Overview

SEN-36007-L3 is a 5-meter capable, maximum 50 Hz sample rate Time-of-Flight (ToF) sensor based on the ST Microelectronics VL53L3. Unlike typical "breakout board" solutions, SEN-36007 is protected by a plastic enclosure, including special, split-view cover glass to prevent internal reflections from causing erroneous readings from the sensor. This package is not water-proof, but is capable of preventing direct mechanical access (rocks, dirt, metal shavings) and ingress of probing fingers from damaging the delicate VL53L3 IC. The sensor package includes a power LED indicator, level translation and power components to enable a 3.0 - 5.5V digital and supply range, and a Qwiic-compatible cable installed. SEN-36007-L3 represents a good balance between cost and performance of a ToF sensing solution. We also offer a SEN-36007-L1 version of this module if your application requires a longer range (VL53L1).

Features

- Protected module for ST's VL53L3
- Qwiic-compatible I2C interface included
- Up to four ranges can be output
- Absolute (mm) ranging, direct ToF
- 10mm minimum detect range
- 5-meter maximum range
- Adjustable sampling to 50Hz
- Invisible 940nm Class 1 laser emitter
- Up to 1MHz I2C clock frequency
- 3.0V - 5.5V I2C and supply voltage range

Includes

- SEN-36007-L3 Multi-zone ToF Module, fully assembled

Typical Applications

- Service robots and vacuum cleaners
- Drones
- Laser-assisted autofocus and tracking
- User detection
- Smart (shelves, vending, sanitary, lighting, building)
- Did we mention robots?!

Description

ST's FlightSense™ technology uses an invisible Class 1 VCSEL laser to measure absolute distance, regardless of color or reflectance. The VL53L3 has several user-adjustable parameters for end-use optimization. These include ranging (distance) modes, ranging (distance) timing and allowance, data validation thresholds, calibration functions, and more.

These adjustable parameters are specific to application needs, so a user must understand their application in order to properly design a robust calibration and implementation. Ultimately, most configuration functions support a handful of primary outputs from the VL53L3:

- Number of targets found
- Ranging distance, in mm
- Return signal rate (signal integrity)
- Ambient signal rate (noise)
- Range status (confidence in result)

Note: all values per object detected
Perhaps the biggest impact on sensor performance is the "**Distance Mode**" chosen by the user. Short, Medium, and Long modes can be selected. Tuning this parameter for your application is an exercise in balancing maximum distance performance with ambient light (noise) immunity. Short mode, for example, provides good ambient light immunity and enables object detection down to 10mm, but provides a maximum of 1.3 meter range. Medium distance mode (sensor default) gives the longest maximum distance ranged at 5 meters (indoors), with strong ambient light conditions cutting this to below 1.6 meters, per ST testing. Low-reflectance targets decrease these values. Long distance mode, contrary to its name, reduces maximum distance in order to save power consumption. If maximum performance is what you are looking for, stick to medium mode. See the VL53L3 ranging performance appnote, section 1.3 for more details.

Ranging timing (**timing budget**) not only impacts maximum ranging distance, but also the repeatability (statistical significance) of the output. Essentially, lowering the timing budget to increase sample frequency rate reduces the maximum distance that can be ranged for a given ambient lighting condition and target color, while simultaneously increasing the standard deviation of the measurement. See VL53L3 datasheet, section 5.1 for more details.

Calibration functions are built into the VL53L3 sensor to account for a number of final-installation conditions. The number of these functions is numerous, and it is recommended to review the VL53L3 datasheet to understand these functions.

Application & Guide

SEN-36007-L3 is designed for rapid setup and integration. Zero soldering. Qwiic-compatible I2C interface. Just about as easy as you can get.

QuickStart

Start by plugging SEN-36007-L3 into a Qwiic-compatible port on either your Qwiic-enabled microcontroller board or something like a Qwiic Mux Breakout. Download the desired application code, flash the board, and start ranging! Please note: if you're using Arduino code examples, be sure to set your serial monitor baud rate to match the Serial.begin() statement in the setup() routine.

Advanced User

ST's VL53LXXX sensors are smart, and with those smarts comes LOTS of configurability. It is highly recommended to spend some time with the VL53L3 datasheet and appnotes once you are up and running to ensure optimal performance in your application.

Common Issues

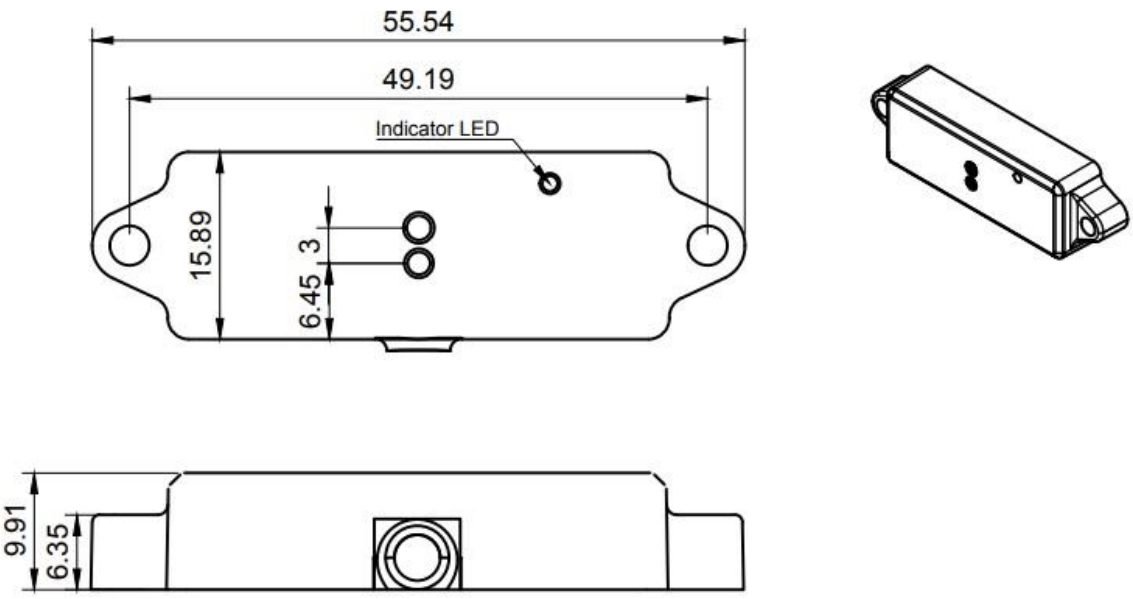
- Conflicting device addresses when using multiple SEN-36007-L3 modules
  - Use an I2C MUX to add additional SEN-36007s without any soldering!
- Inconsistent readings on a target
  - First, consider your ranging mode and expected target distance range (what is the maximum distance you need to sense)

- Adjust the timing budget to allow the sensor time to acquire a statistically relevant result
- Consider applying retroreflective tape to your target for a higher return signal

Ordering Options & Related Parts

SEN-36007-L3: VL53L3 Qwiic 2m, multi-target ToF Module
SEN-36007-L1: VL53L1X Qwiic 4m ToF Module
IFB-10011: Qwiic-compatible I2C MUX based on TCA9548A
WIR-10001: 10cm Qwiic-compatible interconnect cable
SEN-36005: VL53L1-based, 5-16V, CAN interfaced ToF module

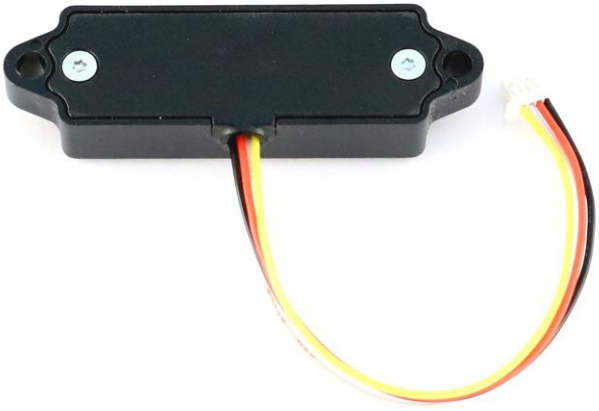
Appendix 1: SEN-36007 Mech Drawing



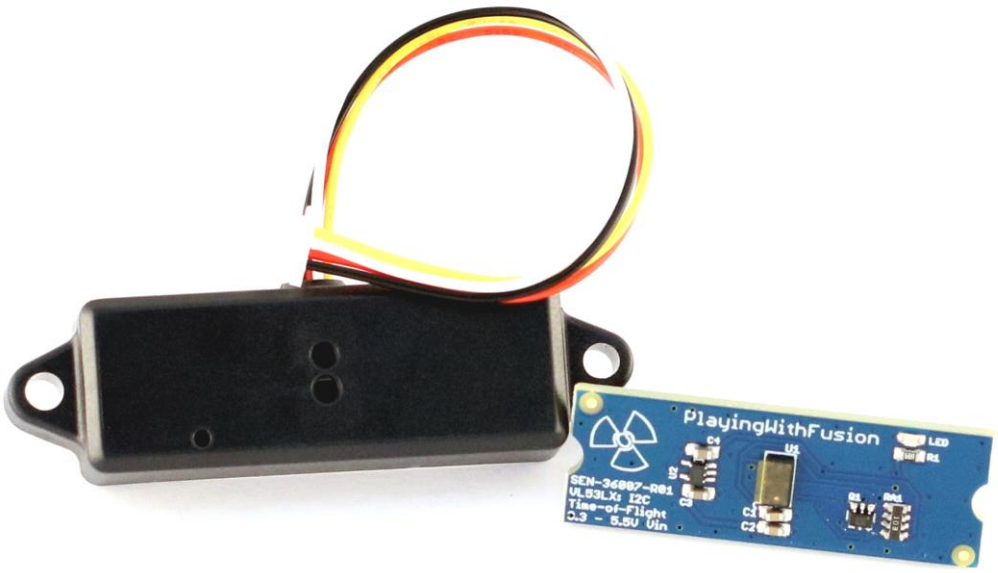
Notes:
1) All dimensions in mm

Appendix 2a: SEN-36007 Front View

Appendix 2b: SEN-36007 Back View



Appendix 2c: SEN-36007-L3 Component View



Revision History

Date	Author	Notes
03/24/2021	J. Steinlage	First revision published