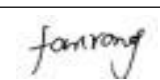# WIFI 2.4GHz&5GHz Module Specification

IEEE 802.11a/b/g/n/ac 2T2R WLAN

Bluetooth 4.2,SDIO/UART Interface

CUSTOMER		CHECKED	APPROVED
	SIGNATURE		
APPROVAL	DATE		
ANRAY		CHECKED	APPROVED
APPROVAL	SIGNATURE	Lujianmei	*fanrong*
VERSION ⚠️⓪	DATE	2020.10.20	2020.10.20

Anray Communication Technology CO.LTD

北京偶极通信设备有限责任公司

Contents

1. General description

1.1 Introduction

P/N: Anray210830702GB02
(Size: 15 * 13 * 2.1mm)

The Anray210830702GB02 is a highly integrated single-chip that support 2-strcam 802.11ac solutions with Multi-user MIMO(Multiple-input,Multiple-Output) with integrated Bluetooth2.1/3.0/4.2/controller, SDIO (SDIO1.1/2.0/3.0) interface,and HS¬UART mixed interface. It combines a WLAN MAC, a 2T2R capable WLAN basebru1d, and RF in s single chip. The module provides a complete solution for a high-performance integrated wireless and Bluetood1 device.

The module baseband implements Multi-user Multiple Input, Multiple Output (MUMIMO) Orthogonal Frequency Division Multiplexing (OFDM) with two transmit and two receive paths (2T2R). Features include two spatial stream transmissions, short Guard Interval (GI) of 400ns, spatial sp1eading, and support for variant channel bandwidth. Moreover, module provides one spatial strean1 space-time block code (STBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range of transmission. At the receiver, extended range and good minimum sensitivity is achieved by having receiver diversity up to 2 antennas. As the recipient, the module also supports explicit sounding packet feedback that helps senders with beamforming capability.

For legacy compatibility, Direct Seq1Uence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802. 11b, 802.1 lg and 802.11a data rates.Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for Legacy data rates, with long or short preamble. The high speed FFT/lFFT paths, combined with BPSK, QPSK, l6QAM, 64QAM and 256QAM modulation of the individual subcarriers, and rate compatible coding rate of 1/2, 2/3, 3/4, and 5/6, provide up to 866.7Mbps for IEEE 802.1 lac MIMO OFDM.

The module builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. For better detection quality, receive diversity with Maximal-Ratio-Combine (MRC) applying up to two receive paths is implemented. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference.Receive vector diversity for multi-stream application is implemented for efficient utilization of the MIMO channel. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end.

The module supports fast receiver Automatic Gain Control (AGC) with sy11chronous and asynchronous control loops among antennas, ante1ma diversity functions, and adaptive transmit power control functions to obtain better performance in the analog portions of the transceiver The module MAC supports 802. 11e for multimedia applications, 802.11i and WAPl (Wireless Authentication Privacy Infrastructure) for security，

and 802.lln/802.l lac for enhanced MAC protocol efficiency Using packet aggregation techniques such as A-MPDU with BAA-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as Legacy Power Save, U-APSD, and MlMO power saving reduce the power wasted during idle time, and compensate for the extra power required to transmit MIMO OFDM.

The module provides sin1ple legacy, 20MHzJ40MHzJ80MHz co-existence mechanisms to ensure backward and network compatibility.

1.2 Features

• CMOS MAC, Baseband PHY and RF in a single chip for IEEE 802. I la/b(g/n/ac compatible WLAN • Support 802.I lac 2×2, Wave-2 compliant with MU-MIMO • Complete 802.11n MIMO solution for 2.4GHz and 5Ghz band	• Maximum PHY data rate up to 173.3 Mbps using 20MHz bandwidth, 400Mbps using 40MHz bandwidth, and 866.7Mbps using 80MHz bandwidth. • Backward compatible with 802.1 la/b/g devices while operating at 802 .11 n data rates • Backward compatible with 802.1 la/n devices while operating at 802 .11 ac data rates.
host Interface • Complies with SDIO 1.1/2.0/3.0 for WLAN with clock rate up to 208MHz	• Complies with HS-UART with configurable baud rate for Bluetooth
Standards supported • IEEE 802.11a/b/g/n/ac compatible WLAN • IEEE 802.11e QoS Enhancement (WMM) • IEEE 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services • IEEE 802.11h DFS, TPC, Spectrum Measurement	• IEEE 802.11 k Radio Resource Measurement • WAPI (Wireless Authentication Privacy Infrastructure) certified.
MAC Features • Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU) • Low latency immediate Block Acknowledgement (BA) • Long NAV for media reservation with CF-End for NA V release • Multiple BSSID feature allows the RTL8822CS-VL to assume multiple MAC identities when used as a wireless bridge	• PHY-level spoofing to enhance legacy compatibility • MIMO power saving mechanism • Channel management and co-existence • Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

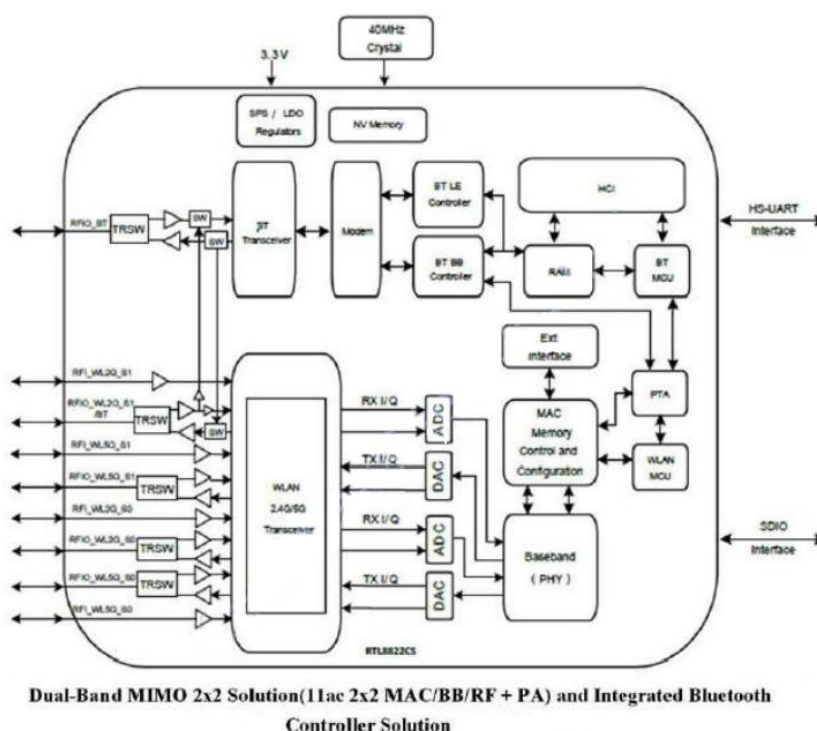| Other Features	
•supports Wake-On-WLAN via Magic Packet and Wake-up frame • Transmit Beam forming	• CCA on secondary through RTS/CTS handshake. • Support TCB/UDP/IP checksum offload
Peripheral Interfaces • Up to 15 General Purpose Input/Output pins • Two configurable LED pins (mux with GPIO pins)	• Generates 40MHz clock for peripheral chip. • Single external power source 3.3V only
PHY Features • IEEE 802. 11ac MIMO OFDM • IEEE 802.11n MIMO OFDM • Two Transmit and Two Receive paths • 5MHz I10MHz/20mhZ/40MHz/ 80MHz band width transmission • Support 2.4Ghz and 5Ghz band ,channels • Short Guard Interval (400ns) • Sounding packet. • DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble • OFDM with BPSK, QPSK, 16QAM, 64QAM and 256QAM modulation. Convolutional Coding Rate: 1/2, 2/3, 3/4, and 5/6	• Maximum data rate 54Mbps in 802.11g, 300Mbps in 802.11n and 866.7Mbps in 802.11ac. • OFDM receive diversity with MRC using up to 2 receive paths. Switch diversity used for DSSS/CCK • Support STBC • Support LDPC • Hardware antenna diversity • Fast receiver Automatic Gain Control (AGC) • On-chip ADC and DAC • Build-in both 2.4GHz and 5GHz PA • Build-in both 2.4GHz and 5GHz LNA

Bluetooth controller	
• Support Bluetooth 4.1 features • Support Bluetooth 4.2 LE Secure Connection by upper layer software upgrade • HS-UART interface for Bluetooth data transmission compliant with H4 and HS specification • PCM interface for audio data transmission via Bluetooth controller • Integrated MCU to execute Bluetooth protocol stack • Supports all packet types in basic rate and enhanced data rate **Bluetooth Transceiver** • Fast AGC control to improve receiving dynamic range • supports AFH to dynamically detect channel quality to improve transmission quality • Integrated internal Class 1, Class 2, and Class 3 PA	• Supports SCO/eSCO link (allows one link for PCM interface and three links for HS-UART) • Supports piconets in a scatternet • Supports Secure Simple Pairing • Supports Low Power Mode (Sniff/Sniff Sub-rating) • Enhanced BT/WLAN Coexistence Control to improve transmission quality in different profiles • Bluetooth 4.0 Dual Mode support: Simultaneous LE and BR/EDR • Supports multiple Low Energy states • Supports Enhanced Power Control • Supports Bluetooth Low Energy • Integrated 32K oscillator for power management
Peripheral Interfaces • General Purpose Input/Output (8 pins)	• Flexible CRYSTAL frequency selection(52, 48, 40, 38.4, 27, 26, 25, 24, 20, 19.2, 17.664,16,14.318, 13 and 12MHz) • Support CRYSTAL or external clock input

1.3 Application

Wireless terminal,industrial remote sensing,security monitoring,medical equipment,electronic station board,intelligent transportation,etc.

2. Electrical Properties

2.1 Schematic diagram

Dual-Band MIMO 2x2 Solution(11ac 2x2 MAC/BB/RF + PA) and Integrated Bluetooth Controller Solution

2.2 General Specification

Model Name	WIFI 2.4GHz &5GHz Module(2T2R)
Standard	Wi-Fi:IEEE802.11a/b/g/n/ac BT:2.1/3.0/4.2
DataTransfer rate	1,2,5.5,6,11,12,18,22,24,30,36,48,54,60,90,120 and maximum of 433Mbps
Modulation Method	DSSS,DQPSK,CCK,OFDM,BPSK,QPSK,l6QAM,64QAM,256QAM
OS Support	Windows 2000,XP32-64,Vista 32/64,Win7 32/64,Linux, Android
Wi-Fi Interface	SDIO 1.1/2.0/3.0
BT Interface	UART
Operating Channel	WIFI 2.4GHz: United States : 11: (Ch. 1-11); Europe : 13: (Ch. 1-13) ; Japan : 14: (Ch. 1-14) BT 2.4GHz: Ch. 0 ~ 78 5G: Ch 36~172
Power Consumption	3.3V±0.2V 1/0 supply voltage

Operating Temperature	-10°C to +60°C
Storage Temperature	-30°C to +85°C
Humidity	5 to 90 % maximum (non-condensing)
Size:L* W * T(mm)	15 * 13 * 2.1±0.15
RoHS	All hardware components are fully compliant with EU RoHS directive

2.3 Power supply DC characteristics

Symbol	PERFORMANCE			
	MIN	TYP	MAX	Unit
VDD33	3.10	3.3	3.50	V
VDDIO	1.8	1.8or3.3	3.50	V

2.4 RF Specification

2.4.1 2.4GHz&5GHz RF Specification

RF Characteristics for IEEE802.11b (11Mbps mode unless otherwise specified)

Items	Contents
Specification	IEEE802.11 b
Channel frequency	2412~2484 MHz
RX (per≤ - 76dBm@8%	-76 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	16dBm
EVM(≤ - 15dB)	- 15dB

RF Characteristics for IEEE802 .11 g (54Mbps mode unless otherwise specified）

Items	Contents
Specification	IEEE802. 11g
Channel frequency	2412 ~ 2484 MHz
RX (per≤ - 68dBm@10%）	-68 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	14 dBm
EVM(≤ - 25dB)	25dB

RF Characteristics for IEEE802 .11 n(BW20_MCS7)

Items	Contents
Specification	IEEE802. 11g
Channel frequency	2412 ~ 2484 MHz
RX (per≤ - 66dBm@10%)	-66 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	13dBm
EVM(≤ - 28dB)	28dB

RF Characteristics for IEEE802 .11 n(BW40_MCS7)

Items	Contents
Specification	IEEE802. 11g
Channel frequency	2412 ~ 2484 MHz
RX (per≤ - 64dBm@10%)	-64 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	13dBm
EVM(≤ - 28dB)	28dB

RF Characteristics for IEEE802 .11 a(54Mbps)

Items	Contents
Specification	IEEE802. 11a(54Mbps)
Channel frequency	4.9GHz~ 5.8GHz
RX (per≤ - 64dBm@10%)	-64 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	14dBm
EVM(≤ - 28dB)	28dB

RF Characteristics for IEEE802 .11 n(BW20_MCS7)

Items	Contents
Specification	IEEE802. 11n (BW20_MCS7)
Channel frequency	4.9GHz~ 5.8GHz
RX (per≤ - 64dBm@10%)	-64 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	14dBm
EVM(≤ - 28dB)	28dB

RF Characteristics for IEEE802 .11 n(BW40_MCS7)

Items	Contents
Specification	IEEE802. 11n (BW40_MCS7)
Channel frequency	4.9GHz~ 5.8GHz
RX (per≤ - 64dBm@10%)	-64 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	14dBm
EVM(≤ - 28dB)	28dB

RF Characteristics for IEEE802 .11AC(BW80_MCS9)

Items	Contents
Specification	IEEE802. 11n (BW40_MCS7)
Channel frequency	4.9GHz~ 5.8GHz
RX (per≤ - 54dBm@10%)	-54 dBm
Freq Err Limit	±10ppm
TX Characteristics	
Power Level (±2 dBm)	13dBm
EVM(≤ - 32dB)	32dB

2.4.2 Bluetooth Specification

Feature	Description	
General Specification		
Bluetooth Standard	Bluetooth V4.1 of 1, 2 and 3 Mbps	
Host Interface	UART	
Antenna Reference	Small antennas with (),-.,2 dBi peak gain	
Frequency Band	2400 GHz ~ 2483.5 GHz	
Number of Channels	79 channels	
Modulation	FHSS, GFSK, DPSK, DQPSK	
RF Specification		
Output Power (Class 1 5)	10	
Output Power (Class 2)	2	
Sensitivity @ BER =O .1 % for GFSK (lMbps)	-92	
Sensitivity @ BER=0.01% for π /4-DQPSK （2Mbps)	-92	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-85	
Maximum Input Level	GFSK (1Mbps):-20dBm	
	π /4-DQPSK（2Mbps）:-20dBm	
	8DPSK (3Mbps) :-20dBm	

3. Pin Definition
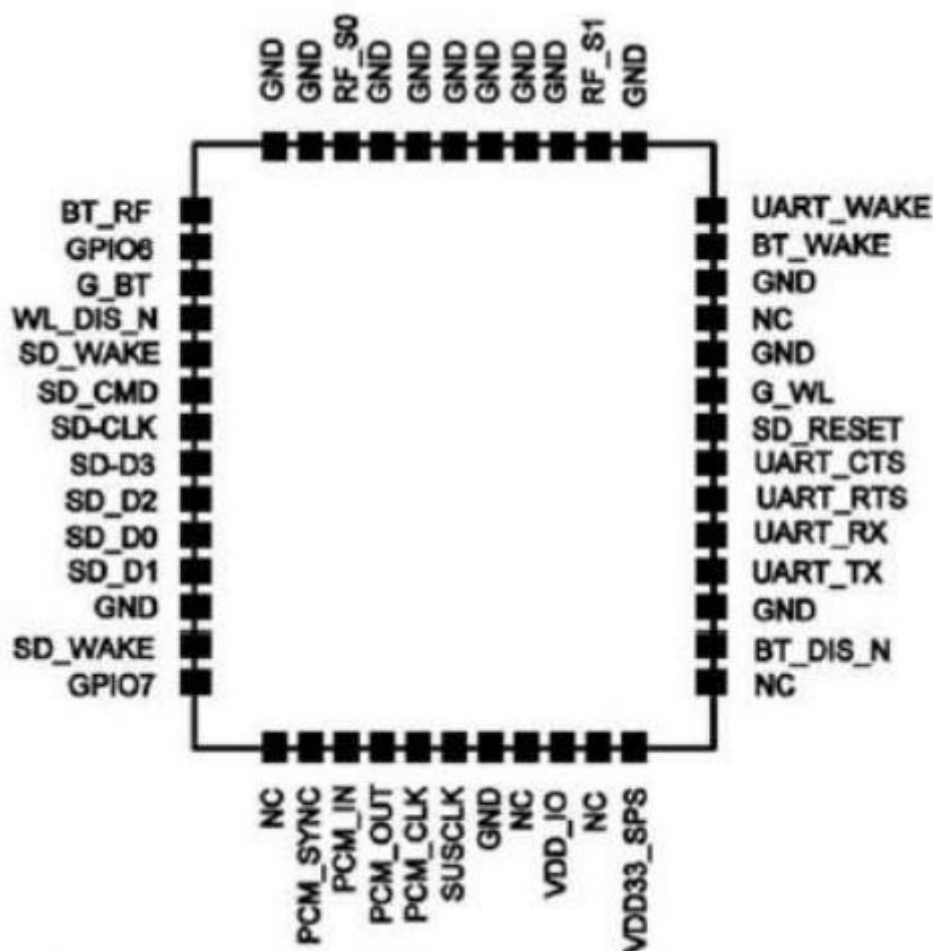
Pin	Function	Description	Voltage	
1	GND	Grow1d connections		
2	RF_S1	ANT 1		
3~8	GND	Ground connections		
9	RT_S0	ANT 0		
10.11	GND	Ground connections		
12	BTRF	BT ANT		
13	GPJ06	General Purpose Input/ Output Pin		
14	G_BT	General Purpose Input/ Output Pin		
15	WL_DIS_N	RF on-off		
16	SD_WAKE	WLAN to wake-up HOST	VDDIO	
17	SD_CMD	SDIO Command Input	VDDIO	
18	SD_CLK	SDIO Clock Input	VDDIO	
19	SD_D3	SOJO Data Line 3	VDDIO	
20	SD_D2	SOJO Data Line 2	VDDIO	

| 21 | SD_D0 | SDIO Data Line 0 | VDDIO | |
22	SD_D1	SDIO Data Line 1	VDDIO	
23	GND	Ground connections		
24	SD_WAKE	WLAN to wake-up HOST	VDDIO	
25	GPIO7	General Purpose Input/Output Pin		
26	NC	NC		
27	PCM_SYNC	PCM Synchronization control, shared with GPIO2	VDDIO	
28	PCM_IN	PCM data Input, shared with GPIOO	VDDIO	
29	PCM_OUT	PCM data Out, shared with GPIOI	VDDIO	
30	PCM_CLK	PCM Clock, shared with GPIO3	VDDIO	
31	SUSCLK	External Low Power Clock input(32.768KHz)		
32	GND	Ground connections		
33	NC	NC		
34	VDD_IO	VDDIO I.8V or 3. 3 V		
35	NC	NC		
36	VD33_SPS	3.3V		
37	NC	NC		
38	BT_DIS_N	Enable pin for Bluetooth device ON pull high , OFF: pull low		
39	GND	Ground connections		
40	UART_TX	High-Speed UART Data Out	VDDIO	
41	UART_RX	High-Speed UART Data In	VDDIO	
42	UART_RTS	High-Speed UART RTS	VDDIO	
43	UART_CTS	High-Speed UART CTS	VDDIO	
44	SD_RESET	RESET SDIO BUS REST	VDDIO	
45	G_WL	General Purpose Input/ Output Pin		
46	GND	Ground connections		
47	NC	NC		
48	GND	Ground connections		
49	BT_WAKE	Host wake-up Bluetooth device	VDDIO	
50	UART_WAKE	Bluetooth device to wake Host	VDDIO	

4. Physical Dimension
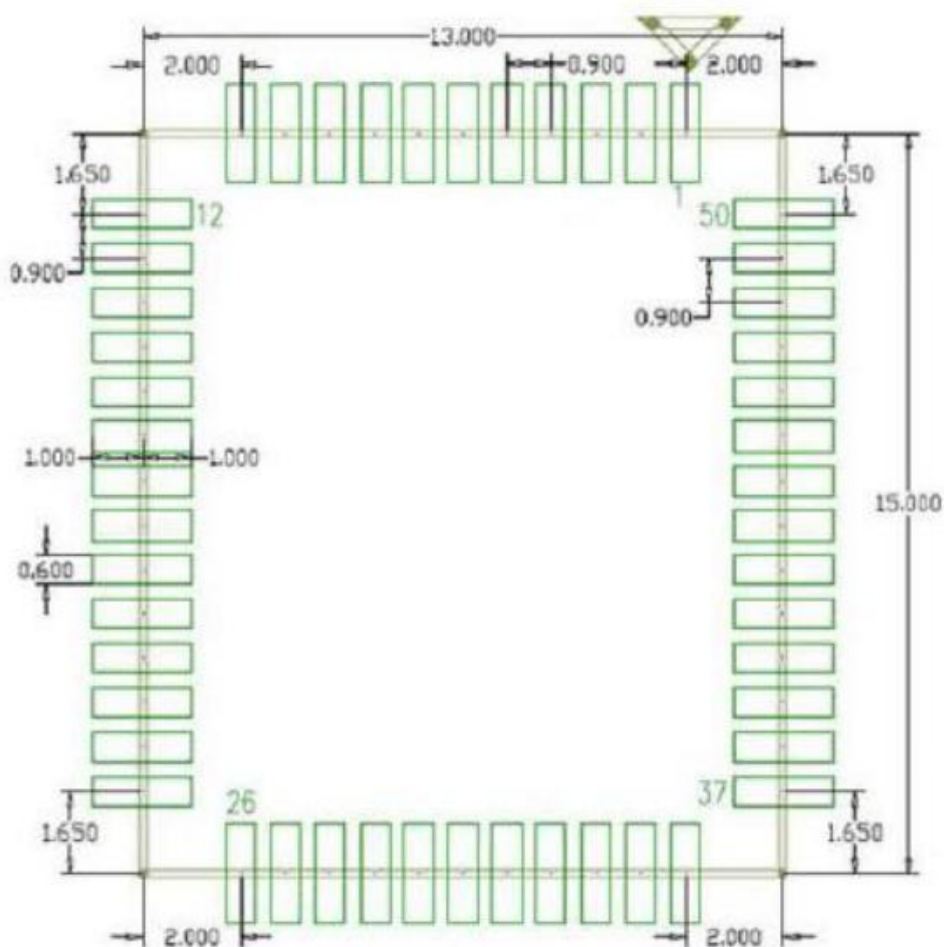
(Unit: mm)
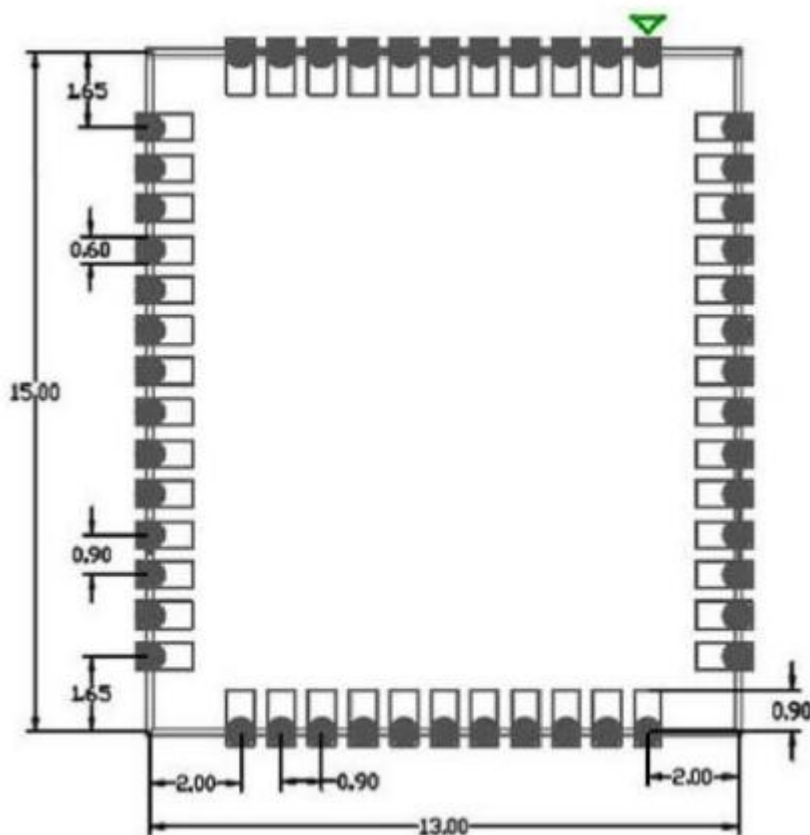
The PCB tolerances within + / -0.2 or so

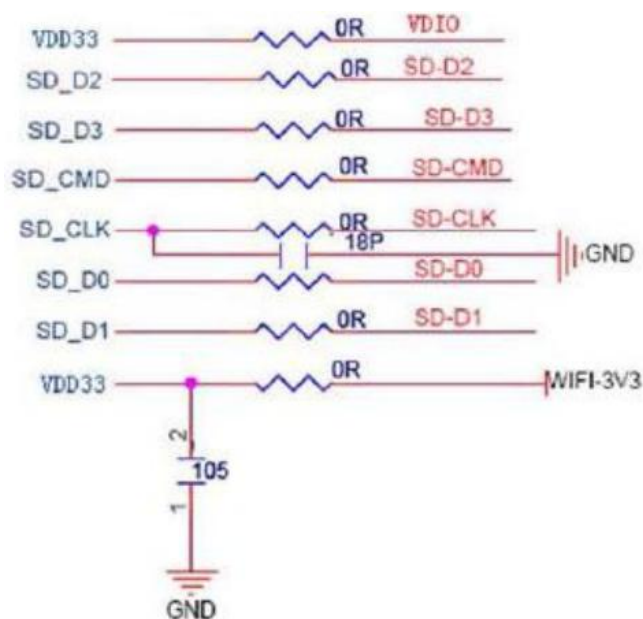# 5. Application circuit diagram

5.1 Reference Design
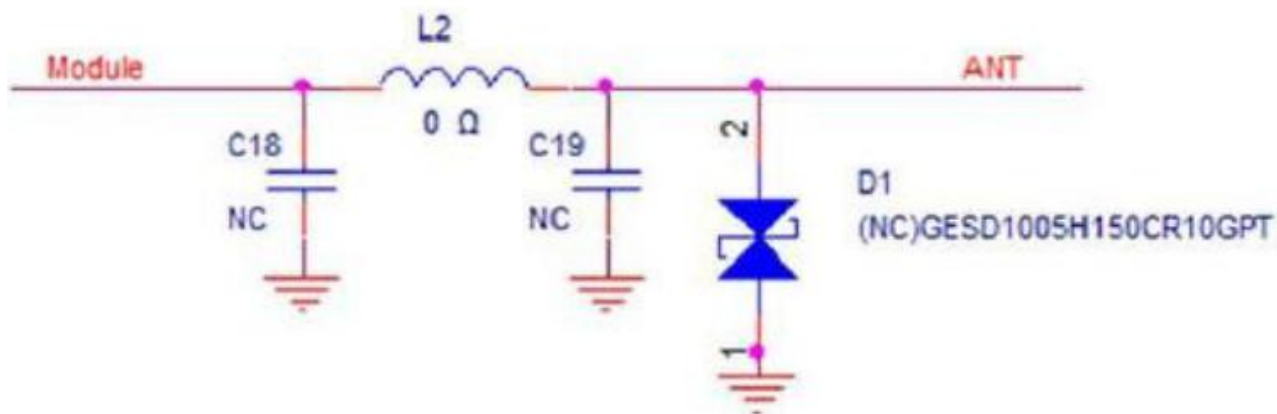
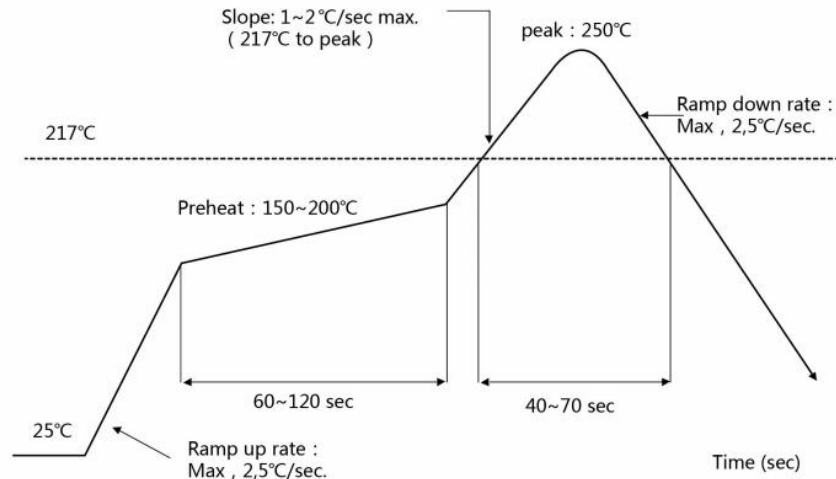## 5.2 Reference Dimension

6. SDIO interface circuit reference

7. Recommended Reflow Profile

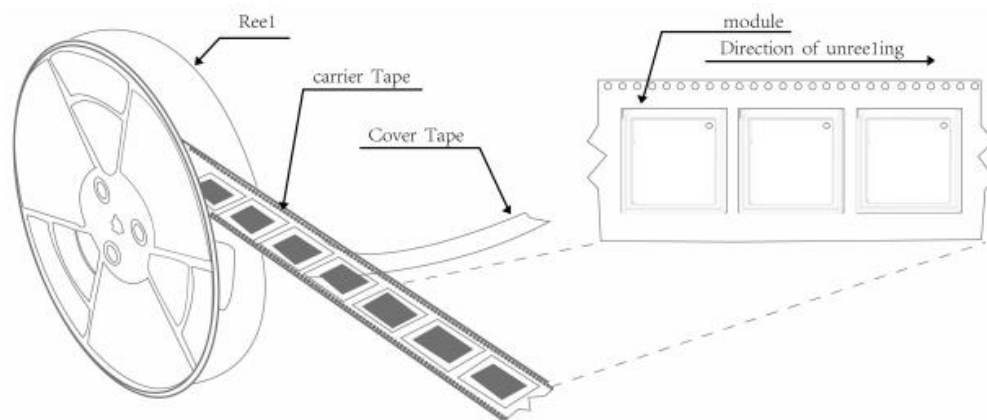Referred to IPC/JEDEC standard.
Peak Temperature : <250°C
Number of Times : ≤2 times

8. Package

Using self-adhesive tape, A roll of 2000pcs.

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