Product Specification

Revision	V1.0		
Date	2019-12-12		
Model Name	BL-M8822CS1-S		
Product Name	802.11a/b/g/n/ac 2T2R WiFi + Bluetooth5.0 SDIO Module		
Bilian Approve Field			
Engineer	**QC**	**Sales**	
Customer Approve Field			
Engineer	**QC**	**Manufactory**	**Purchasing**

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Table of Contents

Revision History

Date	Document Revision	Product Revision	Description
2019/12/13	1.0	V1.0	Preliminary release

1. Introduction

1.1 General Description

BL-M8822CS1-S is a highly integrated dual-band WiFi + bluetooth5.0 2T2R SDIO3.0 module designed base on Realtek RTL8822CS-VS-CG chipset. This module supports 802.11n MIMO on dual band 2.4GHz or 5GHz operating and 802.11ac wave-2 MU-MIMO, backward compatible with IEEE 802.11a/b/g/n/ac standard and provides the maximum PHY data rate up to 867Mbps. The host interface complies with SDIO 1.1/2.0/3.0 for WLAN with clock rate up to 208MHz and HS-UART interface for BT. It includes Bluetooth V2.1/3.0/4.1/4.2 and supports Bluetooth 5.0 system. BL-M8822CS1-S offers feature-rich wireless connectivity and reliable throughput from an extended distance at different kinds of work environment.

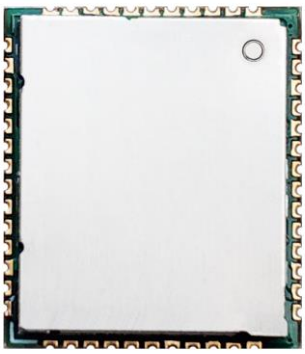

Figure 1-Top View

Figure 2-Bottom View

Note: The above pictures are for reference only

1.2 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 data rate can reach up to 867Mbps
- Connect to external antenna through the half hole
- Power Supply: VDD33 3.3V±0.2V, main power supply; VDIO 3.3±0.2V or 1.8±0.18V, the SDIO, UART and PCM signal level range from 1.8V~3.3V.

1.3 Applications

- MID/DVB/ STB / DV/ IP Camera/ IP TV/ E-book
- Tablet/ Notebook/ Advertising machine/ OTT Box
- VR/AR terminal/ Wireless storage/ Printer/ POS machine
- Mini Driving Recorder/ Doorbell / Intelligent Projector Pico
- Vehicle mounted front/ Rear Terminal UAV/ Robot/ Intelligent Gateway/ Smart city
- Other devices which need to be supported by wireless network

2. Functional Block Diagram

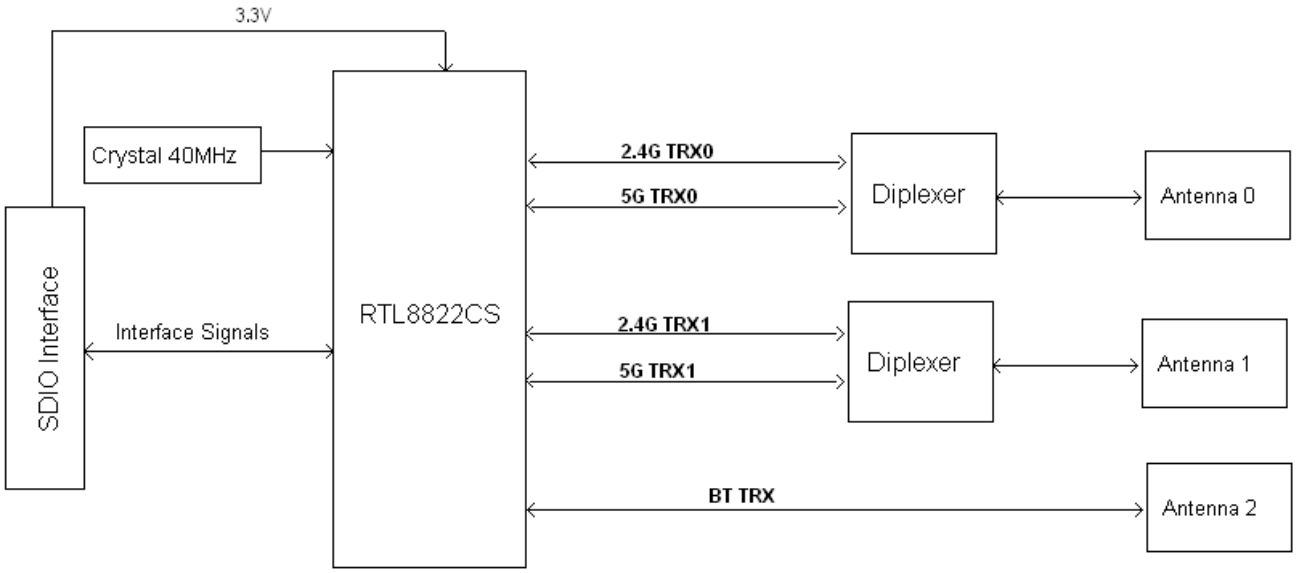

Figure 3-BL-M8822CS1-S

3. Product Technical Specifications

3.1 General Specifications

Item	Description
Product Name	BL-M8822CS1-S
Main Chip	RTL8822CS-VS-CG
Host Interface	SDIO for WLAN; UART for Bluetooth
IEEE Standards	IEEE 802.11a/b/g/n/ac
Operating Frequencies	2.4~2.4835GHz, 5.15~5.85 GHz
Modulation	WiFi : 802.11b DSSS: CCK, DQPSK, DBPSK 802.11g OFDM: 64-QAM,16-QAM, QPSK, BPSK 802.11n OFDM: 64-QAM,16-QAM, QPSK, BPSK

	802.11ac OFDM: 256-QAM, 64-QAM,16-QAM, QPSK, BPSK BT: FHSS: GFSK, π/4-DQPSK, 8PSK
Working Mode	Infrastructure, Ad-Hoc
Wireless Data Rate	WiFi: 802.11b: 1,2,5.5,11Mbps, 802.11a: 6,9,12,18,24,36,48,54Mbps, 802.11g: 6,9,12,18,24,36,48,54Mbps, 802.11n-2.4/5G HT20: MCS0~7, reach up to 144.4Mbps, 802.11n-2.4/5G HT40: MCS0~7, reach up to 300Mbps, 802.11ac-VHT20: MCS0~8, VHT40、80:MCS0~9, reach up to 867Mbps, BT: 1Mbps for BDR、BLE, 2、3Mbps for EDR
Rx Sensitivity	-95dBm (Min)
TX Power	20.5dBm (Max)
Antenna Type	Connect to the external antenna through half hole
Dimension(L*W*H)	15.1*13.1*2.4mm (LxWxH) Tolerance: +/-0.15mm
Clock Source	40MHz
Working Temperature	-10℃ to +70℃
Storage Temperature	-40℃ to +85℃

3.2 WiFi DC Power Consumption

VDD33=VDIO=3.3V，Ta = 25 °C，unit: mA		
Supply current	Typ	Max
RX sense mode(No Link)	172	202

802.11b	1Mbps		11Mbps	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	395	436	347	440
RX mode	178	204	177	206
802.11g	6Mbps		54Mbps	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	455	620	311	652
RX mode	183	216	183	220
802.11n HT20	MCS0		MCS7	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	379	512	264	504
RX mode	182	216	183	216

802.11n HT20	MCS 8		MCS15	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	398	536	265	544
RX mode	177	208	175	212
802.11n HT40	MCS0		MCS7	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	317	432	231	428
RX mode	191	220	190	224
802.11n HT40	MCS 8		MCS15	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	357	544	246	544
RX mode	184	216	185	216
802.11a	6Mbps		54Mbps	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	412	512	279	528
RX mode	176	209	174	212
802.11n HT20(5G)	MCS0		MCS7	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	398	492	273	504
RX mode	167	196	166	192
802.11n HT20(5G)	MCS8		MCS15	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	513	704	319	712
RX mode	167	196	167	200
802.11n HT40(5G)	**MCS0**		**MCS7**	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	369	504	252	504
RX mode	176	207	175	208
802.11n HT40(5G)	MCS8		MCS15	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	448	716	293	720
RX mode	175	204	176	204
802.11acVHT80(5G)	**MCS0**		**MCS9**	
Supply current	Typ.	Max.	Typ.	Max.
Continuous TX mode	392	840	309	816
RX mode	184	212	185	212

3.3 WiFi RF Specification

TX Power & EVM	WiFi-2.4G: 19.0±1.5dBm&<-18dB@11b-11Mbps 18.0±1.5dBm&<-28dB@11g-54Mbps 17.0±1.5dBm&<-28dB@11n-HT20/40-MCS7
	WiFi-5G: 17.0±2dBm&<-28dB@11a-54Mbps 16.0±2dBm&<-28dB@11n-HT20/40-MCS7 14.5±2dBm&<-32dB@11ac-VHT80-MCS9
Receiver Minimum Input Sensitivity@PER	WiFi-2.4G: 11b-1Mbps: -94dBm@PER<8%; 11b-11Mbps: -86dBm@PER<8%; 11g-54Mbps: -75dBm@PER<10%; 11n-HT20-MCS7: -70dBm@PER<10%; 11n-HT40-MCS7: -68dBm@PER<10%;
	WiFi-5G: 11a-54Mbps: -75dBm@PER<10%; 11n-HT20-MCS7: -68dBm@PER<10%; 11n-HT40-MCS7: -70dBm@PER<10%; 11ac-VHT80-MCS9: -59dBm@PER<10%;

RF Test Report										
PathA										
2.4G										
Mode	Rate(Mbps)	Power(dBm)			EVM(dB)			Sensitivity(dBm)		
		CH1	CH7	CH13	CH1	CH7	CH13	CH1	CH7	CH13
11b	1	19	19	19	-33	-33	-34	-97	-97	-97
	11	18	18	18	-33	-33	-33	-89	-89	-89
11g	6	19	19	19	-31	-31	-31	-92	-92	-92
	54	18	18	18	-32	-32	-32	-76	-76	-76
Mode	Rate(Mbps)	Power(dBm)			EVM(dB)			Sensitivity(dBm)		
		CH3	CH7	CH11	CH3	CH7	CH11	CH3	CH7	CH11
11n HT40	MCS0	19	19	19	-33	-33	-33	-90	-89	-89
	MCS7	17	17	17	-34	-34	-34	-69	-69	-69
PathB										
Mode	Rate(Mbps)	Power(dBm)			EVM(dB)			Sensitivity(dBm)		
		CH1	CH7	CH13	CH1	CH7	CH13	CH1	CH7	CH13
11b	1	19	19	19	-33	-33	-33	-97	-96	-97

	11	19	19	19	-33	-33	-33	-89	-89	-89
11g	6	19	19	19	-30	-30	-30	-92	-92	-92
	54	18	18	18	-33	-31	-31	-76	-76	-76
Mode	Rate(Mbps)	Power(dBm)			EVM(dB)			Sensitivity(dBm)		
		CH3	CH7	CH11	CH3	CH7	CH11	CH3	CH7	CH11
11n HT40	MCS0	19	19	19	-33	-33	-33	-90	-90	-90
	MCS7	17	17	17	-34	-34	-34	-70	-70	-70

RF Test Report													
PathA													
5G													
Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 36	CH 100	CH 140	CH 161	CH 36	CH 100	CH 140	CH 161	CH 36	CH 100	CH 140	CH 161
11a	6	19	19	19	19	-29	-29	-29	-29	-92	-92	-92	-92
	54	18	18	18	18	-32	-32	-32	-32	-75	-76	-76	-76
Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 38	CH 102	CH 142	CH 159	CH 38	CH 102	CH 142	CH 159	CH 38	CH 102	CH 142	CH 159
11n HT 40	MCS0	19	19	19	19	-31	-31	-31	-31	-90	-90	-90	-90
	MCS7	17	17	17	17	-32	-32	-32	-32	-72	-71	-71	-71
Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 42	CH 106	CH 138	CH 155	CH 42	CH 106	CH 138	CH 155	CH 42	CH 106	CH 138	CH 155
11ac VHT80	MCS0	18	18	18	18	-29	-29	-29	-29	-87	-87	-87	-86
	MCS9	15	15	15	15	-35	-35	-35	-35	-62	-62	-61	-61
PathB													
5G													
Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 36	CH 100	CH 140	CH 161	CH 36	CH 100	CH 140	CH 161	CH 36	CH 100	CH 140	CH 161
11a	6	19	19	19	19	-30	-30	-30	-30	-92	-92	-92	-92
	54	18	18	18	18	-32	-32	-32	-32	-76	-76	-76	-76
Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 38	CH 102	CH 142	CH 159	CH 38	CH 102	CH 142	CH 159	CH 38	CH 102	CH 142	CH 159
11n HT40	MCS0	19	19	19	19	-31	-31	-31	-31	-90	-90	-90	-90
	MCS7	17	17	17	17	-32	-32	-32	-32	-71	-71	-71	-71

Mode	Rate (Mbps)	Power(dBm)				EVM(dB)				Sensitivity(dBm)			
		CH 42	CH 106	CH 138	CH 155	CH 42	CH 106	CH 138	CH 155	CH 42	CH 106	CH 138	CH 155
11ac VHT80	MCS0	18	18	18	18	-29	-29	-29	-29	-87	-87	-87	-86
	MCS9	15	15	15	15	-35	-35	-35	-35	-62	-62	-61	-61

3.4 Bluetooth RF Specification

RF Characteristics for BT				
Items	Contents			
Specification	BT V5.0/4.2/4.1/V4.0+BLE/V3.0/V2.1+EDR			
Modulation	FHSS: GFSK, π/4-DQPSK, 8DPSK			
Channel frequency	2.401~2.481 GHz			
Data rate	1Mbps,2Mbps,3Mbps			
TX Characteristics	min.	typ.	max.	Unit
Power level(BR/EDR)	0	4	8	dBm
Power level(BLE)	0	4	8	dBm
RX Characteristics	min.	typ.	max.	Unit
Minimum input level(Muti-slot packages sensitivity mode<0.1%)	-90	-85	-80	dBm

ESD CAUTION: Although this module is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this module. It must be protected from ESD at all times and handled under the protection of ESD.

4. Pin Assignments

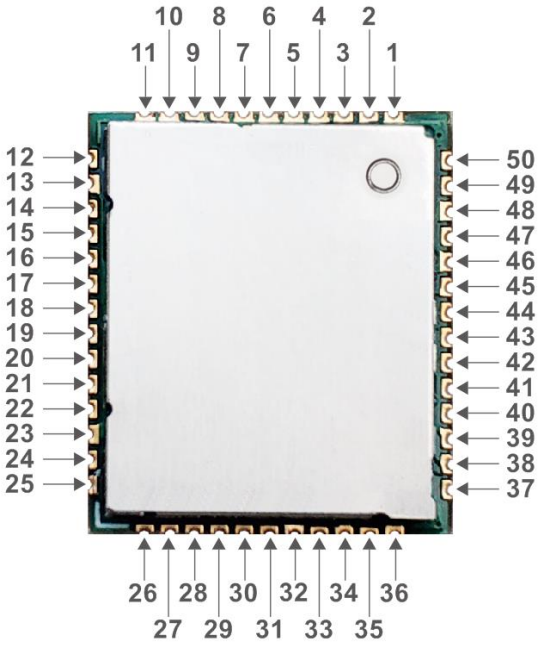

Figure 4-Top view

PIN	Function	Description
1	GND	Ground connections
2	WL_ANT1	WLAN RF ANT1
3	GND	Ground connections
4	GND	Ground connections
5	GND	Ground connections
6	GND	Ground connections
7	GND	Ground connections
8	GND	Ground connections
9	WL_ANT0	WLAN RF ANT0
10	GND	Ground connections
11	GND	Ground connections
12	BT_TRX	BT_ANT
13	NC	No connection(floating)
14	NC	No connection(floating)
15	WL_REG_ON	Input and active low signal, this signal is used by system to turn off WLAN radio with host interface remaining connected
16	WL_WAKE	Output and open drain active low signal. This signal is used to request that the system return from a sleep/suspended state to service a function initiated wake event.
17	SDIO_CMD	SDIO command line

18	SDIO_CLK	SDIO clock line
19	SDIO_DATA3	SDIO data line 3
20	SDIO_DATA2	SDIO data line 2
21	SDIO_DATA0	SDIO data line 0
22	SDIO_DATA1	SDIO data line 1
23	GND	Ground connections
24	WL_WAKE	Output signal, this signal is used to request that the system return from a sleep/suspended state to service a function initiated wake event.
25	NC	No connection(floating)
26	NC	No connection(floating)
27	PCM_SYNC	PCM sync signal
28	PCM_IN	PCM data input
29	PCM_OUT	PCM data output
30	PCM_CLK	PCM clock
31	SUSCLK	External 32k or RTC clock input to reduce power and cost for module.
32	GND	Ground connections
33	NC	No connection(floating)
34	VDIO	Supply voltage for SDIO IO and UART, 3.3V or 1.8V is alternative; VDIO 3.3V for default speed and high-speed modes, 1.8V for SDR12/SDR25/SDR50/DDR50 modes.
35	NC	No connection(floating)
36	VDD33	3.3V Main Power Supply
37	NC	No connection(floating)
38	BT_REG_ON	Input and active low signal, this signal is used by system to shut down BT function with host interface remaining connected. When this pin is pulled low, UART interface will be disabled.
39	GND	Ground connections
40	UART_TXD	Bluetooth UART interface
41	UART_RXD	Bluetooth UART interface
42	UART_RTS_N	Bluetooth UART interface
43	UART_CTS_N	Bluetooth UART interface
44	SD_RESET	Input and active low signal, this signal can externally shut down the module. When this pin is pulled low, SDIO interface will be disabled.
45	NC	No connection(floating)
46	GND	Ground connections
47	NC	No connection(floating)
48	GND	Ground connections
49	HOST_WAKE_BT	Input signal, this signal is used by system to wake up Bluetooth device.
50	BT_WAKE_HOST	Output signal, this signal is used by module to wake host system.

The WL_REG_ON/ BT_REG_ON/ WL_WAKE/ SD_RESET/ HOST_WAKE_BT signal range from 1.8V to 3.3V, the host provides the power source with the targeted power level to the module via the VDIO pin (Pin 34). Power supply, GPIO DC and IO DC characteristics please refer to the fallowing tables.

Symbol	Parameter	Minimum	Typical	Maximum	Units
VDD33	3.3V Supply Voltage	3.1	3.3	3.5	V
VDIO_3.3V	3.3V I/O Supply Voltage	3.1	3.3	3.5	V
VDIO_1.8V	1.8V I/O Supply Voltage	1.62	1.8	1.98	V

Table 1-DC Characteristics

Symbol	Parameter	Minimum	Normal	Maximum	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

Table 2-3.3V GPIO DC Characteristics

Symbol	Parameter	Minimum	Normal	Maximum	Units
VIH	Input high voltage	1.7	1.8	3.6	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

Table 3-1.8V GPIO DC Characteristics

After power-on, the SDIO interface is selected by the module automatically when a valid SDIO command is received. To attain better SDIO host compatibility, the following power-on sequence is recommended. We recommend that the card detection procedures are divided into two phases: A 3.3V/1.8V power pre-charge phase and a formal power-up phase. After the 3.3V ramp up and 1.8V 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 auto loaded to SDIO circuits during the TSDIO_Ready duration and then SDIO pins are pulled up. After CMD5/5/3/7 procedures, card detection is executed.

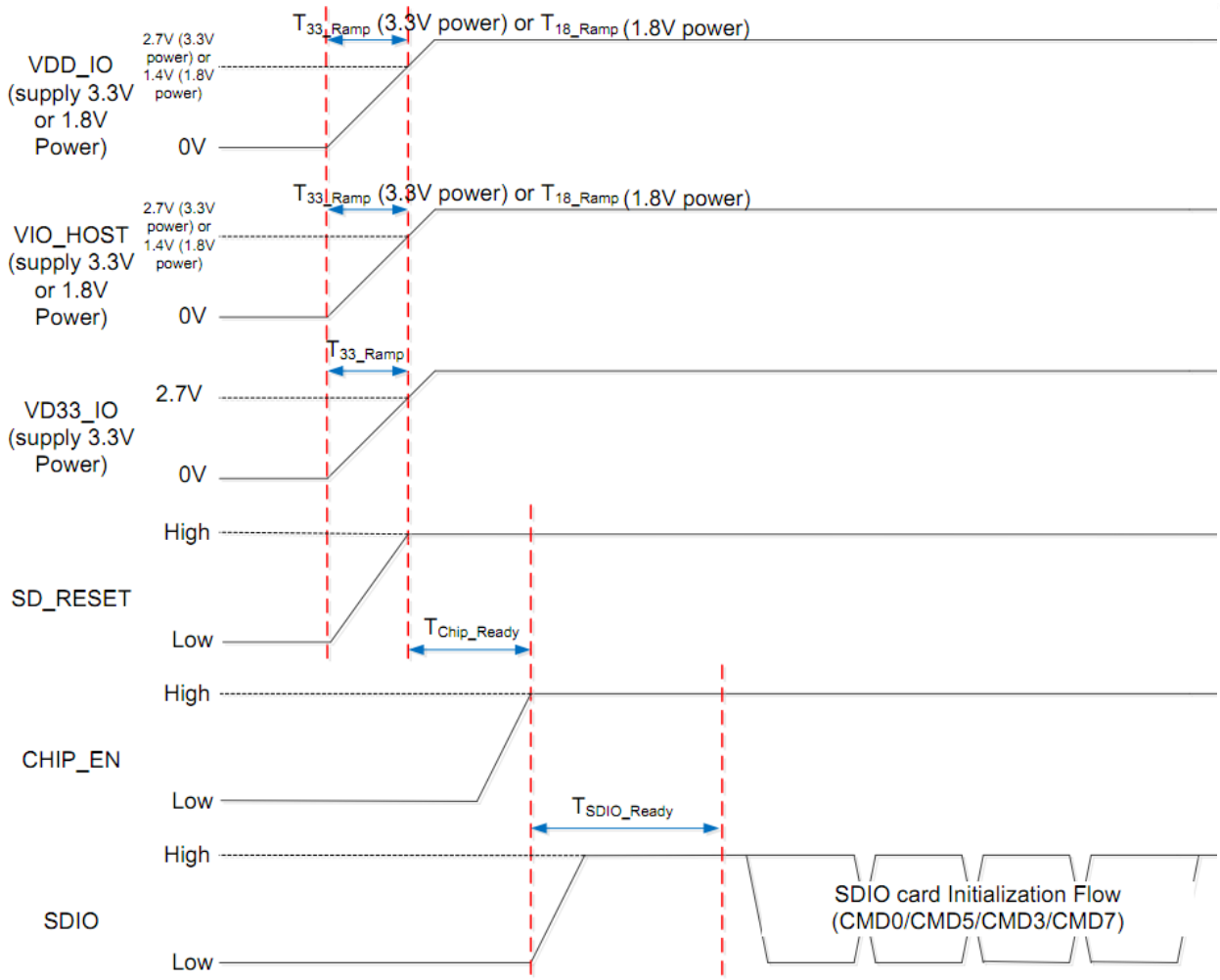

Figure 5-System Power-On Sequence

	Min.	Typical	Max.	Unit	Description
T18_Ramp	0.1	0.5	2.5	ms	The 1.8V power ramp up duration.
T33_Ramp	0.1	0.5	2.5	ms	The 3.3V power ramp up duration.
TChip_Ready	10	100	X	ms	CHIP_EN pull high timing
TSDIO_Ready	10	20	100	ms	SDIO Not Ready Duration. In this state, the module may respond to commands without the ready bit being set. After the ready bit is set, the host will initiate complete card detection procedure.

Table 4-System Power on Timing Parameters

Note: The module pull high CHIP_EN internal.

5. Typical Application Circuit

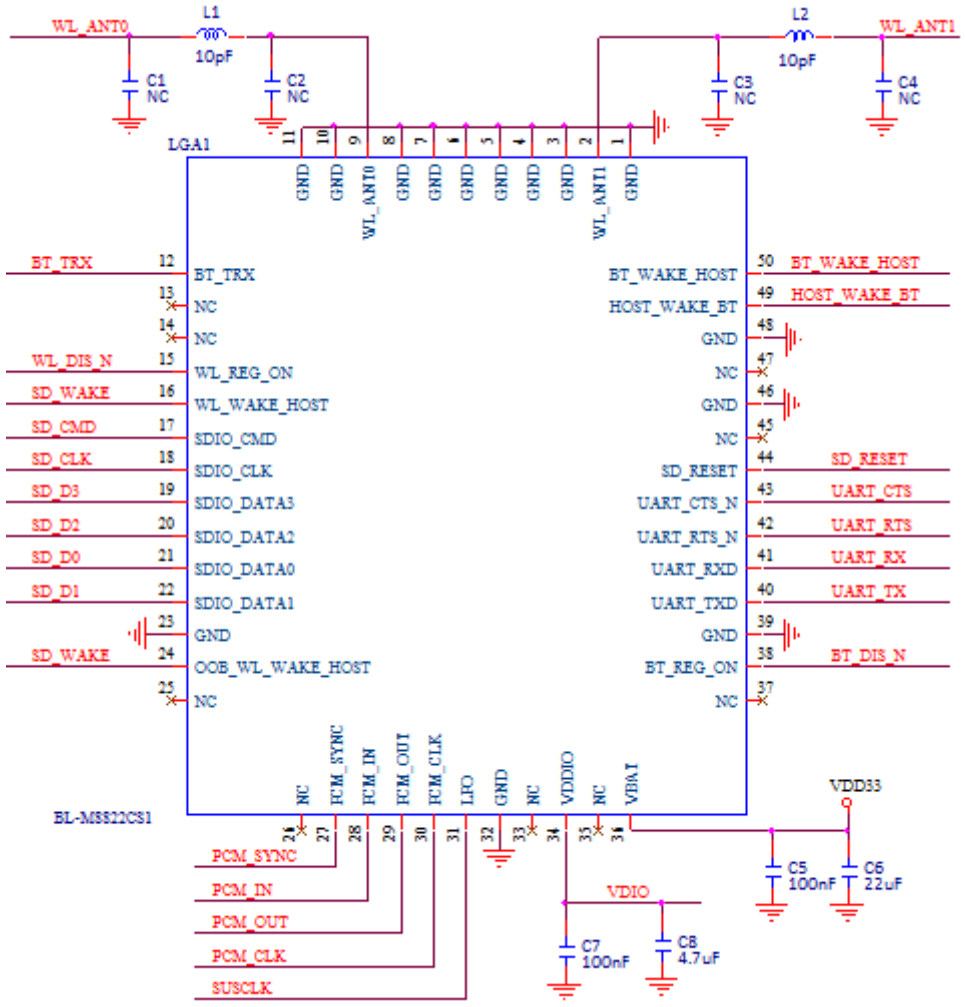

Figure 6

NOTE：

a. RF traces need to keep 50-ohm impedance. Please reserve a “pi” circuit for antenna matching.

b. PIN_15 actives low WLAN disable, no connecting when using; the same as PIN_38.

c. Module’s BT UART_TX connects to reference circuit’s RX, UART_RX connects to reference circuit’s TX.

d. Keep the SDIO lines as equal as possible, minimize the trace length between host and module. Make sure that SD-CLK trace has a good ground reference.

6. Mechanical Specifications

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

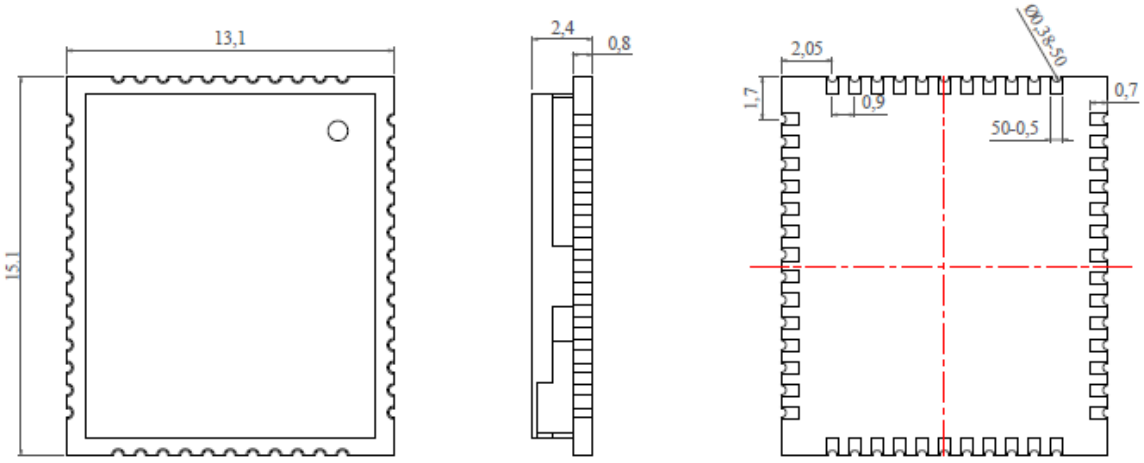

Figure 7-Module dimension

7. Others

7.1 Package Information

Figure 8-Package Information

7.2 Storage Temperature and Humidity

1. Storage Condition: Moisture barrier bag must be stored under 30℃, humidity under 85% RH.
   The calculated shelf life for the dry packed product shall be a 12-months from the bag seal date.
   Humidity indicator cards must be blue, <30%.
2. Products require baking before mounting if humidity indicator cards reads > 30% temp < 30℃,
   humidity < 70% RH, over 96 hours.
   Baking condition: 125℃, 12 hours.
   Baking times: 1 time.

7.3 Recommended Reflow Profile

Reflow soldering shall be done according to the solder reflow profile, Typical Solder Reflow Profile is illustrated in Figures 9. The peak temperature is 245℃.

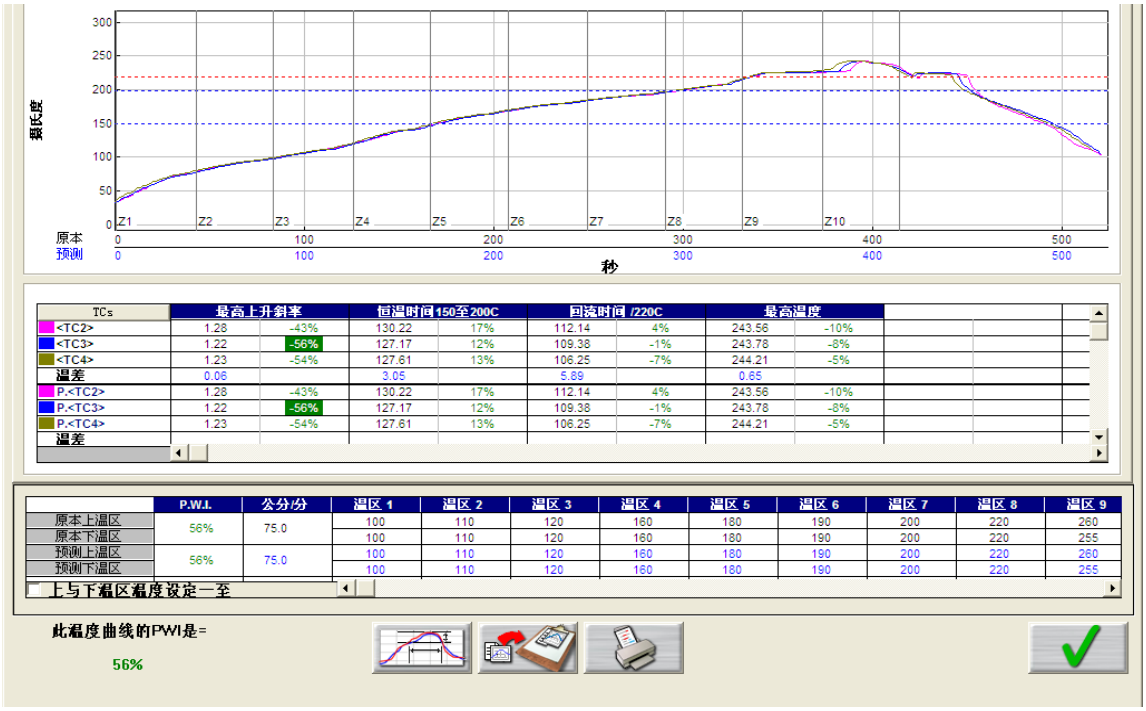

Figure 9-Typical Solder Reflow Profile