FlightSense™ ST time-of-flight Proximity and Ranging sensors

Mass-Market presentation

Imaging Division
Personal Electronics, Industrial & MassMarket

Updated the 02\textsuperscript{nd}, July 2020
ST proprietary FlightSense™ technology

True distance measurement
Independent of target size, color & reflectance

Fast and low power

Truly invisible 940nm illumination

**Time-of-Flight Principle**

Measured distance = \( \frac{\text{Photon travel time}}{2} \times \text{Speed of light} \)

1cm round-trip takes 67ps
ST Pioneer and Leader in Time-of-Flight (ToF)

ST is #1 Worldwide Time-of-Flight sensor supplier

4 Generations
of all-in-one ToF solution deployed since 5 years

>50 OEMs
Over 170 phones with ST’s Time of Flight technology
Several hundreds of non wireless end products on the market
Unlimited variety of use-cases beyond smartphones

>42,000
Evaluation kits deployed

1 Billion
ToF units shipped. Mastering end-to-end supply chain

FlightSense™
VL53L5
4th generation FlightSense™
FlightSense™
Typical Module overview

All-in-One (illumination & sensor) Time of Flight System → Optimized Size, Performance, Cost mix

- Advanced optics with integrated IR filters
- State-of-art assembly & testing ST manufacturing line in Shenzhen
- Monolithic ToF SoC, SPAD Array, RAM/ROM & high safety Class1 VCSEL driver
- Full Class 1 safety high efficiency VCSEL
IEC/EN Class 1 laser product certified:
- For both 60825-1:2007 and 2014 editions
- Under all operating conditions
- Under single-fault failure conditions
  ➔ SAFEST laser class

- Final product laser safety certification guaranteed provided:
  1. The laser output power **must not be increased** by any means, including firmware and hardware
  2. No **magnifying lens** must be added to the product
  3. The ToF sensors should be mounted in the consumer product under a glass/plastic material such that the sensors **cannot be physically accessed** by the user without a specialist tool
FlightSense™
Functions, Use-cases & Applications
Typical Applications

**Camera Assistance**
- Laser autofocus
- Touch-to-Focus
- Scene understanding
- AWB assist based on 940nm content

**Ranging & Proximity**
- True ToF distance
- High accuracy
- Up-to 4 meters

**Multispectral & Flicker**
- True tone color display & ALS
- Camera AWB
- Light flicker measurement and correction

**Face Identification**
- Face anti-spoofing
- Cost, power, size optimized
- All-in-one depth sensing

**Presence, User Detect**
- Security
- Comfort
- Power saving
- Eye protection
- Wellness

**Depth Map & AR/VR**
- All-in-one Module
- High resolution receiver
- Gesture
- Consumer LiDAR
FlightSense™ sensors main functions

Enabling multiple Use-Cases:

• Ceiling detection
• Content analysis
• Cliff detection
• Gesture control
• Hands-free operation
• Light control
• Load management
• Object detection
• Obstacle avoidance
• Occupancy detection
• Parking occupancy
• People counting
• Power saving
• SLAM
• Touch-less operation
• Presence detection
• Volume control
• Wall tracking

To develop unlimited Markets...
Unlimited Markets & Applications

- Laptops
- Tablets
- Cleaning robots
- Service Robots
- Toys
- Drones
- Smart home
- Public Parking
- Industrial
- Lockers
- ATM
- AR/VR
- Printers
- Smart home
- Industrial
- Lockers
- ATM
- Wearable & IoT
- Faucets
- Industrial
- Trucks
- White Goods
- Medical
- Farming
- Warehouse
- Vending machines
- Projectors
- Dispensers
- Lighting
- Cleaning robots
- Service Robots
- Drones
- Smart home
- Public Parking
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- Lockers
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- Wearable & IoT
- Faucets
- Medical
- Farming
- Warehouse
- Vending machines
- Projectors
- Dispensers
- Lighting
Flightsense™ mass-market roadmap

Updated the 26th of May 2020
FlightSense™ Mass-Market Roadmap

Overall performance

XX° FoV
Programmable FoV
XX° Max
Up to 4 zones sequentially
Histogram
MultiObject detection
Perf. Under Ambient
Smudge correction
Close distance
Linearity

XX°

Max. Distance measurement in cm
(in the dark)

VL6180V1
(Gen1)

VL53L0CX
(Gen2)

VL53L1CB
(Gen2)

VL53L1CX
(Gen2)

VL53L3CX
(Gen2)

New
In MP

New
In MP

Already
In MP

Already
In MP

New
In MP

Already
In MP

Close distance
Linearity

Histogram
MultiObject detection
Perf. Under Ambient
Smudge correction
Close distance
Linearity

100cm
200cm
300cm
400cm
Detection Cones (Optical Field-of-view FoV)
Imaging products supported by ST eco-system & and expanding optical partnership eco-system

Complete package
- X-NUCLEO expansion board
- P-NUCLEO packs with STM32 NUCLEO
- Stand-alone Breakout boards

STM32 ODE
- FlightSense™ fully integrated in STM32 Ecosystem
- Compatible with NUCLEO-F401RE and NUCLEO-L476RG
- Referenced on mbed & Arduino platforms

Cover glasses
Oval Cover Glass:
- Reference cover glass proposed in NUCLEO development boards

Square Cover Glass:
- 3 spacers 0.25/0.5/1mm to create various air gaps
- Cover glass holder
FlightSense™ Breakout boards

Breakout boards are available for each sensor variant, for easy integration into customer’s device

- The expansion boards can accept breakout boards, through connectors or flying wires
- For 2.8V supply application, the breakout board can be separated, in order to use only the “mini PCB”, easier to integrate into a customer device
Raspberry Pi®
VL53L1CX breakout board

Pololu Robotics & Electronics
VL6180X carrier (60 cm max range)
VL53L0X carrier (200 cm max range)
VL53L1X carrier (400 cm max range)

FlightSense™
Raspberry, Arduino & arm MBED

ARM MBED
VL6180V0 →
VL53L0CX
VL53L1CX

Forum, open source code
GitHub
Videos
Tutorials