BL-M8723CS2

802.11n 150Mbps WLAN+BLE v4.1

SDIO Module Specification

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(Top View)

(Bottom View)

Module Name: BL-M8723CS2	
Module Type:802.11b/g/n 150Mbps WLAN + Bluetooth BLE v4.1 SDIO Module	
Revision: V0.1	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date	Revised By
0.1	Official release	2024-11-13	Ch

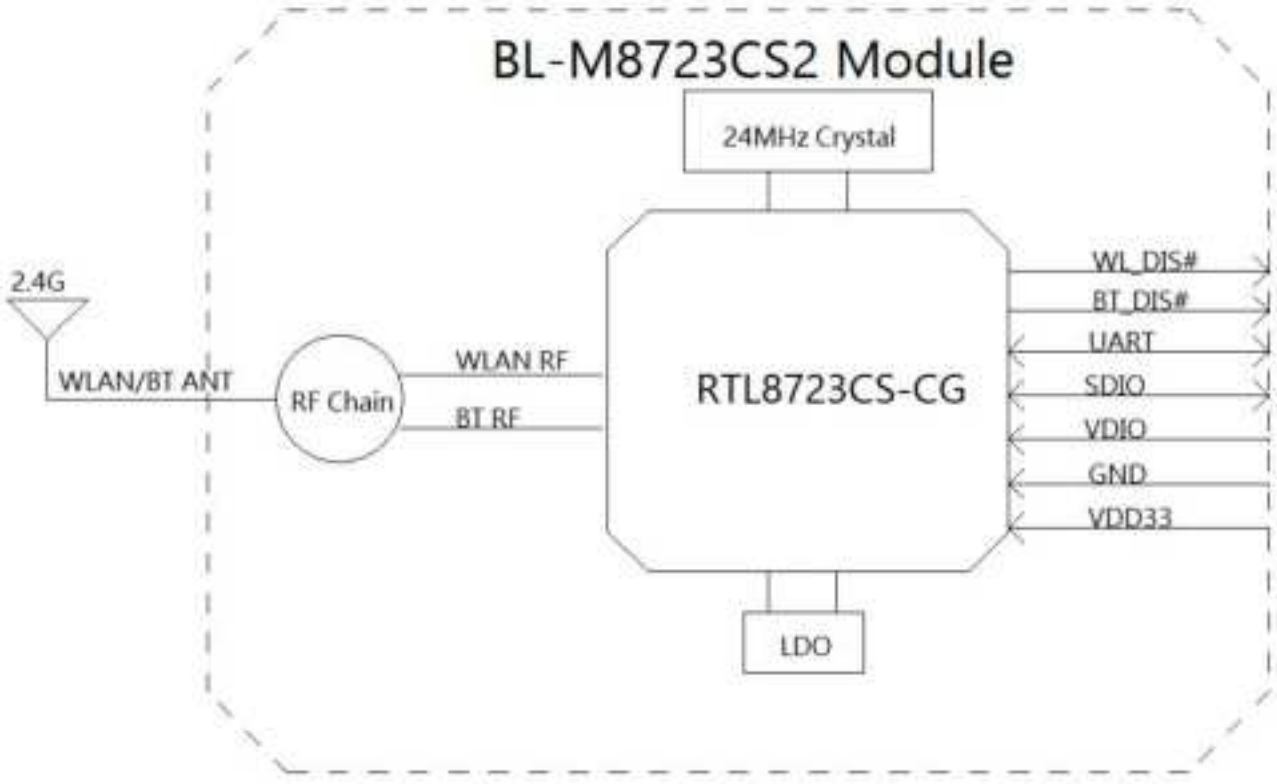
1. Introduction

BL-M8723CS2 is a highly integrated IEEE802.11b/g/n WLAN and Bluetooth BLE4.0/4.1 combo module base on RTL8723CS chip, which combines MCU with SDIO and HS-UART interface, a WLAN MAC, a 1T1R capable WLAN base band, BT Protocol Stack, BT Base band, 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 SDIO 2.0/GSPI interface
- Connect to external antenna through half hole pad
- Power Supply: 3.3V main power and 1.8V/3.3V I/O power

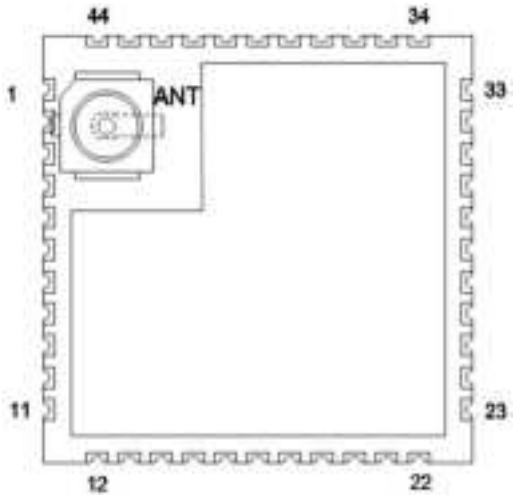
1.2 Block Diagram



1.3 General Specifications

Module Name	BL-M8723CS2
Chipset	RTL8723CS-CG
WLAN Standards	IEEE802.11b/g/n
BT Standards	Bluetooth BLE Core Specification v4.1
Host Interface	SDIO for WLAN & UART for Bluetooth
Antenna	Connect to the external antenna through half hole pad
Dimension	12*12*2.2mm (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℃ to +70℃
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	NC	RF		Reserve 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 GPIO12. 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 WLAN and BT when any of WLAN 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	VDIO	Shared with GPIO9. This Pin Can Externally Shutdown the RTL8723CS WLAN function when WL_DIS# is pulled low. When this pin deasserted, SDIO interface will be disabled. This pin can also support the WLAN radio-off function with host interface remaining connected. When BT_DIS# is also deasserted, RTL8723CS will enter the whole chip reset state.
13	DEV_WAKE_HOST_WL	I/O	VDD33	Function1. General Purpose Input / Output Pin GPIO8 Function2. WLAN to wake-up Host output Function3. BT UART Data In Function4. LED Pin (Active Low) Internal pulled low by 100K resistor
14	SD_D2	I/O	VDIO	SDIO data line 2 / GSPI_CSn (GSPI Chip Select)
15	SD_D3	I/O	VDIO	SDIO data line 3
16	SD_CMD	I/O	VDIO	SDIO command line / GSPI_DI (GSPI Data Input)
17	SD_CLK	I	VDIO	SDIO clock input / GSPI_CLK (GSPI Clock Input)
18	SD_D0	I/O	VDIO	SDIO data line 0 / GSPI_DO (GSPI Data Out)
19	SD_D1	I/O	VDIO	SDIO data line 1 / GSPI_INT (GSPI Interrupt)
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	VDIO	1. General Purpose Input / Output Pin GPIO6 2. High-Speed UART RTS output 3. External 32K or RTC clock input

25	GPIO1	O	VDIO	1. General Purpose Input/Output GOP1 2. Strap Pin, internal pulled low by 100K resistor to set "SPS_Mode" , do not pull high during power on!
26	GPIO3	I	VDIO	General Purpose Input/Output GOP3
27	GPIO0	I	VDIO	General Purpose Input/Output GOP0
28	GPIO2	O	VDIO	General Purpose Input/Output GOP2
29	NC	/		NC
30	NC	/		NC
31	GND	P		Ground connections
32	NC	/		NC
33	GND	P		Ground connections
34	BT_DIS#	I	VDIO	Shared with GPIO11. This Pin can externally shutdown the RTL8723CS BT function when BT_DIS# is pulled low. This pin can also support the BT radio-off function with host interface remaining connected. When WL_DIS# is also deasserted, RTL8723CS will enter the whole chip reset state.
35	CHIP_EN	I	VDD33	Reset active low input signal to reset/power down the module , internal pulled high to VDD33 by 100K resistor
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
	ANT	RF		IPEX connector for 2.4G WLAN/BT ANT

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	℃
External Antenna VSWR			1.7	2.1	/
	VDD33	3.1	3.3	3.5	V

Supply Voltage	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 I/O DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	2.0	3.3	3.5	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 I/O 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, VDIO=3.3V ; Ta: 25℃			
Use Case	VDD33 Current		
	Typ (I_{RMS})	Max (I_{Peak})	Units
WLAN Radio Off (Linux Driver)	40	49	mA
WLAN Unassociated (Linux Driver)	86	95	mA
2.4G WLAN TCP throughput TX 76Mbps (Linux Drive, BT disable)	200	270	mA
2.4G WLAN TCP throughput RX 82Mbps (Linux Drive, BT disable)	101	270	mA
2.4G 11b@1Mbps TX@ 17dBm (TX RF test)	313	342	mA
2.4G 11b@1Mbps RX (RF-Test)	95	138	mA
2.4G 11b@11Mbps TX@ 17dBm (TX RF test)	296	354	mA
2.4G 11b@11Mbps RX (RF-Test)	99	134	mA

2.4G 11g@6Mbps TX@ 17dBm (TX RF test)	290	385	mA
2.4G 11g@6Mbps RX (RF-Test)	97	134	mA
2.4G 11g@54Mbps TX@ 15dBm (TX RF test)	199	360	mA
2.4G 11g@54Mbps RX (RF-Test)	97	134	mA
2.4G 11n@HT20_MCS0 TX@ 17dBm (TX RF test)	291	388	mA
2.4G 11n@HT20_MCS0 RX (RF-Test)	97	134	mA
2.4G 11n@HT20_MCS7 TX @ 14dBm (TX RF test)	176	340	mA
2.4G 11n@HT20_MCS7 RX (RF-Test)	96	134	mA
2.4G 11n@HT40_MCS7 TX@ 14dBm (TX RF test)	142	322	mA
2.4G 11n@HT40_MCS7 RX (RF-Test)	97	134	mA
BT			
BT LE_1M TX@ 3dBm (RF-Test)	105	138	mA
BT LE_1M RX Active (RF-Test)	114	118	mA

4. WLAN RF Specifications

4.1 2.4G WLAN RF Specification

Conditions : VDD33=3.3V, VDIO=3.3V; Ta: 25℃	
Features	**Description**
WLAN Standard	IEEE 802.11b/g/n
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)
Channels	Ch1~Ch11(For 20MHz Channels)
Modulation	802.11b (DSSS): DBPSK, DQPSK, CCK; 802.11g (OFDM): BPSK, QPSK, 16QAM, 64QAM; 802.11n (OFDM): BPSK, QPSK, 16QAM, 64QAM;
Data 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 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	±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 (dBm)**	**Max Input Level (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%

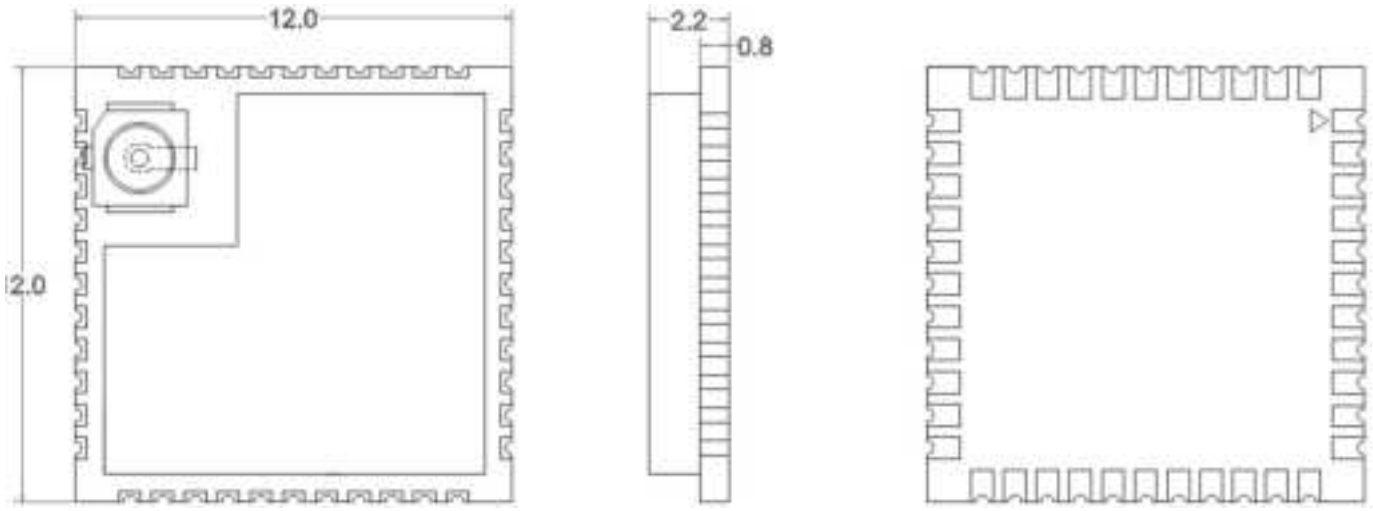
4.2 Bluetooth RF Specification

Conditions : VDD33=3.3V, VDIO=3.3V ; Ta: 25℃			
Features	**Description**		
Bluetooth Specification	Bluetooth BLE Core Specification v4.1		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);		
Power Classes	Bluetooth Low Energy: Class1.5;		
Data Rate & Modulation	LE_1Mbps: GFSK;		
Bluetooth Transmitter Specifications			
Items	**Min (dBm)**	**Typ (dBm)**	**Max (dBm)**
TX Power			
LE_1M TX Power	2	6	10
LE_Modulation characteristics			
Δf1avg	225kHz	268kHz	275kHz
Δf2avg	185KHz	218KHz	/
Δf2max	185kHz	212kHz	/
Δf2avg / Δf1avg	0.8	0.81	/
Bluetooth Receiver Specifications			

Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	PER	Input Level(Typ)	PER
LE_1M	-90dBm	≦5%	-20dBm	≦5%

5. Mechanical Specifications

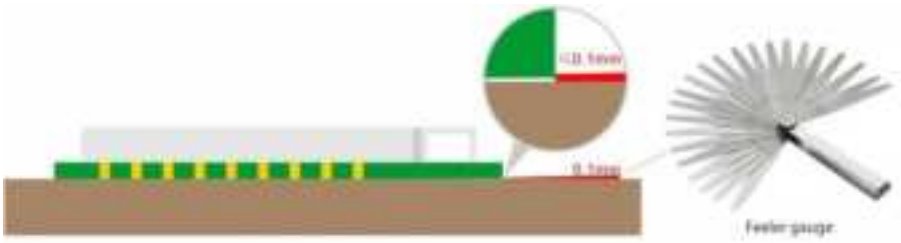
5.1 Module Outline Drawing



(Top View) (Side View) (Bottom View)

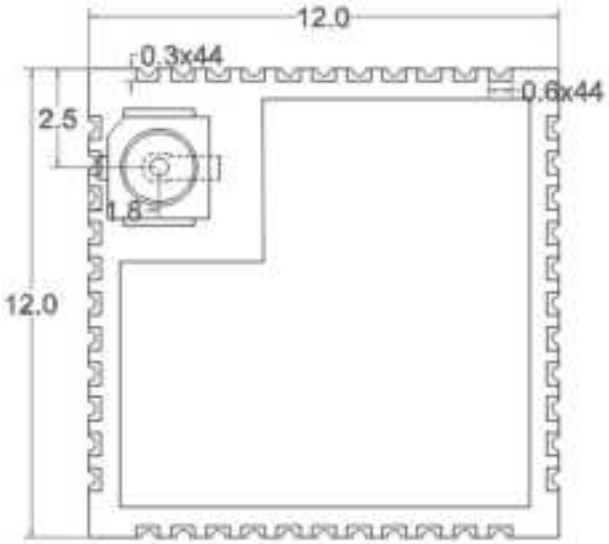
Module dimension: 12.0*12.0*2.2mm (L*W*H; Tolerance: ±0.3mm_L/W, ±0.2mm_H)

IPEX / MHF-1 connector dimension: 2.6*3.0*1.25mm (L*W*H; Ø2.0mm)

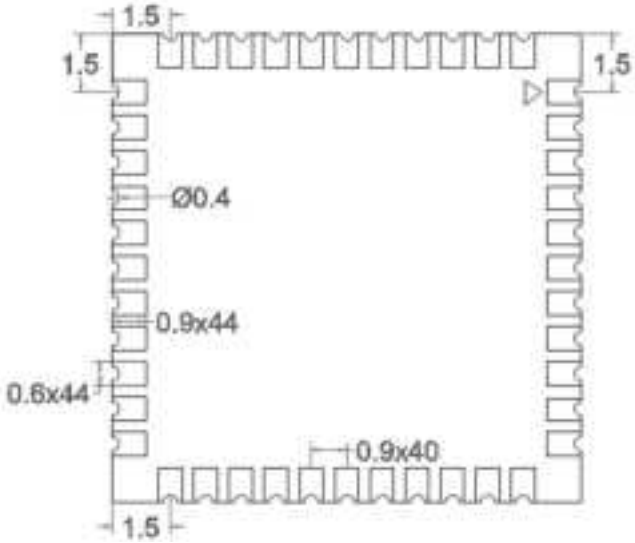


Module Bow and Twist: ≤0.1mm

5.2 Mechanical Dimensions



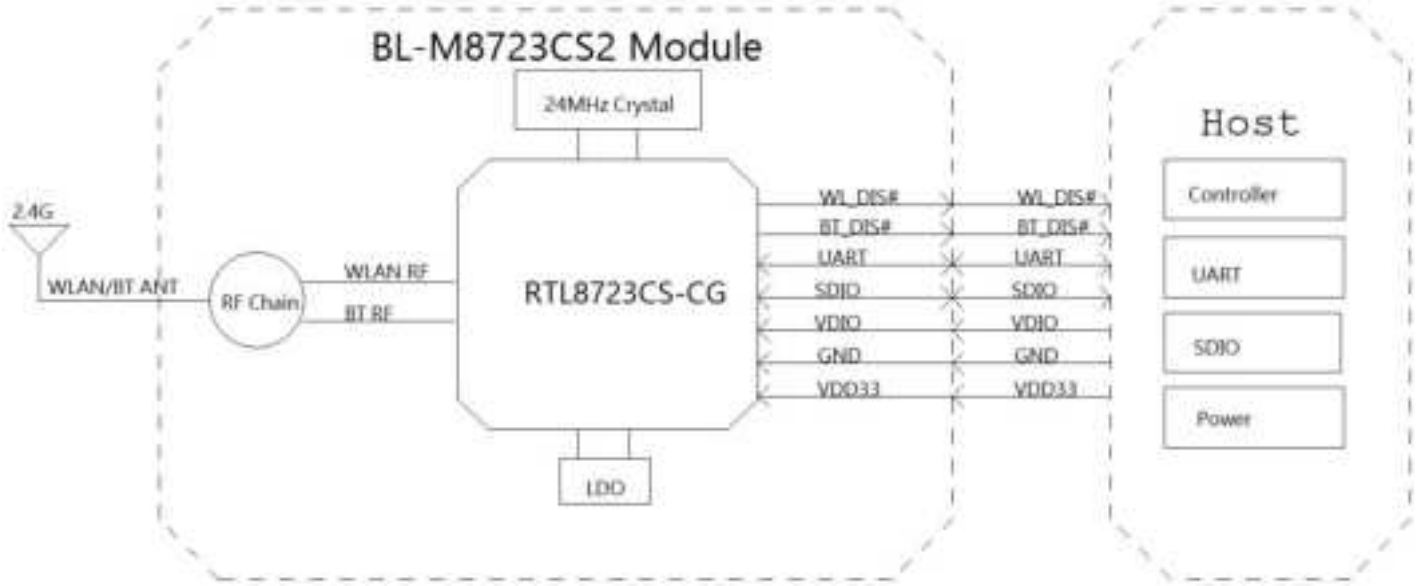
(Top View)



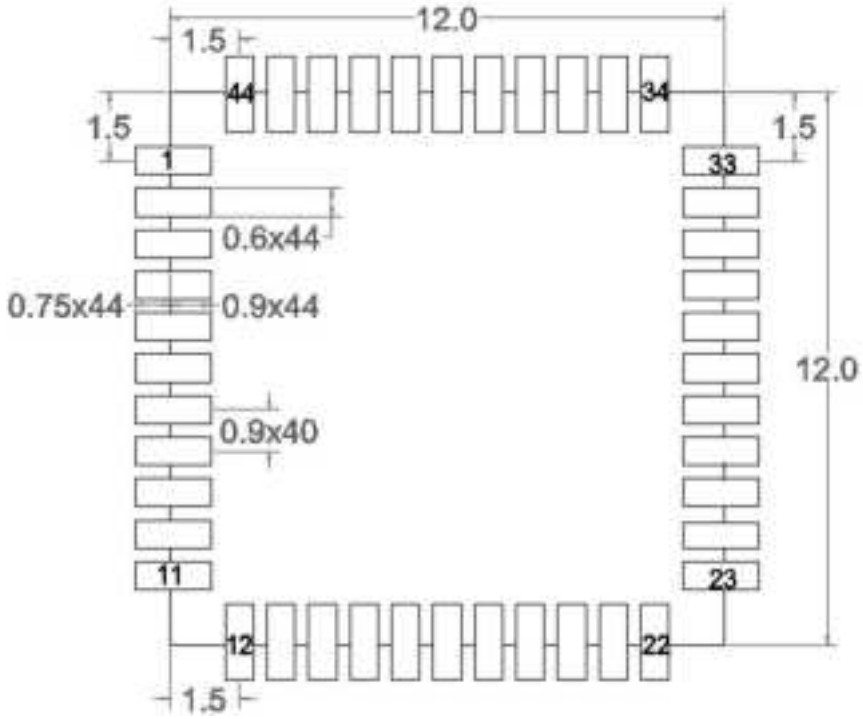
(Bottom View)

6. Application Information

6.1 Typical Application Circuit

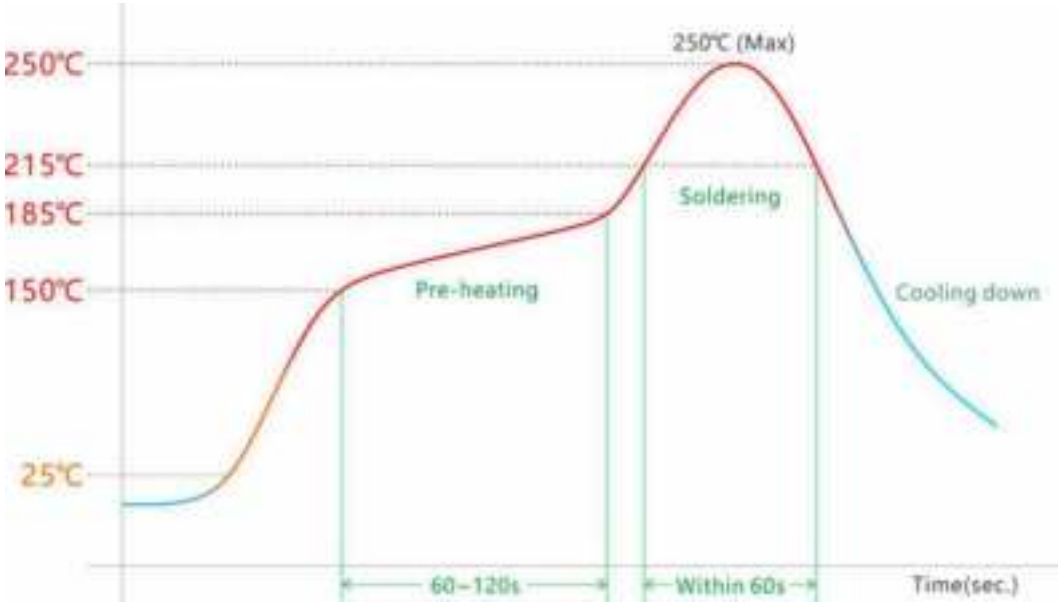


6.2 Recommend PCB Layout Footprint



(Design Unit: mm)

6.3 Reflow Soldering Standard Conditions



Please use the reflow within 2 times.

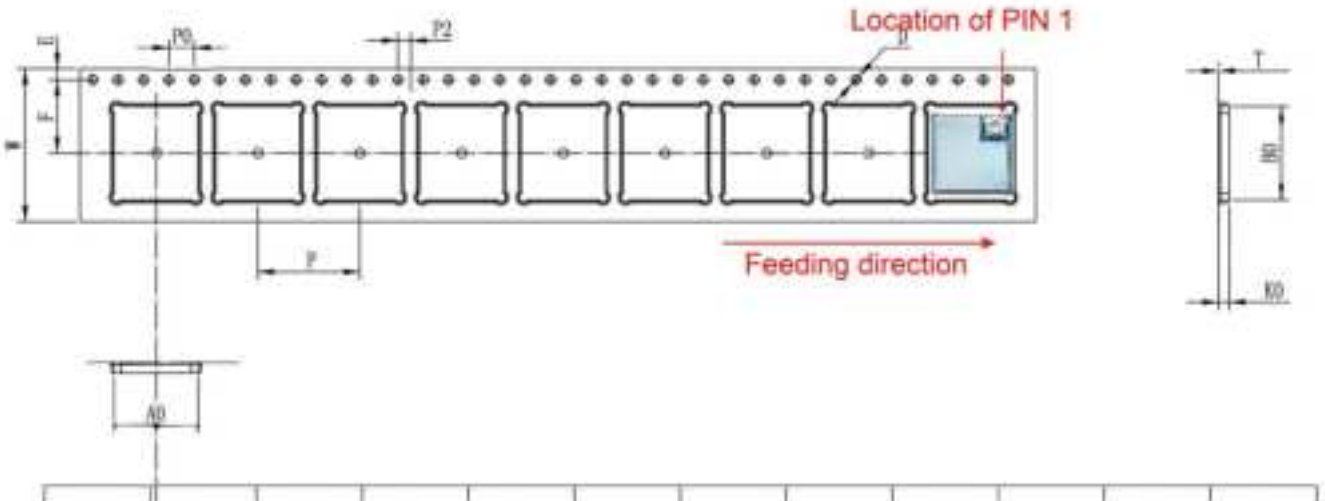
Set up the highest temperature within 250℃.

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8723CS-CG	Realtek Semiconductor Corp.	
2	PCB	BL-M8723CS2	ShenZhen Tie Fa Technology Limited	
			SHEN ZHEN QILI ELECTRON CO.,LTD	
			Huizhou Dayawan Kexiang Technology Circuit Board Co., Ltd	
3	Crystal	24MHz	Chengde oscillator Electronic Technology CO.,LTD	
			LUCKI CM ELECTRONICS CO.,LTD	
			SHENZHEN KAIYUEXIANG ELECTRONICS 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	12.50±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	Φ1.5±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℃ to +85℃
Storage humidity: 10% to 95% RH（Non-Condensing）

Recommended Storage Conditions:

Storage temperature: 5℃ to +40℃
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℃, 24hours, 1time.

ESD Sensitivity:

The Module is a static-sensitive electronic device.
Do not operate or store near strong electrostatic fields.
Take proper ESD precautions!

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.

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursua nt to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful inte rference in a residential installation. This equipment generates uses and can radiate radio frequency energy a nd, if not installed and used in accordance with the instructions, may cause harmful interference to radio com munications. 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 turn ing 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 important announcement Important Note:

Radiation Exposure Statement

This equipment 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 and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Country Code selection feature to be disabled for products marketed to the US/Canada.

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

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G bandby supplied firmware programming tool. OEM shall not supply any tool or info to the end-userregarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

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.

End Product Labeling

The final end product must be labeled in a visible area with the following"

Contains FCC ID: 2AL6KBL-M8723CS2 "

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 end user manual shall include all required regulatory information/warning as show in this manual.

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 has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This equipment 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 Antennas

This radio transmitter
