USB PRODUCT SPECIFICATION

IEEE 802.11 b/g/n 2.4GHz 1T1R WiFi with Bluetooth v2.1+EDR/Bluetooth 3.0/3.0+HS/4.0

RF-UM02WB (Realtek RTL8723AS-VAU) Combo Module

Version 1.0

1. General Description

The Realtek is a highly integrated single-chip 802.11n Wireless LAN (WLAN) USB-MF (USBMulti-function) network interface controller with integrated Bluetooth 2.1/3/0/4.0 controller. It combines a WLAN MAC, a 1T1R capable WLAN baseband, and RF in s single chip. The RTL8723AS-VAU provides a complete solution for a high-performance integrated wireless and Bluetooth device.

The integration provides better coordination between 802.11 and Bluetooth, and with sophisticated dynamic power control and packet traffic arbitration, RTL8723AS-VAU is able to provide the best coexistence performance.

RTL8723AS-VAU also integrates RF/PA/LNA for both 802.11n and Bluetooth so that the number of external components is reduced to minimum. The 802.11 part supports 150Mbps PHY rate and delivers reliable throughput from an extended distance.

The Bluetooth part supports latest 3.0+HS/4.0+LE operation and provides smooth user experience under all usage scenarios. Optimized RF architecture and baseband algorithms provide superb performance and lowest power consumption.

2. IC Features

General
- 68-pin QFN
- CMOS MAC, Baseband PHY, and RF in a single chip for IEEE 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
- Compatible with 802.11n specification
- Backward compatible with 802.11b/g devices while operating in 802.11n mode
- Qualified Bluetooth v2.1+EDR, v3.0+HS and v4.0 LE Systems
- Support for v4.0 Bluetooth Low Energy
- Integrated class1, class2, and class3 PA and modem in Bluetooth Controller

Host Interface
- Complies with USB Specification Revision 2.0 for WLAN and Bluetooth controller
- Bluetooth controller is configured as USB function 0 and WLAN controller is configured as USB function 1
- Support USB2.0 L1-LPM and L2-SS specification

Standards Supported
- IEEE 802.11b/g/n compatible WLAN
- 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
- Switch diversity for DSSS/CCK
- Hardware antenna diversity
- Selectable receiver FIR filters
- Programmable scaling in transmitter and receiver to trade quantization noise against increased probability of clipping
- Fast receiver Automatic Gain Control (AGC)
- On-chip ADC and DAC

BT Controller
- Integrated MCU to execute Bluetooth protocol stack
- Support 3 SCO links simultaneously
- Support 3 scatternets
- IEEE 802.11e QoS Enhancement (WMM)
- IEEE 802.11h TPC, Spectrum Measurement
- 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services
- Cisco Compatible Extensions (CCX) for WLAN devices

WLAN MAC Features
- 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
- Channel management and co-existence
- Multiple BSSID feature allows the RTL8723AS-VAU to assume multiple MAC identities when used as a wireless bridge
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

WLAN PHY Features
- IEEE 802.11n OFDM
- One Transmit and one Receive path (1T1R)
- 20MHz and 40MHz bandwidth transmission
- Enhanced BT/WIFI Coexistence Control to improve transmission quality in different profiles
- Bluetooth Low Energy Dual Mode support

Bluetooth Transceiver Features
- Fast AGC control to improve receiving dynamic range
- Support AFH to dynamically detect channel quality to improve transmission quality
- Integrated internal class1, class2, and class3 PA
- Bluetooth 3.0 compliant
- Bluetooth Low Energy supported
- Integrated 32K oscillator

Peripheral Interfaces
- General Purpose Input/Output (11 pins)
- 4-wire EEPROM control interface (93C46)
- Three configurable LED pins
- Configurable Bluetooth Coexistence Interface

PRODUCT SPECIFICATIONS

Main chipset

WiFi/BT Single Chip: Realtek RTL8723AS-VAU

Functional Specifications

Standards	***WiFi:*** IEEE 802.11b, IEEE 802.11g, Draft IEEE 802.11n, IEEE 802.11d, IEEE 802.11e, IEEE 802.11h, IEEE 802.11i ***BT:*** V2.1+EDR/BT v3.0/BT v3.0+HS/BT v4.0
Bus Interface	***WiFi:***USB ***BT:*** USB
Form Factor	L*W*H = 25mm*11.995mm*1.8mm
Data Rate	**802.11b:** 11, 5.5, 2, 1 Mbps **802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps** **802.11n:** MCS 0 to 7 for HT20MHz MCS 0 to 7 for HT40MHz **BT:** 1 Mbps for Basic Rate 2,3 Mbps for Enhanced Data Rate
Media Access Control	***WiFi:*** CSMA/CA with ACK BT: AFH, Time Division
Modulation Techniques	***802.11b:*** CCK, DQPSK, DBPSK ***802.11g: 64 QAM, 16 QAM, QPSK, BPSK 802.11n:*** 64 QAM, 16 QAM, QPSK, BPSK ***BT:*** 8DPSK, π/4 DQPSK, GFSK
Network Architecture	***WiFi:***

<table>
<tr><td></td><td colspan="3">Ad-hoc mode (Peer-to-Peer)
Infrastructure mode
BT:
Pico Net
Scatter Net</td></tr>
<tr><td>Operating Channel</td><td colspan="3">WiFi 2.4GHz:
11: (Ch. 1-11) – United States

13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan

BT 2.4GHz:
Ch. 0 ~78</td></tr>
<tr><td>Frequency Range</td><td colspan="3">2.400GHz ~ 2.4835 GHz</td></tr>
<tr><td rowspan="2">Transmit Output Power – 1x1 (Tolerance: ±1.5dBm)</td><td>802.11b@11Mbps 16dBm</td><td>802.11g@6Mbps 16dBm
802.11g@54Mbps 14dBm</td><td>802.11n 16dBm (MCS 0_HT20)
13dBm (MCS 7_HT20)
13dBm (MCS 0_HT40)
13dBm (MCS 7_HT40)</td></tr>
<tr><td colspan="3">BT:
Max +5dBm</td></tr>
<tr><td rowspan="2">Receiver Sensitivity</td><td>802.11b@11Mbps -84dBm</td><td>802.11g@54Mbps -72dBm</td><td>802.11n -69dBm (MCS 7_HT20)
-66dBm (MCS 7_HT40)</td></tr>
<tr><td colspan="3">BT:
-89dBm@1Mbps, -90dBm@2Mbps, -83dBm@3Mbps</td></tr>
<tr><td>Security</td><td colspan="3">WiFi :
WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit, IEEE

802.11x, IEEE 802.11i BT:

Simple Paring</td></tr>
<tr><td>Operating Voltage</td><td colspan="3">3.3 V ±2V I/O supply voltage</td></tr>
<tr><td>OS supported</td><td colspan="3">Windows XP/Win7/Linux/Android</td></tr>
</table>

Power Consumption (3.3V) (Typical)	***WiFi :*** ***TX Mode: (Conituous mode)*** 190mA (MCS7/BW40/13dBm) ***RX Mode: (Conituous mode)*** 150mA (MCS7/BW40/-60dBm) ***Associated Idle:*** 120mA ***Unassociated Idle:*** 130mA ***RF disable Mode:*** 120mA ***BT :*** ***Inquiry & Page Scan:*** 1.7mA ***ACL no traffic:*** 15mA ***SCO HV3:*** 30mA ***Parked 1.28s beacon:*** 1.12mA ***Reset:*** 0.05mA

Mechanical

	Length	Width	Height
Dimensions (mm)	25 **(Tolerance:±0.2mm)**	11.995 **(Tolerance:±0.2mm)**	1.8 **(Tolerance:±0.2mm)**

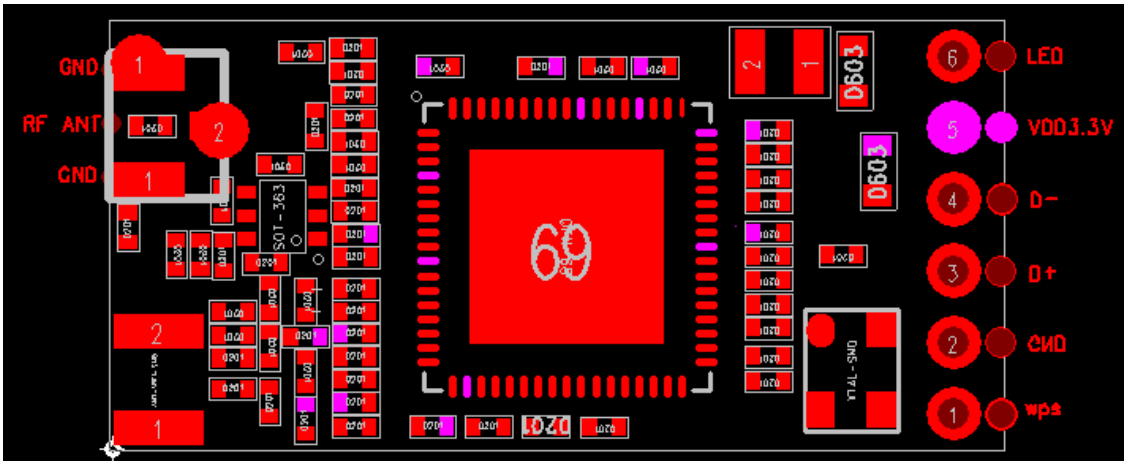

Fig.1 Top Layer (Top View)

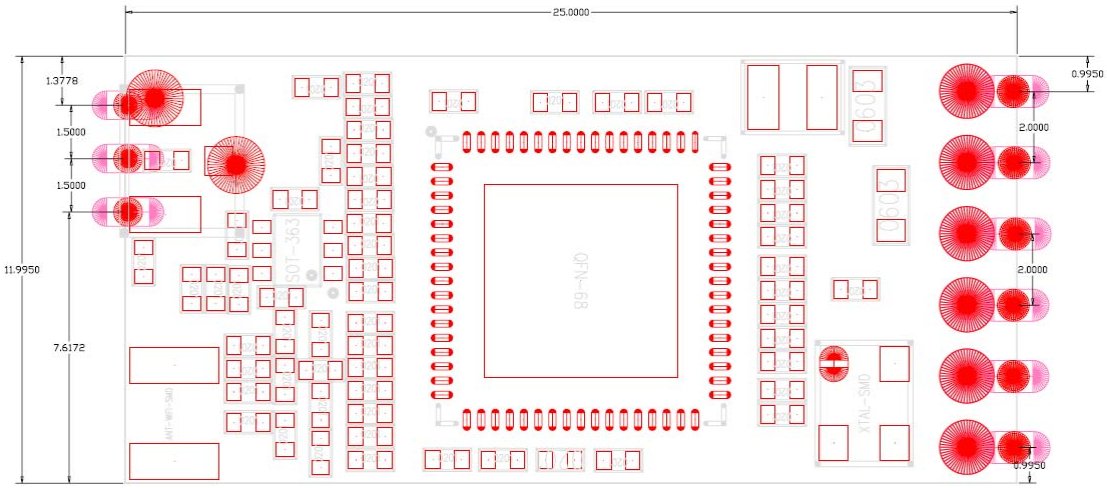

Fig.2 Size chart (Top View)

Block Diagram

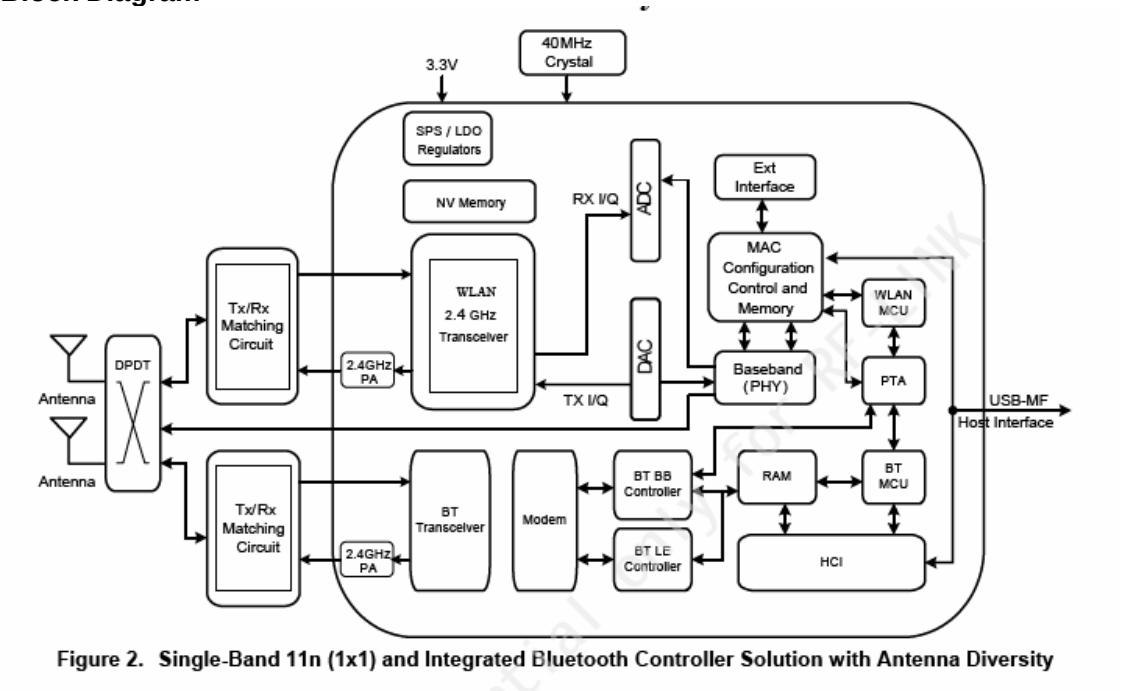

Figure 2. Single-Band 11n (1x1) and Integrated Bluetooth Controller Solution with Antenna Diversity

Block Diagram with Single RF Port

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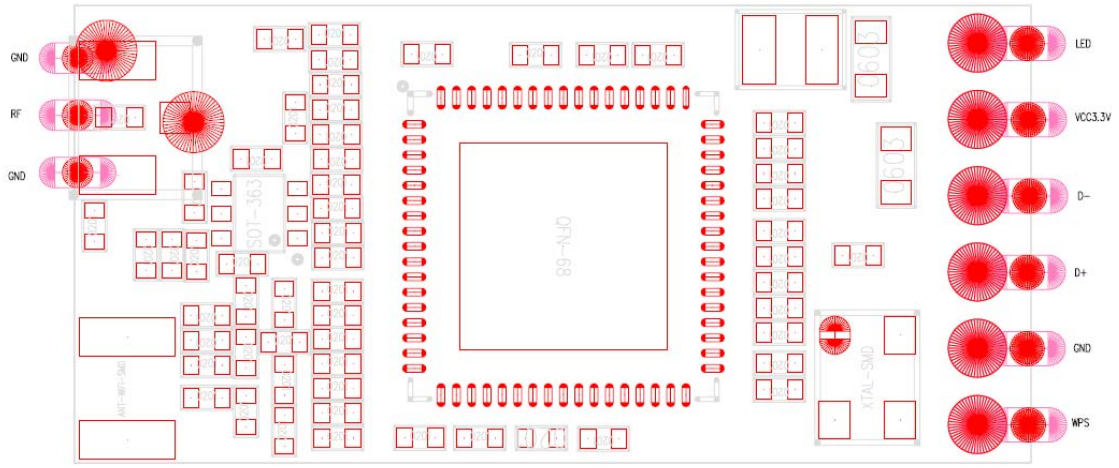
(1) Option for single antenna. WiFi/BT shares the single RF port and a SPDT required for switching between BT and WiFi.

(2) Default this module only require 3.3V single power source and core voltage generated by internal voltage regulator.
(3) This module reserves flexibility for external power source if system can provide VD12/VD15 for this module

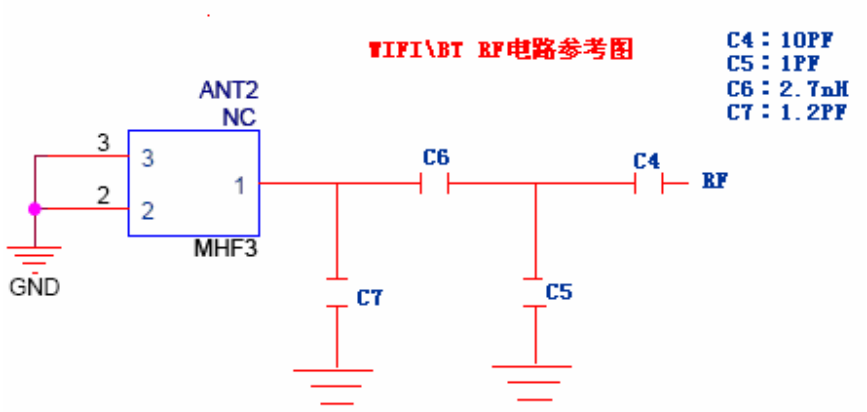
MODULE PIN ASSIGNMENT

Pin	Function	Pin	Function
1	WPS	4	D-
2	GND	5	VCC3.3V
3	D+	6	LED

Module PIN feet definition figure

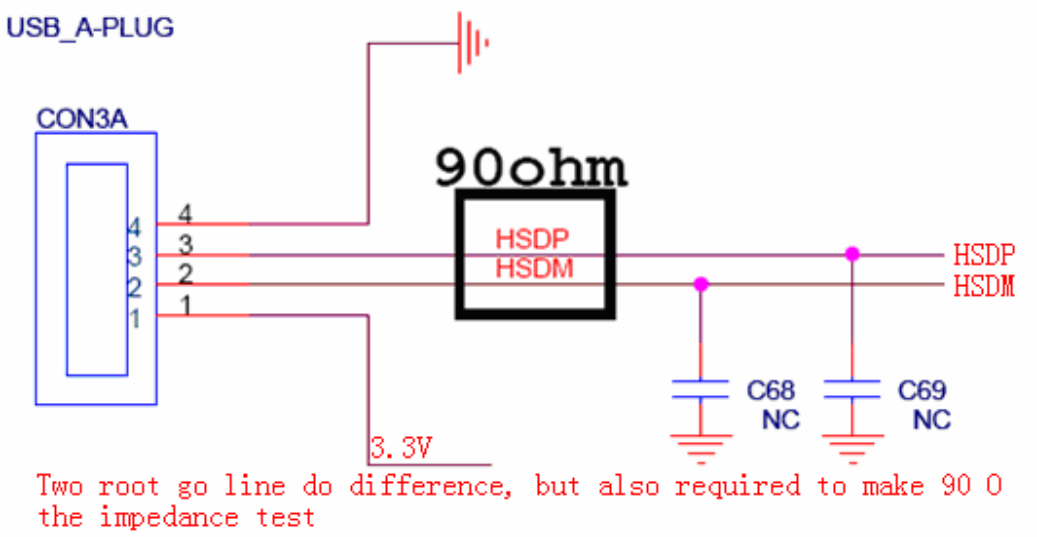


WIFI\BT RF Circuit reference pictures



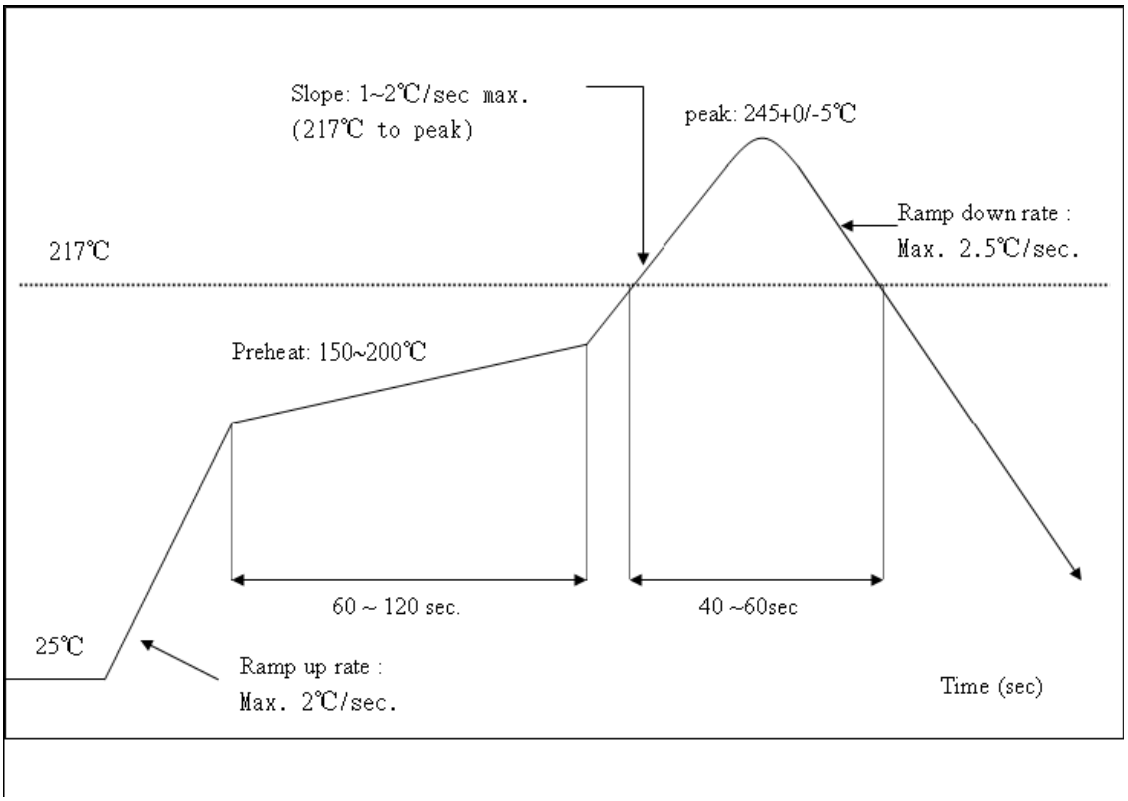
注：以上 RF 走线要做 50 欧的阻抗，走线不能走 90 度，走线不能长于 15MM。

USB interface Circuit reference pictures



Recommended Reflow Profile

Referred to IPC/JEDEC standard.
Peak Temperature : <250°C
Number of Times : ≤2 times



ID SETTING INFORMATION

Reg Domain	World Wide 13 Channels 1-11 with active scan Channels 12,13 with passive scan Channel 14 with no scan
Reg Domain Code	0x0A
Vendor ID	***WiFi :*** 0x0BDA ***BT :*** 0x0BDA
Device ID	***WiFi :*** 0x0724 ***BT :*** 0x0724 (PID)
Subsystem Device ID	0x0724 (Realtek demoboard)
Subsystem Vendor ID	0x0BDA

ENVIRONMENTAL

Operating

Operating Temperature: 0°C to +70 °C
Relative Humidity: 5-90% (non-condensing)

Storage

Temperature: -40°C to +80°C (non-operating)
Relevant Humidity: 5-95% (non-condensing)

MTBF caculation

Over 150,000hours