RAK473M UART WiFi Module

Datasheet V1.0

Content

1. General Description

RAK473M module is a Wi-Fi module that fully compliant with IEEE 802.11b/g/n wireless standards, It combines an ARM-CM3 MCU, WLAN MAC, a 1T1R capable WLAN baseband, and RF in the module. It have onboard antenna, and external antenna interface, RF output PIN also exist in the board. RAK473M internally integrated TCP / IP protocol stack, supporting numerous protocols such as ARP, IP, ICMP, TCP, UDP, DHCP CLIENT, DHCP SERVER, DNS and other etc. It supports AP mode, Station mode. It also support rich AT command for all kinds of application. Users can easily and quickly use it to wifi networking and data transmission. The baud rate of module serial port is up to 921600bps, which can fully meet the low-rate applications.

In network part, RAK473M supports storing network parameters in the module, and reduce time connect to network. The module has built-in WEB server, supporting wireless network parameters configuration, supporting wireless firmware upgrade. It also supports WPS and EasyConfig. In application part, HTTP, MQTT, MDNS and SSL also be supported.

It also provides a bunch of configurable GPIOs which are configured as SPI ,UART, I2C, I2S, PWM, for different applications and control usage. RAK473M integrates internal 2M SRAM ,and 512KB DRAM and 2MB flash for complete WIFI protocol functions.

2. Features

Application

- UART serial AT command set operation
- Support for multiple baud rate
- Support wireless configuration and OTA upgrade firmware
- Support the UART interface, OTW upgrade function
- Support for fast networking, easyconfig, WPS function
- Support MDNS, MQTT, HTTP, TLS applications

Standards Supported

- 802.11b/g/n compatible WLAN
- 802.11e QoS Enhancement (WMM)
- 802.11i (WPA, WPA2). Open, shared key,and pair-wise key authentication services
- WIFI WPS support
- Light Weight TCP/IP protocol

WLAN MAC Features

- CMOS MAC, Baseband PHY, and RF in a single chip for 802.11b/g/n compatible WLAN
- Complete 802.11n solution for 2.4GHz band
- 72.2Mbps receive PHY rate and 72.2Mbps transmit PHY rate using 20MHz bandwidth
- 150Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
- Backward compatible with 802.11b/g devices while operating in 802.11n mode
- Compatible with 802.11n specification
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- Long NAV for media reservation with CF-End for NAV release
- PHY-level spoofing to enhance legacy compatibility
- Power saving mechanism

WLAN PHY Feature

- 802.11n OFDM
- One Transmit and one Receive path (1T1R)
- 20MHz and 40MHz bandwidth transmission

- Short Guard Interval (400ns)
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, and 640QAM modulation. Convolutional Coding Rate: 1/2, 2/3,3/4, and 5/6
- Maximum data rate 54Mbps in 802.11g and 150Mbps in 802.11n
- Fast receiver Automatic Gain Control (AGC)

Peripheral Interfaces

- Maximum 2 PCM with 8/16KHz sample rate
- Maximum 2 SPI supported with baud rate up to 41.5MHz.
- Support 4 PWM with configurable duration and duty cycle from 0 ~ 100%
- Support 4 External Timer Trigger Event (ETE function) with configurable period in low power mode
- Maximum 20 GPIO pins
- A high speed UART interface with baud rate up to 4MHz

3. System Block Diagram

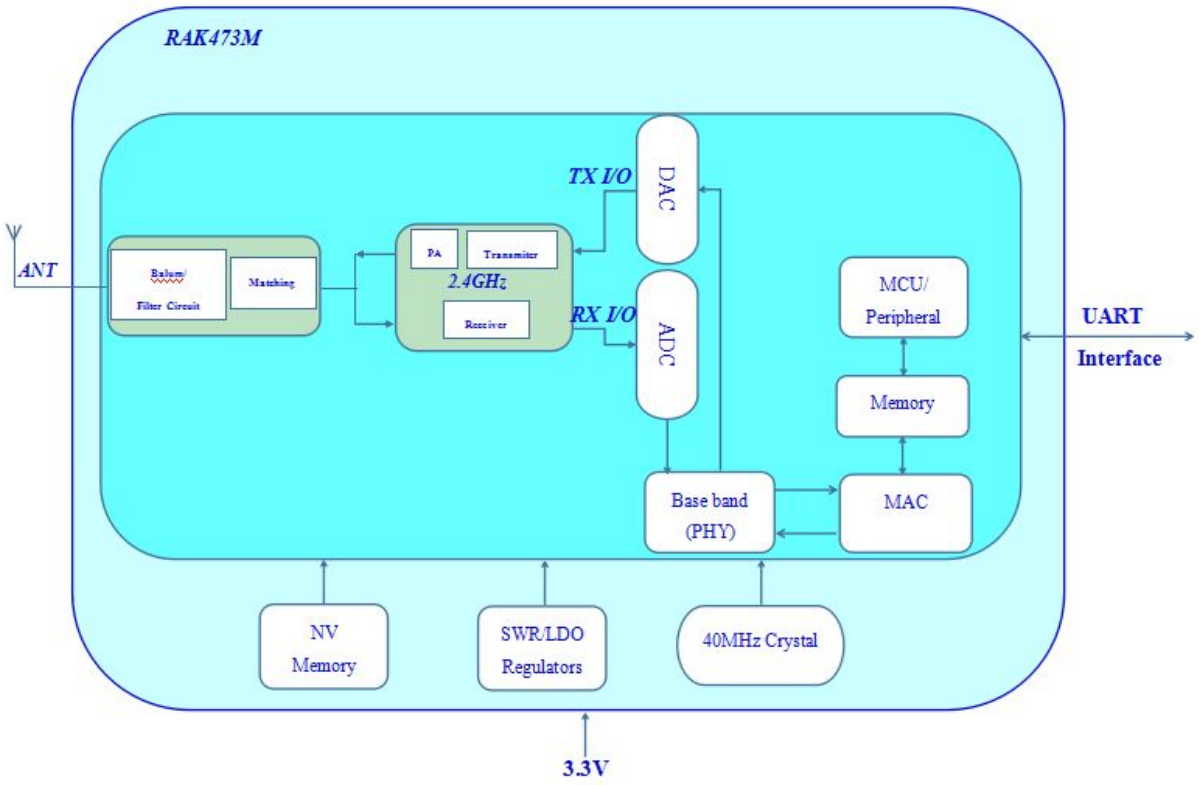

Figure 3-1 RAK473M System Diagram

4. Module Hardware Description

4.1 Module photo

Figure 4-1 RAK473M Top View

Figure 4-2 RAK473M Bottom View

4.2 Package information

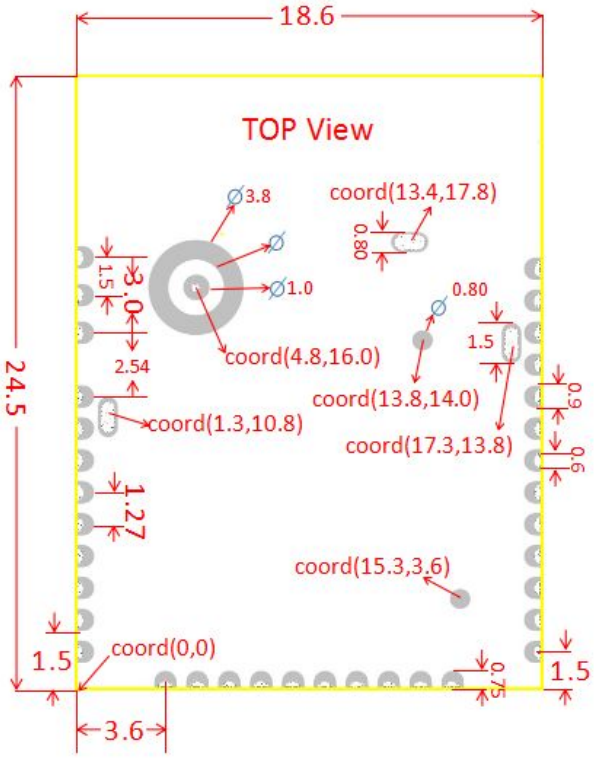

Figure 4-3 Module Pin Size (mm)

4.3 Pin definition

Table 4-1: Pin Definition

Pin Serial No.	Name	Type	Description
1,3,12,13,14,16,20,21,33	GND	Ground	All ground pins are connected to ground pad or the copper.
22	VCC3.3V	Power	3.3V power supply.
2	RF_OUT	O	2.4GHz RF output
4	VDDIO	Power	3.3V for Digital IO or digital blocks
11	RESET	I	Module reset pin, Active low.
17	LINK	O，PU	Work status indicator pin of module, output low effective.
23	TXD	O	Serial data communication interface send
26	RXD	I	Serial flow control pin, ready to receive, Active low.
24	RTS	O	Serial flow control pin, The default output low. Active low, ready to receive data / request the other party to send data.
25	CTS	I	Serial flow control pin, Input pull. Active low, ready to send data/request each other to send data. High level cannot send data, low level can send data.
Others	NC	NC	Remain disconnected when no use

Note:

1. I - input O - output PU – pulling up PD - pulling down NC - not connected
2. Pin in NC, remains disconnected

Link indicator:

OTA upgrade ——50 ms high-speed flashing

EasyConfig, WPS configuration ——200ms fast flash

After the network connection ——On (Output Low)

Idle ——1S slow flash

4.4 Reference design

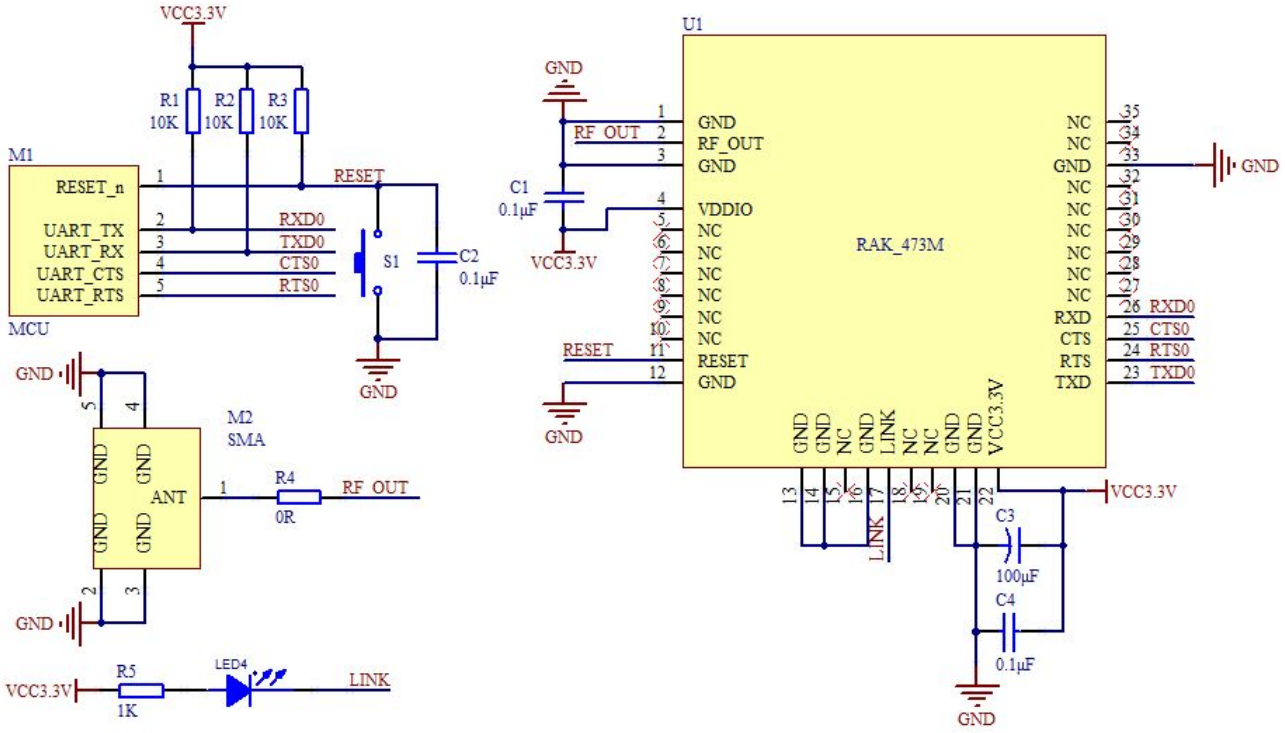

Figure 4-4 Module Typical Design Reference

5. Electrical Specification

5.1 General specification

ITEMS	CONTENTS
Operating Frequency	2.400-2.4835GHz
WiFi Standard	802.11b/g/n
Modulation	11b: DBPSK,DQPSK and CCK and DSSS 11g: BPSK,QPSK16QAM,64QAM and OFDM 11n: MCSO-15 OFD
Data rates	11b:1,2,5.5 and 11Mbps 11g:6,9,12,18,24,36,48 and 54 Mbps 11n:MCSO-15,up to 150Mbps
Host Interface	UART
Dimension	Typical (L x W):21mm x 18mm
Operation Temperature	-20℃ to +85℃
Storage Temperature	-55℃ to +125℃
Operation Voltage	3.3V±0.2V

5.2 802.11b Mode

ITEMS	CONTENTS				
Specification	IEEE802.11b				
Mode	DSSS/CCK				
Channel	CH 1to CH13				
Data rate	1,2,5.5,11Mbps				
1.Power Levels (calibrated)	Min.	Typ.	Max.	Unit	Note
1)16dBm Target (For each antenna Port)	15	17	19	dBm	
Frequency error	-25	0	+25	kHz	
3. Minimum input level sensitivity	Min.	Typ.	Max.	Unit	Note
1)11Mbps(FER≤8%)	---	-82	---	dBm	
2)Maximum input level (FER≤8%)	---	-10	---	dBm	

5.3 802. 11g Mode

ITEMS	CONTENTS				
Specification	IEEE802.11g				
Mode	OFDM				
Channel	CH 1to CH13				
Data rate	6,9,12,18,24,36,48,54Mbps				
1.Power Levels (calibrated)	Min.	Typ.	Max.	Unit	Note
1)16dBm Target (For each antenna Port)	12	14	16	dBm	
2.Constellation error(EVM)@target power	Min.	Typ.	Max.	Unit	Note
1)54Mbps	---	-30	-28	dB	
3.Frequency error	-25	0	+25	kHz	
4.Minimum input level sensitivity	Min.	Typ.	Max.	Unit	
1)54Mbps(PER≤10%)	---	-78	---	dBm	
5.Maximum input level (PER≤10%)	---	-10	---	dBm	

5.4 802. 11n HT20 Mode

ITEMS	CONTENTS				
Specification	IEEE802.11n HT20@2.4GHz				
Mode	OFDM				
Channel	CH 1to CH13				
Data rate	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/ 14/15				
1.Power Levels	Min.	Typ.	Max.	Unit	Note
1)16dBm Target (For each antenna Port)	12	14	16	dBm	
2.Constellation error(EVM)@target power	Min.	Typ.	Max.	Unit	Note
1)MCS7	---	-30	-28	dB	
3.Frequency error	-25	0	+25	kHz	

4.Minimum input level sensitivity	Min.	Typ.	Max.	Unit	
1)MCS7(PER≤10%)	---	-76	---	dBm	
5.Maximum input level (PER≤10%)	---	-10	---	dBm	

5.5 802. 11n HT40 Mode

ITEMS	CONTENTS				
Specification	IEEE802.11n HT40@2.4GHz				
Mode	OFDM				
Channel	CH 1to CH13				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15				
1.Power Levels (calibrated)	Min.	Typ.	Max.	Unit	Note
1)16dBm Target (For each antenna Port)	12	14	16	dBm	
2.Constellation error(EVM)@target power	Min.	Typ.	Max.	Unit	Note
1)MCS7		-30	-28	dB	
3.Frequency error	-25	0	+25	kHz	
4.Minimum input level sensitivity	Min.	Typ.	Max.	Unit	
1)MCS7(PER≤10%)	---	-74	---	dBm	
5.Maximum input level (PER≤10%)	---	-10	---	dBm	

6. Order information

6.1 Order part number

Table 6-1 : Order model

Product	Describe	Antenna	MOQ(PCS)	Evaluation Board
RAK473MA-XXXX	UART interface module, with on-board antenna	On-board	400	RAK473-EVB
RAK473MB-XXXX	UART interface module, with external antenna	External , U.fl/i.PEX	400	
RAK473MC-XXXX	UART interface module, with RF output interface	RF output	400	

6.2 Module size

Packaging: Hard plastic pallets

Weight: <= 3 g/pcs

Table 6-2: Thickness (Height)

RAK473M	Thickness (Height)
With Shield CAN	3.15±0.15mm

Note: In considering height design of the product, please consider your motherboard thickness error and product fit gap (recommended 0.10-0.15mm).

7. Contact information

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8. Change Note

Version	Author	Date
V0.1	Frank	2015-12-04