Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

MEMS and Sensors
Smart Motion tracking, IoT and enhanced user experience

life.augmented

ST MEMS shipped
11 BILLION

Content

The one-stop MEMS and Sensors supplier

For your MEMS needs, ST provides a complete solution

ST has shipped more than 10 billion micro-electromechanical sensors and has one of the industry's most extensive MEMS portfolio including accelerometers, gyroscopes, digital compasses, inertial modules, MEMS microphones, and environmental sensors including pressure, temperature and humidity.

- A unique sensor portfolio, from discrete to fully-integrated solutions, to meet all design needs
- High-volume manufacturing capacity to provide cost-competitive solutions, fast time-to-market and security of supply
- High-performance sensor fusion to improve the accuracy of multi-axis sensor systems in order to enable new emerging and highly-demanding applications, such as indoor navigation and location-based services such as IoT, indoor navigation and location-based services
- High-quality products, already tested in different application fields, including mobile, portable, gaming, consumer, automotive and health care segments
- Multiple sites dedicated to MEMS, with full in-house dual sourcing, guaranteeing 100% security of supply

COMPLETE SOLUTION
- Large sensor portfolio
- Integrated HW + SW solutions
- 100% security of supply
- Scalability of solutions
- Quality is a must for ST
- ST is MEMS market leader
- STM32 Open Development Environment support

ST's leadership continues with a strong commitment to Sustainable Technology, delivering motion MEMS products with decreasing environmental impact, generation after generation, providing improved life quality by bringing environmental and social benefits to end users.

life.augmented | **SUSTAINABLE** TECHNOLOGY

Sensors in your hand

All portable devices become easy-to-use and fun

CONSUMER APPLIANCES

- Smartphones and tablets (AXL, GYRO, MAG, PS, RH, IMU, Microphones)
  - Motion tracking for gesture-based user interfaces
  - Electronic compasses
  - Location-based services
  - Heading and navigation
  - Relative humidity sensing
- Gaming devices (AXL, GYRO, MAG)
  - Accurate detection of orientation and angular rate
- Remote control (AXL, GYRO, MAG, Microphones)
  - Gesture recognition and pointing (3D mouse)
- Notebooks and ultrabooks (AXL, GYRO, MAG, TS)
  - Sensor hub
  - Hard-disk protection
  - Lid closure
  - Orientation
- Cameras (DSC/DVD) (AXL, GYRO)
  - OIS and user interfaces

AXL: accelerometer
GYRO: gyroscope
MAG: magnetometer
PS: pressure sensor
TS: temperature sensor
RH: humidity sensor
OIS: optical image stabilization
IMU: inertial module unit

Sensors in your training

Sensors for improving your fitness workout

FITNESS AND WELLNESS APPLICATIONS

- Athlete performance monitoring
  - Movement recognition through shoes and wearable sensors (AXL, IMU)
  - Golf and tennis swing detection (AXL, GYRO, MAG)
  - Body tracking recognition (AXL, GYRO, MAG)
- Watches, personal navigation devices (PND) and pedometers
  (AXL, GYRO, MAG, PS, IMU)
  - Map orientation
  - Heading and navigation
  - Power-saving using auto-wake-up functionality
  - Taps (display activation)
- Treadmills and barbells (AXL)
  - Tilting angle and shock detection during steps
- Step detection
- Pedometer
- Step counter

AXL: accelerometer
GYRO: gyroscope
MAG: magnetometer
PS: pressure sensor
TS: temperature sensor
RH: humidity sensor
IMU: inertial module unit

Sensors in your home/Smart appliances

Devices offer enhanced user interfaces helping to decrease energy consumption

HOME APPLIANCES

- Home alarm systems and car garages (AXL, MAG, Microphones)
  - Vibration and shock detection
  - Detection of door open/close position
- White goods (AXL, GYRO, PS, RH, IMU, TS, IMU)
  - Control of basket rotation (washing machines)
  - Power consumption optimization
  - Vibration detection for noise reduction and maintenance
  - Detection of door open/close position
  - Fluid column pressure measurement
- Smart home automation control (TS, RH)
  - Heating, ventilation and air conditioning (HVAC, PS)
  - Relative humidity level monitoring and weather stations
  - Incubators, refrigerator crispers and storage
  - Respiratory equipment/humidifiers
- Electric, gas/water meters (AXL, MAG)
  - Tilting, vibration and shock detection
  - Anti-tamper mechanisms
- Home environment monitoring (TS, RH, PS)
  - Ambient temperature and relative humidity monitoring

|	
AXL: accelerometer	TS: temperature sensor
GYRO: gyroscope	RH: humidity sensor
MAG: magnetometer	OIS: optical image stabilization
PS: pressure sensor	IMU: Inertial Module Unit

Sensors in your car

For safer cars and easier navigation

AUTOMOTIVE

- Telematics
  - E-Calls (AXL)
  - Black boxes and crash detection (AXL)
  - Fleet tracking (AXL, GYRO, IMU)
  - Driver's behavior tracking (AXL, GYRO, IMU)
  - Key fobs (AXL)
- Security
  - Car alarms and anti-theft systems (AXL)
  - Tilt detection (AXL)
- Navigation
  - 3D navigation (AXL, GYRO, IMU)
  - Dead reckoning (AXL, GYRO, IMU)
- Safety
  - SRS with rollover detection (AXL, GYRO, IMU)
  - Hill-start assist, head safety light leveling and braking assistance (AXL)
  - Vehicle dynamics, stability control (AXL, GYRO, IMU)
  - Electronic suspensions (AXL, GYRO, IMU)
  - Tire pressure monitoring systems (AXL)
  - Smart tires (AXL)

AXL: accelerometer
GYRO: gyroscope
MAG: magnetometer
TS: temperature sensor
RH: humidity sensor
IMU: Inertial Module Unit

GPS
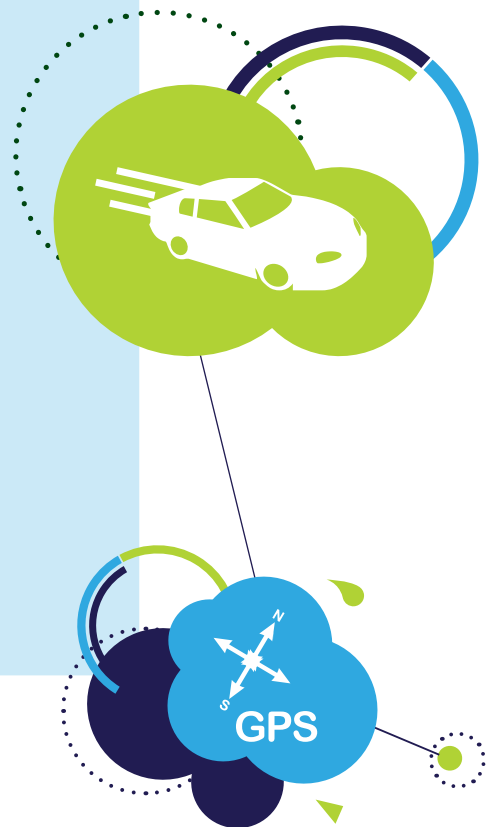
Sensors at work

## For industrial applications

INDUSTRIAL

- Robotics and automation
  (AXL, GYRO, IMU)
  - nertial navigation and wheel
    encoder position accuracy
  - Self-balancing robots
- Condition monitoring of
  transportation and industrial
  equipment (high-g AXL, RH, TS)
  - Vibration and rotational speed
    monitoring
- Asset and parcel tracking and
  monitoring (High-g AXL, GYRO, TS)
  - Shock detection and logging
- Building and structure monitoring
  (AXL)
  - Vibration and tilt monitoring
- Seismic exploration and
  geophones (AXL)
  - Vibration monitoring
- Drills (AXL, GYRO, IMU)
  - Safety and chuck rotation
    monitoring
  - Tilt detection

AXL: accelerometer
GYRO: gyroscope
MAG: magnetometer

TS: temperature sensor
RH: humidity sensor
IMU: Inertial Module Unit
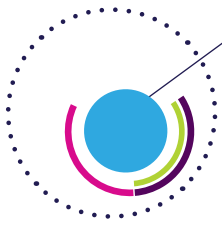
Sensors in health care

For advanced medical applications

MEDICAL

- Implantable medical devices (AXL)
  - Pacemakers, defibrillators and neuro-stimulators
- Concussion detection in sports (high g AXL)
  - Helmets, patches and mouth guards
- Motion detection and body motion reconstruction (AXL, GYRO, MAG, PS, IMU)
  - Man-down and personal emergency response systems (PERS)
  - Rehabilitation and training
  - Improved straight line motion and tilt detection for safety
- Instrument guidance in surgery (AXL, GYRO, IMU)
- Healthcare mobility aids including wheelchairs and scooters (AXL, GYRO, PS, IMU)

AXL: accelerometer
GYRO: gyroscope
MAG: magnetometer
PS: pressure sensor
TS: temperature sensor
RH: humidity sensor
OIS: optical image stabilization
IMU: Inertial Module Unit

Accelerometers

Smart motion features with ultra-low power consumption

ST's state-of-the-art MEMS accelerometers include analog and digital sensors featuring up to ±400g acceleration full scale and from 1.62 to 3.6 V supply voltage. Accelerometers have advanced power-saving features that make them suitable for ultra-low-power applications. These features include low-power mode, auto wake-up function and a FIFO buffer that can be used to store data, thus reducing the host processor loading and system power consumption.
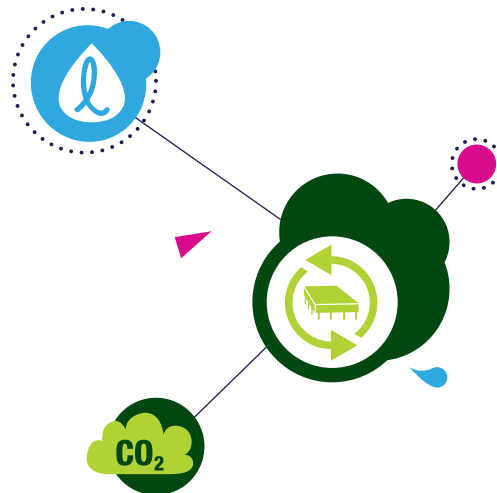
The small size and embedded features of ST's accelerometers make them an ideal choice for handheld portable applications and where long battery life is required.

The ST accelerometers can be applied in Industrial applications too and in the portfolio are present also Automotive grade MEMS accelerometers qualified according to AEC-Q100.

BENEFITS

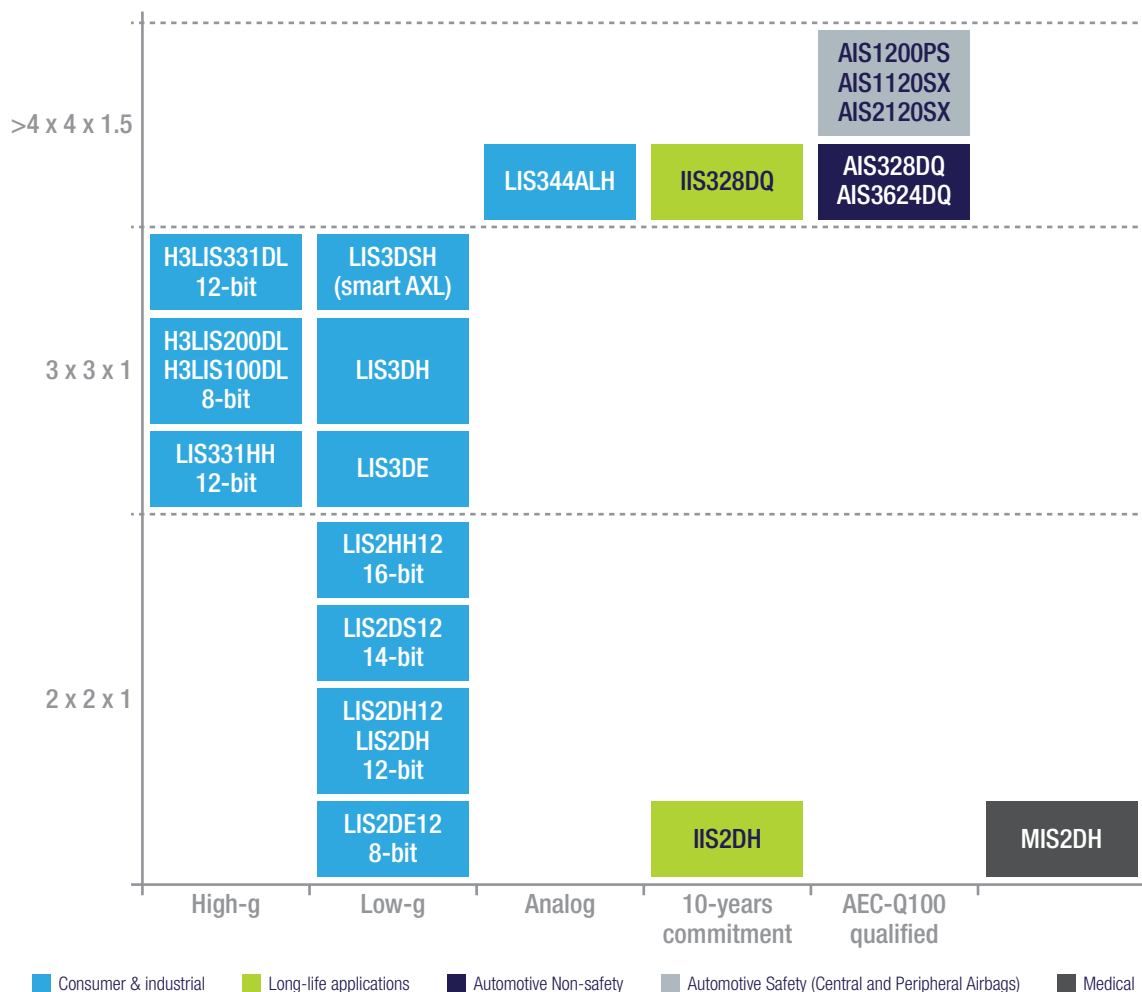- High performance
- Small footprint for ultra-compact solutions
- Low power consumption and ultra-low-power operating modes that allow advanced power saving and smart sleep-to-wake-up functions
- Practical and easy-to-use built-in features
- Embedded state machines enable custom motion recognition reducing system complexity
- Pinout compatibility
- FIFO

**SUSTAINABLE TECHNOLOGY**

CO_2 -42%

-43%

ACCELEROMETERS

>4 x 4 x 1.5		AIS1200PS AIS1120SX AIS2120SX
	LIS344ALH	IIS328DQ	AIS328DQ AIS3624DQ
3 x 3 x 1	H3LIS331DL 12-bit / LIS3DSH (smart AXL)	
	H3LIS200DL H3LIS100DL 8-bit / LIS3DH	
	LIS331HH 12-bit / LIS3DE	
2 x 2 x 1	LIS2HH12 16-bit	
	LIS2DS12 14-bit	
	LIS2DH12 LIS2DH 12-bit	
	LIS2DE12 8-bit	IIS2DH	MIS2DH
	High-g / Low-g	Analog	10-years commitment	AEC-Q100 qualified

Legend: Consumer & industrial · Long-life applications · Automotive Non-safety · Automotive Safety (Central and Peripheral Airbags) · Medical

ACCELEROMETERS

Part number	Package/size (mm)	Typical full-scale (g)	Typical noise density (µg/√ Hz)	Key features
LIS2DH12	LGA12 (2 x 2 x 1)	±2; ±4; ±8; ±16	220	12-bit, embedded FIFO, board-compatible with compasses
LIS2HH12	LGA12 (2 x 2 x 1)	±2; ±4; ±8	140	16-bit, higher temperature stability
LIS2DS12	LGA12 (2 x 2 x 0.8)	±2; ±4; ±8; ±16	100	14-bit, embedded smart functionalities
LIS2DE12	LGA12 (2 x 2 x 1)	±2; ±4; ±8; ±16	220	8-bit
LIS3DH	LGA16 (3 x 3 x 1)	±2; ±4; ±8; ±16	220	12-bit
LIS331HH	LGA16 (3 x 3 x 1)	±6; ±12; ±24	650	12-bit, up to ±24g full scale
LIS344ALH	LGA16 (4 x 4 x 1.5)	±2; ±6	50	Low noise, analog output
AIS328DQ	QFN24 (4 x 4 x 1.8)	±2; ±4; ±8	218	AEC-Q100 qualified, temperature range -40 to +105 °C
AIS3624DQ	QFN24 (4 x 4 x 1.8)	±6; ±12; ±24	600	AEC-Q100 qualified, ideal for emergency calls, temperature range -40 to +105 °C
AIS1120SX/ AIS2120SX	SO8	±120	-	AEC-Q100 qualified, Airbag central unit temperature range -40 to +105 °C
AIS1200PS	SO16	±200	-	AEC-Q100 qualified, Airbag satellite sensor temperature range -40 to +125 °C
IIS328DQ	QFN24 (4 x 4 x 1.8)	±2; ±4; ±8	218	10 years longevity, Golden manufacturing flow, robust and highly selective testing, temperature range -40 to +105 °C
IIS2DH	LGA12 (2 x 2 x 1)	±2; ±4; ±8; ±16	220	10 years longevity, Golden manufacturing flow, robust and highly selective testing,
H3LISxxxDL	LGA16 (3 x 3 x 1)	±100; ±200; ±400	15000	Low power consumption (ideal for high shock detection)
MIS2DH	LGA12 (2 x 2 x 1)	±2; ±4; ±8; ±16	220	Specifically designed for medical applications including Class III FDA implantable devices

Note: a complete list of part numbers is available at www.st.com/accelerometers
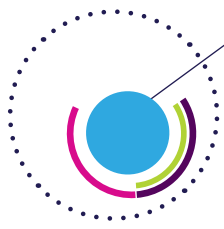
Gyroscopes

Superior accuracy and stability over time and temperature

ST's innovatively-designed sensors with different combinations of analog and digital outputs provide high performance. Our gyroscopes offer superior stability over time and temperature, with a rate noise density up to 0.011 dps/√Hz. This guarantees the level of accuracy required by the most advanced motion-based applications.

These 3-axis gyroscopes have a single sensing structure for motion measurement along all three orthogonal axes, while other solutions on the market rely on two or three independent structures. ST's solution eliminates any interference between the axes that inherently degrades the output signal, thus increasing the accuracy and reliability of motion-controlled functionalities.

ST's gyroscopes measure angular rate with a large full-scale range to meet the requirements of different applications, ranging from gesture recognition and image stabilization, to indoor and personal navigation and OIS applications. ST's angular rate sensors are already used in mobile phones, tablets, 3D pointers, game consoles, digital cameras and many other devices.

The ST gyroscopes are the right choice to be implemented in a wide range of Industrial applications; also available are Automotive grade MEMS gyroscopes qualified according to AEC-Q100.
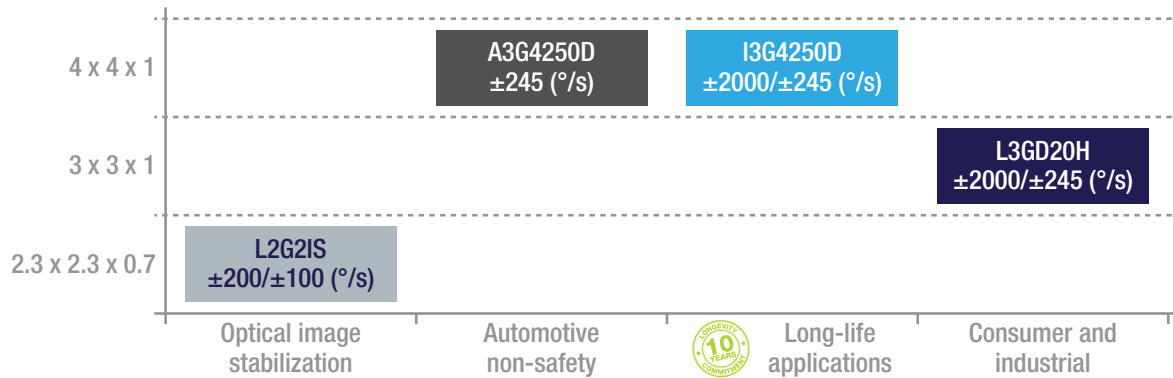
BENEFITS

- Wide full-scale range (from ±65 to ±2000 dps) for optical image stabilization and smart user interfaces
- High performance combined with low power consumption to address demanding applications and extend battery life
- Embedded FIFO for smart data storage and power saving
- Fast start-up for high responsiveness and system efficiency

SUSTAINABLE TECHNOLOGY

CO_2 -33%

💧 -32%

3-AXIS DIGITAL GYROSCOPES

4 x 4 x 1	A3G4250D ±245 (°/s)	I3G4250D ±2000/±245 (°/s)
3 x 3 x 1		L3GD20H ±2000/±245 (°/s)
2.3 x 2.3 x 0.7	L2G2IS ±200/±100 (°/s)	

Optical image stabilization · Automotive non-safety · Long-life applications · Consumer and industrial

3-AXIS DIGITAL GYROSCOPES

Part number	Package/size (mm)	Typical full scale (dps)	Typical noise density (dps/√Hz)	Key features
A3G4250D	LGA16 (4 x 4 x 1.1)	± 245	0.03	AEC-Q100 qualification, low noise and high/stability over temperature
L2G2IS	LGA (2.3 x 2.3 x 0.7)	±100/±200	0.06	OIS gyroscope
L3GD20H	LGA16 (3 x 3 x 1.0)	± 245/±500/±2000	0.011	Embedded FIFO
I3G4250D	LGA16 (4 x 4 x 1.1)	± 245/±500/±2000	0.03	10 years longevity, Golden manufacturing flow, robust and highly selective testing.

Note: a complete list of part numbers is available at www.st.com/gyroscopes
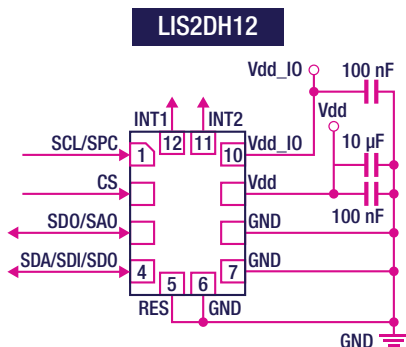
# Digital compasses

Accurate compass heading in any condition

ST's digital compasses include combo solutions, with accelerometer and magnetic sensor integrated in a single LGA package and standalone magnetometers, to give the possibility of designing a solution locating the magnetic sensor in the suitable position of printed circuit board (PCB).

Accurately detecting the direction and magnitude of external magnetic fields and using accelerometer measurements for tilt compensation, ST's digital compasses ensure very accurate compass heading even when the portable device is inclined.

ST's LSM303AGR combines high performance, low power accelerometer and magnetometer with high dynamic range (+/-49 gauss) with temperature offset compensation. LSM303AGR includes embedded self-test and smart power functionalities to minimize current consumption. The LSM303AGR is board and software compatible with the latest generation of accelerometers, thus offering maximum design flexibility.

LIS2DH12

Vdd_IO	100 nF
INT1 INT2	Vdd
SCL/SPC 1	12 11 10 Vdd_IO 10 µF
CS	Vdd
SDO/SAO	GND 100 nF
SDA/SDI/SD0 4	5 6 7 GND
RES	GND
	GND

LSM303AGR

Vdd_IO $C_4 = 100$ nF	
INT1_XL DRDY_MAG	Vdd $C_2 = 10$ µF
SCL/SPC 1 12 11 10 Vdd_IO	
CS_XL	Top view Vdd
CS_MAG	GND $C_3 = 100$ nF
SDA/SDI/SD0 4 5 6 7	INT_MAG
$C_1 = 100$ nF C1 GND	
	GND

EASY BOARD COMPATIBILITY
- Same component outline dimensions
- Same pinout dimensions
- Same pinout structure
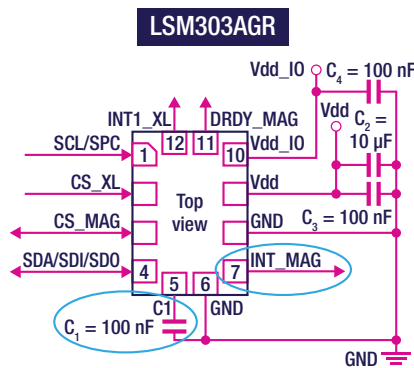
- Small changes to:
  - Pin 5, connect a capacitor
 - Pin 7, connect to EXT (interrupt signal for other use)

BENEFITS
- Superior sensing precision combined with low power consumption
- Wide magnetic range with high sensitivity magnetic-scale range
- Ultra low magnetic offset and low noise
- Compact package footprint, pinout compatible with 2x2 accelerometer
- Ultra low magnetic parameter changes with thermal drift
- New possibilities for advanced navigation and location-based services in ever portable consumer devices

SUSTAINABLE TECHNOLOGY

CO_2 -44%

-42%

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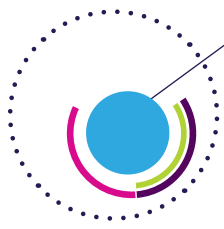
iNEMO® inertial modules

Accelerometer + gyroscope SIP solution featuring multiple degrees of freedom

iNEMO inertial modules integrate complementary types of sensors to offer more compact, robust and easy-to-assemble solutions compared to discrete MEMS products. iNEMO solutions bring motion sensing systems to the level required for the most demanding applications, such as enhanced gesture recognition, gaming, drones, augmented reality, indoor navigation, pedestrian dead reckoning, wearables, OIS/EIS and localization-based services.

FOCUS ON LSM6DSM/LSM6DSL

Ultra low power	Industry-leading low-power performance for 3A+3G combo Down to 0.29mA in Always-on mode
	For OIS application up to 1/6 less than the best alternative solution in the market
Ultra small size	Tiny size to fit in the smallest, slimmest mobile, wearable and IoT devices
	2.5 x 3.0 x 0.83 mm
Ultra performing	Industry-best resolution for gyroscope and accelerometer
	Gyroscope rate noise down to 3.8 mdps/√Hz (typical)
Ultra capable	4-Kbyte "smart" FIFO memory to batch more data before system wake-up
	2 times larger than the best alternative solution
Ultra smart	Embedded efficient and reliable motion tracking, pedometer and context awareness
	Saving power and enabling faster system reaction times
Ultra scalable	Ideal companion for the ultra-low-power STM32 family of microcontroller
	The best combination of a 6-axis sensor with a sensor hub, UI and OIS/EIS features

SUSTAINABLE TECHNOLOGY

CO_2 -32%

-33%

2.5 x 3.0 x 0.83 mm

Parameter	LSM6DSM	LSM6DSL	LSM6DS3H	LSM6DS3
Current consumption in High-performance mode (mA)	0.65	0.65	1.25	1.1
Current consumption in Normal mode (mA)	0.45	0.45	0.9	0.9
Noise density in High-performance mode @ 2g Accelerometer (µg/√Hz)	90	90	90	90
Typical gyro noise density in High-performance mode (mdps/√Hz)	3.8	4.5	6	7
ODR (Hz)	Accel:1 to 6664	Accel:1 to 6664	Accel:12.5 to 6664	Accel:12.5 to1666
	Gyro:12.5 to 6664	Gyro:12.5 to 6664	Gyro:12.5 to 3332	Gyro:12.5 to 1666
FIFO depth	Up to 4 Kbytes	Up to 4 Kbytes	Up to 8 Kbytes	Up to 8 Kbytes
Sensor data collection	Yes	Yes	Yes	Yes
OIS/EIS	Yes/Yes	No/Yes	Yes/Yes	No/Yes
Sensor sync	Yes	Yes	Yes	Yes

Automotive inertial module: 3D accelerometer and 3D gyroscope

The ASM330LXH inertial module unit (IMU) addresses non-safety automotive applications such as vehicle tracking systems, rate-activated functions, inertial navigation assistance and telematics units.
The ASM330LXH is a system-in-package featuring both a 3D digital accelerometer and a 3D digital gyroscope. It has a user-selectable full scale acceleration range of ±2/±4/±8/±16 g and an angular rate range of ±125/±245/±500/±1000/±2000 dps. The ASM330LXH has two operating modes enabling the accelerometer and gyroscope sensors to be either activated at the same ODR or the accelerometer can be enabled while the gyroscope is powered down.

FEATURES
- Single-chip solution
- 6-axis
- Smallest footprint
- Synchronized output
- Low power consumption

BENEFITS
- Cost-effective
- Independent on tilt installation
- Compact system design
- Precise motion reconstruction (by algorithm)
- Battery saving (ignition off)

AEC-Q100 COMPLIANT

PPAP LEVEL-3 AVAILABLE

Environmental sensors

Collect humidity, atmospheric pressure and temperature accurate data for environmental awareness

STMicroelectronics offers a full kit of environmental sensors, including pressure, humidity and temperature sensors. These sensors rely on dedicated mechanical structures that guarantee the best performance even in challenging environmental conditions.
They are adopted in many wearable devices to monitor health and for fitness programs, in smart home or other industrial applications to monitor weather conditions and guarantee good equipment safety.

PRESSURE SENSOR

ST's absolute digital output barometer integrates ST's consolidated pressure sensor with the new fully molded package to further improve robustness, reliability and moisture resistance while reducing package thickness.
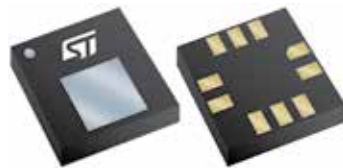
BENEFITS

- Ultra-small footprint
- Low-power consumption
- Fully-molded package ensure stability and robustness in any condition and water resistance

Part number	Package (mm)	Pressure range (hPa)	Relative accuracy (hPa)	Absolute accuracy (hPa)	Noise	ODR (Hz)	Current consumption	Highshock survivability (g)	Advanced digital features	Reliability
LPS25HB	HLGA-10L, 2.5 x 2.5 x 0.76 Full-molded	260 to 1260	±0.1	±0.2	3 Pa RMS (without embedded filter) 1 Pa RMS (with embedded filter)	1, 10, 25	25 µA @ 1 Hz 4 µA @ 1 Hz (low res)	10.000	FIFO for Pressure Sensor data Programmable Interrupt/Data ready	• Improved moisture resistance • Improved shock/ vibration suppression • Proven experience: 250 Mpcs in the market
LPS22HB	HLGA-10L, 2 x 2 x 0.76 Full-molded	260 to 1260	±0.05	±0.1	1 Pa RMS (without embedded filter) 0.5 Pa RMS (with embedded filter)	1, 10, 25, 50, 75	15 µA @ 1 Hz (high resolution mode) 4 µA @ 1 Hz (low power mode)	22.000	FIFO for Pressure and Temperature Sensor data Programmable Interrupt/Data ready	

Note: a complete list of part numbers is available at www.st.com/pressure

HUMIDITY AND TEMPERATURE SENSOR

The HTS221 is an ultra-compact sensor that measures relative humidity and temperature. Housed in a tiny but robust HLGA package (2 x 2 x 0.9 mm), the HTS221 is suitable for wearable and portable devices and all applications where comfort, health and safety might be negatively impacted by humidity and temperature variations.

BENEFITS

- Ultra-small footprint
- Low-power consumption to address wearable devices
- Allows customized calibration for best design flexibility
- Humidity accuracy: ± 3.5% rH, 20 to +80% rH
- Temperature accuracy: ± 0.5 °C,15 to +40 °C

Part number	General description	Package	Supply voltage min-max (V)	Humidity (RH) min-max (% RH)	Interfaces
HTS221	Capacitive digital sensor for relative humidity and temperature	HLGA-6L 2 x 2 x 0.9 mm	1.7-3.6	0-100	SPI, I²C

TEMPERATURE SENSORS

ST's temperature sensors temperature sensors include both analog and digital temperature sensor ICs. Both types are suitable for use in a wide range of applications, such as industrial, consumer, medical and computer market segments.

The analog temperature sensors feature low power consumption and good linearity, and can operate over a temperature range as wide as -55 to +130 °C. The digital temperature sensors feature low power consumption, up to 12-bit resolution and can operate over a temperature range as wide as -55 to +125 °C.

2 x 2 x 0.5 mm

BENEFITS

- Small footprint
- High accuracy
- Dual alarm
- One-shot mode for energy saving

DIGITAL TEMPERATURE SENSORS

Part number	Package	Package size	General description	I/O Interface	Operating voltage min-max (V)
STCN75	MSOP(TSSOP8)	3 x 3 mm	Digital temperature sensor and thermal watchdog	SMBus/I²C compatible	2.7-5.5
STDS75	MSOP(TSSOP8)	3 x 3 mm	Digital temperature sensor and thermal watchdog	SMBus/I²C compatible	2.7-5.5
STLM75	MSOP(TSSOP8), SO-8	3 x 3 mm, 4.90 x 3.90 mm	Digital temperature sensor and thermal watchdog	SMBus/I²C compatible	2.7-5.5
STTS75	MSOP(TSSOP8), SO-8	3 x 3 mm, 4.90 x 3.90 mm	Digital temperature sensor and thermal watchdog	SMBus/I²C compatible	2.7-5.5
STTS751	UDFN-6L	2 x 2 mm	2.25 V low-voltage local digital temperature sensor	SMBus/I²C compatible	2.25-3.6
STTS2002	TDFN8	2 x 3 mm	2.3 V memory module temperature sensor with a 2 Kb SPD EEPROM	SMBus/I²C compatible	2.3-3.6
STTS2004	TDFN8	2 x 3 mm	2.2 V memory module temperature sensor with a 4 Kb SPD EEPROM	SMBus/I²C compatible	2.2-3.6

ANALOG TEMPERATURE SENSOR

Part number	Package	Package size	General description	Operating voltage min-max (V)	Operating supply current typ (mA)
STLM20	UDFN-4L, SOT323-5L	1 x 1.30 mm, 2 x 1.25 mm	Ultra-low current 2.4 V precision analog temperature sensor	2.4-5.5	0.008

Note: a complete list of part numbers is available at www.st.com/tempsensors

MEMS analog and digital microphones

Crystal-clear audio quality with the size, cost and volume production of MEMS sensors

Microphones based on MEMS technology offer an excellent audio quality. They are less susceptible to mechanical vibrations, temperature variations and electromagnetic interference compared to traditional electret microphones. The MEMS process makes these microphones the ideal stereo solution wherever two perfectly matched microphones are required.
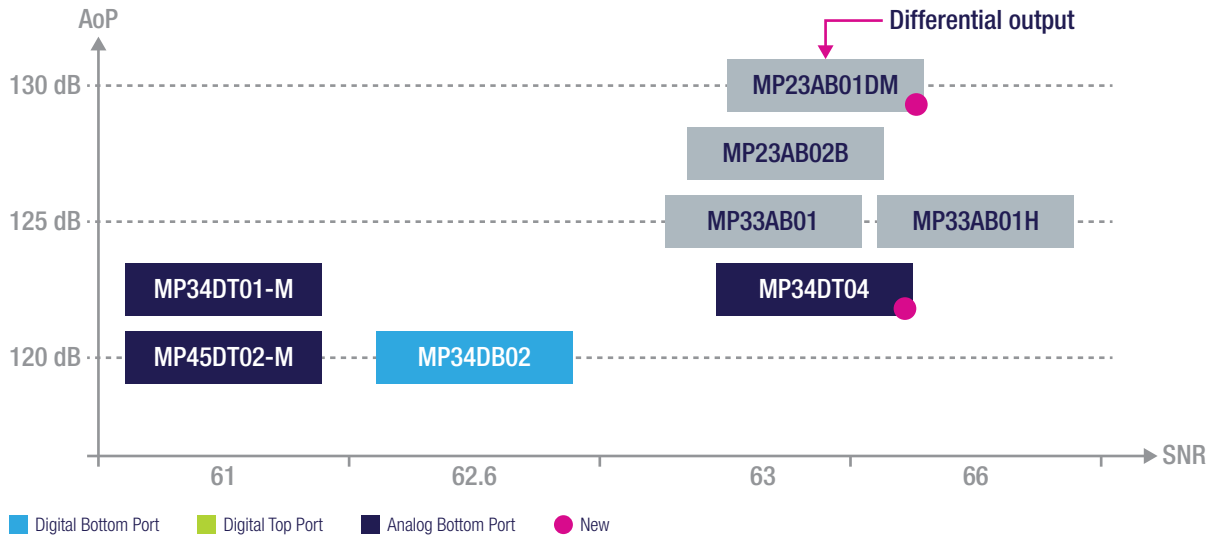
BENEFITS OF MEMS MICROPHONES

- Enhanced performance
  - High stability of sensitivity after reflow
  - Very stable unit-to-unit performance
- Consolidated micromachining technology
  - New applications enabled: stereo capture, noise cancellation, beam forming
  - High shock resistance

TARGETED APPLICATIONS

- Mobile phones
- Laptops
- Phablets
- Smartphones
- Digital cameras and camcorders
- Gaming
- Portable media players
- Hands-free devices
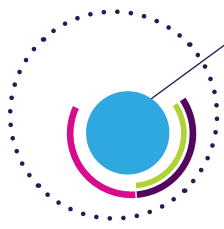- Tablets
- Hearing aids
- Headsets

AoP

Differential output

130 dB ···· MP23AB01DM

MP23AB02B

125 dB ···· MP33AB01 · MP33AB01H

MP34DT01-M · MP34DT04

120 dB ···· MP45DT02-M · MP34DB02

SNR

61 · 62.6 · 63 · 66

■ Digital Bottom Port ■ Digital Top Port ■ Analog Bottom Port ● New

DIGITAL MEMS MICROPHONES

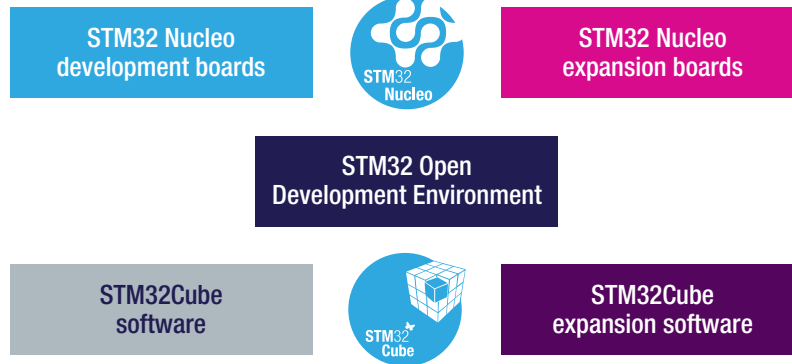| Part number	Top/bottom port	Package size (mm)	Supply voltage (V)	SNR (dB)	Sensitivity (dBV)	AoP (dB spl)	Current consumption (µa)
MP45DT02-M	Top	4.72 x 3.76 x 1.25 (Metal)	1.64 to 3.6	61	-26	120	650
MP34DT01-M	Top	3 x 4 x 1 (Plastic)	1.64 to 3.6	63	-26	120	650
MP34DT04	Top	3 x 4 x 1.06 (Metal)	1.64 to 3.6	61	-26	120	650
MP34DB02	Bottom	3 x 4 x 1 (Metal)	1.64 to 3.6	62.6	-26	120	650

ANALOG MEMS MICROPHONES

Part number	Top/bottom port	Package size (mm)	Supply voltage (V)	SNR (dB)	Sensitivity (dBV)	AoP (dB spl)	Current consumption (µa)
MP23AB02B	Bottom	3.35 x 2.5 x 0.98 (Metal)	1.5 to 3.6	64	-38	125	220
MP33AB01	Bottom	3.76 x 2.95 x 1 (Plastic)	1.5 to 3.6	63	-38	125	250
MP33AB01H	Bottom	3.76 x 2.95 x 1 (Plastic)	1.5 to 3.6	66	-38	125	250
MP23AB01DM	Bottom	3.35 x 2.5 x 0.98 (Metal)	2.1 to 3.6	64	-38	130	250

Design support

STM32 Nucleo development boards		STM32 Nucleo expansion boards
	STM32 Open Development Environment	
STM32Cube software		STM32Cube expansion software

Open Development Environment

The STM32 Open Development Environment (STM32 ODE) is an open, flexible, easy and affordable way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

The STM32 ODE is made up of four elements:

- **STM32 Nucleo development boards.** A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer.
- **STM32 Nucleo expansion boards.** Boards with additional functionality to add sense, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking the expansion boards.
- **STM32Cube software.** A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator.
- **STM32Cube expansion software.** Expansion software provided free of charge for use with STM32 Nucleo expansion boards and compatible with the STM32Cube software framework.

The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, mbed and GCC-based environments.

FOCUS ON THE NEW NUCLEO EXPANSION BOARD FOR SENSORS

The X-NUCLEO-IKS01A1 is a MEMS inertial and environmental sensor evaluation board system. It is compatible with the Arduino UNO R3 connector layout, and is designed around STMicroelectronics' LSM6DS0 3-axis accelerometer + 3-axis gyroscope, the LIS3MDL 3-axis magnetometer, the HTS221 humidity sensor and the LPS25HB pressure sensor.

The board can also be used to evaluate the new LSM6DS3, evolution of LSM6DS0, by connecting the STEVAL-MKI160V1 DIL24 adapter.

The X-NUCLEO-IKS01A1 interfaces with the STM32 microcontroller via the I^{2}C pin, and it is possible to change the default I^{2}C port.

X-NUCLEO-IKS01A1

STEVAL-MKI160V1

OPEN SOFTWARE EXPANSION

The Open Software Expansion development suite ("OpenSoftwareX") offers drivers, middleware and application software to jump start your STM32 design with ST products like MEMS, Bluetooth low energy, sensors, etc. It enables fast prototyping using the STM32 Open Development Environment with leading-edge components that can quickly be transformed into final designs.

The Open Software Expansion environment is made up of several free libraries, such as:

- Open.MEMS:
  - Sensor fusion library for STM32 platform osxMotionFX
  - Sensor carrying position for STM32 platform osxMotionCP
  - Sensor activity recognition for STM32 platform osxMotionAR
  - Sensor gesture recognition for STM32 platform osxMotionGR
- Open.RF: BlueNRG Bluetooth Low Energy library for the most commonly-used BT smart profiles
- Open.Audio:
  - Real-time beam forming for STM32 platform
  - Real-time sound source localization for STM32 platform
  - Real-time echo cancellation for STM32 platform
  - Bluetooth Low Energy and microphones for STM32 platform

Open.MEMS

Open.MEMS libraries combine data from several sensors achieving the high level of accuracy required by portable and wearable devices and other emerging applications, such as IoT.

The osxMotionFX library is the evolution of iNEMO Engine Pro sensor fusion algorithm and API, ported to the STM32 Open Development Environment. Like its predecessor, the osxMotionFX is filtering and predictive software that uses advanced algorithms to integrate and read real-time outputs from multiple sensors, achieving accurate position information, independently of environmental conditions. The fusion of real-time motion-sensor data is set to significantly improve user experience by increasing accuracy, resolution, stability and response time in advanced motion-based applications in the consumer, computer, industrial and medical fields. The osxMotionFX sensor fusion library is designed for use in combination with the STM32F4 Nucleo development boards (NUCLEO-F401RE, F411 and F476). When installed on your PC, Open.MEMS libraries must be activated through a licensing wizard tool (included into the osxMotionFX software package).

Additional sensor fusion libraries are also available:

- The osxMotionAR provides real-time information on user activity (stationary, walking, fast walking, biking, or driving)
- The osxMotionCP provides real-time information regarding the position
- The osxMotionGR provides real-time information on phone-related gestures such as wake up, glance and pick up
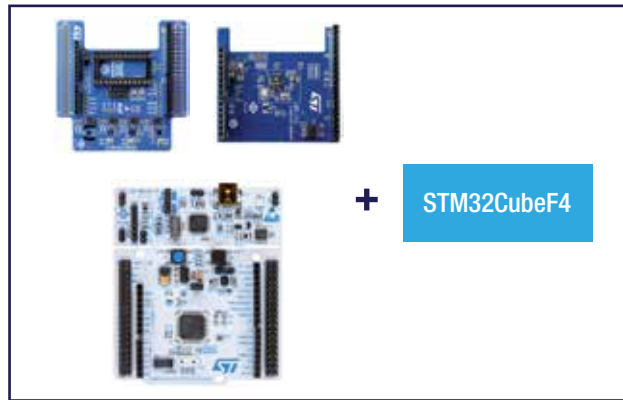
BENEFITS

- Licensing wizard tool makes it easier to quickly get started evaluating your sensor fusion design

MULTI-SENSOR, BLUETOOTH APPLICATION DEVELOPMENT PLATFORM

The BLUEMICROSYSTEM1 framework uses Bluetooth Low Energy, inertial (e.g. motion MEMS) and environmental (e.g. humidity, pressure, temperature) sensors. It enables fusing together and transmitting real-time sensor data to a smartphone (Android- or iOS-based) via Bluetooth. BLUEMICROSYSTEM1 provides an implementation example for the STM32F4 Nucleo platform equipped with the MEMS and environmental sensor expansion board (X-NUCLEO-IKS01A1) and the Bluetooth low energy expansion board (X-NUCLEO- IDB04A1).

BLUEMICROSYSTEM1 is suitable for all applications and markets, including IoT and wearables, that need to effectively sense, process and transmit valuable information with very low power consumption and high performance.

Open.Framework:
BlueMicrosystem1 application development platform

+ STM32CubeF4

Google play

Available on the App Store

DESIGN SUPPORT FOR NON-SAFETY AUTOMOTIVE AND INDUSTRIAL SENSORS

With an extensive expertise in sensor integration and the development of new applications, ST can assist customers in their design-in phase. ST's evaluation kits and firmware allows a real-time evaluation of sensor performance in customer applications.

ST offers a complete evaluation solution including:

- A full set of DIL24 MEMS non-safety automotive and industrial adapters supporting fast prototyping
- eMotion motherboard compatible with all adapters and based on an STM32 microcontroller
- UNICO graphic user interface for direct and real-time access to the sensor outputs and configuration registers.

USB connector

MEMS-sensor adapter

STM32 microcontroller

JTAG/SWD

Test points
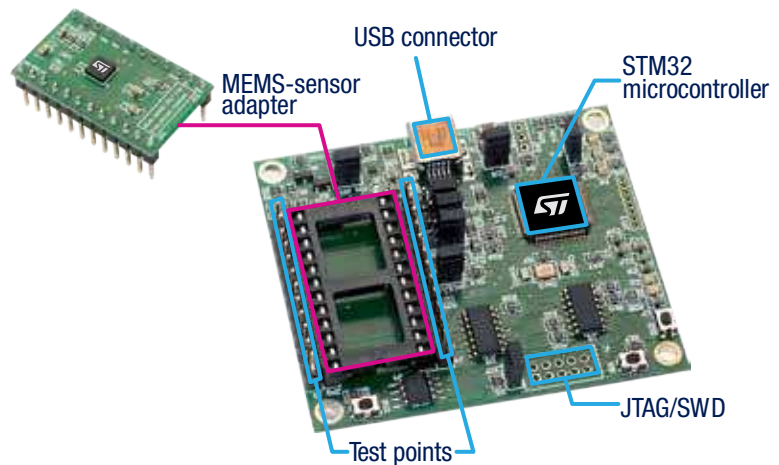
Board	Description	Order code
Motherboard	ST MEMS motherboard is based on the high-performance STM32F103 32-bit ARM Cortex™-M3 MCU Interfaces: USB connector and JTAG/SWD for debuggingDFU-compatible for USB microprocessor firmware updates Compatible with all ST MEMS adapters	STEVAL-MKI109V2 STEVAL-MKI109V3*
Adapter board	AIS328DQ	STEVAL-MKI110V1
	AIS3624DQ	STEVAL-MKI158V1
	A3G4250D	STEVAL-MKI125V1
	ASM330LXH	STEVAL-MKI171V1*
	H3LIS100DL	STEVAL-MKI166V1
	H3LIS200DL	STEVAL-MKI167V1
	H3LIS331DL	STEVAL-MKI153V1
	IIS2DH	STEVAL-MKI168V1
	I3G4250D	STEVAL-MKI169V1
	IIS328DQ	STEVAL-MKI170V1
	LIS2DS12	STEVAL-MKI174V1
	LIS344ALH	STEVAL-MKI015V1
	LSM6DS3	STEVAL-MKI160V1
	LSM303AGR	STEVAL-MKI172V1
	LIS2DH12	STEVAL-MKI151V1
	LIS2HH12	STEVAL-MKI164V1
	LIS3DH	STEVAL-MKI105V1
	LPS22HB	STEVAL-MET001V1
	L3GD20H	STEVAL-MKI36V1

Note: * available in Q4 16

Technical support

TECHNICAL DOCUMENTS

To see all technical documents and files for a specific product, go to www.st.com/sensors and select the product you are interested in through our product catalogue. Each part number has a corresponding web page where you can easily find all associated technical documents and resources.

DEVELOPERS' LINKS

- For more information about STM32ODE: www.st.com/stm32ode
- To download Open Software suites: www.st.com/opensoftware
- For more information about expansion boards: www.st.com/x-nucleo
- To take part to our forums: www.st.com/e2e

ONLINE SUPPORT

For technical support or questions about product availability, pricing, where-to-buy, or other related issues, go to www.st.com/onlinesupport.