



BL-M8723DU1

802.11b/g/n150Mbps WLAN+

Bluetooth v4.2

Combo USB Module Specification

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(Top View)



(Bottom View)

Module Name: BL-M8723DU1	
Module Type: 802.11b/g/n 150Mbps WLAN + Bluetooth v4.2 Combo USB Module	
Revision: V1.0	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date	Revised By
1.0	Official release	2024-03-19	Garry

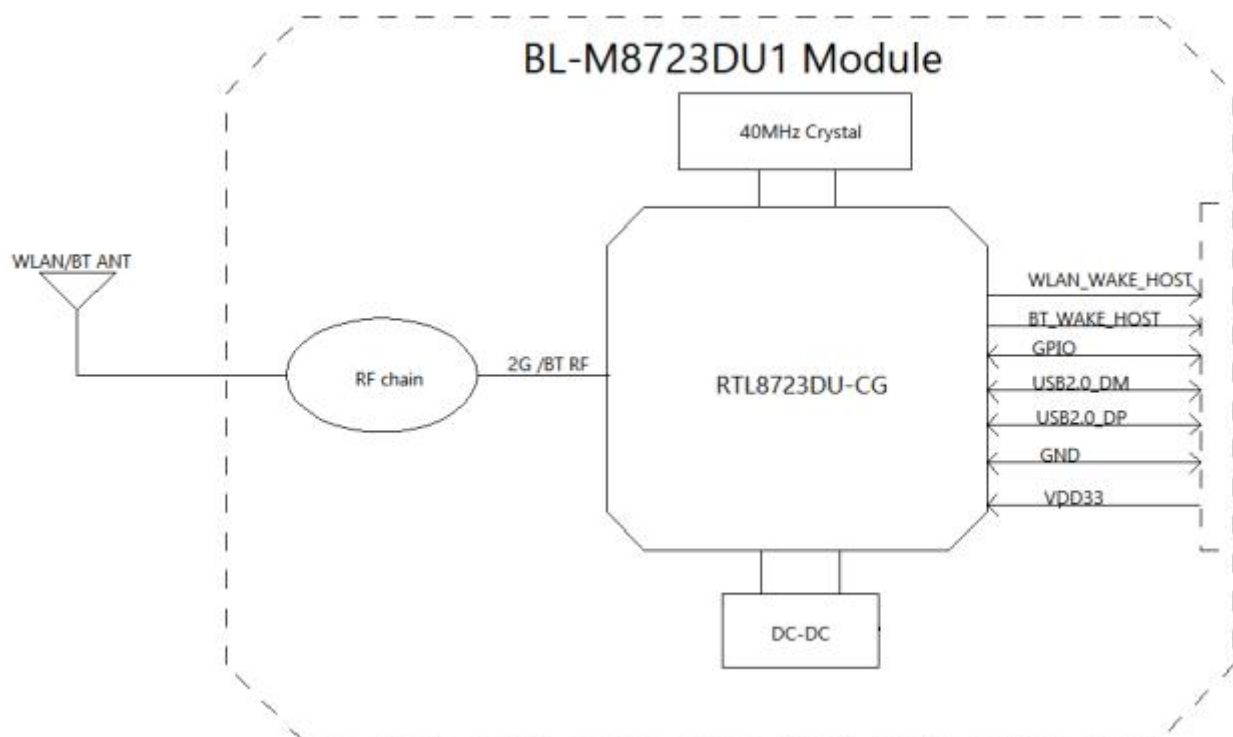
1. Introduction

BL-M8723DU1 is a highly integrated single-band WLAN + Bluetooth v4.2 Combo USB Module. It compatible IEEE802.11b/g/n standard and provides the maximum PHY rate up to 150Mbps. Supports Bluetooth dual mode with BT v2.1/v4.2 compliant, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective, high throughput from an extended distance.

1.1 Features

- Operating Frequencies: 2.4~2.4835GHz
- Complies with USB2.0 for WLAN and BT controller
- IEEE Standards: IEEE 802.11b/g/n
- Wireless PHY rate can reach up to 150Mbps
- Bluetooth v4.2 Dual Mode support Simultaneous LE and BR / EDR
- Connect to external antenna through half hole

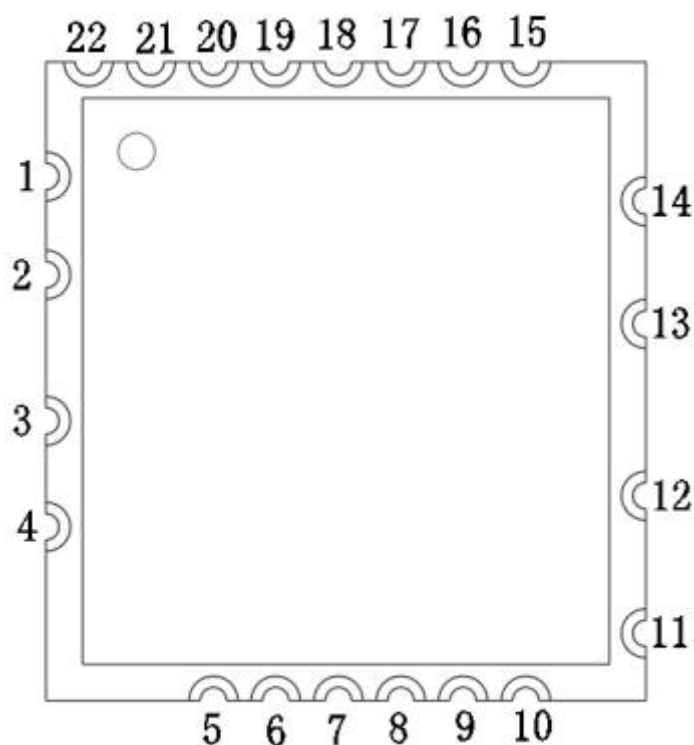
1.2 Block Diagram



1.3 General Specifications

Module Name	BL-M8723DU1
Chipset	RTL8723DU-CG
WLAN Standards	IEEE802.11b/g/n
Bluetooth Standards	Bluetooth Core Specification v2.1/v4.2
Host Interface	USB2.0 for WLAN & Bluetooth
Antenna	Connect to the external antenna through half hole pad
Dimension	12.9*12.2*2.3mm
Power Supply	DC 3.3V±0.2V @ 500 mA (Max)
Operation Temperature	-20°C to +70°C
Operation Humidity	10% to 95% RH (Non-Condensing)

2. Pin Assignments



2.1 Pin Definition

No	Pin Name	Type	I/O Level	Module Pin Description
1	GND	RF		RF Ground
2	WLAN/BT_ANT	RF		RF PAD for WLAN/BT_ANT0
3	NC	--		NC (Reserved RF PAD for WLAN/BT_ANT1)
4	GND	RF		RF Ground
5	BT_PCM_IN	I/O		Shared with GPIO0,General Purpose Input/Output Pin
6	BT_PCM_OUT	I/O		Shared with GPIO1,General Purpose Input/Output Pin
7	BT_PCM_SYNC	I/O		Shared with GPIO2,General Purpose Input/Output Pin
8	BT_PCM_CLK	I/O		Shared with GPIO3,General Purpose Input/Output Pin
9	BT_WAKE_HOST	O	VDD33	1.General Purpose Input / Output GPIO14 2.Bluetooth device to wake-up Host output
10	HOST WAKE BT	I	VDD33	1.General Purpose Input / Output GPIO13 2.Host to wake-up this Bluetooth device input
11	VDD33	P		Power supply 3.3V
12	USB2.0-DM	AI/O		USB2.0 data-
13	USB2.0-DP	AI/O		USB2.0 data+
14	GND	P		Ground Connection
15	NC	--		NC Connection
16	WL_DIS#	I	VDD33	1.Shared with GPIO9,This Pin Can Externally Shutdown the RTL8723DU WLAN function when WL_DIS# is Pulled Low. When this pin deasserted, USB interface will be disabled 2.This pin can also support the WLAN Radio-off function with host interface remaining connected 3.internal pull high by 100K resistor.
17	BT_DIS#	I	VDD33	1.Shared with GPIO11,This Pin Can Externally Shutdown the RTL8723DU BT function when BT_DIS# is Pulled Low 2.This pin can also support the BT Radio-off function with host interface remaining connected 3.internal pull high by 100K resistor
18	NC	--		NC Connection
19	HOST WAKE WL	I	VDD33	1.General Purpose Input / Output GPIO8 2.HOST to wake-up WLAN input
20	WL_WAKE_HOST	O	VDD33	1.General Purpose Input / Output GPIO6 2.WLAN to wake-up Host output 3.internal pull high by 100K resistor

21	NC	--		NC Connection
22	NC	--		NC Connection

P: Power; I: Input; O: Output; I/O: In/Output; A I/O: Analog; 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	2.0	/
Supply Voltage	VDD33	3.1	3.3	3.5	V

3.2 Digital I/O 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 Current Consumption

Conditions : VDD33=3.3V ; Ta:25°C ;			
Use Case	VDD33 Current (average)		
	Typ	Max	Units
WLAN Unassociated (Linux Driver)	120	130	mA
2.4G 11b 1Mbps TX @ 17dBm (TX RF test)	320	330	mA

2.4G 11b 11Mbps TX @ 17dBm (TX RF test)	285	300	mA
2.4G 11n HT20-MCS7 RX (RX RF test)	92	96	mA
2.4G 11n HT40-MCS0 TX @ 16dBm (TX RF test)	238	246	mA
2.4G 11n HT40-MCS7 TX @ 14dBm (TX RF test)	180	190	mA
BT BR_1M TX@4dBm	159	186	mA
BT BR_1M RX Active	138	165	mA

4. WLAN & Bluetooth 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,CSMA/CA		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Modulation	802.11b DSSS: CCK, DQPSK, DBPSK 802.11g OFDM: 64QAM,16QAM, QPSK, BPSK 802.11n OFDM: 64QAM,16QAM, QPSK, BPSK		
Data Rate	802.11b: 1, 2 ,5.5,11Mbps, 802.11g: 6,9,12,18,24,36,48,54Mbps, 802.11n-HT20: MCS0~7, 6.5~72.2Mbps, 802.11n-HT40: MCS0~7, 13~150Mbps,		
Frequency Tolerance	≤ ±20ppm		
2.4G Transmitter Specifications (ANT0. TX power of some rates is calibrated, customers can define the target TX power of other rates by modifying configuration file of the driver software. Customers must define the TX power same or lower than recommended Target TX Power as below)			
TX Rate	TX Power(dBm)	TX Power Tolerance(dBm)	EVM(dB)
802.11b@1Mbps	Recommended Target TX Power 17	±2	≤-10
802.11b@11Mbps	Calibrated TX Power 17	±2	≤-10
802.11g@6Mbps	Recommended Target TX Power 16	±2	≤-10
802.11g@54Mbps	Calibrated TX Power 14	±2	≤-25
802.11n@HT20_MCS0	Recommended Target TX	±2	≤-10

	Power 16		
802.11n@HT20_MCS7	Calibrated TX Power 14	± 2	≤ -28
802.11n@HT40_MCS0	Recommended Target TX Power 16	± 2	≤ -10
802.11n@HT40_MCS7	Calibrated TX Power 14	± 2	≤ -28
2.4G Receiver Specifications			
RX Rate	Min Input Level(dBm)	Max Input Level(dBm)	PER
802.11b@1Mbps	-92	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-89	-20	< 10%
802.11g@54Mbps	-72	-20	< 10%
802.11n@HT20_MCS0	-88	-20	< 10%
802.11n@HT20_MCS7	-69	-20	< 10%
802.11n@HT40_MCS0	-87	-20	< 10%
802.11n@HT40_MCS7	-67	-20	< 10%

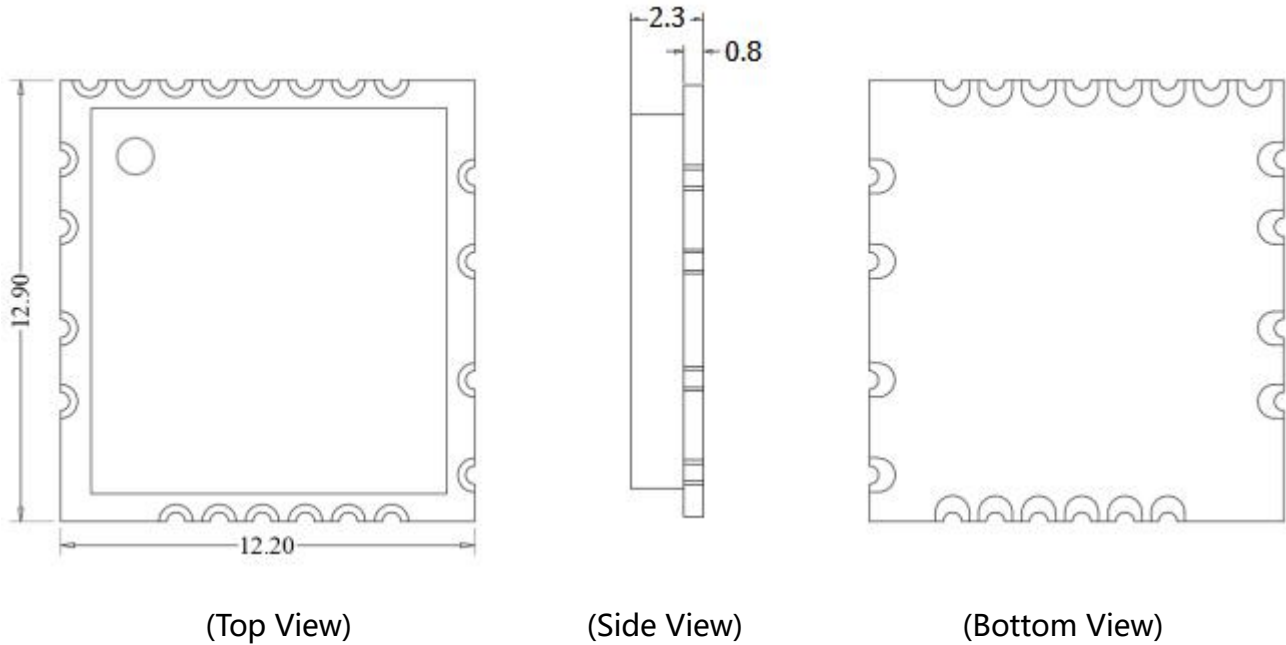
4.2 Bluetooth RF Specification

Conditions: VDD33=3.3V; Ta:25°C			
Features	Description		
Bluetooth Specification	Bluetooth Core Specification v2.1/v4.2		
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;		
Data Rate & Modulation	BR_1Mbps: GFSK; EDR_2Mbps: $\pi/4$ -DQPSK; EDR_3Mbps: 8DPSK; LE_1Mbps: GFSK (Uncoded);		
Bluetooth Transmitter Specifications			
Items	Min	Typ	Max
TX Power			

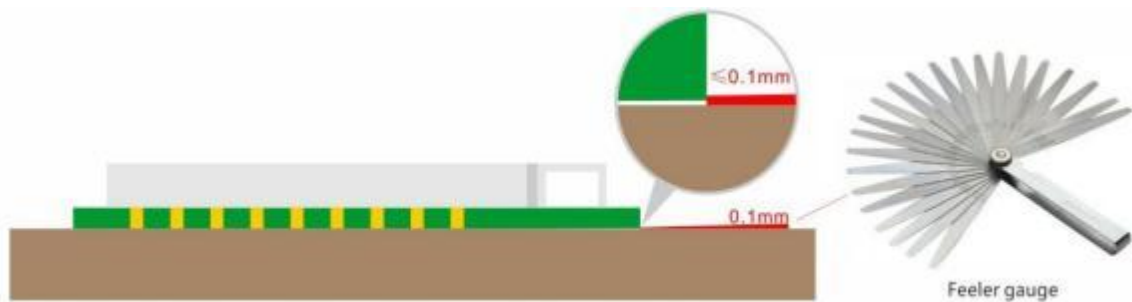
BR_1M	0dBm	4dBm	6dBm	
EDR_2/3M	0dBm	4dBm	6dBm	
LE_1M	0dBm	4dBm	6dBm	
Items	Min	Typ	Max	
BR_1M (DH1) Modulation Characteristics				
Δf1avg	140KHz	165.4kHz	175KHz	
Δf2avg	140KHz	148.51kHz	175KHz	
Δf2max	115KHz	154.7kHz	/	
Δf2avg/Δf1avg	0.8	0.91	/	
BR_1M (DH1) Initial Carrier Frequency Tolerance				
Init Freq Error	-75kHz	-10.3kHz	+75kHz	
EDR_3M(3DH5) EDR Carrier Frequency Stability and Modulation Accuracy				
ωi	-75KHz	-9.03KHz	+75KHz	
ωi+ωo	-75KHz	-9.86KHz	+75KHz	
ωo	-10KHz	-0.81KHz	+10KHz	
8DPSK RMS DEVM	/	0.042	0.13	
8DPSK DEVM	/	0.09	0.25	
LE_1M Modulation Characteristics				
Δf1avg	225KHz	259.87KHz	275KHz	
Δf2avg	225KHz	244.49KHz	275KHz	
Δf2max	185KHz	236.7KHz	/	
Δf2avg/Δf1avg	0.8	0.93	/	
Bluetooth Receiver Specifications				
Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	BER	Input Level(Typ)	BER
BR_1M (DH1)	-90dBm	≤0.1%	-5dBm	≤0.1%
EDR_3M (3DH5)	-85dBm	≤0.01%	-5dBm	≤0.1%
	Input Level (Typ)	PER	Input Level (Typ)	PER
LE_1M	-87dBm	≤5%	-5dBm	≤5%

5. Mechanical Specifications

5.1 Module Outline Drawing

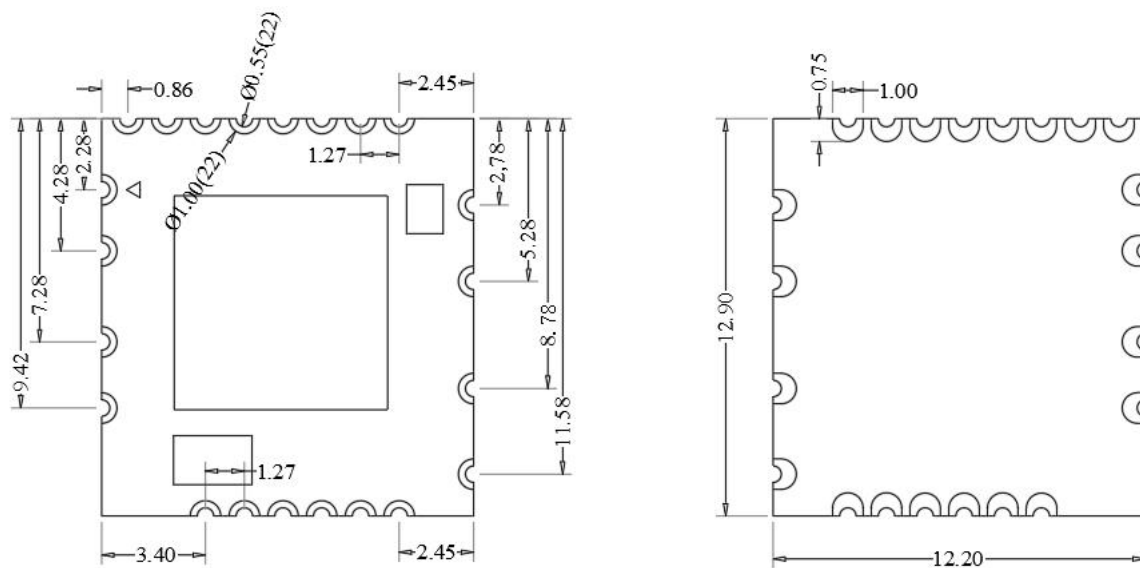


Module dimension: 12.9*12.2*2.3mm (L*W*H; Tolerance: $\pm 0.3\text{mm}_L/W$, $\pm 0.2\text{mm}_H$)



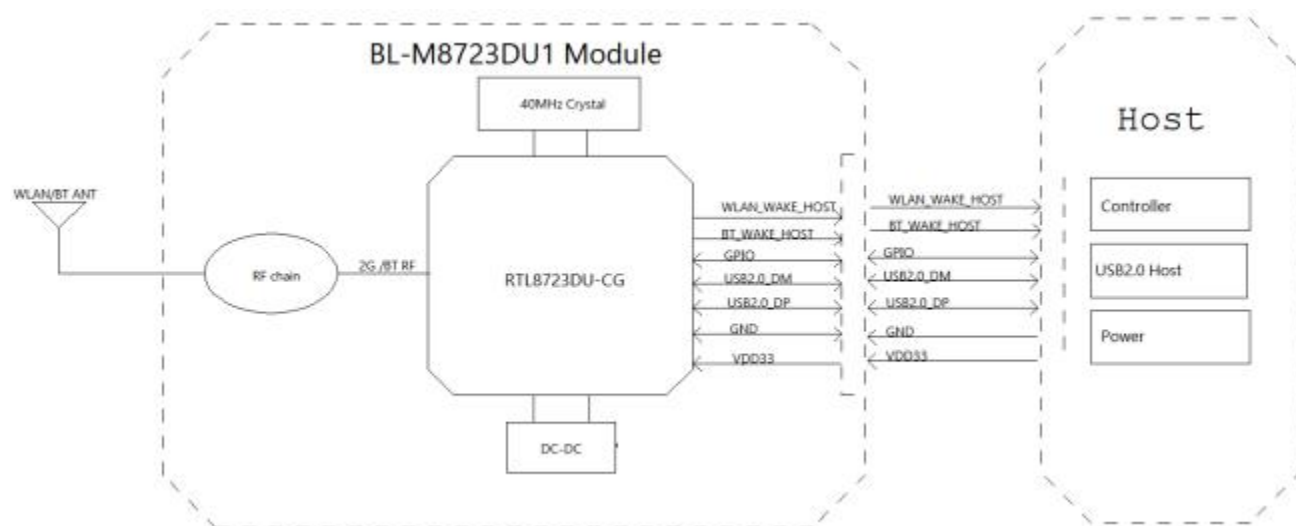
Module Bow and Twist: $\leq 0.1\text{mm}$

5.2 Mechanical Dimensions



6. Application Information

6.1 Typical Application Circuit



6.2 HW Application Note

6.2.1 VDD33 Power requirement:

- A、DC 3.1~3.5V & Ripple Voltage <100mV power supply input, Maximum Peak current $\geq$ 0.5A.
- B、For achieve fast transient response, a current mode buck converter recommended.
- C、On customer's motherboard, use 10uF and 100nF MLCC capacitors close to the module's VDD33 Pin for power input decoupling. Each GND Pin has three close vias to ensure connectivity and thermal conductivity.

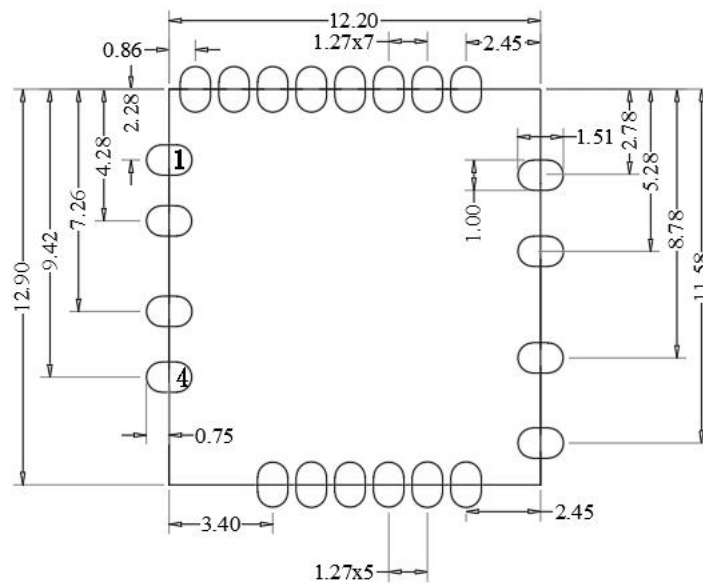
6.2.2 USB interface Design Guidelines:

- A、The module provides a USB device interface which is compatible with USB2.0 specification, High-Speed mode supports data transmission rate up to 480Mbps.
- B、On customer's motherboard, PCB traces of the USB high-speed signal pair should be maintain 90 Ω differential impedance, structure of "Differential Coated Coplanar Waveguide With Ground" with the advantages of impedance control and GND surrounding isolation interference may be an ideal choice. To avoid interference, USB signal pair must be far away from power, RF and other signals, GND copper can be used to surround and isolate them.
- C、PCB traces of the USB high-speed signal pair as short as possible, as far away from other signal as possible, minimize the length mismatch of signal pair, avoid layer change and maintain a complete reference layer to reduces signal reflections and impedance changes.
- D、If It is necessary to change layers for USB signal pair routing, use GND vias close to signal pair's vias as the shortest return path.

6.2.3 RF Path Design Guidelines:

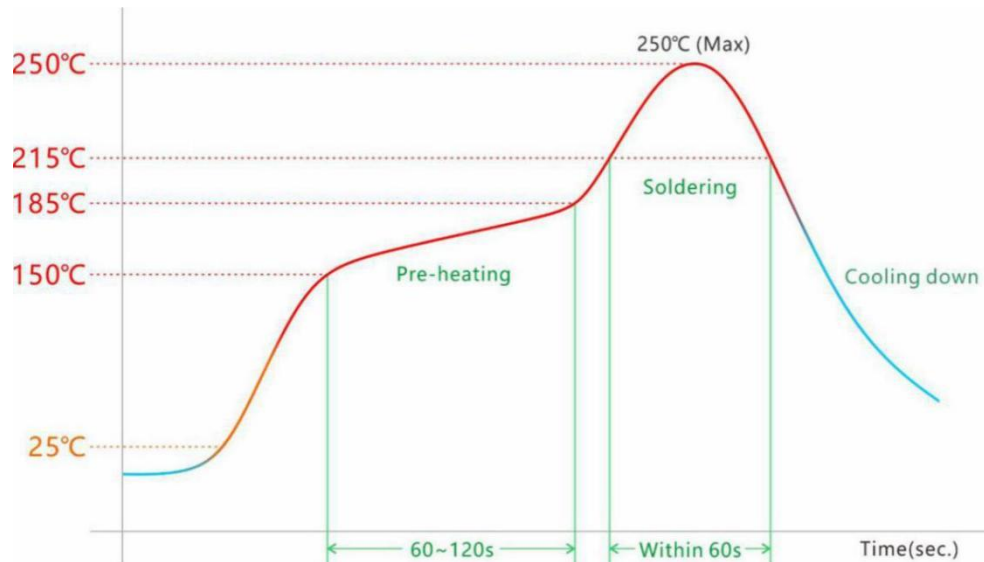
- A、On customer's motherboard, keep complete GND copper area under and around the module, do not route Power, RF, USB and other signals there to avoid interfering with the module causing RF performance derating problem.
- B、PCB traces of the RF path as short as possible, as far away from other signal as possible, avoid layer change, and should be maintain continuous 50 Ω characteristic impedance, structure of "Coated Coplanar Waveguide With Ground" with the advantages of impedance control and GND surrounding isolation interference may be an ideal choice. It is necessary to maintain a complete GND reference layer below the RF path area.
- C、RF Pin and antenna PAD/RF connector PAD on customer's motherboard are significantly wider than PCB traces of the RF path, which will cause RF impedance discontinuity. To improve this problem, in addition to adjusting the local impedance of these PADs, a " π " circuit can be reserved near the antenna/RF connector which can match both RF path impedance and antenna impedance.

6.3 Recommend PCB Layout Footprint



(Design Unit:mm)

6.4 Reflow Soldering Standard Conditions



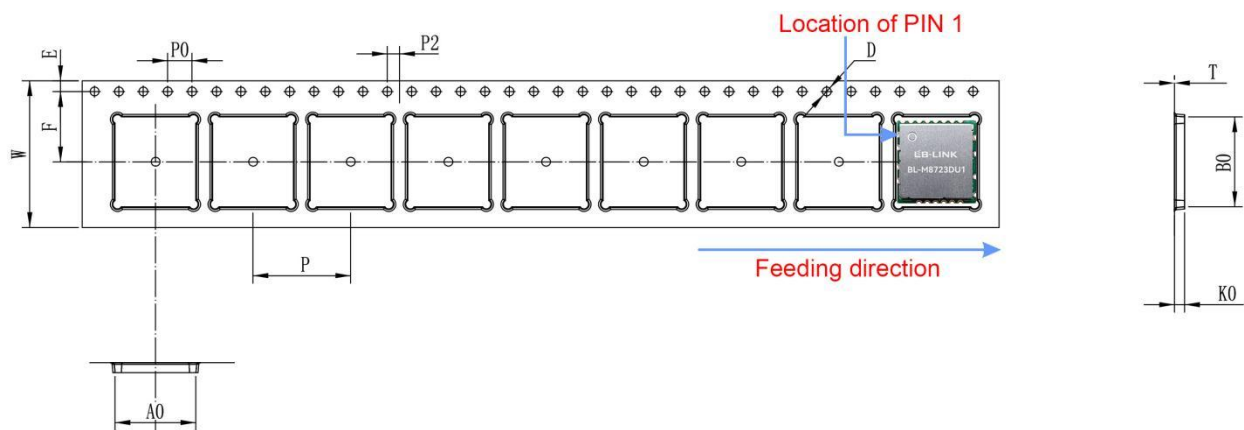
Please use the reflow within 2 times.
Set up the highest temperature within 250°C.

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8723DU-CG	Realtek Semiconductor Corp.	
2	PCB	BL-M8723DU1	ShenZhen Tie Fa Technology Limited	
			MILLION SOURCE PRINTED CIRCUIT BOARD CO.,LTD	
			SHEN ZHEN QILI ELECTRON CO.,LTD	
3	Crystal	40MHz-3225	LUCKI CM ELECTRONICS CO.,LTD	
			JinHua East Crystal Electronic CO.,LTD	
			Chengde oscillator Electronic Technology CO.,LTD	

8. Package and Storage Information

8.1 Package Dimensions



ITEM	W	A0	B0	K0	E	F	P	P0	P2	D	T
DIM	24.00±0.3	12.70±0.1	13.60±0.1	2.50±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 1 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**

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, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation.
- 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.

This modular has been tested and found to comply with part 15 requirements for Modular Approval.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC Part 15 Subpart C and Subpart F has been investigated. It is applicable to the modular transmitter

2.3 Specific Operational Use Conditions - Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

- The antenna must be installed such that 20cm is maintained between the antenna and users,
- The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot 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 cannot 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.

2.4 Limited Module Procedures

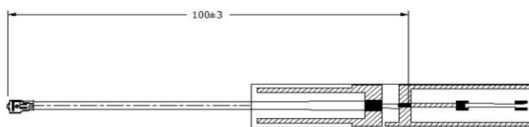
Not applicable

2.5 Trace Antenna Designs

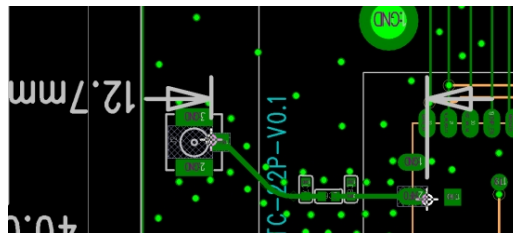
PCB antenna specification

Below is chip antenna specification

You can see antenna size is 47(L)mm*8(W)mm*0.17(T)mm From below specification.



The cable is RF-Φ 1.13 cable with IPEX and length is 100mm



Note:PCB is RF-4 material, 0.6 m thick; four solderjoints on PCB for OSP process or tinning.

The module needs to be attached to the PCB board and connected to the external antenna through the solder joint of the circuit on the PCB. the internal structure is FPC. A resistance of 0R is added between the module and the antenna at C6 to ensure that the impedance of the connection between the module and the antenna reaches 50R. The IPEX position on the PCB is where the external antenna is connected.

2.6 RF Exposure Considerations

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

2.7 Antenna Type and Gain

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module.

Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

Antenna Specification list below:

Antenna Type	Antenna Model No.	Maximum Antenna Gain (dBi)	Frequency Range
PCB Antenna	BL-M8723DU1	2.50	2400 – 2500 MHz

2.8 End Product Labelling Compliance Information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: “ Contains FCC ID: **2AL6KBLM8723DU1** ” . The FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on Test Modes and Additional Testing Requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new FCC authorization.

Host manufacturer installed this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, 15.209, 15.207 requirement, then the host can be sold legally.

2.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rules requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rules requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this modular installed.

2.11 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.

The host integrator must follow the integration instructions provided in this document and ensure that the composite system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369 .

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB Publication 996369.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and RF Exposure essential requirements of the FCC rules.

2.12 How to Make Changes - Important Note

In the event that these conditions cannot 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 cannot 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.