

WG221BL

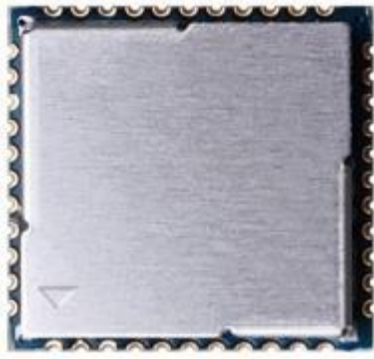
802.11n 150Mbps WLAN+BT v4.2

SDIO Module Specification

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(Top View)



(Bottom View)

Module Name: WG221BL	
Module Type: 802.11b/g/n 150Mbps WLAN + Bluetooth v4.2 SDIO Module	
Revision: V1.0	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
LB-link Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date
1.0	Official release	2022-11-04

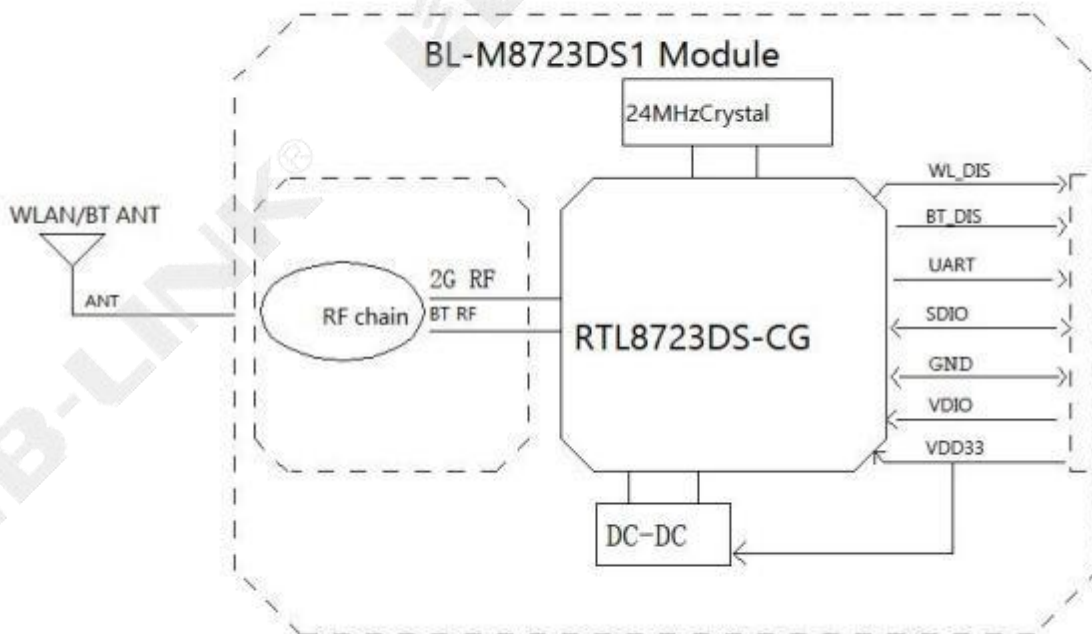
1. Introduction

WB221BL is a highly integrated IEEE802.11b/g/n WLAN and Bluetooth 2.1/4.2 combo module base on RTL8723DS chip, which combines MCU with SDIO and HS-UART interface, a WLAN MAC, a 1T1R capable WLAN baseband, BT Protocol Stack, BT Baseband, modem, and WLAN/BT RF in a single chip. The module provides a complete solution for a high throughput performance integrated WLAN and Bluetooth.

1.1 Features

- 👉 Operating Frequencies: 2.4~2.4835GHz
- 👉 IEEE Standards: IEEE 802.11b/g/n
- 👉 Wireless PHY rate can reach up to 150Mbps
- 👉 Supports Bluetooth v2.1+EDR/v4.2 dual mode with simultaneously BR/EDR and LE active links
- 👉 Connect to external antenna through half hole pad
- 👉 Power Supply: 3.3V main power and 1.8V/3.3V I/O power

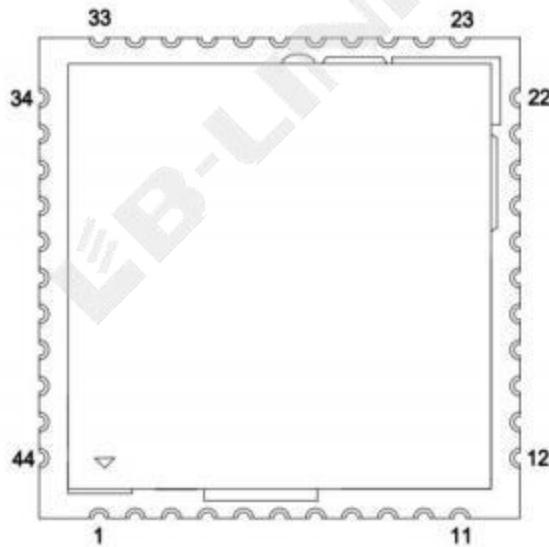
1.2 Block Diagram



1.3 General Specifications

Module Name	WG221BL
Chipset	RTL8723DS-CG
WLAN Standards	IEEE802.11b/g/n
BT Standards	Bluetooth Core Specification v4.2/2.1
Host Interface	SDIO for WLAN & UART for Bluetooth
Antenna	Connect to the external antenna through half hole pad
Dimension	12*12*2.1mm (L*W*H)
Power Supply	DC 3.3V±0.2V @ 450 mA (Max) main power DC 3.3V±0.2V or 1.8V±0.1V I/O power
Operation Temperature	-20°C to +70°C
Operation Humidity	10% to 95% RH (Non-Condensing)

2. Pin Assignments



(Top View)

2.1 Pin Definition

No	Pin Name	Type	I/O Level	Description
1	GND	RF		RF Ground connections
2	WLAN/BT ANT	RF		RF Pad for 2.4G WLAN/BT ANT
3	GND	RF		RF Ground connections
4	NC	/		NC
5	NC	/		NC
6	HOST_WAKE_DEV	I	VDIO	Shared with GPIO13. This pin can be configured as the host wakes

				up the WLAN or Bluetooth controller or both of them in Remote Wake up Mode
7	DEV_WAKE_HOST_BT	O	VDIO	Shared with GP1O14. This pin is shared with either WLAN or BT functions to wake up the host when the remote wake function is enabled. The polarity can be defined by the customer. It can be configured as shared wake up pin by both WL and BT when any of WL and BT function issue the wake signal to the host.
8	NC	/		NC
9	VDD33	P		DC 3.3V power supply
10	NC	/		NC
11	NC	/		NC
12	WL_DIS#	I	VDD33	Shared with GP1O9. This pin can externally shut down WLAN function when WL DIS # is pulled low, and SDIO interface will be also disabled. This pin can also be configured as the WLAN Radio-off function with host interface remaining connected. There is no pull-up resistor inside the module and high level input is required to enable WLAN function.
13	DEV_WAKE_HOST_WL	O	VDIO	Shared with GPIO6. This pin is shared with either WLAN or BT functions to wake up the host when the remote wake function is enabled. The polarity can be defined by the customer. It can be configured as shared wake up pin by both WL and BT when any of WL and BT function issue the wake signal to the host.
14	SD_D2	I/O	VDIO	SDIO data line
15	SD_D3	I/O	VDIO	SDIO data line
16	SD_CMD	I/O	VDIO	SDIO command line
17	SD_CLK	I	VDIO	SDIO clock input
18	SD_D0	I/O	VDIO	SDIO data line
19	SD_D1	I/O	VDIO	SDIO data line
20	GND	P		Ground connections
21	NC	/		NC
22	VDIO	P		1.8V or 3.3V power supply for some digital I/O
23	NC	/		NC
24	LPO	I	VDD33	Shared with GPIO13. External 32K or RTC clock input
25	PCM_OUT	O	VDIO	1. PCM data output, shared with GPIO1. 2. Strap Pin, internal pull low by 100K resistor to set "SPS_Mode" , do not pull High during power on!
26	PCM_CLK	I	VDIO	PCM Clock input, shared with GPIO3
27	PCM_IN	I	VDIO	PCM data input, shared with GPIO0
28	PCM_SYNC	O	VDIO	PCM synchronization control, shared with GPIO2
29	NC	/		NC

30	NC	/		NC
31	GND	P		Ground connections
32	NC	/		NC
33	GND	P		Ground connections
34	BT_DIS#	I	VDD33	Shared with GPIO11. This pin can externally shut down BT function when BT DIS # Is pulled Low, and UART interface will be also disabled. This pin can be also defined as the BT Radio-off function with host interface remaining connected. There is no pull-up resistor inside the module and high level input is required to enable BT function.
35	NC	/		NC
36	GND	P		Ground connections
37	NC	/		NC
38	NC	/		NC
39	NC	/		NC
40	NC	/		NC
41	GND	P		Ground connections. (This pin has been connected to other GNDs on the module, so it NC or connected to other signals such as UART_CTS in the customer's application circuit will not affect normal use)
42	UART_TX	O	VDIO	High-Speed UART Data output
43	UART_RX	I	VDIO	High-Speed UART Data input
44	UART_CTS	I	VDIO	High-Speed UART CTS input

P: Power, I: Input, O: Output, I/O: In/Output, RF: Analog RF Port

3. Electrical and Thermal Specifications

3.1 Recommended Operating Conditions

Parameters		Min	Typ	Max	Units
Ambient Operating Temperature		-20	25	70	°C
External Antenna VSWR			1.7	2.1	/
Supply Voltage	VDD33	3.1	3.3	3.5	V
	VDIO(3.3V)	3.1	3.3	3.5	V
	VDIO(1.8V)	1.7	1.8	1.9	V

3.2 Digital 3.3V GPIO DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	2.0	3.3	3.6	V

VIL	Input Low Voltage	--	0	0.9	V
VOH	Output High Voltage	2.97	--	3.3	V
VOL	Output Low Voltage	0	--	0.33	V

3.3 Digital 1.8V IO DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	1.3	1.8	2.0	V
VIL	Input Low Voltage	--	0	0.8	V
VOH	Output High Voltage	1.62	--	1.8	V
VOL	Output Low Voltage	0	--	0.18	V

3.4 Current Consumption

Conditions : VDD33 = 3.3V ; Ta:25°C			
Use Case	VDD33 Current		
	Typ (I _{RMS})	Max (I _{Peak})	Units
WLAN Radio Off (Linux Driver)	42	50	mA
WLAN Unassociated (Linux Driver)	40	60	mA
2.4G 11b@1Mbps TX@ 17dBm (TX RF test)	285	310	mA
2.4G 11b@1Mbps RX (RF-Test)	60	70	mA
2.4G 11b@11Mbps TX@ 17dBm (TX RF test)	280	310	mA
2.4G 11b@11Mbps RX (RF-Test)	59	70	mA
2.4G 11g@6Mbps TX@ 17dBm (TX RF test)	250	280	mA
2.4G 11g@6Mbps RX (RF-Test)	63	77	mA
2.4G 11g@54Mbps TX@ 15dBm (TX RF test)	260	270	mA
2.4G 11g@54Mbps RX (RF-Test)	60	65	mA
2.4G 11n@HT20_MCS0 TX@ 17dBm (TX RF test)	255	272	mA
2.4G 11n@HT20_MCS0 RX (RF-Test)	65	70	mA
2.4G 11n@HT20_MCS7 TX @ 14dBm (TX RF test)	220	285	mA
2.4G 11n@HT20_MCS7 RX (RF-Test)	63	70	mA
2.4G 11n@HT40_MCS7 TX@ 14dBm (TX RF test)	220	270	mA
2.4G 11n@HT40_MCS7 RX (RF-Test)	63	80	mA
BT			

BT BR_1M DH5 TX@ 5dBm (RF-Test)	125	152	mA
BT EDR_3M DH5 TX@ 5dBm (RF-Test)	119	147	mA
BT LE_1M TX@ 5dBm (RF-Test)	122	161	mA
BT BR_1M DH5 RX Active (RF-Test)	103	127	mA
BT EDR_3M DH5 RX Active (RF-Test)	102	130	mA
BT LE_1M RX Active (RF-Test)	110	133	mA

4. WLAN RF Specifications

4.1 2.4G WLAN RF Specification

Conditions : VDD33 = 3.3V ; Ta:25°C			
Features	Description		
WLAN Standard	IEEE 802.11b/g/n		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Ch1~Ch13 (For 20MHz Channels)		
Modulation	802.11b (DSSS): DBPSK, DQPSK, CCK; 802.11g (OFDM): BPSK, QPSK, 16QAM, 64QAM; 802.11n (OFDM): BPSK, QPSK, 16QAM, 64QAM;		
Date Rate	802.11b: 1, 2, 5.5, 11Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps; 802.11n (HT40): MCS0~MCS7(1T1R_SISO) 13.5~150Mbps;		
Frequency Tolerance	≤ ±20ppm		
2.4G Transmitter Specifications			
TX Rate	TX Power (dBm)	TX Power Tolerance (dBm)	EVM (dB)
802.11b@1Mbps	Recommended Target TX Power =17	±1.5	≤-10
802.11b@11Mbps	Calibrated TX Power =17	±1.5	≤-12
802.11g@6Mbps	Recommended Target TX Power ≤17	±1.5	≤-10
802.11g@54Mbps	Calibrated TX Power =15	±1.5	≤-25
802.11n@HT20_MCS0	Recommended Target TX Power ≤17	±1.5	≤-10
802.11n@HT20_MCS7	Calibrated TX Power =14	±1.5	≤-28
802.11n@HT40_MCS0	Recommended Target TX Power ≤17	±1.5	≤-10
802.11n@HT40_MCS7	Calibrated TX Power =14	±1.5	≤-28
2.4G Receiver Specifications			

RX Rate	Min Input Level (Typ, dBm)	Max Input Level (Typ,dBm)	PER
802.11b@1Mbps	-93	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-90	-15	< 10%
802.11g@54Mbps	-72	-15	< 10%
802.11n@HT20_MCS0	-88	-15	< 10%
802.11n@HT20_MCS7	-67	-15	< 10%
802.11n@HT40_MCS0	-86	-15	< 10%
802.11n@HT40_MCS7	-66	-15	< 10%

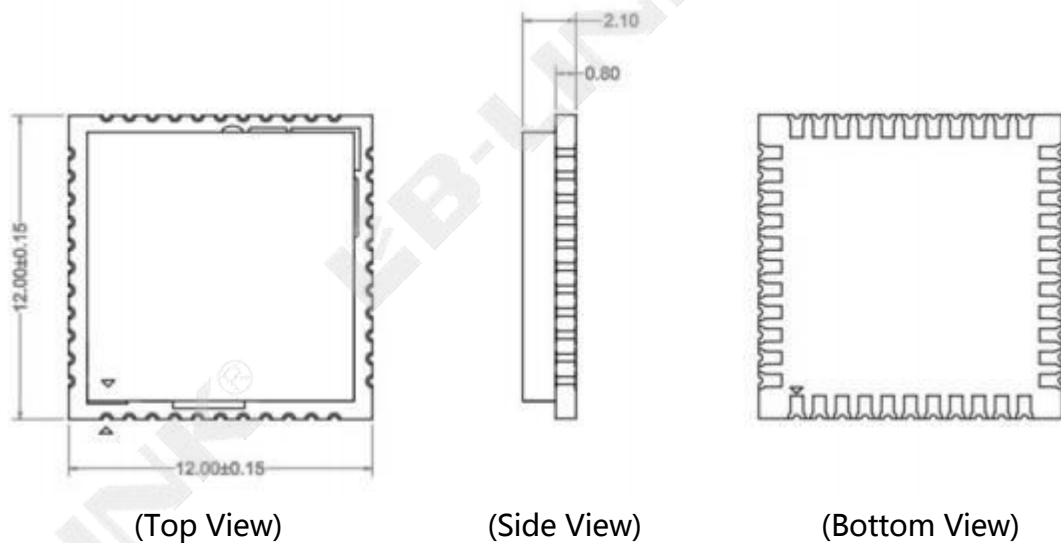
4.2 Bluetooth RF Specification

Conditions : VDD33 = 3.3V ; Ta:25°C			
Features	Description		
Bluetooth Specification	Bluetooth Core Specification v4.2/v2.1		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);		
Power Classes	Bluetooth Classic: Class1; Bluetooth Low Energy: Class1.5;		
Date Rate & Modulation	BR_1Mbps: GFSK; EDR_2Mbps: $\pi/4$ -DQPSK; EDR_3Mbps: 8DPSK; LE_1Mbps: GFSK;		
Bluetooth Transmitter Specifications			
Items	Min (dBm)	Typ (dBm)	Max (dBm)
TX Power			
BR_1M TX Power	2	5	8
EDR_2/3M TX Power	2	5	8
LE_1M TX Power	2	5	8
BR_1M(DH1) Modulation Characteristics			
Δf_{1avg}	140KHz	166.26KHz	175KHz
Δf_{2avg}	140KHz	156.33KHz	175KHz
Δf_{2max}	115KHz	152.29KHz	/
$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	1.09	/
EDR_3M(3DH5) Modulation Accuracy			
8DPSK RMS DEVM	/	0.047	0.13
8DPSK DEVM	/	0.089	0.25
LE_Modulation characteristics			

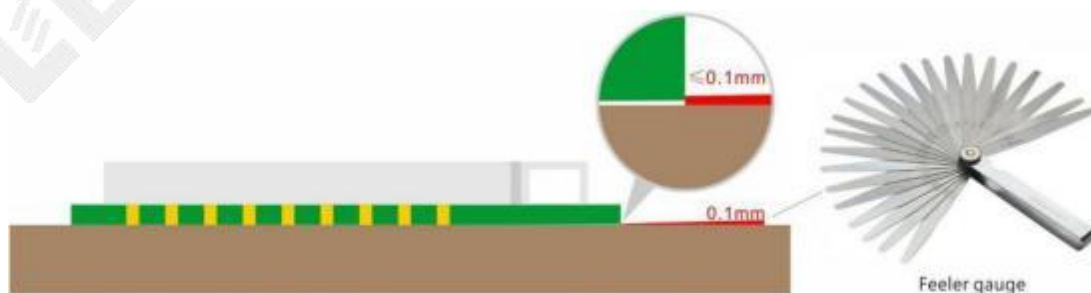
Δf_{1avg}	225kHz	251.7kHz	275kHz	
Δf_{2avg}	180KHz	241.2KHz	275kHz	
Δf_{2max}	185kHz	244.7kHz	/	
$\Delta f_{2avg} / \Delta f_{1avg}$	0.8	0.93	/	
Bluetooth Receiver Specifications				
Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	BER	Input Level(Typ)	BER
BR_1M (DH1)	-88dBm	$\leq 0.1\%$	-20dBm	$\leq 0.1\%$
EDR_3M(3DH5)	-82dBm	$\leq 0.01\%$	-20dBm	$\leq 0.1\%$
Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	PER	Input Level(Typ)	PER
LE_1M	-87dBm	$\leq 5\%$	-20dBm	$\leq 5\%$

5. Mechanical Specifications

5.1 Module Outline Drawing

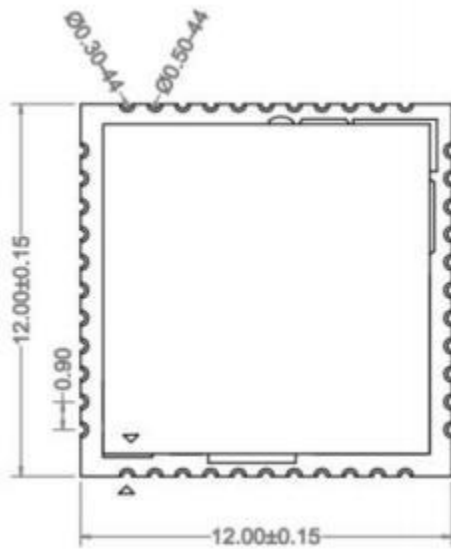


Module dimension: 12.0*12.0*2.1mm (L*W*H; Tolerance: $\pm 0.15\text{mm}$)

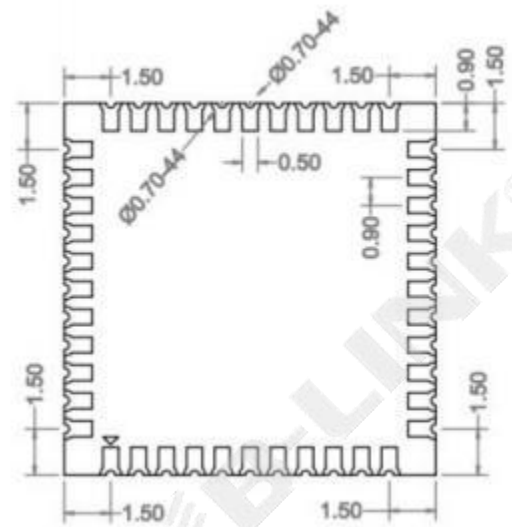


Module Bow and Twist : $\leq 0.1\text{mm}$

5.2 Mechanical Dimensions



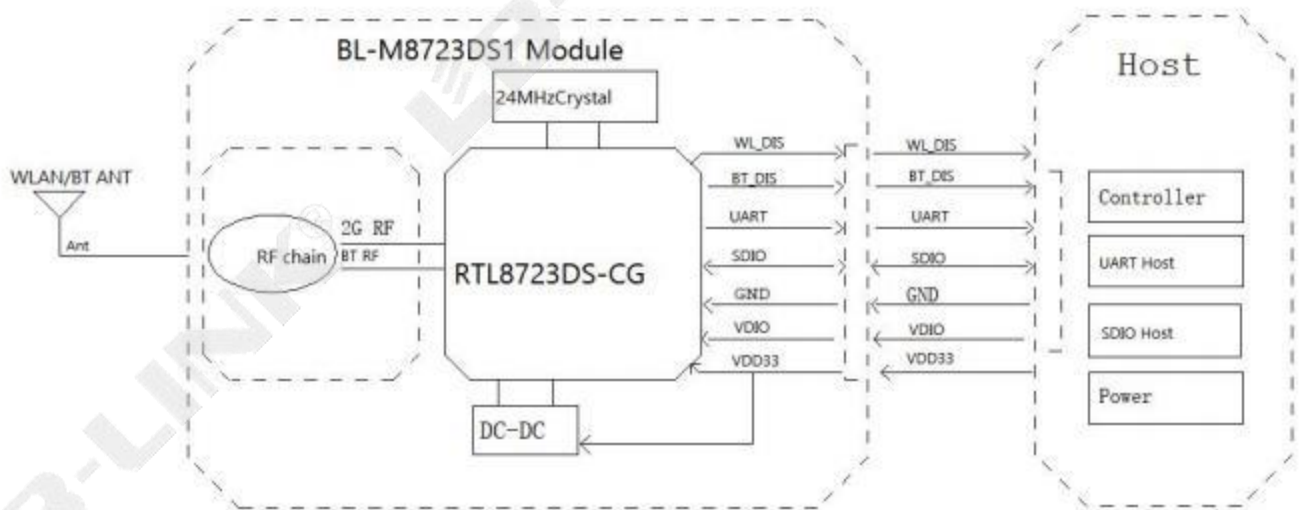
(Top View)



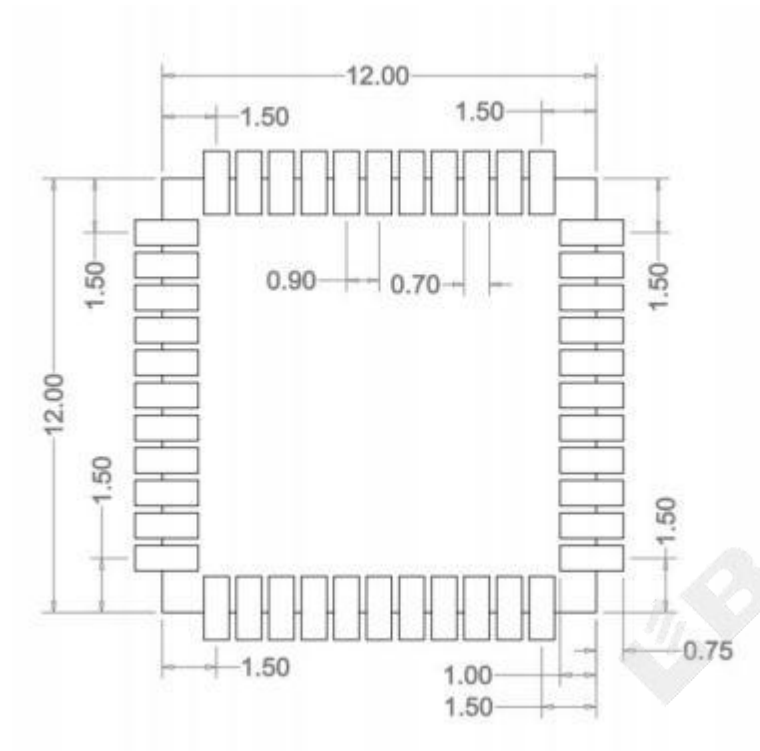
(Bottom View)

6. Application Information

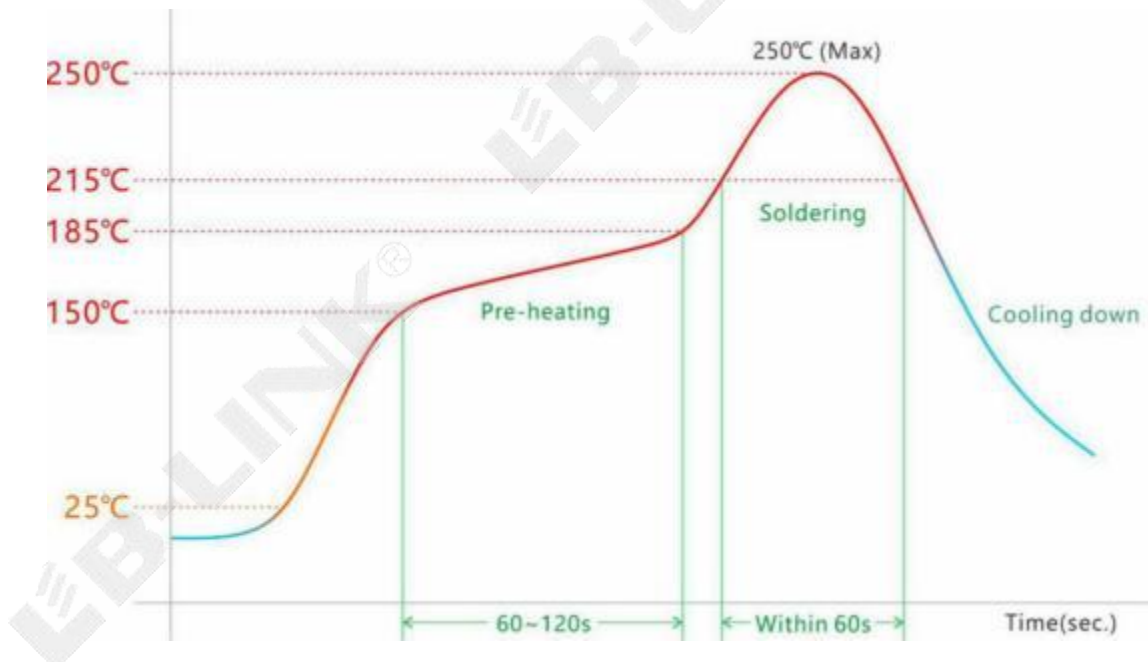
6.1 Typical Application Circuit



6.2 Recommend PCB Layout Footprint



6.3 Reflow Soldering Standard Conditions



Please use the reflow within 2 times.

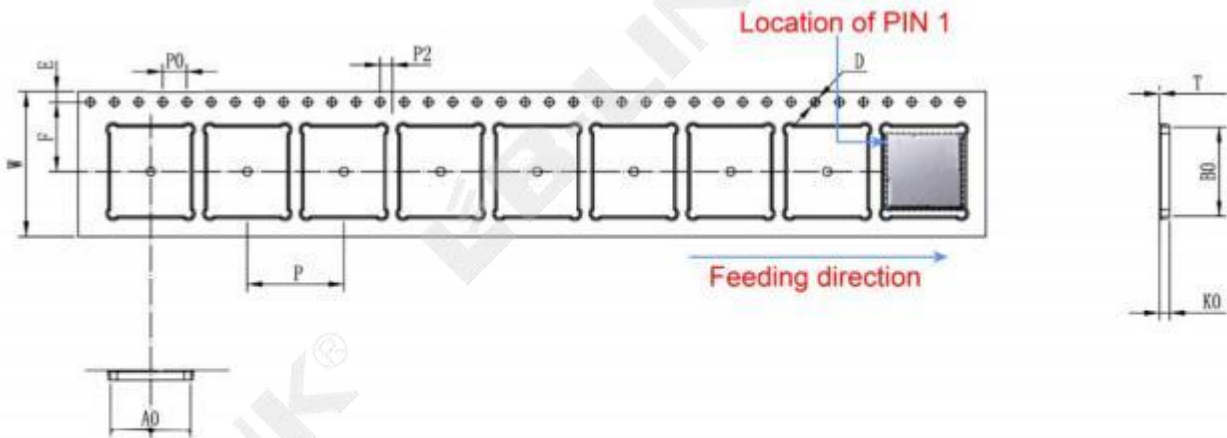
Set up the highest temperature within 250°C.

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8723DS-CG	Realtek	
2	PCB	BL-M8723DS1	Shen Zhen Tie Fa Technology limited	
			Guangdong KINGSHINE ELECTRONICS CO., LTD	
			Quzhou Sunlord Electronics Co., Ltd	
3	Crystal	24MHz-2520	Hubei TKD Electronics Technology Co., Ltd	
			LUCKI CM ELECTRONICS CO., LTD	
			HOSONIC ELECTRONIC CO., LTD.	
			SHENZHENKAIYUEXIANGELECTRONICS CO., LTD JinHua East Crystal Electronic Co.,Ltd.	

8. Package and Storage Information

8.1 Package Dimensions



ITEM	W	AO	BO	KO	E	F	P	P0	P2	D	T
DIM	24.00±0.3	12.50±0.1	12.50±0.1	2.40±0.1	1.75±0.1	11.5±0.1	20.00±0.1	4.00±0.1	2.00±0.1	Ø1.5±0.1	0.30±0.05



Package specification:

1. 1,000 modules per roll and 5,000 modules per box.
2. Outer box size: 37.5*36*29cm.
3. The diameter of the blue environment-friendly rubber plate is 13 inches, with a total thickness of 28mm (with a width of 24mm carrying belt).
4. Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
5. Each carton is packed with 5 boxes.

8.2 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40°C to +85°C

Storage humidity: 10% to 95% RH (Non-Condensing)

Recommended Storage Conditions:

Storage temperature: 5°C to +40°C

Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.

The Module shall be stored without opening the packing.

After the packing opened, the Module shall be used within 72hours.

When the color of the humidity indicator in the packing changed,

The Module shall be baked before soldering.

Baking condition: 60°C, 24hours, 1time.

ESD Sensitivity :

ESD Protection: 2KV(HBM ,Maximum rating)

The Module is a static-sensitive electronic device.

Do not operate or store near strong electrostatic fields.

Take proper ESD precautions!



ESD CAUTION

Note1:

This modular 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.

Note2:

This modular complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Note3:

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module:

“Contains Transmitter Module FCC ID: 2ACOE-WG221BL” or “Contains FCC ID: 2ACOE-WG221BL” must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

Note4:

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

Note5:

1) List of applicable FCC rules:

FCC part 15.247

2) Summarize the specific operational use conditions

This Device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. The host product manufacturer should state this information to the host instruction manual.

3) Limited module procedures:

No applicable.

4) Trace antenna designs

No applicable.

5) RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, and minimum of 20cm separation between antenna and body. The host product shall show the same or similar statement to the end users.

6) Antennas

Antenna types not included in this list, having a gain greater than the maximum gain indicated.

For that type, are strictly prohibited for use with this device.

Antenna type: External Antenna

Bluetooth Antenna Max. Gain:3.81dBi
BLE AntennaMax.Gain:3.81dBi
Each 2.4G WIFI Antenna Max. Gain: 3.81dBi

7) Label and compliance information

The end product must carry a label stating "Contains Transmitter Module FCC ID: 2ACOE-WG221BL" or shall use e-labeling.

8) Information on test modes and additional testing requirements

The host manufacturer can use the software "RTLBTAPP 5.2.2.73" and "Bluetooth RF Test Tool 5.3.1.45" for access to the test modes. Connected to the computer through the serial port of the host product, the channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

9) Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) list on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuitry.

10) The device is going to be operated in 2402-2480MHz frequency range. It is restricted indoor environment only.

11) The device working temperature -20 °C to +70 °C

12) The device working voltage 3.3V±10%

13) Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.