VL53L5
a FlightSense™product

Time-of-Flight mini depth camera
Data brief

Features

- Fully integrated miniature module
  - Emitter: 940 nm invisible vertical cavity surface emitting laser (VCSEL) and integrated analog driver
  - 61 ° diagonal square system field of view (FoV) using diffractive optical elements (DOE) on both transmitter and receiver
  - Receiving array of single photon avalanche diodes (SPADs) in both transmitter and receiver apertures
  - Low-power microcontroller running firmware
  - Size: 6.4 x 3.0 x 1.5 mm

- Fast, accurate distance ranging
  - Parallel multi zone output; either 4x4 or 8x8 separate regions of interest (ROI)
  - Up to 400 cm ranging
  - 60 Hz frame rate capability
  - Histogram processing and algorithmic compensation minimizes or removes impact of cover glass crosstalk
  - Fully autonomous device with on-board histogram and ranging processing running on ST in-house 32Bit MCU

  - Dynamic crosstalk compensation for fingerprint smudge via latest patented ToF techniques
- Easy integration
  - Flexible power supply options, single 3.3 V or 2.8 V operation or combination of either 3.3 V or 2.8 V AVDD with 1.8 V IOVDD
  - Compatible with wide range of cover glass materials
  - I²C or SPI interface
  - Low-power pin and two general purpose inputs (GPIOs) for interrupt and synchronization
  - Full set of software drivers (Linux and Android compatible) for turnkey

Applications

- Laser assisted autofocus (LAF). Enhances the camera AF system speed and robustness especially in difficult low light or low contrast scenes. Ideal companion for phase detection autofocus (PDAF) sensors.
- Scene understanding. Multi-zone and multi-object distance detection enables touch-to-focus or focus bracketing for best shot selection.
- Camera assist. Further camera assistance by enabling flash dimming, indoor/outdoor detection and background removal assist
- Augmented reality/virtual reality (AR/VR) enhancement. Dual camera stereoscopy and 3D depth assistance thanks to multi zone distance measurement
- Video focus tracking. 60 Hz ranging allows optimization of continuous focus algorithm

Description

The VL53L5 is a state of the art, Time-of-Flight (ToF), laser-ranging sensor enhancing the ST FlightSense product family.

Housed in a miniature reflowable package, it integrates a SPAD array, physical infrared filters, and diffractive optics (DOE) to achieve the best ranging performance in various ambient lighting conditions with a range of cover glass materials.

The use of a DOE above the vertical cavity surface emitting laser (VCSEL) allows a square FoV to be projected onto the scene. The reflection of this light is focused by the receiver lens onto a SPAD array.

The VL53L5 uses ST's latest generation, direct ToF technology which allows absolute distance measurement whatever the target color and reflectance. It provides accurate ranging up to 400 cm and its 32bit MCU with extra HW accelerator can post-process the histogram and stream a ready to use depth information at fast speeds (60Hz), which makes it the fastest, multi-point, miniature ToF sensor on the market.

With patented algorithms and ingenious module construction, the VL53L5 is also able to detect different objects within the FoV with depth information at 60 Hz.

Scene browsing and multi zone detection is possible with the VL53L5 thanks to a software customizable detection array to achieve a quicker touch-to-focus or mini depth map.

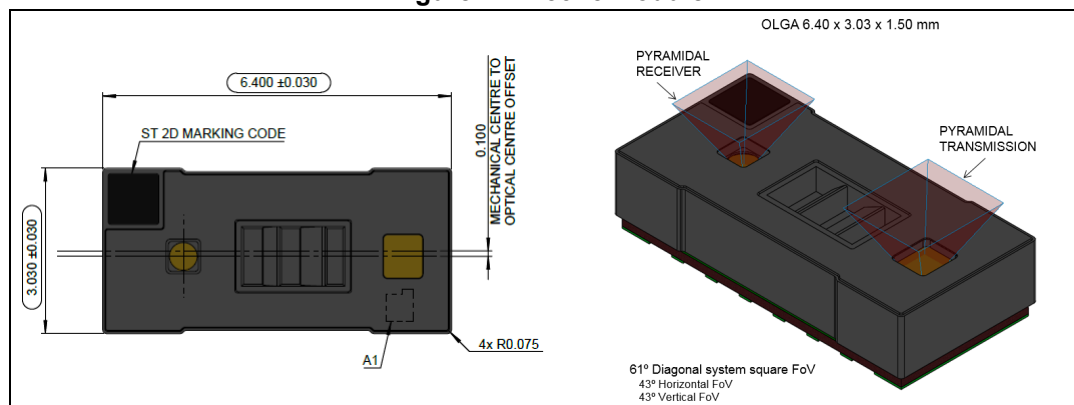## Technical specification

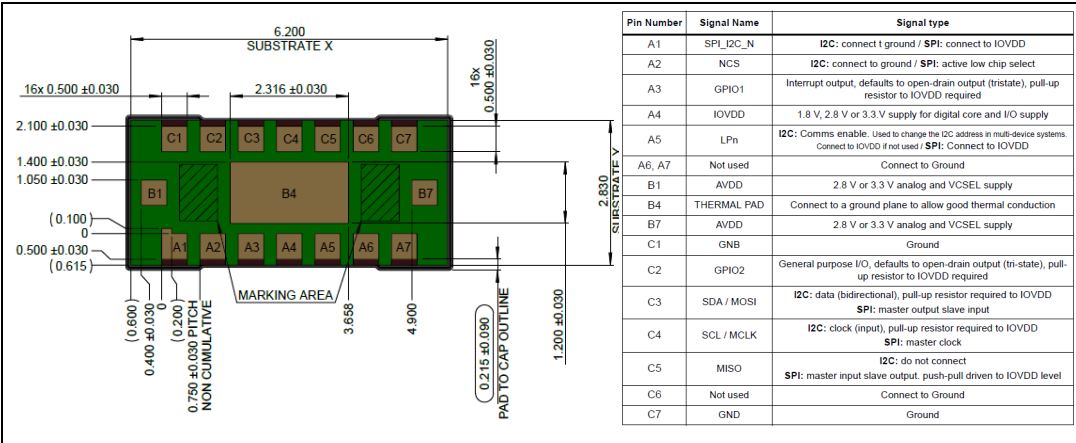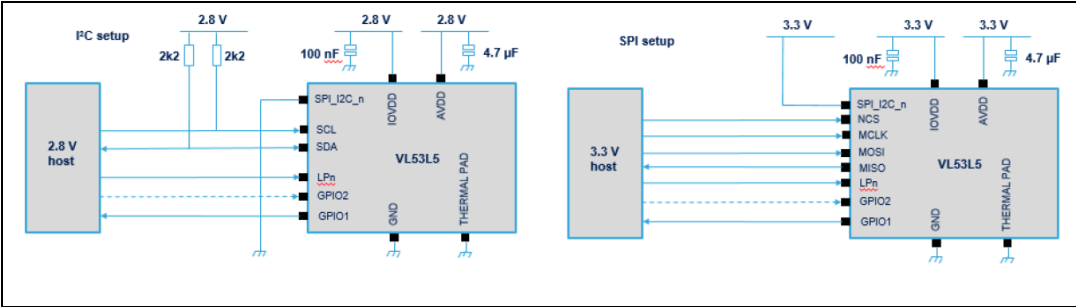**Figure 1. VL53L5 Module**

Figure 2. VL53L5 Pinout

Pin Number	Signal Name	Signal type
A1	SPI_I2C_N	**I2C:** connect t ground / **SPI:** connect to IOVDD
A2	NCS	**I2C:** connect to ground / **SPI:** active low chip select
A3	GPIO1	Interrupt output, defaults to open-drain output (tristate), pull-up resistor to IOVDD required
A4	IOVDD	1.8 V, 2.8 V or 3.3 V supply for digital core and I/O supply
A5	LPn	**I2C:** Comms enable. Used to change the I2C address in multi-device systems. Connect to IOVDD if not used / **SPI:** Connect to IOVDD
A6, A7	Not used	Connect to Ground
B1	AVDD	2.8 V or 3.3 V analog and VCSEL supply
B4	THERMAL PAD	Connect to a ground plane to allow good thermal conduction
B7	AVDD	2.8 V or 3.3 V analog and VCSEL supply
C1	GNB	Ground
C2	GPIO2	General purpose I/O, defaults to open-drain output (tri-state), pull-up resistor to IOVDD required
C3	SDA / MOSI	**I2C:** data (bidirectional), pull-up resistor required to IOVDD / **SPI:** master output slave input
C4	SCL / MCLK	**I2C:** clock (input), pull-up resistor required to IOVDD / **SPI:** master clock
C5	MISO	**I2C:** do not connect / **SPI:** master input slave output. push-pull driven to IOVDD level
C6	Not used	Connect to Ground
C7	GND	Ground

Figure 3. VL53L5 Electrical Schematics examples

Ordering information

Table 1. Ordering information

Sales type	Package	Packing
VL53L5CAV0GC/1	Optical LGA16 with liner	Tape and reel (with liner)

ECOPACK®

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

Revision history

Table 2. Document revision history

Date	Revision	Changes
11-Jan-2018	1.0	Initial release
19-Oct-2020	1.1	Update

Mouser Electronics

Authorized Distributor

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