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Developing with Sensors Made Simple

STMicroelectronics

MEMS and Sensors

Sensors are Everywhere

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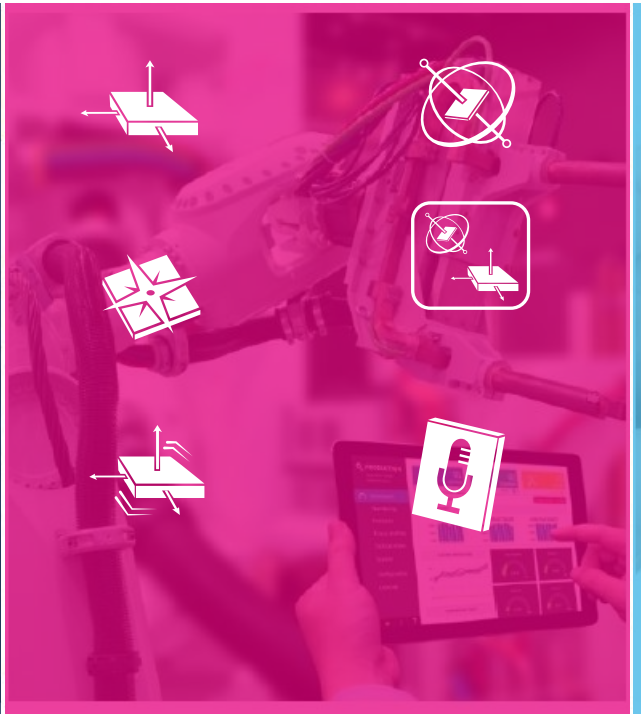
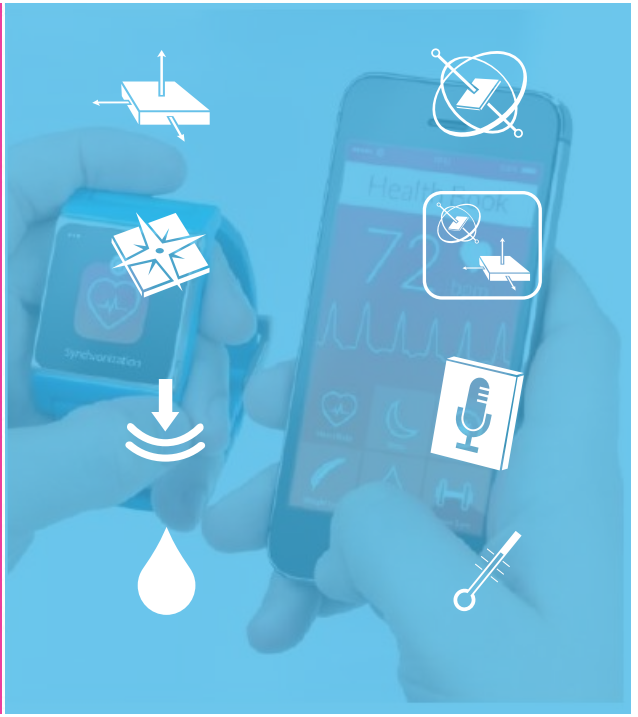
The IoT Movement

ST Sensors Addressable Market Segment

Automotive	Industrial	Consumer
		

AEC-Q100

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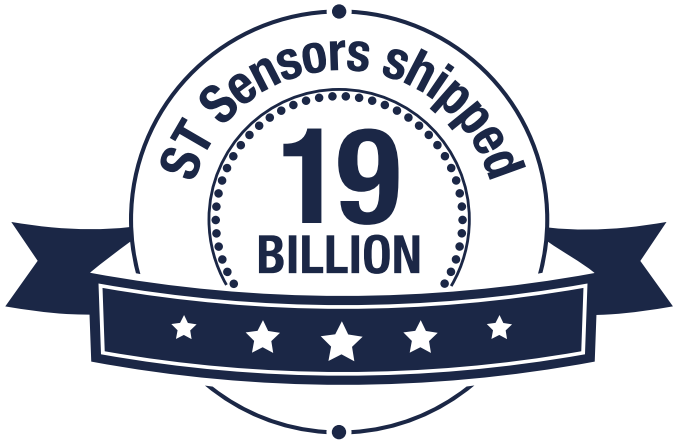
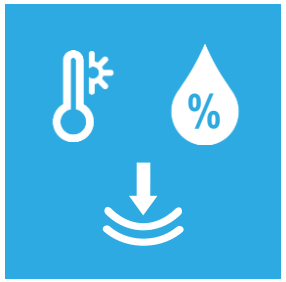
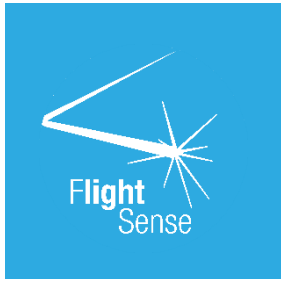
Broad Sensors Portfolio



Motion

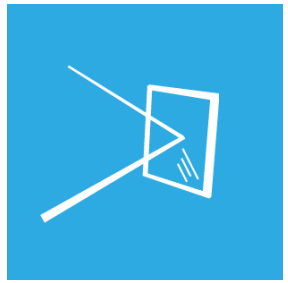


Environment



Optical

Microphones



Micro-Actuators

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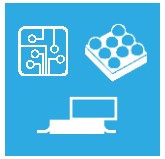
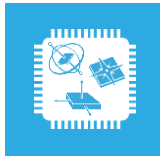
Sensors Evolution



Technologies
Manufacturing

Accuracy
Stability



Multi Sensors
Integration

Embedded
Smart Functions

Low Power
Always ON

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Sensors Evolution

Technologies
Manufacturing

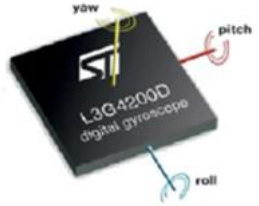
Accuracy
Stability

Multi Sensors
Integration

Embedded
Smart Functions

Low Power
Always ON

3x3x1mm LGA



4x4x1mm

6.1mA	Current consumption	0.55mA	91% Power reduction
220µg/√Hz	Acceleration noise	60µg/√Hz	73% Accel noise reduction
±0.03dps/°C	Gyro offset vs. temp	±0.005dps/°C	83% Improvement in temperature stabilization
30mdps/√Hz	Gyro noise	4mdps/√Hz	87% Noise reduction
25mm²	Size	7.5mm²	70% Size reduction
Up to ± 2000dps	Dynamic full-scale	Up to ± 4000dps	100% Increase in Full-scale range
None	Programmability	Pedometer, FSM, MLC	Embedded FSM and ML Core
	Cost		75% Cost reduction

2.5x3x0.86mm

Finite State Machine
Machine Learning Core

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Online Hands-on Exercise with Sensors

Course outline

- Part 1: Introduction
- Part 2: Software Installation
- Part 3: Software Configuration
- Part 4: Lab 0 - Read All Sensors in Polling Mode
- Part 5: Lab 1 - LIS2DW12 XL Orientation Change Detection
- Part 6: Lab 2 - LPS22HH Barometer Read from Internal FIFO
- Part 7: Lab 3 - LSM6DSO XL Embedded Step Counter
- Part 8: Lab 4 - LIS2DW12 XL Wake Up Detection
- Part 9: Lab 5 - LSM6DSO XL Single & Double Tap Detection
- Part 10: Lab 6 - LSM6DSO XL 6.6 kHz Data Rate Read at 20 Hz

Developing with Sensors Made Simple

Free massive open online course (MOOC) with hands-on exercises

Register for the course

Learn the key features of each of these sensors and how to use the hardware with the software to set up the sensors, log sensor data, optimize sensor configurations and leverage embedded smart sensor functions

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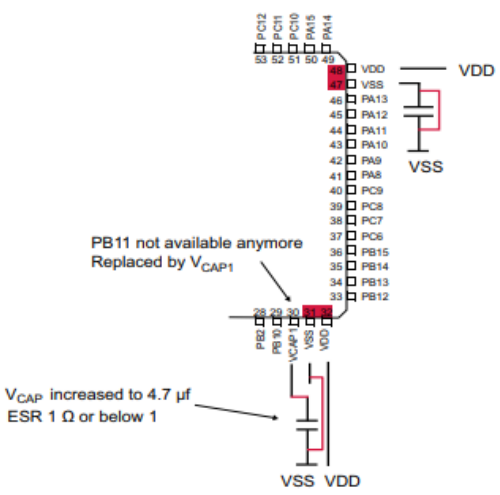
Developing With Sensors Made Simple

Complicated



Bus	Boundary address	Peripheral
APB1	0x4000 7000 - 0x4000 73FF	PWR
	0x4000 6000 - 0x4000 6FFF	Reserved
	0x4000 5C00 - 0x4000 5FFF	I2C3
	0x4000 5800 - 0x4000 5BFF	I2C2
	0x4000 5400 - 0x4000 57FF	I2C1
	0x4000 4800 - 0x4000 53FF	Reserved
	0x4000 4400 - 0x4000 47FF	USART2
	0x4000 4000 - 0x4000 43FF	I2S3ext
	0x4000 3C00 - 0x4000 3FFF	SPI3 / I2S3
	0x4000 3800 - 0x4000 3BFF	SPI2 / I2S2
	0x4000 3400 - 0x4000 37FF	I2S2ext
	0x4000 3000 - 0x4000 33FF	IWDG
	0x4000 2C00 - 0x4000 2FFF	WWDG
	0x4000 2800 - 0x4000 2BFF	RTC & BKP Registers
	0x4000 1000 - 0x4000 27FF	Reserved
	0x4000 0C00 - 0x4000 0FFF	TIM5
	0x4000 0800 - 0x4000 0BFF	TIM4
	0x4000 0400 - 0x4000 07FF	TIM3
	0x4000 0000 - 0x4000 03FF	TIM2

Table 42. **CTRL1_XL register**

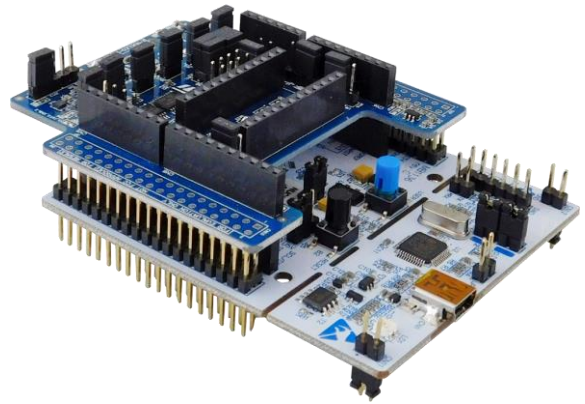
ODR_XL3	ODR_XL2	ODR_XL1	ODR_XL0	FS1_XL	FS0_XL	LPF2_XL_EN	0

Table 43. **CTRL1_XL register description**

ODR_XL[3:0]	Accelerometer ODR selection (see Table 44)
FS[1:0]_XL	Accelerometer full-scale selection (see Table 45)
LPF2_XL_EN	Accelerometer high-resolution selection (0: output from first stage digital filtering selected (default); 1: output from LPF2 second filtering stage selected)

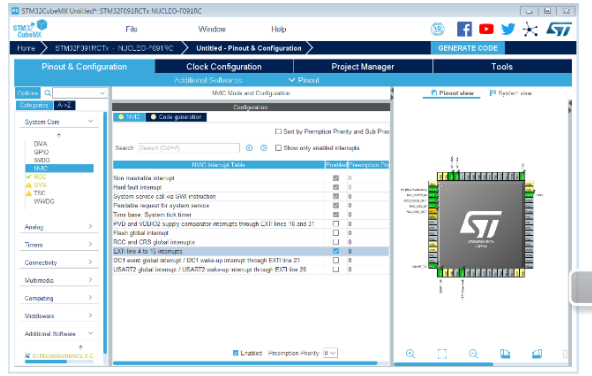
Simple

HW STM32 **Nucleo** with Sensor **Nucleo** e**X**pansion



SW

STM32**CubeIDE** / STM32**CubeMX**, **X-Cube-MEMS1** software package



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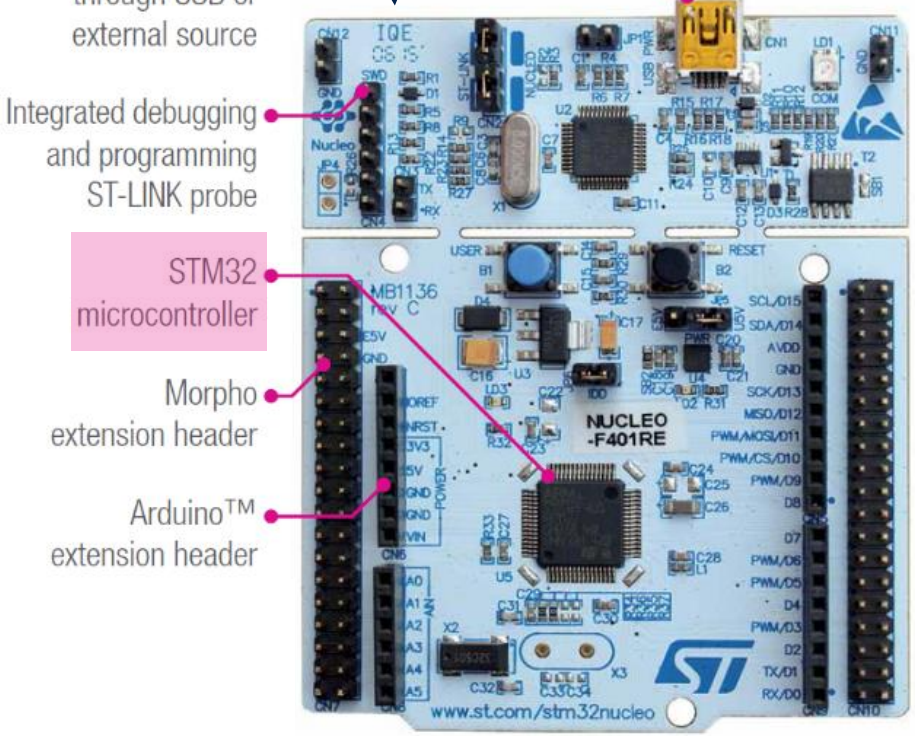
#2

#1

HW #1 **NUCLEO-L476RG** Board



STM32 Nucleo

STM32

STM32 complete product range
from ultra-low power to high performance

High performance MCUs	STM32**F2**	STM32**F4**	STM32**H7**	STM32**F7**	
Mainstream MCUs	STM32**F0**	STM32**G0**	STM32**F1**	STM32**F3**	STM32**G4**
Ultra-low power MCUs	STM32**L0**	STM32**L1**	STM32**L5**	STM32**L4**	STM32**L4+**
Wireless MCUs	STM32**WL**	STM32**WB**			

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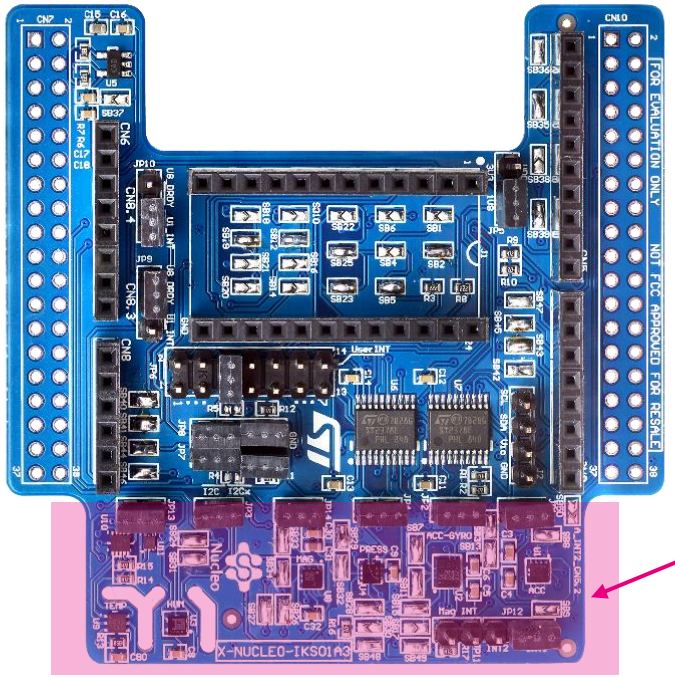
HW #2 **X-NUCLEO-IKS01A3** Board
Motion MEMS and Environmental Sensors



Low Power Accelerometer:

LIS2DW12

IMU Accelerometer + Gyroscope:

LSM6DSO

Pressure:

LPS22HH

Magnetometer:

LIS2MDL

Temperature:

STTS751

Humidity:

HTS221

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Online Hands-on Exercise with Sensors

Upcoming Events & Technical Seminars

Developing with Sensors Made Simple

Free massive open online course (MOOC) with hands-on exercises

Register for the course

Featured Events

22 Jun - 18 Aug 2020

Discover our STM32 security ecosystem, from theory to practice online workshop More

14 Jul - 14 Sep 2020

ST Sensors and Embedded Tech Virtual Event More

Event	Date	Location
ST Online Embedded Tour	19 Feb 2020 - 31 Jan 2021	Online
Motor Control hands-on workshop series	26 Feb - 19 Nov	USA
ST Technology Tour 2020	26 Mar - 05 Nov	USA/Canada
APEC 2020 - ST Virtual Booth	16 Apr - 31 Oct	Online
Sensor development MOOC with hands-on exercises	15 Jun - 02 Oct	On demand

https://www.st.com/content/st_com/en/about/events/events.html/sensor-development-with-x-cube-mems1-mooc.html

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Thank you

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