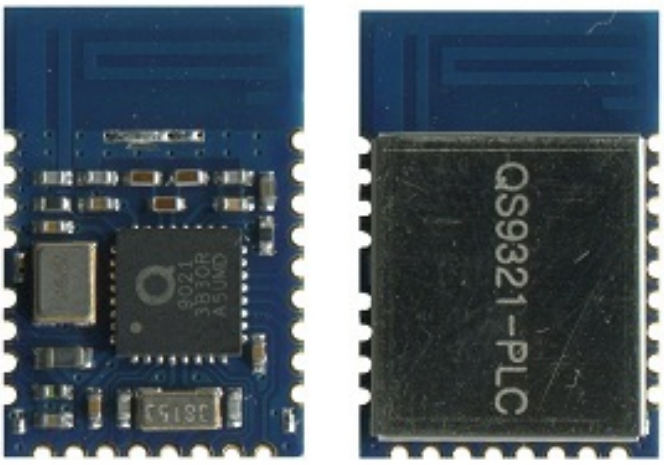
QS9321 Bluetooth 4.0 Low Energy Module

User Manual

Version 1.2



VERSION HISTORY

Version	Comment
0.1	First draft
0.9	Update pin out description
1.0	First release
1.1	Add the photo of QS9321 with shielding box
1.2	Change transparent transfer baud rate to 115200. Connect Pin19 to Vin in figure 1 and 7.

Table of Contents

1 Key Features

◆ Bluetooth® 4.0 Low Energy wireless module

- Frequency bands: 2400MHz to 2483.5MHhz
- 1Mbps on air data rate
- Slave and Master mode operation
- Support up to 8 simultaneous links in master mode
- 128-bit AES coprocessor
- Complete BLE protocol stack and application profiles

◆ Integrated 32-bit Cortex-M0 MCU with

- 64KB system memory
- 128KB flash

◆ Ultra Low Power Consumption

- 2uA deep sleep mode
- 3uA sleep mode (32kHz RC OSC on)
- DC-DC mode
  - 9.25mA RX current at 3V
  - 8.8mA TX current @0dBm Tx power at 3V
- Non DC-DC mode
  - 13.6mA RX current at 3V
  - 13.3mA TX current @0dBm Tx power at 3V
- Integrated DC-DC converter and LDO
- Single 2.4V~3.6V power supply

◆ High Performance

- -95dBm RX sensitivity (Non DC-DC mode)
- -93dBm RX sensitivity (DC-DC mode)
- Tx power from -20dBm to 4dBm
- Excellent link budget up to 99dB

◆ Complete Protocol Stack and Profile

- Bluetooth® v4.0
- Bluetooth® v4.0 host stack including L2CAP , SMP, ATT, GATT, GAP
- Qualified application profiles and services
- Controller subsystem QDID: B021031
- Host stack subsystem QDID: B021098
- Profile subsystem QDID: B021946

◆ Ease of Design

- Small form factor: 12x18x2.4mm(with shielding box), 12x18x1.8mm(without shielding box)
- Easy to use command set over UART/SPI to communicate with App MCU

◆ Application

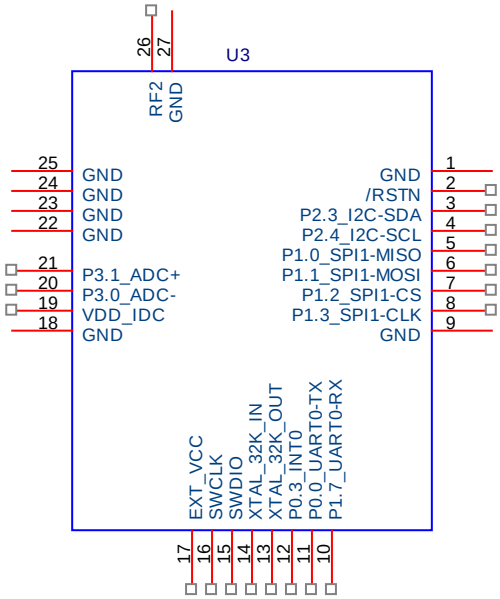
- Sports & Fitness
- Healthcare & Wellness
- Remote Control
- PC Peripherals (mouse, keyboard)
- Mobile Phone Accessories
- Home/building Automation
- Industrial automation
- Wireless Sensor Networks

2 Description

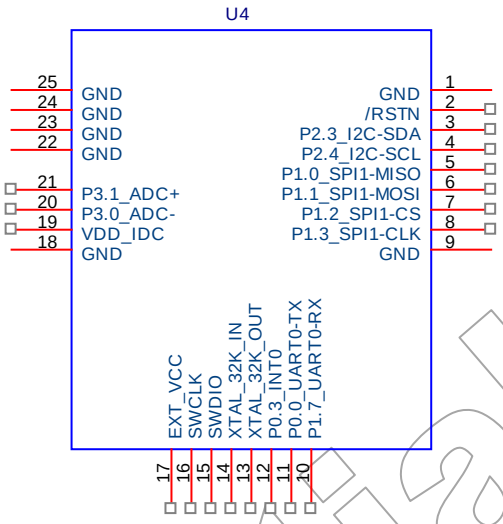
The QS9321 is a compact, surface mount Bluetooth 4.0 Low Energy (BLE) compliant wireless module. It integrates an advanced single-chip BLE SoC chip – QN9021 with RF circuit and antenna in a compact module. Due to its small size, outstanding performance at very low power consumption and easy modular handling, the QS9321 is leading the way for the new generation of Bluetooth low energy modules.

The pre-qualified module enables users to add Bluetooth Low Energy to traditional products within the shortest time.

3 Pin out



Extern Antenna pin out



PCB Antenna pin out

Table 1 Pin out description

PIN	NAME	FUNCTION	DESCRIPTION
1	GND	Ground	Should be connected to ground plane on application PCB
2	/RSTN	Digital Input	Hardware reset, active low.
3	P2.3/SDA	Digital in/out	GPIO / I2C data with pull-up
4	P2.4/SCL	Digital in/out	GPIO / I2C clock
5	P1.0/SPI_MISO	Digital in/out	GPIO / SPI data master in/slave out
6	P1.1/SPI_MOSI	Digital in/out	GPIO / SPI data master out/slave in
7	P1.2/SPI_CS	Digital in/out	GPIO / SPI chip select
8	P1.3/SPI_CLK	Digital in/out	GPIO / SPI clock
9	GND	Ground	Should be connected to ground plane on application PCB
10	P1.7/UART_RX	Digital input	GPIO / UART RX data input
11	P0.0/UART_TX	Digital output	GPIO / UART TX data output
12	P0.3/INT0	Digital in	GPIO / Interrupt
13	32K_CLOCK1	Analog in	Not connected
14	32K_CLOCK2	Analog out	Not connected
15	SWDIO	Digital in/out	SWD data with pull-up
16	SWCLK	Digital in	SWD clock input with pull-up
17	VCC	Power	Power supply (2.4~3.6V)
18	GND	Ground	Should be connected to ground plane on application PCB

19	VDD_IDC	Power	Not connected
20	P3.0/ADC-	Analog in	GPIO / ADC-
21	P3.1/ADC+	Analog in	GPIO / ADC+
22	GND	Ground	Should be connected to ground plane on application PCB
23	GND	Ground	Should be connected to ground plane on application PCB
24	GND	Ground	Should be connected to ground plane on application PCB
25	GND	Ground	Should be connected to ground plane on application PCB
26	RF1		Antenna connect pin.(Only in extern antenna board)
27	GND	Ground	Should be connected to ground plane on application PCB (Only in extern antenna board)

4 Electrical Characteristics

Table 2 Recommended Operating Conditions

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
VCC	Power supply	Relative to GND	2.4	3.0	3.6	V
TA	Operating temperature		-40	+25	+85	℃

Table 3 DC Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Icc	Current consumption	Deep sleep mode		2		uA
		Sleep mode		3		uA
		Idle mode (w/o DC-DC)		0.84		mA
		MCU @8MHz (w/o DC-DC)		1.35		mA
		RX mode(w/o DC-DC)		13.6		mA
		RX mode (w/t DC-DC)		9.25		mA
		TX mode @0dBm Txpower (w/o DC-DC)		13.3		mA
		TX mode @0dBm Txpower (w/t DC-DC)		8.8		mA

(Typical values are T_A = 25℃ and VCC =3V)

Notes:

1. Current includes that of analog and digital;
2. Depend on IO conditions.
3. **Deep sleep mode:** digital regulator off, no clocks, POR, RAM/register content retained
4. **Sleep mode:** digital regulator off, 32k RC OSC on, POR, sleep timer on, and RAM/register content retained
5. **Idle:** 16MHz OSC on, no radio or peripherals, 8 MHz system clock and MCU idle (no code execution)
6. **MCU@8 MHz:** MCU running at 8 MkHz RC OSC clock, no radio or peripherals
7. **RX sensitivity** is -95dBm sensitivity when DC-DC is disabled.
8. **RX sensitivity** is -93dBm sensitivity when DC-DC is enabled.

5 Application Reference Circuit Schematic

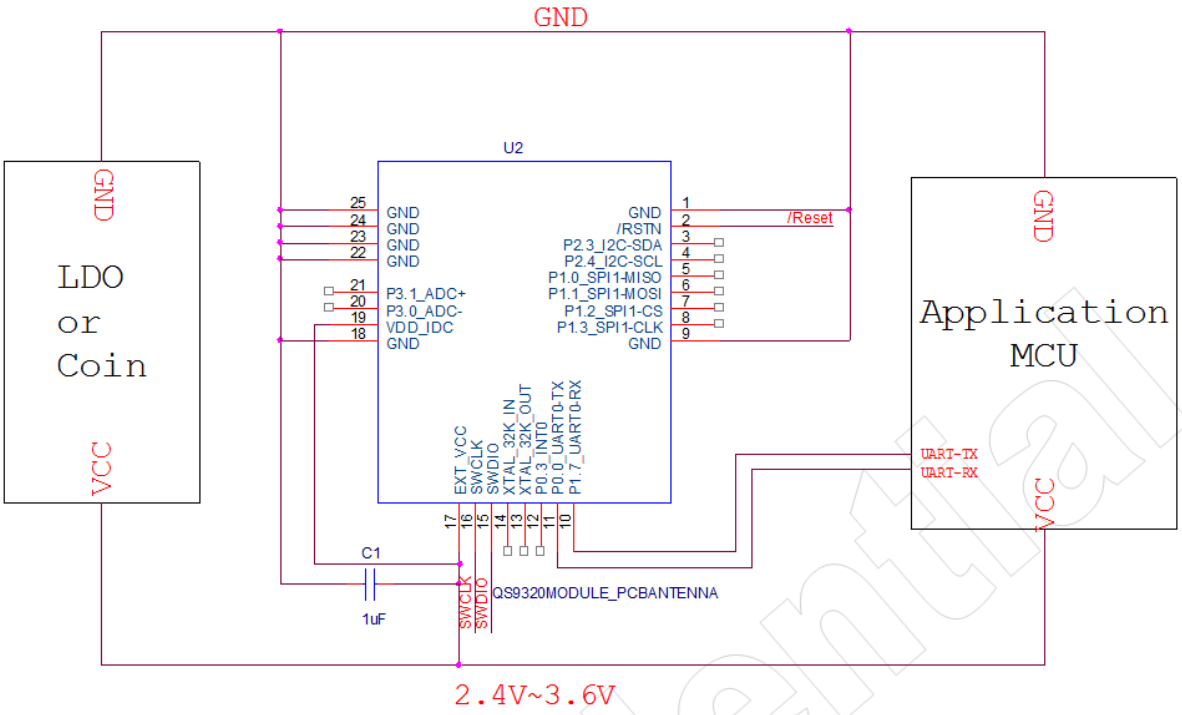


Figure 1: **Example schematic for QS9321 work in Network process**

6 Layout and Physical Dimensions

6.1 Physical dimensions

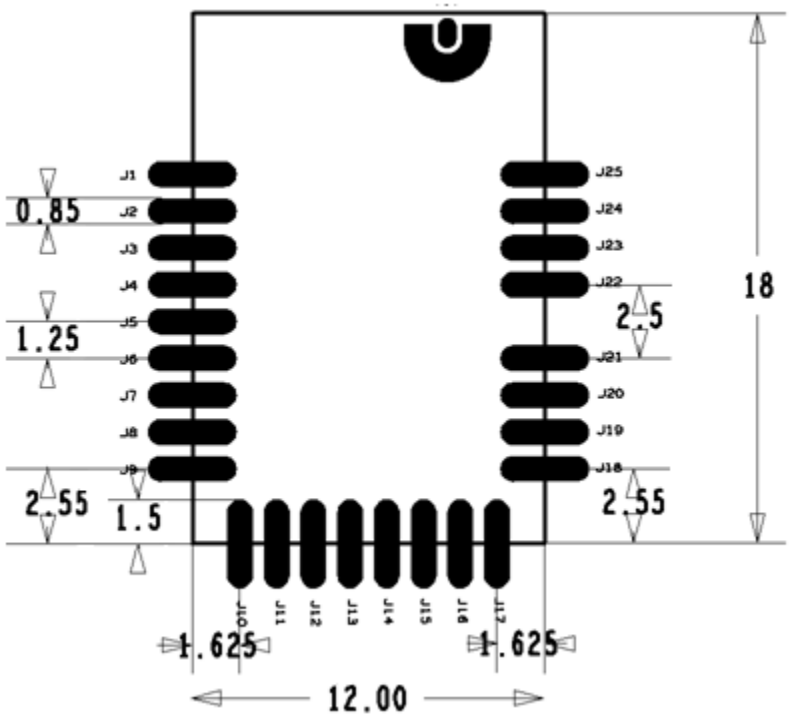


Figure 3 Extern Antenna (mm)

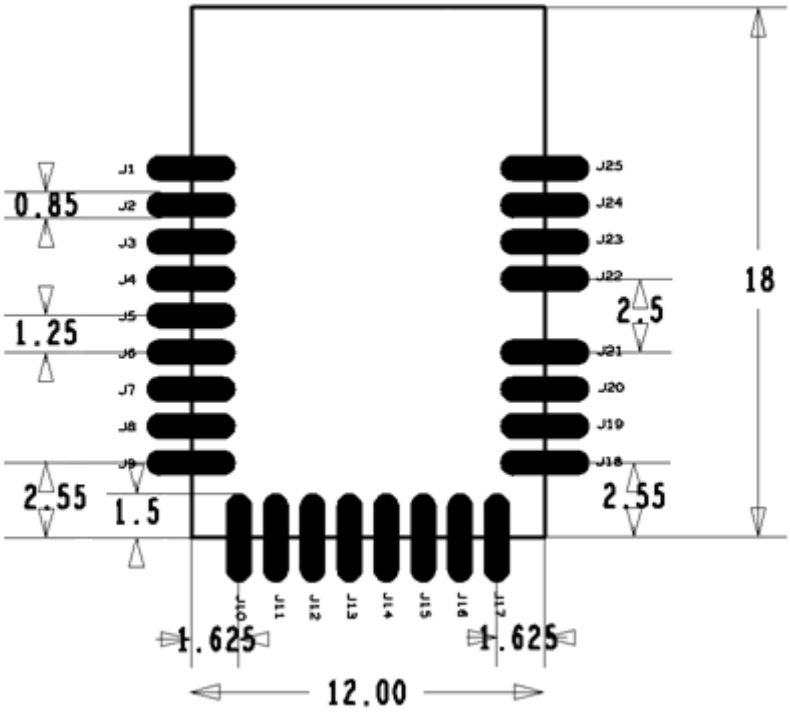


Figure 4 PCB Antenna (mm)

6.2 Layout guide

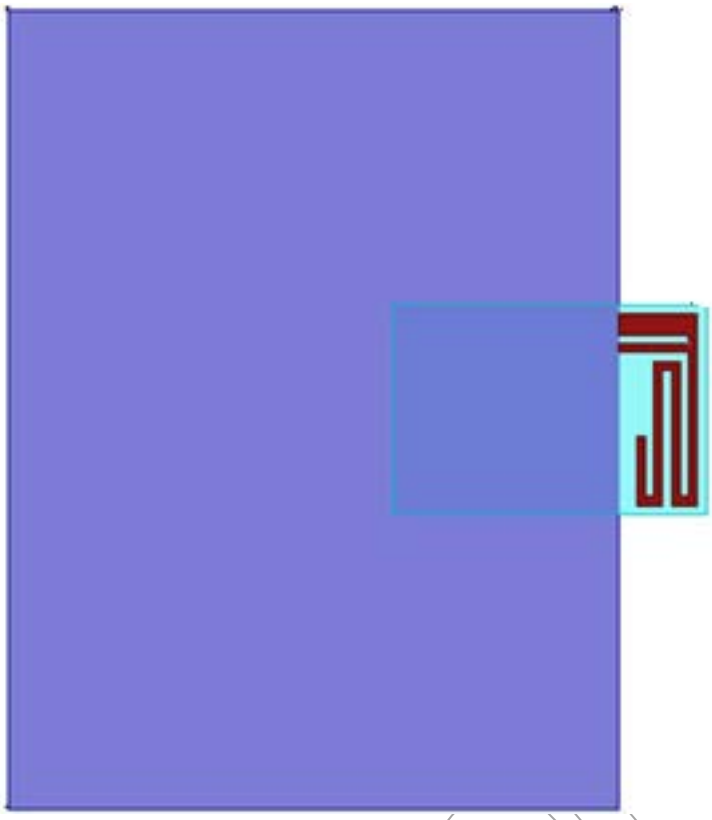
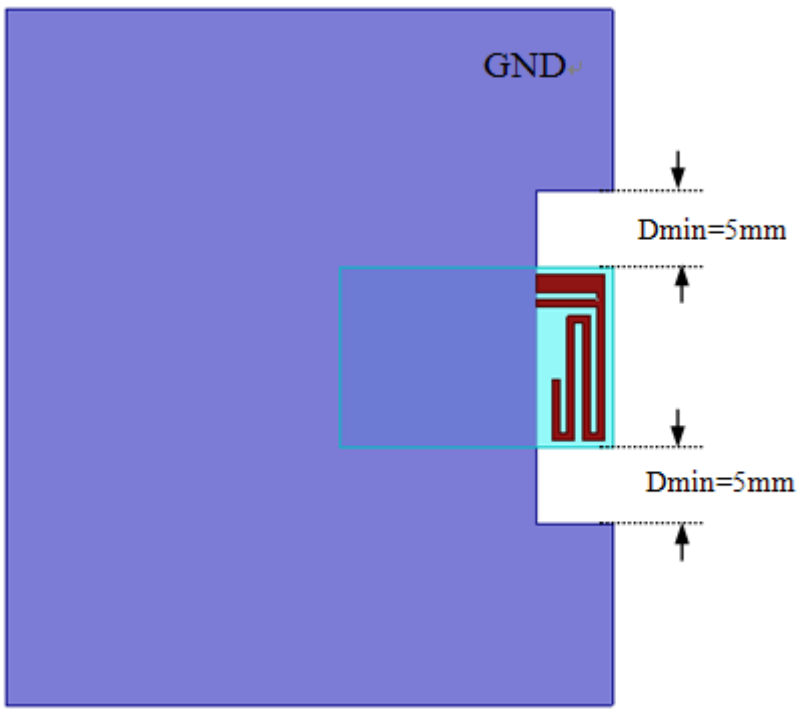


Figure 5 Layout for high performance



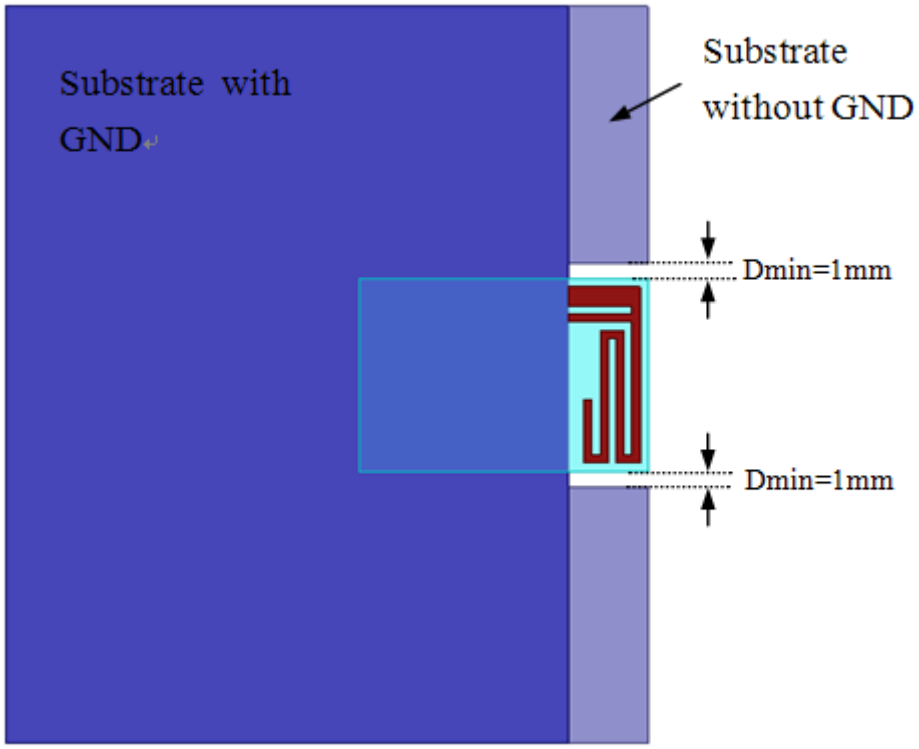


Figure 6 Layout under extreme condition

7 Transparent Transfer Function

7.1 Feature

- Baud Rate : 115200
- Length of frame: <=20byte

7.2 Reference circuit schematic

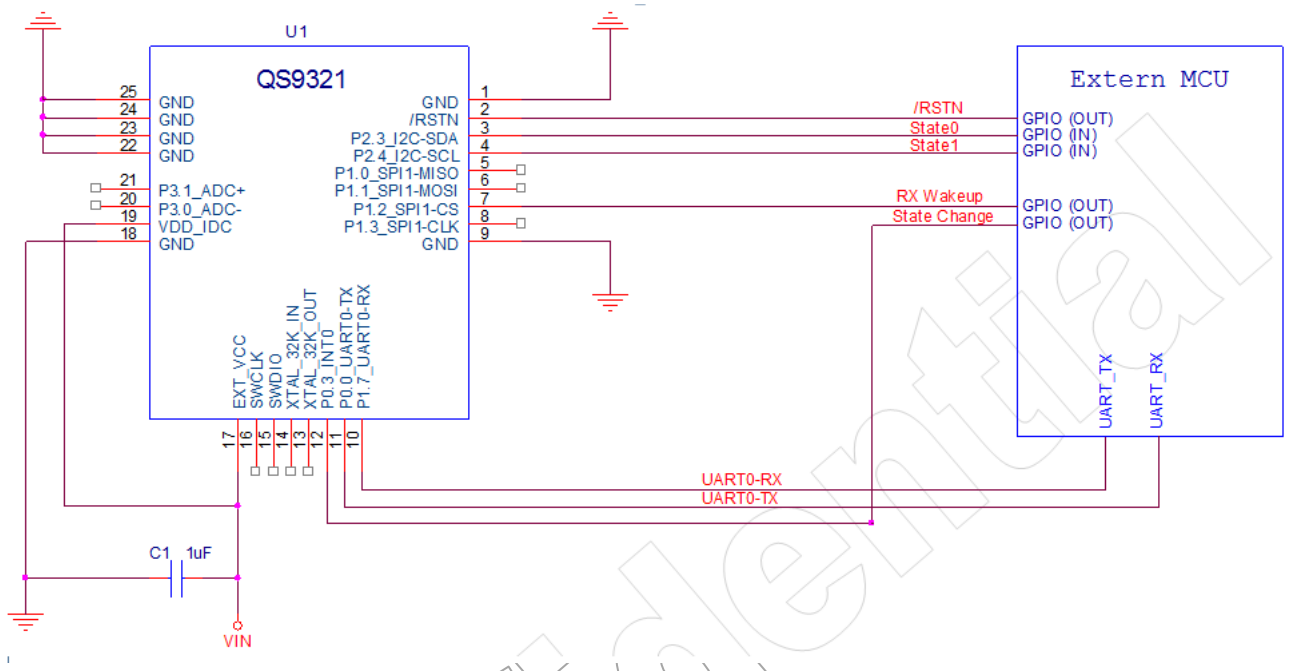


Figure 7 Reference circuit schematic

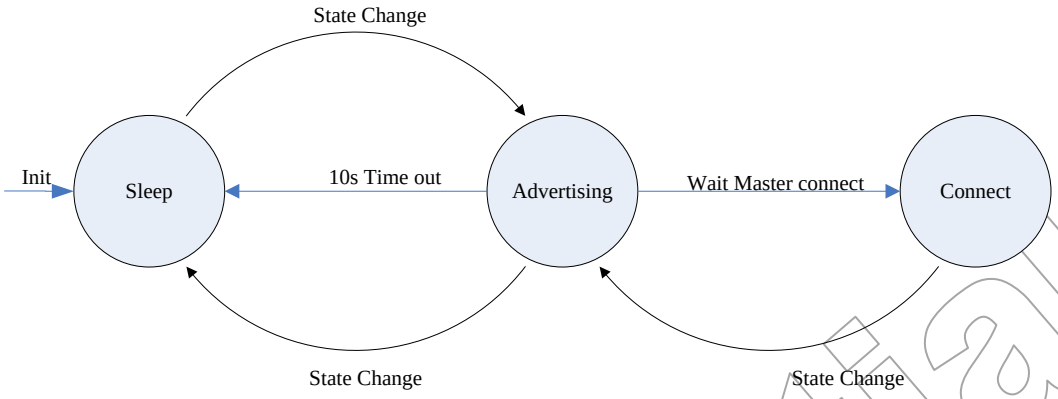
7.3 Software

(a) State indicate

P23(output)	P24(output)	STATE
0	0	Sleep
0	1	Advertise
1	0	Connect Empty
1	1	Connect Full

(b) State change：

GPIO	Function	timer cycle	Remark
P03	State change	t1	t1>=1ms ;Falling edge



(c) Data transmit

GPIO	Function	timer cycle	Remark
P12	RX Wakeup		Falling edge

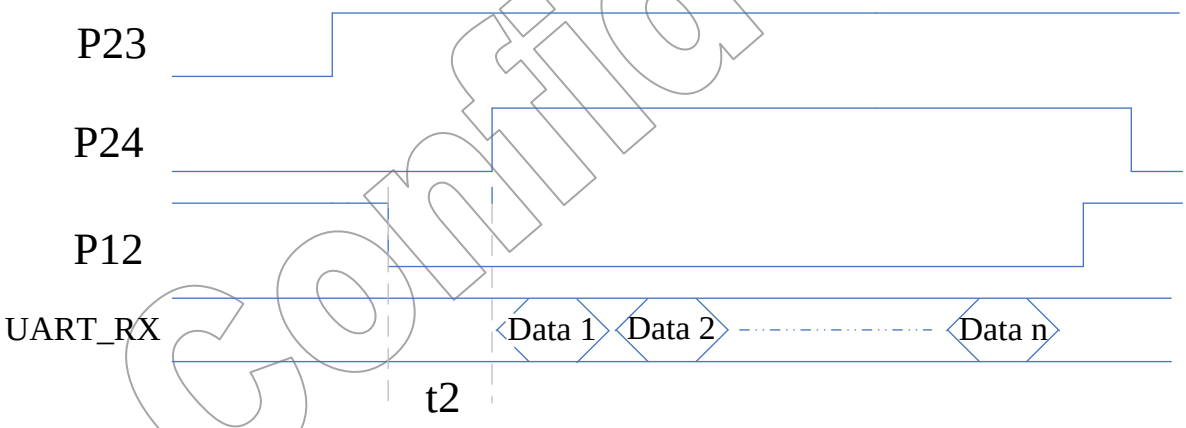


Figure 8 Waveform of module receiving UART data

NOTE: (1) T2>=1ms.

(2) RX Wakeup pin should keep low until one frame sent completed.

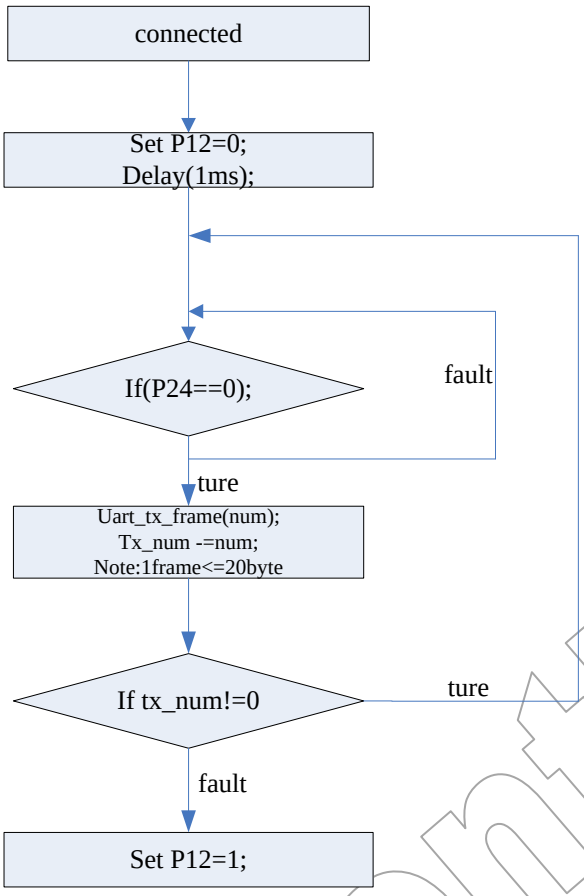


Figure 9 Flowchart of control