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Product Specification

IEEE 802.11 b/g/n 2.4GHz 1T1R WiFi with Bluetooth v2.1+EDR/Bluetooth 3.0/4.0
(Single Antenna)

Project Name	WiFi+BT Module
Model NO	F23BDSM43

Approved: William Tan	Checked: Jim Hu	Drafted: Neal Yu

CONTENTS

0. Revision History

REV NO	Date	Modifications	Draft	Approved
REV 1.0	2016-03-05	First Released	Neal Yu	William Tan

1. Introduction

1.1 Overview

F23BDSM43 is a small size and low profile WiFi + BT Combo module, The size is 12mm*17mm. It can be easily manufactured on SMT process and highly suitable for tablet PC, ultra book, mobile device and consumer products. It provides 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 802.11 b/g/n MIMO technology and Bluetooth can support BT2.1+EDR/BT3.0 and BT4.0.

F23BDSM43 uses Realtek RTL8723BS. It is a highly integrated 802.11b/g/n 1T1R WLAN, an integrated Bluetooth 2.1/3.0/4.0 module. It combines a WLAN MAC, a 1T1R capable WLAN baseband, BT protocol Stack(LM, LL, and LE), BT baseband, modem, and WLAN/BT RF in the module. The N**F23BDSM43** provides a complete solution for a high throughput performance integrated wireless LAN and Bluetooth controller.

1.2 Product Features

General
- 12mm*17mm
- 802.11b/g/n 1T1R WLAN and Bluetooth module

Host Interface
- Complies with SDIO 1.1/2.0/3.0 for WLAN with clock rate up to 100MHz (DDR50)
- Complies with HS-UART with configurable baud rate for Bluetooth

WLAN 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
- One Transmit and one Receive path (1T1R)
- Short Guard Interval (400ns)
- Maximum data rate 54Mbps in 802.11g; and 150Mbps in 802.11n
- 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services

BT Features
- Compatible with Bluetooth v2.1+EDR and v3.0 Systems
- Supports Bluetooth 4.0 Low Energy(BLE)
- Integrated MCU to execute Bluetooth protocol stack
- PCM interface for audio data transmission via Bluetooth controller
- Supports AFH to dynamically detect channel quality to improve transmission quality

1.3 Block diagram

The general block diagram for the module is shown in Figure 1

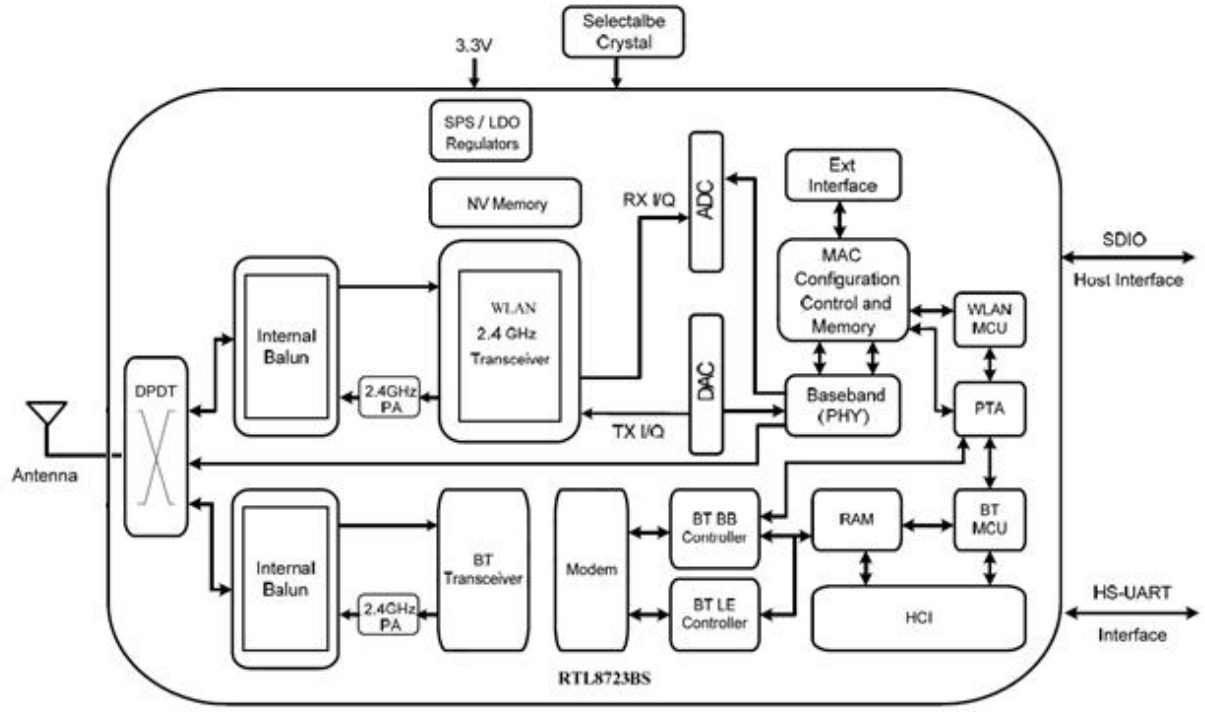


Figure 1

2. General specification

General features	
Main Chipset	Realtek RTL8723BS
Host Interface	SDIO for WLAN UART for BT
WiFi Standards	802.11b/g/n
BT Standards	Bluetooth 2.1/3.0/4.0
Dimension	L17.0mm*W12.0mm*H1.7mm
Operating conditions	
Operating Voltage	3.3±10% Vdc
Operating Temperature	0°C to +70°C
Storage Temperature	-40°C to +80°C
RF features	
Operating Frequency	2.400～2.4835GHz
Channels	**WiFi:** USA/Canada: channel 1~11; **BT:** Channel 0~78
Modulation	**WiFi:** 802.11b(DSSS): CCK(11, 5.5Mbps), DQPSK(2Mbps), DBPSK(1Mbps); 802.11g(OFDM): BPSK(9,6Mbps), QPSK(18,12Mbps), 16QAM(36,24Mbps), 64QAM(54,48Mbps); 802.11n(OFDM): BPSK, QPSK, 16QAM, 64QAM(150Mbps) **BT:** 8DPSK, π /4 DQPSK, GFSK
PHY Data rates	**WiFi:** 802.11b: 11,5.5,2,1 Mbps 802.11g: 54,48,36,24,18,12,9,6 Mbps 802.11n: up to 150Mbps **BT:** 1 Mbps for Basic Rate 2,3 Mbps for Enhanced Data Rate
Output Power	**WiFi:** 802.11b <16dBm 802.11g <15dBm 802.11n <14dBm **BT:** Max <10dBm

EVM	802.11b EVM≦35% 802.11g EVM≦-25dB 802.11n EVM≦-28dB
Sensitivity	**WiFi:** **802.11b@8% PER** 1Mbps -88dBm 2Mbps -87dBm 5.5Mbps -85dBm 11Mbps -82dBm **802.11g@10% PER** 6Mbps -86dBm 9Mbps -85dBm 12Mbps -84dBm 18Mbps -82dBm 24Mbps -80dBm 36Mbps -77dBm 48Mbps -73dBm 54Mbps -71dBm **802.11n_HT20@10% PER** MCS 0 -83dBm MCS 1 -82dBm MCS 2 -80dBm MCS 3 -78dBm MCS 4 -75dBm MCS 5 -71dBm MCS 6 -69dBm MCS 7 -67dBm **BT:** -89dBm @ 1Mbps -86dBm @ 2Mbps -83dBm @ 3Mbps
Other features	
Antenna	Chip Antenna (Single Antenna)
Network Architecture	**WiFi:** Ad-hoc mode (Peer-to-Peer) Infrastructure mode Software AP WiFi Direct **BT:** Pico Net, Scatter Net
Security	**WiFi:** WPA, WPA-PSK, WPA2, WPA2-PSK, WEP 64bit & 128bit, IEEE 802.11x, IEEE 802.11i **BT:** Simple Paring
OS Supported	Android /Linux/ Win CE /XP/WIN7/iOS

3. Electrical Characteristics

3.1 Power Supply DC Characteristics

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIN33	3.3V Supply Voltage	3.0	3.3	3.6	V
VDDIO	DC supply for digital I/O	1.62	1.8-3.3	3.6	V

3.2 Digital I/O Pin 1.8V DC Characteristics

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	1.7	1.8	2.0	V
V_{IL}	Input low voltage	-	0	0.8	V
V_{OH}	Output high voltage	1.62	-	1.8	V
V_{OL}	Output low voltage	0	-	0.18	V

3.3 Digital I/O Pin 3.3V DC Characteristics

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	2.0	3.3	3.6	V
V_{IL}	Input low voltage	-	0	0.9	V
V_{OH}	Output high voltage	2.97	-	3.3	V
V_{OL}	Output low voltage	0	-	0.33	V

3.4 SDIO/GSPI Interface AC Characteristics

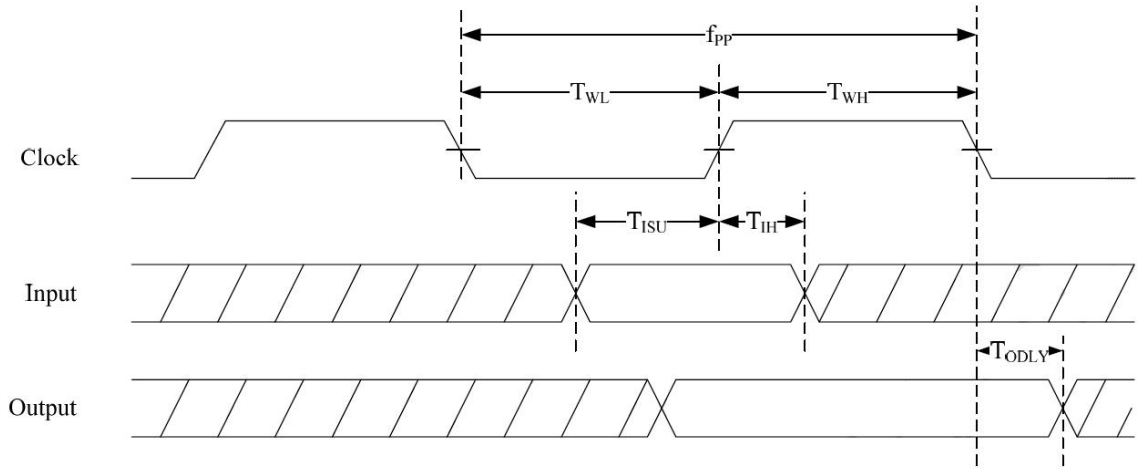


Figure 2. SDIO Interface Timing

SDIO Interface Timing Parameters

NO	Parameter	Mode	MIN	MAX	Unit
f_{PP}	Clock Frequency	Default	0	25	MHz
		HS	0	50	MHz
T_{WL}	Clock Low Time	DEF	10	-	ns
		HS	7	-	ns
T_{WH}	Clock High Time	DEF	10	-	ns
		HS	7	-	ns
T_{ISU}	Input Setup Time	DEF	5	-	ns
		HS	6	-	ns
T_{IH}	Input Hold Time	DEF	5	-	ns
		HS	2	-	ns
T_{ODLY}	Output Delay Time	DEF	-	14	ns
		HS	-	14	ns

3.4 SDIO Interface Power-On Sequence

After power-on, the SDIO interface is selected by the RTL8723BS automatically when a valid SDIO command is received. To attain better SDIO host compatibility, the following power-on sequence is Recommended.

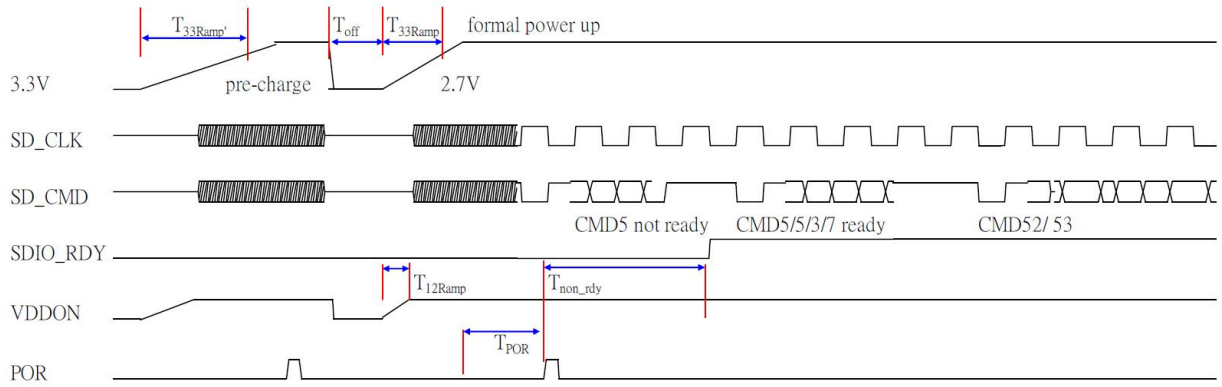


Figure 3. SDIO Interface Power-On Sequence

SDIO Interface Power-On Sequence

Symbol	Description
$T_{33ramp'}$	3.3V Power Pre-Charge Ramp Up Duration Before Formal Power Up. We recommend that a 3.3V power-on and then power-off sequence is executed by the host controller before the formal power on sequence. This procedure can eliminate host card detection issues when power ramp up duration is too long, or when a system warm reboot fails.
T_{off}	The duration 3.3V is cut off before formal power up.
T_{33ramp}	The 3.3V main power ramp up duration.
T_{12ramp}	The internal 1.2V ramp up duration.
T_{POR}	The duration from when the power-on reset releases and the power management unit executes power on tasks. A power on reset will detect both 3.3V and 1.2V power ramp up after a predetermined duration.
T_{non_rdy}	SDIO Not Ready Duration. In this state, the RTL8723BS-VD may respond to commands without the ready bit being set. After the ready bit is set, the host will initiate complete card detection procedure.

We recommend that the card detection procedures are divided into two phases: A 3.3V power pre-charge phase and a formal power-up phase.

During the 3.3V power pre-charge phase, the power ramp up duration is not limited. The 3.3V power is cut off and is turned on after the Toff period. The ramp up time is specified in the T33ramp duration.

After main 3.3V ramp up and 1.2V ramp up, the power management unit is enabled by the power ready detection circuit. The power management unit enables the SDIO block. eFUSE is then autoloaded to SDIO circuits during the Tnon_rdy duration. After the autoload has completed, the SDIO sets the ready bit. After CMD5/5/3/7 procedures, card detection is executed. When the driver has loaded, normal CMD52 and CMD53 are used.

SDIO Interface Power-On Timing Parameters

Symbol	MIN	Typical	MAX	Unit
$T_{33ramp'}$	-	-	No Limit	ms
T_{off}	250	500	1000	ms
T_{33ramp}	0.1	0.5	2.5	ms
T_{12ramp}	0.1	0.5	1.5	ms
T_{POR}	2	2	8	ms
T_{non_rdy}	1	2	10	ms

3.5 UART Interface Power-On Sequence

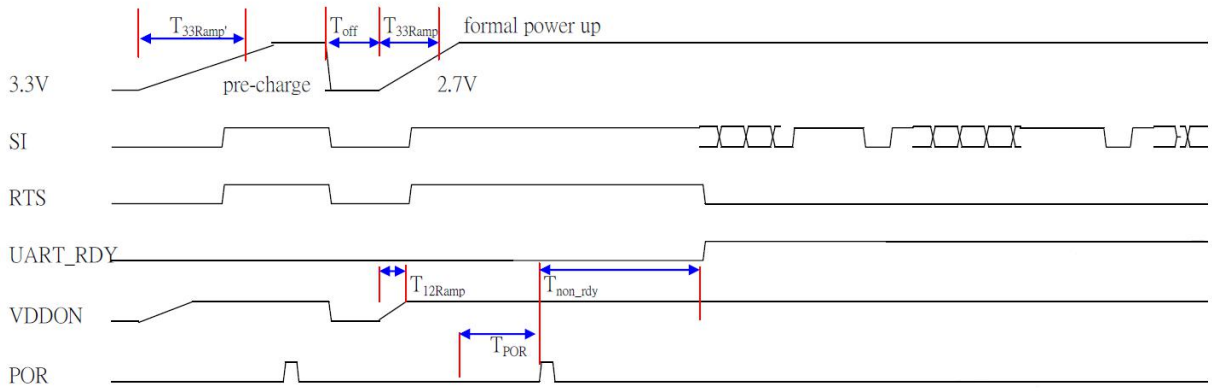


Figure 4. UART Power On Sequence With Hardware Flow Control

UART Interface Power-On Sequence

Symbol	Description
$T_{33ramp'}$	3.3V Power Pre-Charge Ramp Up Duration Before Formal Power Up. We recommend that a 3.3V power-on and then power-off sequence is executed by the host controller before the formal power on sequence. This procedure can eliminate host card detection issues when power ramp up duration is too long, or when a system warm reboot fails.
T_{off}	The duration 3.3V is cut off before formal power up.
T_{33ramp}	The 3.3V main power ramp up duration.
T_{12ramp}	The internal 1.2V ramp up duration.
T_{POR}	The duration from when the power-on reset releases and the power management unit executes power on tasks. A power on reset will detect both 3.3V and 1.2V power ramp up after a predetermined duration.
T_{non_rdy}	UART Not Ready Duration. In this state, the RTL8723BS-VD will not respond to any commands.

We recommend that the card detection procedures are divided into two phases: A 3.3V power pre-charge phase and a formal power-up phase.

During the 3.3V power pre-charge phase, the power ramp up duration is not limited. The 3.3V power is cut off and is turned on after the Toff period. The ramp up time is specified in the T33ramp duration.

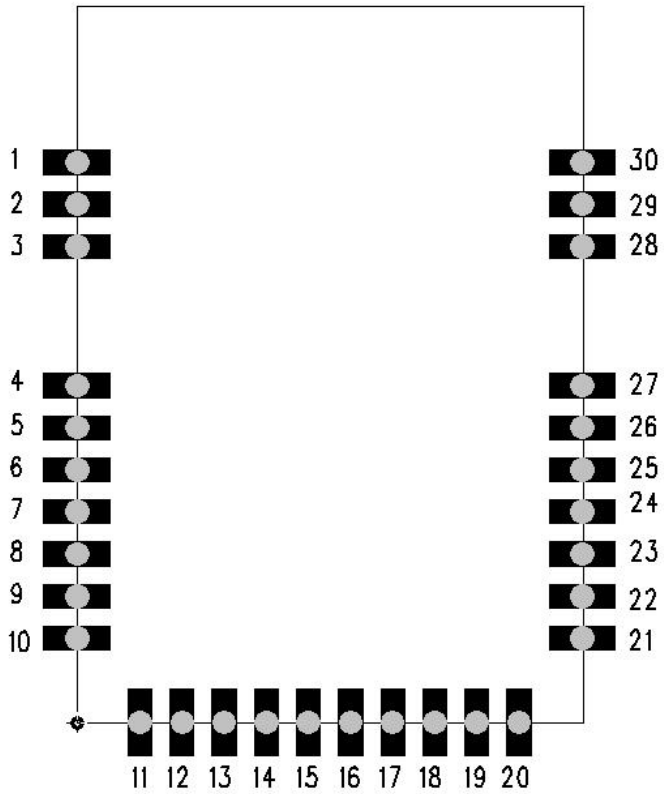
After main 3.3V ramp up and 1.2V ramp up, the power management unit is enabled by the power ready detection circuit. The power management unit enables the Bluetooth block. The Bluetooth firmware

theninitializes all circuits, included the UART. In addition to wait the Tnon_rdy time, if the host supports UART hardware flow control it can detect RTS signals and follow the formal UART flow control handshake.

UART Interface Power On Timing Parameters

Symbol	MIN	Typical	MAX	Unit
$T_{33ramp'}$	-	-	No Limit	ms
T_{off}	250	500	1000	ms
T_{33ramp}	0.1	0.5	2.5	ms
T_{12ramp}	0.1	0.5	1.5	ms
T_{POR}	2	2	8	ms
T_{non_rdy}	1	2	10	ms

4. Pin Definition(Top View)



Pin Assignment

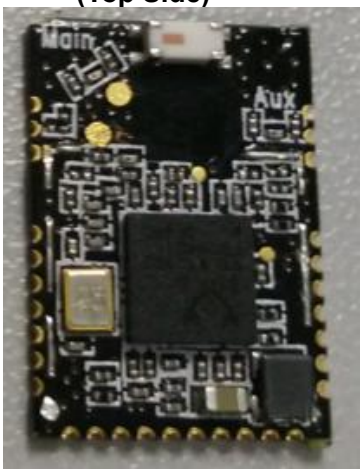
Pin#	Name	Description	Remark
1	GND	Ground	
2	ANT1	Antenna 1	
3	GND	Ground	
4	PCM_IN	PCM data Input	High level: 1.8V
5	PCM_OUT	PCM data Output	High level: 1.8V
6	PCM_CLK	PCM Clock	
7	PCM_SYNC	PCM Synchronization control	
8	GND	Ground	
9	BT_WAKE_HOST_DEV		
10	HST_WAKE_BT	Host wake up BT, active high	

11	UART_CTS	High-Speed UART CTS	
12	UART_IN	High-Speed UART Data In	VDDIO
13	UART_OUT	High-Speed UART Data Out	VDDIO
14	GND	Ground	VDDIO
15	SD_CLK	SDIO Clock Input	VDDIO
16	SD_CMD	SDIO Command Line	VDDIO
17	SD_D0	SDIO Data Line 0	VDDIO
18	SD_D1	SDIO Data Line 1	VDDIO
19	SD_D2	SDIO Data Line 2	VDDIO
20	SD_D3	SDIO Data Line 3	VDDIO
21	GND	Ground	
22	3.3V	3.3V Power Supply	VDDIO
23	VDDIO	Digital IO Supply Voltage	
24	SUSCLK_IN	External sleep clock input(32.768kHz)	
25	WLAN_WAKE_HOST		VDDIO
26	WL_ENABLE	Wlan Radio-off Function	VDDIO
27	BT_RESET	BT Radio-off Function	VDDIO
28	GND	Ground	
29	ANT2	Antenna 2	
30	GND	ground	

5.Mechanical Specification

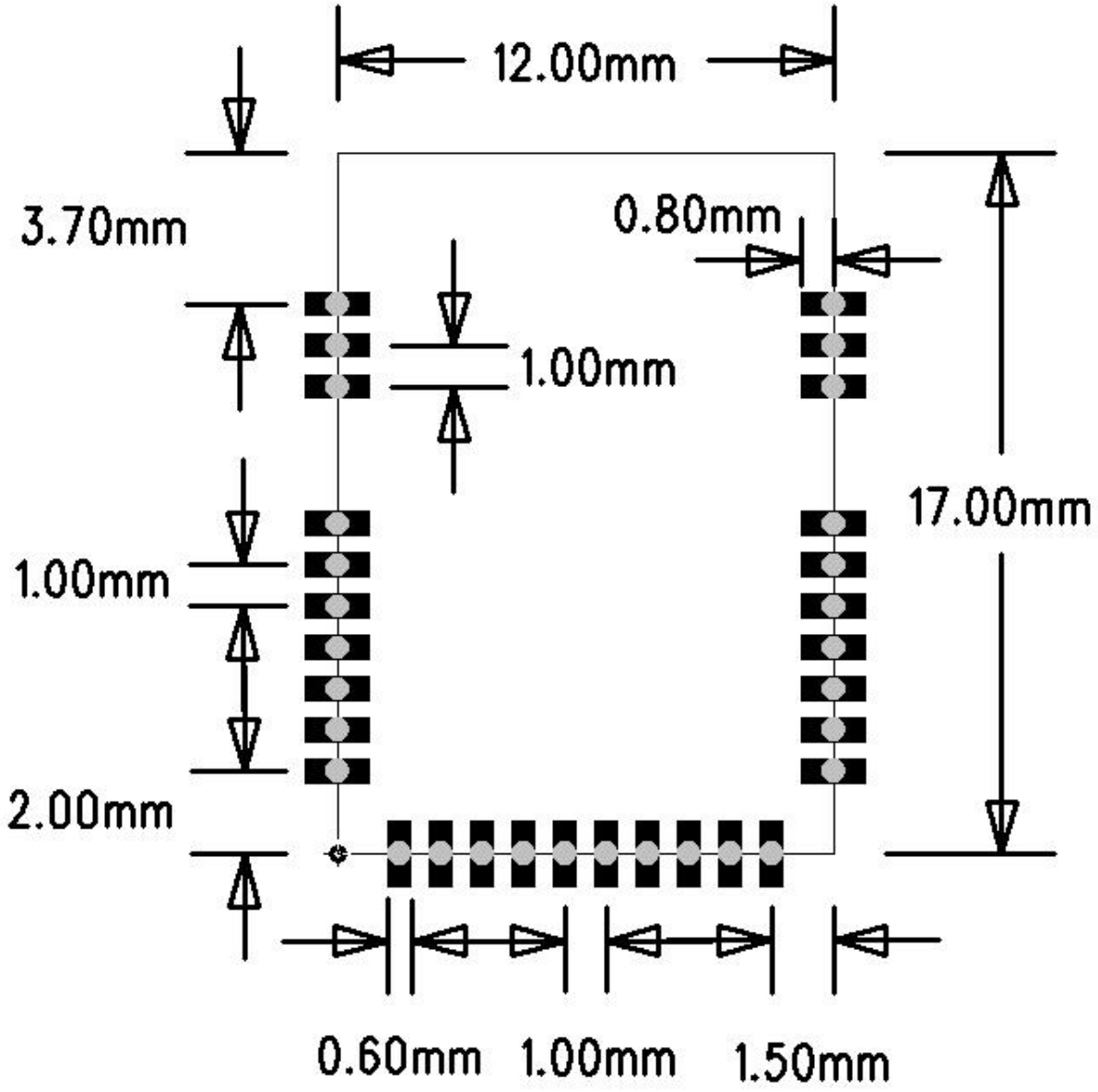
5.1 Outline Drawing(Unit: mm)

(Top Side)

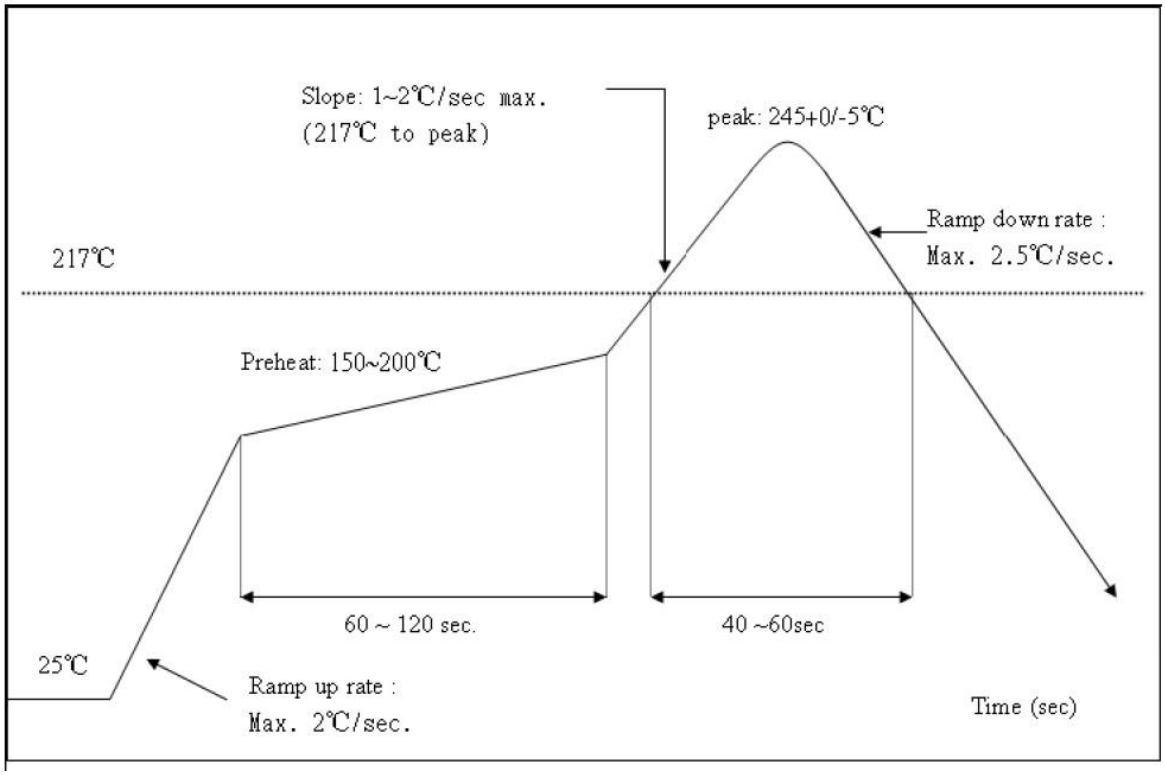


(Bottom Side)

Top View


12.00mm
3.70mm
0.80mm
1.00mm
17.00mm
1.00mm
2.00mm
0.60mm
1.00mm
1.50mm

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



5.3 Patch WIFI modules installed before the notice:

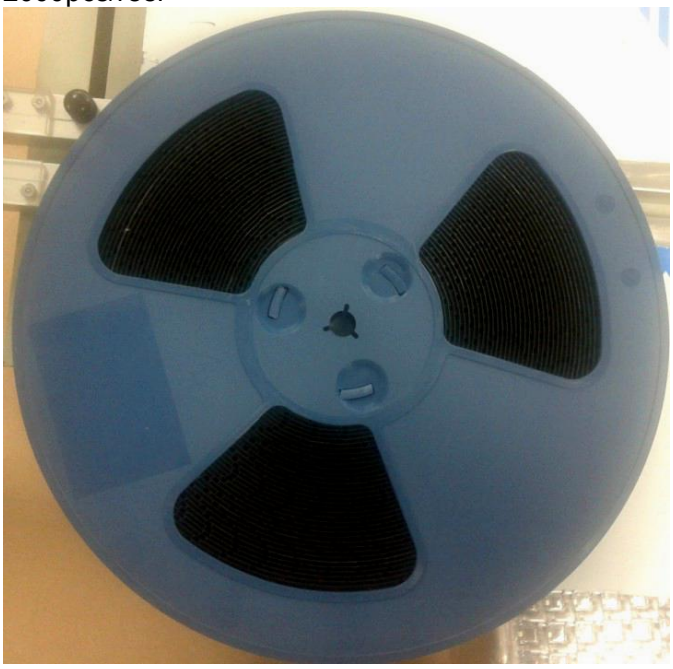
WIFI module installed note:
1. Please press 1 : 1 and then expand outward proportion to 0.7 mm, 0.12 mm thickness When open a stencil
2. Take and use the WIFI module, please insure the electrostatic protective measures.
3. Reflow soldering temperature should be according to the customer the main size of the products, such as the temperature set at 250 + 5 ℃ for the MID motherboard.

About the module packaging, storage and use of matters needing attention are as follows:
1. The module of the reel and storage life of vacuum packing: 1). Shelf life: 8 months, storage environment conditions: temperature in: < 40 ℃, relative humidity: < 90% r.h.
2. The module vacuum packing once opened, time limit of the assembly:
Card: 1) check the humidity display value should be less than 30% (in blue), such as: 30% ~ 40% (pink), or greater than 40% (red) the module have been moisture absorption.
2.) factory environmental temperature humidity control: ≦ 30 ℃, ≦ 60% r.h..
3). Once opened, the workshop the preservation of life for 168 hours.
3. Once opened, such as when not used up within 168 hours:
1). The module must be again to remove the module moisture absorption.
2). The baking temperature: 125 ℃, 8 hours.
3.) After baking, put the right amount of desiccant to seal packages.

6. Package

6.1 Reel Packaging

2000pcs/reel



FCC Statement:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

---Reorient or relocate the receiving antenna.

---Increase the separation between the equipment and receiver.

---Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

---Consult the dealer or an experienced radio/TV technician for help.

WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

LABEL OF THE END PRODUCT:

The final end product must be labelled in a visible area with the following "Contains TX FCC ID: 2AATL-F23BDSM43". If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF Exposure

This device has been evaluated and shown compliant with the FCC RF Exposure limits under fixed exposure conditions (antennas are greater than 20cm from a person's body) when installed in certain specific OEM configurations.

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Due to missing shielding the module is strictly limited to integration by the Grantee himself or his dedicated OEM integrator under control of the Grantee. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE:

This device is intended only for OEM integrators under the following conditions:

(1) According to FCC Part 15 Subpart C Section 15.212, the radio elements of the modular transmitter must have their own shielding. However, due to there is no shielding for this WIFI/BT module, this module is granted as a Limited Modular Approval.

(2) This module has been designed to operate with a Integral Chip antenna having a maximum gain of 1.5dBi. Only this type of antenna may be used.

(3) Integration is typically strictly restricted to Grantee himself or dedicated OEM integrators under control of the Grantee.

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter. then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

The module will be responsible to satisfy SAR/RF Exposure requirements, when the module integrated into any (portable, mobile, fixed) host device.

This module is intended for OEM integrator only and the OEM integrators and instructed to ensure that the end user has no manual instructions to remove or install the device. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

The module has no shielding and tested stand alone. This module is tested and approved as Limited modular approval with stand alone configuration, any OEM incorporated this radio module into any system are require additional testing and evaluation.

The module is only certified with the installed antenna. Any change of the antenna will void the certification. The host device including this RF module need to undergo separate certification.

The OEM integrator has to be aware not to provide information to the end use regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warming as shown in this manual.