Getting started with the STEVAL-PDETECT1 Presence Detection evaluation board

Introduction

The STEVAL-PDETECT1 is a presence detection add-on evaluation kit for STWIN.box, targeting human presence applications. It enables low-power applications, user privacy, and it reduces false triggers with multisensor modalities.

It is possible to use simultaneously up to three add-on boards in a daisy-chain configuration.

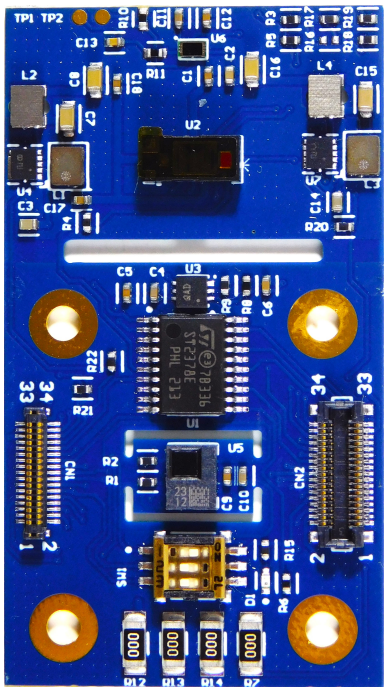
The kit is based on three sensors: STHS34PF80, VL53L8CX, and VD6283TX.

The STHS34PF80 sensor has been designed to measure the amount of IR radiation emitted from an object within its field of view. The information is digitally processed by the ASIC, which can be programmed to monitor motion, presence, or an overtemperature condition.

The VL53L8CX is a multizone (either 4x4 or 8x8) ToF ranging sensor, which enhances performance under ambient light with a reduced power consumption. Based on STMicroelectronics' FlightSense technology, the sensor is designed to provide accurate ranging up to 400 cm with a 65° diagonal field of view (FoV).

The VD6283TX (1.83 x 1.0 x 0.55 mm) is ST's new color sensor with advanced light flicker extraction. Light measurement is fast and accurate thanks to an individual ADC and a readout for each color channel. The VD6283TX uses hybrid color filters with precise responses allowing accurate computation of the correlated color temperature (CCT) and Lux information. The VD6283TX can be used for display brightness management or scene light correction.

Figure 1. STEVAL-PDETECT1 evaluation kit



1 Getting started

1.1 Features

- Kit content:
  - STEVAL-PDETCS1 board
  - TMOS long range Fresnel lens: TMOS63-10
  - Plastic case for TMOS63-10 Fresnel lenses
  - Time-of-Flight cover glass: IR136C0-IC09-A066
  - STEVAL-FLTCB03 flex cable
- Compatible with STEVAL-STWINBX1 (not included)
- Key sensor products:
  - VD6283TX ambient light sensor
  - VL53L8CX FlightSense sensor
  - STHS34PF80 infrared sensor for motion and presence detection
- Ready to use data logging application

1.2 Kit components

The STEVAL-PDETECT1 development kit includes:

- STEVAL-PDETCS1: presence detection expansion board for STWIN.box
- STEVAL-FLTCB03: 34 pin flex cable (3cm)
- TMOS63-10: TMOS long range lens
- IR136C0-IC09-A066: time-of-flight sensor cover glass
- Plastic case and lens holder

1.3 Laser safety considerations

The STEVAL-PDETECT1 contains a laser emitter and corresponding drive circuitry. The laser output is designed to meet Class 1 laser safety limits under all reasonably foreseeable conditions including single faults in compliance with IEC 60825-1:2014.

Do not increase the laser output power by any means. Do not use any optics to focus the laser beam.

Caution: Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Figure 2. Class 1 laser label

The STEVAL-PDETECT1 complies with:

- IEC 60825-1:2014
- 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1:2014 as described in Laser Notice No.56, dated May 8, 2019
- EN 60825-1:2014 including EN 60825-1:2014/A11:2021
- EN 50689:2021 except for the requirement of clause 5 from EN50689 regarding Child Appealing Products. If designing a Child Appealing Product, please contact ST Technical Application Support

1.4 VL53L8 series Time-of-Flight sensor characteristics

Laser wavelength: 940 nm

Invisible laser radiation

Maximum laser power emitted: 215 mW

Integration time: 2 ms minimum

1.5 Main board architecture and components

Figure 3. STEVAL-PDETECT1 main components

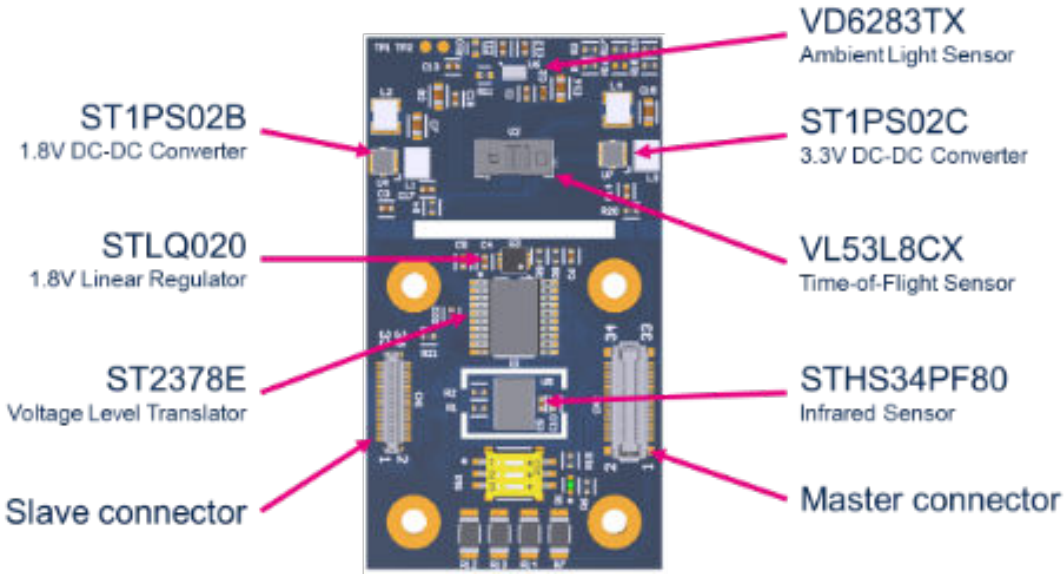
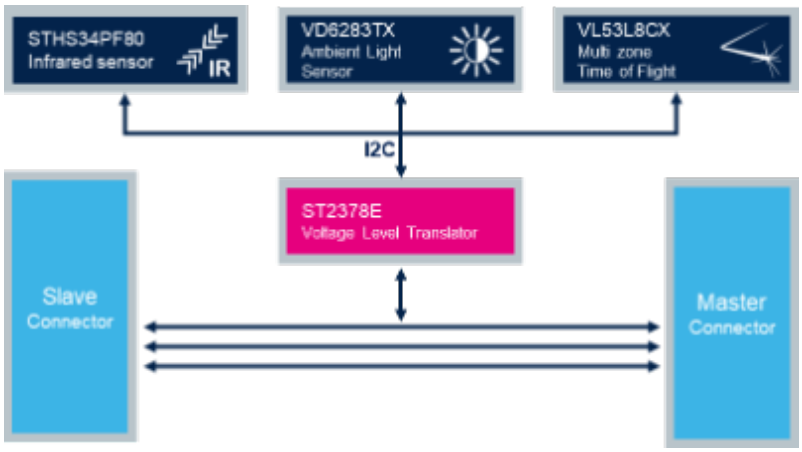


Figure 4. STEVAL-PDETECT1 Block Diagram



STHS34PF80 Low-power, high-sensitivity infrared (IR) sensor for presence and motion detection.

VD6283TX Hybrid filter multispectral sensor with light flicker engine.

VL53L8CX Low-power high-performance 8x8 multizone Time-of-Flight (ToF) sensor.

1.5.1 STHS34PF80 low-power, high-sensitivity infrared (IR) sensor for presence and motion detection

The STHS34PF80 is an uncooled, factory-calibrated, infrared motion and presence detection sensor with operating wavelength between 5 µm and 20 µm.

The STHS34PF80 sensor has been designed to measure the amount of IR radiation emitted from an object within its field of view. The information is digitally processed by the ASIC, which can be programmed to monitor motion, presence, or an overtemperature condition.

Thanks to its exceptional sensitivity, the STHS34PF80 can detect the presence of a human being at a distance up to 4 meters without the need of an optical lens.

The STHS34PF80 is housed in a small 3.2 x 4.2 x 1.455 (max) mm 10-lead LGA package.

1.5.2 VL53L8CX low-power high-performance 8x8 multizone Time-of-Flight (ToF) sensor

The VL53L8CX is an 8x8 multizone, ToF ranging sensor, which enhances performance under ambient light with a reduced power consumption. Based on STMicroelectronics' FlightSense technology, the sensor is designed to provide accurate ranging up to 400 cm with a 65° diagonal FoV.

The VL53L8CX integrates a powerful new generation VCSEL, and two advanced metasurface lenses. The hardware is housed in an innovative "all in one" module. This enables a wider variety of high-performance usecases, such as low-power system activation, gesture recognition, SLAM for robotics, liquid level monitoring, and many more.

Thanks to STMicroelectronics' patented algorithms, the VL53L8CX can detect and track multiple targets within the FoV, with a 64-zone depth measurement. The STMicroelectronics' histograms ensure a cover glass crosstalk immunity above 60 cm.

Like all ToF sensors based on STMicroelectronics' FlightSense technology, the VL53L8CX measures an absolute distance regardless of the target color and reflectance.

The VL53L8CX supports SPI and I²C interfaces for high frequency frame rates and short-boot times.

The VCSEL of the VL53L8CX emits fully invisible 940 nm IR light. Such VCSEL has a Class 1 certification that is safe for the eyes. Scene browsing and multizone detection are possible with the VL53L8CX. This is due to a software customizable detection array. It detects human presence quickly and at low-power. Such detection is known as a minidepth map.

1.5.3 VD6283TX hybrid filter multispectral sensor with light flicker engine

The VD6283TX (1.83 x 1.0 x 0.55 mm) is ST's new color sensor with advanced light flicker extraction. Light measurement is fast and accurate thanks to an individual ADC and a readout for each color channel.

The VD6283TX uses hybrid color filters with precise responses allowing accurate computation of the correlated color temperature (CCT) and Lux information. The VD6283TX can be used for display brightness management or scene light correction.

With a patented architecture and a high-performance photodiode design, the VD6283TX can extract light flickering frequencies to avoid “banding effects” on videos, or check that they are safe for human eye.

The VD6283TX is the only sensor able to extract different light flicker waveforms from 100 Hz and 2 kHz, including LED square signals, that can run flicker operations simultaneously with ALS operations.

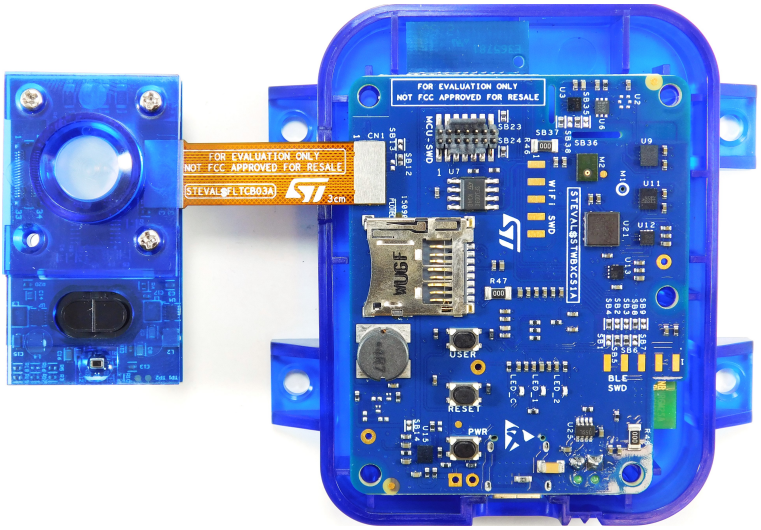
1.6 How to use the kit

The STEVAL-PDETECT1 expansion board can be used with the STEVAL-STWINBX1 kit (STWIN.box). The device can be attached to the STWIN.box using the provided flex cable, through the 34-pin connectors available on both platforms.

The STWIN.box is not included in the kit and must be purchased separately.

To plug the flex cable onto the STWIN.box, remove the plastic case cover.

Figure 5. STEVAL-PDETECT1 connected to STWIN.box



You can then remount the cover, as it leaves enough space for the flex cable.

The easiest way to read data from the STEVAL-PDETECT1 sensors is by programming the STWIN.box with the FP-SNS-DATALOG2 function pack. The firmware package provides a ready to use, precompiled binary to perform sensor data acquisition.

Note: Be careful when you remove the flex cable as you may damage it. The safest way to remove it is by pulling it next to the connectors using tweezers.

1.6.1 How to assemble the kit

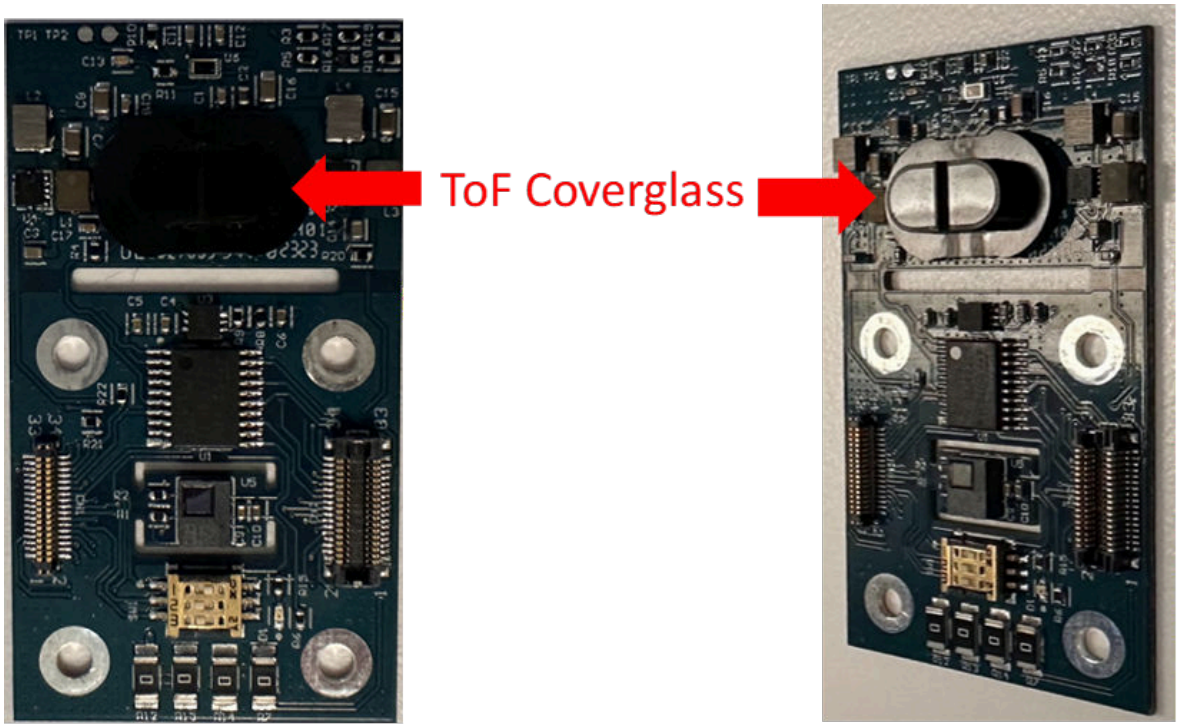
ToF protective glass

The board is released with a protective tape on the ToF sensor. Before assembling the kit, take off this tape from the sensor.

Then, remove the protective liner from the adhesive portion on the bottom of the cover glass.

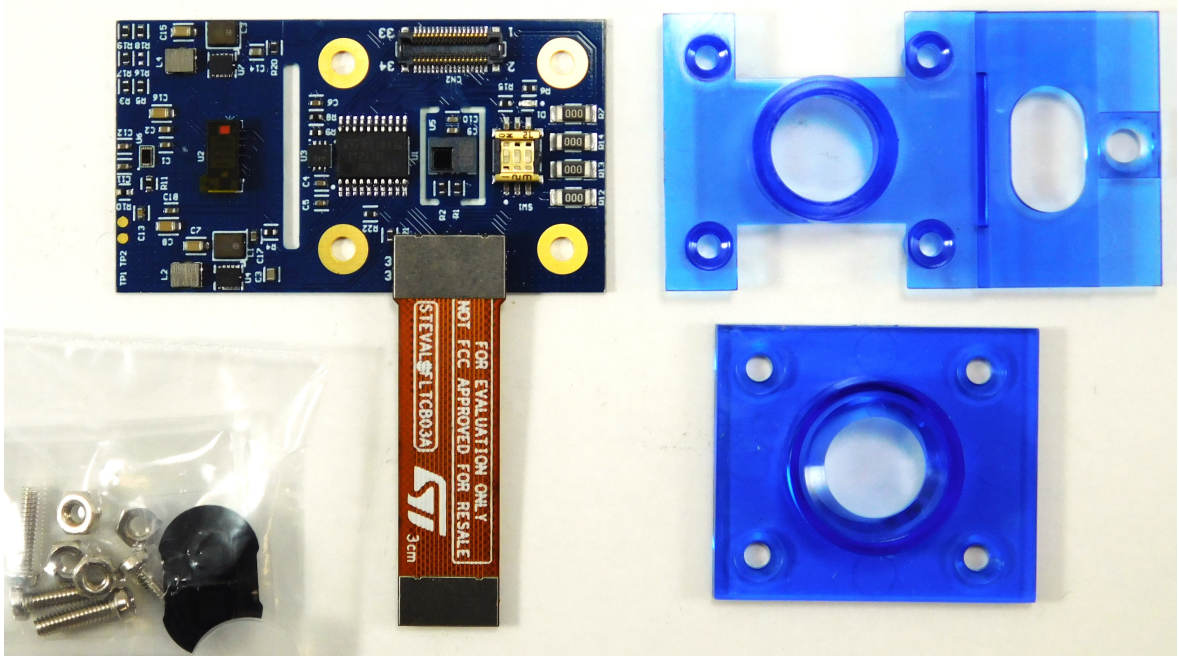
Place the cover glass over the VL53L8CX ToF device (U2) and apply slight pressure down toward the PCB to attach the adhesive portion.

Figure 6. ToF cover glass



TMOS63-10 lens and plastic holder

Figure 7. Material for mechanical assembly



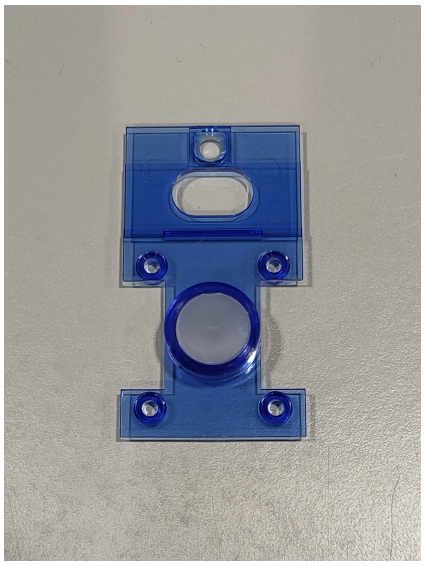
STEVAL-PDETECT1 is released with a plastic case and a Fresnel lens specifically designed for the IR sensor for presence and motion detection. They are designed to protect and enhance the board's performance.

The Fresnel lens is mainly designed for narrowing field-of-view and enlarging the distance. For further details, please refer to the product website.

To assemble the kit:

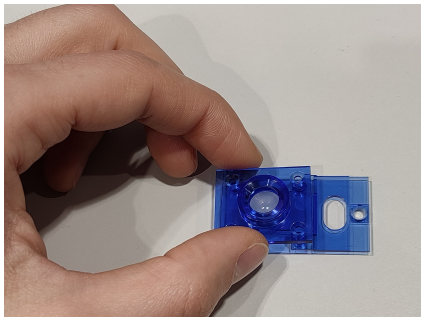
Step 1. Insert the Fresnel lens in the plastic holder. Press the lens inside the holder until you can hear a “click”

Figure 8. Fresnel lens



Step 2. Place the second part of the plastic case on top of the first

Figure 9. Plastic case



Step 3. Insert the flex cable on the PDETECT board, place the screws in the four holes and put the case on top of the board

Figure 10. Flex cable

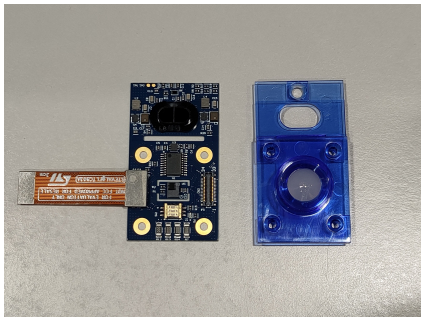
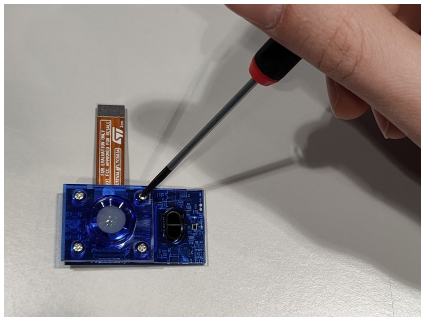
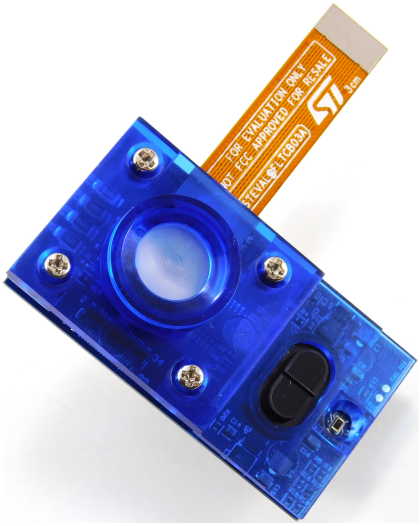


Figure 11. Case on top



Step 4. Once fixed the screws, the board is ready to be used

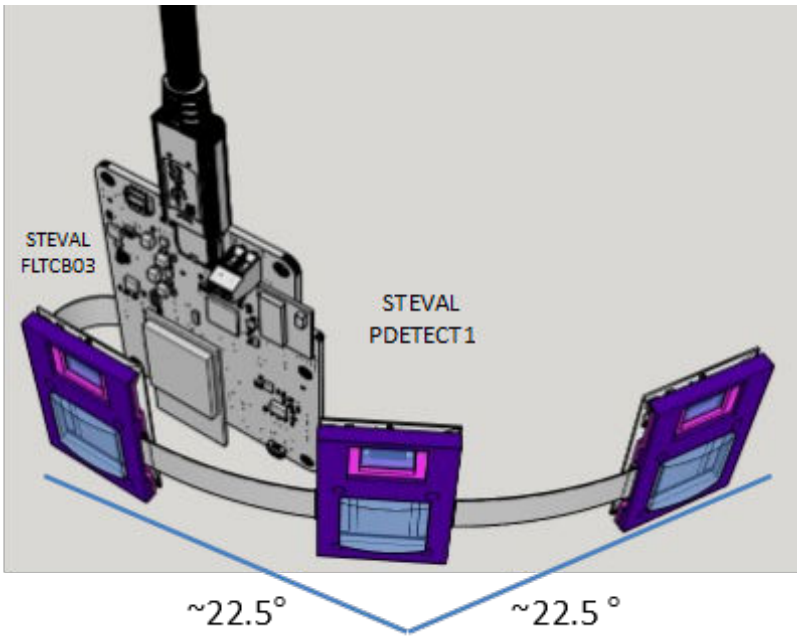
Figure 12. Board ready



1.7 Switch configuration

On the board there is a 3-way switch that is used to differentiate the multiple STEVAL-PDETECT1 boards that may be connected to the same STWIN.box in daisy chain configuration (up to 3).

Figure 13. Daisy chain configuration



When one single board is used, it should be configured as following: 1. ON, 2. OFF, 3. OFF.

Figure 14. Switch configuration

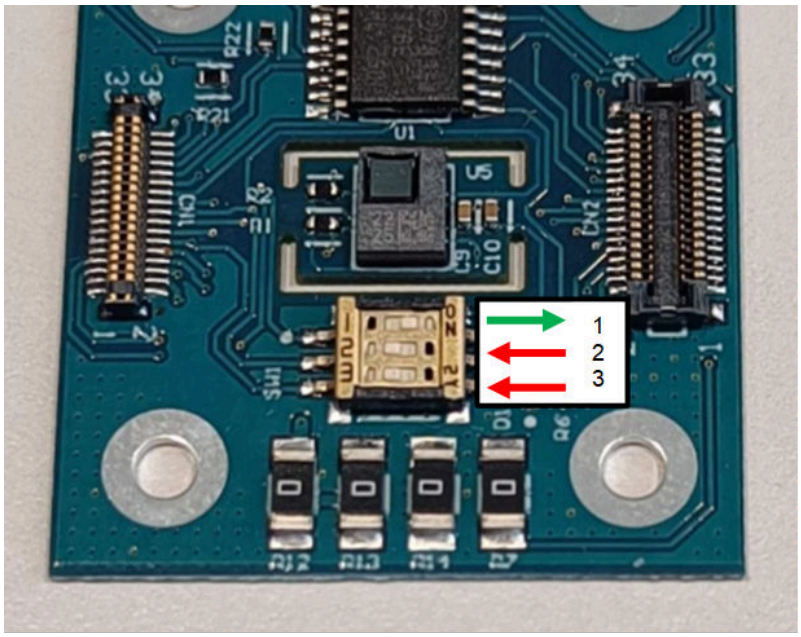


Table 1. Configuration table

Board	Switch
Board 1	1 --> ON 2 --> OFF 3 --> OFF
Board 2	1 --> OFF 2 --> ON 3 --> OFF
Board 3	1 --> OFF 2 --> OFF 3 --> ON

2 Schematic diagrams

Figure 15. STEVAL-PDETCS1 circuit schematic

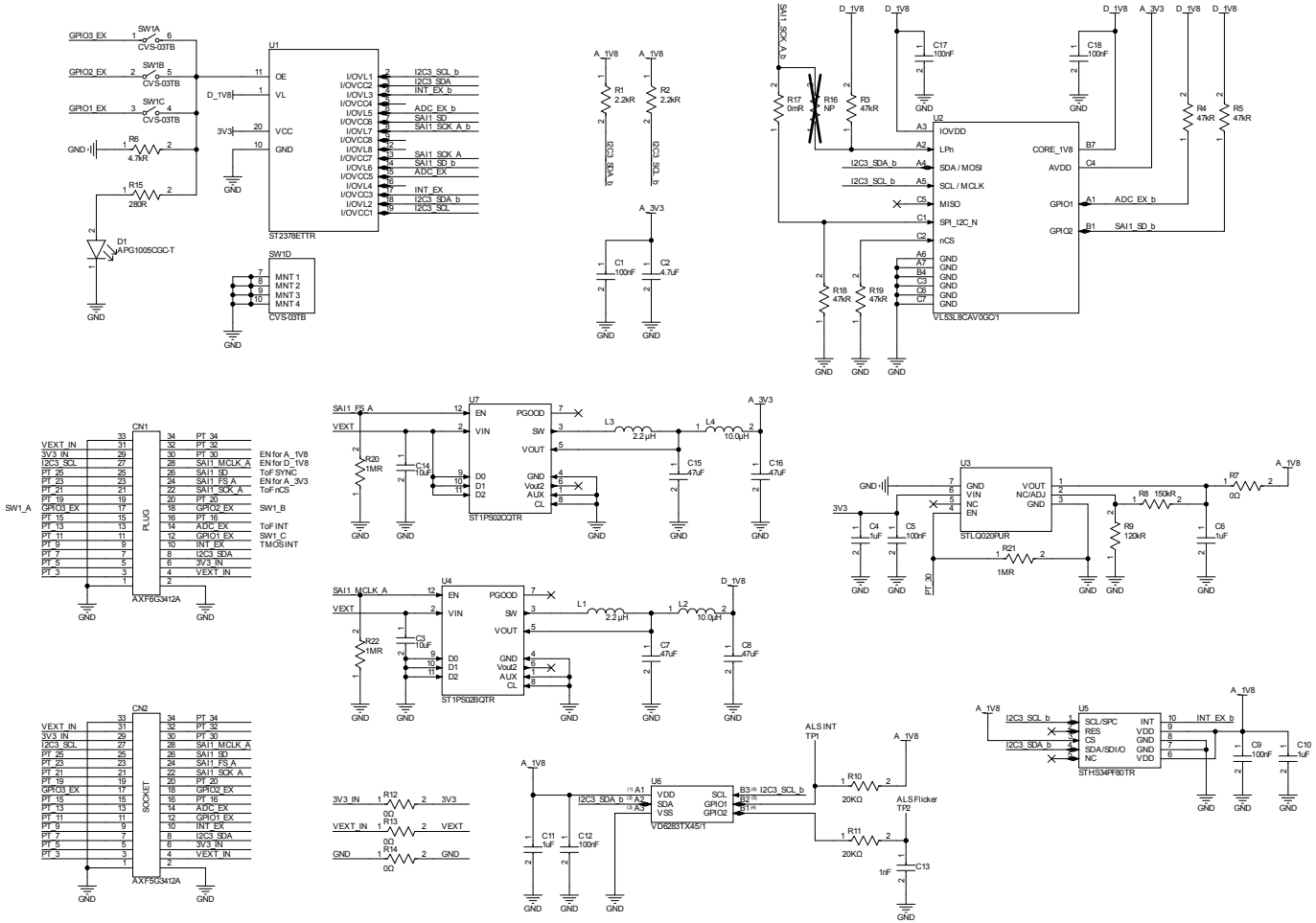
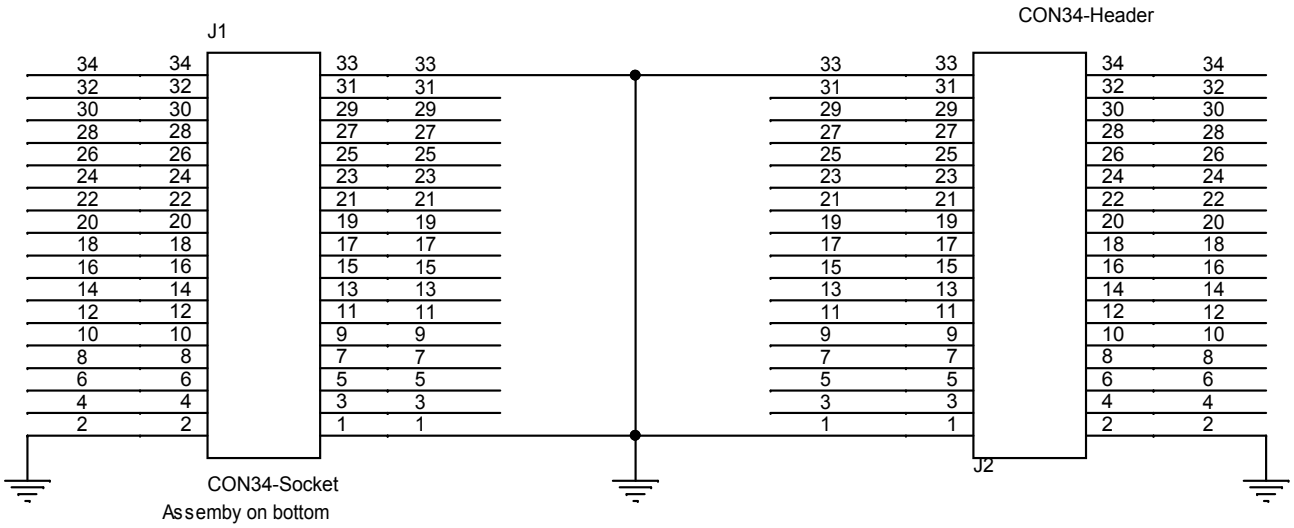


Figure 16. STEVAL-FLTCB03 circuit schematic



3 Bill of materials

Table 2. STEVAL-PDETECT1 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	Table 3. STEVAL-PDETCS1	-	Presence detection board	ST	Not available for separate sale
2	1	Table 4. STEVAL-FLTCB03	-	34pin Flex Cable - 3cm	ST	Not available for separate sale
3	1	Lens	TMOS63-10 Lens	Far field of view lens	Fresnel Factory	TMOS63-10
4	1	Sensor Cover	IR136C0-IC09-A066, Lens/cover	ToF cover	Hornix	IR136C0-IC09-A066
5	1	Plastic Holder - 2 pieces	PF63_10 Holder, Plastic holder	Plastic Holder for Far field of view lens	-Custom made-molding	-
6	4	Screws	90 SLOTTED CSK SCREW, Screws	M2x0.4 - 8mm Flat Head Machine Screw Phillips Steel	RS-PRO	914-1762
7	4	Nuts	HEX NUT, STEEL, Nuts	M2x0.4 Hex Nut (4mm) Steel	RS-PRO	248-4551

Table 3. STEVAL-PDETCS1 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	U5	STHS34PF80, OLGA-10L	Infrared sensor for presence and motion detection	ST	STHS34PF80
2	1	U6	VD6283TX45/1, BGA6-ball	Hybrid filter multispectral sensor with light flicker engine	ST	VD6283TX45/1
3	1	U2	VL53L8CXV0GC/1, LGA	VL53L8 series Time-of-Flight sensors	ST	VL53L8CXV0GC/1
4	1	U3	STLQ020PUR, DFN6 2x2	200 mA ultra-low quiescent current LDO	ST	STLQ020PUR
5	1	U4	ST1PS02BQTR, TQFN12	400 mA nano-quiescent synchronous step-down converter	ST	ST1PS02BQTR
6	1	U1	ST2378ETTR, TSSOP20	8-bit Dual supply 1.71 V to 5.5 V level translator	ST	ST2378ETTR
7	1	U7	ST1PS02CQTR, TQFN12	400 mA nano-quiescent synchronous step-down converter	ST	ST1PS02CQTR
8	6	C1, C5, C9, C12, C17, C18	CL05B104JO5NNNC, C0402, 16V, ±5%	CAP CER 0.1UF 16V X7R 0402	Samsung Electro-Mechanics	CL05B104JO5NNNC

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
9	1	C2	C1005X5R0J475K050BC, C0402, 6.3V, ±10%	CAP CER 4.7UF 6.3V X5R 0402	TDK Corporation	C1005X5R0J475K050BC
10	2	C3, C14	CL05A106MP8NUB8, C0402, 10V, ±20%	CAP CER 10UF 10V X5R 0402	Samsung Electro-Mechanics	CL05A106MP8NUB8
11	4	C4, C6, C10, C11	CL05A105JQ5NNNC, C0402, 6.3V, ±5%	CAP CER 1UF 6.3V X5R 0402	Samsung Electro-Mechanics	CL05A105JQ5NNNC
12	4	C7, C8, C15, C16	6D476MAT2A, C0603, 6.3V, ±20%	CAP CER 47UF 6.3V X5R 0603	KYOCERA AVX	06036D476MAT2A
13	1	C13	CL05B102JB5NFNC, C0402, 50V, ±5%	CAP CER 1000PF 50V X7R 0402	Samsung Electro-Mechanics	CL05B102JB5NFNC
14	1	CN1	AXF6G3412A	CONN HDR 34POS SMD GOLD	Panasonic Electric Works	CONN HDR 34POS SMD GOLD
15	1	CN2	AXF5G3412A	CONN SOCKET 34POS SMD GOLD	Panasonic Electric Works	CONN SOCKET 34POS SMD GOLD
16	1	D1	APG1005CGC-T, L0402	LED GREEN CLEAR CHIP SMD	Kingbright	APG1005CGC-T
17	2	L1, L3	VLS252010HBX-2R2M-1, L1008, 1.76A	FIXED IND 2.2UH 1.76A 120MOHM SM	TDK Corporation	VLS252010HBX-2R2M-1
18	2	L2, L4	74438323100, L1008, 0.6A	FIXED IND 10UH 600MA 843MOHM SMD	Würth Elektronik	74438323100
19	2	R1, R2	AC0402JR-072K2L, R0402, 1/16W, ±5%	RES SMD 2.2K OHM 5% 1/16W 0402	YAGEO	AC0402JR-072K2L
20	5	R3, R4, R5, R18, R19	MCR01MZPJ473, R0402, 1/16W, ±5%	RES SMD 47K OHM 5% 1/16W 0402	Rohm Semiconductor	MCR01MZPJ473
21	1	R6	CRCW04024K70JNED, R0402, 1/16W, ±5%	RES SMD 4.7K OHM 5% 1/16W 0402	Vishay Dale	CRCW04024K70JNED
22	4	R7, R12, R13, R14	RC1206JR-070RL, R0402, 1/4W	RES 0 OHM JUMPER 1/4W 1206	YAGEO	RC1206JR-070RL
23	1	R8	RC1005F154CS, R0402, 1/16W, ±1%	RES SMD 150K OHM 1% 1/16W 0402	Samsung Electro-Mechanics	RC1005F154CS
24	1	R9	RC1005F124CS R0402 1/16W ±1% R0402 1/16W ±1%	RES SMD 120K OHM 1% 1/16W 0402	Samsung Electro-Mechanics	RC1005F124CS
25	2	R10, R11	RT0402DRE0720KL, R0402, 1/16W, ±0.5%	RES SMD 20K OHM 0.5% 1/16W 0402	YAGEO	RT0402DRE0720KL

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
26	1	R15	CRCW0402280RFKED, R0402, 1/16W, ±1%	RES SMD 280 OHM 1% 1/16W 0402	Vishay Dale	CRCW0402280RFKED
27	1	R16	CRCW04020000Z0ED, R0402, 1/16W	RES SMD 0 OHM JUMPER 1/16W 0402 (not mounted)	Vishay Dale	CRCW04020000Z0ED
28	1	R17	CRCW04020000Z0ED, R0402, 1/16W	RES SMD 0 OHM JUMPER 1/16W 0402	Vishay Dale	CRCW04020000Z0ED
29	3	R20, R21, R22	CRCW04021M00FKED, R0402, 1/16W, ±1%	RES SMD 1M OHM 1% 1/16W 0402	Vishay Dale	CRCW04021M00FKED
30	1	SW1	CVS-03TB, 0.1A	SWITCH SLIDE DIP SPST 100MA 6V	Nidec Components Corporation	CVS-03TB

Table 4. STEVAL-FLTCB03 bill of materials

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	J1	AXF5G3412A smd	34Pin Connector - Socket	Panasonic Electric Works	AXF5G3412A
2	1	J2	AXF6G3412A smd	34Pin Connector - Plug	Panasonic Electric Works	AXF6G3412A

4 Kit versions

Table 5. STEVAL-PDETECT1 versions

PCB version	Schematic diagrams	Bill of materials
STEVAL$PDETECT1A [1]	STEVAL$PDETECT1A schematic diagrams	STEVAL$PDETECT1A bill of materials

1. *This code identifies the STEVAL-PDETECT1 evaluation kit first version. The evaluation kit with order code STEVAL-PDETECT1 contains the boards STEVAL$PDETCS1A and STEVAL$FLTCB03A.*

5 Regulatory compliance

Notice for US Federal Communication Commission (FCC)

FCC NOTICE:

This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Notice for Innovation, Science and Economic Development Canada (ISED)

Canada compliance:

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Notice for European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Notice for United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Revision history

Table 6. **Document revision history**

Date	Revision	Changes
08-Mar-2024	1	Initial release.

Contents

List of tables

List of figures