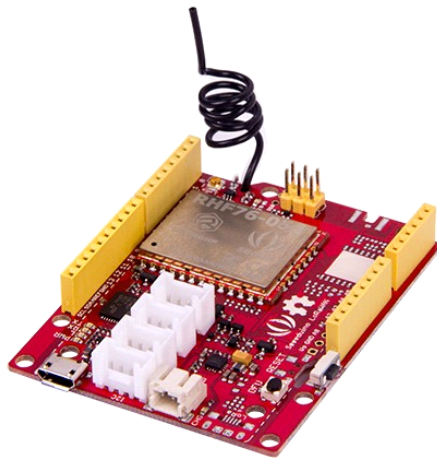




# Seeeduino LoRaWAN

SKU 102010128

- LoRaWAN Class A/C
- Ultra long range communication
- Ultra low power consumption
- Arduino programming (based on Arduino Zero bootloader)
- Embedded with lithium battery management chip
- 4 Grove connectors onboard



## Description

Seeeduino LoRaWAN is an Arduino development board with LoRaWAN protocol embedded, through which you can get started quickly to experience LoRa's advantage in the field of IoT.

Based on communication module RHF76-052AM, Seeeduino LoRaWAN is compatible with LoRaWAN Class A/C and supports a variety of communication frequencies. The 4 onboard standard grove connectors allow Seeeduino LoRaWAN to connect with hundreds of grove sensors

and actuators for Seeeduino conveniently, as a result, users are able to be more focus on the application itself without worrying about the compatibility issue between different modules.

In addition, the board has embeded an integrated lithium battery management chip that allows the board to be charged by USB interface. In low consumption mold, a full charged lithium battery can power the board for several months. By using Seeeduino LoRaWAN. You can build an IoT application very quickly.

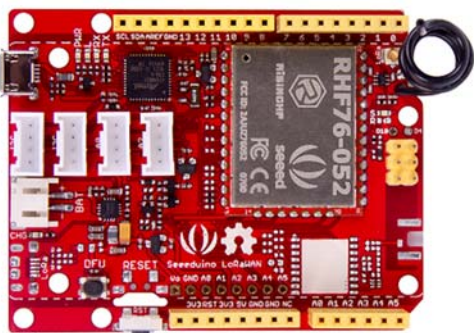
We also offer another version with GPS module embeded, click [here](#) to find the Seeeduino LoRaWAN W/GPS.

## Features

- LoRaWAN Class A/C
- Ultra long range communication
- Ultra low power consumption
- Arduino programming (based on Arduino Zero bootloader)
- Embeded with lithim battery management chip
- 4 Grove connectors onboard

# Seeeduino LoRaWAN

## Introduction



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Based on the communication module RHF76-052AM, Seeeduino LoRaWAN is compatible with LoRaWAN Class A/C and supports a variety of communication frequencies.

The 4 onboard standard Grove connectors allow Seeeduino LoRaWAN to connect with hundreds of Grove sensors and actuators from Seeedstudio conveniently, as a result, users are able to be more focus on the application itself without worrying about the compatibility issue between different modules. In addition, the board has embedded an integrated lithium battery management chip that allows the board to be charged by USB interface. In low consumption mode, a full charged lithium battery can power the board for several months.

If you want to build an IoT application quickly, Seeeduino LoRaWAN is your best choice.

<b>Product Version</b>	<b>Released Date</b>
<b>Seeeduino LoRaWAN</b>	<b>Dec 20, 2016</b>
<b>Seeeduino LoRaWAN W/GPS</b>	<b>Dec 20, 2016</b>

### Tip

Seeeduino LoRaWAN W/GPS is consist of GPS module.

## Features

- Minimum current (3.7V lipo battery) - 2mA
- Minimum current (3.7V lipo battery & remove PWR LED) - 650 uA

## Arduino/Processor

- ATSAM21G18 @ 48MHz with 3.3V logic/power
- Arduino compatible (based on Arduino Zero bootloader)
- Embedded with lithium battery management chip and status indicator led
- 20 GPIOs
- 4 on-board Grove connectors
- 18 x PWM pins
- 6 x analog inputs
- 1 x analog output (A0)
- 3.3V regulator with 200mA output
- Reset button

## LoRaWAN/RHF76-052

- 1.45uA sleep current in WOR mode (Spec of the modules, not the board)
- High link budget of 160dB. -140dBm sensitivity and 19dBm Output power.
- Dual band, 434/470MHz and 868/915MHz
  - 19dBm@434MHz/470MHz
  - 14dBm@868MHz/915MHz
- Support LoRaWAN protocol, Class A/C
- Ultra long range communication
- Ultra low power consumption
- Firmware upgrade
- Small size: 23mm X 28mm with 33 pin SMT package

### Warning

Unlike most Arduino & Genuino boards, the Zero runs at 3.3V. The maximum voltage that the I/O pins can tolerate is 3.3V. Applying voltages higher than 3.3V to any I/O pin could damage the board.

## Specification

Item	Value
Microcontroller	ATSAMD21G18, 32-Bit ARM Cortex M0+
Operating Voltage	3.3V
Digital I/O Pins	20
PWM Pins	All but pins 2 and 7
UART	2 (Native and Programming)
Analog Input Pins	6, 12-bit ADC channels
Analog Output Pins	1, 10-bit DAC
External Interrupts	All pins except pin 4

Item	Value
DC Current per I/O Pin	7 mA
Flash Memory	256 KB
SRAM	32 KB
EEPROM	None
Clock Speed	48 MHz
Lenght	68 mm
Width	53 mm
Weight	19.6g(without GPS), 19.9(with GPS)

## Application Ideas

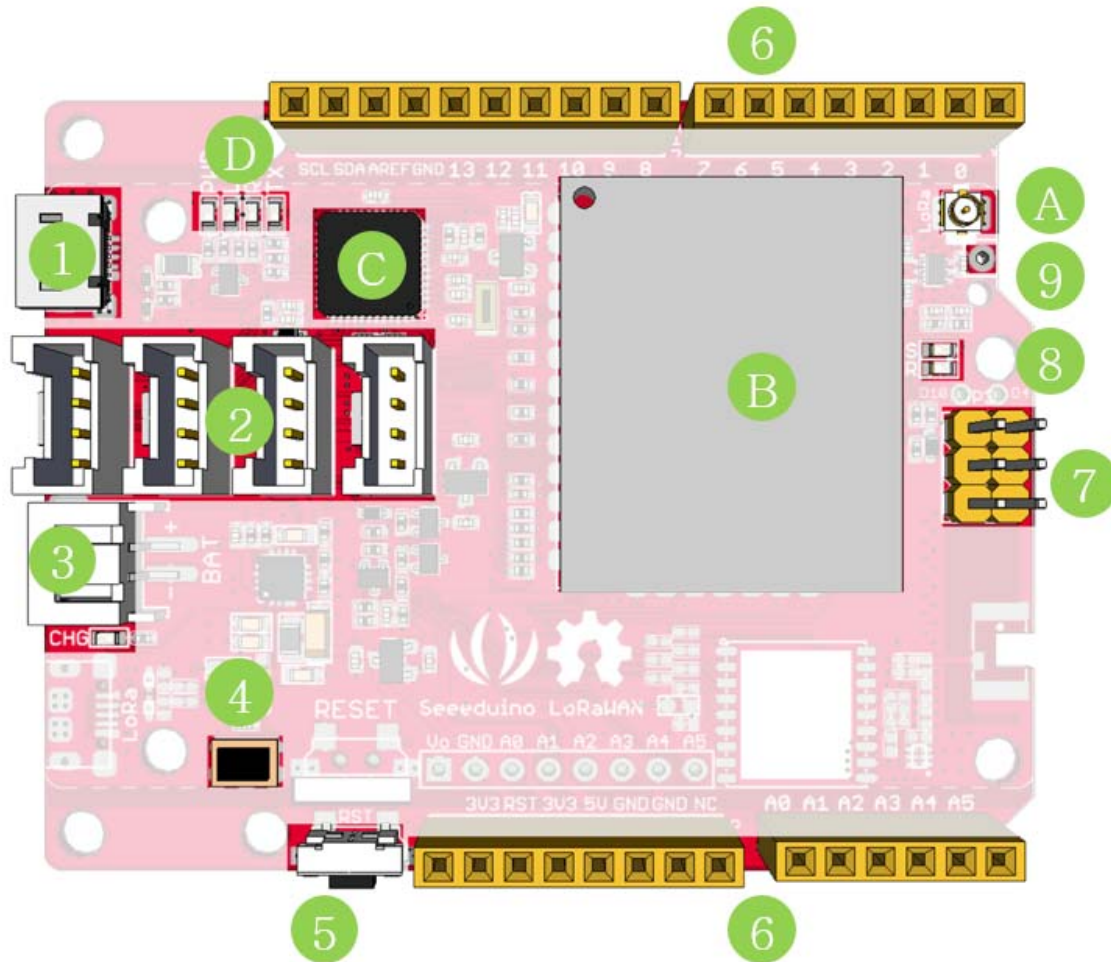
- Internet of Things
- Smart House
- Security
- Smart Grid
- Intelligent Farm
- Intelligent Park

### Tip

Use Grove modules to expand your application

There are 4 Grove connects on board. If this is your first time to hear about Grove, please put had on [Grove System](#) for more details. In brief, Groves is hundreds of sensor that in standard style, which is consist of sensors, actuators, displays as well as communication.

## Hardware Overview



- 1. Micro USB - Programming and supply power to the board
- 2. Grove connectors
- 3. JST2.0 Lipo battery input (3.7V) and charge status led
- 4. DFU Button - Firmware mode button
- 5. Reset Button
- 6. Arduino Pinout
- 7. ICSP pins
- 8. Firmware mode led
- 9. Wire antenna
- A. uFL antenna
- B. RF module - RHF76-052AM
- C. ARM Cortex M0 processor - ATSAMD21G18
- D. LEDs
  - *RX/TX* - blink when data on UART(from/to USB)
  - *L* - an led connect to D13
  - *PWR* - power

## Pin Map

<b>Pin Name</b>	<b>GPIO Num</b>	<b>External Interrupt</b>	<b>PWM</b>	<b>Analog In</b>	<b>Analog Out</b>	<b>Function</b>	
0	#0	YES	YES			RX(Serial1)	
1	#1	YES	YES			TX(Serial1)	
2	#2	YES					
3	#3	YES	YES				
4	#4		YES				
5	#5	YES	YES				
6	#6	YES	YES				
7	#7	YES					
8	#8	YES	YES				
9	#9	YES	YES				
10	#10	YES	YES				
11	#11	YES	YES			SPI_MOSI	
12	#12	YES	YES			SPI_MISO	
13	#13	YES	YES			SPI_SCK	
SDA	#20	YES	YES				
SCL	#21	YES	YES				
A0	#A0	YES	YES	YES	YES		
A1	#A1	YES	YES	YES			
A2	#A2	YES	YES	YES			
A3	#A3	YES	YES	YES			
A4	#A4	YES	YES	YES		Voltage of	

Pin Name	GPIO Num	External Interrupt	PWM	Analog In	Analog Out	Function
						Battery
A5	#A5	YES	YES	YES		Charge Status

#### Note

All pins can act as Digital Input and Output

## Getting Started - Arduino IDE

#### Note

This chapter is based on Win10 and Arduino IDE v1.6.0

First you need to install the latest Arduino IDE, and [ADD Seeeduino LoRa to your Arduino IDE.](#)

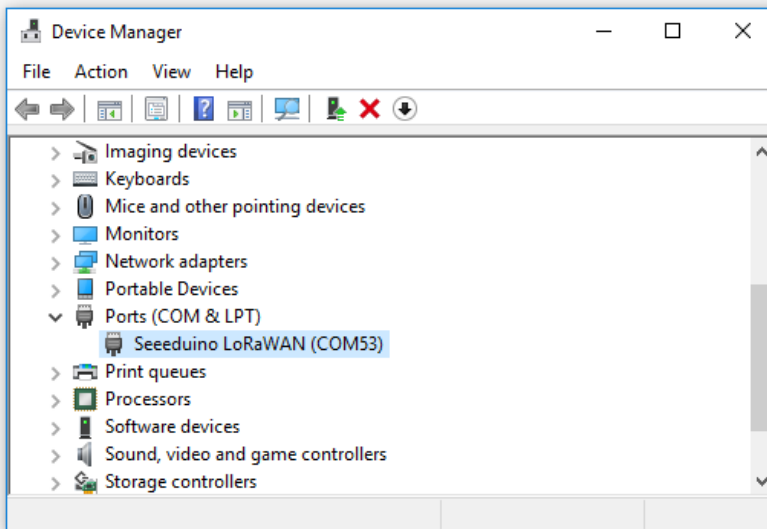
### Install the Driver (For Windows)

When the first time to insert the board, you should get a USB COM device name Seeeduino LoRaWAN that need to install a driver. Click on the below button to download driver for the board.

[Download Driver for Seeeduino LoRaWAN](#)

To make sure the driver was installed successful, open your Device Manager to see if **Seeeduino LoRaWAN** exists.





## Blink

Now we can upload our first demo - Blink to Seeeduino LoRaWAN.

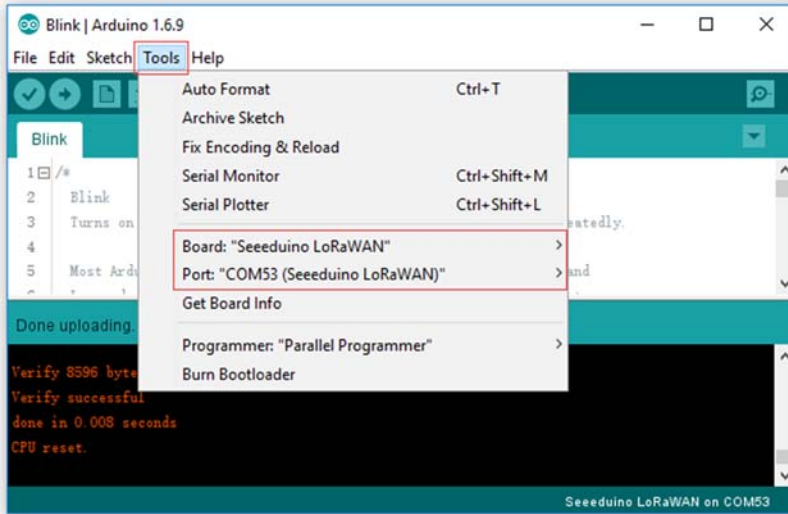
Open your Arduino IDE and click on **File > Examples > 01.Basics > Blink** to open the sketch or copy the blow code:

```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

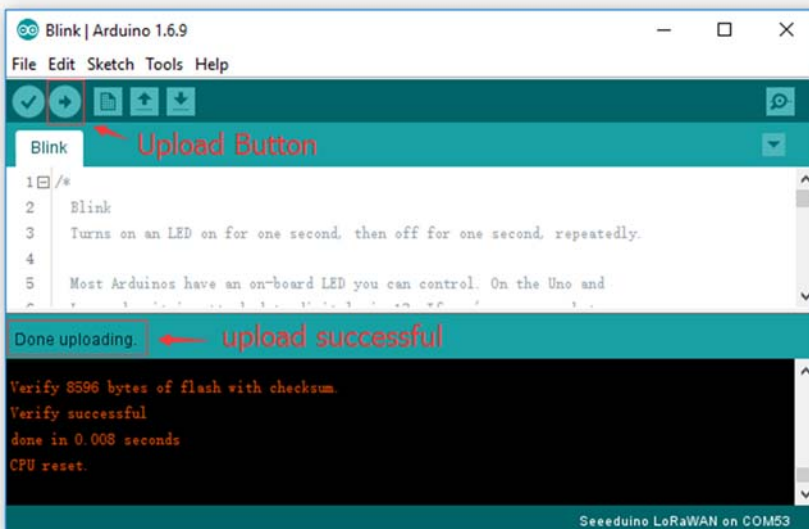
// the Loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);           // wait for a second
  digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
  delay(1000);           // wait for a second
}
```

And Then,

- Click on **Tools > Board > Seeeduino LoRaWAN**
- Click on **Tools > Port** to select a right port number. (Don't choose COM1)



Then click on the **Upload** button on the left-top of Arduino IDE, seconds later the sketch was uploaded successful.



If the uploading is success, you should the some info in red and please the on-board LED, it's blinking.

```
Done uploading.
Verify 8596 bytes of flash with checksum.
Verify successful
done in 0.008 seconds
CPU reset.
29 - 17 Seeeduino LoRaWAN on COM53
```

## Battery

You can power the board via a 3.7V Lipo battery. There's a JST2.0 cable included, use it if you can't get a battery with JST2.0 connector.

### Warning

Make sure the positive and negative end of your battery is connected right, otherwise the board may be damaged.

Charge status pin and positive pin of the battery had been connect to A4 and A5, which allow you to detect the charge status and measure voltage of the battery via coding.

Copy and upload the below code to detect the battery status.

```
// battey of Seeeduino LoRaWAN
const int pin_battery_status = A5;
const int pin_battery_voltage = A4;

void setup() {
  SerialUSB.begin(115200);
  pinMode(pin_battery_status, INPUT);
}

void loop() {
  int a = analogRead(pin_battery_voltage);
  float v = a/1023.0*3.3*11.0; // there's an 1M and 100k resistor divider
  SerialUSB.print(v, 2);
  SerialUSB.print('\t');
  SerialUSB.println(digitalRead(pin_battery_status));

  delay(1000);
}
```

### Note

Charge status return 0 while charging, return 1 while charge done or no battery insert.

## Send and Receive Example

There is a well written library for the LoRaWAN modules, for simple applications you even don't need to know much about the protocol about LoRa, which is complex and hard to read. And please note that you still need some acknowledge about LoRa protocol if you want an advanced application. You don't need to download the library, it's included in the package already. You can open it at **File > Examples > LoRaWAN**.

You need 2 piece of Seeeduino LoRaWAN to complete this example, one for sending and another for receiving.

### Sending

Open your Arduino IDE and click on **File > Examples > LoRaWAN > p2p\_tx** to open the sketch or you can copy the code below. This sketch will broadcast a string "Hello World!" every 3000 ms.

```
// Seeeduino LoRaWAN - TX example
#include <LoRaWAN.h>

void setup(void)
{
  SerialUSB.begin(115200);
  lora.init();
  lora.initP2PMode(433, SF12, BW125, 8, 8, 20);
}

void loop(void)
{
  lora.transferPacketP2PMode("Hello World!");
  SerialUSB.println("Send string.");
  delay(3000);
}
```

### Receiving

Open your Arduino IDE and click on **File > Examples > LoRaWAN > p2p\_rx** to open the sketch or you can copy the code below.

```
// Seeeduino LoRaWAN - RX example
#include <LoRaWAN.h>

unsigned char buffer[128] = {0, };

void setup(void)
{
```

```

SerialUSB.begin(115200);
lora.init();
lora.initP2PMode(433, SF12, BW125, 8, 8, 20);
}

void loop(void)
{
  short length = 0;
  short rssi = 0;

  memset(buffer, 0, 128);
  length = lora.receivePacketP2PMode(buffer, 128, &rssi, 1);

  if(length)
  {
    SerialUSB.print("Length is: ");
    SerialUSB.println(length);
    SerialUSB.print("RSSI is: ");
    SerialUSB.println(rssi);
    SerialUSB.print("Data is: ");
    for(unsigned char i = 0; i < length; i++)
    {
      SerialUSB.print("0x");
      SerialUSB.print(buffer[i], HEX);
      SerialUSB.print(" ");
    }
    SerialUSB.println();
  }
}

```

After both of the sketch is well uploaded, open the serial monitor of the receiving board, check if you can get some data as below.

```

COM53 (Seeeduino LoRaWAN)
Data is: Hello World!
Length is: 12
RSSI is: -20
Data is: Hello World!
Length is: 12
RSSI is: -19
Data is: Hello World!
Length is: 12
RSSI is: -19
Data is: Hello World!

```

Autoscroll     
 No line ending     
 115200 baud

## Note

There will be a gateway kit for LoRa soon, and we will add getting started about APB and OTAA mode at wiki of the kit.

## Examples

We had provide many useful examples. You can open **File > Examples > LoRaWan** get more details. Those examples include:

- ABP
- OTAA
- p2p-rx
- p2p-tx

## GPS Data

### Note

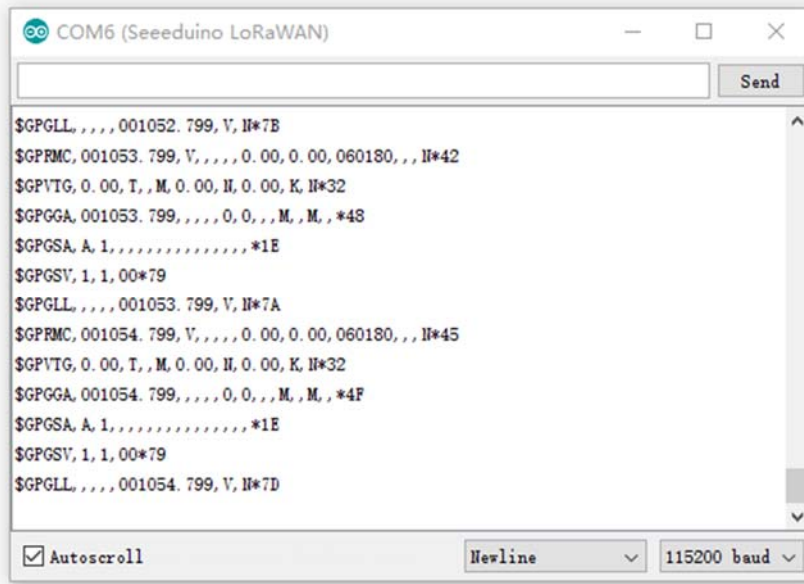
This chapter works with Seeeduino LoRaWAN W/GPS only.

Copy below code you Seeeduino LoRaWAN W/GPS.

```
void setup()
{
  Serial.begin(9600);
  SerialUSB.begin(115200);
}

void loop()
{
  while(Serial.available())
  {
    SerialUSB.write(Serial.read());
  }
  while(SerialUSB.available())
  {
    Serial.write(SerialUSB.read());
  }
}
```

Open Serial Monitor then you will get data from GPS.



## Update firmware

The firmware version of is 2.0.10, if you want to update firmware, few steps need to follow.

If you want to check version of you board, please upload below code to your board.

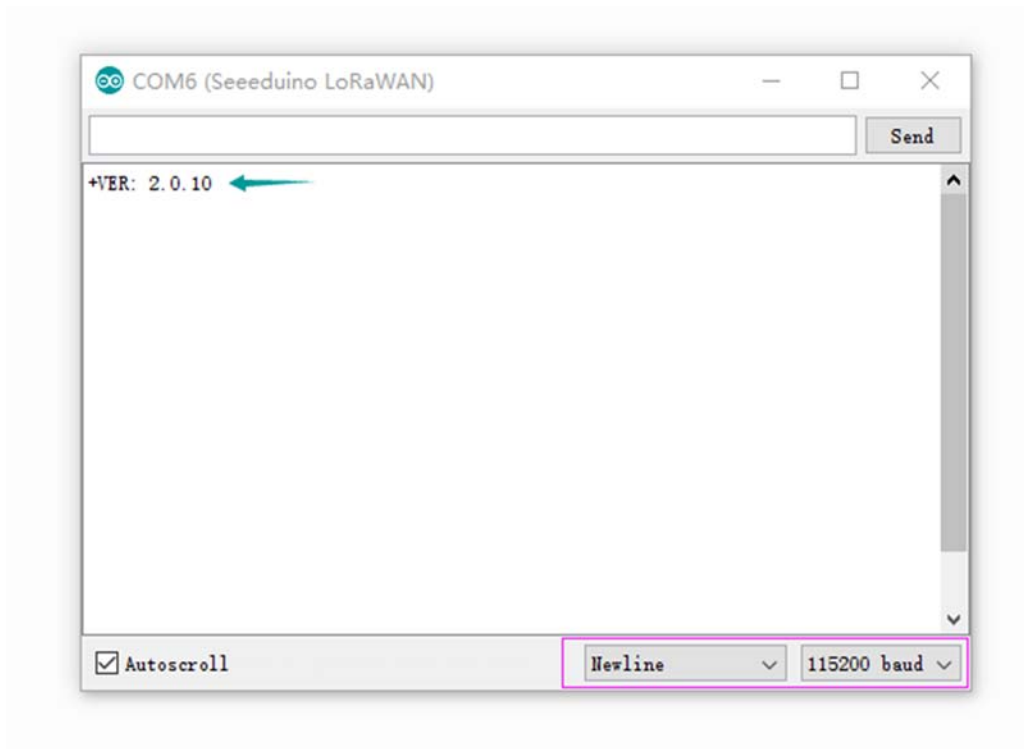
```
void setup()
{
  Serial1.begin(9600);
  SerialUSB.begin(115200);
}

void loop()
{
  while(Serial1.available())
  {
    SerialUSB.write(Serial1.read());
  }
  while(SerialUSB.available())
  {
    Serial1.write(SerialUSB.read());
  }
}
```

Open your Serial Monitor and INPUT

**AT+VER**

Then you will get the version of your board.



## Step1

Copy and upload below code to your board.

```
// Update firmware to RHF76-052AM
#include <Arduino.h>

void setup()
{
  SerialDBG.begin(115200);
  SerialUSB.begin(115200);
}

void loop()
{
  while(SerialDBG.available())
  {
    SerialUSB.write(SerialDBG.read());
  }
  while(SerialUSB.available())
  {
    SerialDBG.write(SerialUSB.read());
  }
}
```

Input **AT+VER** to get the version of your board. If it's not the most recent version, please following below steps to upgrade it.



## Step2

Remove the board from USB and reconnect again, then press the DFU Button, after the Firmware mode led blinking you can go to the next step.

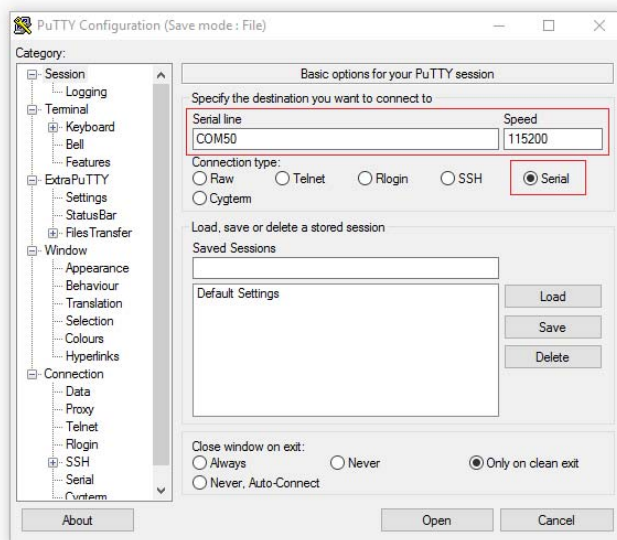
## Step3

Click to download the latest firmware, which is a .bin file.

Firmware V2.0.10

## Step4

Open PuTTY and connect to the board



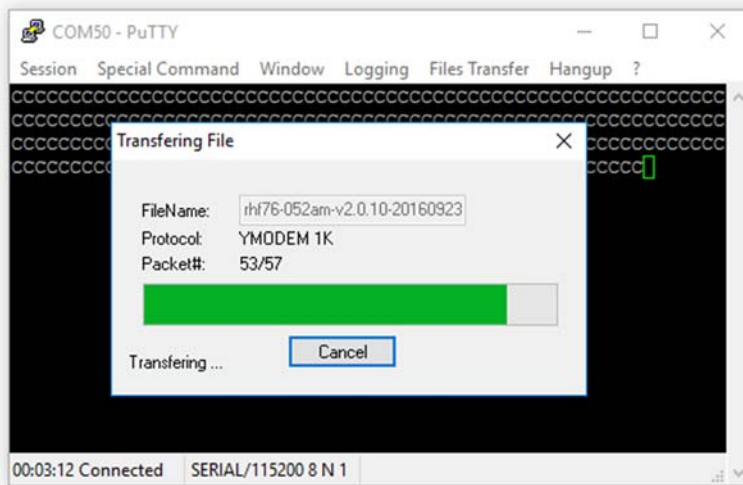
## Tip

You can find the latest PuTTY here: <http://www.extrapuTTY.com/download.php>

## Step5

After connect your board to PuTTY successful, you will find the char 'C' print on the monitor continually. Click on **Files Transfer > Ymodem > Send**, and select the .bin file we had downloaded at Step4.

Then the updating is started.



## Resources

- [Schematics in Eagle](#)
- [Sketchup file\(3D\)](#)
- [CE certification of RHF 76-052](#)
- [RHF76-052 Firmware V2.0.10](#)
- [Datasheet of RHF76-052AM](#)

## Help us make it better

Thank you for choosing [Seeed](#). A couple of months ago we initiated a project to improve our documentation system. What you are looking at now is the first edition of the new documentation system. Comparing to the old one, here is the progresses that we made:

- Replaced the old documentation system with a new one that was developed from Mkdocs, a more widely used and cooler tool to develop documentation system.
- Integrated the documentation system with our official website, now you can go to Bazaar and other section like Forum and Community more conveniently.
- Reviewed and rewrote documents for hundreds of products for the system's first edition, and will continue migrate documents from old wiki to the new one.

An easy-to-use instruction is as important as the product itself. We are expecting this new system will improve your experience when using Seeed's products. However since this is the first edition, there are still many things need to improve, if you have any suggestions or findings, you are most welcome to submit the amended version as our contributor or give us suggestions in the survey below, Please don't forget to leave your email address so that we can reply.

Happy hacking