

3D dToF all-in-one lidar module



Product status link

[VL53L9CA](#)

Features

- Fast and accurate 3D direct Time-of-Flight (dToF) camera module
 - Multizone ranging output with up to 54 x 42 separate zones and binning options
 - On-chip postprocessing streaming 2D IR image and depth map with confidence level
 - Ranging from <5 cm up to 10 m
 - Up to 60 Hz frame rate capability
 - Histogram processing and algorithmic compensation minimize or remove the impact of cover glass crosstalk and veiling glare
 - Scan by two vertical-cavity surface-emitting lasers (VCSEL) flood illumination
- Fully integrated miniature module with wide field of view (FoV)
 - Emitter: 940 nm invisible light VCSEL and integrated analog driver
 - 71° diagonal FoV using metasurface optical elements (MOE) on both transmitter and receiver
 - Receiving array of single photon avalanche diodes (SPADs)
 - Size: 12.8 x 6.1 x 4.6 mm
- Easy integration
 - True all-in-one module with integrated SPAD sensor and VCSEL PMIC
 - Single reflowable component
 - Flexible power supply options:
 - Supports dual power supply operation: 1.2 V & 3.3 V
 - Compatible with a wide range of cover glass materials

Application

- Telephoto zoom camera assist. High resolution and long range allow image crop to align with telephoto camera.
- Augmented reality/virtual reality (AR/VR) enhancement. Dual camera stereoscopy assistance thanks to 2D and depth multizone distance measurement at 60 fps
- Laser-assisted autofocus (LAF). Enhances the camera AF system speed and robustness, especially in difficult low light or low contrast scenes
- Video focus tracking. 60 Hz ranging allows optimization of continuous focus algorithm
- Scene understanding. Multizone and multiobject distance detection enables 3D room mapping and obstacle detection or SLAM for robotics applications
- Wide FoV and multizone scanning allows content management (liquid level control, load in trucks, tanks, waste bins)
- Gesture recognition
- Keystone correction for video projectors
- Smart buildings and smart lighting (user detection to wake up devices)
- IoT (user and object detection)

Description

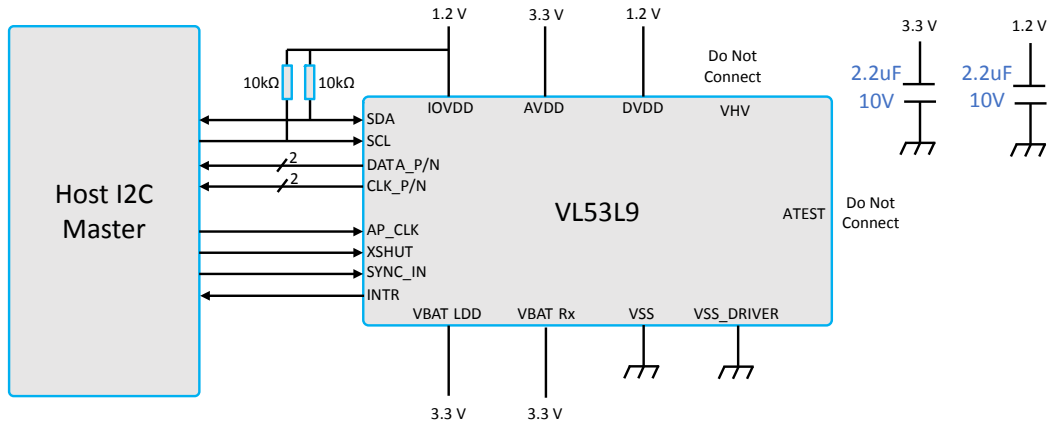
The VL53L9CA is a state of the art, dToF 3D lidar (light detection and ranging) module with market leading resolution of up to 2.3k zones enhancing the ST FlightSense product family. Housed in a miniature reflowable package, it integrates all necessary components to make it a true all-in-one and easy to integrate module. The VL53L9CA includes a SPAD array, postprocessing SoC, two VCSELs powered by a dedicated BCD VCSEL driver, physical infrared filters, metasurface optical elements (MOE), and an embedded PMIC. The module is class 1 laser safe, offering skin protection in addition.

The use of a MOE above the VCSELs allows to project an optimized rectangular FoV onto the scene. The receiver lens focuses the reflection of this light onto the SPAD array.

Unlike conventional IR sensors, the VL53L9CA uses ST's latest generation BSI stacked direct ToF technology, which allows absolute distance measurement whatever the target color and reflectance. It provides accurate ranging from below 5 cm up to 10 m and can stream a postprocessed 2D IR image, depth and confidence map at maximum frame rate (60 Hz), which makes it the fastest, truly integrated 3D lidar camera module on the market. Raw histogram output is also available for dedicated use-case development such as AI-based postprocessing.

The VL53L9CA achieves the best ranging performance, including under strong ambient light conditions, with a range of cover glass materials. Multizone distance measurements are possible up to 54 x 42 zones with a wide 54°x42° FoV, which can be reduced by software.

1 Application schematic

Figure 1. Example application schematic

Table 1. Power supply details

Voltage rail	Range
VBAT	2.8 V to 4.8 V
AVDD	2.8 V or 3.3 V
DVDD	1.2 V
IOVDD	1.2 V or 1.8V

Revision history

Table 2. Document revision history

Date	Version	Changes
20-Feb-2024	1	Initial release

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