



life.augmented



LSM6DSV32X
6-axis IMU with 32g
accelerometer and
advanced features

Imagine a single component that answers all your needs

Context awareness



Always the right configuration for each context

Activity monitoring



Fitness tracking
Safety
Health monitoring

Fall & shock detection



Detect shock events, free fall and drop height

Increased security

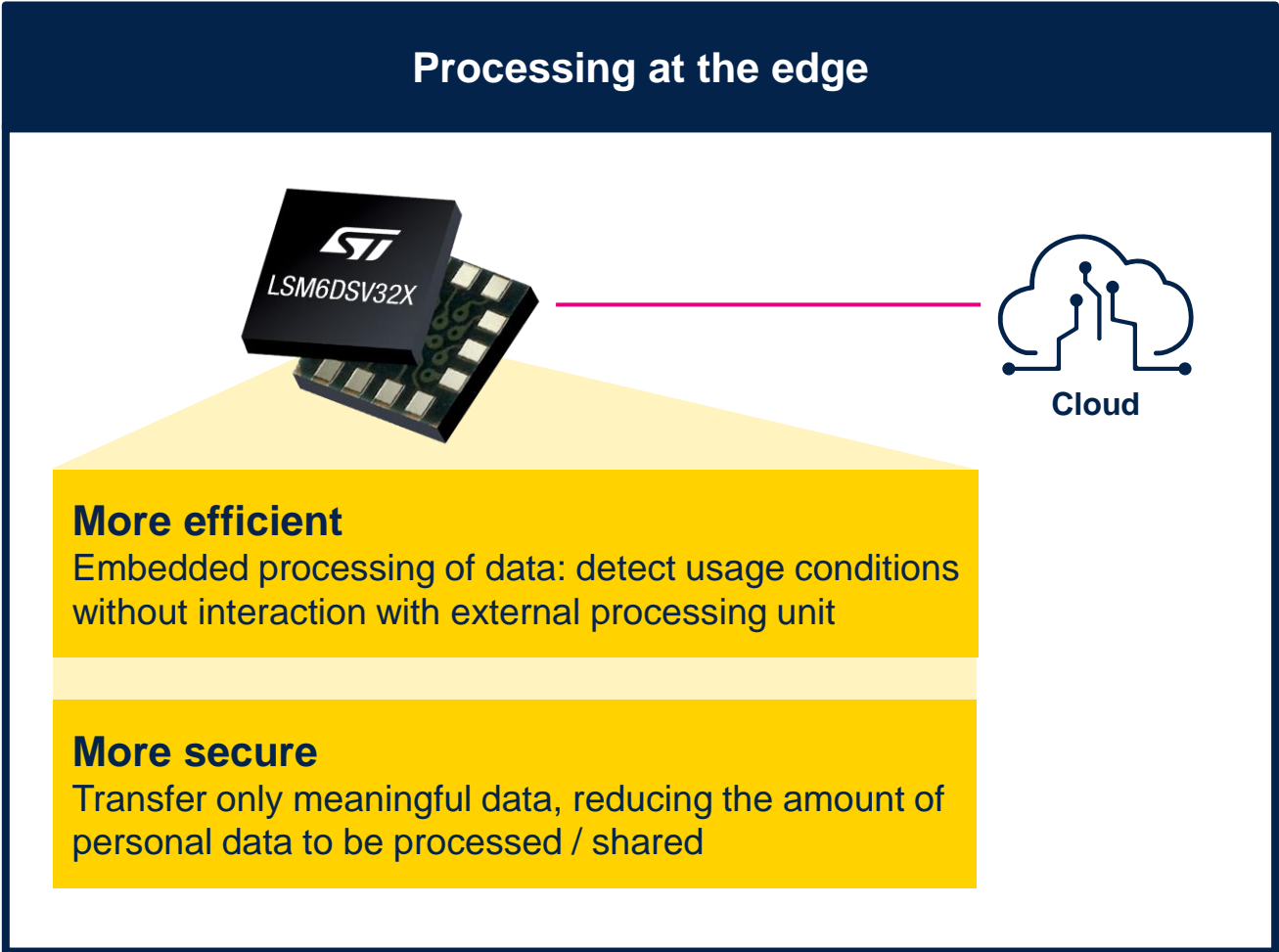
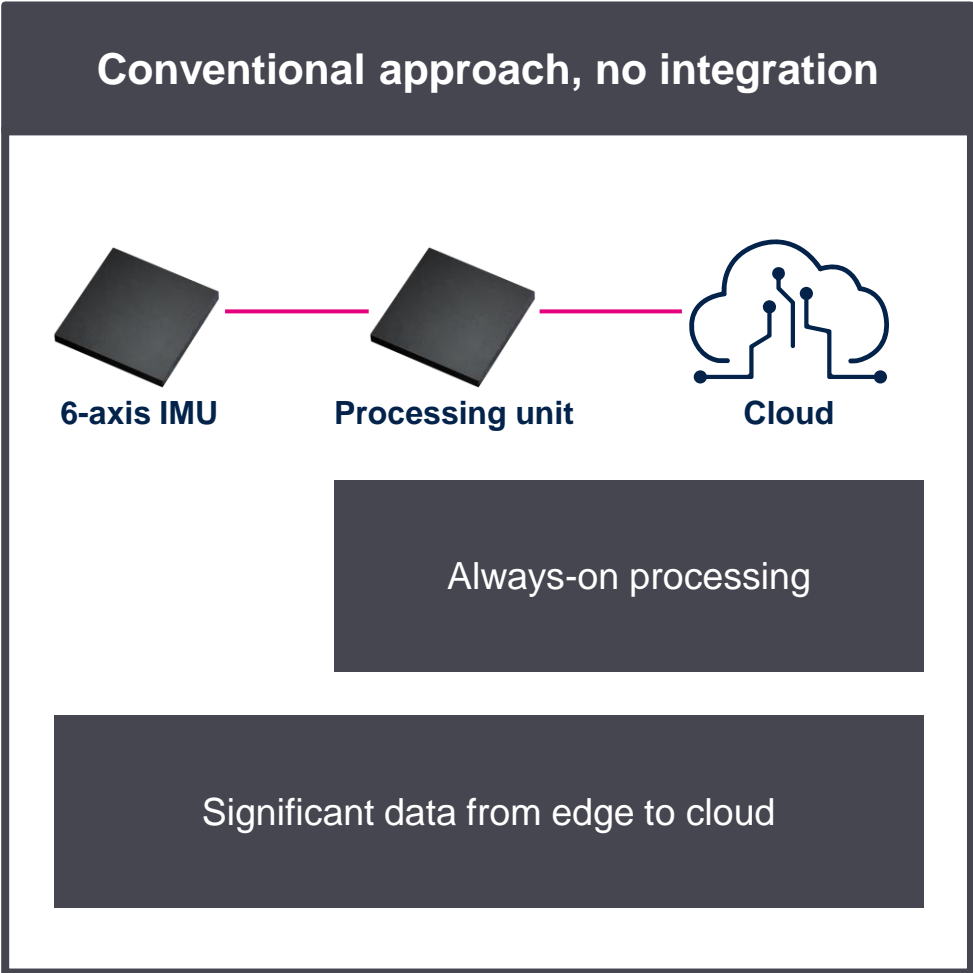


Processing in the edge, protecting personal data

LSM6DSV32X 6-axis IMU enable is your solution – Efficient, flexible, and available!

LSM6DSV32X

Increased performance, efficiency & security



LSM6DSV32X in brief

Smart 32g IMU with processing at the edge
for sport, wearable & IoT applications

Mass production

High full scale IMU

- Accelerometer @ 32g, Gyroscope @ 4000 dps
- Low noise accelerometer: 80 $\mu\text{g}/\sqrt{\text{Hz}}$
- Gyroscope 2.8 $\text{mdps}/\sqrt{\text{Hz}}$
- Accurate ODR $\leq 1\%$

Edge processing

- Machine learning core & finite state machine
- Adaptive self configuration
- 4.5k smart FIFO
- 2 user programmable interrupts (+ IBI on I³C)

Highly integrated

- Sensor Hub with processing capabilities
- Interface: SPI, I2C, I3C®, with 1.2V compatibility
- Qvar for UI



2.5 x 3.0 x 0.83 mm

Focused applications with LSM6DSV32X

Wearable



- Motion tracking
- Context awareness (walking, jogging, biking, running,..)
- Pedometer & Step Counter
- Safety (shock detection)

IoT & asset tracking



- Motion tracking
- Safety (Shock detection)
- Free fall height detection
- Context awareness
- Tilt detection

Wearable LSM6DSV32X

Edge processing

LSM6DSV32X brings AI at the edge. It transfers **meaningful data**, reducing the amount of personal data to be processed by application processor or cloud.

Highlights

- Acceleration full scale up to 32g
- Machine learning core (MLC) & finite state machine (FSM)
- Adaptive self configuration

Advantages

- AI-based recognition of wrist movements and gym activity
- Embedded sensor hub allowing to process third-party data in MLC and FSM
- Free fall height estimation and shock detection
- Enhanced user interface with Qvar electrostatic sensin
- Ecosystem of tools and design examples

IoT and asset trackers

LSM6DSV32X

Edge processing

LSM6DSV32X machine learning core can be programmed to detect shock and identify when your parcel is in trouble. It wake up the whole system only when needed.

Highlights

- Shock detection (with different level of tracking)
- Machine learning core (MLC) & finite state machine (FSM)
- Adaptive self configuration

Advantages

- Context detection for optimal power configuration
- Free fall height estimation and shock detection
- Embedded sensor HUB with possibility to process third party data in MLC and FSM
- Meaningful data processing reducing data transfer
- Ecosystem of tools and design examples

Wearable One device for everything you need



Extended range

Wide range full scale up **32g** and **4000 dps** enable enhanced tracking for wearable

Context awareness

Machine learning core (MLC) and **finite state machine (FSM)** for activity tracking & optimized configuration application-based

3-D tracking

Embedded sensor fusion algorithm to enable 3-D orientation and enhanced gym activity tracking

Smart, always aware

Adaptive self configuration (ASC)
ST smart sensors reconfigures themselves

Free fall height estimation

Scalable solution for embedded **shock** event detection with **free fall height** estimation

Ready

Configuration & software examples for optimal time to market

Extended range full scale up to 32g & 4000 dps

Measure your performance and ensure safety during your run!



The device automatically **reconfigures itself** thanks to the **ASC** feature based on the device context, maximizing the **system efficiency**.

MLC and **FSM** detect the context and track your activities without the need of additional data processing

Detect **falls** and **impacts** to allow the transmission of a **fall-down alert** to first responders

Context awareness detection

Adding intelligence in the edge with MLC and FSM



Embedded MLC & FSM process the accelerometer and gyroscope data to detect usage conditions with **no interaction required** with external processor

A few examples*

1 μ A

Identify activity and inactivity (i.e. wake up the system only when needed)

6 μ A

Gym activity recognition

6 μ A

Wrist tilt detection for display wake up

From 1 μ A to 35 μ A

Scalable solution to detect **free fall, shock** and **fall height estimation** (or man Ddown)

* Power consumption values related to MLC & FSM only

Free fall height estimation

Feel at ease: LSM6DSV32X can monitor the shocks



Scalable solution to detect **shock**, **free fall**, and estimate height of the free fall

Embedded processing and **FSM** detect the context without the need of additional data processing at system level

From **free fall height exceedance** detection*, to the **accurate height estimation & shock intensity** always the right algorithm ,

* Power consumption values are related to the embedded processing in 1 μ A to 35 μ A

3-D orientation

Track and monitor orientation in 3-D space



Detect and track device orientation with the **embedded low power sensor fusion** algorithm with **30 μ A**

Plug and play solution that provided **6x game rotation vector** (accelerometer + gyroscope) & **gyro-bias calibration**

Rotation vector is available in **quaternion format**, and it can be stored in the **embedded FIFO**

Static accuracy⁽¹⁾: 0.5, 1.5, 1.5 deg
Low dynamic accuracy⁽¹⁾: 0.7, 0.5, 0.5 deg
Calibration time⁽²⁾: 0.8 s
Orientation stabilization time: 0.7 s
Extra power: 30 μ A @ 120 MHz

Embedded pedometer

Embedded step counter with ST smart sensors



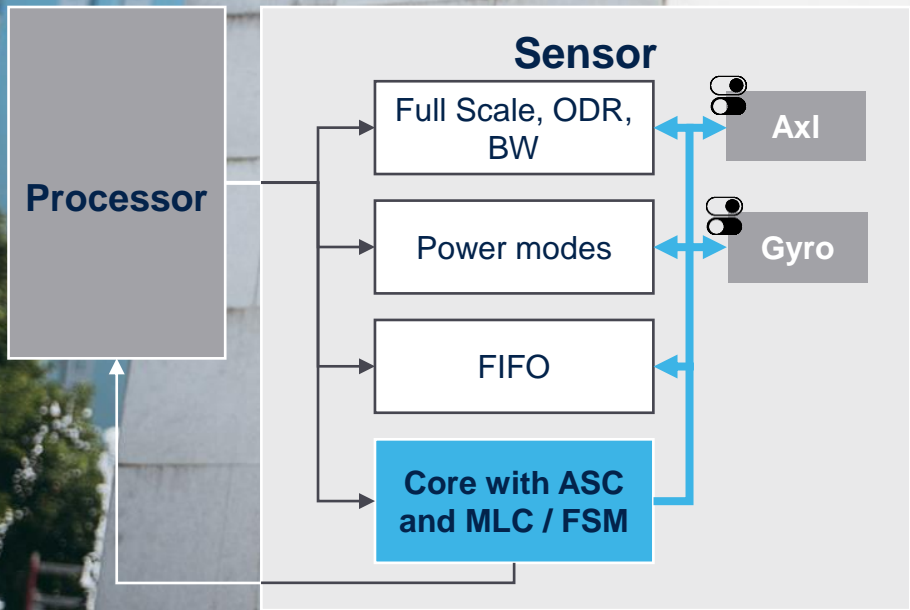
- **Track steps** during the day or during physical activity, with **2 μ A** (ODR @ 30 Hz)
- **No processing** required from MCU

Adaptive self configuration (ASC)

From “Always-on” to “Smart, always-Aware”







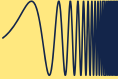


The device automatically **reconfigures itself**, based on the actual context, maximizing the **system efficiency**.





MLC and FSM detect the context without the need of additional data processing

ASC allows to independently configure gyroscope and accelerometer channels. **No tradeoff required!**

Embedded solutions with edge processing for wearables

Configuration example	Description	Where?
 Activity recognition for wrist	Stationary / other, walking / fast walking, jogging / running	Accelerometer data processed by MLC
 Gym activity recognition	Bicep curls, lateral rises, squats	Accelerometer data processed by MLC
 Gestures detection	Flip-up / down, 4D, glance, pick-up, phone-to-ear, jiggle / shake, wrist navigation, wrist-tilt	Accelerometer + Gyroscope data processed by FSM (or MLC)
 Free fall & shock height estimation	Detect free-fall & shock events with free fall height estimation	Accelerometer data processed by FSM
 Shock intensity estimation	Detect shock events with intensity estimation	Accelerometer data processed by FSM & MLC
 Pedometer	Step detection, step counter and significant motion detection	Accelerometer pedometer
 Pose recognition	Detect 14 classes	Accelerometer data processed by MLC

Embedded solutions with edge processing for asset tracking

Configuration example	Description	Where?
 Stationery & motion detection	Stationary upright / stationary not upright / in motion / shaken detection	Accelerometer data processed by MLC
 Free fall and impact	Impact detection / free fall detection	Accelerometer data processed by FSM

Examples of edge processing with MLC and FSM

The perfect solutions for IoT & wearable platforms



- 10 μA** Human activity recognition for wrist-worn device
- 6 μA** Gym activity recognition
- 35 μA** Free Fall & Shock Height estimation
- 6 μA** Wrist-tilt
- 6 μA** Jiggle gesture
- 18 μA** Android wear OS navigation gestures
- 110 μA** Tap detection
- 5 μA** Pedometer (Advanced by MLC & FPR block)
- 1 μA** Sleep detection

(*) Power consumption referred to MLC/FSM only



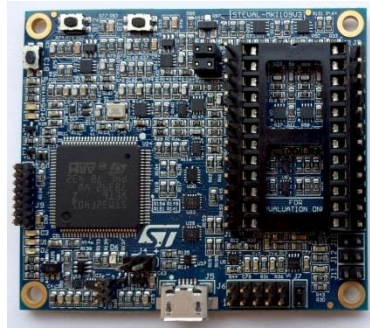
- [MLC: https://github.com/STMicroelectronics/STMems_Machine_Learning_Core](https://github.com/STMicroelectronics/STMems_Machine_Learning_Core)
- [FSM: https://github.com/STMicroelectronics/STMems_Finite_State_Machine](https://github.com/STMicroelectronics/STMems_Finite_State_Machine)

ST ecosystem supporting learning and prototyping

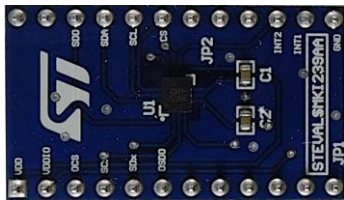
From product to system in a nutshell



SensorTile.Box PRO



Professional MEMS tool
(STEVAL-MKI109V3)



LSM6DSV32X EVB
(STEVAL-MKI240KA)



MEMS
Studio

Hardware

STEVAL-MKI240KA

SensorTile.Box PRO &
STEVAL-MKI109V3

Application example

Human activity recognition

Gym activity recognition

Adaptive Self Configuration

Free fall height estimation

UI (touch, swipe)

and many more...

Development tools

MEMS Studio: graphical design app to build advanced algorithms

Our technology starts with You

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