RAK12014 WisBlock ToF Sensor Module Datasheet

Overview

Description

The RAK12014, a part of the RAKwireless WisBlock Sensor Series, is a Time-of-Flight (ToF) module designed based on VL53L0X from STMicroelectronics. The VL53L0X is a ToF laser-ranging module, providing accurate distance measurement up to 2 m.

The VL53L0X's 940 nm VCSEL emitter (Vertical-Cavity Surface-Emitting Laser) is invisible to the human eye and coupled with internal physical infrared filters. It enables longer-ranging distances, higher immunity to ambient light, and better robustness to cover glass optical crosstalk.

Features

- Time-of-Flight(ToF) module
- Measures absolute range up to 2 meters
- I2C Interface
- Xshutdown (reset) and interrupt GPIO
- 2.6 V ~ 3.5 V power supply
- Module Size: 10 mm x 10 mm

Specifications

Overview

Mounting

The RAK12014 WisBlock ToF Sensor Module can be mounted to the IO slot of the WisBlock Base board. **Figure 1** shows the mounting mechanism of the RAK12014 on a WisBlock Base board, such as the RAK5005-O .
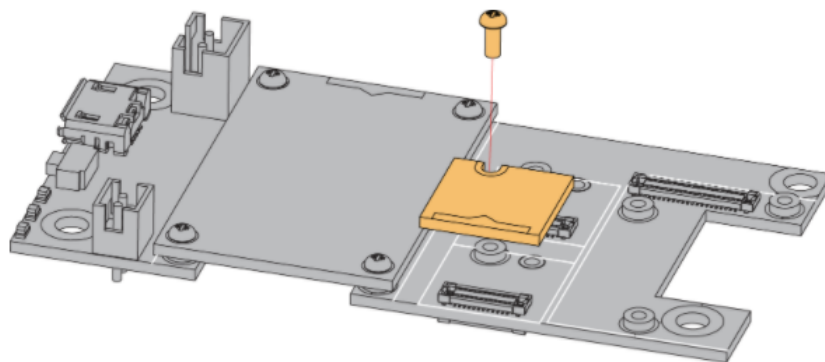

Figure 1: RAK12014 WisBlock ToF Sensor Module Mounting

Hardware

The hardware specification is categorized into four parts. It shows the pinouts and their corresponding functions and diagrams. It also covers the electrical and mechanical parameters that include the tabular data of the functionalities and standard values of the RAK12014 WisBlock ToF Sensor Module.

Pin Definition

The RAK12014 WisBlock ToF Sensor Module comprises a standard WisIO connector. The WisIO connector allows the RAK12014 module to be mounted to a WisBlock baseboard, such as RAK5005-O. The pin order of the connector and the pinout definition is shown in **Figure 2**.

> 📝 **NOTE**
>
> - **I2C** related pins: **XSHUT(RESET)**, **INT**, **3V3_S**, and **GND** are connected to WisBlock connector.
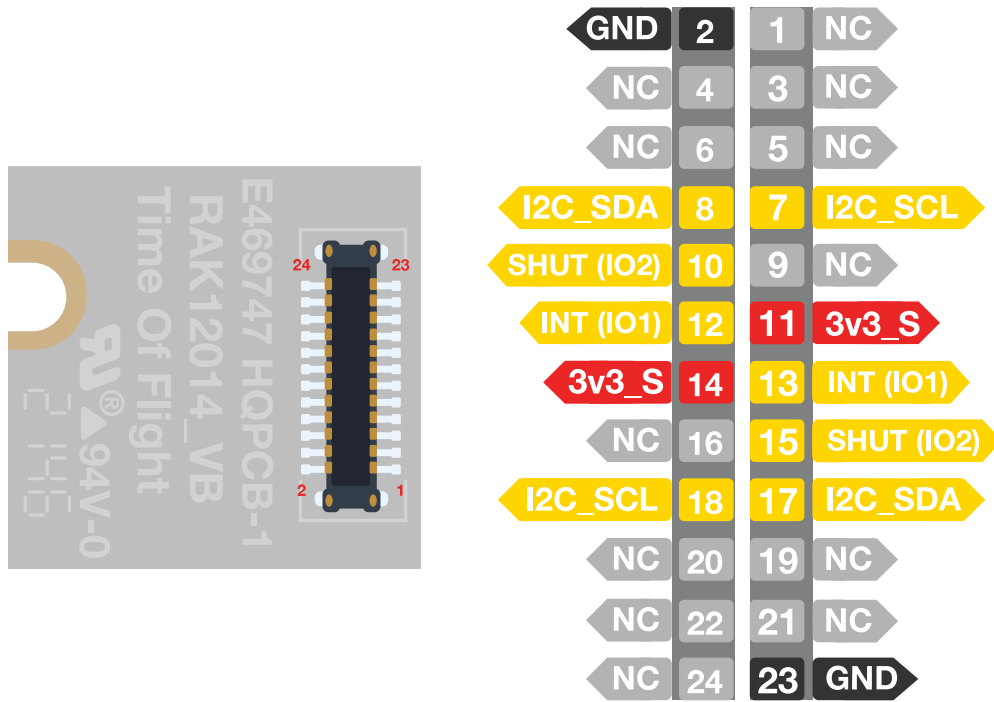

Figure 2: RAK12014 WisBlock ToF Sensor Module Pinout

Electrical Characteristics

Absolute Maximum Ratings

Parameter	Minimum	Maximum	Unit
3V3_S	-0.5	3.6	V
Imax	-	40	mA

Power Supply Ratings

Symbol	Description	Condition	Min.	Nom.	Max.	Unit
3V3_S	supply Voltage	Input voltage must within this range	2.6	3.3	3.5	V
IDD1	Operation mode current	Timed ranging inter measurement	-	16	-	uA
IDD2	Operation mode current	Active Ranging average consumption (including VCSEL)	-	19	-	mA
IDD3	Operation mode current	HW STANDBY	3	5	7	uA
P	Power Dissipation	Average power consumption at 10Hz with 33 ms ranging sequence	-	-	20	mW

Mechanical Characteristics

Board Dimensions

Figure 3 shows the dimensions and the mechanical drawing of the RAK12014 module.
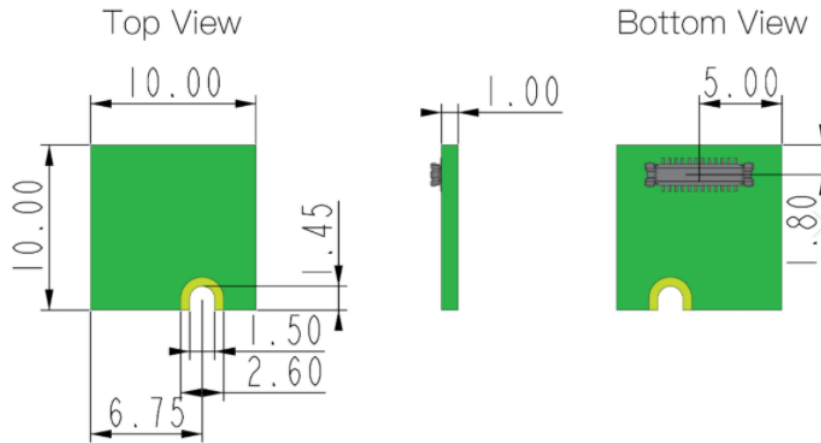

Figure 3: RAK12014 WisBlock ToF Sensor Module Dimensions
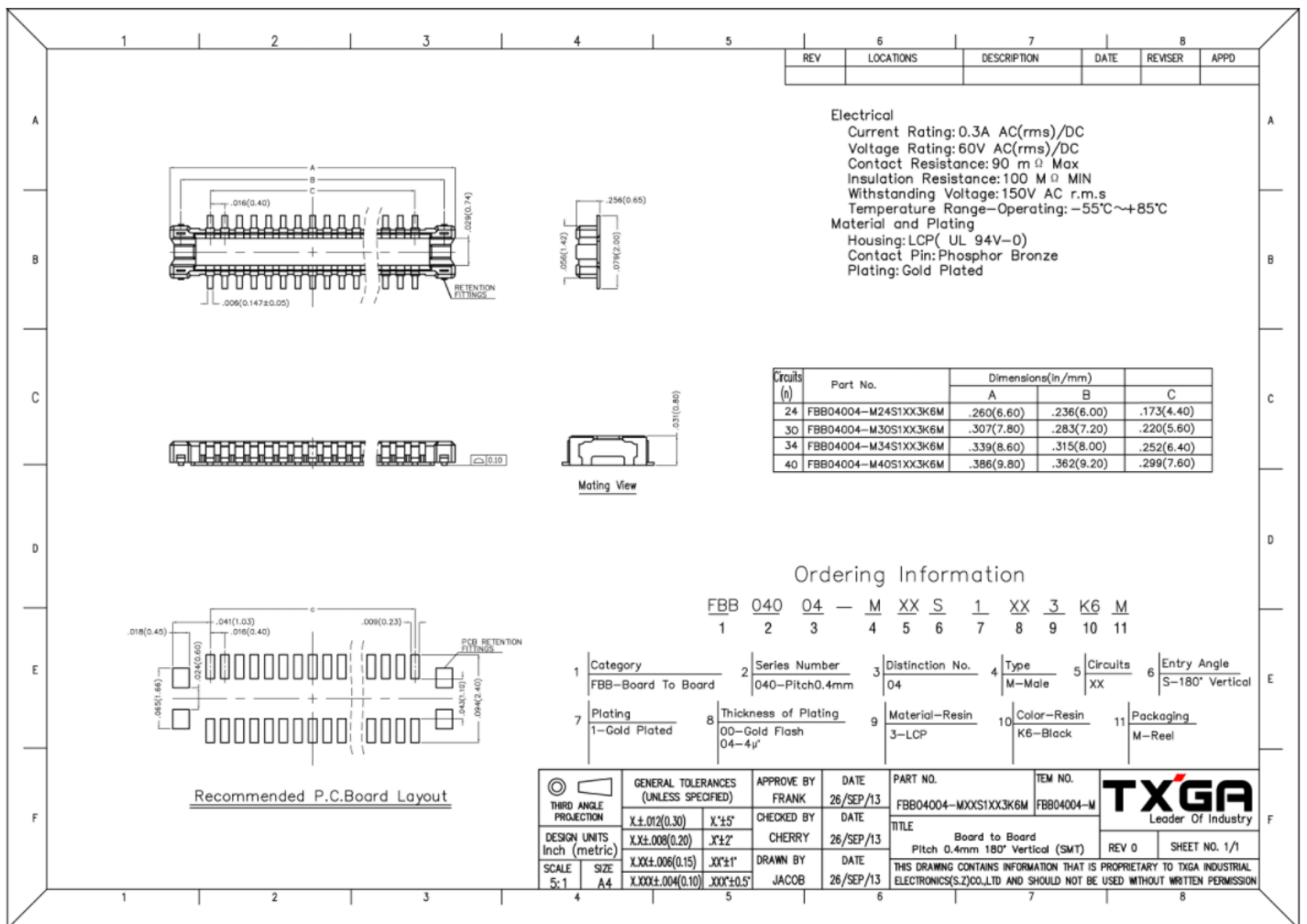
WisConnector PCB Layout

Figure 4: WisConnector PCB Footprint and Recommendations
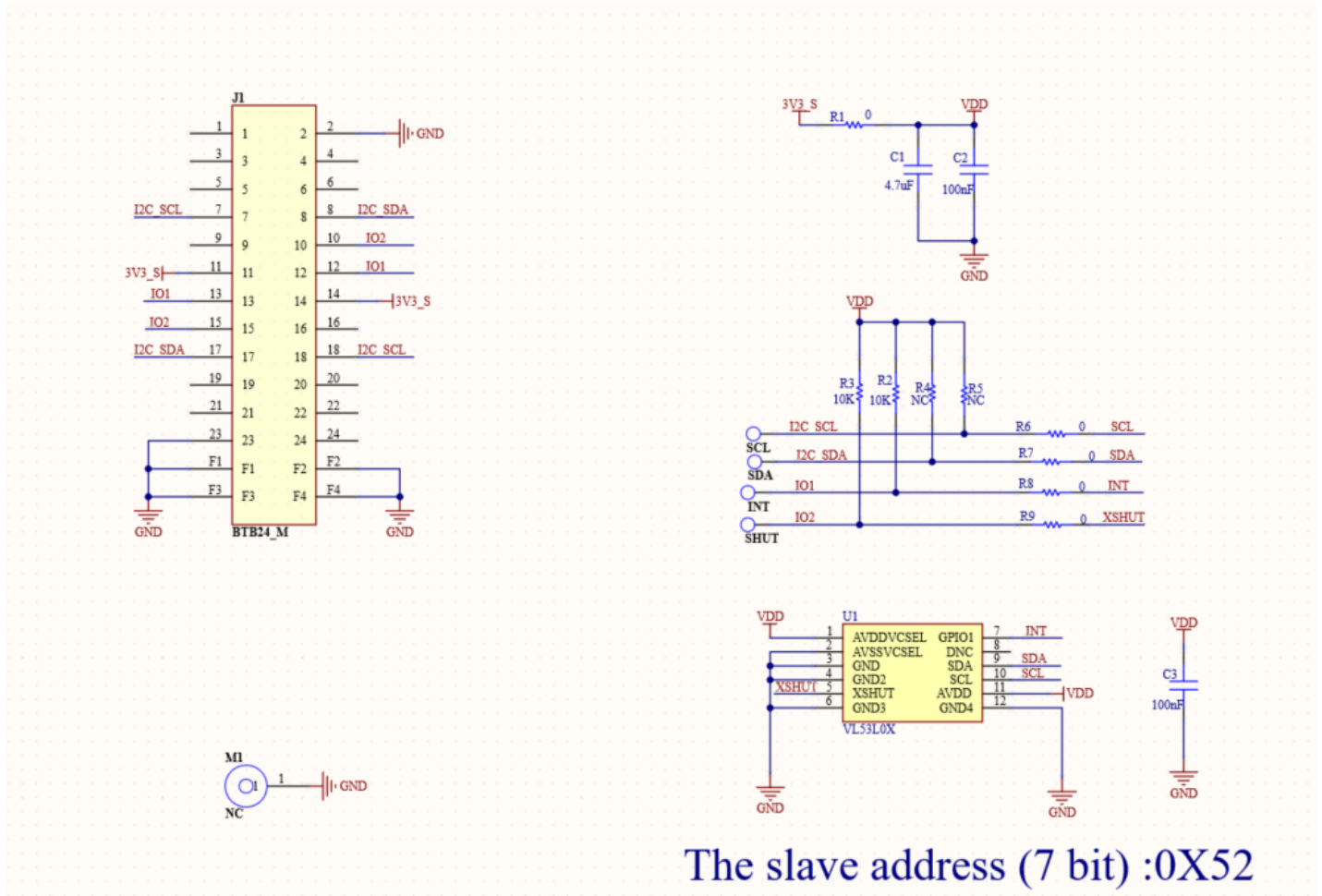
Schematic Diagram

The slave address (7 bit) :0X52

Figure 5: RAK12014 WisBlock ToF Module Schematic

📝 **NOTE**

- Field Of View (FOV) and Reflectance targets will affect the measuring distance and accuracy.
- To get better performance, you may need to apply algorithms for the object being measured. But for usual measurements, the default output is sufficient.

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RAK12014 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using the RAK12014 WisBlock ToF Sensor, make sure to prepare the necessary items listed below:

Hardware

- RAK12014 WisBlock ToF Sensor⧉
- Your choice of WisBlock Base⧉
- Your choice of WisBlock Core⧉
- USB Cable
- RAK19008 WisBlock IO Extension Cable⧉
- Li-Ion/LiPo battery (optional)
- Solar charger (optional)

Software

- Download and install the Arduino IDE⧉ .
- To add the RAKwireless Core boards to your Arduino Boards Manager, install the RAKwireless Arduino BSP⧉ .

Product Configuration

Hardware Setup

The RAK12014, a part of the RAKwireless WisBlock Sensor Series, is a Time-of-Flight (ToF) module designed based on VL53L0X from STMicroelectronics. The VL53L0X is a ToF laser-ranging module, providing accurate distance measurement up to 2 m. For more information about RAK12014, refer to the Datasheet.

This sensor module can be mounted on any Sensor slot of the WisBlock Base board, as shown in **Figure 1**. Also, always secure the connection of the WisBlock module by using compatible screws.
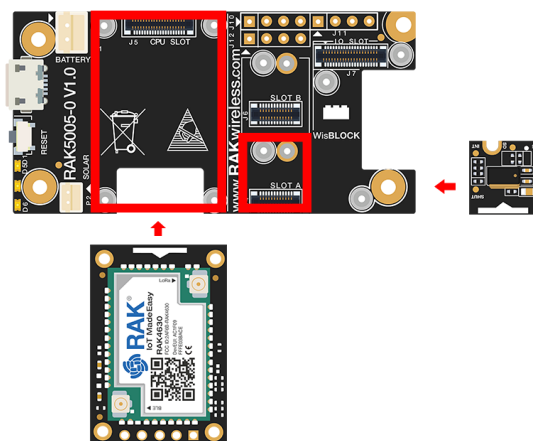

Figure 1: RAK12014 connection to WisBlock Base

Assembling and Disassembling of WisBlock Modules

Assembling

As shown in **Figure 2**, the location for Slot A, B, C, and D are properly marked by silkscreen. Follow carefully the procedure defined in RAK5005-O module assembly/disassembly instructions☐ to attach a WisBlock module. Once attached, carefully fix the module with three pieces of M1.2 x 3 mm screws.
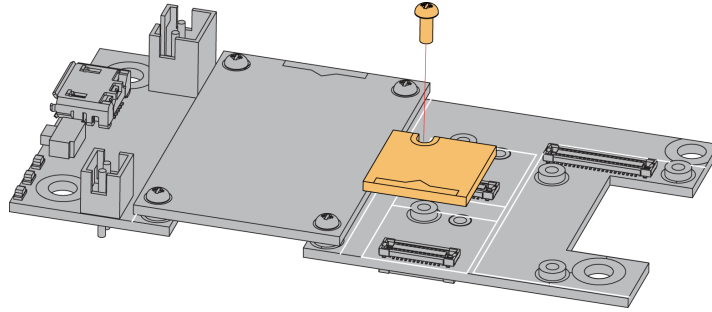

Figure 2: RAK12014 assembly to WisBlock Base

Disassembling

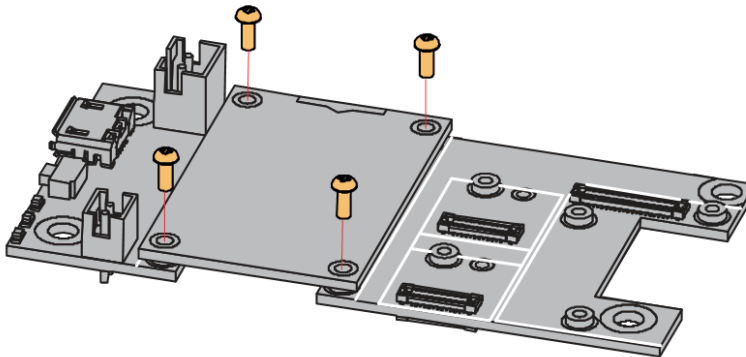The procedure in disassembling any type of WisBlock module is the same.

1. First, remove the screws.

Figure 3: Removing screws from the WisBlock module

2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.
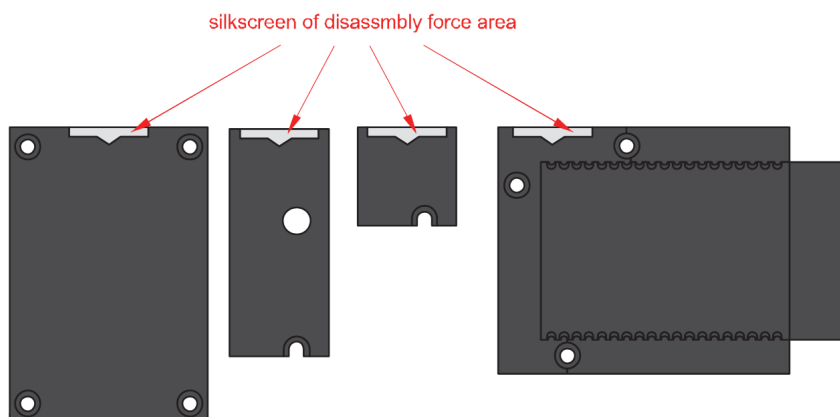
Figure 4: Detaching silkscreen on the WisBlock module

3. Apply force to the module at the position of the connector, as shown in **Figure 5**, to detach the module from the baseboard.
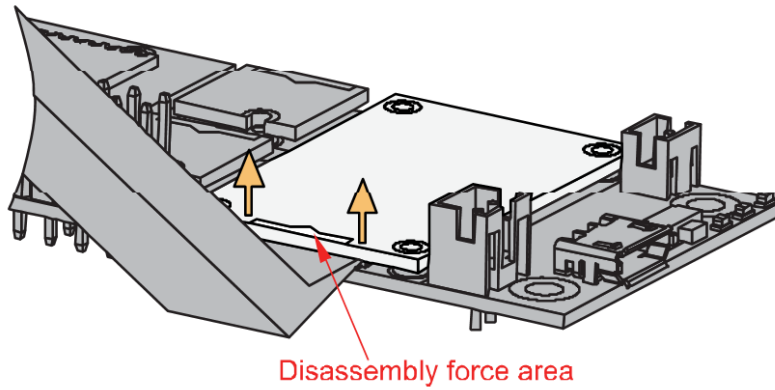
Figure 5: Applying even forces on the proper location of a WisBlock module

> 📝 **NOTE**
>
> If you will connect other modules to the remaining WisBlock Base slots, check on the WisBlock Pin Mapper ⧉ tool for possible conflicts.

After all this setup, you can now connect the battery (optional) and USB cable to start programming your WisBlock Core.

> ⚠️ **WARNING**
>
> - Batteries can cause harm if not handled properly.
> - Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
> - If a non-rechargeable battery is used, it has to be unplugged first before connecting the USB cable to the USB port of the board to configure the device. Not doing so might damage the battery or cause a fire.
> - Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.
> - Make sure the battery wires match the polarity on the RAK5005-O board. Not all batteries have the same wiring.

Software Configuration and Example

In this example, you will be able to measure distance via Serial Monitor.

1. You need to select first the WisBlock Core you have, as shown in **Figure 6** to **Figure 8**.
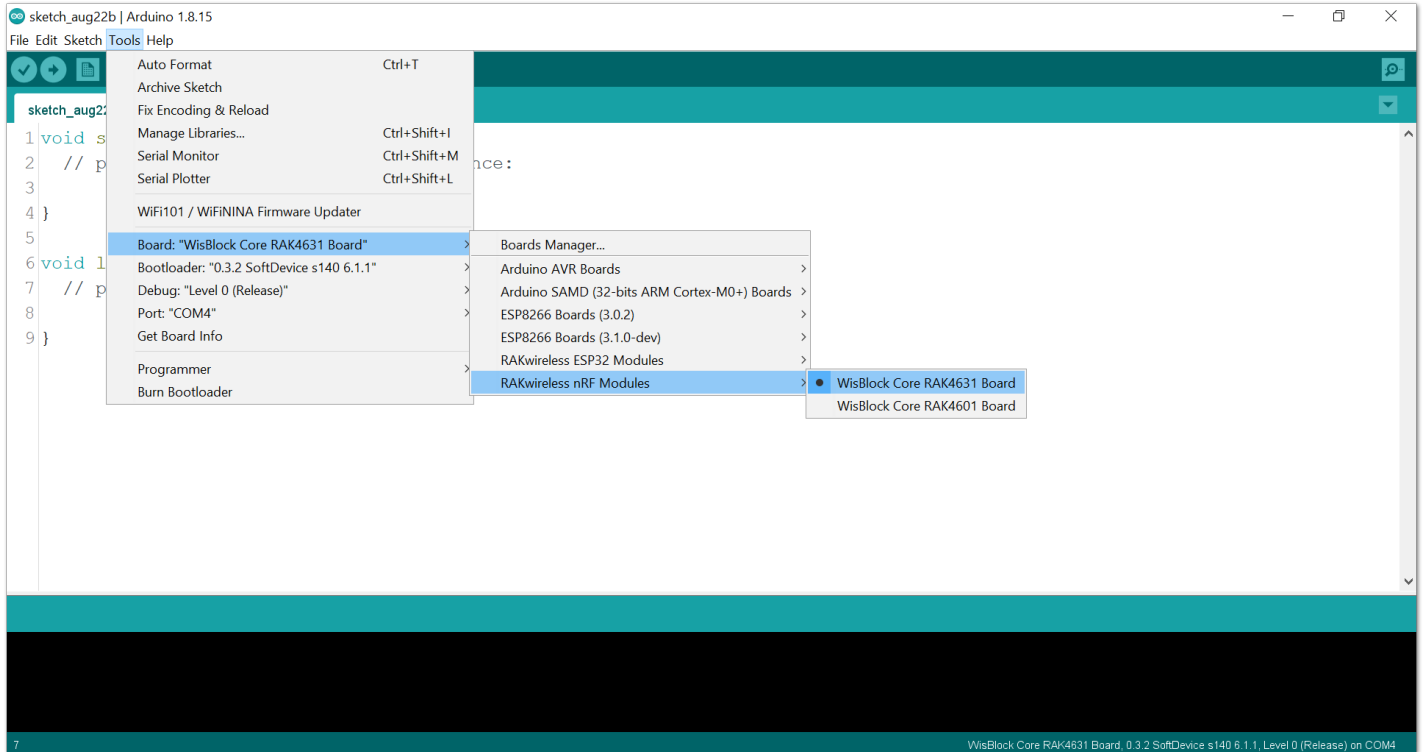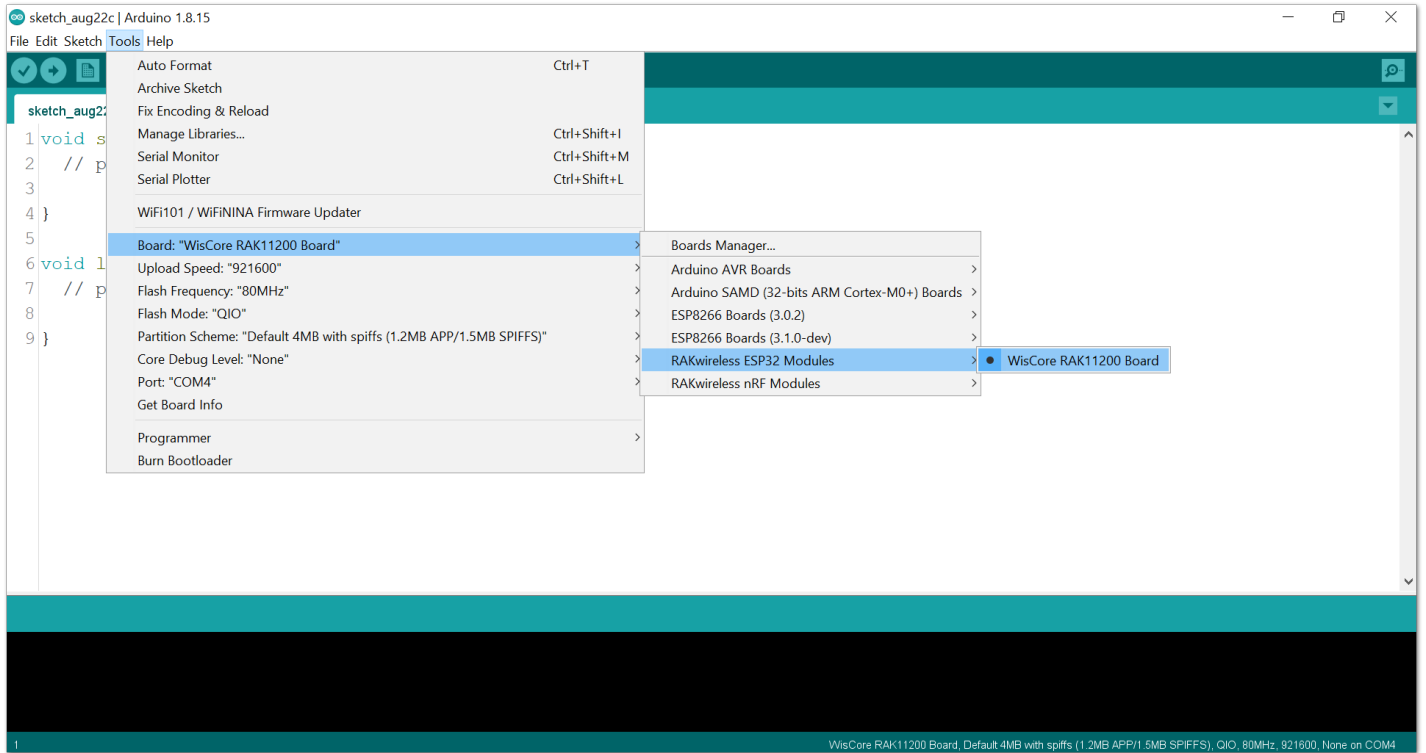
Figure 6: Selecting RAK4631 as WisBlock Core

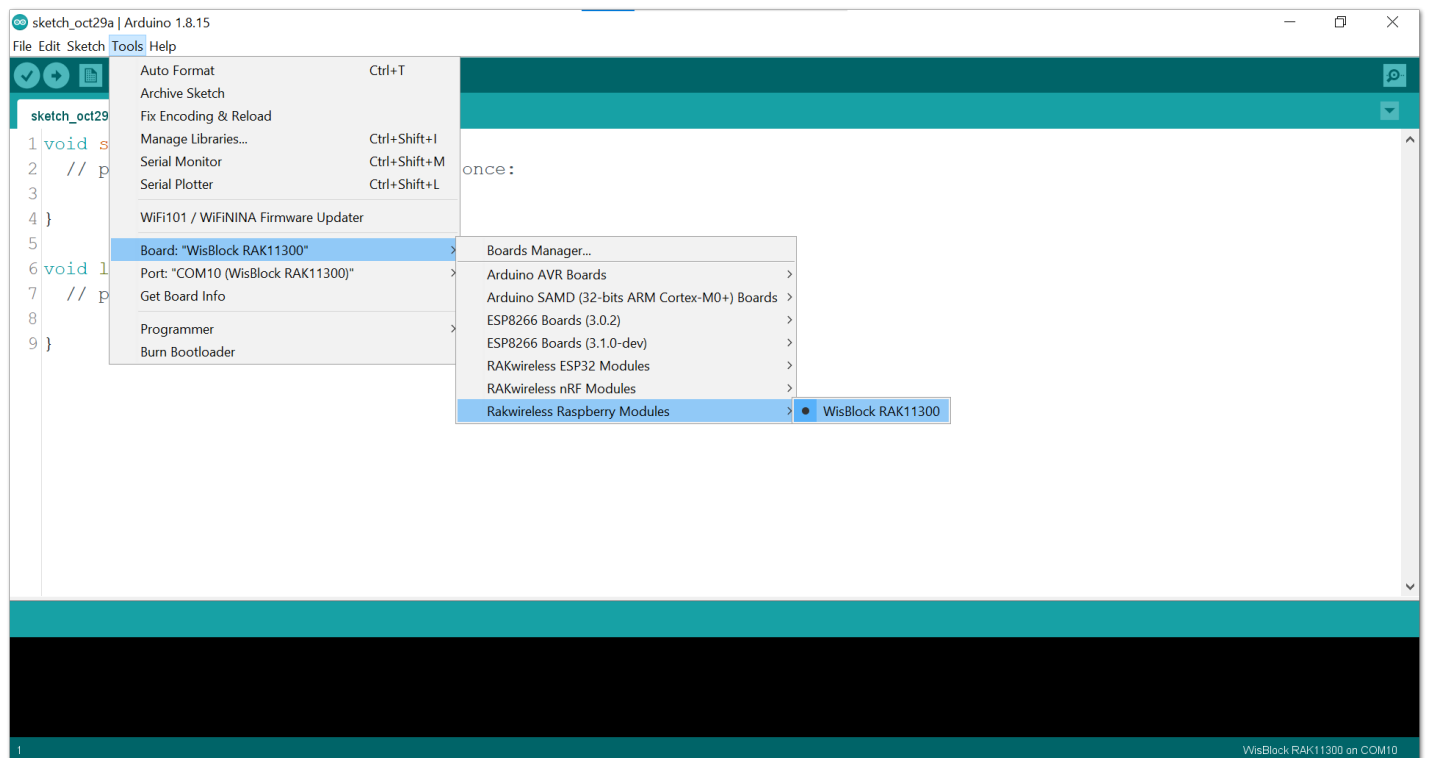**Figure 7:** Selecting RAK11200 as WisBlock Core

Figure 8: Selecting RAK11300 as WisBlock Core

2. Copy the example code below:

```c
/**
   @file RAK12014_Distance_Detection.ino
   @author rakwireless.com
   @brief Distance detection by laser
   @version 0.1
   @date 2021-8-28
   @copyright Copyright (c) 2020
**/



#include <Wire.h>
#include <vl53l0x_class.h>      // Click to install library: http://librarymanager/All#stm32duino
VL53L0X sensor_vl53l0x(&Wire, WB_IO2);



void setup() {
  pinMode(WB_IO2, OUTPUT);
  digitalWrite(WB_IO2, HIGH);
  int status;

  // Initialize serial for output.
  Serial.begin(115200);

  // Initialize I2C bus.
  Wire.begin();

  // Configure VL53L0X component.
  sensor_vl53l0x.begin();

  // Switch off VL53L0X component.
  sensor_vl53l0x.VL53L0X_Off();

  // Initialize VL53L0X component.
  status = sensor_vl53l0x.InitSensor(0x52);
  if(status)
  {
    Serial.println("Init sensor_vl53l0x failed...");
  }
}



void loop() {
  // Read Range.
  uint32_t distance;
  int status;
  status = sensor_vl53l0x.GetDistance(&distance);

  if (status == VL53L0X_ERROR_NONE)
  {
    // Output data.
    char report[64];
    snprintf(report, sizeof(report), "| Distance [mm]: %ld |", distance);
    Serial.println(report);
  }
  delay(300);
}
```

If you experience any error in compiling the example sketch, check the updated code for the RAK12014 WisBlock ToF Sensor that can be found on the RAK12014 WisBlock Example Code Repository⧉ .

3. Install the required library, as shown in **Figure 9** and **Figure 10**.
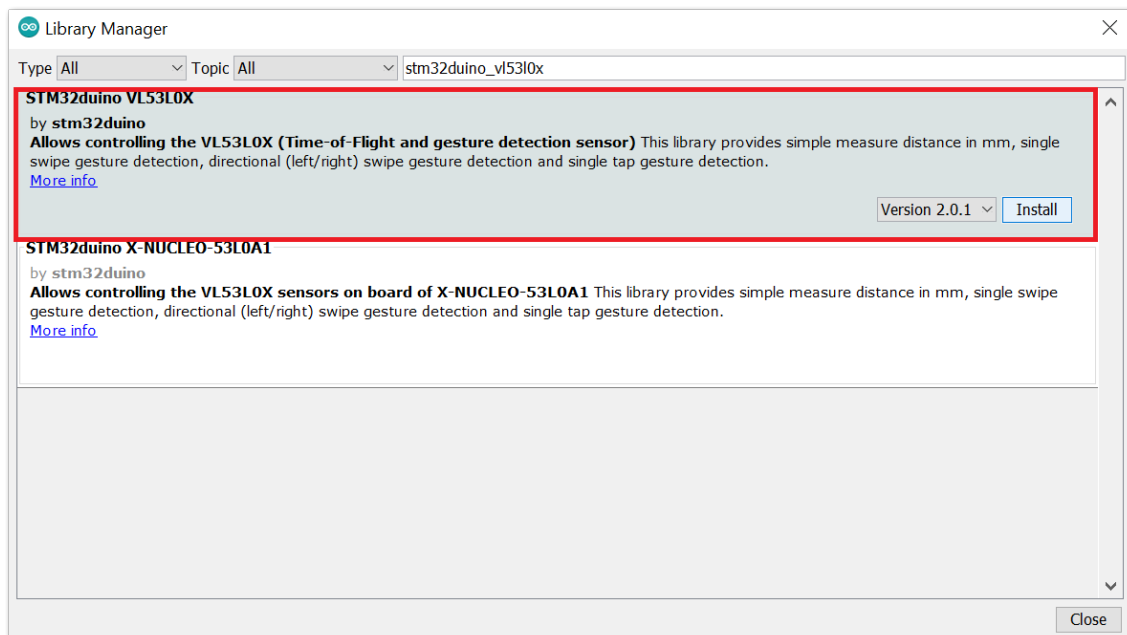

Figure 9: Getting the library link

Figure 10: Installing the library

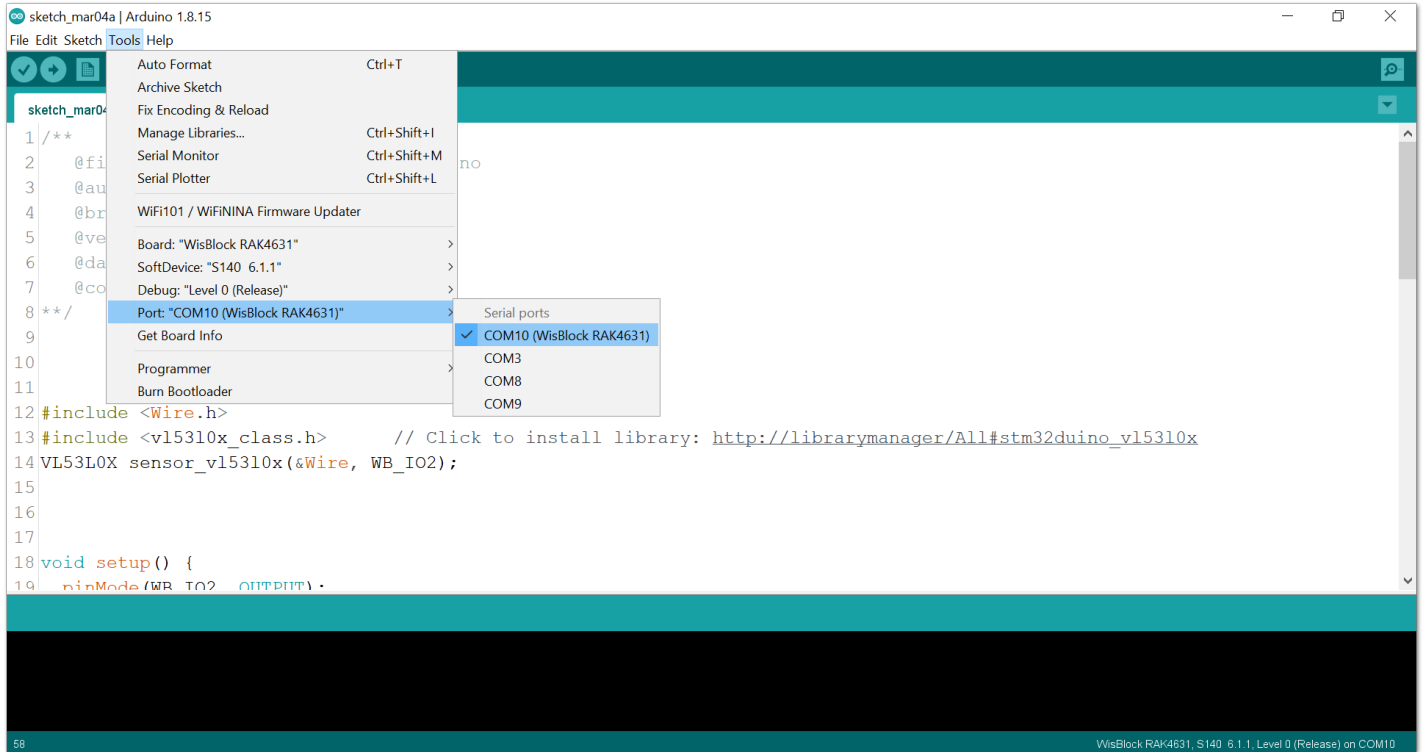4. Select the right serial port and upload the code, as shown in **Figure 11** and **Figure 12**.
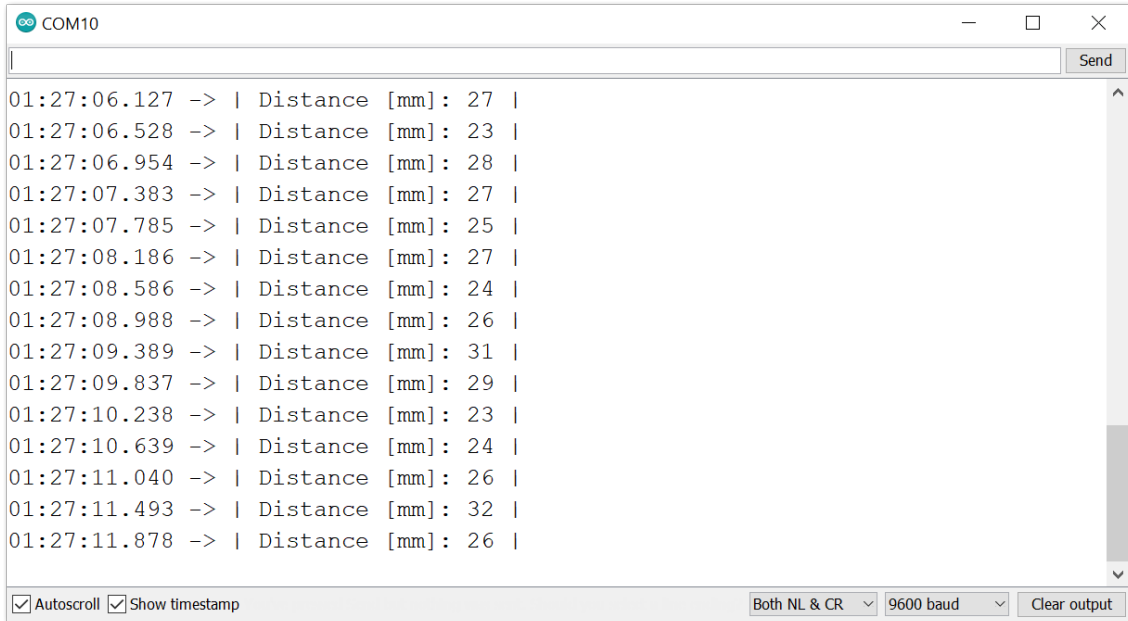
Figure 11: Selecting the correct serial port

Figure 12: Uploading the sample code

📝 **NOTE:**

RAK11200 requires the BOOT0 pin to be configured properly before uploading. If not done properly, uploading the source code to RAK11200 will fail. Check the full details on the RAK11200 Quick Start Guide.

5. When you have successfully uploaded the sample code, you may open up your serial monitor as shown in **Figure 13**. You can try to experiment with the data by moving the sensor away from the detected surface.

Figure 13: Serial monitor reading

📝 **NOTE:**

You can also try the other code example for the RAK12014 ToF Sensor module, which can be found on the RAK12014 WisBlock Example Code Repository ☐ .

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