MEMS

Apr. 2013

More doc is here:
http://www.emcu.it/MEMS/MEMS.html

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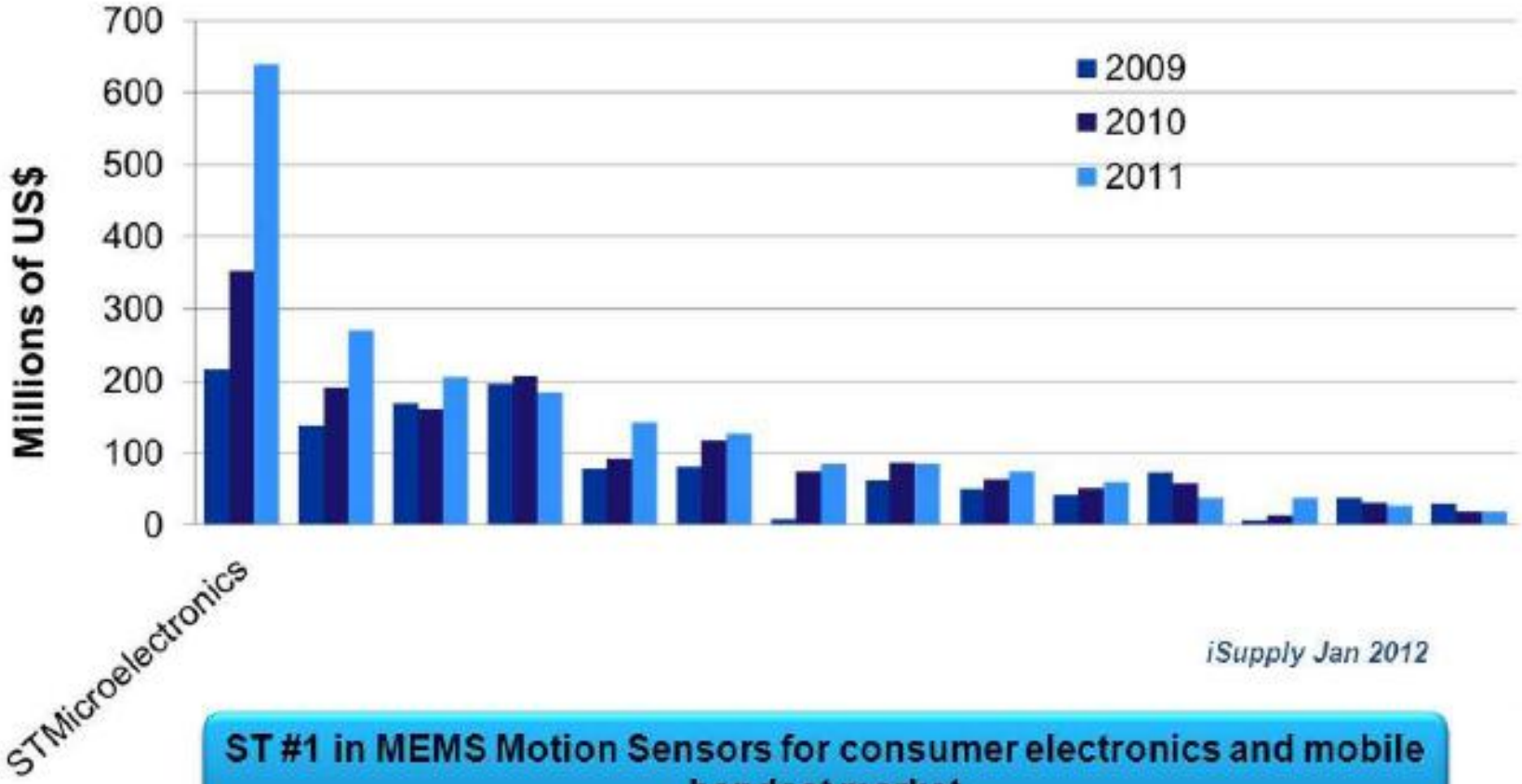
Top MEMS Manufacturers for Consumer and Mobile



ST #1 in MEMS Motion Sensors for consumer electronics and mobile handset market

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MEMS Enable New Applications

Optical Image Stabilization

Location Based Services

Indoor navigation

Advanced User Interface & Gaming

Augmented Reality

Fitness/Wellness & In-House Tele-health

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Sensors

- Accelerometers
- Gyroscopes
- E-compasses, magnetometers
- iNEMO Inertial Modules
- Pressure sensors
- Temperature sensors
- Touch sensors
- Microphone

Smart sensors, sensor hub

Smart sensors

Sensor with embedded core

iNemo engine software

Sensor fusion SW

http://www.emcu.it/MEMS/MEMS.html
http://www.st.com/web/en/catalog/sense_power/FM89

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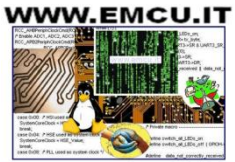
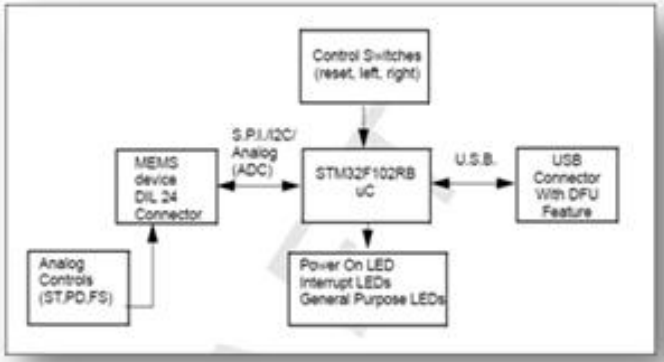
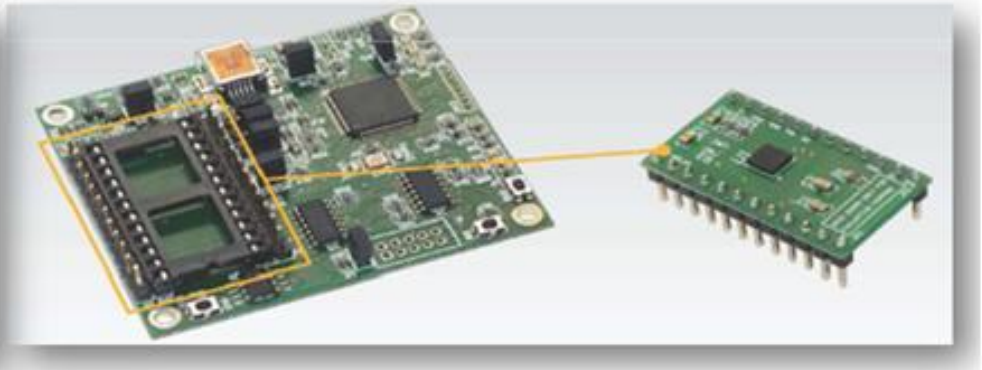


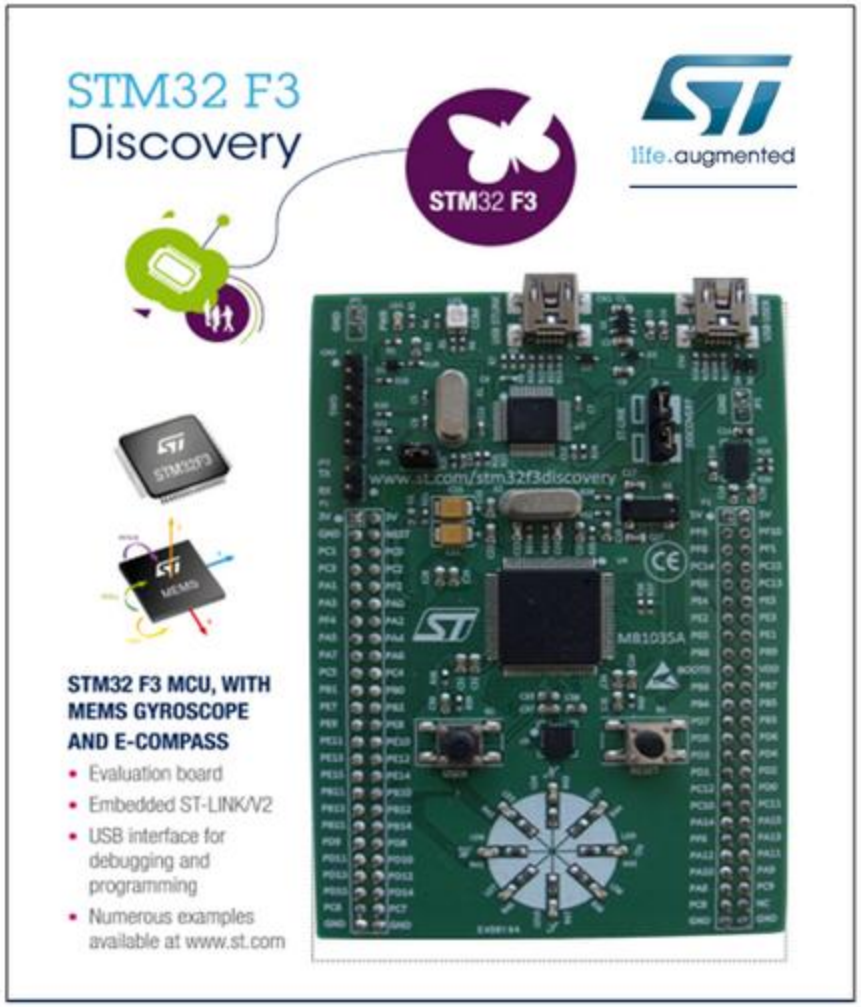
Universal evaluation board STEVAL-MKI109V2

- The eMotion motherboard and software is designed around an STM32 microcontroller. It is compatible with all ST Motion MEMS with the correct adapter.





http://www.emcu.it/MEMS/MEMS.html#Accelerometer_eva-board



•In circuit ST-LINK/V2 debugger / programmer included to debug Discovery kit applications or other target board applications.

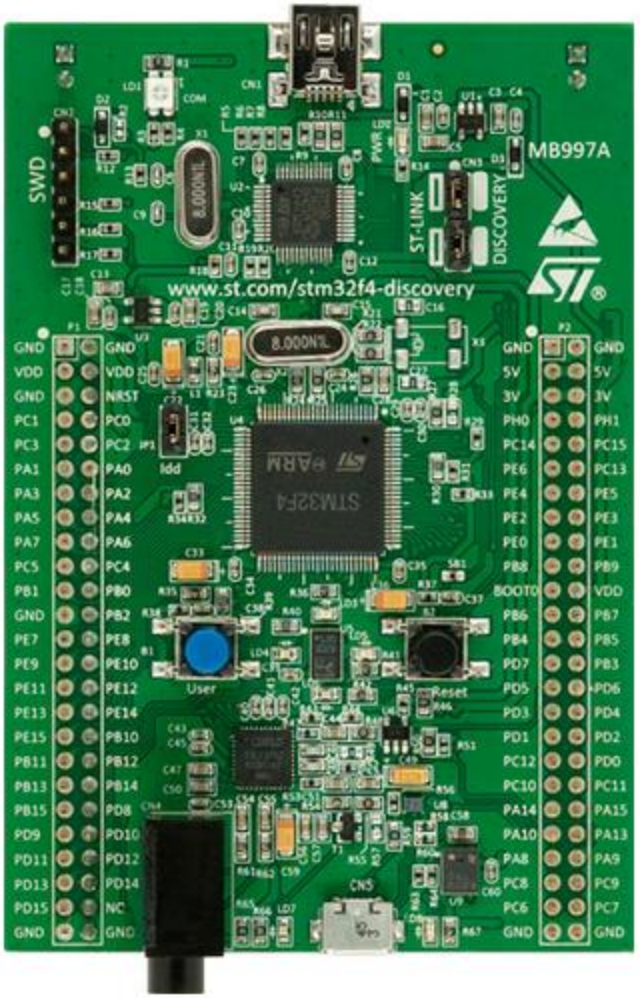
• Devices : **STM32F303VCT6**

•Included the ST MEMS devices :

- **L3GD20** 3-axis digital gyroscope.
- **LSM303DLHC** 6-axis geomagnetic module containing an e-compass including an accelerometer

http://www.emcu.it/STM32F3xx/STM32F3xx.html#Evaluation_Board

Key Features



- STM32F407VGT6 microcontroller featuring 32-bit ARM Cortex-M4F core, 1 MB Flash, 192 KB RAM in an LQFP100 package
- On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)
- Board power supply: through USB bus or from an external 5 V supply voltage
- External application power supply: 3 V and 5 V
- LIS302DL, ST MEMS motion sensor, 3-axis digital output accelerometer
- MP45DT02, ST MEMS audio sensor, omni-directional digital microphone
- CS43L22, audio DAC with integrated class D speaker driver
- Eight LEDs:LD1 (red/green) for USB communicationLD2 (red) for 3.3 V power onFour user LEDs, LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)2 USB OTG LEDs LD7 (green) VBus and LD8 (red) over-current
- Two push buttons (user and reset)
- USB OTG FS with micro-AB connector
- Extension header for all LQFP100 I/Os for quick connection to prototyping board and easy probing

http://www.emcu.it/STM32F4xx/STM32F4xx.html#STM32F4-Discovery_

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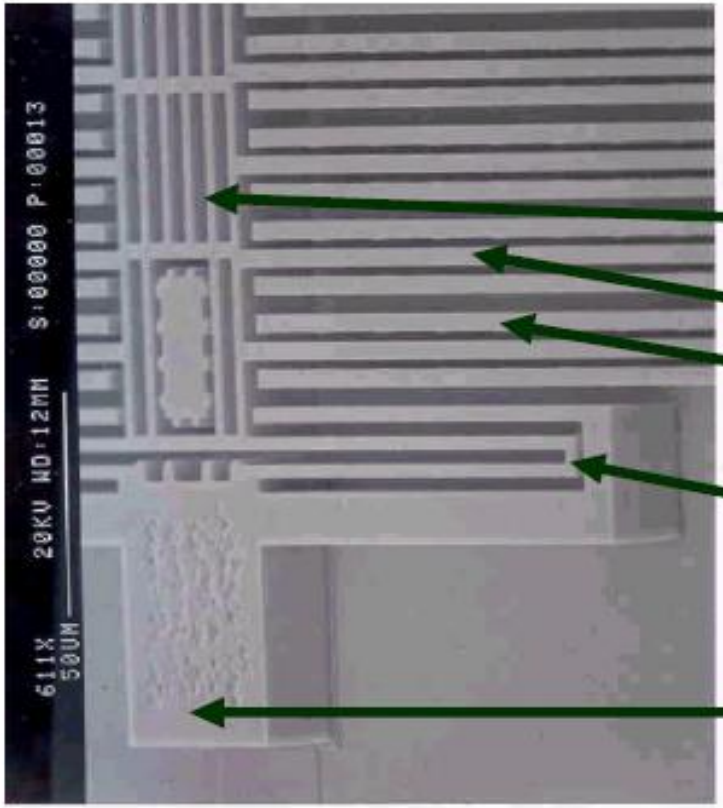
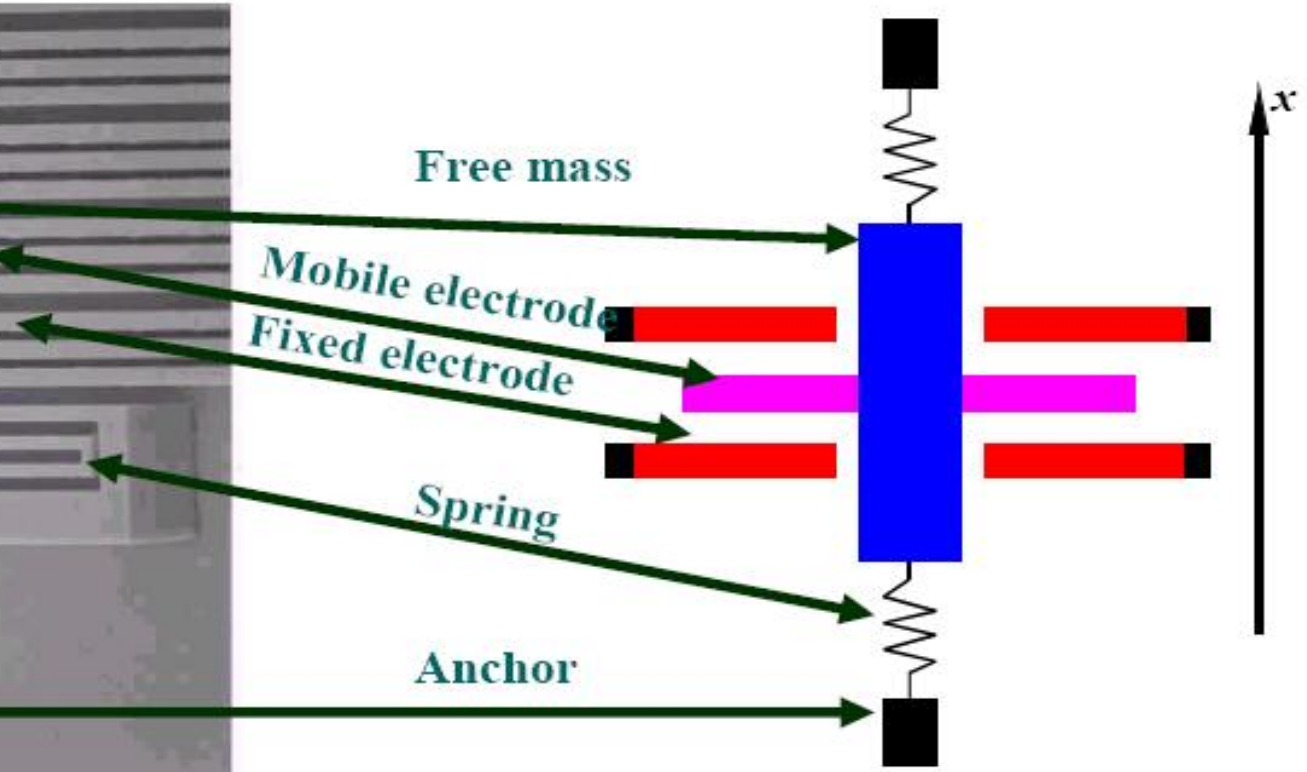
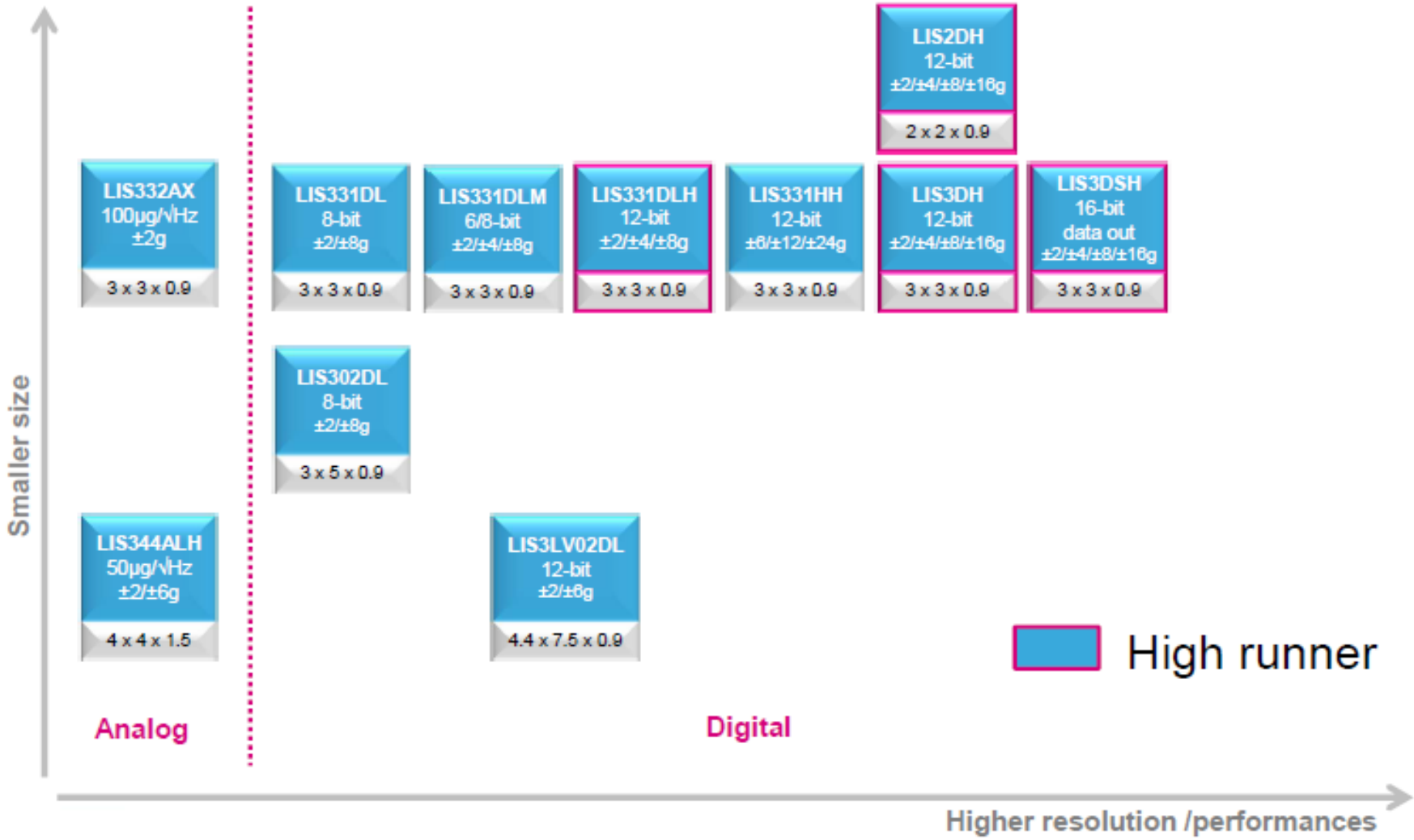
Accelerometers

Silicon implementation of mechanical elements

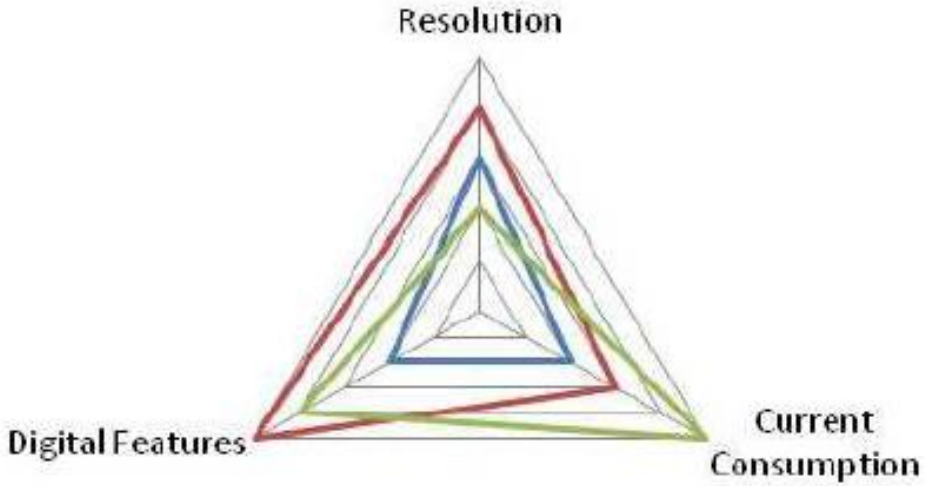




3-axis Accelerometers Portfolio



Always the Right Tradeoff



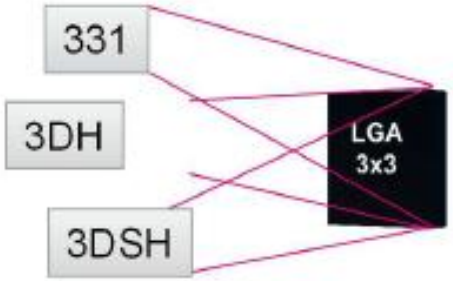
LIS331DLH

LIS3DH

LIS2DH

LIS3DSH

Pin to pin and software compatible



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High Performance Accelerometers

LIS331DLH

FEATURES

- User selectable from ±2g up to ±8g
- 16 bit data output
- Package - 3x3x1mm LGA
- 2 independent programmable interrupt generators for free-fall and motion detection
- Sleep to wake-up function

LIS3DSH

FEATURES

- User selectable form ±2g up to ±16g
- Embedded FIFO
- Embedded Finite State Machine
- 14-bit data resolution
- Package - 3x3x1mm LGA
- Higher performances – more functionalities integrated inside the sensor
- Complete customizable motion recognition

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Ultra low-power Accelerometers

LIS3DH

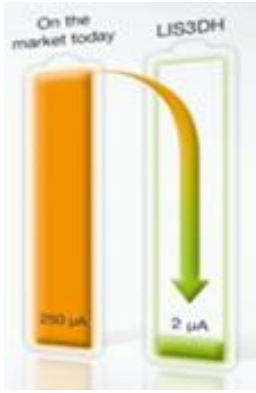
FEATURES

- Selectable Full-scale from ±2g up to ±16g
- High resolution
- Ultra low power consumption
- 4D/6D orientation detection
- Programmable interrupts
- Embedded FIFO
- Power-down and Sleep mode
- Digital Interfaces I2C/SPI
- Small Package 3x3x1mm LGA

LIS2DH

FEATURES

- Selectable Full-scale from ±2g up to ±16g
- High resolution
- Ultra low power consumption
- 4D/6D orientation detection
- Programmable interrupts
- Embedded FIFO
- Power-down and Sleep mode
- Digital Interfaces I2C/SPI
- **Small Package 2x2x1mm LGA**



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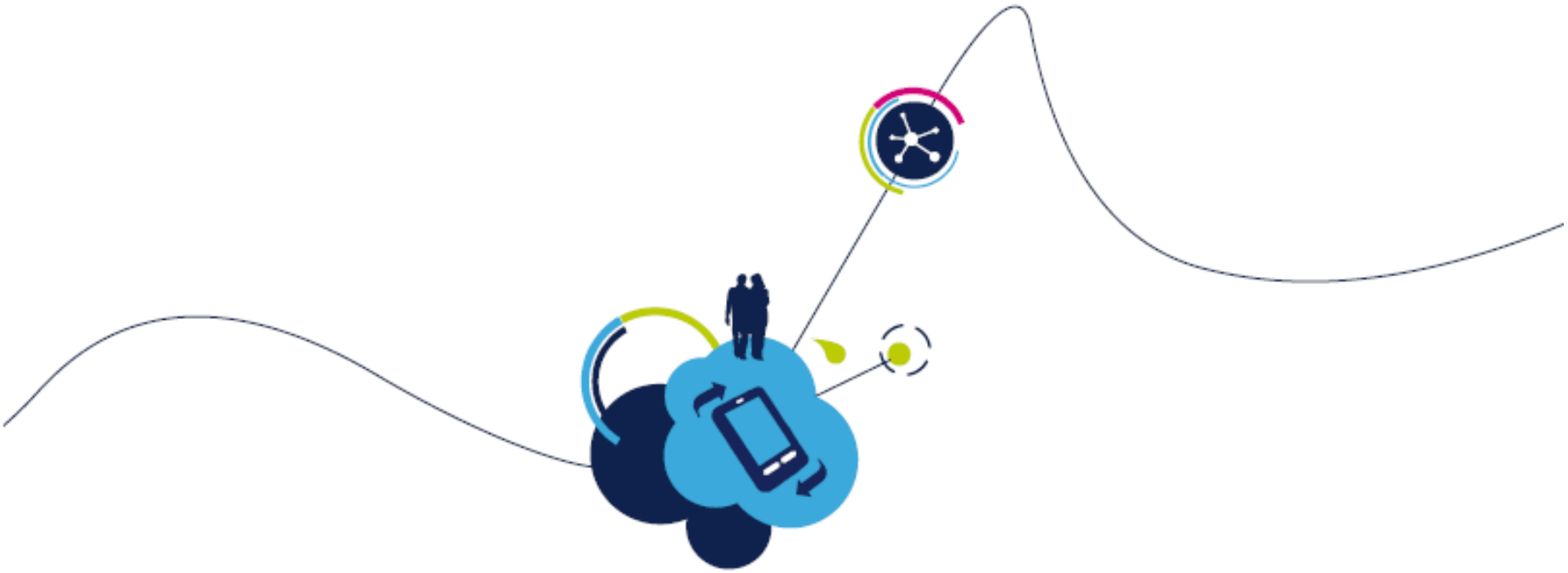
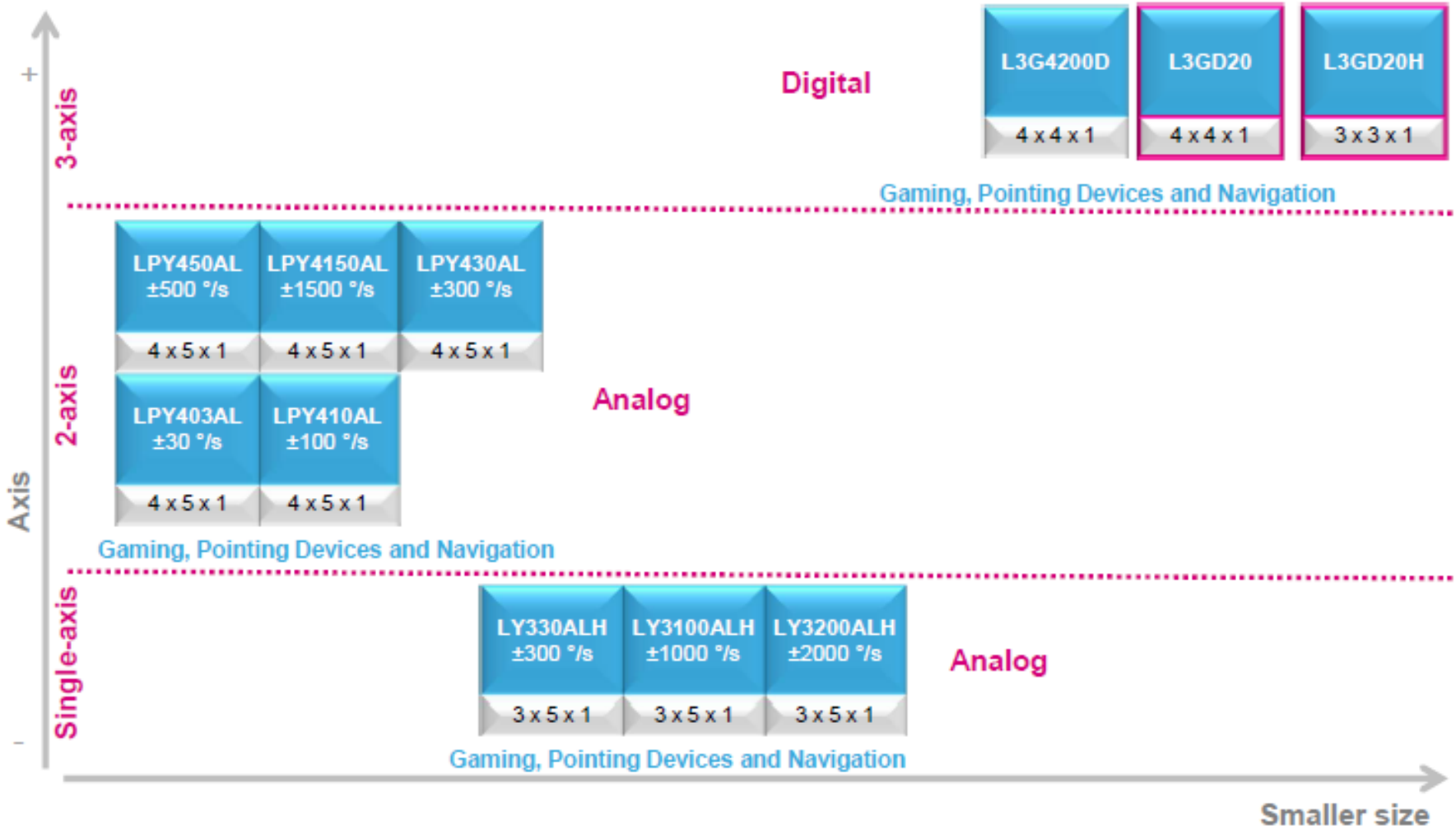


Gyroscopes

Gyroscopes Portfolio



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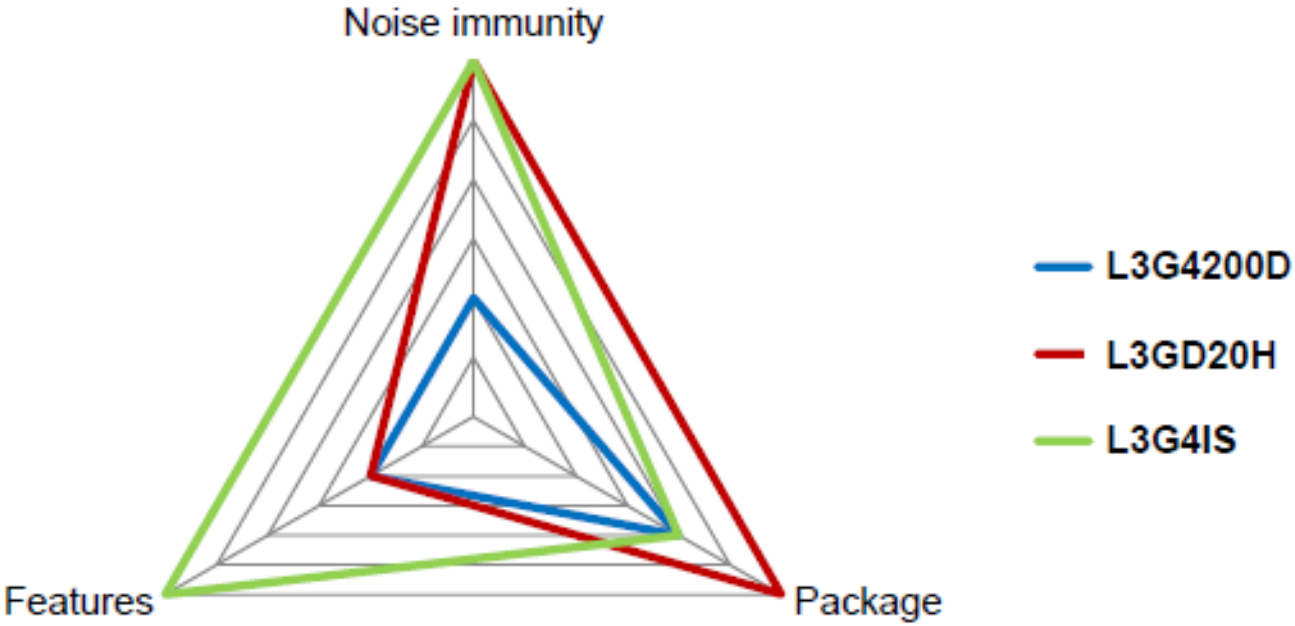
Always the Right Tradeoff



L3G4200D

L3GD20

L3GD20H

Pico Gyro

L3G4IS

Dual Core

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Gyroscopes

L3GD20

FEATURES

- Immunity to audio noise and mechanical vibrations
- Full-scale from ±250 dps3 up to ±2000 dps
- Digital interfaces I2C/SPI
- Embedded FIFO
- Programmable interrupts
- Power-down/sleep mode for smart power saving
- LGA package - 4x4x1mm

L3GD20H

FEATURES

- Immunity to audio noise and mechanical vibrations
- Full-scale from ±245 dps3 up to ±2000 dps
- Digital interfaces I2C/SPI
- Low power consumption
- Programmable interrupts
- Embedded FIFO
- Power-down/sleep mode for smart power saving
- **LGA package - 3x3x1mm**

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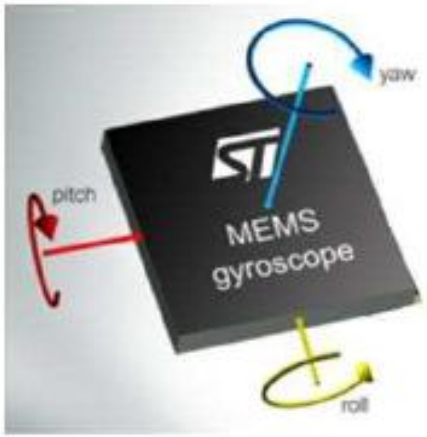
Gyroscope: L3GD20 vs. L3GD20H



	L3GD20	L3GD20H
Mechanical frequency	Single driving frequency: 20 KHz	Single driving frequency: 20 KHz
Wide supply voltage	From 2.4V to 3.6V	From 2.2V to 3.6V
Turn-on time	250 msec	50 msec
Supply current	6.1 mA	5.0 mA
Rate noise density	0.03 dps/√Hz	0.011 dps/√Hz
Output Data Rate	105 / 208 / 420 / 840 Hz	12 / 24 / 48 / 96 / 190 / 380 / 758 Hz
Digital interfaces	SPI / I²C	SPI / I²C
Embedded FIFO	5 different modes	7 different modes
Package size	4x4x1 LGA-16	3x3x1 LGA-16

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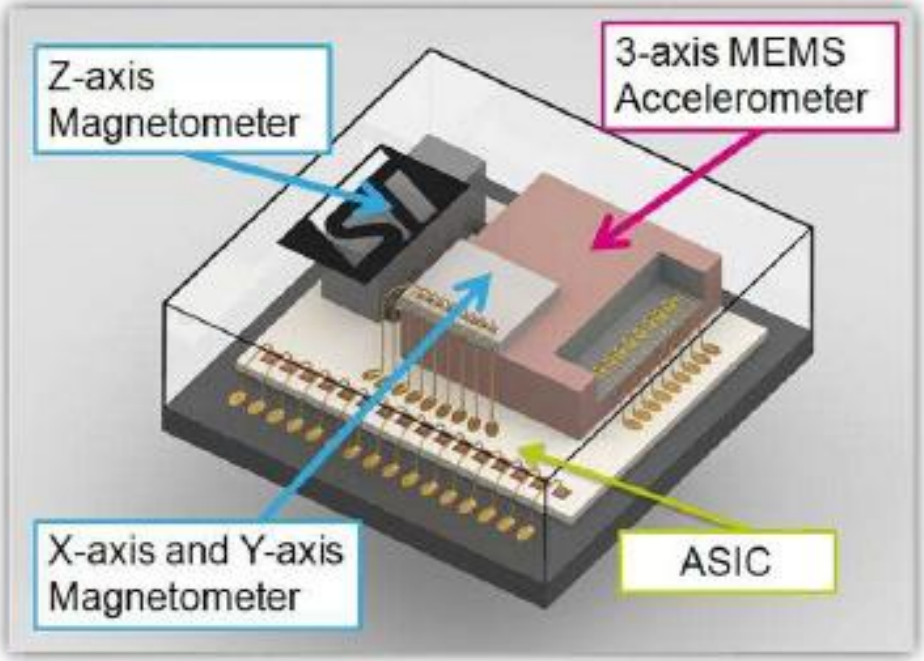
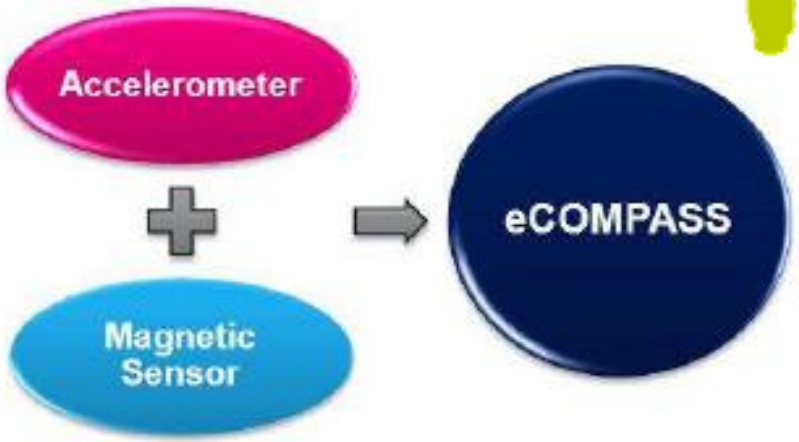
Digital Compasses

eCompasses

ST's digital compasses integrate a **3-axis digital accelerometer** with a **3-axis digital magnetic** sensor in a single LGA package





Integration of different sensors in the same package

- More compact, robust and easy-to-assemble solutions
- Superior stability over time and temperature
- Particularly suitable for applications such as location-based services, pedestrian dead reckoning, map/display orientation, and direction finding

eCompasses

LSM303DLH

Key features

- 3-axis accelerometer: from ±2 to ±8 g
- 3-axis magnetic sensor: up to 8.1 gauss
- Independent sensing power management
- Magnetic resolution: 8 mgauss
- I²C interface
- Package: LGA-28, 5.0 x 5.0 x 1.0 mm³

LSM303DLM

Key features

- 3-axis accelerometer: from ±2 to ±8 g
- 3-axis magnetic sensor: up to 8.1 gauss
- Low power consumption
- Independent sensing power management
- Magnetic resolution: 5 mgauss
- I²C interface
- Package: LGA-28, 5.0 x 5.0 x 1.0 mm³

Parameter *	LSM303DLH	LSM303DLM
Magnetic measurement range	1.3 to 8.1 gauss	1.3 to 8.1 gauss
Magnetic sensitivity – X,Y axis	0.9 to 4.3 mgauss/digit	0.9 to 4.3 mgauss/digit
Magnetic sensitivity – Z axis	1 to 4.8 mgauss/digit	1 to 4.8 mgauss/digit
Magnetic resolution	8 mgauss	5 mgauss

The LSM303DLM replaces the LSM303DLH compass and introduces additional improvements:

- 50% less power consumption
- 30% increase in magnetic resolution
- No need for a dedicated digital supply voltage for magnetic digital core

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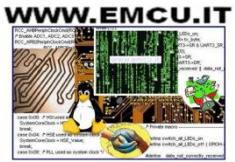
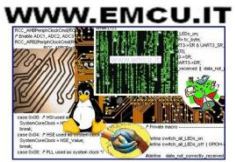


eCompasses

Products : 4 |

Part Number	Marketing Status	Package	Sensing Axes	Range(FS) typ(g)	Magnetic Range(M_FS) typ(Gauss)	Output Type
LIS3MDL	Evaluation	VFLGA 2X2X1 12LD PITC...	X, Y, Z	-	12	Digital
LSM303D	Active	LLGA 16 3x3x1.0; LLGA ...	X, Y, Z	± 2 ± 6 ± 8 ± 16	12	Digital
LSM303DLHC	Active	LGA 14 3x5x1.0	X, Y, Z	±2 ±4 ±8 ±16	8.1	Digital
LSM303DLM	Active	LGA 28 5x5x1.0	X, Y, Z	±2,±4,±8	8.1	Digital



iNEMO

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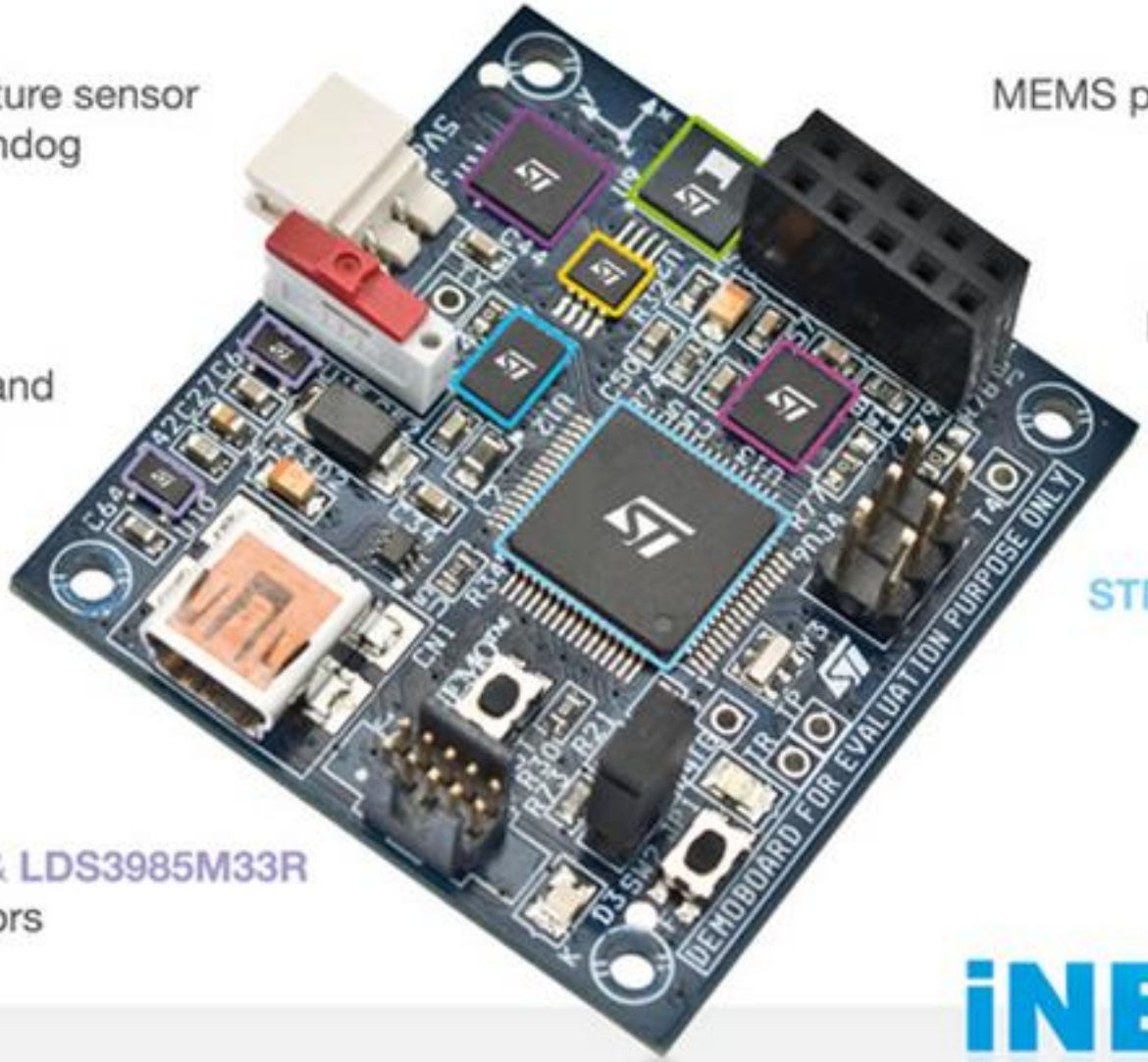
iNEMO™ V2 - EvaBoard

STLM75DS2F
Digital temperature sensor & thermal watchdog

LPS001DL
MEMS pressure sensor

LPR430AL
MEMS Pitch & Roll gyroscope

LSM303DLH
6-axis module: accelerometer and magnetometer



LY330ALH
MEMS Yaw gyroscope

STM32F103RET7
32-bit MCU

LD3985M18R & LDS3985M33R
Voltage regulators

iNEMO™

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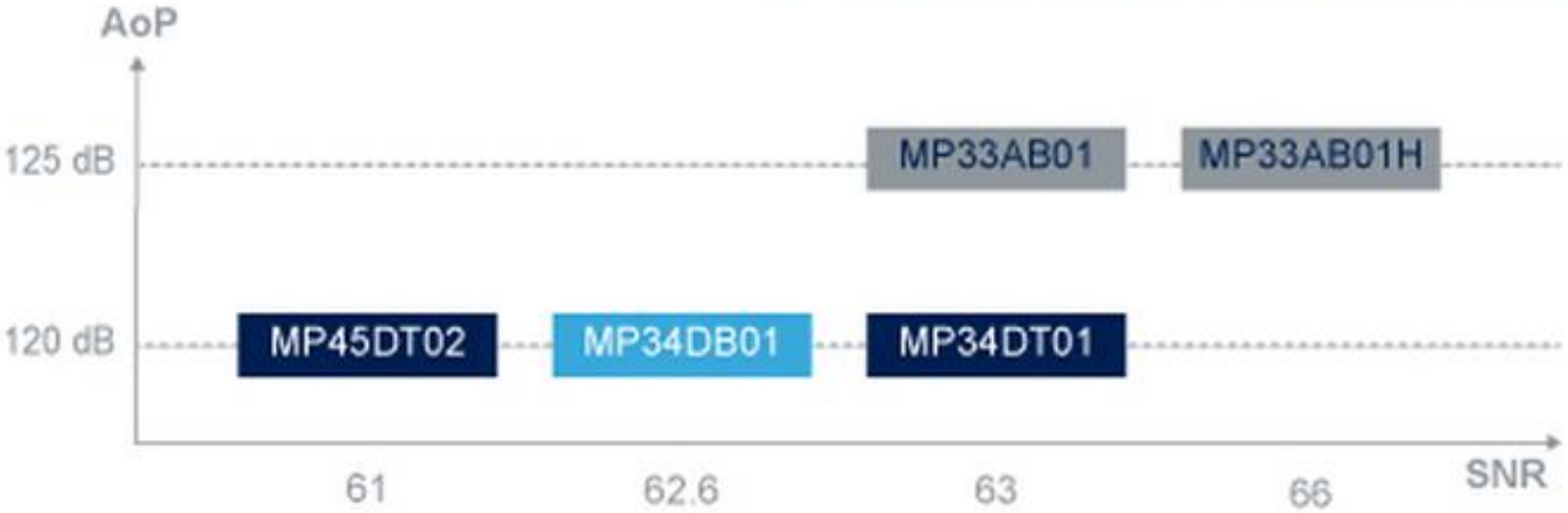
Microphones

- Best-in-class audio performance
- Ultra-miniaturized packages
- Top port devices simplify board design
- ST MEMS microphones are the unique with bottom and top port offering same performance

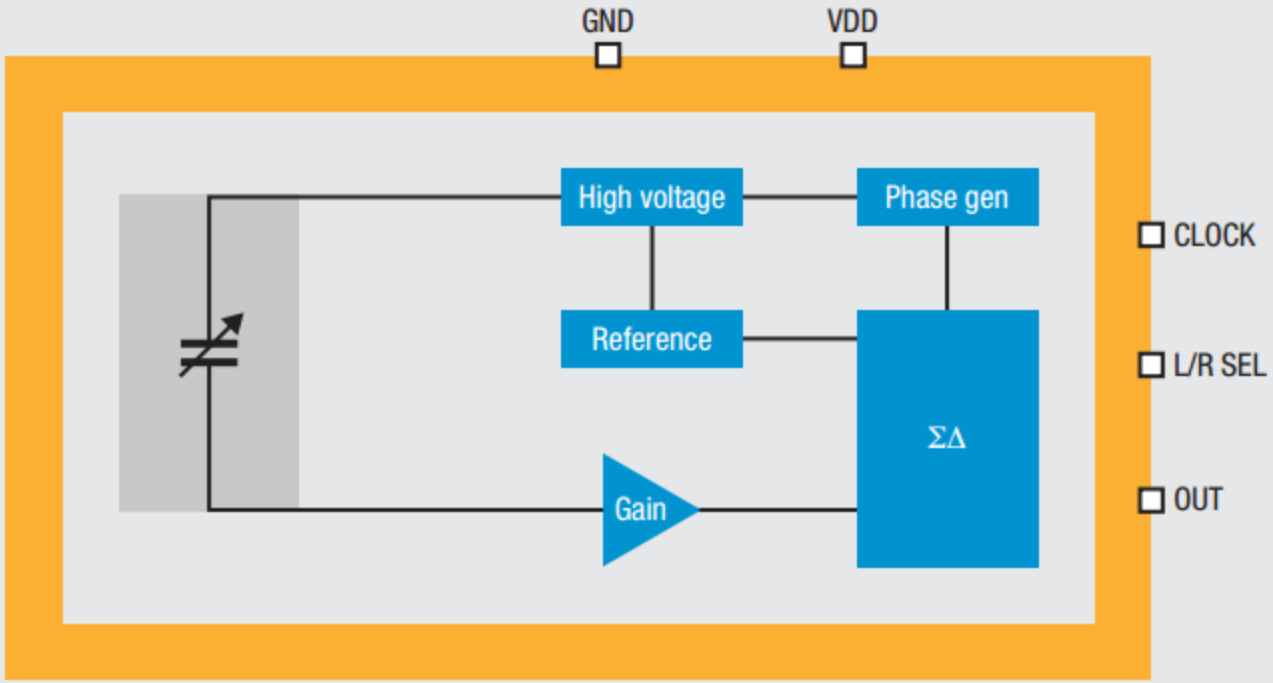


Microphones

- Single supply voltage operation
- up to **66** dB SNR
- 120 dB SPL acoustic overload point
- Omni-directional sensitivity
- **PDM** single-bit output with stereo operation support
- Flat frequency response over the full professional audio bandwidth (**20 Hz to 20 kHz**)
- Low power consumption
- Temperature range from **-30 to +100 ° C**

Microphones

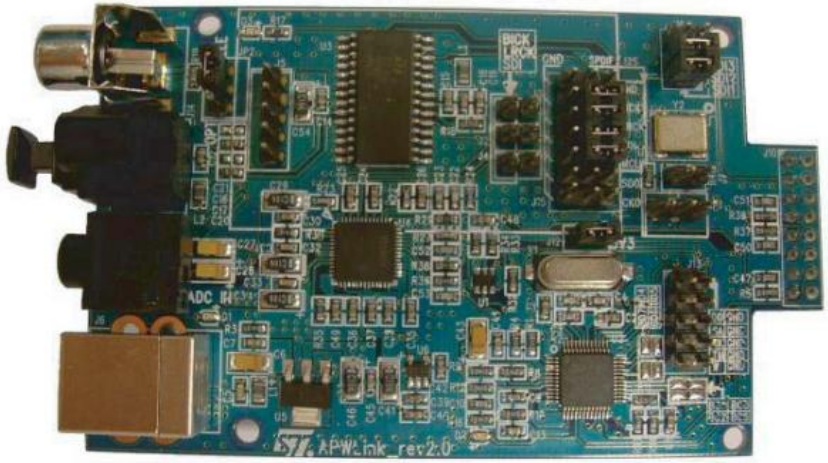
Diagram



- Pulse density modulation (PDM) digital output
- Internal reference voltage
- No external components required
- Stereo operation capability

Eva Board

STEVAL-CCA035V1



STEVAL-MKI138V1

MP34DT01 microphone adapter board

STEVAL-MKI126Vx

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Pressure

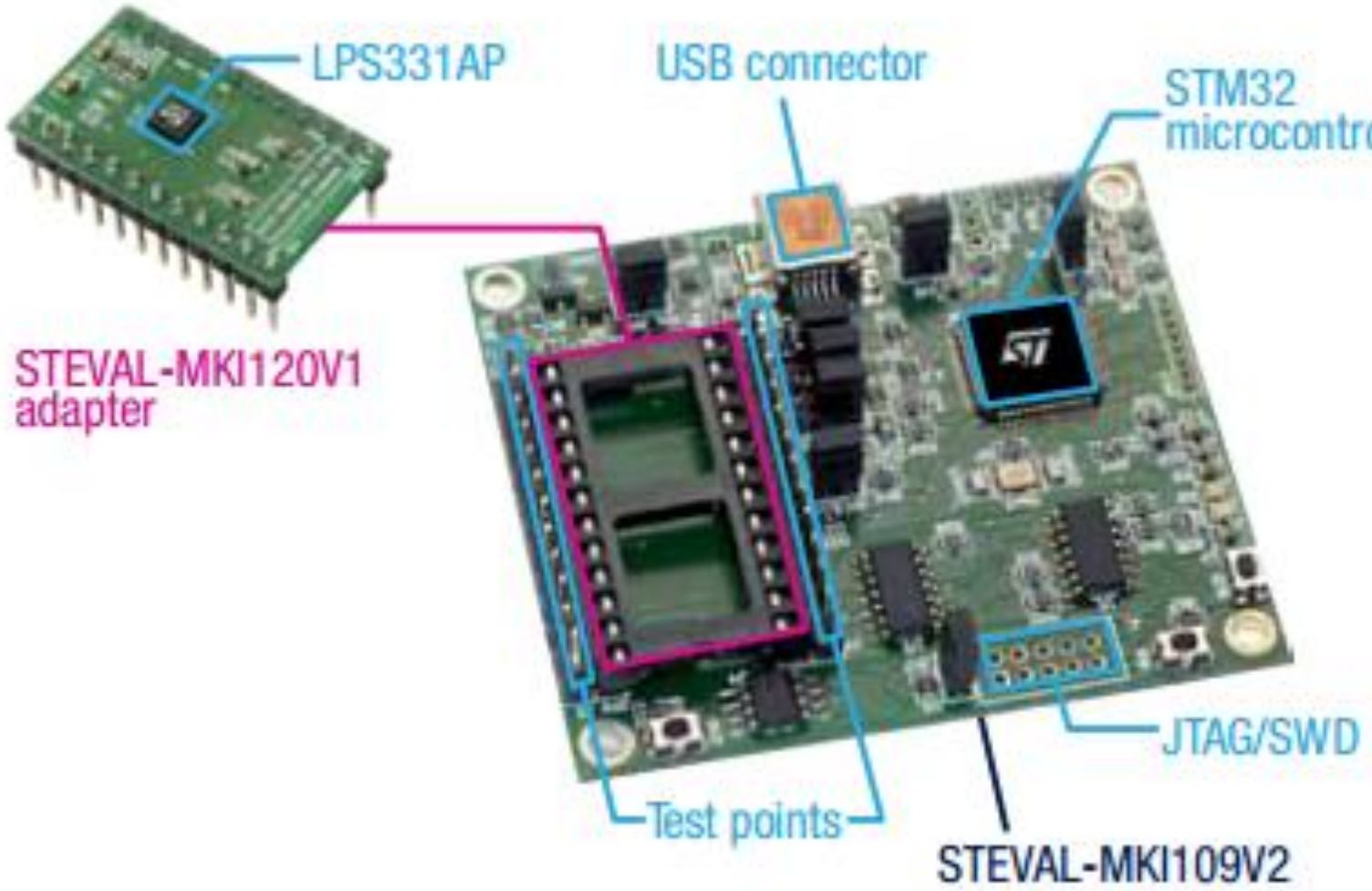
Targeted applications

- Indoor and outdoor navigation
- Enhanced GPS for dead-reckoning
- Altimeter and barometer for portable devices
- Weather station equipment
- Sport watches

Pressure

- **260** to **1260 mbar** absolute pressure range
- High-resolution mode: **0.020** mbar RMS
- Low power consumption:
  - Low resolution mode: **5.5** µA
  - High resolution mode: **30** µA
- High overpressure capability: 20x full scale
- **Embedded temperature compensation**
- Embedded 24-bit ADC
- **SPI** and **I2C** interfaces
- Supply voltage: 1.71 to 3.6 V
- Temperature range: -40 to +85 ° C
- High shock survivability: 10,000g

Pressure - EvaBoard



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