# SDIO 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-SM02BD (Realtek RTL8723AS) Combo Module

Version 1.1

# CONTENT

## PRODUCT DESCRIPTION

RF-SM02 is a small size and low profile of WiFi+BT combo module with LGA (Land-Grid Array) footprint, board size is 20mm*10mm with module height 2mm. It can be easily manufactured on SMT process and highly suitable for tablet PC, ultra book, mobile device and consumer product. It provides GSPI/SDIO interface for WiFi to connect with host processor and high speed UART interface for BT. It also has a PCM interface for audio data transmission with direct link to external audio codec via BT controller. The WiFi throughput can go up to 150Mbps in theory by using 1x1 802.11n b/g/n MIMO technology and Bluetooth can support BT2.1+EDR/BT3.0 and BT4.0.

RF-SM02 uses Realtek RTL8723AS, a highly integrated WiFi/BT single chip based on advanced COMS process. RTL8723AS almost integrates whole WiFi/BT function blocks into a chip, such as SDIO/UART, MAC, BB, AFE, RFE, PA, EEPROM and LDO/SWR, except fewer passive components remained on PCB.

## PRODUCT FEATURES

- Operate at ISM frequency bands (2.4GHz)
- GSPI/SDIO for WiFi and UART for Bluetooth
- IEEE standards support: IEEE 802.11b, IEEE 802.11g, IEEE 802.11n, IEEE 802.11d, IEEE 802.11e, IEEE 802.11h, IEEE 802.11i
- Fully Qualified Bluetooth 2.1 + EDR specification including both 2Mbps and 3Mbps modulation mode
- Fully qualified Bluetooth 3.0
- Fully qualified Bluetooth 4.0 Dual mode
- Full –speed Bluetooth operation with Piconet and Scatternet support.
- Enterprise level security which can apply WPA/WPA2 certification for WiFi.
- WiFi 1 transmitter and 1 receiver allow data rates supporting up to 150 Mbps downstream and 150 Mbps upstream PHY rates
- Support sophisticated WiFi/BT coexistence mechanism to enhance collocation performance
- Support antenna diversity for WiFi and BT antenna selection
- Support Bluetooth adaptive power management mechanism
- Full-featured software utility for easy configuration and management
- RoHS compliance
- Low Halogen compliance

# PRODUCT SPECIFICATIONS

## Main chipset

**WiFi/BT Single Chip: Realtek RTL8723AS-CG**

Functional Specifications

| | |
|---|---|
| **Standards** | ***WiFi:***<br>IEEE 802.11b, IEEE 802.11g, Draft IEEE 802.11n, IEEE 802.11d, IEEE 802.11e, IEEE 802.11h, IEEE 802.11i<br>***BT:***<br>V2.1+EDR/BT v3.0/BT v3.0+HS/BT v4.0 |
| **Bus Interface** | ***WiFi:*** GSPI/SDIO ***BT:*** UART |
| **Form Factor** | L*W*H = 20mm*10mm*2mm |
| **Data Rate** | **802.11b:**<br>11, 5.5, 2, 1 Mbps<br>**802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps**<br>**802.11n:**<br>MCS 0 to 7 for HT20MHz<br>MCS 0 to 7 for HT40MHz<br>**BT:**<br>1 Mbps for Basic Rate 2,3 Mbps for Enhanced Data Rate |
| **Media Access Control** | ***WiFi:***<br>CSMA/CA with ACK BT:<br>AFH, Time Division |
| **Modulation Techniques** | ***802.11b:***<br>CCK, DQPSK, DBPSK<br>***802.11g: 64 QAM, 16 QAM, QPSK, BPSK 802.11n:***<br>64 QAM, 16 QAM, QPSK, BPSK<br>***BT:***<br>8DPSK, π/4 DQPSK, GFSK |
| **Network Architecture** | ***WiFi:***<br>Ad-hoc mode (Peer-to-Peer )<br>Infrastructure mode<br>***BT:***<br>Pico Net<br>Scatter Net |

<table>
<tr><td>Operating Channel</td><td colspan="3">WiFi 2.4GHz:<br>11: (Ch. 1-11) – United States<br>13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan<br>BT 2.4GHz:<br>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<br>802.11g@54Mbps 14dBm</td><td>802.11n 16dBm (MCS 0_HT20)<br>13dBm (MCS 7_HT20)<br>13dBm (MCS 0_HT40)<br>13dBm (MCS 7_HT40)</td></tr>
<tr><td colspan="3">BT:<br>Max +10dBm</td></tr>
<tr><td rowspan="2">Receiver Sensitivity</td><td>802.11b@11Mbps -84dBm</td><td>802.11g@54Mbps -73dBm</td><td>802.11n -69dBm (MCS 7_HT20)<br>-66dBm (MCS 7_HT40)</td></tr>
<tr><td colspan="3">BT:<br>-89dBm@1Mbps, -90dBm@2Mbps, -83dBm@3Mbps</td></tr>
<tr><td>Security</td><td colspan="3">WiFi :<br>WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit, IEEE<br>802.11x, IEEE 802.11i BT:<br>Simple Paring</td></tr>
<tr><td>Operating Voltage</td><td colspan="3">3.3 V ±9% I/O supply voltage</td></tr>
<tr><td>OS supported</td><td colspan="3">Windows XP/Win7/Linux/Android</td></tr>
<tr><td>Power Consumption (3.3V) (Typical)</td><td colspan="3">WiFi :<br>TX Mode: (Conituous mode)<br>260mA (MCS7/BW40/13dBm)<br>RX Mode: (Conituous mode)<br>190mA (MCS7/BW40/-60dBm)<br>Associated Idle: 4mA<br>Unassociated Idle: 2.9mA<br>RF disable Mode: 3mA<br>BT :<br>Inquiry & Page Scan: 1.7mA<br>ACL no traffic: 15mA<br>SCO HV3: 20mA<br>Parked 1.28s beacon:1.12mA<br>Reset: 0.05mA</td></tr>
</table>

**Mechanical**

| | Length | Width | Height |
|---|---|---|---|
| Dimensions (mm) | 22.25<br>**(Tolerance:±0.2mm)** | 11.745<br>**(Tolerance:±0.2mm)** | 1.7<br>**(Tolerance:±0.2mm)** |

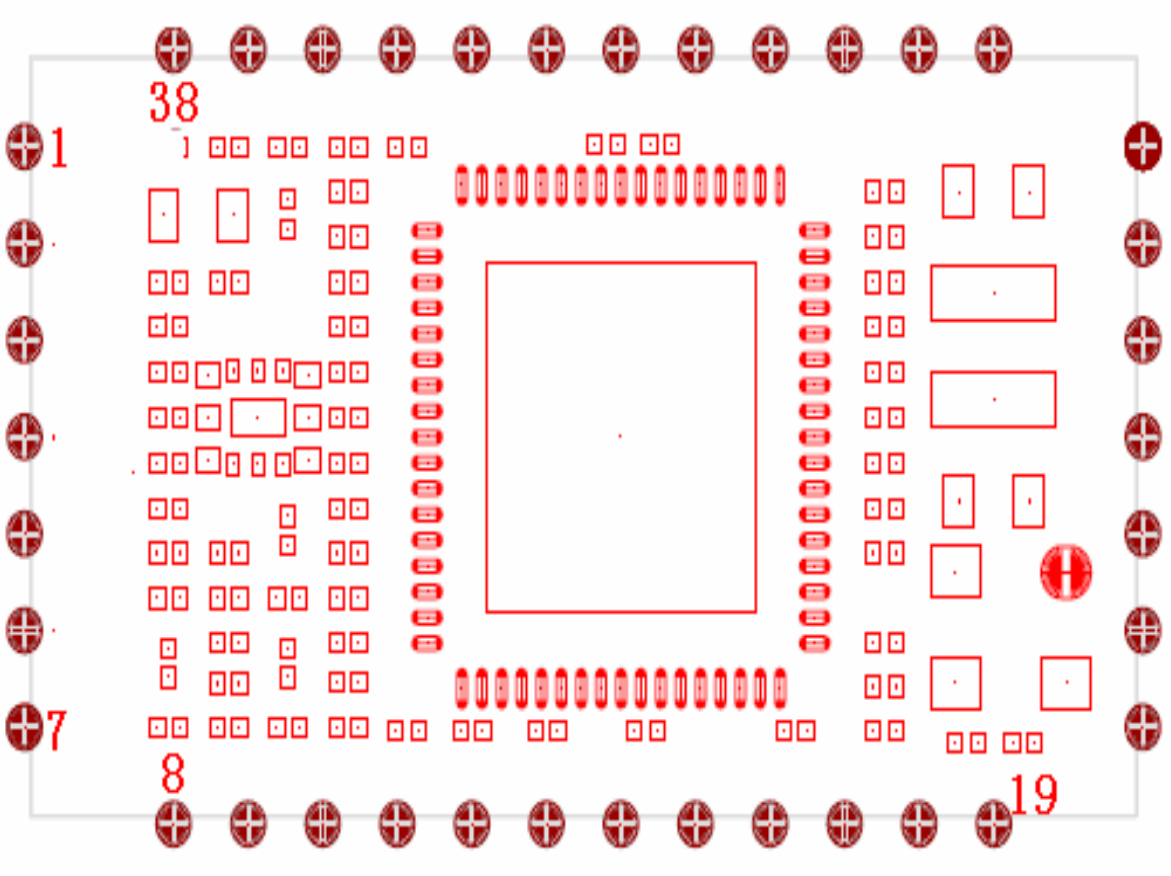



Fig.1 Top Layer (Top View)

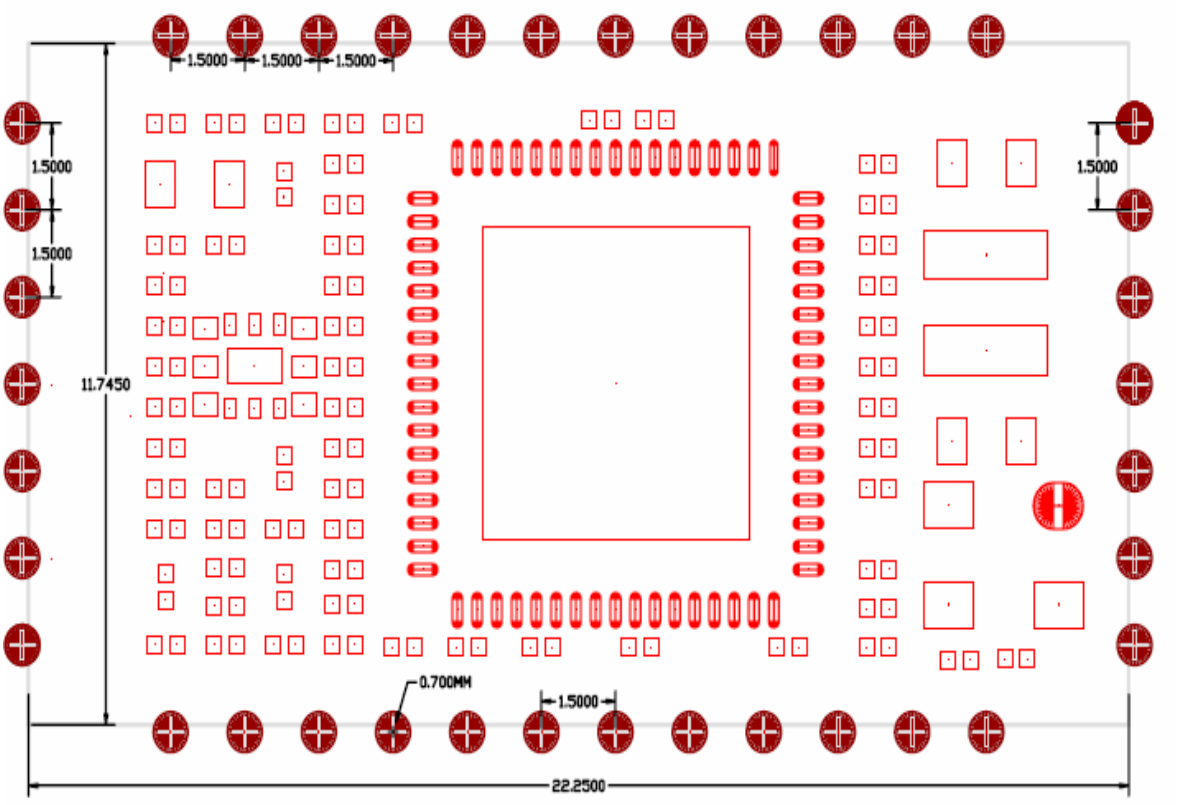



Fig.2 Size chart (Top View)

**Block Diagram**

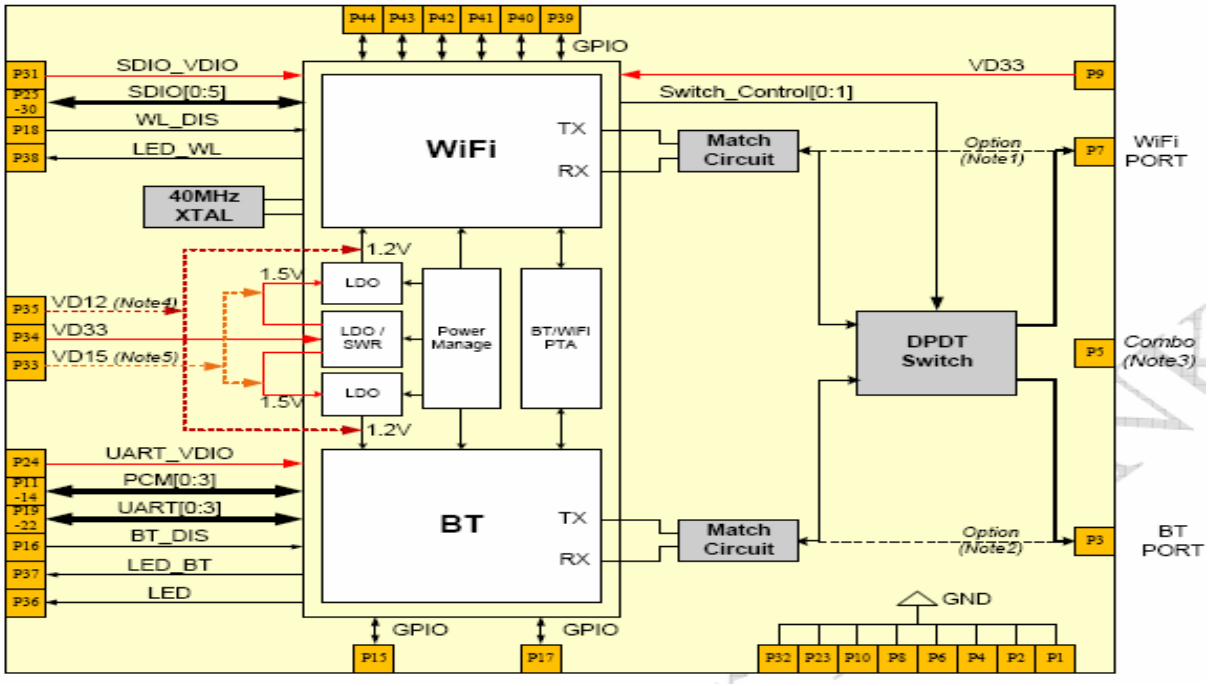



Fig.3 Block Diagram with Dual RF Port

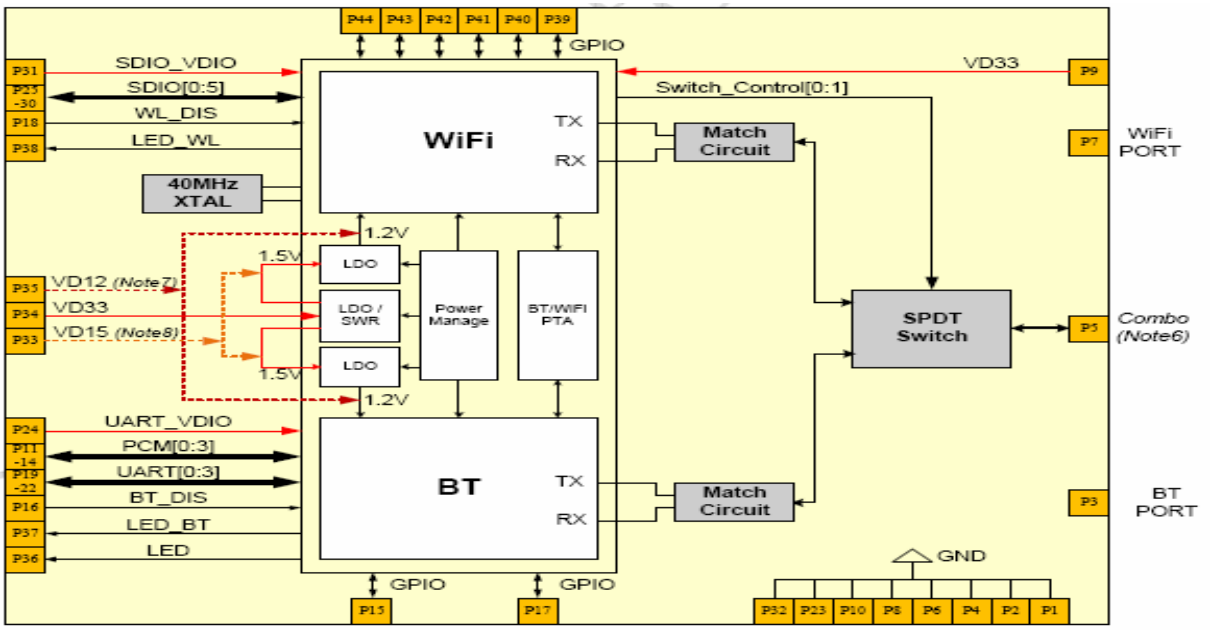



Fig.4 Block Diagram with Single RF Port

*(2) This module also reserves flexibility to support separate WiFi/BT RF fixed path without DPDT.*

*Note3,6:*

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

*Note4,5,6,7:*

*(1) Default this module only require 3.3V single power source and core voltage generated by internal voltage regulator.*

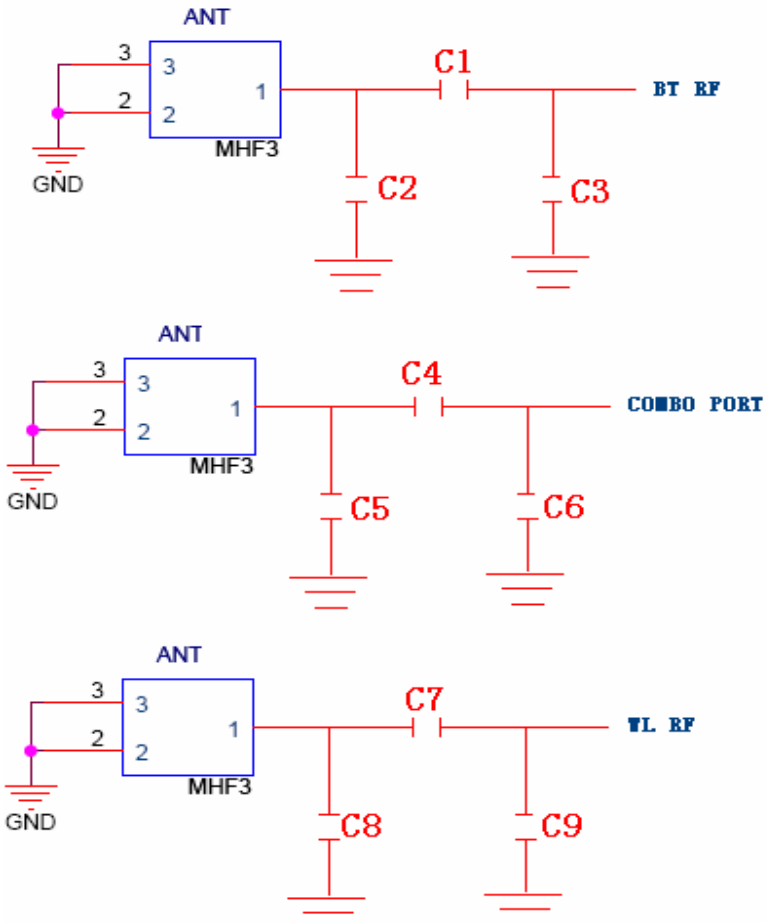
*(2) This module reserves flexibility for external power source if system can provide VD12/VD15 for this module*

## MODULE PIN ASSIGNMENT

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | GND | 20 | UART_VDIO<br>VDD for UART Pin, the power supply is same as the signal level of<br>UART bus (3.3V ~ 1.8V) |
| 2 | BT_RF | 21 | SD_D1 |
| 3 | GND | 22 | SD_D0 |
| 4 | COMBO_RF | 23 | SD_CLK |
| 5 | GND | 24 | SD_CMD |
| 6 | WL_RF | 25 | SD_D3/USB_D+ |
| 7 | GND | 26 | GND |
| 8 | GND | 27 | SD_D2/USB_D- |
| 9 | BT_PCM_CLK<br>General Purpose Input/Output Pin | 28 | SD_VDIO<br>VDD for SDIO Pin, the power supply is same as the signal level of<br>SDIO bus (3.3V ~ 1.8V) |
| 10 | BT_PCM_SYNC | 29 | VD33 |
| 11 | BT_PCM_OUT<br>Trap function: weak pull low to enable integrated switching regulator;<br>weak pull high to enable integrated linear regulator .<br>General Purpose Input/Output Pin | 30 | LED<br>LED Pins (Active Low) |
| 12 | BT_PCM_IN<br>Trap function: weak pull low to enable RTL8723 to enter normal operation mode.<br>General Purpose Input/Output Pin | 31 | LED_BT |
| 13 | GPIO(12)/WPS<br>This pin is for WIFI function to wakeup host when remote wake function is enabled. The Polarity can be defined by customer. | 32 | LED_WL |
| 14 | GPIO(11)/BT_DIS<br>This Pin Can Externally Shutdown the RTL8723AS (no requirement for Extra Power Switch) when WL_DISn is pulled low<br>This pin can also support the BT Radio-off function with host interface remaining connected. | 33 | GND |
| 15 | GPIO(11)/WL_DIS<br>This Pin Can Externally Shutdown the RTL8723AS (no requirement for Extra Power Switch) when BT_DISn is pulled low<br>This pin can also support the WLAN Radio-off function with host interface remaining connected. | 34 | GND |
| 16 | UART_IN<br>High-Speed UART Data In | 35 | GND |
| 17 | UART_RTS<br>High-Speed UART RTS | 36 | GND |
| 18 | UART_CTS<br>High-Speed UART CTS | 37 | EESK |
| 19 | UART_OUT<br>High-Speed UART Data Out | 38 | GND |

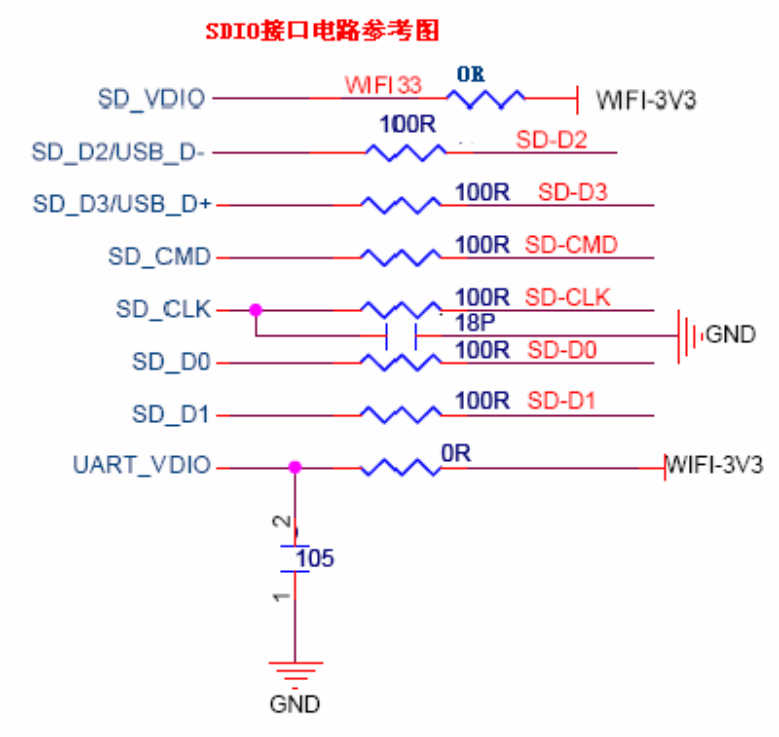
## Module PIN feet definition figure


## WIFI\BT RF Circuit reference pictures



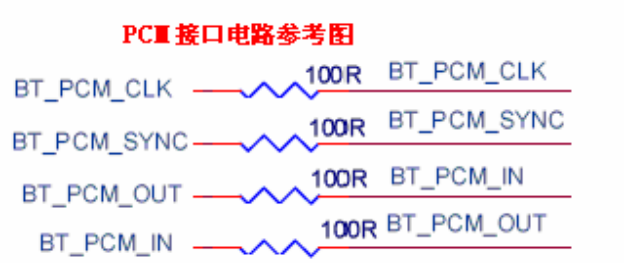

注：以上 RF 走线要做 50 欧的阻抗，走线不能走 90 度，走线不能长于 15MM。

## SDIO interface Circuit reference pictures



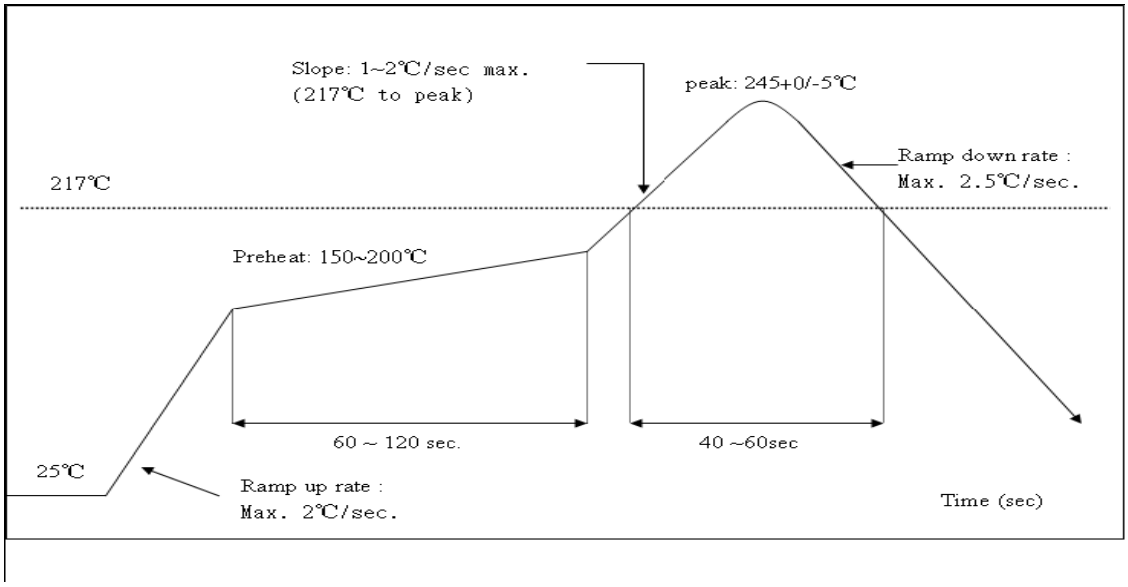

## BT interface Circuit reference pictures


## PCM 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<br>Channels 1-11 with active scan<br>Channels 12,13 with passive scan<br>Channel 14 with no scan |
| Reg Domain Code | 0x0A |
| Vendor ID | ***WiFi :***<br>0x10EC<br><br>***BT :***<br>0x0BDA |
| Device ID | ***WiFi :***<br>0x8723<br><br>***BT :***<br>0x8723 (PID) |
| Subsystem Device ID | 0x8723 (Realtek demoboard) |
| Subsystem Vendor ID | 0x10EC |

## 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