WeMos D1 mini RFM Shield

RFM Shield for WeMos D1 mini and pro

1   Forewords

WeMos is a cheap and easy to use Ethernet (WiFi) IoT gateway, but lacks of RFM connectivity for application that is using HopeRF / Semtec transceivers.

This document describes a RFM shield that can be easily added to a WeMos appliance to offer RFM connectivity on top of the Ethernet one.

The design of this shield is a simplified versions of the one proposed by Charles Henry Hallard see:

- https://github.com/hallard/WeMos-RFM69
- https://github.com/hallard/WeMos-Lora

2   Availability

Version 0 is currently available on:

https://pcbs.io/search?query=Wemos_D1_Mini_RFM_Shield_V0

3   Specification

3.1 Board size

Board footprint is slightly greater that the WeMos one.
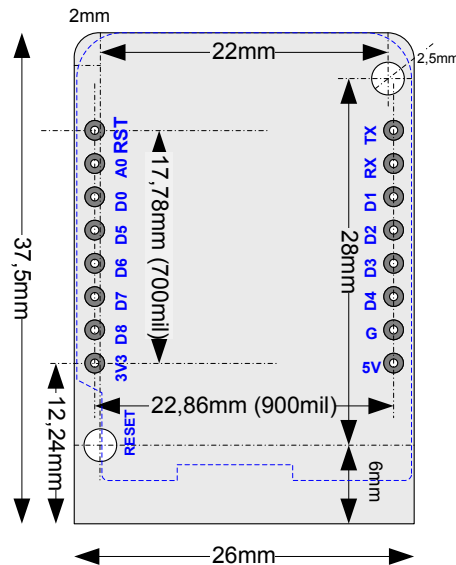
3.2 Features

- Allows usage of various RFM transceivers such as:
    - RM12B
    - RFM69W
    - RFM69HW
    - RFM69CW
    - RFM69HCW
    - RFM95/96/97/98

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- Provide I/O connection for OOK modulation
- Supports variety of antennas
    - Wire or Coil
    - UFL terminated
    - SMA terminated
- Usage of a switch for software or factory reset
- Mounting holes

3.3 Particularities

3.3.1 ESP8266 GPIO16 as SPI Slave Select rather than GPIO15

Background

- ESP8266 SPI IO pins definition are the following
  see /packages/esp8266/hardware/esp8266/2.3.0/variants/generic/common.h
    - static const uint8_t SS   = 15;
    - static const uint8_t MOSI = 13;
    - static const uint8_t MISO = 12;
    - static const uint8_t SCK   = 14;
- D1_mini pins definition is
  see/packages/esp8266/hardware/esp8266/2.3.0/variants/d1_mini/pins_arduino.h
    - static const uint8_t D0 = 16;
    - static const uint8_t D1 = 5;
    - static const uint8_t D2 = 4;
    - static const uint8_t D3 = 0;
    - static const uint8_t D4 = 2;
    - static const uint8_t D5 = 14;
    - static const uint8_t D6 = 12;
    - static const uint8_t D7 = 13;
    - static const uint8_t D8 = 15;
    - static const uint8_t RX = 3;
    - static const uint8_t TX = 1;

ESP8266 GPIO15 is used for SPI Salve Select (D1_mini pin D8), but this pin also supports interrupts. So it should theoretically better to use GPIO15 for other purposes than for slave select.

At the other hand, GPIO16 (D1 mini pin D0) do no support interrupt and may therefore be used as Slave Select

So the modification introduced by Charles Henry Hallard to use GPIO16 as SPI SS and GPIO15 as IRQ to manage RFM transceiver SPI interrupts.

We also note that it is the only solution to connect the RFM IRQ signal, all WeMos pins are used.

Impact

Two impacts:

1. Physical connections between RFM transceivers SPI SS and WeMos (ESP8266) is not standard
2. The WeMos script configuration for RFM transceiver initialisation shall take care of this modification.
   Typically (using the RFM69 library)
   #define RFM_SS   D0   // GPIO16 of ESP8266 for SS

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#define RFM_INTPIN   D8   // GPIO15 of ESP8266 for IRQ
#define RFM_OOKPIN   D2   // Define Data pin for OOK transfer
#define IS_RFM69H   true   // Only for RFM69H transceivers;
const byte RFM_INTNUM = digitalPinToInterrupt(RFM_INTPIN); // RFM69 Interrupt number
static RFM69   radio (RFM_SS,RFM_INTPIN,IS_RFM69H,RFM_INTNUM); //Create a RFM69 Instance

3.3.2 OOK modulation

OOK modulation of the RFM signal is made possible (using the OOK library) connecting the DIO2 pin of the RFM transceivers to the D2 pin of the WeMos.

3.3.3 Software reset

One optional push button switch connecting the ground to WeMos pin D1 allows manual signal detection.

This signal is typically used for warm reset or factory reset.

The switch can be mounted on the front or bottom side of the PCB according to the physical mounting aspects.
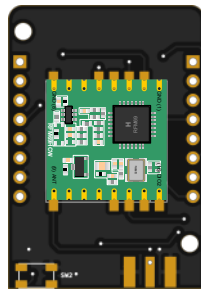
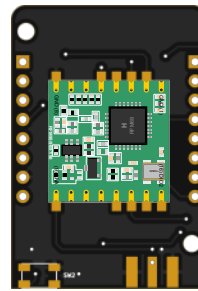## 4   Configuration examples

4.1   Antenna types

Wire/Coil Antenna   **U.FL Connector**   **SMA Connector**

4.2   Transceivers

RFM12B   **RFM69CW**   **RFM69W**   **RFM69HW**
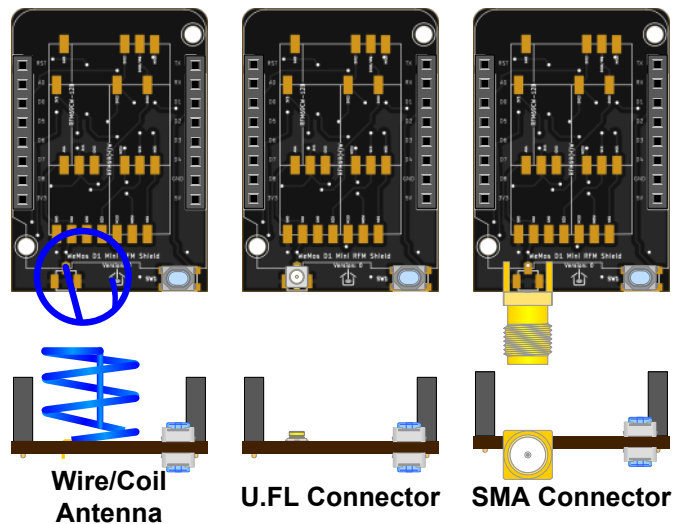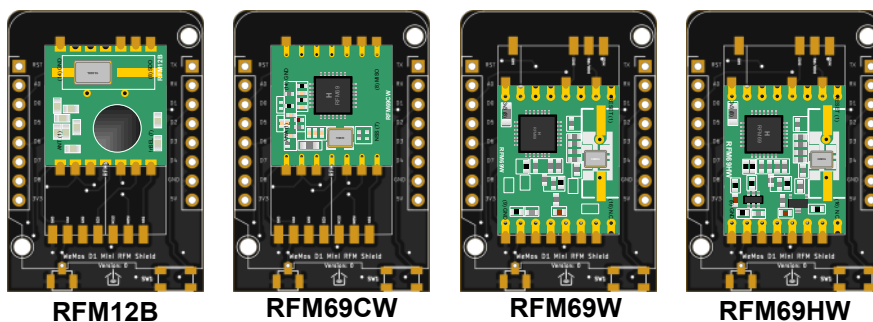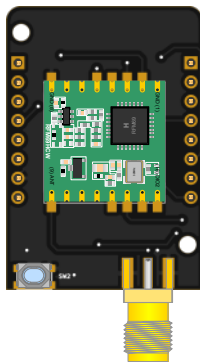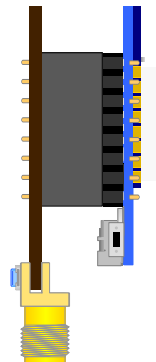
WeMos D1 mini RFM Shield
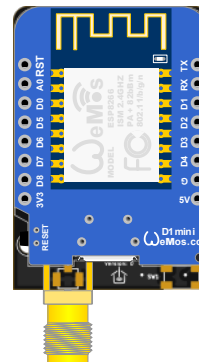

RFM69HCW

RFM69HCW

4.3   Physical Layout
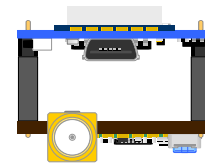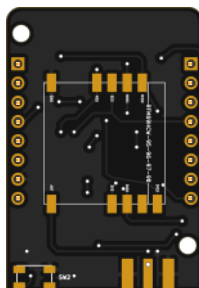
WeMos D1 mini and D1 mini Pro
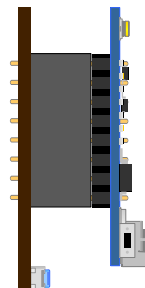

**Typical Bottom
View**

**Typical
Side View**
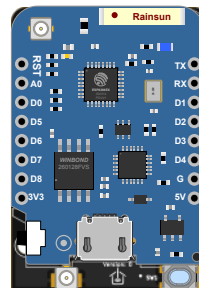
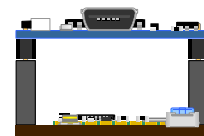**Typical Top
View**

**Typical Front
View**

**Typical Bottom
View**

**Typical
Side View**

**Typical Top
View**

**Typical Front
View**

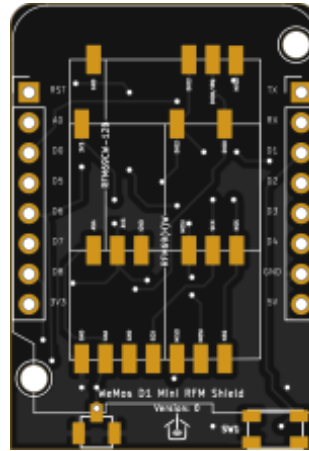# WeMos D1 mini RFM Shield

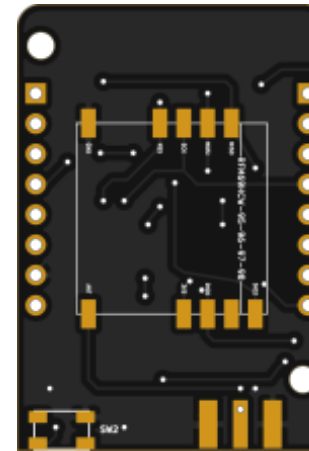## 5   Appendix

5.1   Logical diagram
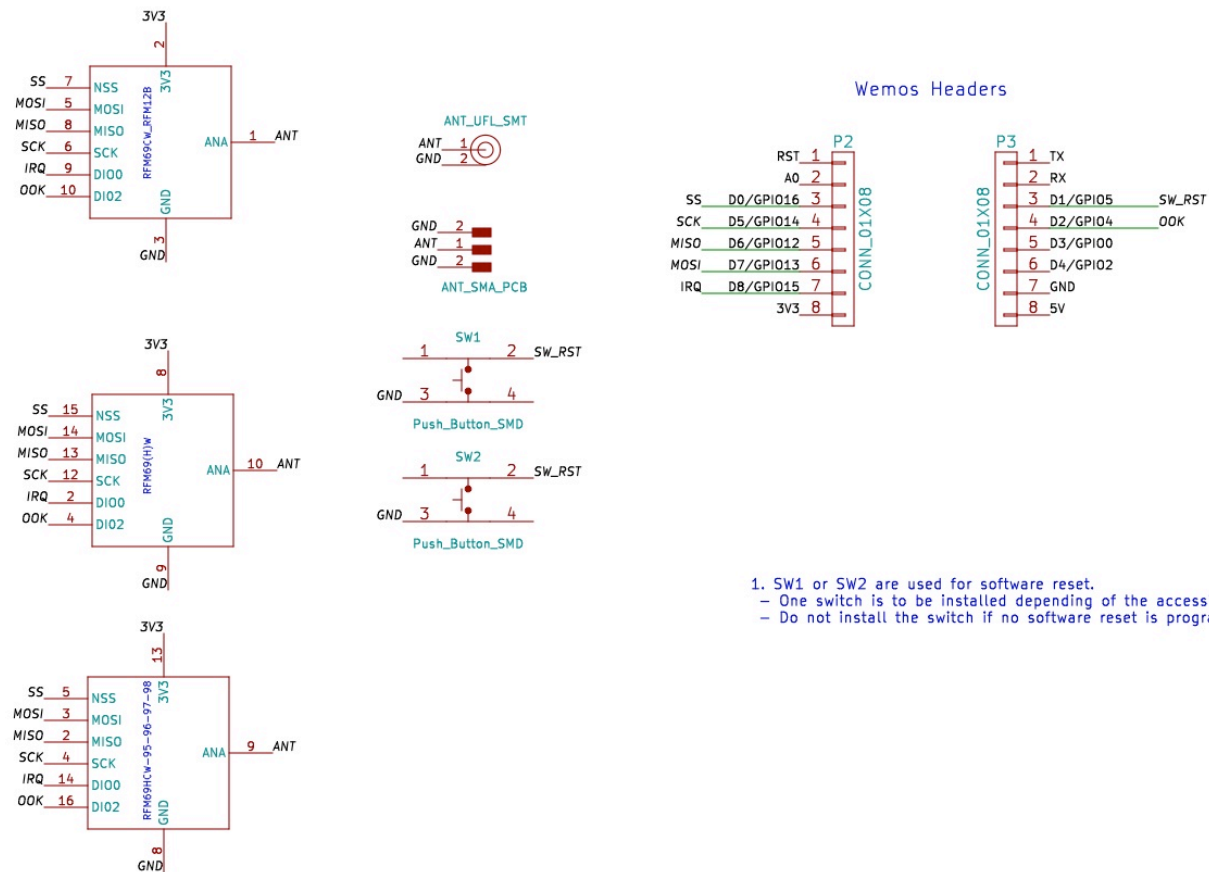
WeMos D1 mini RFM Shield

5.2 PCB Layout

Wemos D1 Mini
RFM Shield Top

Wemos D1 Mini
RFM Shield Bottom

5.3 Interconnections

RFM12B	RFM69W	RFM69HW	RFM69CW	RFM69HCW	RFM95/96/97/98W	ESP8266 Assembly	WeMos	Comments
VDD (2)	3V3 (8)	3V3 (8)	3V3 (2)	3V3 (13)	3V3 (13)	3V3	3v3	
GND (3)	GND (9)	GND (9)	GND (3)	GND (8)	GND (8)	GND	GND	
FSK (16)	DIO2 (4)	DIO2 (4)	DIO2 (16)	DIO2 (16)	DIO2 (16)	GPIO4	D2	This pin is used for RFM OOK Data
SDO (8)	MISO (13)	MISO (13)	MISO (8)	MISO (2)	MISO (2)	GPIO12	D6	
SDI (5)	MOSI (14)	MOSI (14)	MOSI (5)	MOSI (3)	MOSI (3)	GPIO13	D7	
SCK(6)	SCK(2)	SCK(12)	SCK(6)	SCK(4)	SCK(4)	GPIO14	D5	
nIRQ(9)	DIO0(2)	DIO0(2)	DIO0(9)	DIO0 (14)	DIO0 (14)	GPIO15	D8	Used as Interrupt (default SS)
nSEL (7)	NSS (15)	NSS (15)	NSS (7)	NSS (5)	NSS (5)	GPIO16	D0	Used as Slave Select
						GPIO3	RX	
						GPIO2	D4	Build in LED
						GPIO1	TX	
						GPIO5	D1	Used as Reset Pin
						GPIO0	D3	
ANT (1)	ANT (10)	ANT (10)	ANT (1)	ANT (9)	ANT (9)			