Design Manual of AFW12xTx Module Hardware

V1.1   2017.08

Contents

1 Introduction

1.1 Abstract

The document mainly lists the issues that need attention in all stages during the use of 99 IoT Wi-Fi module AFW12xTx design by users in order to reduce design costs and increase product stability as far as possible.

AFW12xTx is a complete and self-contained WiFi network solution module that can run either in MCU+WIFI mode or as a slave on other master MCU. The sensor and other applied specific devices can be integrated through GPIO port.

1.2 Basic characteristics of module

➢ Standard: 802.11 b/g/n   1x1

➢ Working mode: STA, AP, STA+AP

➢ Complete IoT solution (SDK, Cloud service, APP)

➢ Supporting Simple Configuration intelligent networking function (APP is provided)

➢ Supporting Amazon, Baidu cloud, Jingdong cloud, Ali cloud

➢ Each module has unique global MAC ID

➢ Antenna: outer antenna, IPEX antenna interface, onboard antenna

➢ Working ambient temperature: -20 to 85℃

1.3 Module type

Module name	Module description
AFW121TI	PCB onboard antenna
AFW121TO	IPEX outer antenna (optional)
AFW122TI	PCB onboard antenna
AFW122TO	IPEX outer antenna (optional)

1.4 Sketch map of module
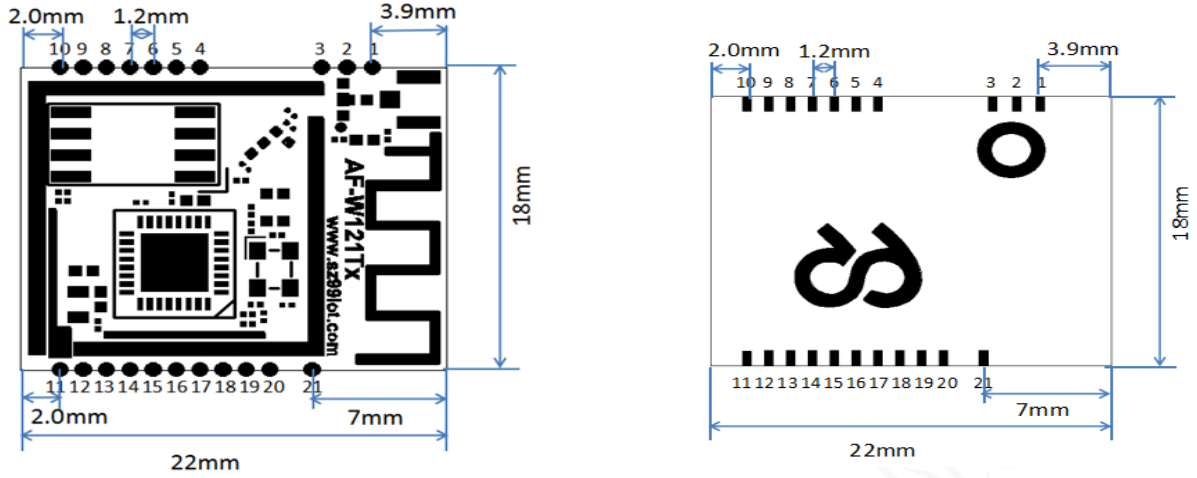
| 引脚 Pin	名称 /主功能 Name/ main function	类型 Type	可选功能 Optional functions	其它功能 Other functions
1	GND			
2	Wi-Fi-ANTENA			
3	GND			
4	NC/GND			
5	CHIP_EN(RESET)	I	Power ON\OFF	Reset
6	GPIOA_14	I/O	PWM0/ SWD_CLK	
7	GPIOA_15	I/O	PWM1/ SWD_DATA	
8	GPIOA_0	I/O	PWM2/EXT_32K/WL_LED	
9	GPIOA_12	I/O	PWM3	
10	GND			
11	VDD33			
12	GND			
13	VBAT_MEAS			
14	GPIOA_5	I/O	SDIO_SIDEBAND_INT/ PWM4	
15	GPIOA_18	I/O	UART0_RXD/SPI1_CLK /SPI0_CLK / I2C1_SCL / SD_D2/ TIMER4_TRIG/ I2S_MCK	
16	GPIOA_19	I/O	UART0_CTS/SPI1_CS/SPI0_CS I2C0_SDA/SD_D3/TIMER5_TRIG I2S_SD_TX	

17	GPIOA_22	I/O	UART0_RTS / SPI1_MISO/ SPI0_MISO / I2C0_SCL SD_D0 / PWM5 / I2S_WS	
18	GPIOA_23	I/O	UART0_TXD/ SPI1_MOSI/ SPI0_MOSI / I2C1_SDA SD_D1 / PWM0	
19	GPIOA_30	I/O	UART2_Log_TXD/ I2C0_SDA/ PWM3 / RTC_OUT	
20	GPIOA_29	I/O	UART2_Log_RXD / I2C0_SCL PWM4	
21	GND			

Note:

1. PIN19, 20 are for the use when Wi-Fi debugs LOG information input and output port.

2. PIN19 of module AFW121Tx needs to be pulled up to 3.3V externally, or floating, or to ensure that power-on time isn't low level.

3. Please keep CHIP_EN or other pins floating if they are not used.

1.5 Block diagram of hardware
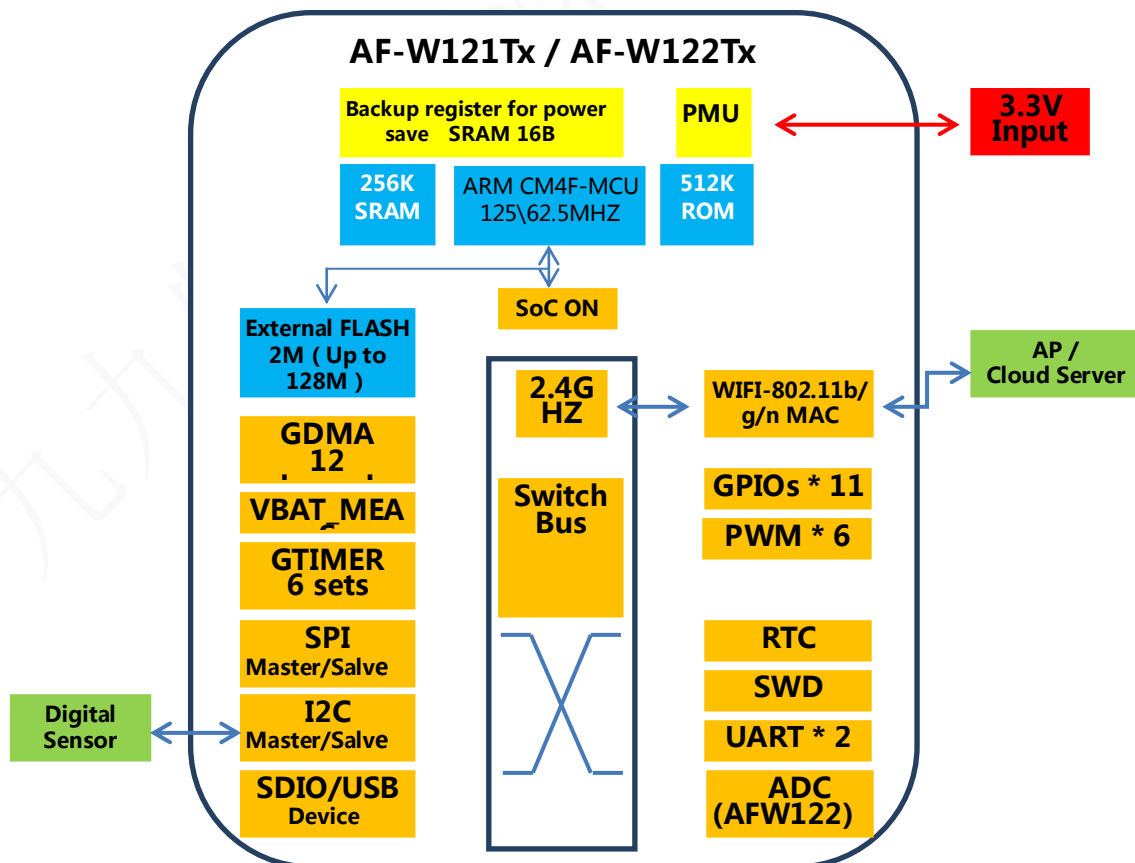
2 Design issues of hardware

2.1 Power design

As shown in Figure 1.4 above

（1）Input pin of main power supply is [PIN11], module supply voltage is DC 3.0～3.6, filter capacitor of 4.7-10uF needs to be placed near its location; loading capability of 3.3V power supply, the power supply with rated output current ≥500mA is recommended.

（2）Use of DC/DC powerchip: voltage output meets 3.3V and the maximum current output meets 500mA, input capacitor is as close as possible to voltage input pin, thickening ground wire width or grounded copper area, punching more via holes for different layers.

（3）For LDO design, the voltage output meets 3.3V and the maximum current output meets 500mA, paying attention to device junction temperature, the formula of power consumption is PD=(Vin-Vout) * Iload + Vin * IGND, in which Vin is input voltage, Vout is output voltage, Iload is load current, IGND is ground current.

（4）[PIN13] is ADC input pin, which can be used to detect battery voltage.
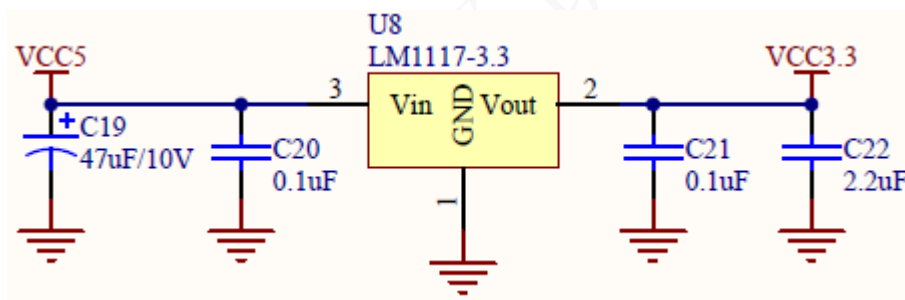
2.2 Power OFF PIN

As shown in Figure 1.4 above

（1）[PIN5] is module reset pin: Power OFF（RESET）.The pull-up of the 10K resistor has been done inside the module, If this PIN is not controlled by the MCU, it can be left unconnected . If it is low, the module is shutdown mode.

（2）If the module is not controlled by other MCU, the decoupling capacitor of 100nF is recommended to be added near its location to enhance the stability of the system.

（3）If other MCU is needed to reset-control the module through the pin, a low pulse signal is needed and the duration of low level is at least 10ms.

（4）If the voltage of power supply is unstable (lower than 3.0V), it may cause module halt. It is recommended to add Brown out reset circuit, and the recommended chip is as follows:

【ONSEMI/MAX809STR/SOT23/LM1117-3.3】. It can also be monitored by other (master control) MCU.

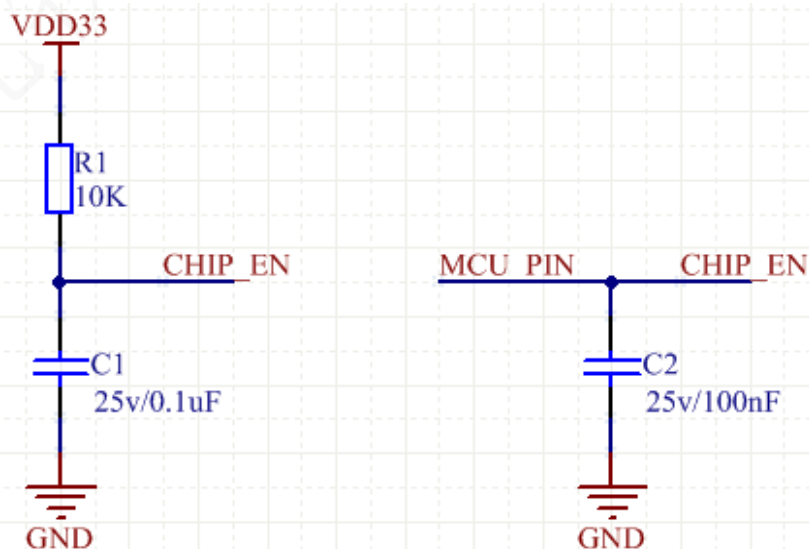## 2.3　**Reference circuit design**

Reference circuit design of module AFW121Tx/AFW122Tx, 5V to 3.3V conversion
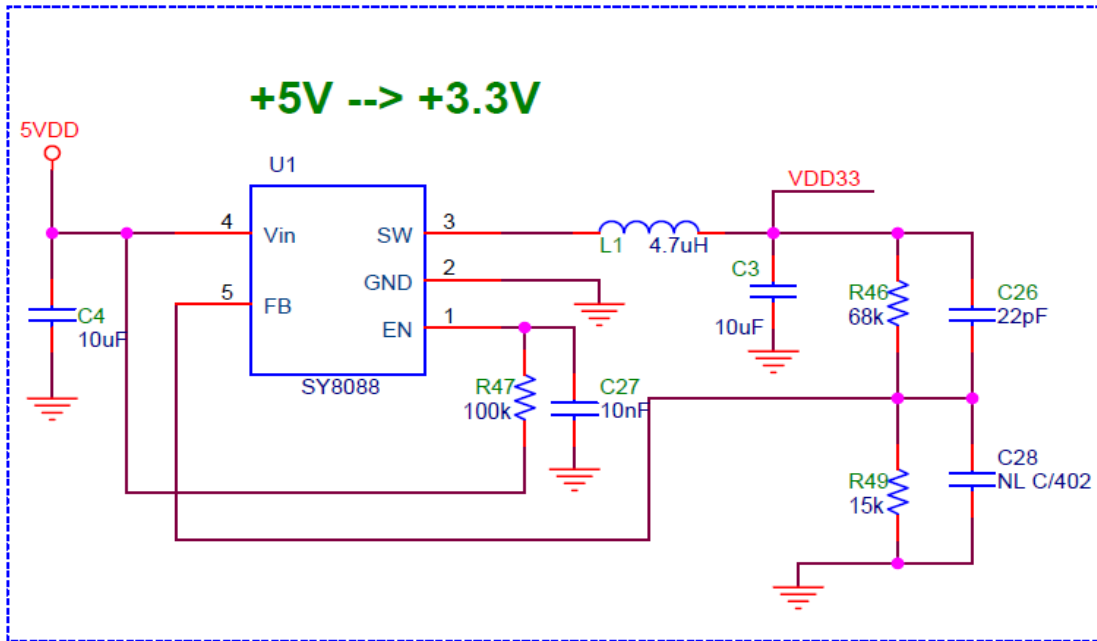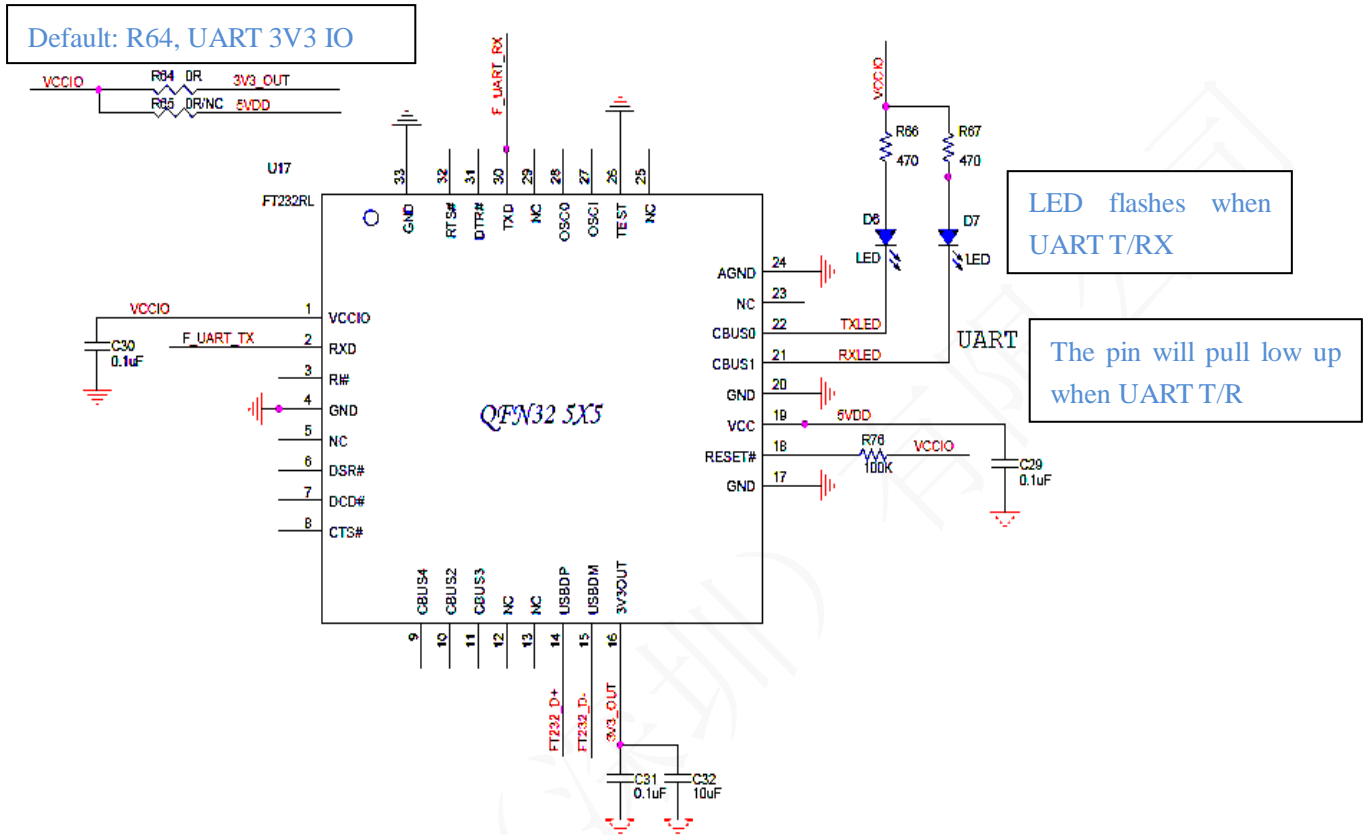

5V to 3.3V conversion, LDO reference circuit design


Reset reference circuit design

UART level switching circuit

USB to UART

Default: R64, UART 3V3 IO

LED flashes when UART T/RX

The pin will pull low up when UART T/R

3 Application programming interface

（1） Users can use simulation tool and build environment for debugging.

（2） SWD port can be used to achieve DPA programming (master computer software does not open temporarily).

（3） The module uses SWD port for programming debugging, the PINs (module PIN6, 7) need to be connected are shown in following figure:

SWD_CLK 6

SWD_DATA 7

3V3

GND
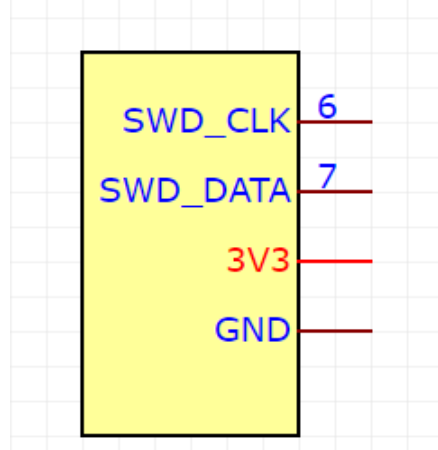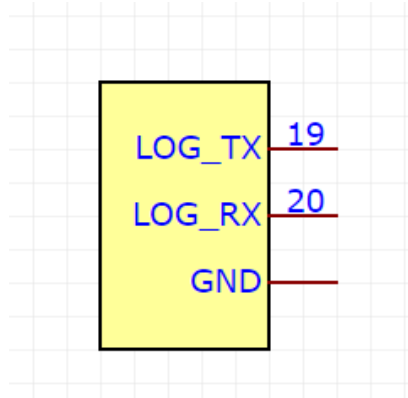
4 Log serial port

（1） PIN19 is a boot PIN:

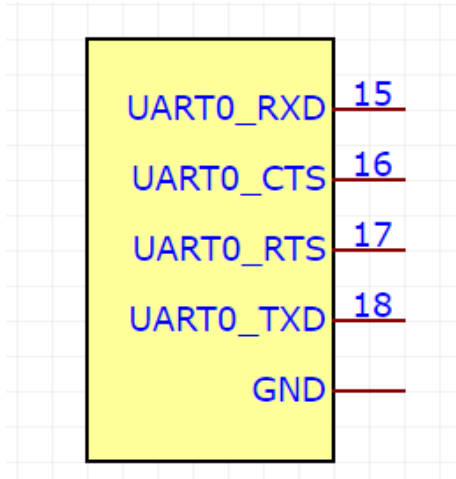| Level	Function
0	Download image from UART
1	Boot from Flash

（2） Serial port pinboard is used to observe output log by connecting abovementioned PIN to find abnormity of module software conveniently.

（3） Serial port pinboard is used to achieve AT Conmand operation by connecting abovementioned PIN.

（4） Serial port pinboard is used to achieve firmware programming by connecting abovementioned PIN.
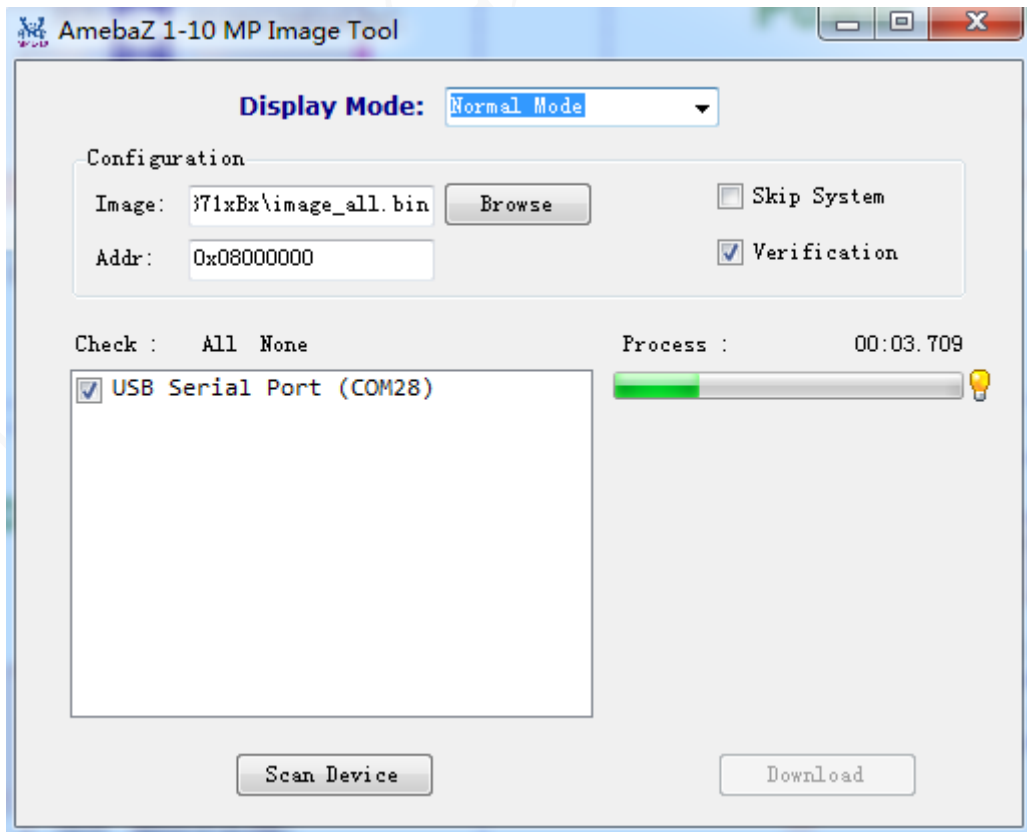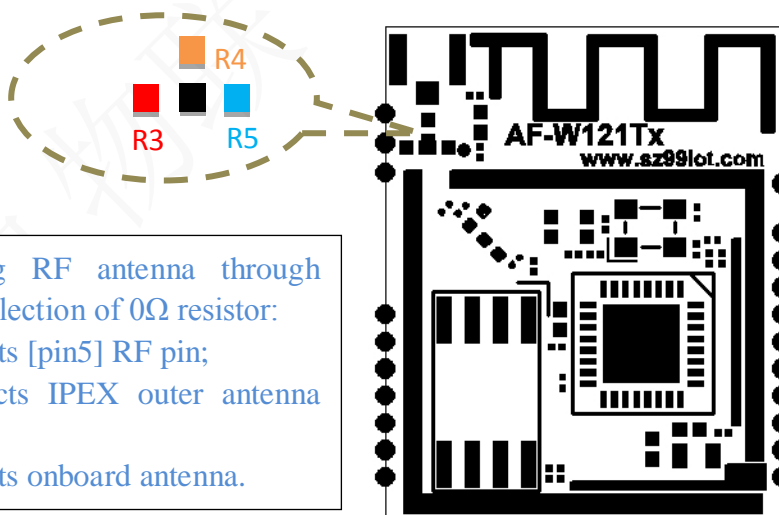
5   Communication serial port

In general, it is recommended to communicate with other MCU through this serial port, the pins which need to be connected are shown in following figure: [PIN16], [PIN17] are optional. These two pins are used to achieve fluid control.

6   **RF design and layout issues**

6.1 **RF selecting resistor**

Selecting RF antenna through above selection of 0Ω resistor:
R3 selects [pin5] RF pin;
R4 selects IPEX outer antenna pedestal;
R5 selects onboard antenna.

6.2 **Directions for module layout**

（1） When using onboard antenna, layout forbidden area is seen in the figure below;

（2） The module must be placed vertically with the onboard antenna top located or the module is placed horizontally with component side up;

（3） When the module is placed vertically, the clear height of module's both sides is at least over 12mm;

When the module is placed horizontally, the clear height under the module is over 6mm;

Cable and other metals are prohibited above the module;

（4） Neither can copper be cladded nor can metal devices, sensors, interference sources or other materials that have an impact on signal be placed under the layout forbidden area.
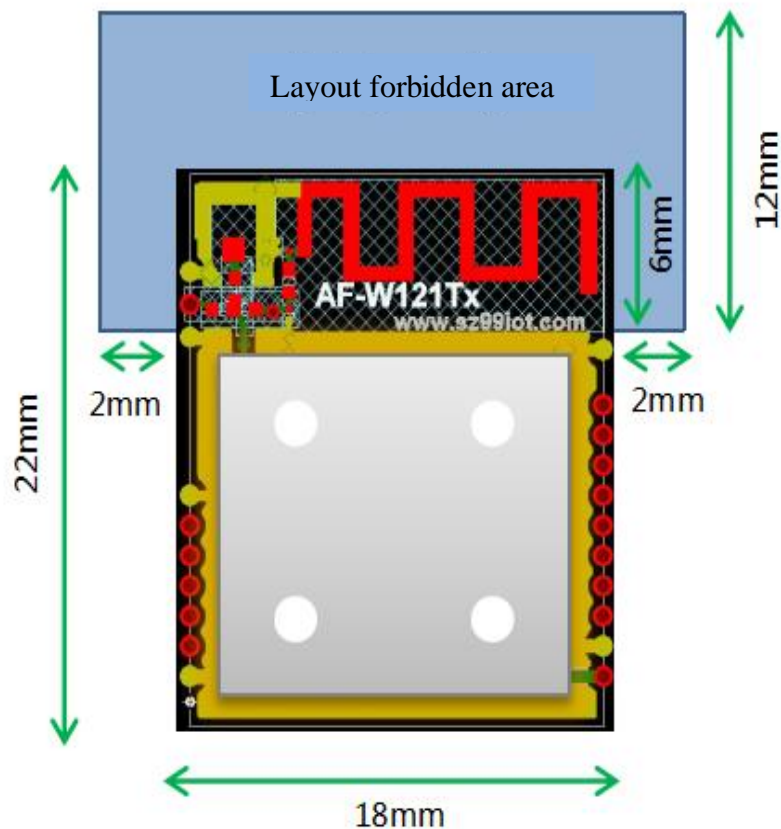
6.3 **Advice on module layout**

When users use the module with onboard PCB antenna, they can put the module in the following areas of the baseboard, or place the antenna of module outside the baseboard, so the module onboard antenna has a larger clearance area compared to the bottom to reduce the impact of metal devices on PCB antenna and wireless signals. Or PCB is hollowed under the antenna.
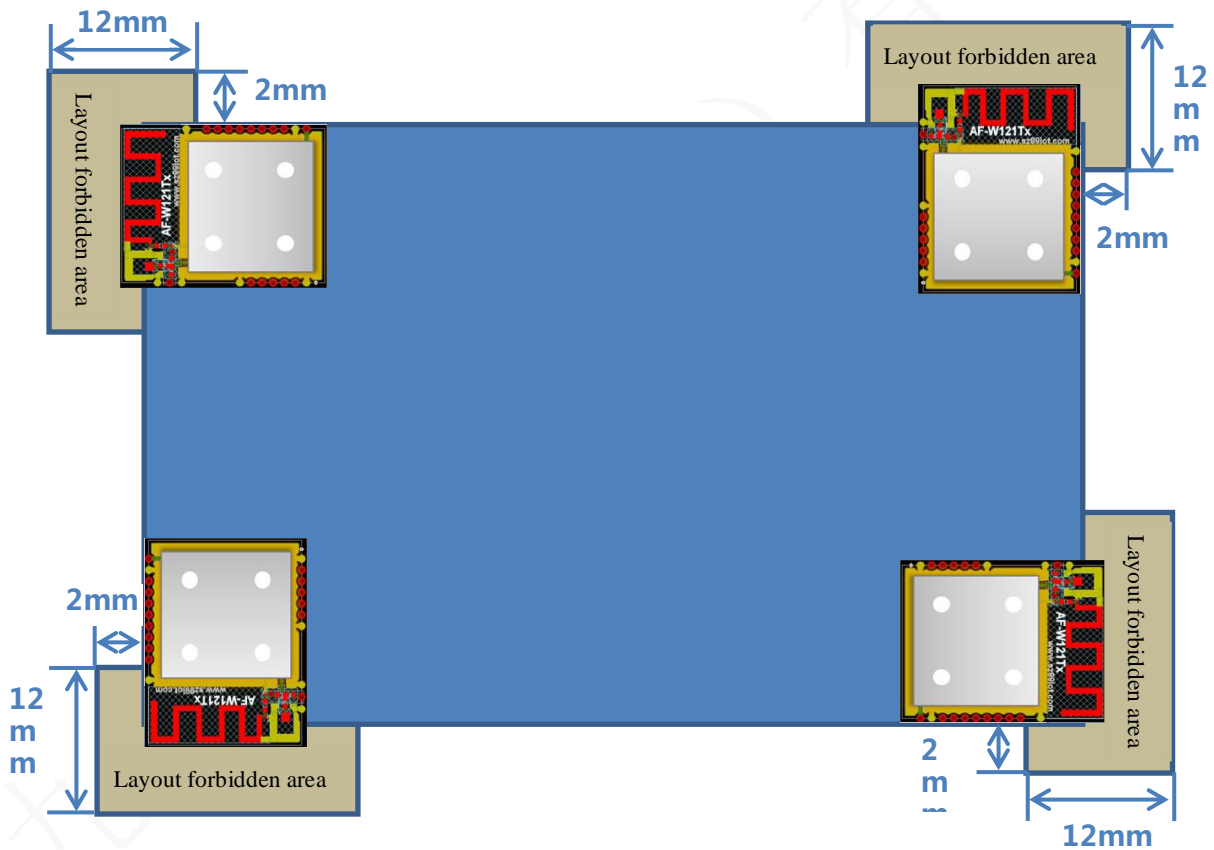
Updating description of historical versions

Revision	Release Data	Summary
V1.0	2017/03/10	First draft
V1.2	2017/08/15	Adding module layout description, firmware download description

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7 Purchase and support

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