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ST's FlightSense* Time-of-Flight solutions for touchless interactions

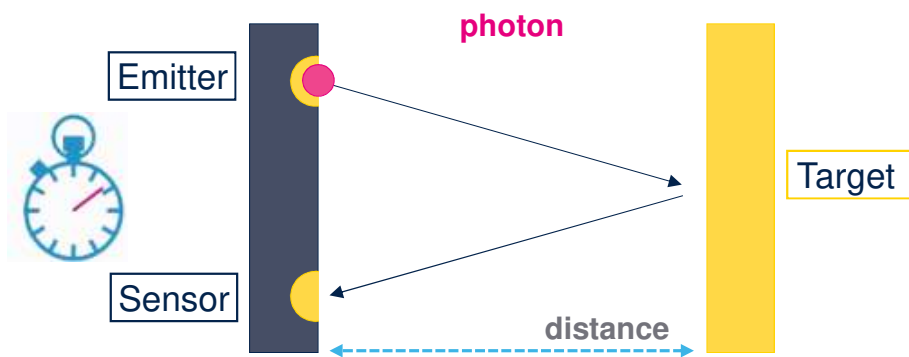
July 21, 2020



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FlightSense* ... Making light work

Time-of-Flight Principle



$$\text{Measured distance} = \text{Photon travel time} / 2 \times \text{Speed of light}$$

1 cm round-trip takes 67ps

● ST proprietary FlightSense* technology

● True distance measurement
Independent of target size,
color & reflectance

● Fast and low power

● Truly invisible 940nm illumination

FlightSense* 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 solutions 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



VL53L1CX

3rd generation FlightSense



FlightSense* Typical Module overview

All-in-one (illumination & sensor) Time-of-Flight system for optimized size, performance, and 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

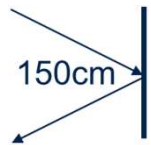
Use cases

FlightSense* technology

Key features

High performance distance measurement

Actual distance measurement
Accurate distance measurement
Immunity to color, texture, and material



± 20mm



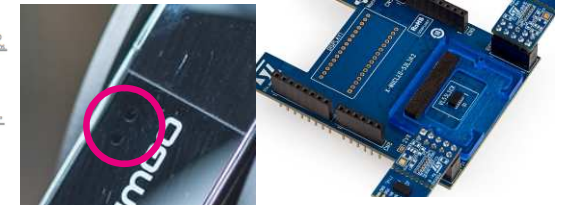
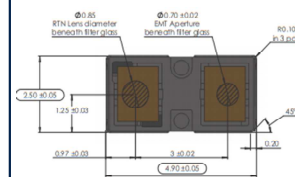
Low power consumption

Can be integrated to battery powered devices
Autonomous low power mode available



Easy and quick integration

All-in-one and small footprint
Can be hidden behind black cover glass
Full package available for prototyping



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Possible applications (1/2)

Liquid level management

Liquid level control
Gel tank level management

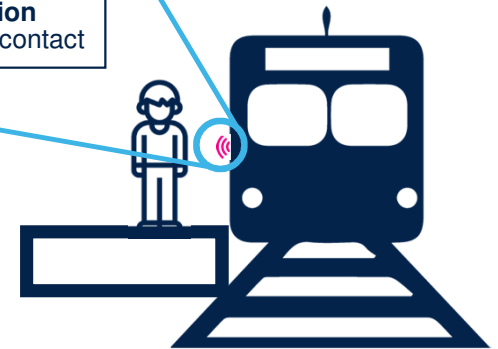
Monitoring in real time
Avoiding empty tank

Hydro alcoholic gel dispenser



Touchless buttons

Basic gesture recognition
Open/close the door without contact

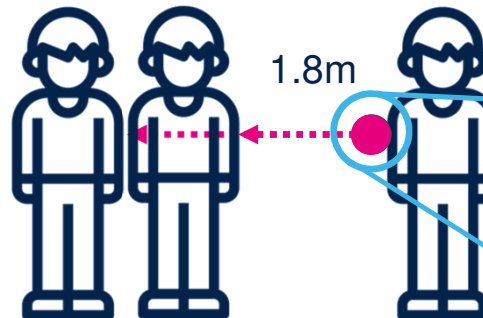


Public transportation

Proximity detection

Basic gesture recognition
"zero-touch" control of devices

Social distancing awareness



Social distancing

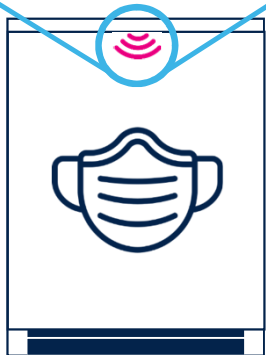
Accurate distance measurement
Keeping safe distance between people in public spaces

Possible applications (2/2)

Content management

Inventory control
Check how many masks are remaining

Monitoring in real time
Avoiding empty stock



Mask dispensers

Touchless Human Machine Interface

Basic gesture recognition
Avoid contact with screen

Presence detection
Turn on the screen if someone is in front



Public screen

Shops/Restaurants
entrance

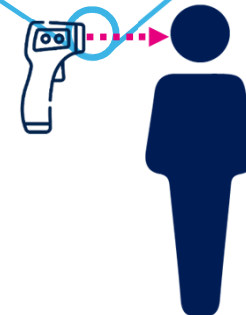


People counting

Counting entry/exit
Respecting maximum persons
authorized in a shop

Presence detection








User detection
Turn on/off the thermometer if a user
is detected

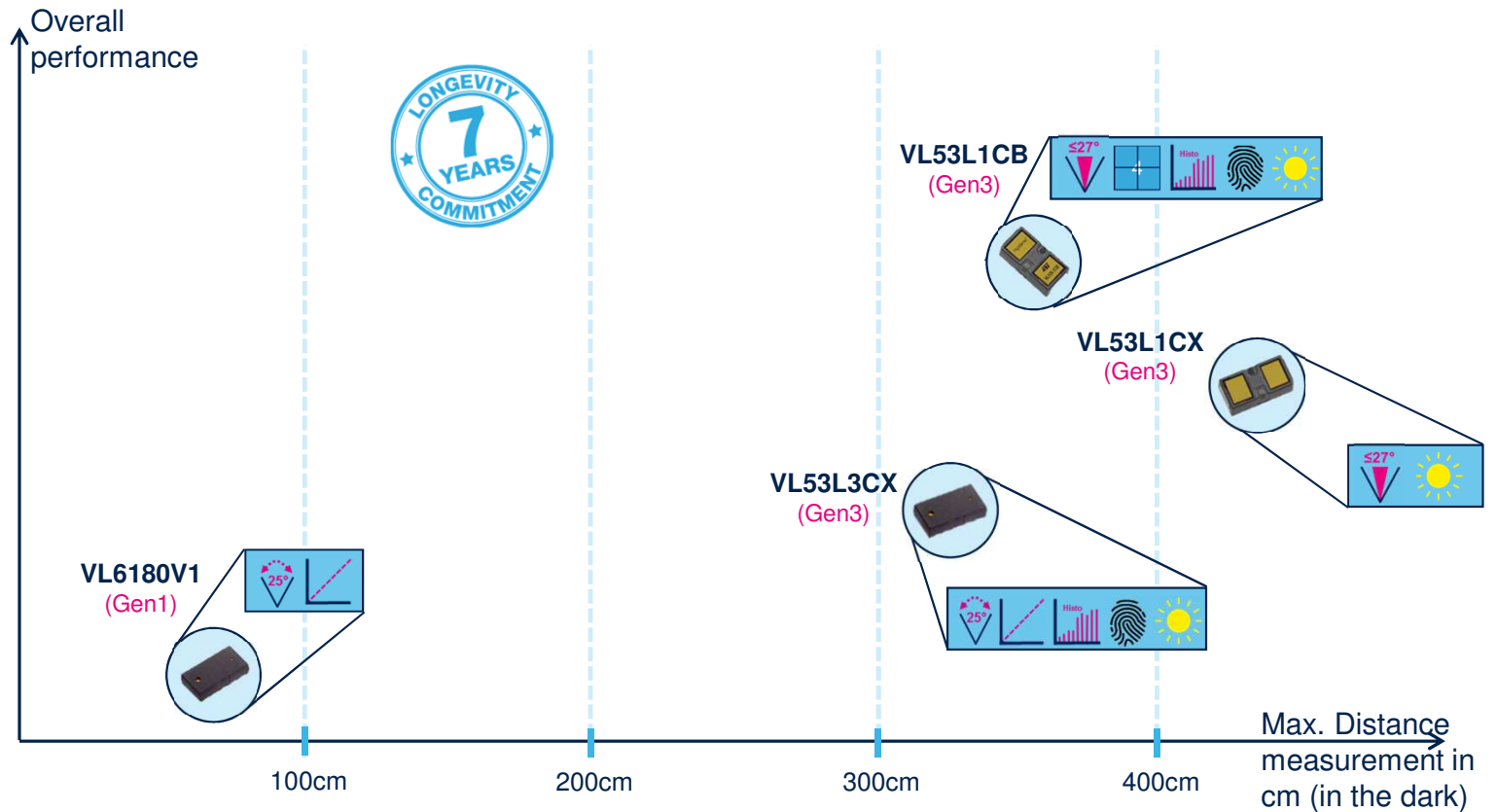


Thermometer
Thermal camera








FlightSense roadmap

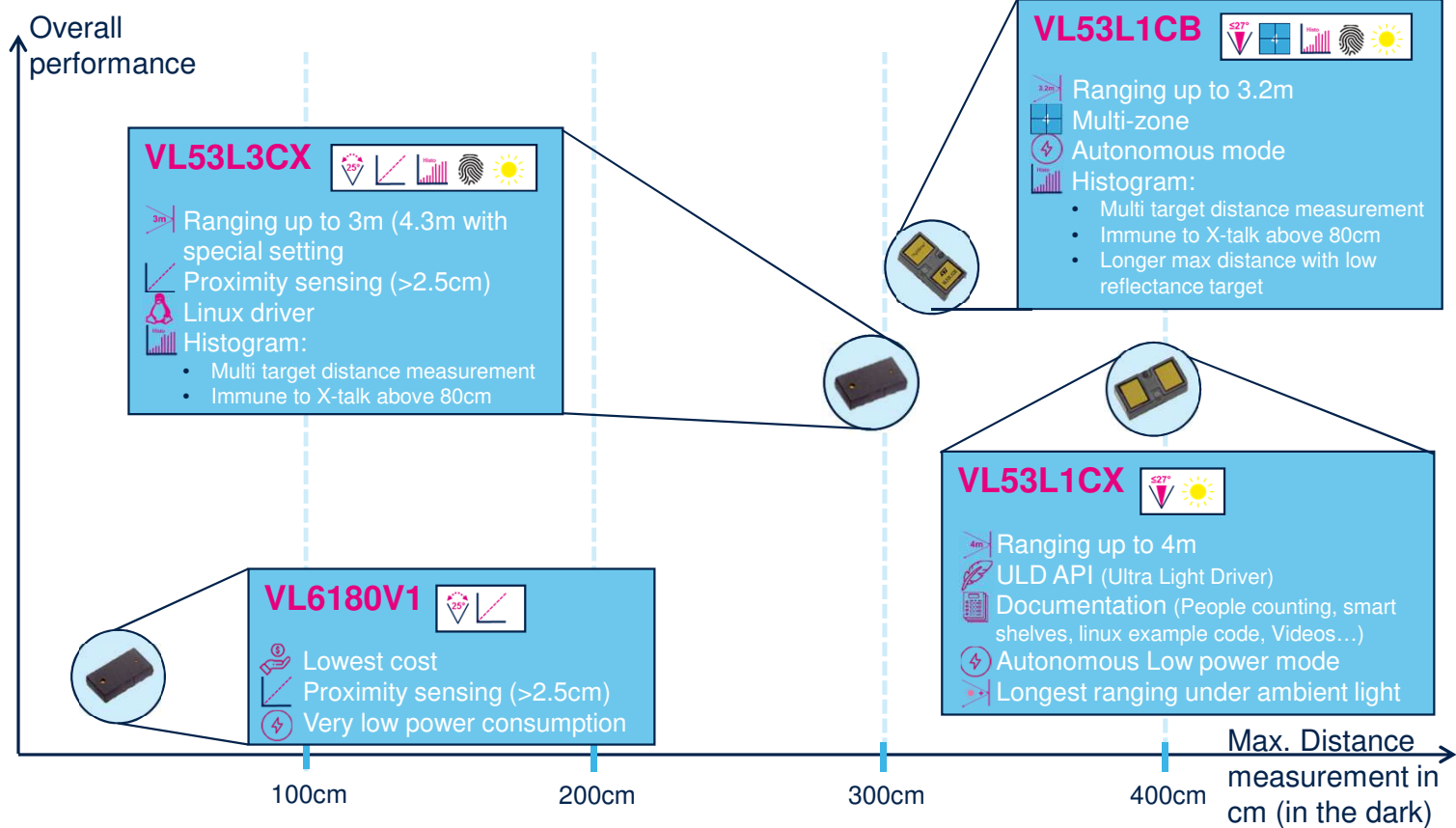
FlightSense* Roadmap

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










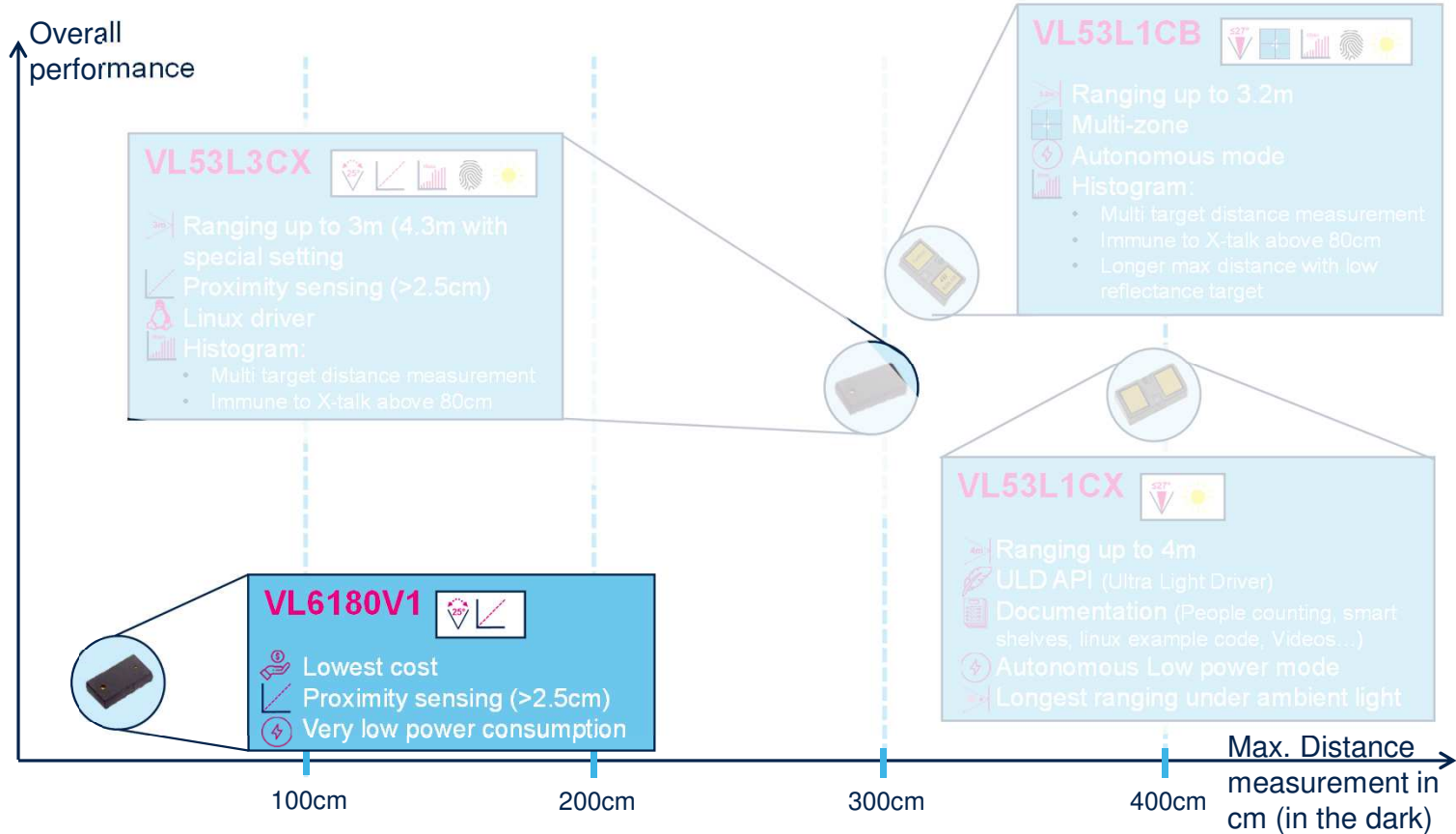
FlightSense* key advantages

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










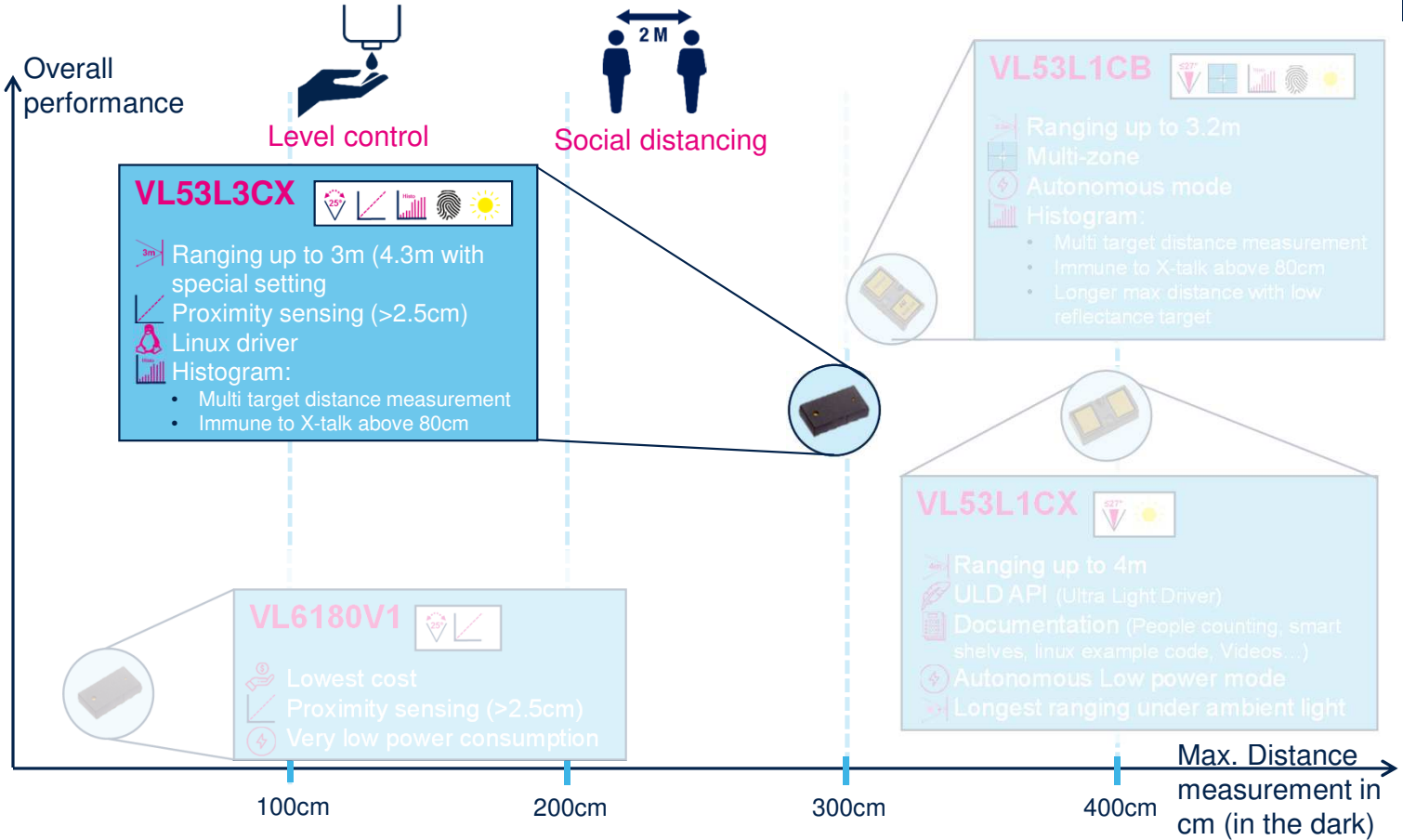
Focus on VL6180V1

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










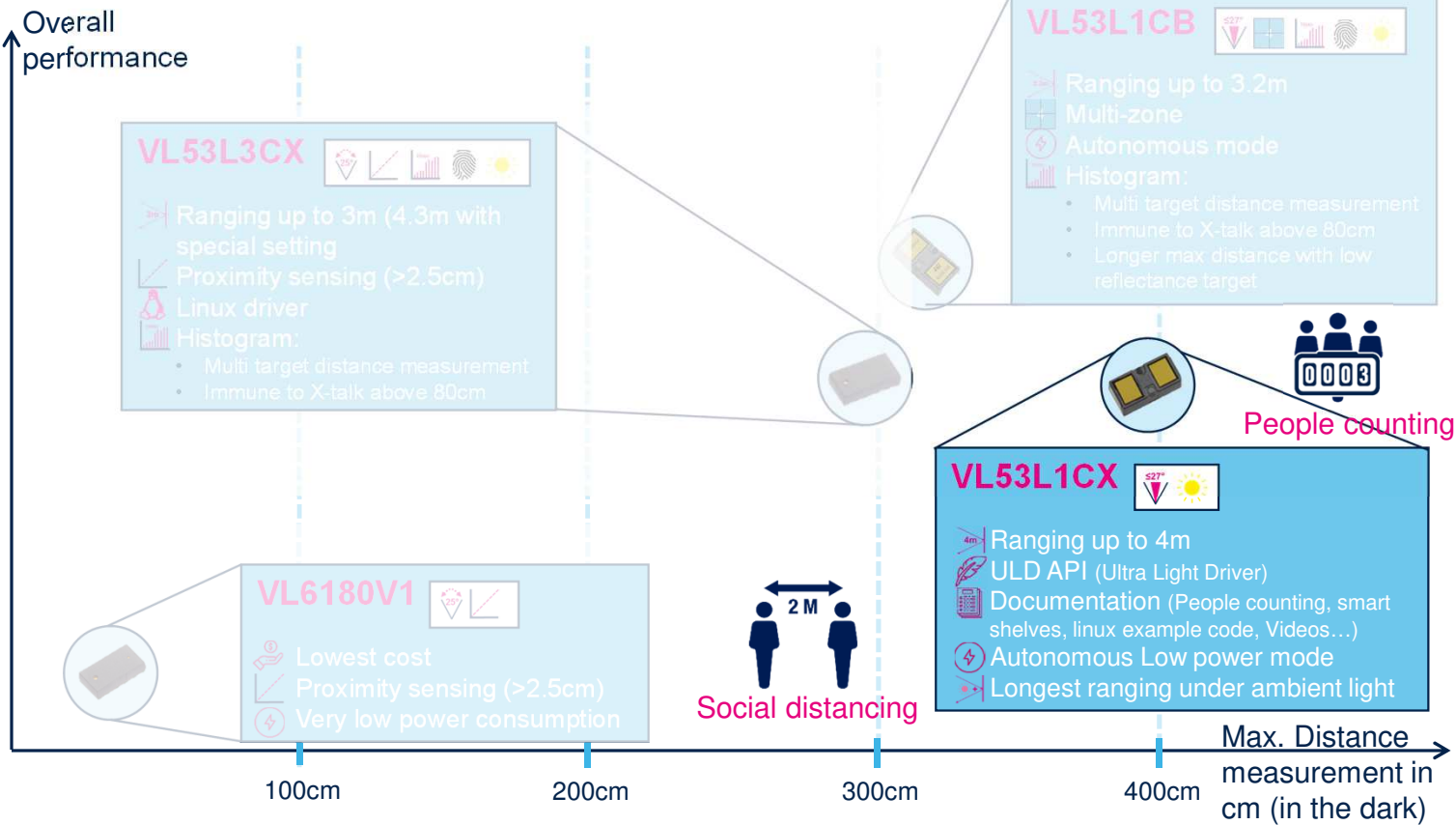
Focus on VL53L3CX

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










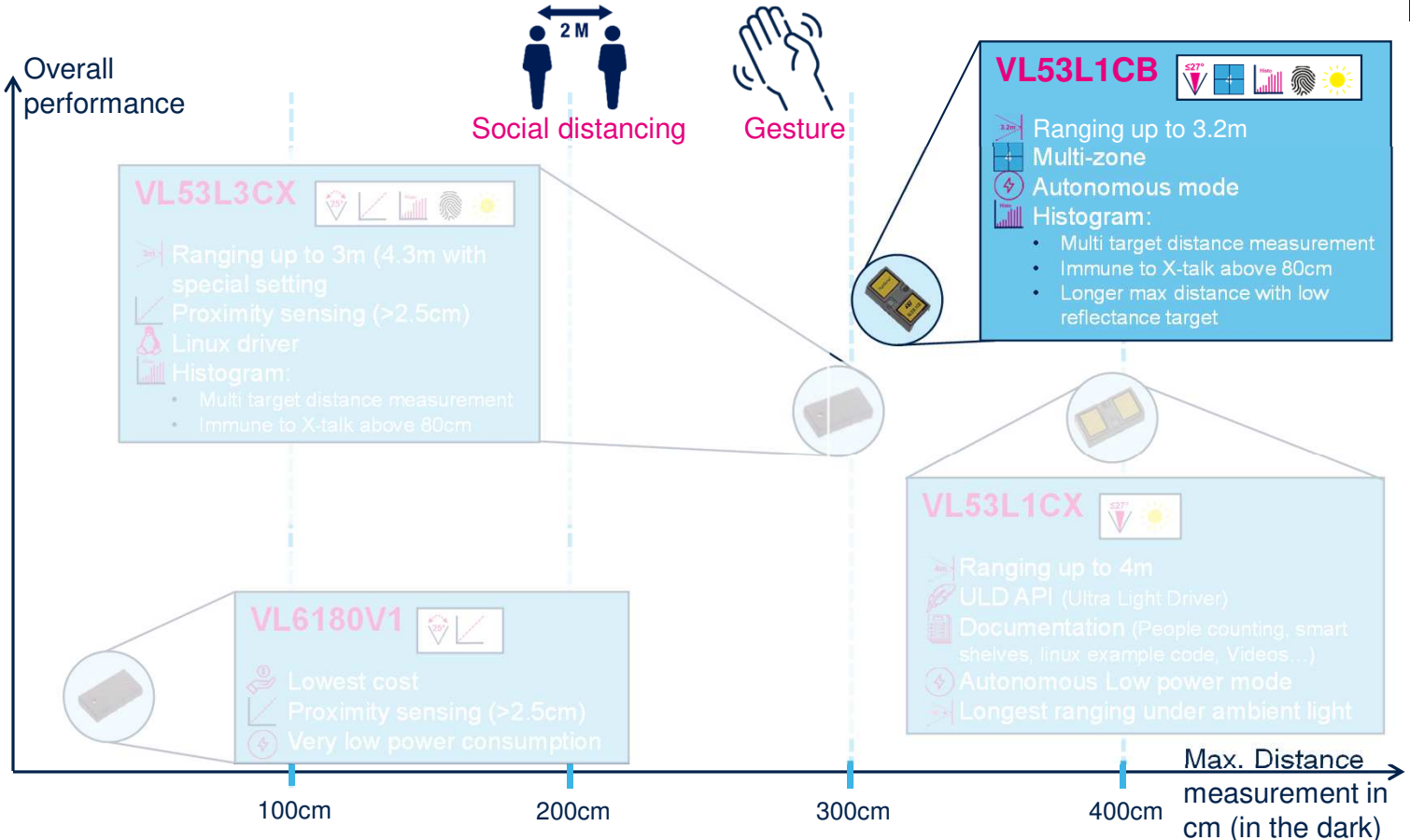
Focus on VL53L1CX

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

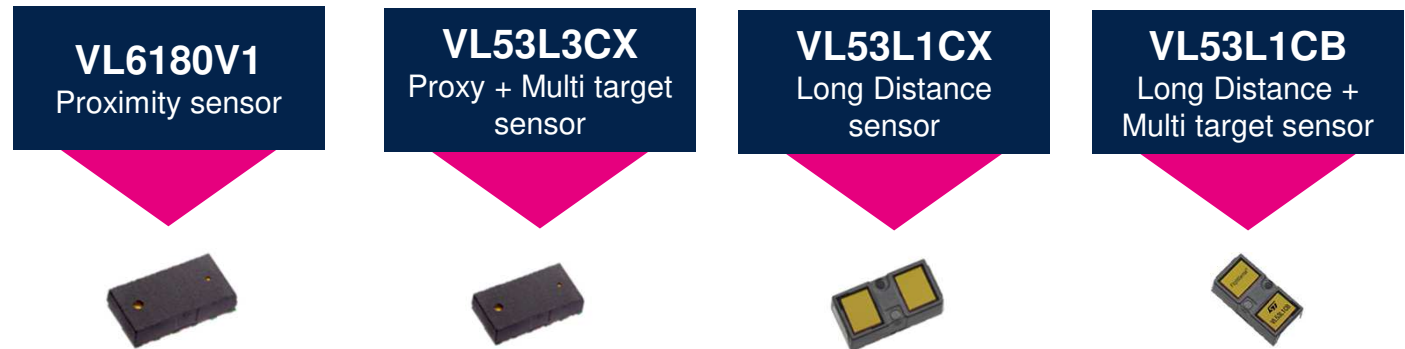


Focus on VL53L1CB

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



Use cases by product

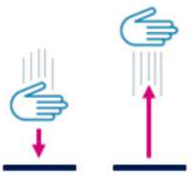
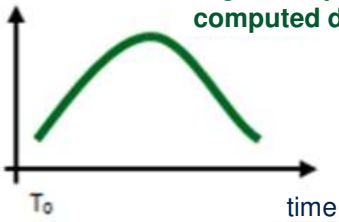
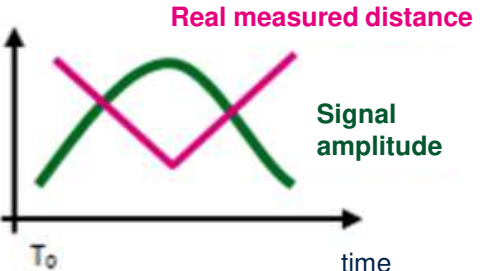

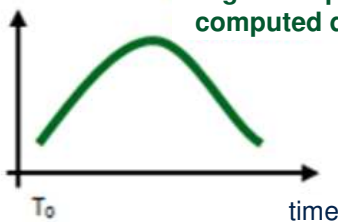
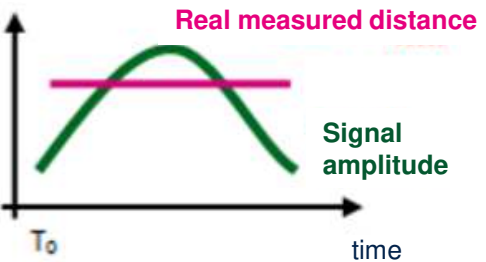


Contactless button	•	•		
Liquid Level control	•	•		
Content management		•	•	•
Basic gestures*	•	•	•	•
Social distancing		•	•	•
People counting			•	•

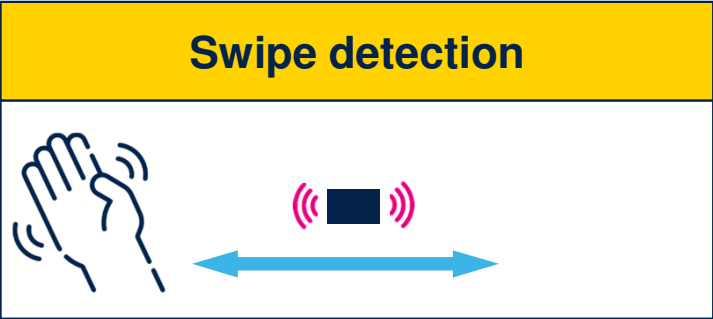
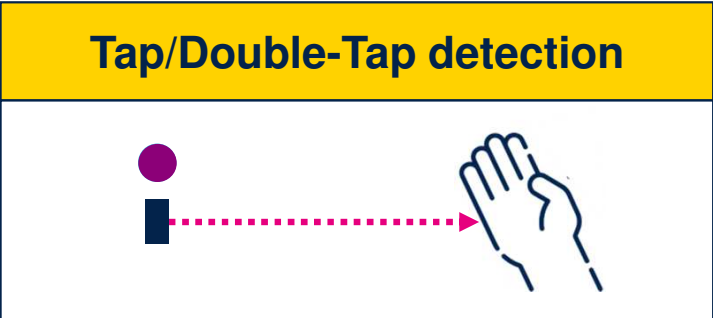
* Basic gesture: Tap detection, Double-Tap detection, Swipe detection, Level control
 Directional swipe detection is possible using two sensors

Focus on gesture recognition

Gesture Recognition FlightSense* vs conventional IR

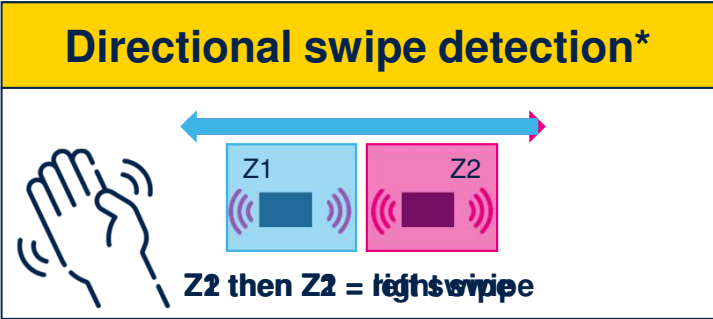
Hand movement	Conventional IR sensor	FlightSense
 <p>Up/Down</p>	 <p>Signal Amplitude = computed distance</p> <p>T_0 time</p>	 <p>Real measured distance</p> <p>Signal amplitude</p> <p>T_0 time</p>
 <p>Swipe</p>	 <p>Signal Amplitude = computed distance</p> <p>T_0 time</p>	 <p>Real measured distance</p> <p>Signal amplitude</p> <p>T_0 time</p>
Sensor answer	1 output	2 outputs

Gesture description



Applications

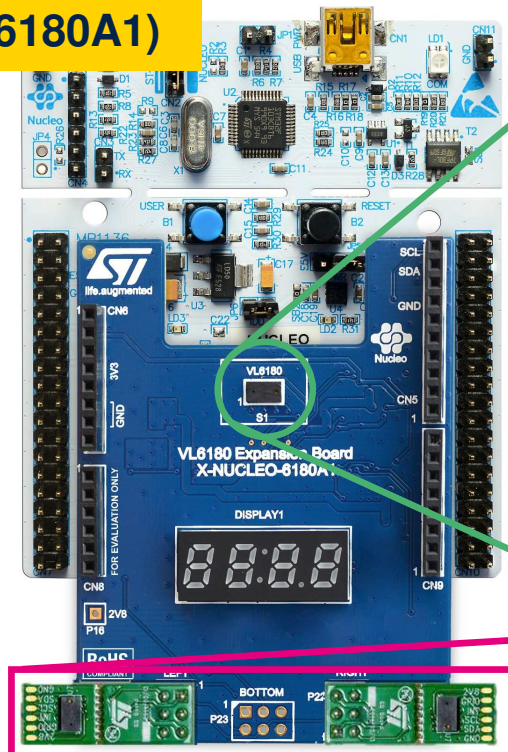
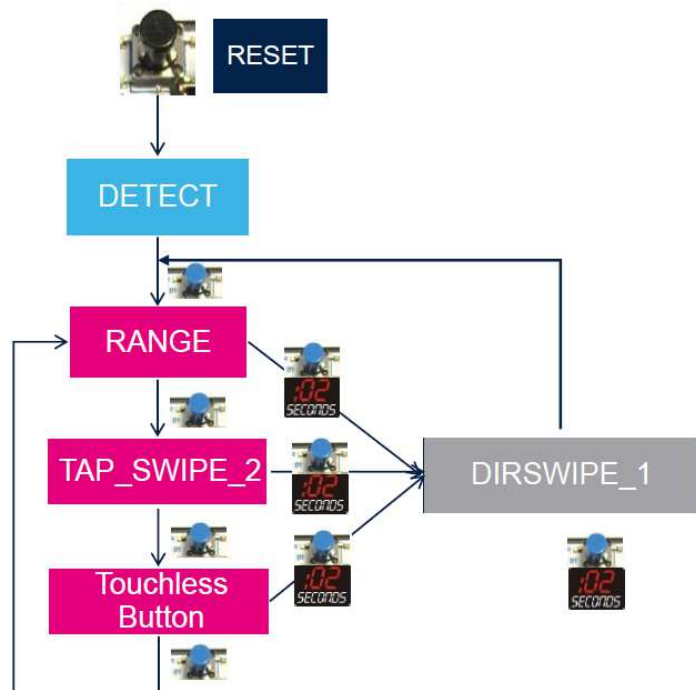
- Touchless switch
- Turn on/off a device
- Open a door
- Swipe a page
- Control volume/brightness
- ...



*using two sensors

Gesture Recognition STSW-IMG014 gesture code example

Works with Proximity ToF sensor expansion board for STM32 Nucleo (X-NUCLEO-6180A1)

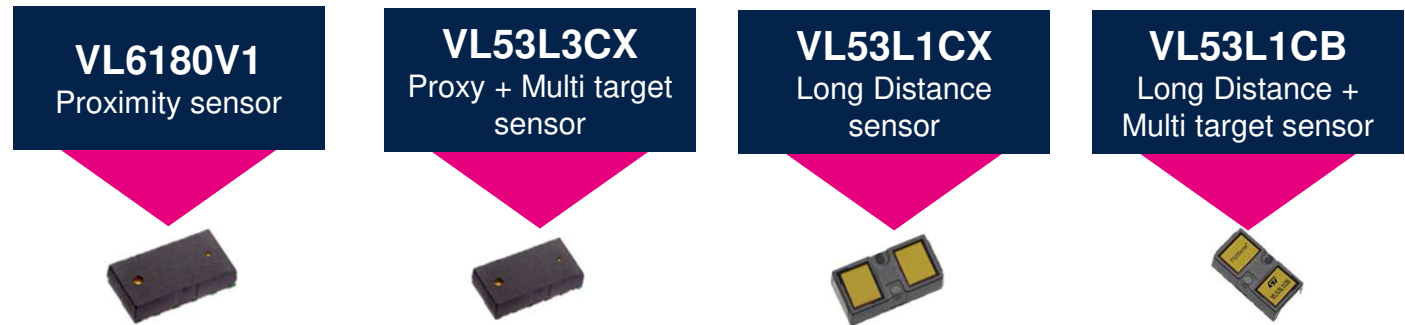


- Range**
 - Works up to 20cm
 - Level control
- Tap & Swipe Detection**
 - Works up to 20cm
 - Tap detection ([] or [_])
 - Swipe detection (_ _ or _ _ _)
- Touchless Button**
 - Works up to 5cm
 - Fast
 - Robust
- Directional Swipe**
 - Works up to 20cm
 - Two sensors*
 - Robust

* You need to use two breakout boards as delivered in the VL6180-SATEL

Development tools and software resources

SW code and drivers available for download



API Driver (full version)	STSW-IMG011	STSW-IMG015	ULD (Ultra Lite Driver) (STSW-IMG009) Full version (STSW-IMG007)	STSW-IMG019
X-Cube SW for Nucleo development tools	X-CUBE-6180A1	X-CUBE-53L3A2	X-CUBE-53L1A1	X-CUBE-53L1A2
Linux driver	N/A	STSW-IMG021	STSW-IMG013 (STSW-IMG009 based)	TBC
Other SW code examples	Gesture code (STSW-IMG014)	N/A	People counting (STSW-IMG010) 2D LIDAR (STSW-IMG017)	N/A



FlightSense* ecosystem and tools

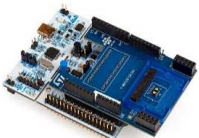
Imaging products supported by ST eco-system & and expanding optical partnership network

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 & Raspberry Pi platforms

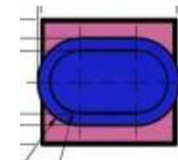
Cover glasses

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

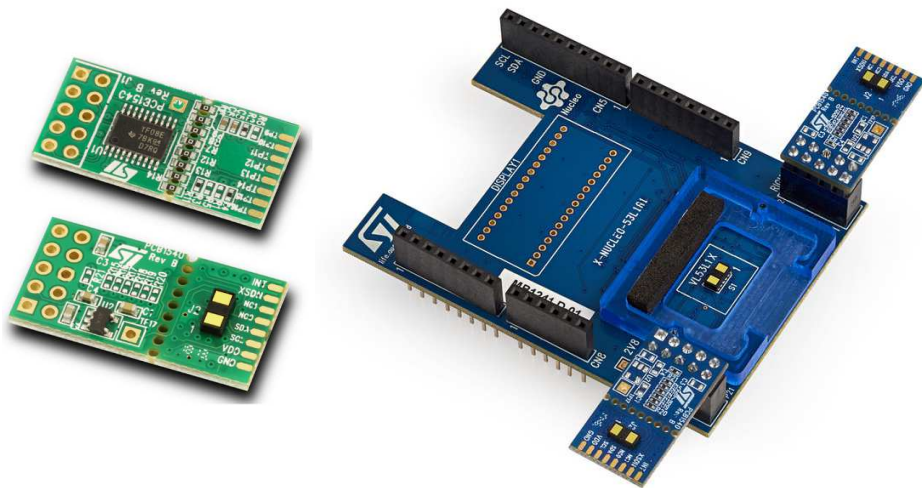


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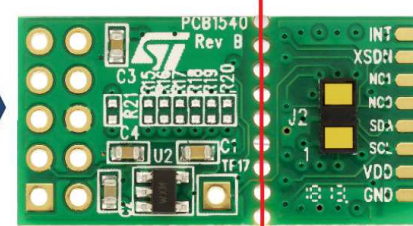
FlightSense* breakout boards

Breakout boards are available for each ToF sensor, for easy integration into your device

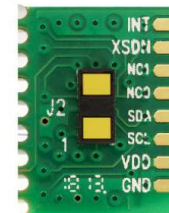
- The expansion boards can accept breakout boards, through connectors or flying wires
- For 2.8V supply application, the breakout board can be separated, in order to use only the “mini PCB”, easier to integrate into a customer device



5V to 2.8V
supply
application



Mini
PCB



2.8V
supply
application



FlightSense* is part of Blue Tile & Blue Coin programs

Blue Tile STEVAL-BCN002V1B: Bluetooth LE enabled sensor node development kit with VL53L1CX

Features

- Advanced audio processing
 - Sound Source Localization
 - Beamforming
- Wide band audio over BLE
- Advanced Audio and ToF User Interaction
- Sensor fusion
 - Ranging (Time of Flight)**
 - Inertial, environmental, acoustic, Complete development kit
 - SW Compatible with STM32 ODE
 - CoinStation + small Cradle



Main components

- BlueNRG-2: Bluetooth Low Energy
- BALF-NRG-02D3: balun and harmonic filter
- LSM6DSO: 6DoF inertial module
- LIS2MDL: magnetic sensor
- VL53L1CX: long range sensor**
- MP34DT05TR-A: digital microphone
- LPS22HH: pressure sensor
- HTS221: digital sensor for humidity and temperature







www.st.com/en/evaluation-tools/steval-bcn002v1b

FlightSense developer resources and order codes





VL6180V1 developer resources and order codes

Go to [st.com/en/imaging-and-photonics-solutions/VL6180](https://www.st.com/en/imaging-and-photonics-solutions/VL6180) or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL6180V1 sensor		VL6180V1NR/1	Delivery in T&R MOQ: 5ku LT = 16 weeks
VL6180V1 Nucleo Expansion board		X-NUCLEO-6180A1/	To go along with STM32F401 Nucleo board. Comes with 2x 2v8 Breakout boards
Pack: VL6180V1 Nucleo Expansion board + STM32F401 NUCLEO		P-NUCLEO-6180A1/	X-NUCLEO-6180A1 expansion board delivered together with STM32F401 NUCLEO board
VL6180V1 Breakout boards		VL6180-SATEL	2x Breakout boards delivered





VL53L3CX developer resources and order codes

Go to [st.com/en/imaging-and-photonics-solutions/VL53L3CX](https://www.st.com/en/imaging-and-photonics-solutions/VL53L3CX) or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL53L3CX sensor		VL53L3CXV0DH/1	Delivery in T&R MOQ: 4.5ku With protective liner LT = 16 weeks
VL53L3CX Nucleo Expansion board		X-NUCLEO-53L3A2/	To go along with STM32F401 Nucleo board. Comes with cover-glass holder, 2x cover-window samples, 3x spacers, 2x 2v8 Breakout boards
Pack: VL53L3CX Nucleo Expansion board + STM32F401 NUCLEO		P-NUCLEO-53L3A2/	X-NUCLEO-53L3A2 expansion board delivered together with STM32F401 NUCLEO board
VL53L3CX Breakout boards		VL53L3CX-SATEL	2x Breakout boards delivered

VL53L1CX developer resources and order codes

Go to [st.com/en/imaging-and-photonics-solutions/VL53L1X](https://www.st.com/en/imaging-and-photonics-solutions/VL53L1X) or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL53L1CX sensor		VL53L1CXV0FY/1	Delivery in T&R MOQ: 3.6ku With protective liner LT = 16 weeks
VL53L1CX Nucleo Expansion board		X-NUCLEO-53L1A1/	To go along with STM32F401 Nucleo board. Comes with cover-glass holder, 2x cover-window samples, 3x spacers, 2x 2v8 Breakout boards
Pack: VL53L1CX Nucleo Expansion board + STM32F401 NUCLEO		P-NUCLEO-53L1A1/	X-NUCLEO-53L1A1 expansion board delivered together with STM32F401 NUCLEO board
VL53L1CX Breakout boards		VL53L1CX-SATEL	2x Breakout boards delivered

VL53L1CB developer resources and order codes

Go to [st.com/en/imaging-and-photonics-solutions/VL53L1](https://www.st.com/en/imaging-and-photonics-solutions/VL53L1) or contact your usual distributor

Item	Picture	Commercial Product (= Order Code)	Comments
VL53L1CB sensor		VL53L1CBV0FY/1	Delivery in T&R MOQ: 3.6ku With protective liner LT = 16 weeks
VL53L1CB Nucleo Expansion board		X-NUCLEO-53L1A2/	To go along with STM32F401 Nucleo board. Comes with cover-glass holder, 3x cover-window samples, 3x spacers, 2x 2v8 Breakout boards
Pack: VL53L1CB Nucleo Expansion board + STM32F401 NUCLEO		P-NUCLEO-53L1A2/	X-NUCLEO-53L1A2 expansion board delivered together with STM32F401 NUCLEO board
VL53L1CB Breakout boards		VL53L1-SATEL	2x Breakout boards delivered

On st.com
August 20

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