E103-RTL8812CU User Manual

RTL8812CU 2.4GHz&5.8GHz WiFi Wireless Module



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1 Product Overview

1.1 Product Introduction

E103-RTL8812CU is a low-cost, high-performance 2.4GHz+5.8GHz dual-band WiFi module developed by Chengdu Ebyte Electronic Technology Co., Ltd. based on Realtek RTL8812CU-CG chip solution. It complies with IEEE 802.11b/g/n/ac standards, and the interface is USB 2.0 with a maximum rate of up to 867Mbps , which can provide feature-rich wireless connections and reliable data throughput. With rich interfaces and powerful processors, it provides a complete solution for integrated wireless WLAN devices with high throughput performance.

1.2 Features

- Frequency bands are 2.4GHz~2.484GHz and 5.15GHz~5.85GHz ;
- Wireless speed can reach up to 867 Mbps ;
- The communication transmission distance can reach 200m;
- Compliant with IEEE 802.11b/g/n /ac Protocol standards;
- The communication interface is USB 2.0 ;
- Working temperature: -20～＋70℃;
- Widely used in the Internet of Things;

1.3 Application Scenarios

- Wifi video transmission;
- Drones;
- WiFi audio transmission;
- Router;
- Wifi repeater;
- Universal modules for smart home such as serial port forwarding;
- Cloud service applications;

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2 Specifications

2.1 Basic parameters

RF parameters	unit	Numeric	Remark
WiFi Protocols	-	IEEE 802.11b/g/n/ac	-
Reference distance	m	200	Antenna gain 5dBi , module communicates with device
Communication interface	-	USB 2.0	-
Working frequency band	GHz	2.4～2.484 & 5.15～5.85	Supports global license-free ISM 2.4GHz /5GHz band
Operating temperature	℃	-20～70	-
Operating humidity	RH	10%～95%	No condensation

2.2 Hardware Parameters

Hardware Parameters	Parameter Details	Remark
Chip	RTL8812CU-CG	-
Packaging	SMD	-
Antenna interface	IPEX	Characteristic impedance is about 50 ohms
Communication interface	USB 2.0	-
size	31*20mm	The error size is ±0.2mm
weight	2.2g	The error is ±0.1g

2.3 Electrical parameters

2.3.1 Recommended conditions of use

parameter		Min	Typical	Max	Units
Operating temperature		-20	25	70	℃
External Antenna Standing Wave		-	1.7	2	/
Supply voltage	VDD33	3.0	3.3	3.5	V

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2.3.2 I/O interface power specifications

symbol	parameter	Min	Typical	Max	unit
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

2.3.3 Current consumption parameters

Test conditions	VDD33 Current (average value)		
	Typical	Max	unit
WLAN Radio off (Linux Driver)	20	50	mA
WLAN Unassociated (Linux Driver)	100	150	mA
2.4G 11b@1Mbps TX (RF-Test) 18dBm	420	450	mA
2.4G 11b@11Mbps TX (RF-Test) 17dBm	370	400	mA
2.4G 11b@11Mbps RX (RF-Test)	225	260	mA
2.4G 11g@6Mbps TX (RF-Test) 16dBm	350	400	mA
2.4G 11g@6Mbps RX (RF-Test)	225	260	mA
2.4G 11g@54Mbps TX (RF-Test) 16dBm	310	350	mA
2.4G 11n@HT20 MCSO TX (RF-Test) 16dBm	370	420	mA
2.4G 11n@HT20 MCSO RX (RF-Test)	225	260	mA
2.4G 11n@HT20 MCS7 TX (RF-Test) 16dBm	330	350	mA
2.4G 11n@HT40 MCS7 TX (RF-Test) 16dBm	340	370	mA
2.4G 11n@HT40 MCS8 TX (2RF-Test) 16dBm	415	440	mA
2.4G 11n@HT40 MCS8 RX (2RF-Test)	220	260	mA
2.4G 11n@HT40 MCS15 TX (2RF-Test) 16dBm	420	450	mA
2.4G 11n@HT40 MCS15 RX (2RF-Test)	220	260	mA
5G 11a@6Mbps TX (RF-Test RF0 and RF1) 24dBm	720	800	mA
5G 11a@6Mbps RX (RF-Test)	215	300	mA

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5G 11a@54Mbps TX (RF-Test) 18dBm	420	500	mA
5G 11n@HT20 MCS0 TX (RF-Test) 18dBm	431	51 0	mA
5G 11n@HT40 MCS7 TX (RF-Test) 18dBm	410	420	mA
5G 11n@HT40 MCS8 TX (2RF-Test) 18dBm	570	600	mA
5G 11n@HT40 MCS8 RX (2RF-Test)	210	300	mA
5G 11 n@HT40 MCS15 TX (2RF-Test) 18dBm	580	600	mA
5G 11n@HT40 MCS15 RX (2RF-Test)	220	260	mA
5G 11ac@VHT80 MCSO TX (2RF-Test) 16dBm	400	430	mA
5G 11ac@VHT80 MCSO RX (2RF-Test)	240	270	mA
5G 11ac@VHT80 MCS9 TX (2RF-Test) 15dBm	370	400	mA
5G 11ac@VHT80 MCS9 RX (2RF-Test)	270	300	mA
Note: Using electrical parameters VDD33=3.3V, operating temperature: 25℃			

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3 Mechanical Dimensions and Pin Definition

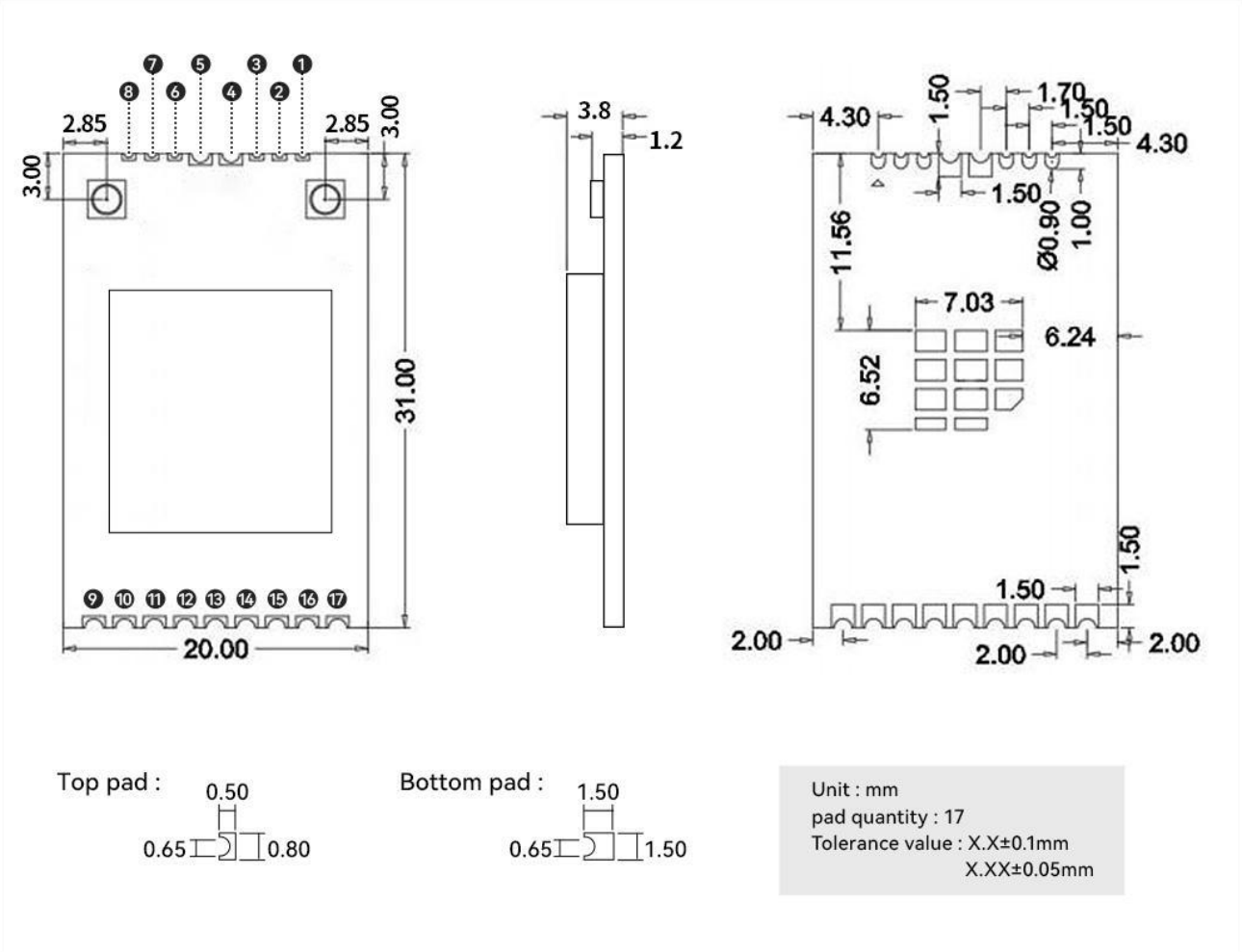


Figure 1 : E103-RTL8812CU Dimensions

Serial number	Pin Name	Pin Type	Pin Function Description
1	GND	RF	Antenna ground pin
2	NC	/	Reserve 2.4G/5G RF PAD for WLAN ANT1
3	GND	RF	Antenna foot
4	GND	P	Ground
5	GND	P	Ground
6	GND	RF	Antenna ground pin
7	NC	/	Reserve 2.4G/5G RF PAD for WLAN ANT0
8	GND	RF	Antenna foot
9	GND	P	Ground
10	NC	/	NC
11	NC	/	NC
12	NC	/	NC

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13	GND	P	Ground
14	DP	AI/O	USB Transmitter/Receiver Differential Pair
15	DM	AI/O	USB Transmitter/Receiver Differential Pair
16	VDD33	P	VDD 3.3V power supply
17	RESET	I	Reset input, this pin can be used to externally shut down/reset the module; The module reset pin is internally pulled high by a 47K resistor and triggers reset when it is at a low level.
	IPEXO	RF	2.4G/ 5G RF to IPEX Connector for WLAN ANT 0
	IPEX1	RF	2.4G/ 5G RF to IPEX Connector for WLAN ANT1
Note: I-input; O-output; I/O-digital I/O; P-power or ground;			

4 WiFi protocol features

4.1 2.4GHz parameter characteristics

characteristics	Parameter Details
Protocol Standards	IEEE 802.11b/g/n
Working frequency band	2.4 ～ 2.484GHz (2.4GHz ISM Band)
Channel	Ch1 ~ Ch1 3 (For 20MHz Channels)
Modulation	802. 1 1b (DSSS): DBPSK, DQPSK, CCK; 802. 11g (OFDM): BPSK, QPSK, 16QAM, 64QAM; 802. 1 1 n (OFDM): BPSK, QPSK, 16QAM, 64QAM;
Transfer rate	802. 11b: 1, 2, 5. 5, 1 1Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCSO ~ MCS7 (1T1R SISO) 6.5 ~ 72. 2Mbps; 802.11n (HT20): MCS8 ~ MCS15 (2T2R MIMO) 13 ~ 144.4Mbps; 802.11n (HT40): MCSO ~ MCS7 (1T1R SISO) 13.5 ~ 150Mbps; 802.11n (HT40): MCS8 ~ MCS15 (2T2R MIMO) 27 ~ 300Mbps;
Frequency deviation tolerance	≤±20ppm
Operating conditions : VDD33 = 3.3V; operating temperature : 25°C	

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4.2 2.4GHz transmitter parameters (WLAN_ANT0 & WLAN_ANT1)

Transfer rate	Transmit power(dBm)	Power Deviation(dBm)	EVM(dB)
802.11b@1Mbps	Recommended Target TX power: 18	±1.5	≦ -10
802.11b@11Mbps	calibrated TX Power : 18	±1.5	≦ -10
802.11g@6Mbps	Recommended Target TX power: 18	±1.5	≦ -10
802.11g@54Mbps	calibrated TX Power : 16	±1.5	≦ -25
802.11 n@HT20 MCSO	Recommended Target TX power: 18	±1.5	≦ -10
802.11n@HT20 MCS7	calibrated TX Power : 16	±1.5	≦ -28
802.11n@HT40 MCSO	Recommended Target TX power: 18	±1.5	≦ -10
802.11n@HT40 MCS7	calibrated TX Power : 16	±1.5	≦ -28
Note: To calibrate the transmit power for the above transmission rates, customers can define the target transmit power for other rates by modifying the configuration file of the driver software. The transmit power defined by the customer must be the same as or lower than the recommended target transmit power.			

4.3 2.4GHz receiver parameters (WLAN_ANT0 & WLAN_ANT1)

Receiving rate	Min Input Level(dBm)	Max Input Level(dBm)	PER
802.11b@1Mbps	-94	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-92	-10	< 10%
802.11g@54Mbps	-74	-10	< 10%
802.11n@HT20_MCS0	-88	-10	< 10%
802.11n@HT20_MCS7	-70	-10	< 10%
802.11n@HT40_MCS0	-86	-10	< 10%
802.11n@HT40_MCS7	-68	-10	< 10%

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4.4 5GHz parameter characteristics

characteristics	Parameter Details
Protocol Standards	IEEE 802.11 a/n/ac
Working frequency band	5.15～5.25GHz; 5.25～5.35GHz; 5.47～5.73GHz; 5.735～5.835GHz (5GHz ISM Band)
Channel	Ch36, Ch40, Ch44, Ch48; Ch52 ~ Ch64; Ch100 ~ Ch140; Ch149 ~ Ch165 (For 20MHz Channels)
Modulation	802.11a(OFDM): BPSK, QPSK, 16QAM, 64QAM; 802. 11n (OFDM): BPSK, QPSK, 16QAM, 64QAM; 802. 11ac (OFDM): BPSK, QPSK, 16QAM, 64QAM, 256QAM;
Transfer rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n(HT20): MCSO～MCS7(1T1R SISO) 6.5～72 . 2Mbps; 802.11n(HT20): MCS8～MCS15(2T2R MIMO) 13～144.4Mbps; 802.11n(HT40): MCSO～MCS7(1T1R SISO) 13.5～150Mbps; 802.11n(HT40): MCS8～MCS15(2T2R MIMO) 27～300Mbpsi 802.11ac(VHT20):MCSO～MCS8(1T1R SISO) 6.5～86.7Mbps; 802.11ac(VHT20):MCSO～MCS8(2T2R MIMO) 13～173.3Mbps; 802.11ac(VHT40):MCSO～MCS9(1T1R SSO)13.5～200Mbps; 802.11ac(VHT40):MCSO～MCS9(2T2R MIMO)27～400Mbps; 802.11ac(VHT80):MCSO～MCS9(1T1R SSO)29.3～433.3Mbps; 802.11ac(VHT80):MCSO～MCS9(2T2R MIMO)58.5～866.7Mbpsi
频偏公差	≤±20ppm
Operating conditions : VDD33 = 3.3V; operating temperature : 25°C	

4.5 5GHz transmitter parameters (WLAN_ANT0 & WLAN_ANT1)

Transfer rate	Transmit power(dBm)	Power Deviation(dBm)	EVM(dB)
802.11a@6Mbps	*Recommended Target TX power: **24	±1.5	≤ - 10
802.11a@54Mbps	calibrated TX Power : 18	±1.5	≤ - 25
802.11n@HT20_MCSO	Recommended Target TX power : 20	±1.5	≤-10
802.11n@HT20_MCS7	calibrated TX Power : 18	±1.5	≤-28
802.11n@HT40_MCSO	Recommended Target TX power : 20	±1.5	≤-10
802.11n@HT40_MCS7	calibrated TX Power : 18	±1.5	≤-28
802.11ac@VHT20_MCSO	Recommended Target TX power :18	±1.5	≤-10
802.11ac@VHT20_MCS8	calibrated TX Power : 15	±1.5	≤-30

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802.11ac@VHT40_MCSO	Recommended Target TX power : 18	±1.5	≤-10
802.11ac@VHT40_MCS9	calibrated TX Power : 15	±1.5	≤-32
802.11ac@VHT80_MCSO	Recommended Target TX power : 18	±1.5	≤-10
802.11ac@VHT80_MCS9	calibrated TX Power : 15	±1 . 5	≦-32
Note: To calibrate the transmit power for certain rates, customers can define the target transmit power for other rates by modifying the configuration file of the driver software. The transmit power defined by the customer must be the same as or lower than the recommended target transmit power.			

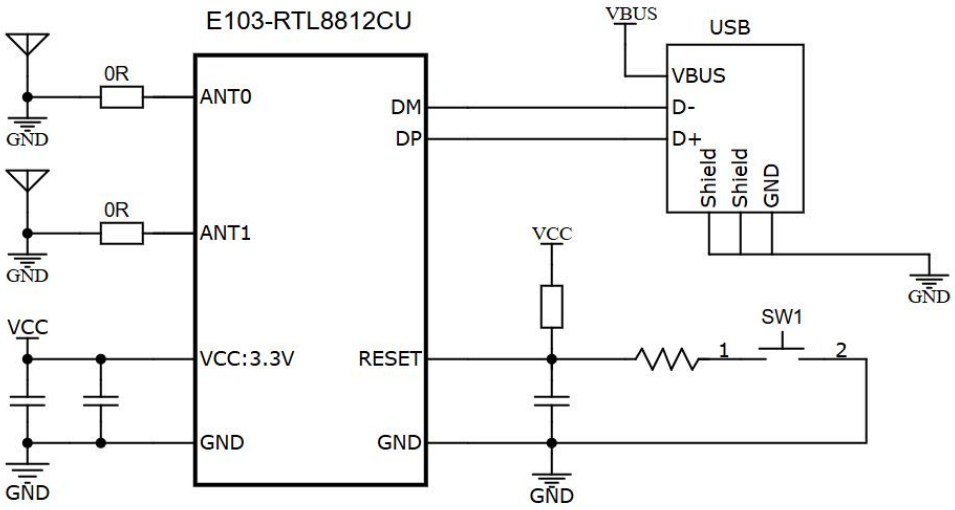
4.6 5GHz receiver parameters (WLAN_ANT0 & WLAN_ANT1)

Receiving rate	Min Input Level(dBm)	Max Input Level(dBm)	PER
802.11a@6Mbps	-92	-10	< 10%
802.11a@54Mbps	-74	-10	< 10%
802.11n@HT20_MCSO	-88	-10	< 10%
802.11n@HT20_MCS7	-70	-10	< 10%
802.11n@HT40_MCSO	-86	-10	< 10%
802.11n@HT40_MCS7	-68	-10	< 10%
802.11ac@VHT20_MCSO	-88	-10	< 10%
802.11ac@VHT20_MCS8	-68	-10	< 10%
802.11ac@VHT40_MCSO	-86	-10	< 10%
802.11ac@VHT40_MCS9	-62	-10	< 10%
802.11ac@VHT80_MCSO	-84	-10	< 10%
802.11ac@VHT80_MCS9	-58	-10	< 10%

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5 Recommended Schematic



Note: Users can choose the USB interface according to actual needs.

6 Frequently Asked Questions

6.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance) ;
- The power supply voltage is lower than the recommended value at room temperature. The lower the voltage, the lower the power output .
- This causes poor matching between the antenna and the module or quality issues with the antenna itself.

6.2 Modules are vulnerable to damage

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity ;

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- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

7 Welding Operation Instructions

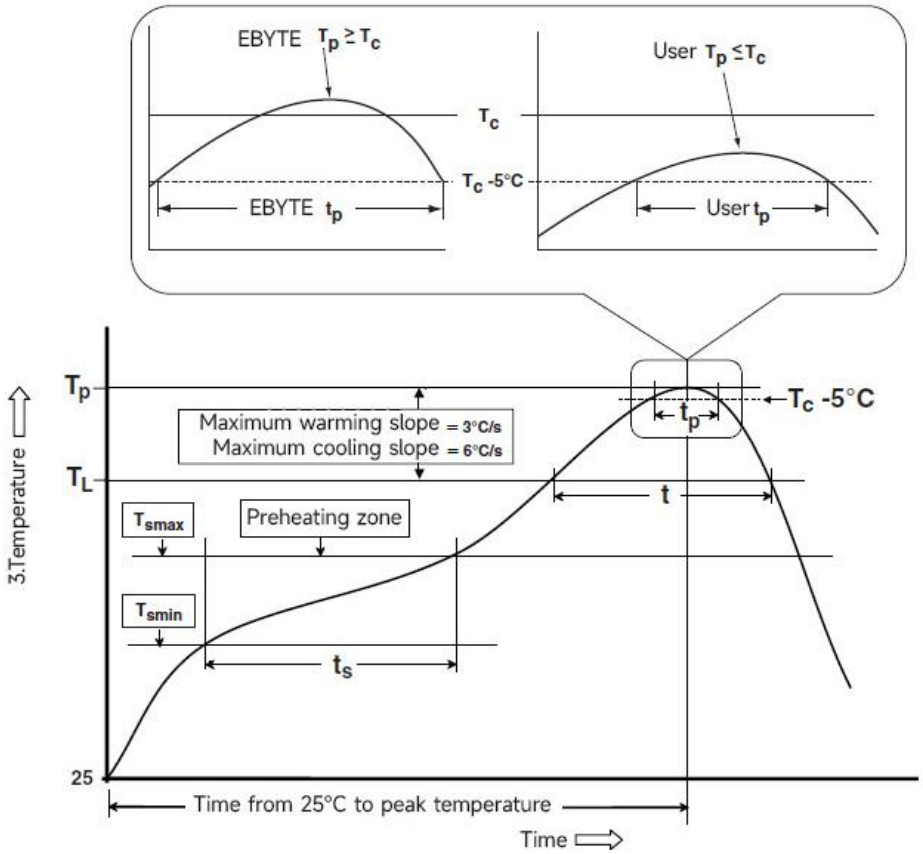
7.1 Reflow temperature

Reflow profile characteristics		Leaded process assembly	Lead-free assembly
Preheating /keeping	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin ~ Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL ~ Tp)		3℃/sec, max.	3℃/sec, max.
Liquidus temperature (TL)		183℃	217℃
Keep time above TL		60 to 90 seconds	60 to 90 seconds
Package peak temperature Tp		Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.	Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.
The time (Tp) within 5°C of the specified classification temperature (Tc) is shown in the figure below.		20 seconds	30 seconds
Cooling slope (Tp ~ TL)		6℃/sec, max.	6℃/sec, max.
Time from room temperature to peak temperature		Max. 6 minutes	Max. 8 minutes
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user			

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7.2 Reflow Oven Curve



8 Antenna Guide

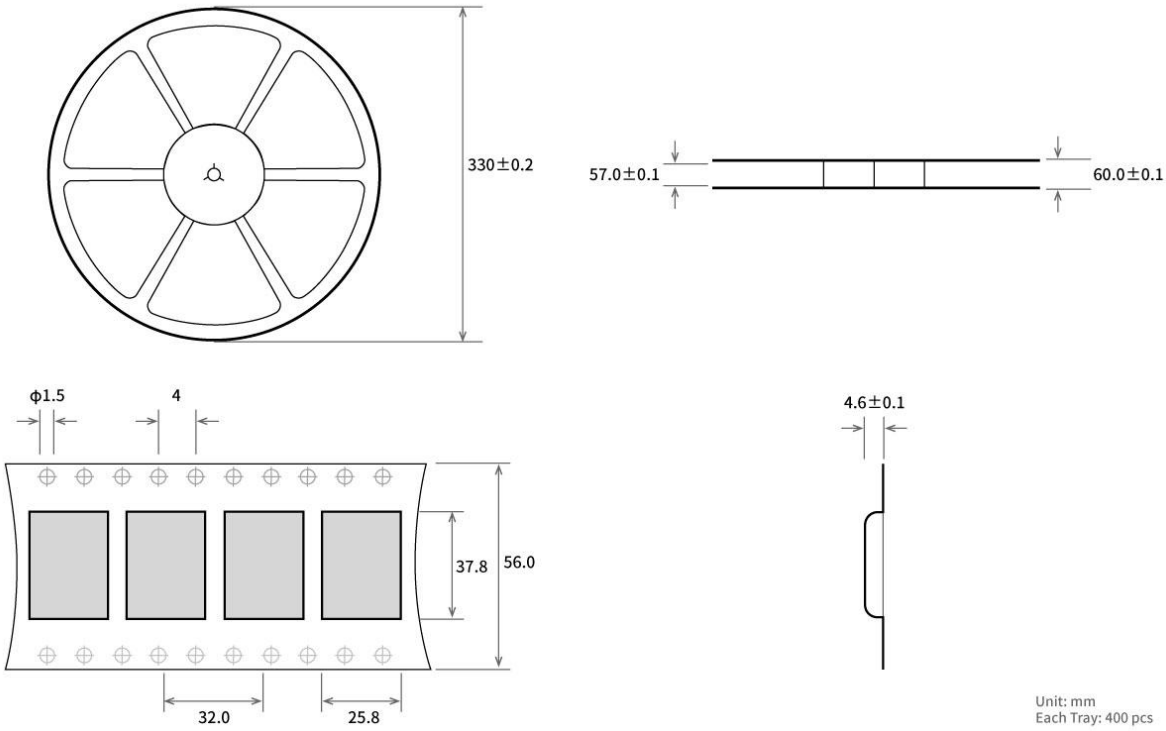
Antennas play an important role in the communication process. Usually, poor-quality antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as matching antennas for our wireless modules with excellent performance and reasonable prices.

Product Model	Type	Frequency band	Gain	size	Feeder	interface	Features
		Hz	dBi	mm	cm		
TX2400-JKD-20	Rubber antenna	2.4G	5.0	13x175x25	-	SMA-J	Fixed bending , omnidirectional antenna
TX2400-JK-11	Rubber antenna	2.4G	2.5	8x90x10	-	SMA-J	Fixed bending , omnidirectional antenna
TX2400-JZLW-15	Rubber cabinet antenna	2.4G	5.0	165	-	IPEX-1	Straight, omnidirectional antenna

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9 Bulk Packaging Methods



Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2024-9-3	Initial release	Hao
1.1	2026-1-7	Correct pin description	Hao

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