



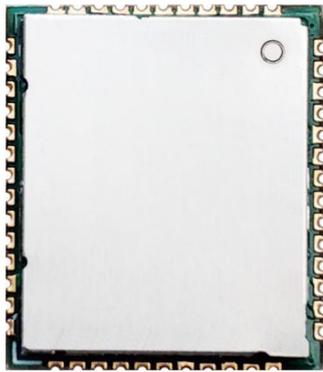
B-LINK®

BL-M8822CS1-S

**802.11ac 867Mbps WLAN + BT v5.0
SDIO Module Specification**

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(Top View)



(Bottom View)

Module Name: BL-M8822CS1-S	
Module Type: 802.11a/b/g/n/ac 867Mbps WLAN + Bluetooth v5.0 Combo SDIO Module	
Revision: V1.1	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
BL-link Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date	
1.0	Official release	2019-12-13	
1.1	Content optimization	2023-04-06	Cxf

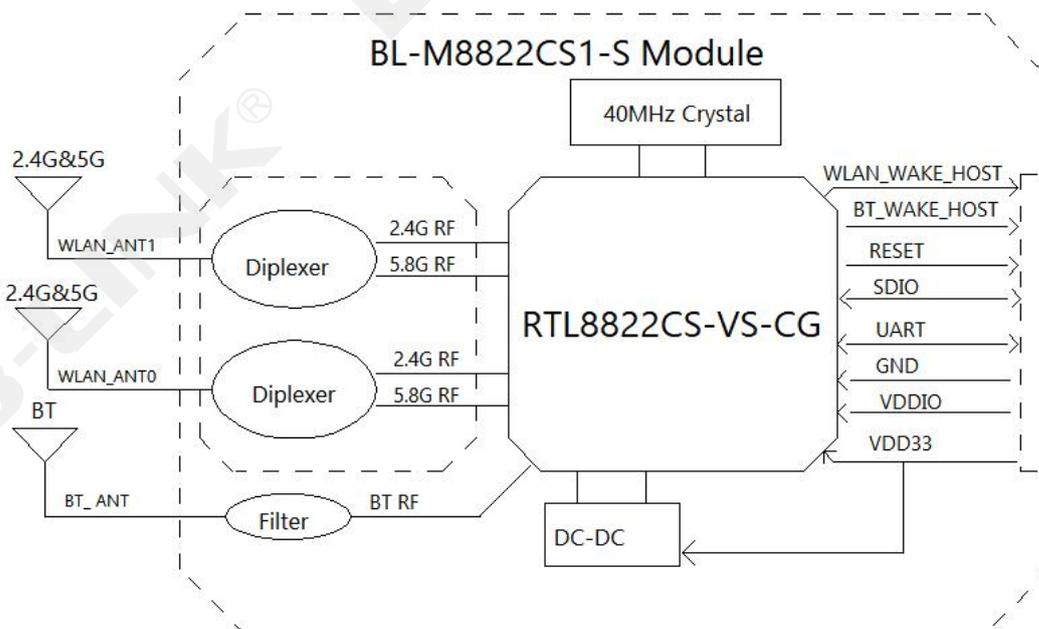
1. Introduction

BL-M8822CS1-S is a highly integrated dual band WLAN+Bluetooth v5.0 combo module, It combines a 2T2R Dual-band WLAN subsystem and a Bluetooth v5.0 subsystem which features dual BT controllers. The module is compatible with IEEE 802.11a/b/g/n/ac standard and provides the maximum PHY rate up to 867Mbps, it supports BT/BLE dual mode with BT v5.0/4.2/2.1 compliant, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance

1.1 Features

- Operating Frequencies: 2.4~2.4835GHz or 5.15~5.85GHz
- Host Interface is SDIO (SDIO 1.1/2.0/3.0) and UART for BT
- IEEE Standards: IEEE 802.11a/b/g/n/ac
- Wireless PHY rate can reach up to 867Mbps
- Bluetooth Specification: v5.0/4.2/3.0/2.1 system
- Power Supply: DC 3.3V main power and 1.8V/3.3V I/O power.

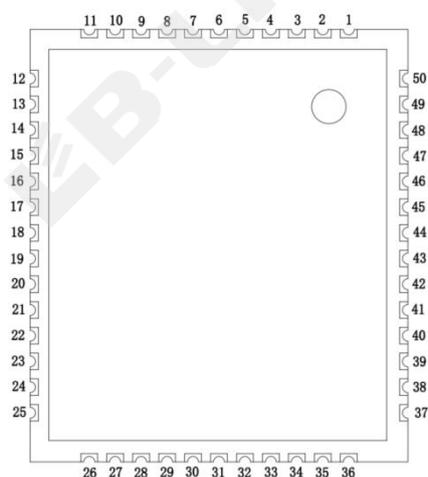
1.2 Block Diagram



1.3 General Specifications

Module Name	BL-M8822CS1-S
Chipset	RTL8822CS-VS-CG
WLAN Standard	IEEE 802.11 a/b/g/n/ac
BT Specification	Bluetooth Core Specification v5.0/4.2/2.1
Host Interface	SDIO for WLAN & UART interface for Bluetooth
Antenna	Connect to the external antennas through half hole
Dimension	15.1*13.1*2.4mm (L*W*H)
Power Supply	3.3V±0.2V main power supply @ 900 mA (Max) 3.3V±0.2V or 1.8V±0.1V I/O power supply
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	Module Pin Description
1	GND	RF		RF Ground connections
2	WLAN_ANT1	RF		RF Pad for 2.4G / 5G WLAN_ANT1
3	GND	RF		RF Ground connections
4	GND	RF		RF Ground connections

5	GND	RF		RF Ground connections
6	GND	RF		RF Ground connections
7	GND	RF		RF Ground connections
8	GND	RF		RF Ground connections
9	WLAN_ANT0	RF		RF Pad for 2.4G / 5G WLAN_ANT0
10	GND	RF		RF Ground connections
11	GND	RF		RF Ground connections
12	BT_ANT	RF		RF Pad for BT_ANT
13	NC	/		No connection(floating)
14	NC	/		No connection(floating)
15	WL_REG_ON	I	VDDIO	Shared with GPIO15. This pin can be defined as the WLAN Radio-off function with host interface remaining connected. When this pin is pulled low, WLAN Radio will be disabled
16	WLAN_WAKE_HOST	O	VDDIO	1.General Purpose Input / Output Pin GPIO10 2.WLAN device to wake-up Host output 3.PIN16 and PIN24 are the selection feet
17	SDIO_CMD	I/O	VDDIO	SDIO command line
18	SDIO_CLK	I/O	VDDIO	SDIO clock line
19	SDIO_DATA3	I/O	VDDIO	SDIO data line 3
20	SDIO_DATA2	I/O	VDDIO	SDIO data line 2
21	SDIO_DATA0	I/O	VDDIO	SDIO data line 0
22	SDIO_DATA1	I/O	VDDIO	SDIO data line 1
23	GND	P		Ground connections
24	WLAN_WAKE_HOST	O	VDDIO	1.General Purpose Input / Output Pin GPIO10 2.WLAN device to wake-up Host output 3.PIN16 and PIN24 are the selection feet
25	NC	/		NC
26	NC	/		NC
27	PCM_SYNC	I/O	VDDIO	1.General Purpose Input / Output Pin GPIO2 2.PCM sync I/O signal
28	PCM_IN	I	VDDIO	1.General Purpose Input / Output Pin GPIO0 2.PCM data input
29	PCM_OUT	O	VDDIO	1.General Purpose Input / Output Pin GPIO1 2.PCM Data output
30	PCM_CLK	I/O	VDDIO	1.General Purpose Input / Output Pin GPIO3 2.PCM Clock input
31	LPO	I	VDDIO	External 32k or RTC clock input. If not used keep NC
32	GND	P		Ground connections
33	NC	/		NC
34	VDDIO	P	1.8or3.3V	I/O Voltage supply input (1.8V or 3.3V)

35	NC	/		NC
36	VDD33	P	3.3V	DC 3.3V power supply
37	NC	/		NC
38	BT_REG_ON	I	VDDIO	Shared with GPIO11. This pin can externally shut down the RT18822CS-VS-CG BT function when BT DIS# is pulled Low. When this pin is pulled low, UART inter face will be also disabled This pin can be also defined as the BT Radio-off function with host interface remaining connected.
39	GND	P		Ground connections
40	UART_TXD	O	VDDIO	High-Speed UART Data Out
41	UART_RXD	I	VDDIO	High-Speed UART Data In
42	UART_RTS	O	VDDIO	High-Speed UART RTS
43	UART_CTS	I	VDDIO	High-Speed UART CTS
44	SD_RESET	I	VDDIO	Shared with GPIO9. This pin can externally shut down the RTL8822CS-VS-CG WLAN function when SD RESET is pulled low. When this pin is pulled low, SDIO / G-SPI interface will be disabled.
45	NC	/		NC
46	GND	P		Ground connections
47	NC			No connection(floating)
48	GND	P		Ground connections
49	HOST_WAKE_BT	I	VDDIO	1.General Purpose Input / Output Pin GPIO13 2.Host to wake-up this Bluetooth device input
50	BT_WAKE_HOST	O	VDDIO	1.General Purpose Input / Output Pin GPIO14 2.Bluetooth device to wake-up Host output

P: Power or Ground; I/O: In/Output; I: Input; A I/O: Analog In/Output; AI: Analog Input; AO: Analog Output; RF: Analog RF Port or RF Ground;

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	3.0	3.3	3.5	V
	VDDIO	1.62	1.8	1.98	V
		3.1	3.3	3.5	V

3.2 Digital 3.3V GPIO 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 IO DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	1.7	1.8	3.5	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 (Bluetooth over UART) ;			
Use Case	VDD33 Current		
	Typ(I _{RMS})	Max(I _{peak})	Units
WLAN & BT Unassociated (Linux Driver)	60	88	mA
2.4G WLAN 300Mbps Web browsing (Linux Driver, BT disable)	223	546	mA
5G WLAN 867Mbps Web browsing (Linux Driver, BT disable)	248	720	mA
BT LE MP3 playback (Linux Driver, WLAN enable)	262	392	mA
2.4G WLAN TCP throughput TX 145Mbps (Linux Drive, BT disable)	308	426	mA
2.4G WLAN TCP throughput RX 152Mbps (Linux Drive, BT disable)	228	384	mA
5G WLAN TCP throughput TX 152Mbps & BT LE MP3 playback (Linux Driver)	420	672	mA
5G WLAN TCP throughput RX 155Mbps & BT LE MP3 playback (Linux	298	632	mA

Driver)			
2.4G 11b@11Mbps TX (1TX RF test) 19dBm	347	440	mA
2.4G 11g@6Mbps TX (1TX RF test) 19dBm	455	620	mA
2.4G 11n@HT20_MCS15 TX (2TX RF test) 17dBm	265	544	mA
2.4G 11n@HT40 MCS0 TX (2TX RF test) 19dBm	317	432	mA
2.4G 11n@HT40 MCS15 TX (2TX RF test) 17dBm	246	544	mA
2.4G 11n@HT40 MCS15 RX (2RX RF test)	246	544	mA
5G 11a@6Mbps TX (1TX RF test) 19dBm	412	512	mA
5G 11a@54Mbps TX (1TX RF test) 17dBm	279	528	mA
5G 11n@HT20_MCS15 TX (2TX RF test) 16dBm	319	712	mA
5G 11n@HT40_MCS15 TX (2TX RF test) 16dBm	303	736	mA
5G 11ac@VHT80 MCS0 TX (2TX RF test) 17dBm	431	840	mA
5G 11ac@VHT80 MCS9 TX (2TX RF test) 15dBm	332	832	mA
5G 11ac@VHT80 MCS9 RX (2TX RF test)	185	212	mA
BT BR_1M TX (BT RF test, WLAN disable) 5dBm	268	435	mA
BT BR_1M RX Active (BT RF test, WLAN disable)	278	412	mA
BT EDR_3M TX (BT RF test, WLAN disable) 5dBm	269	438	mA
BT EDR_3M RX Active (BT RF test, WLAN disable)	282	412	mA
BT LE_2M TX (BT RF test, WLAN disable) 5dBm	272	430	mA
BT LE_2M RX Active (BT RF test, WLAN disable)	275	412	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
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)
Channels	Ch1~Ch13 (For 20MHz Channels)

Modulation	802.11b (DSSS): CCK, DQPSK, DBPSK; 802.11g (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;
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 (HT20): MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps; 802.11n (HT40): MCS0~MCS7(1T1R) 13.5~150Mbps; 802.11n (HT40): MCS8~MCS15(2T2R) 27~300Mbps;
Frequency Tolerance	$\leq \pm 20$ ppm

2.4G Transmitter Specifications (WLAM_ANT0&WLAN_ANT1. 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 : 19	± 2	≤ -10
802.11b@11Mbps	Calibrated TX Power : 19	± 2	≤ -10
802.11g@6Mbps	Recommended Target TX Power : 19	± 2	≤ -10
802.11g@54Mbps	Calibrated TX Power : 18	± 2	≤ -25
802.11n@HT20_MCS0	Recommended Target TX Power : 19	± 2	≤ -10
802.11n@HT20_MCS7	Calibrated TX Power : 17	± 2	≤ -28
802.11n@HT40_MCS0	Recommended Target TX Power : 19	± 2	≤ -10
802.11n@HT40_MCS7	Calibrated TX Power : 17	± 2	≤ -28

2.4G Receiver Specifications (WLAN_ANT0&WLAN_ANT1)

RX Rate	Min Input Level (Typ.dBm)	Max Input Level (Typ.dBm)	PER
802.11b@1Mbps	-94	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-90	-10	< 10%
802.11g@54Mbps	-74	-10	< 10%
802.11n@HT20_MCS0	-89	-10	< 10%
802.11n@HT20_MCS7	-72	-10	< 10%
802.11n@HT40_MCS0	-88	-10	< 10%
802.11n@HT40_MCS7	-68	-10	< 10%

4.2 5G WLAN RF Specification

Conditions: VDD33=3.3V; Ta:25°C			
Features	Description		
WLAN Standard	IEEE 802.11a/n/ac		
Frequency Range	5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz; 5.735~5.835GHz (5GHz ISM Band)		
Channels	Ch36, Ch40, Ch44, Ch48; Ch52~Ch64; Ch100~Ch140; Ch149~Ch165 (For 20MHz Channels)		
Modulation	802.11a (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256;		
Date Rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps; 802.11n (HT20): MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps; 802.11n (HT40): MCS0~MCS7(1T1R) 13.5~150Mbps; 802.11n (HT40): MCS8~MCS15(2T2R) 27~300Mbps; 802.11ac (VHT20): MCS0~MCS8(1T1R) 6.5~86.7Mbps; 802.11ac (VHT20): MCS0~MCS8(2T2R) 13~173.3Mbps; 802.11ac (VHT40): MCS0~MCS9(1T1R)13.5~200Mbps; 802.11ac (VHT40): MCS0~MCS9(2T2R)27~400Mbps; 802.11ac (VHT80): MCS0~MCS9(1T1R)29.3~433.3Mbps; 802.11ac (VHT80): MCS0~MCS9(2T2R)58.5~867Mbps;		
Frequency Tolerance	$\leq \pm 20\text{ppm}$		
5G Transmitter Specifications (WLAM_ANT0&WLAN_ANT1. 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)
802.11a@6Mbps	Recommended Target TX Power : 19	± 2	≤ -10
802.11a@54Mbps	Calibrated TX Power : 17	± 2	≤ -25
802.11n@HT20_MCS0	Recommended Target TX Power : 18	± 2	≤ -10

802.11n@HT20_MCS7	Calibrated TX Power : 16	±2	≤ -28
802.11n@HT40_MCS0	Recommended Target TX Power : 18	±2	≤ -10
802.11n@HT40_MCS7	Calibrated TX Power : 16	±2	≤ -28
802.11ac@VHT80_MCS0	Recommended Target TX Power : 17	±2	≤ -10
802.11ac@VHT80_MCS9	Calibrated TX Power : 15	±2	≤ -32

5G Receiver Specifications (WLAN_ANT0&WLAN_ANT1)

RX Rate	Min Input Level (Typ.dBm)	Max Input Level (Typ.dBm)	PER
802.11a@6Mbps	-90	-10	< 10%
802.11a@54Mbps	-72	-10	< 10%
802.11n@HT20_MCS0	-89	-10	< 10%
802.11n@HT20_MCS7	-70	-10	< 10%
802.11n@HT40_MCS0	-88	-10	< 10%
802.11n@HT40_MCS7	-68	-10	< 10%
802.11ac@VHT80_MCS0	-84	-10	< 10%
802.11ac@VHT80_MCS9	-58	-10	< 10%

4.3 Bluetooth RF Specification

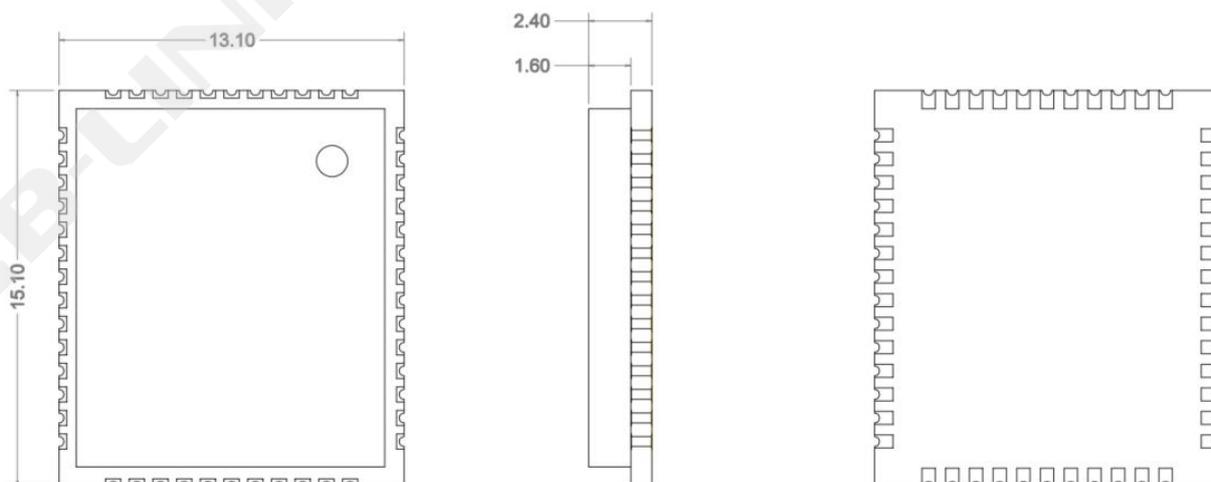
Conditions: VDD33=3.3V; Ta:25°C	
Features	Description
Bluetooth Specification	Bluetooth Core Specification v5.0/4.2/2.1
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)
Channels	Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);
Power Classes	Bluetooth Classic: Class1; Bluetooth Low Energy: Class1.5;

Date Rate & Modulation	BR_1Mbps: GFSK; EDR_2Mbps: $\pi/4$ -DQPSK; EDR_3Mbps: 8DPSK; LE_125Kbps: GFSK (Coded_S=8); LE_500Kbps: GFSK (Coded_S=2); LE_1Mbps: GFSK (Uncoded); LE_2Mbps: GFSK (Uncoded);		
Bluetooth Transmitter Specifications			
Items	Min (dBm)	Typ (dBm)	Max (dBm)
TX Power			
BR_1M	0	4	8
EDR_2/3M	0	4	8
LE_125K/500K/1M/2M	0	4	8
Items	Min	Typ	Max
BR_1M (DH1) Modulation Characteristics			
Δf_{1avg}	140KHz	158.2KHz	175KHz
Δf_{2avg}	140KHz	160.1KHz	175KHz
Δf_{2max}	115KHz	162.2KHz	/
$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	1.01	/
Items	Min	Typ	Max
EDR_3M(3DH5) EDR Carrier Frequency Stability and Modulation Accuracy			
ω_i	-75KHz	3.12KHz	+75KHz
$\omega_i + \omega_o$	-75KHz	2.44KHz	+75KHz
ω_o	-10KHz	-0.8KHz	+10KHz
8DPSK RMS DEV _M	/	0.069	0.13
8DPSK DEV _M	/	0.094	0.25
Items	Min	Typ	Max
LE_1M Modulation Characteristics			
Δf_{1avg}	225KHz	248.6KHz	275KHz
Δf_{2avg}	225KHz	237.2KHz	275KHz
Δf_{2max}	185KHz	245.1KHz	/

$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	0.95	/	
Items	Min	Typ	Max	
LE_2M Modulation Characteristics				
Δf_{1avg}	450KHz	498.1KHz	550KHz	
Δf_{2avg}	450KHz	503.3KHz	550KHz	
Δf_{2max}	370KHz	497.5KHz	/	
$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	1.01	/	
Bluetooth Receiver Specifications				
Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	BER	Input Level(Typ)	BER
BR_1M (DH1)	-90 dBm	$\leq 0.1\%$	-5 dBm	$\leq 0.1\%$
EDR_3M (3DH5)	-80 dBm	$\leq 0.01\%$	-5 dBm	$\leq 0.1\%$
	Input Level (Typ)	PER	Input Level (Typ)	PER
LE_125K/500K	-92 dBm	$\leq 5\%$	-5 dBm	$\leq 5\%$
LE_1M	-88 dBm	$\leq 5\%$	-5 dBm	$\leq 5\%$
LE_2M	-84 dBm	$\leq 5\%$	-5 dBm	$\leq 5\%$

5. Mechanical Specifications

5.1 Module Outline Drawing

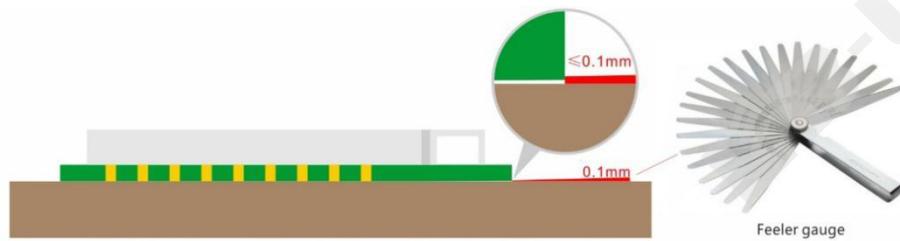


(Top View)

(Side View)

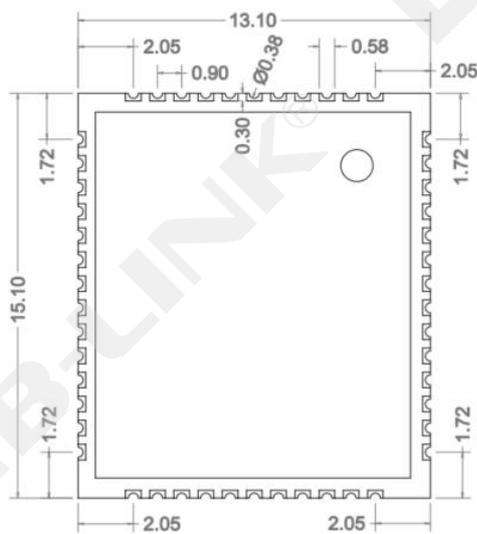
(Bottom View)

Module dimension: Typical (L*W*H): 15.1*13.1*2.4mm Tolerance: +/-0.15mm

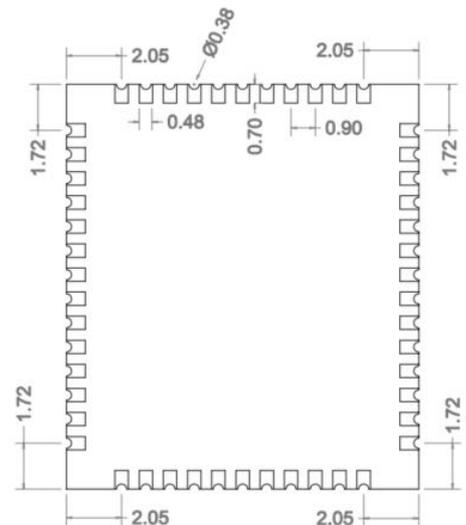


Module Bow and Twist: $\le 0.1\text{mm}$

5.2 Mechanical Dimensions



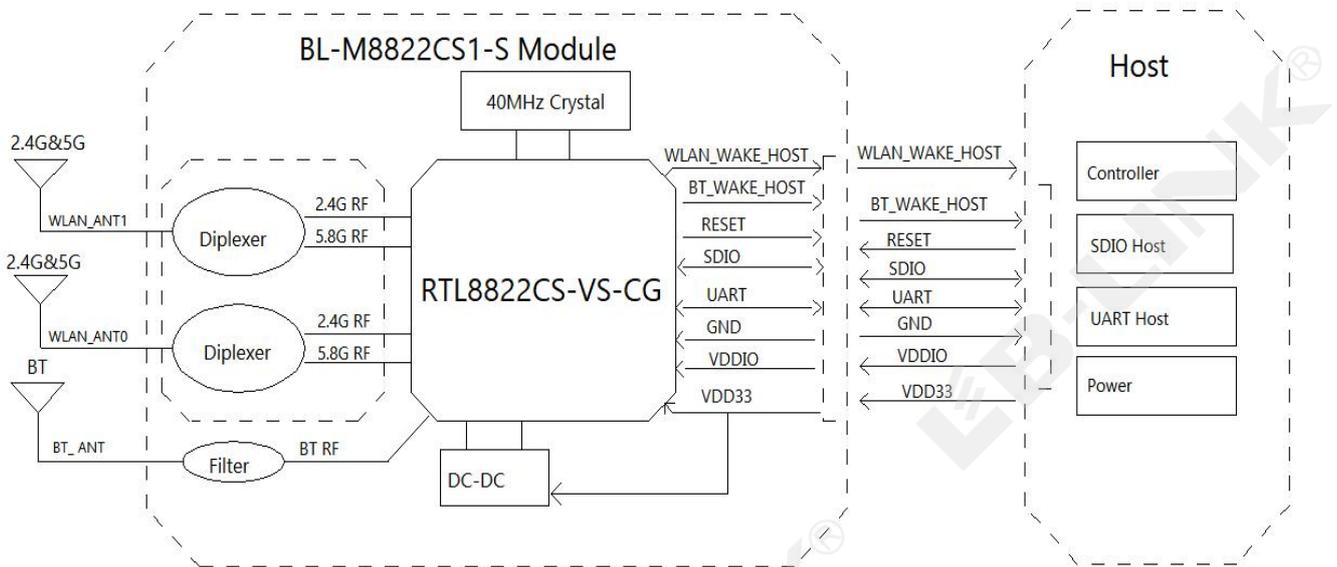
(Top View)



(Bottom View)

6. Application Information

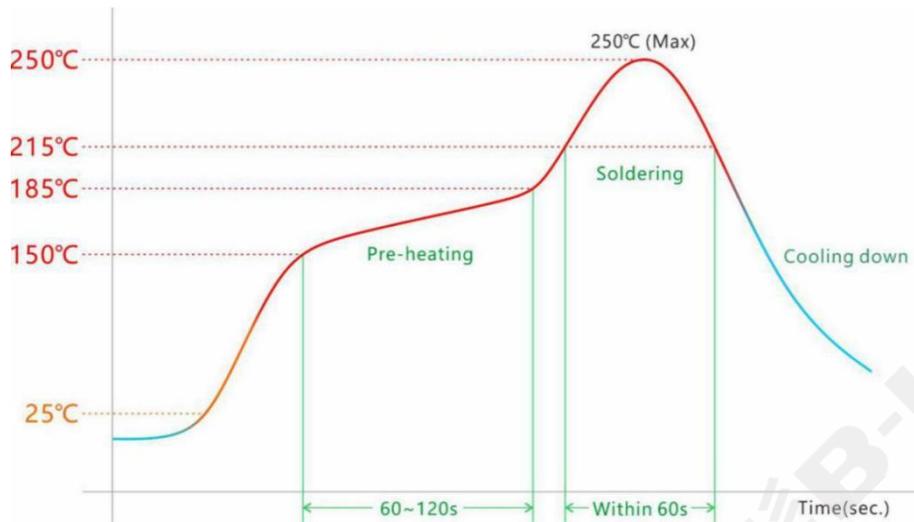
6.1 Typical Application Circuit



6.2 HW Application Note

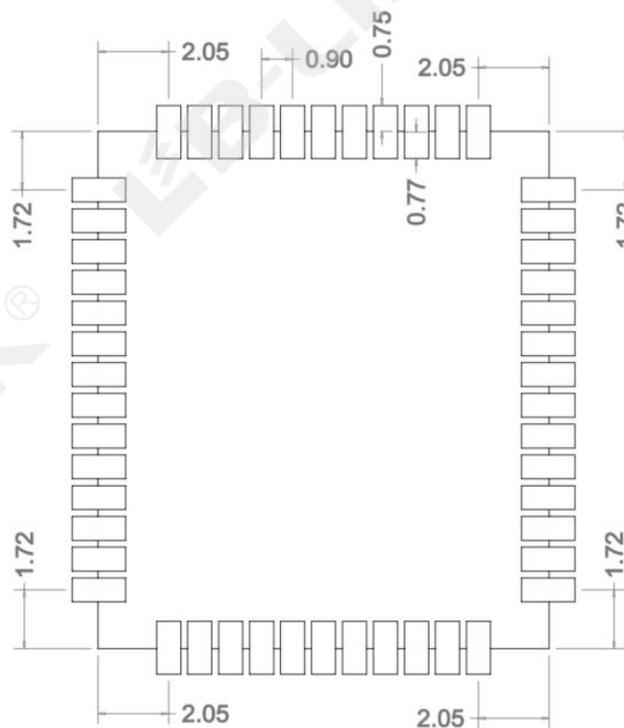
- RF needs to maintain 50 ohm impedance.
- The module UART_TX is connected to the RX of the reference circuit, and the UART_RX is connected to the TX of the reference circuit.
- Keep the SDIO lines as equal as possible and minimize the distance between the host and the module. Make sure SD-CLK has a good ground reference.
- Power supply voltage: DC 3.1 ~ 3.5V, ripple voltage <80mV
- For fast transient response, a current mode buck converter is recommended

6.3 Reflow Soldering Standard Conditions



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

6.3 Recommend PCB Layout Footprint



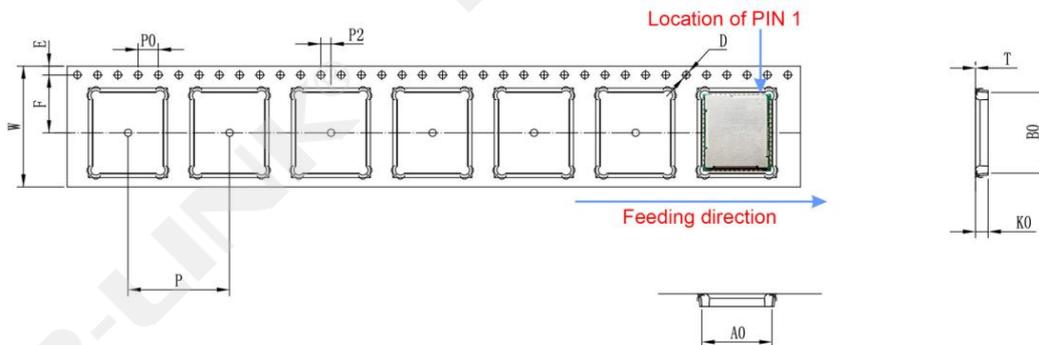
(Design size: mm)

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8822CS-VE-CG	Realtek Semiconductor Corp.	
2	PCB	BL-M8822CS1	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	
			Chengde oscillator Electronic Technology CO.,LTD	
			JinHua East Crystal Electronic CO.,LTD	
4	Diplexer	DIP1608	Advanced Ceramic X Corp.	
			Dongguan Hekang 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	13.40±0.1	15.60±0.1	2.70±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:

- 1,000 modules per roll and 5,000 modules per box.
- Outer box size: 37.5*36*29cm.
- 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).
- Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
- 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 (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