
- **ISM330DHCX** 6-Axis IMU
- **HTS221** Humidity and Temp. Sensor
- **STTS751** Temperature Sensor
- **LPS22HH** Pressure Sensor
- **IIS2MDC** 3D Magnetometer
- **TS922EJT** Low noise, low distortion Op Amp
- **IMP23ABSU** Analog Microphone
- **IMP34DT05** Digital Microphone

For new designs:
- **STTS22H** (not footprint and SW compatible),

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**For use with:**
- **STEVAL-STWINWFV1**

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**Additional ICs and Function Packs**

- **ESDALC6V1-1U2** Single Line ESD protection
- **USBLC6-2P6** USB ESD protection
- **EMIF06-MSD02N16** EMI filter and ESD protection

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**Contact Information**

- **STMicroelectronics**
- **www.st.com**
Tilt/Inclination and health structural monitoring
Inclinometers accurately measure a tilt angle under static or quasi-static conditions. To measure angles of objects in highly dynamic conditions, see also Dynamic Inclinometer using 6-axis IMU in st.com.
NEW

2-axes ultra accurate, ultra low power digital inclinometer

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. of axis</td>
<td>2-axis</td>
</tr>
<tr>
<td>Full Scale [g]</td>
<td>± 0.5/1.0/2.0/3.0</td>
</tr>
<tr>
<td>Output i/f</td>
<td>I²C/SPI digital output interface</td>
</tr>
<tr>
<td>Bandwidth [Hz]</td>
<td>25/50/200</td>
</tr>
<tr>
<td>Noise Density [µg/√Hz]</td>
<td>15</td>
</tr>
<tr>
<td>Offset change vs Temp [mg/°C]</td>
<td>0.05</td>
</tr>
<tr>
<td>Current Cons. [mA]</td>
<td>0.4 - with 2 axes delivering full performance</td>
</tr>
<tr>
<td>Operating Temp [°C]</td>
<td>-40 ; +105</td>
</tr>
<tr>
<td>Package [mm³]</td>
<td>Ceramic Cavity LGA 5x5x1.7 16Lead</td>
</tr>
</tbody>
</table>

Applications

- IMU for precise positioning and navigation
- Precision Inclinometer
- Antenna pointing and platform leveling
- Structural health monitoring
- Leveling Instruments

2-axis Digital
High resolution
High Accuracy (<0.5° over Temp. and Time)
Ultra Low Power
105°C Operating Temp

Programmable MLC integrates AI algorithms and reduce power consumption at system level
Programmable Finite State Machine can also process data by Sensor HUB to efficiently collect data from external sensors
Smart embedded FIFO up to 3 kbytes
Tilt sensing with Industrial Sensors

Technical Material, libraries and documentation support

- Tilt Sensing with ST's Industrial sensors
  - Technical presentation about tilt sensing to show the theory behind and introduce our industrial sensor portfolio and HW and SW tools

- Tilt sensing using MLC (IIS2/CLX)
  - Describes new MLC example for tilt sensing with IIS2/CLX, presents available tools and shows how to use these tools
IIS2ICLX measures with very high resolution the vibrations in the low frequency range (up to 260 Hz), which are essential for vibration-based monitoring (VBM) of structures, an important method of assessing the condition and the safety of vulnerable structures.

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**Milan earthquake**
December, 17th at 16:59 CET

**Magnitude MI 3.9**

**Epicenter 4 km from Milan**
**Hypocenter 56 km depth**

**Recorded with IIS2ICLX at ST@Corenaredo**
(6 km from the epicenter)
Audio (noise, voice and ultrasound)
Voice interaction, sound and noise capture

- e.g. presence detection

Voice is convenient for HMI: Simple & Easy

- e.g. Hands-Free Voice Control

$\downarrow$ BoM

Microphone Applications

Remote Control

Voice assistant

Failure detection in ultrasonic BW measurement

- e.g. predictive maintenance
ST MEMS microphones for Industry 4.0

The Right Sensor for Every Predictive Maintenance Need

**IMP23ABSU Analog**
- **Main parameters**
  - Sensitivity: 38dB ±1dB
  - SNR: 64dB(A) (min)
  - AOP: 130dBSPL
- **Wide Acoustic Bandwidth (up to 80 kHz)**

**IMP34DT05 - DIGITAL**
- **Main parameters**
  - Sensitivity: 26dB ±3dB
  - SNR: 64dB(A) (typ)
  - AOP: 122.5dBSPL
- **High ESD protection ±15KV**

**FEATURES / BENEFITS**
- Wide Dynamic range Analog single ended microphone
- Analog device enabling ultra wide bandwidth for ultrasonic detection (predictive maintenance)
- Ultra low power device for battery operated applications

**FEATURES / BENEFITS**
- High acoustic overload point to avoid sensor saturation due to loud sound detection
- Top port high robustness organic package (CbM)
- Digital output (PDM) is the optimal solution for complexity, cost and reliability

**RHLGA 5LD**
3.5x2.65x0.98 mm

**HCLGA 4LD**
3x4x1 mm
**Key Features**

- Analog single-ended interface
- Supply 1.52-3.6V
- High Acoustic Overload Point of 130 dB SPL
- Nominal sensitivity -38dBV ±1dB @ 94 dB SPL
- 64 dB SNR
- Up to 80kHZ of ultrasound bandwidth for predictive maintenance
- -40 to 85 deg temperature
- 3.5x2.65x0.98mm bottom port package

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*Acoustic sound within the human hearing range. Most background noise in plants and other industrial facilities, including turbines, motors, and compressors, falls within this frequency range.*

*Acoustic sound beyond the human hearing range. Very few background noise will occur on this area. Leaking gas produces acoustical sound within this range.*

Reference: AZOsensors.com

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See AN6522 for more details

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**Ultrasound frequency response**

**Full frequency response in logarithmic scale**
Ultrasound microphone for air and gas leakages

- N2 or air leaks are common on tools with large number of pneumatic valves
- Widely used in chemical process industry where the presence of chemical vapor harms valves functionality, keeping under control every valve is very challenging
- Gas leak detector with ultra-sound microphone is an “non-intrusive” monitoring method
Sensors Nodes for Environmental monitoring
New Temperature sensor STTS22H in brief
Technology evolution

### TARGET SPECIFICATIONS

- **Supply voltage:** 1.5V – 3.6V
- **Current consumption:** 1.7μA in one shot mode
- **Output interface:** I2C / SMBus 3.0
- **Programmable interrupt / threshold
- **SMBus ALERT support**
- **Programmable I2C address (up to 4)**
- **Operating temperature range:** -40 °C to +125 °C
- **Accuracy:** ±0.5°C (max) [-10°C – 60°C]
- **Selectable ODR** (down to 1Hz)
- **One shot reading mode**
- **Package:** UDFN-6L 2.0 x 2.0 x 0.5mm with exposed pad down for better temperature matching with external environment.

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**Max Datasheet limit**

**Min Datasheet limit**

**±0.5°C**

**MAXIMUM ACCURACY**

**Temperature Sensors Demo KIT**

**NIST certification available**

**10-years longevity commitment**
New Products
New Products Plans

High Pressure monitoring

- Altitude monitoring for optimized 5G Antenna set-up
- 105°C required
- Combustion optimization for gardening tools
- Gas meters & Boilers
- Automation pick and place required fast ODR& low latency

Presence Detection

- Short distance detection (wake-up & Content detection)
- Presence detection in Home (Light control, display HMI..)
- Collaborative environment
New ST Pressure Sensors ILPS22QS and ILPS28QSW

1st Dual Full scale (up to 4Bar) Pressure sensor enable to cover a wide spectrum of industrial applications

**ILPS22QS**
Dual Full Scale Barometer
- Dual FS : ~ 1.26Bar / ~ 4Bar
- High performance with low power
- Absolute Accuracy = ± 0.5hPa (-20~80°C)
- Noise RMS [UHP] = 0.3Pa
- 1.2V I3C Digital Interface
- LGA 2 x 2 x 0.73 mm³
- Extended Operating Temperature: -40°C +105°C

**ILPS28QSW**
Dual Full Scale WP Pressure Sensor
- Dual FS : ~ 1.26Bar / ~ 4Bar
- Noise RMS [UHP] = 0.3Pa
- Superior robustness to ESD
- Robustness PKG to mechanical stress.
- Small Soldering Drift
- CLGA 2.85 x 2.85 x 1.95 mm³
- Extended Operating Temperature: -40°C +105°C

Sample Available
MP : Q1-22

Water Proofing Package up to 10Bar

Wider Full Scale up to 4Bar

Ultra low power consumption

Robustness PKG to mechanical stress of 10Bar Water proofing

ST Confidential
## How to go further in Industrial Applications and Key customers identification

Enabled by new generation of ST Pressure Sensors

### Industrial use cases

<table>
<thead>
<tr>
<th>Gas Meters and Boilers</th>
<th>Industrial measurements</th>
<th>Water Meters and Faucets</th>
<th>Pumps, Pools and Lifts</th>
<th>Airplane mode detection</th>
<th>Air Flow and Monitoring</th>
<th>Home Appliances</th>
<th>Motors/Liquids and Batteries</th>
<th>Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas metering in Meters and Domestic Boilers / new electric injection generation</td>
<td>Differential measurements, Pick and place machines, Tools</td>
<td>Flow rate and Leakage detection</td>
<td>Altitude and Depth</td>
<td>Recognize take-off and landing to set the radio/GPS signal</td>
<td>Air flow detection</td>
<td>Water level and Air flow detection</td>
<td>Sensor comes in direct contact with liquids, water, gasoline, diesel, oil... checking the height</td>
<td>Monitoring of atmospheric pressure and in the patient’s airways during insufflation of air and oxygen</td>
</tr>
<tr>
<td>Gas metering and Gas tank</td>
<td>Industrial measurements</td>
<td>Water meter Faucets &amp; irrigation</td>
<td>Pumps Pool Robot Lifts manufacturers</td>
<td>Asset Tracking SMART Filter HVAC Condition Monitoring</td>
<td>Washing Machine Dish Washer Vacuum Cleaner Cooking chamber Laundry dryer filter</td>
<td>Motors as chainsaw and lawnmower Liquids level</td>
<td>Ventilators</td>
<td>ST Confidential</td>
</tr>
</tbody>
</table>
Introducing new category of sensors: Qvar™ and TMOS

QVAR: Sensing Electrostatic charge variation (1-2 meters)

Qvar stands for Electric Charge (Q) Variation (var):

Enabled sensors detect the differential electric potential variation induced on the electrodes connected on

Electrodes on body
(In contact/Not in contact with human skin)

Electrodes in proximity
(Radar function)

Improved Activity Detection
Presence Sensing

QVar only available at ST

TMOS: Infrared Radiation Sensing (5-10 meters)

STHS34PF80 is the first of a family Presence/Motion detection by absolute temperature from embedded IR technology

Also to detect static presence (no movement) Compete with PIR sensor
Qvar™ enabled sensors
Combined with Motion and Pressure

Sensors fusion to improve user experience

Motion MEMS + Qvar
- 6x IMU
- Presence detection
- Contact & Proximity check
- E-Button
- Human body motion

Pressure Sensor + Qvar
- Pressure
- Presence detection
- Contact & Proximity check
- Floor level detection
- In liquid detection
- User activity detection

QVar only available at ST
Samples available
TMOS Human Presence detection

Test With Additional LENS: reach is improved
STHS34PF80 gain sensitivity
Something to proceed together ..
Most Useful tools to have in mind

**Hardware devices**

- SensorTile.box
- STWIN
- STM32 CubeMX
- AlgoBuilder Suite
- Unico & Unicleo - GUI

**Software**

- Profi MEMS tool
- ST BLE Sensor App

**Consumer sensors**
- X-NUCLEO-IKS01A3

**Industrial sensors**
- X-NUCLEO-IKS02A1

**Nucleo and expansions**
- STEVAL-MKI109V3

**Evaluate All ST sensors through DIL24 adapter**

**for Android and iOS**

- Display, program and sensor data push to Clouds

**for Linux, Mac OSX and Windows**

- Generate and develop new apps
- Develop specific functions using development environment
- No need to program anything

**Entry Mode**

**Expert Mode**

**Pro Mode**
The right SW for your Sensors

Accuracy/Calibration

- Accelerometer
- Gyroscope / IMU
- Magnetometer eCompass

Position tracking

- Accelerometer
- Gyroscope / IMU
- Magnetometer eCompass

Activity/Sport tracking

- Accelerometer
- Gyroscope / IMU
- Pressure Sensor

Health care

- Accelerometer
- Pressure Sensor

These libraries are available free of charge in X-CUBE-MEMS1 and X-CUBE-MEMS-XT1 packages.
Open position at STMicroelectronics

Company: STM - Global semiconductor leader serving customers across the spectrum of electronics applications
https://www.st.com

Position: Technical Product Marketing (junior)

We are searching an engineer interested to support the customers to build complete solutions and involved in the promotion of ST products.

Electronical competences are important in the interaction with colleagues and to bring to customers the value of ST products.

Products area: ST MEMS Sensors, RF Connectivity and Power Management.

Location: Settimo Milanese (Milano)

Reference: antonio.cirone@st.com – 366-6325260
Thank you