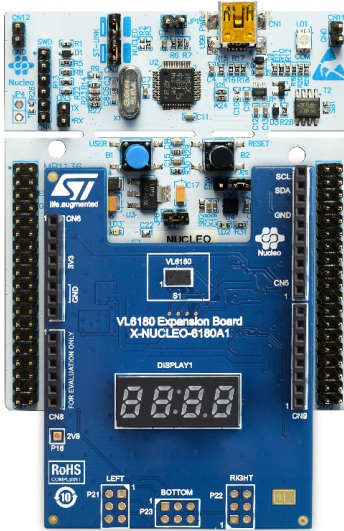


## Proximity Time-of-Flight sensor Nucleo pack based on VL6180 for STM32F401RE



### Features

- 1x VL6180 proximity Time-of-Flight (ToF) sensor
  - 4-digit display, displaying the distance of a target from the proximity sensor
  - Excellent ranging accuracy, independent of reflectance of the target
- 1x NUCLEO-F401RE board
- Power management access point
- Equipped with Arduino UNO R3 connector
- RoHS compliant
- Full system SW (software) is supplied and can be downloaded on [www.st.com/VL6180](http://www.st.com/VL6180) from the Tools & Software page
- 3x VL6180 breakout boards can be connected on the N-NUCLEO-6180A1 expansion board, in order to integrate the VL6180 in customer's application.

### Description

The P-NUCLEO-6180A1 is an evaluation pack that provides an introduction to the proximity ranging capabilities of the VL6180 sensor, combined with the powerful STM32F401RE microcontroller.

The VL6180 is based on patented FlightSense technology. This is a ground-breaking technology allowing absolute distance to be measured independent of target reflectance. Instead of estimating the distance by measuring the amount of light reflected back from the object (which is significantly influenced by color and surface), the VL6180 precisely measures the time the light takes to travel to the nearest object and reflect back to the sensor (Time-of-Flight).

The STM32 Nucleo board, NUCLEO-F401RE, provides an affordable and flexible way for users to try out new ideas and build prototypes with any STM32 microcontroller line, choosing from the various combinations of performance, power consumption and features.

Order code	Description
P-NUCLEO-6180A1	NUCLEO-F401RE board and X-NUCLEO-6180A1 expansion board
VL6180-SATEL	Optional board: VL6180 breakout board

# 1 Board descriptions

## 1.1 NUCLEO-F401RE board

Information about NUCLEO-F401RE board can be found on [www.st.com](http://www.st.com)

## 1.2 X-NUCLEO-6180A1 expansion board

The X-NUCLEO-6180A1 expansion board allows the user to test the VL6180 functionality and to program it, which helps understand how to develop an application using the VL6180. It integrates:

- a 4-digit display to render the range value in mm
- a 2.8 V regulator to supply the VL6180
- two level shifters to adapt the I/O level to the micro controller main board
- the necessary connectivity for the application

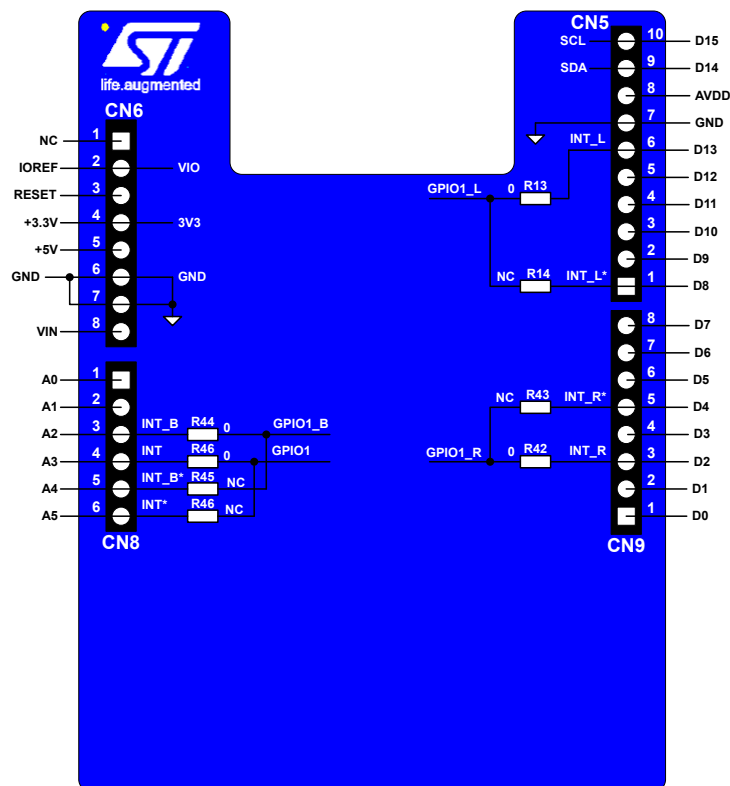
The evaluation of the VL6180 can be done with the P-NUCLEO-6180A1 pack, using the GUI (graphical user interface) SW which can be download from [st.com](http://st.com) under the reference STSW-IMG012.

Example code is available in the X-CUBE-6180A1 SW which can also be download from [st.com](http://st.com).

The X-NUCLEO-6180A1 expansion board and the NUCLEO-F401RE board are connected through the Arduino compatible connectors CN5, CN6, CN8, and CN9 (see the figure and tables below).

The Arduino connectors on the NUCLEO-F401RE board support the Arduino Uno Revision 3.

Figure 1. Arduino Uno connector layout



**Table 1. Arduino Uno left connector on NUCLEO-F401RE board**

CN number	X-NUCLEO-6180A1 expansion board	Pin number	Pin name	MCU pin	X-NUCLEO-6180A1 expansion board function
CN6 power		1	NC		
	VIO	2	VIO		Level shifter reference (3.3 V)
		3	NC		
	Power	4	3V3		3.3 V supply
		5	NC		
	Gnd	6	Gnd	Gnd	Gnd
	Gnd	7	Gnd	Gnd	Gnd
		8	NC		—
CN8 analog		1	NC		
		2	NC		
	GPIO1_B	3	INT_B	PA4	Interrupt signal from X-NUCLEO-6180A1 bottom breakout plug-in
	GPIO1	4	INT	PB0	Interrupt signal from X-NUCLEO-6180A1 on board soldered device
	GPIO1_B	5	INT_B*	PC1 or PB9(1)	Interrupt signal from X-NUCLEO-6180A1 bottom breakout plug-in
	GPIO1	6	INT*	PC1 or PB8 (1)	Interrupt signal from X-NUCLEO-6180A1 on board soldered device

1. Depending on the nucleo board solder bridges (see details on the nucleo documentation). These interrupt signals are duplicated, but not used, which offers the hardware connection flexibility in case of a conflict on the MCU interface when the expansion board is used superposed with other expansion boards. In such cases, remove the 0-ohm resistor from the interrupt and connect it in place of the “do not mount” resistor.

**Table 2. Arduino Uno right connector on NUCLEO-F401RE board**

CN number	X-NUCLEO-6180A1 expansion board	Pin number	Pin name	MCU pin	X-NUCLEO-6180A1 expansion board function
CN5 digital	SCL	10	D15	PB8	I2C1_SCL
	SDA	9	D14	PB9	I2C1_SDA
		8	NC		
	Gnd	7	Gnd	Gnd	Gnd
	GPIO1_L	6	INT_L	PA5	Interrupt signal from X-NUCLEO-6180A1 left breakout plug-in
		5	NC		
		4	NC		
		3	NC		
		2	NC		
	GPIO1_L	1	INT_L*	PA9	Interrupt signal from X-NUCLEO-6180A1 left breakout plug-in <sup>(1)</sup>
CN9 digital		8	NC		
		7	NC		
		6	NC		
	GPIO1_R	5	INT_R*	PB5	Interrupt signal from X-NUCLEO-6180A1 right breakout plug-in <sup>(1)</sup>
		4	NC		
	GPIO1_R	3	INT_R	PA10	Interrupt signal from X-NUCLEO-6180A1 right breakout plug-in
		2	NC		
		1	NC		

1. These interrupt signals are duplicated, but not used, which offers the hardware connection flexibility in case of a conflict on the MCU interface when the expansion board is used superposed with other expansion boards. In such cases, remove the 0-ohm resistor from the interrupt and connect it in place of the “do not mount” resistor.

### 1.3 Optional VL6180 breakout boards

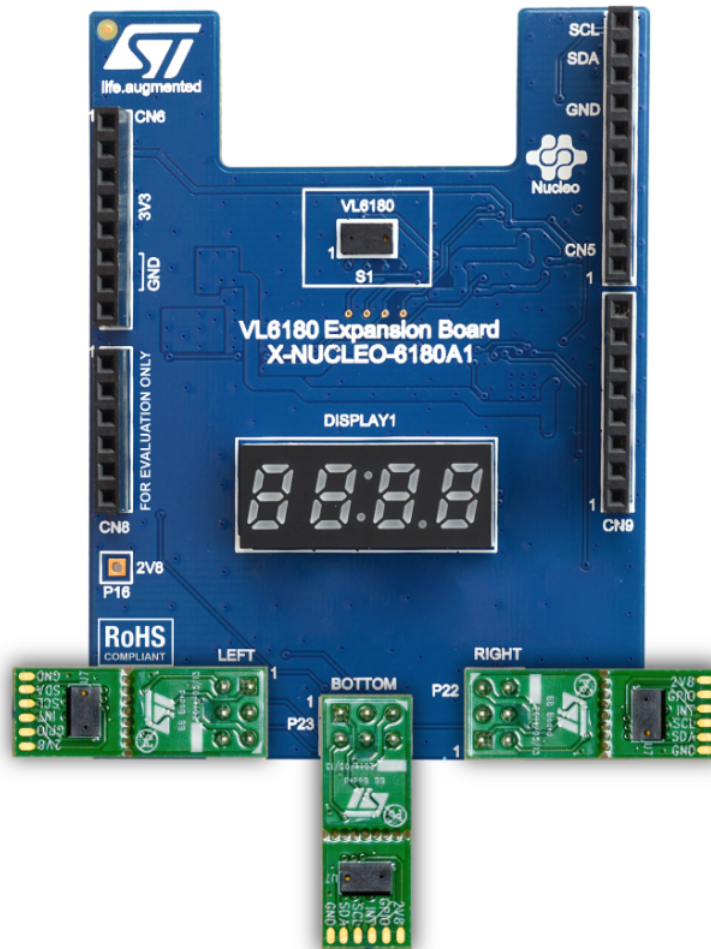
The X-NUCLEO-6180A1 expansion board can be connected to three VL6180 breakout boards (see figure below). This allows the development of applications that can control up to four VL6180 devices.

The I2C bus is common with the on-board VL6180 device.

Each breakout board can be connected through a dedicated connector to the expansion board and has its own:

- Interrupt(GPIO1-x) pin, routed from each breakout connector to the Arduino Uno connectors
- Reset(GPIO0-y) pin, routed from each breakout connector to the GPIO expander device

**Figure 2. Connections of VL6180 breakout boards**



*Note:* The VL6180 breakout boards can be ordered using the reference: VL6180-SATEL

**Figure 3. VL6180-SATEL (2x breakout boards)**



## 2 Laser safety considerations

The VL6180 contains a laser emitter and corresponding drive circuitry. The laser output is designed to remain within Class 1 laser safety limits under all reasonably foreseeable conditions, including single faults, in compliance with the IEC 60825-1:2007. The laser output remains within Class 1 limits as long as the STMicroelectronics recommended device settings are used and the operating conditions specified in the datasheet are respected. The laser output power must not be increased and no optics should be used with the intention of focusing the laser beam.

Figure 4. Class 1 laser product label



### Compliance

The VL6180 laser emitter and corresponding drive circuitry comply with 21 CFR 1040.10 and 1040.11 except for deviations conforming with the laser notice No.50, dated June 24, 2007.

### **3 Package information**

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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](http://www.st.com). ECOPACK is an ST trademark.



## Revision history

**Table 3. Document revision history**

Date	Version	Changes
10-Mar-2020	1	Initial release

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