RAK13007 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using the RAK13007 WisBlock module, make sure to prepare the necessary items listed below:

Hardware

- RAK13007 WisBlock Relay Module
- Your choice of WisBlock Base
- Your choice of WisBlock Core
- USB Cable
- Li-Ion/LiPo battery (optional)
- Solar charger (optional)

Software

- Download and install the ArduinoIDE .
- To add the RAKwireless Core boards on your Arduino board, install the RAKwireless Arduino BSP. Follow the steps in the Github repo .

Product Configuration

Block Diagram

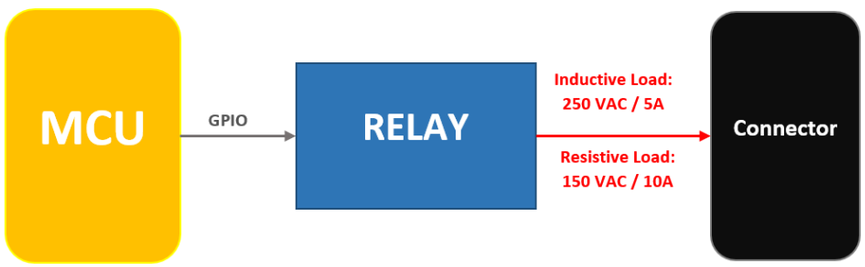

Figure 1: RAK13007 Block Diagram

The RAK13007 uses one relay to isolate the output of the MCU. The dielectric strength between coil and contacts of a relay is 2500 V_{DC}, 50/60 Hz 1 min.

⚠ **WARNING**

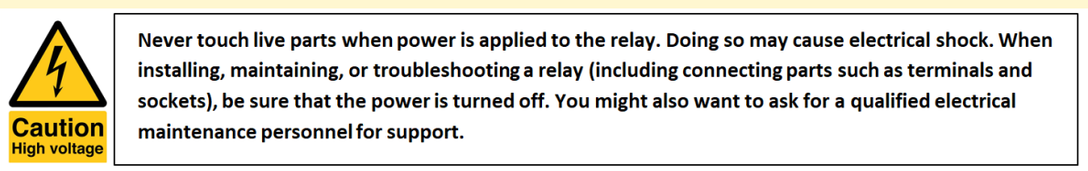

Figure 2: Safety Precaution

Hardware Setup

RAK13007 is a WisBlock Interface module that extends the WisBlock system to be used on isolated digital output applications. There is one digital output that is isolated by an electromechanical relay. The RAK13007 digital output is used to programmatically switch on/off devices operating at high voltage or high current applications.

For more information about RAK13007, refer to the Datasheet.

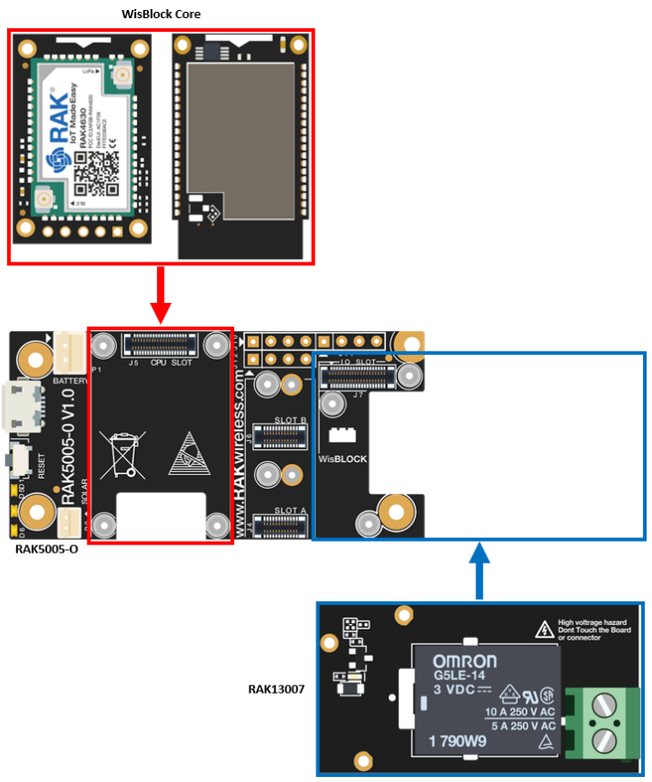

Figure 3: RAK13007 connection to WisBlock Base

Assembling and Disassembling of WisBlock Modules

Assembling

The RAK13007 module can be mounted on the IO slot of the WisBlock Base board, as shown in **Figure 4**. Also, always secure the connection of the WisBlock module by using compatible screws.

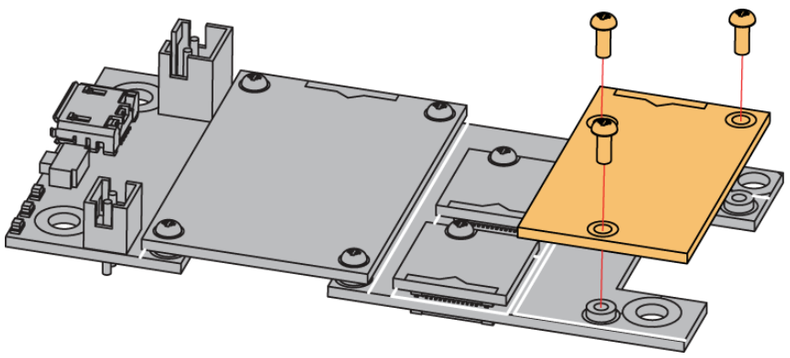

Figure 4: RAK13007 mounting connection to WisBlock Base module

Disassembling

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

1. First, remove the screws.

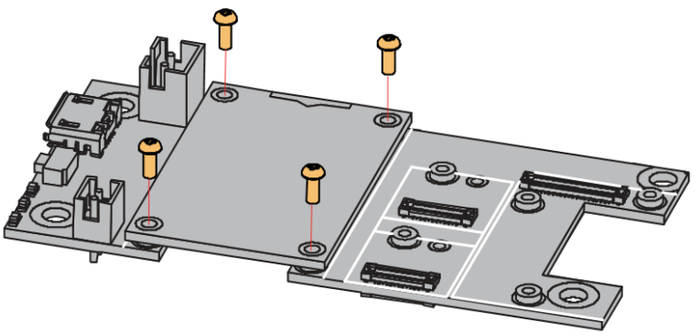

Figure 5: Removing screws from the WisBlock module

2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.

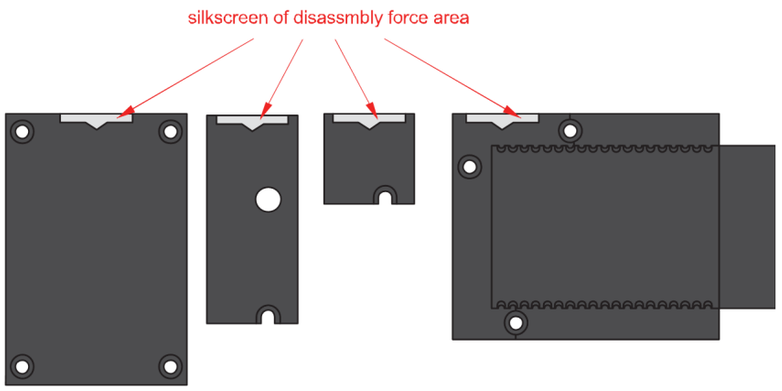

Figure 6: Detaching silkscreen on the WisBlock module

3. Apply force to the module at the position of the connector, as shown in **Figure 7**, to detach the module from the base board.

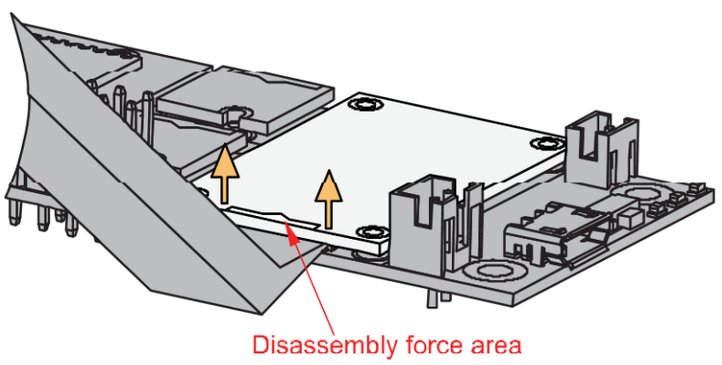

Figure 7: Applying even forces on the proper location of a WisBlock module

> 📝 **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 WisBlock Base board. Not all batteries have the same wiring.

Software Configuration and Example

In the example, you will be using the module. Before connecting high voltage modules to the RAK13007, make sure to follow safety precautions.

For RAK13007, the accessible pin assignment is defined as follows in the Arduino IDE:

- `WB_IO4` for Relay Output pin

Initial Test of the RAK13007 WisBlock Module

Arduino Setup

Figure 8 is an illustration on how to use the RAK13007 relay for switching applications. You can connect any module or device to the RAK13007 as long as it operates on its recommended voltage rating.

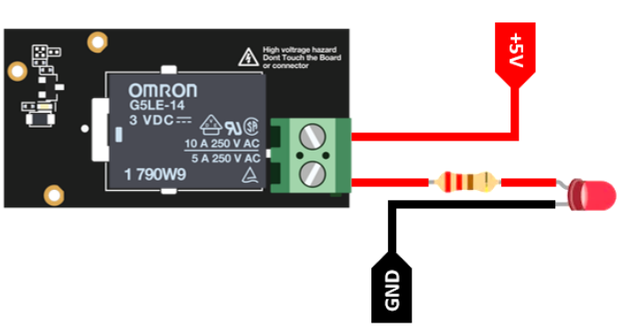

Figure 8: RAK13007 switching the LED

If you have already installed the RAKwireless Arduino BSP , the WisBlock Core and example code should now be available on the Arduino IDE.

1. You need to select first the WisBlock Core you have.

RAK4631 Board

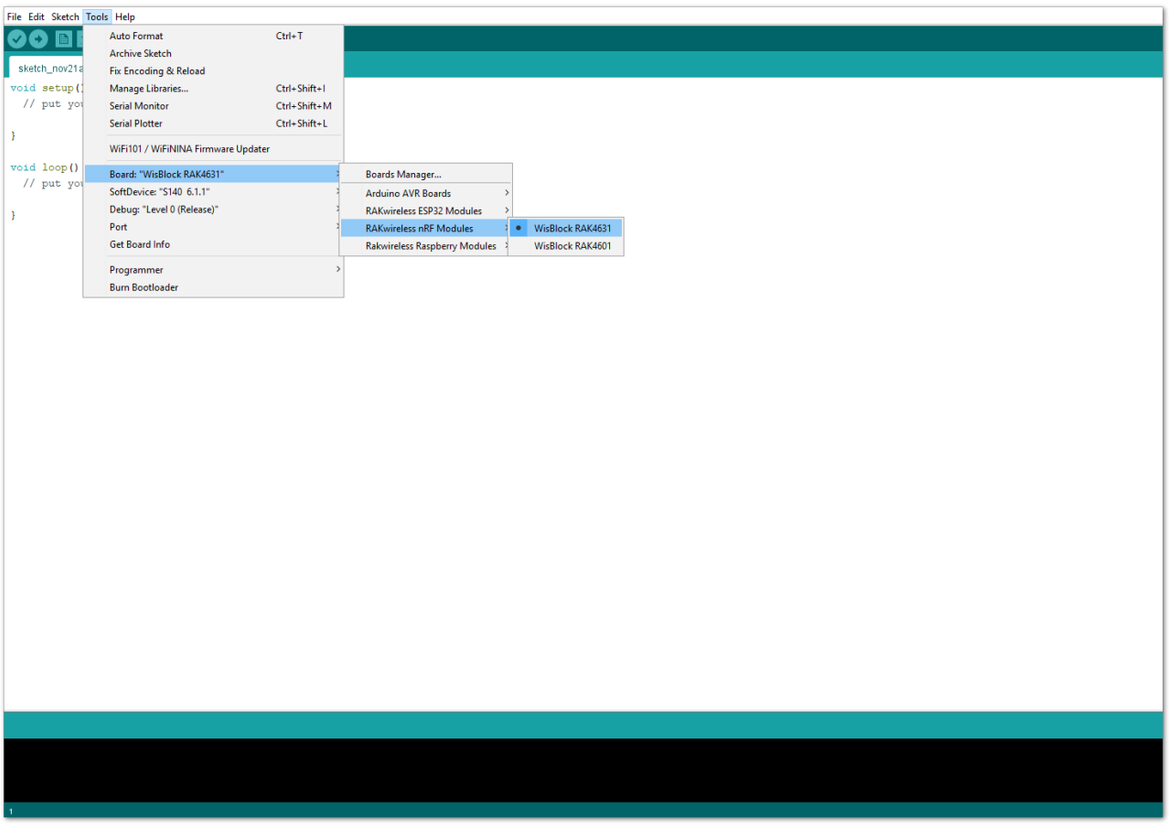

Figure 9: Selecting RAK4631 as WisBlock Core

RAK11200 Board

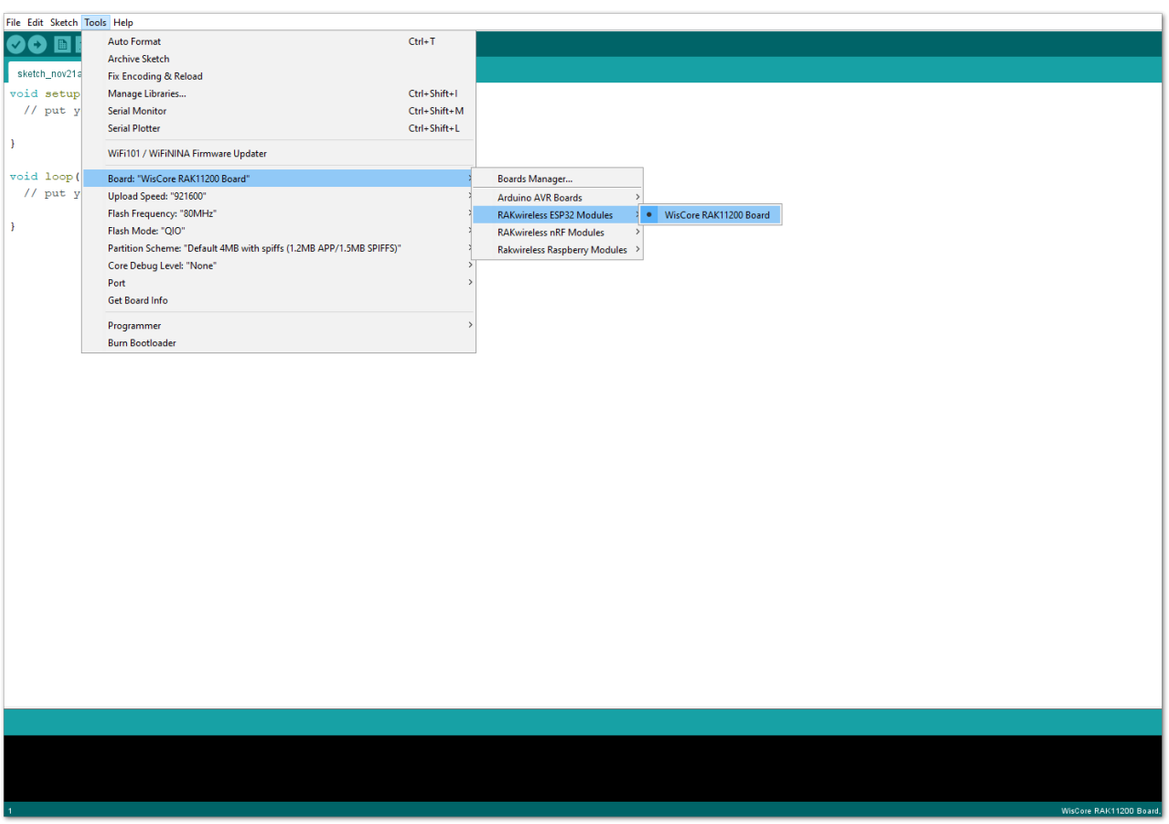

Figure 10: Selecting RAK11200 as WisBlock Core

RAK11310 Board

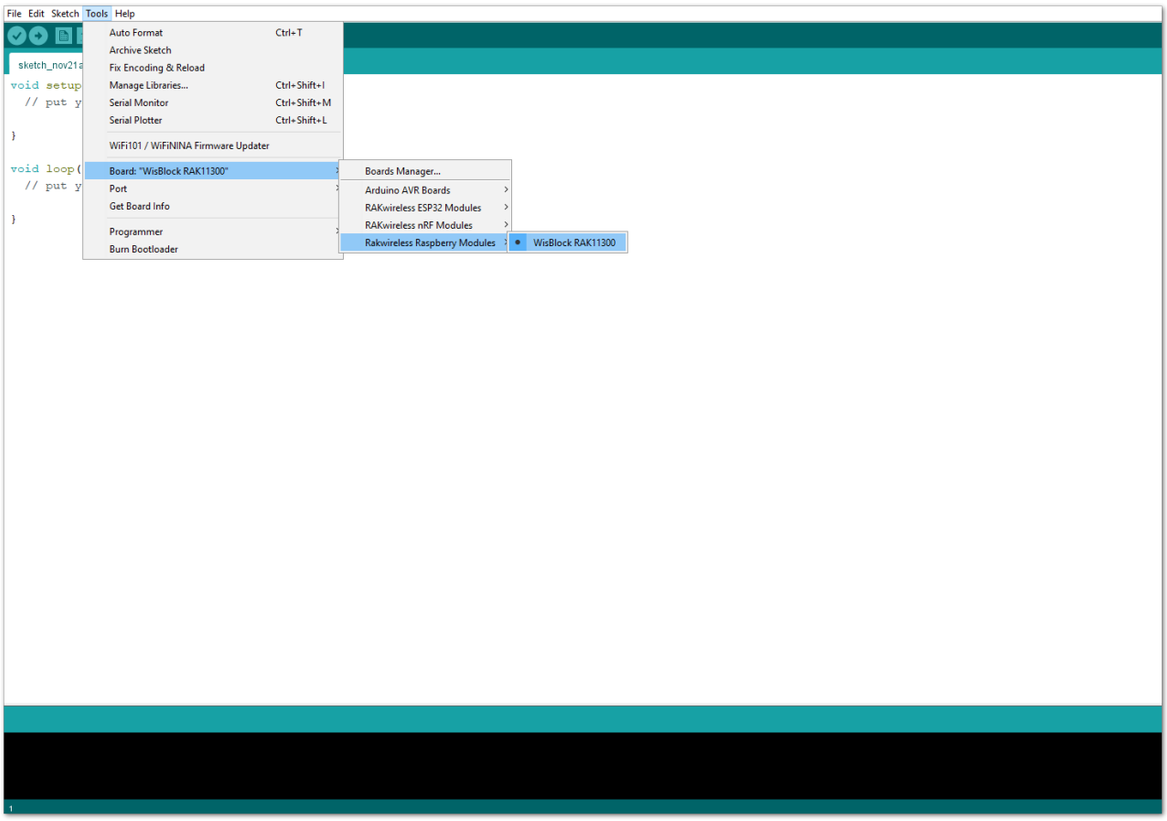

Figure 11: Selecting RAK11310 as WisBlock Core

2. Next, copy the following sample code into your Arduino IDE:

```c
/**
   @file RAK13007_Relay_G5LE-14-DC3.ino
   @author rakwireless.com
   @brief Withstands impulse of up to 4,500 V
   @version 0.1
   @date 2021-8-28
   @copyright Copyright (c) 2020
**/
#include <Wire.h>

void setup() {
  pinMode(WB_IO2, OUTPUT);
  digitalWrite(WB_IO2, HIGH);
  pinMode(WB_IO4, OUTPUT);
  // Initialize serial for output.
  Serial.begin(115200);
}

void loop() {
  digitalWrite(WB_IO4, LOW);
  delay(5000);
  digitalWrite(WB_IO4, HIGH);
  delay(5000);
}
```

> 📝 **NOTE**
>
> If you experience any error in compiling the example sketch, check the updated code for your WisBlock Core Module that can be found on the RAK13007 WisBlock Example Code Repository . This sample code in Github will work on all WisBlock Core.

3. Once the example code is open, you can now select the right serial port and upload the code, as shown in **Figure 12** and **Figure 13**.

> 📝 **NOTE**
>
> If you're using the RAK11200 as your WisBlock Core, the RAK11200 requires the **Boot0** pin to be configured properly first before uploading. If not done properly, uploading the source code to RAK11200 will fail. Check the full details on the RAK11200 Quick Start Guide .

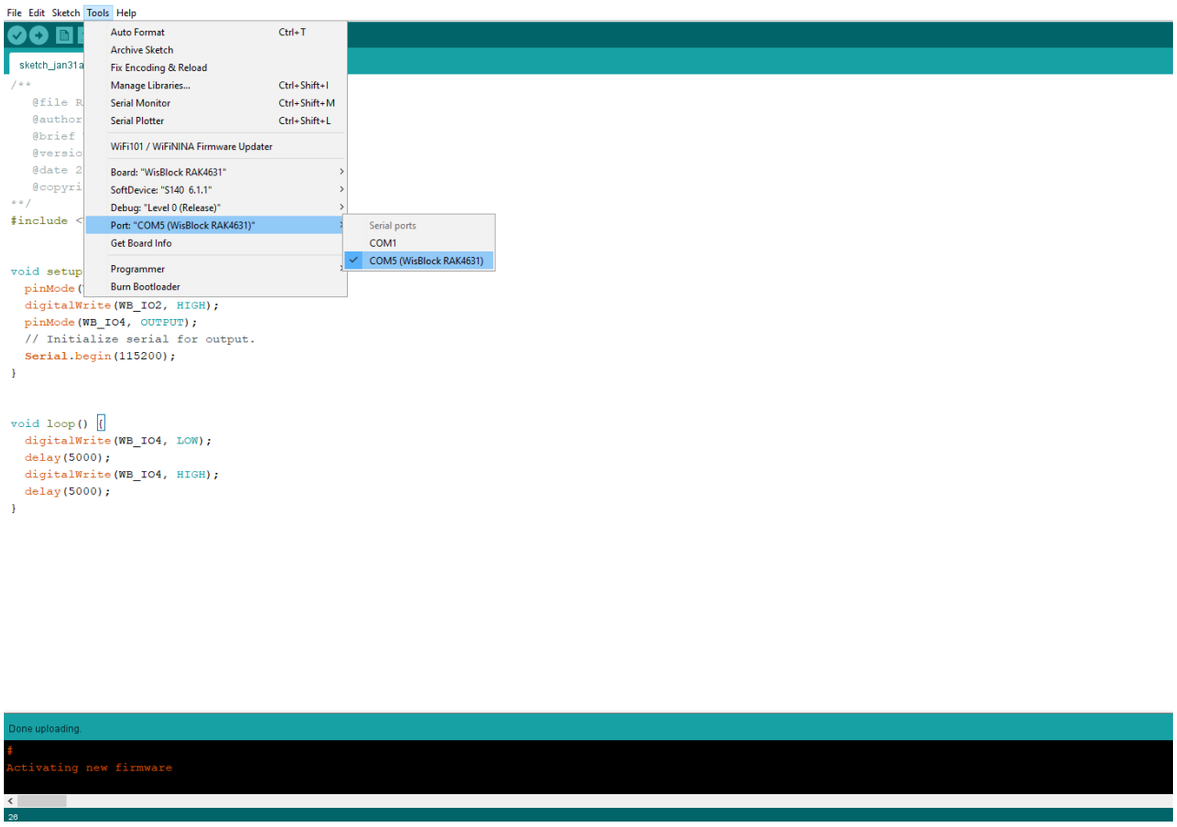

Figure 12: Selecting the correct Serial Port

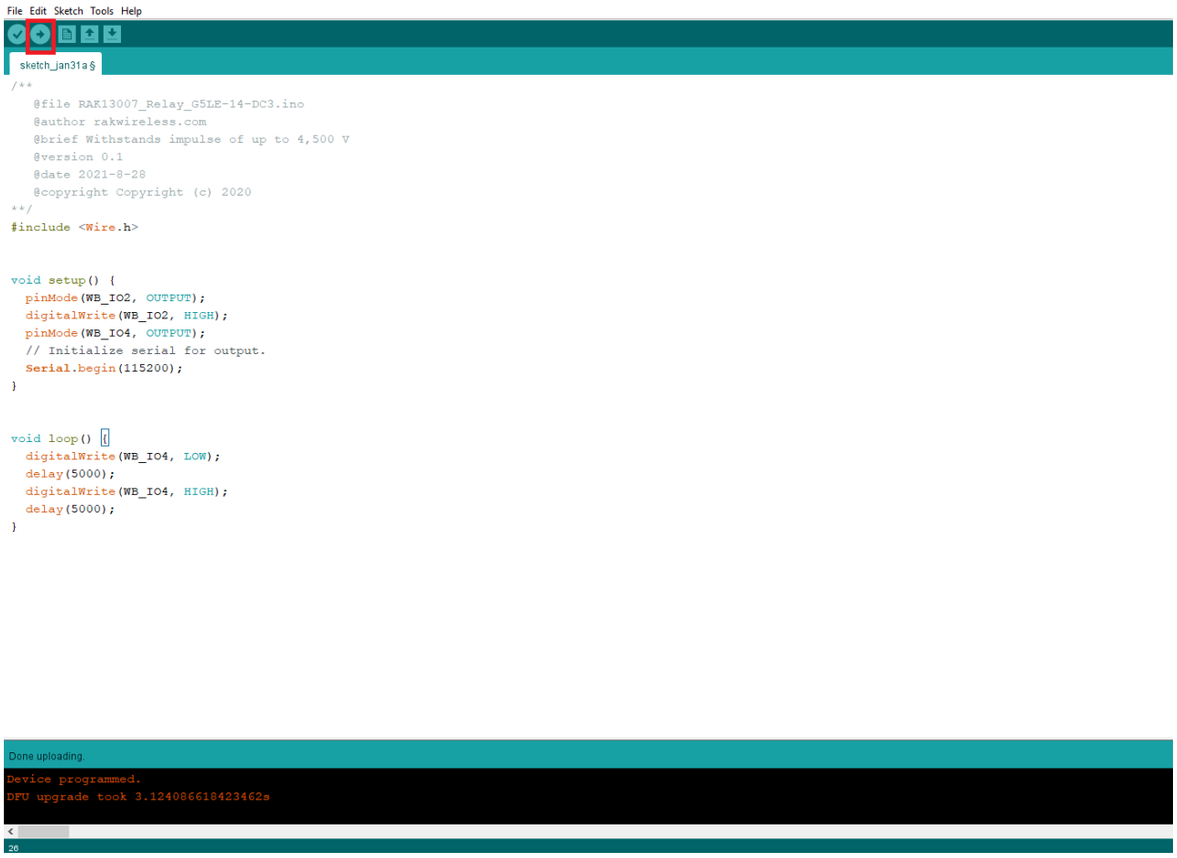

Figure 13: Uploading the RAK13007 example code

4. When you have successfully uploaded the example sketch, you will now see the RAK13007 Relay module switches the LED on and off every 5 seconds. Also, notice that the built-in red led on the RAK13007 module lights on when there is contact, or it is normally closed, and then lights off when it is normally open. You'll also be able to hear clicking sounds from the RAK13007 module, which means that the relay is switching.

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RAK13007 WisBlock Relay Module Datasheet

Overview

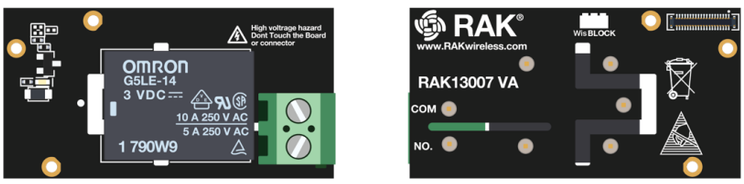


Figure 1: RAK13007 WisBlock Relay Module

Description

RAK13007 is a WisBlock Interface module that extends the WisBlock system to be used on isolated digital output applications. There is one digital output that is isolated by an electromechanical relay. The RAK13007 digital output is used to programmatically switch on/off devices operating at high voltage or high current applications.

Features

- One relay isolated output
- The isolation between internal and external signal is up to 2,500 VDC, 50/60 Hz for 1 min.
- Inductive Load: 250 V_{AC} / 5_A and 30 V_{DC} / 4_A
- Resistive Load: 150 V_{AC} / 10_A and 30 V_{DC} / 8_A
- Module size: 25 x 48 mm

Specifications

Overview

The overview covers the RAK13007 block diagram and the mounting mechanics of the board into the WisBlock Base board.

Mounting

The RAK13007 module can be mounted on the IO slot of the WisBlock Base board. **Figure 2** shows the mounting mechanism of the RAK13007 on a WisBlock Base module, such as a RAK5005-O.

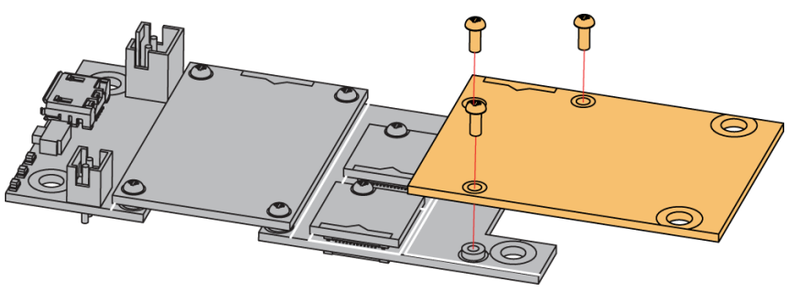


Figure 2: RAK13007 mounting mechanism on a WisBlock Base module

Block Diagram

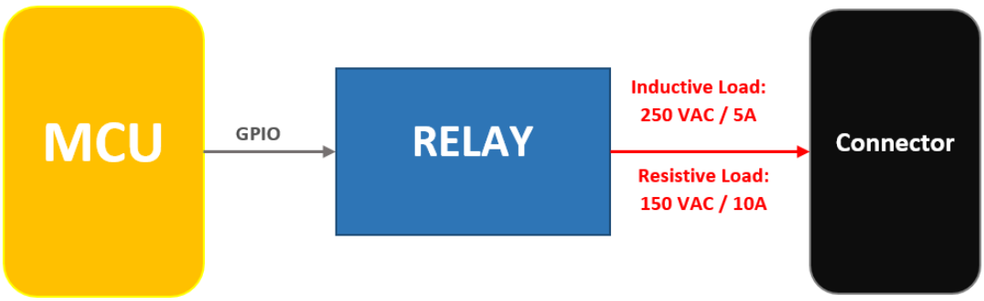


Figure 3: RAK13007 Block Diagram

The RAK13007 uses one relay to isolate the output of the MCU. The dielectric strength between coil and contacts of a relay is 2500 V_{DC}, 50/60 Hz 1min.

⚠ **WARNING!!**

Never touch live parts when power is applied to the relay. Doing so may cause electrical shock. When installing, maintaining, or troubleshooting a relay (including connecting parts such as terminals and sockets), be sure that the power is turned off. You might also want to ask for a qualified electrical maintenance personnel for support.

Figure 4: Safety Precaution

Hardware

The hardware specification is categorized into four (4) parts. It discusses the pinouts and their corresponding functions and diagrams of the module. It also covers the electrical and mechanical characteristics that include the tabular data of the functionalities and standard values of the RAK13007 WisBlock Relay Module.

Pin Definition

The RAK13007 WisBlock module has a 40-pin WisConnector that is compatible to the WisBlock Base IO Slot. The pin order of the connector and the pinout definition is shown in **Figure 5**.

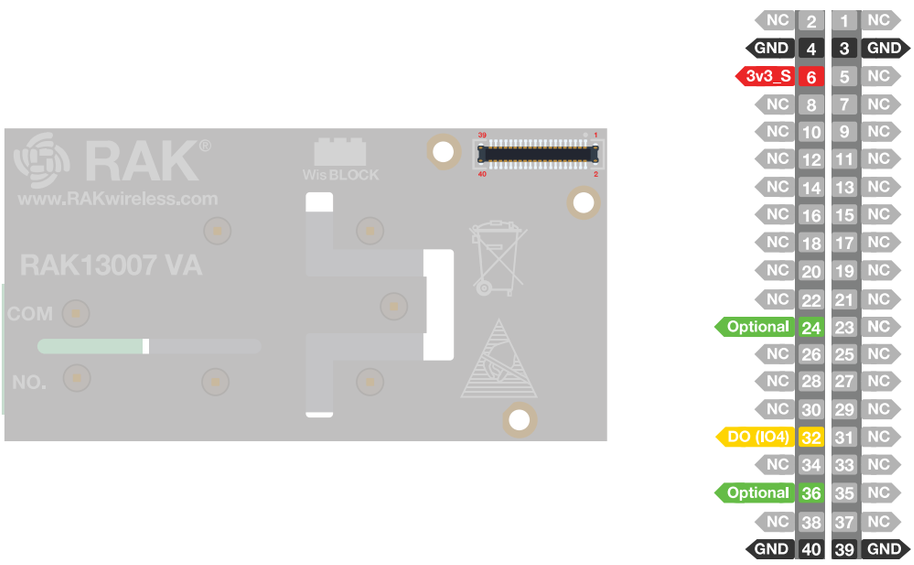


Figure 5: RAK13007 Pinout Diagram

📝 **NOTE**

- By default, **IO4** is used as the Digital Output (DO) pin.
- DO pin can be changed by reworking some resistors on the PCB module. There are reserved options to change the GPIO to control DO.
- **3V3_S** voltage output from the WisBlock Base that powers the RAK13007 module can be controlled by the WisBlock Core via WB_IO2 (WisBlock IO2 pin). This makes the module ideal for low-power IoT projects since the WisBlock Core can totally disconnect the power of the RAK13007 module.

Electrical Characteristics

This section shows the maximum and minimum ratings of the RAK13007 module and its recommended operating conditions. Refer to the table presented below.

Recommended Operating Conditions

Description	Conditions
Contact Resistance	100 mΩ
Operate Time	10 ms max.
Release Time	5 ms max.
Bounce Time	Operate: Approx. 0.6 ms Release: Approx. 7.2 ms
Max. Switching Frequency	Mechanical: 18,0000 operations/hr Electrical: 1,8000 operations/hr at rated load
Insulation Resistance	100 MΩ min. at 500 V_{DC}
Dielectric Strength	2,000 V_{AC}, 50/60 Hz for 1 min between coil and contacts 750 V_{AC}, 50/60 Hz for 1 min between contacts of the same polarity 1,500 V_{AC} (for suffix -G) 1 min between contacts of the same polarity
Impulse Withstand Voltage	4,500 V (1.2 x 50 us) between coil and contacts
Insulation Distance	Creepage (Typ): 3.3 mm Clearance (Typ): 2.7 mm
Tracking Resistance (CTI)	250 V
Vibration Resistance	Destruction: 10 to 55 to 10 Hz, 0.75 mm single amplitude (1.5 mm double amplitude) Malfunction: 10 to 55 to 10 Hz, 0.75 mm single amplitude (1.5 mm double amplitude)
Shock Resistance	Destruction: 1,000 m/s² Malfunction: 100 m/s²
Endurance	Mechanical: 10,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr) for standard type 36,000 operations min. (10 A at 250 V_{AC}) 100,000 operations min. (at 1,800 operations/hr), 12 A at 250 V_{AC} - applicable for G5LE-1-E, NO contact only
Ambient Temperature	Operating: -40 °C to 85 °C (with no icing)
Ambient Humidity	Operating: 5% to 85%
Weight	Approx. 12 g

Mechanical Characteristics

Board Dimensions

Figure 6 shows the mechanical dimensions of the RAK13007 module.

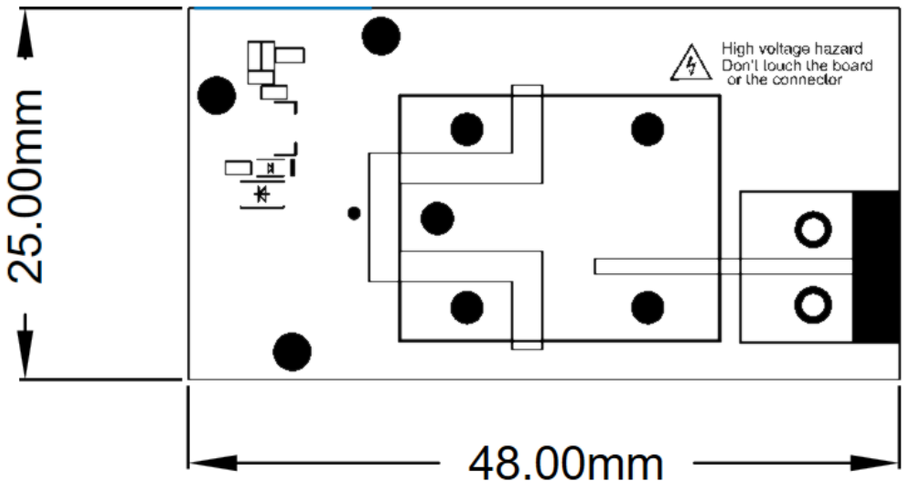
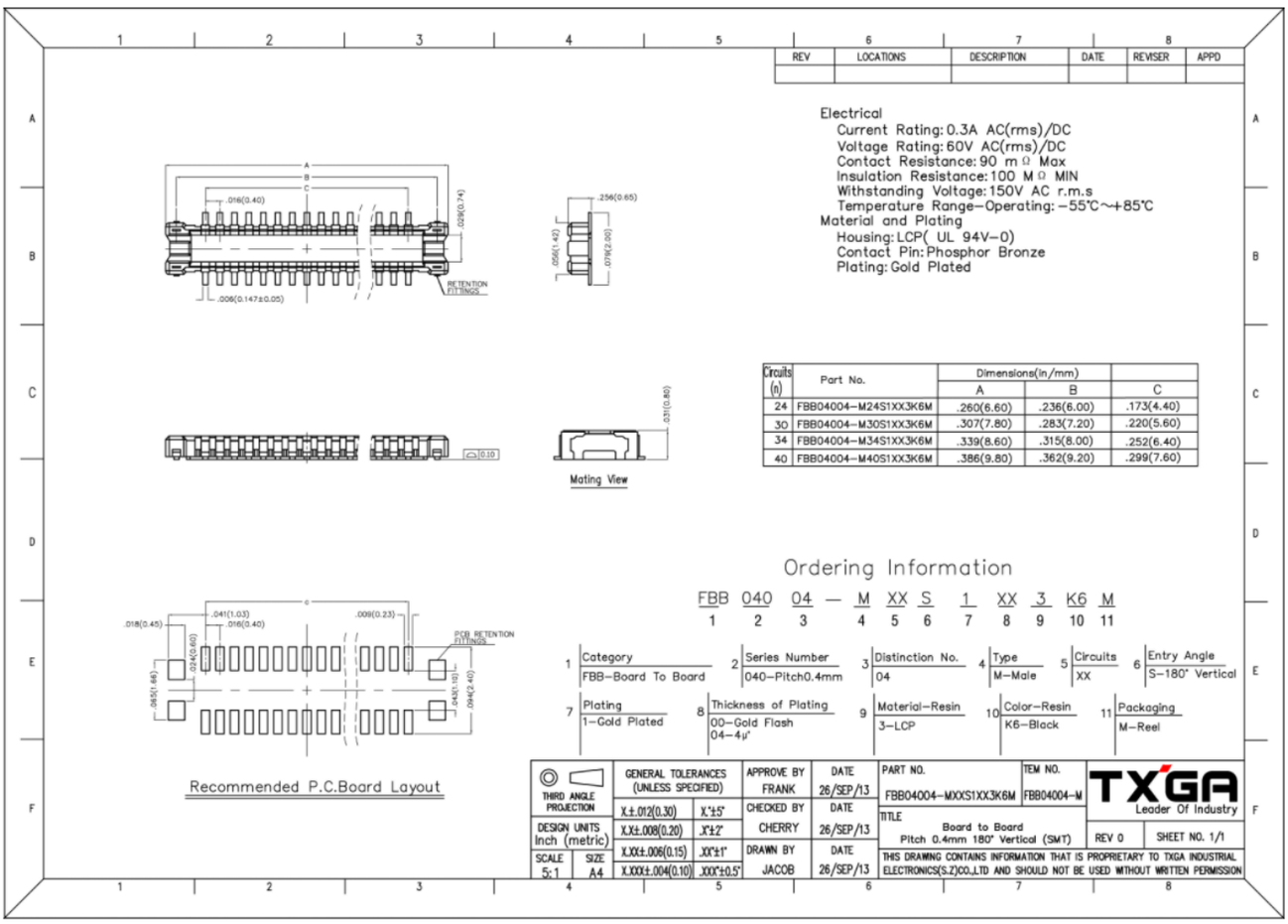


Figure 6: RAK13007 Mechanical Dimensions

WisConnector PCB Layout



Circuits (n)	Part No.	Dimensions(in/mm) A	B	C
24	FBB04004-M24S1XX3K6M	.260(6.60)	.236(6.00)	.173(4.40)
30	FBB04004-M30S1XX3K6M	.307(7.80)	.283(7.20)	.220(5.60)
34	FBB04004-M34S1XX3K6M	.339(8.60)	.315(8.00)	.252(6.40)
40	FBB04004-M40S1XX3K6M	.386(9.80)	.362(9.20)	.299(7.60)

Figure 7: WisConnector PCB Footprint and Recommendations

Schematic Diagram

Figure 8 shows the schematic of the RAK13007.

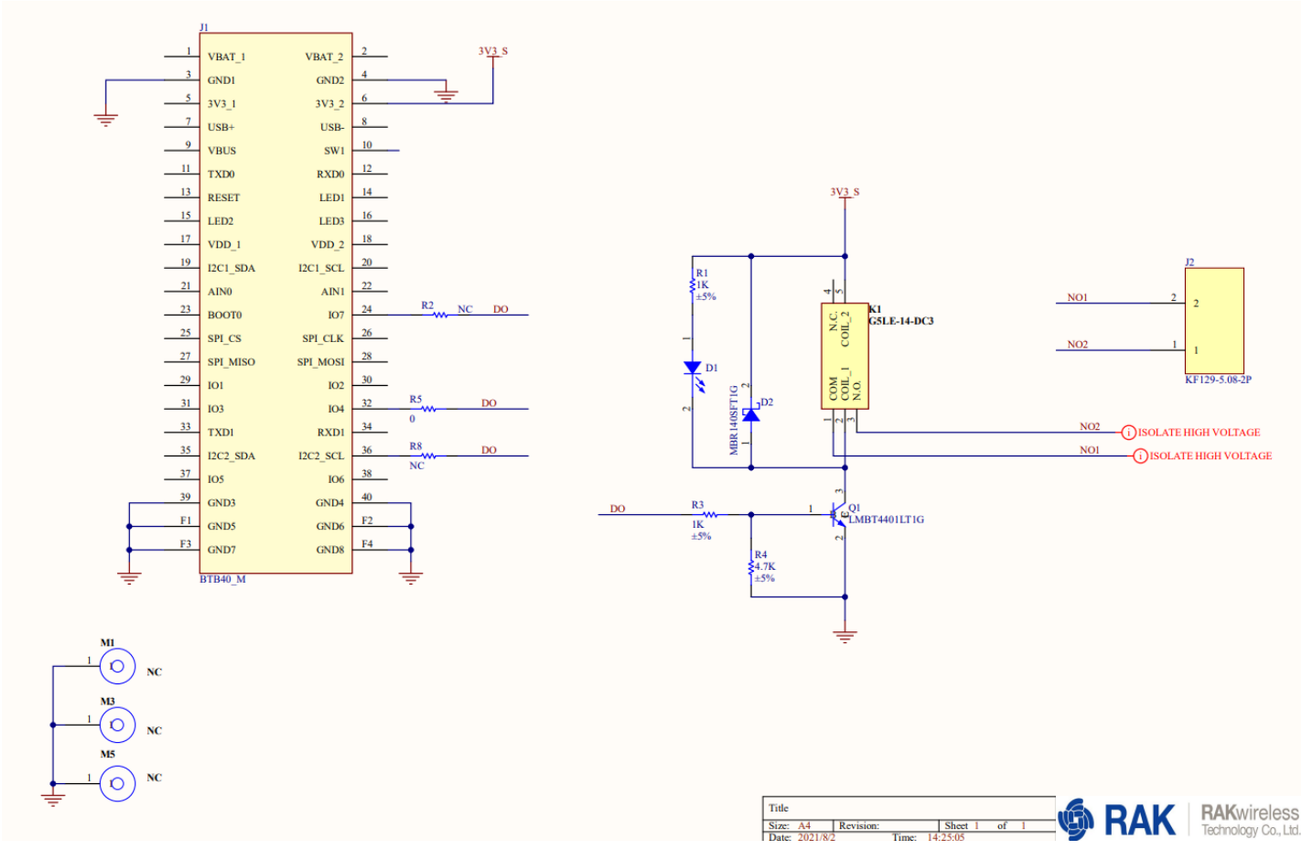


Figure 8: RAK13007 WisBlock Module Schematics

Relay Module

Figure 9 shows the schematic of the RAK13007 module. It uses **3V3_S** for the relay coil power supply.

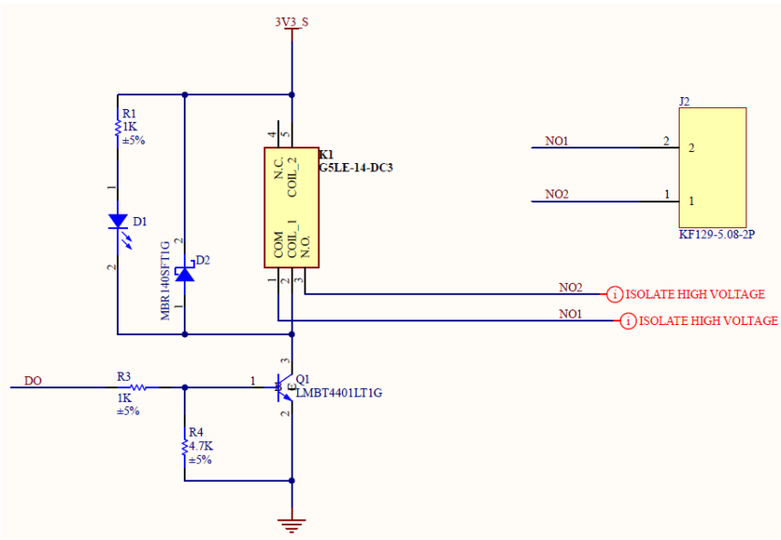


Figure 9: RAK13007 WisBlock Relay Schematic