VL53L9CX

All-in-one 3D dToF LiDAR module

Direct time-of-flight sensor with 2.3k zones, below 5 cm to 9 m ranging distance, multi-target detection, and distance measurement for each zone

Low-power, calibration free, extremely simple to integrate, and inherently privacy compliant, our first 3D direct Time of Flight sensor delivers up to 54 × 42 zones of high resolution depth sensing.

Based on ST's advanced in-house optical technology, its integrated processing and compact module design enables fast, accurate 3D sensing for a wide range of applications.

KEY FEATURES AND BENEFITS

- Ranging from below 5 cm to 9 m at 100 fps
- 55° × 42° field of view (71° diagonal) with 1° angular resolution over the full FoV
- 150mW (typical system power at full resolution)
- Dual VCSEL flood illumination at 940 nm invisible light.
- On chip processing with streaming of 2D IR images, depth maps, and ambient light maps

KEY APPLICATIONS

- 3D mapping
- Obstacle detection
- Content level monitoring (truck loading, waste bins)
- Gesture recognition
- Smart buildings
- People counting/mapping
- Projectors
- Fall detection

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Technology

A state-of-the-art direct ToF 3D LiDAR module with up to 2.3k zones of resolution, the VL53L9CX comes in a miniature, reflowable package. A dual-scan flood illumination strategy replaces traditional sequential dot scanning, enabling robust detection of small objects and edges while eliminating motion artifacts in fast-moving scenes. The module integrates a SPAD array, post-processing SoC, two VCSELs, physical infrared filters, metasurface optical elements (MOE), and an embedded power-management IC. Its reflowable design simplifies integration into diverse systems, reducing complexity and cost and enabling rapid deployment.
Certified as Class 1 laser-safe, the device also incorporates multilevel laser-safety checks to ensure eye safety and reliable operation.

Seamless detection

Unlike conventional IR sensors, the VL53L9CX uses ST's latest-generation BSI stacked direct ToF technology, enabling absolute distance measurement regardless of target color or reflectance. It provides accurate ranging from below 5 cm up to 9 m and can stream processed data at up to 100 Hz, making it one of the fastest, truly integrated 3D LiDAR sensor modules on the market.
It delivers rich scene information, including depth maps, 2D IR images (with and without active illumination), reflectance, and confidence data, ready to feed advanced perception and AI algorithms.

Developer resources

To evaluate this Time-of-Flight sensor, two different evaluation kits will be available: a ready-to-use VL53L9CX X-Nucleo expansion board for STM32 Nucleo with I3C connectivity, and STEval board with I3C and MIPI connectivity that can be integrated into prototypes for real-world testing. All our sensors are supported by a user-friendly graphical user interface (GUI) for easy configuration and evaluation.

Board	X-NUCLEO	STEval
Order code	X-NUCLEO-53L9A1	STEVAL-VL53L9

3D dToF use-cases


Industrial


Robotics


Content monitoring


People sensing


Smart Building


Drone


Gesture


AR / VR

Product details

Order code	Package size (mm)	Number of zones	Operating range	Max ranging frequency	Power consumption	Supply voltage
VL53L9CX	12.8 x 6.1 x 4.6 mm	54 x 42 = 2,268 zones	5 cm to 9 m	100 fps	150 mW *	IOVDD 1.2V or 1.8 V AVDD 2.8V or 3.3V

Note: * typical system power at full resolution