

保密等级：机密

SPECIFICATION

产品规格书

SKI.WB800DU1.9

IEEE 802.11b/g/n/ax 1T1R USB Wi-Fi Module

Integrated BT 5.2

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REVISION HISTORY

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1. Introduction（简介）

SKI.WB800DU1.9 is based on AICSEMI AIC8800D, complied with IEEE 802.11b/g/n /ax & BT5.2 standard from 2.4-2.5GHz.

The HW architecture for the module is shown in Figure 1. It combines a WLAN MAC, a 1T1R capable WLAN baseband, and RF in CMOS single chip, which are designed to meet both the low power and high throughput application. The AIC8800D provides a complete solution for a high-performance integrated wireless and Bluetooth device. This documentation describes the engineering requirements specification.

SKI.WB800DU1.9 是一个基于 AICSEMI AIC8800D 方案的 Wi-Fi&蓝牙模组，符合 IEEE 802.11b/g/n/ax&BT5.2 标准，频段 2.4-2.5GHz。

模块的硬件体系结构如图 1 所示。它在 CMOS 单片机中集成了 WLAN MAC、1T1R 能力的无线局域网基带和 RF，旨在满足低功耗和高吞吐量的应用。AIC8800D 为高性能集成无线通信和蓝牙设备提供了完整的解决方案，本文档描述工程需求规范。

2. Features（特性）

Protocol 支持标准	IEEE Std. 802.11b
	IEEE Std. 802.11g
	IEEE Std. 802.11n
	IEEE Std. 802.11ax
	Bluetooth 2.1+EDR/3.0/4.x/5.2
Chip Solution 芯片方案	AIC8800D
Band 波段	2.4GHz
Dimensions 尺寸	25mm×30mm×6mm
Bandwidth 带宽	20/40M
Remark 备注	

型号	安装方式	支持标准	数据速率 (MAX)	频段	天线接口	备注
SKI.WB800DU1.9	SMD	IEEE 802.11a/b/g/n/ac/ax	229Mbps	2.4GHz	Internal antenna	

3. Block Diagram (结构框图)

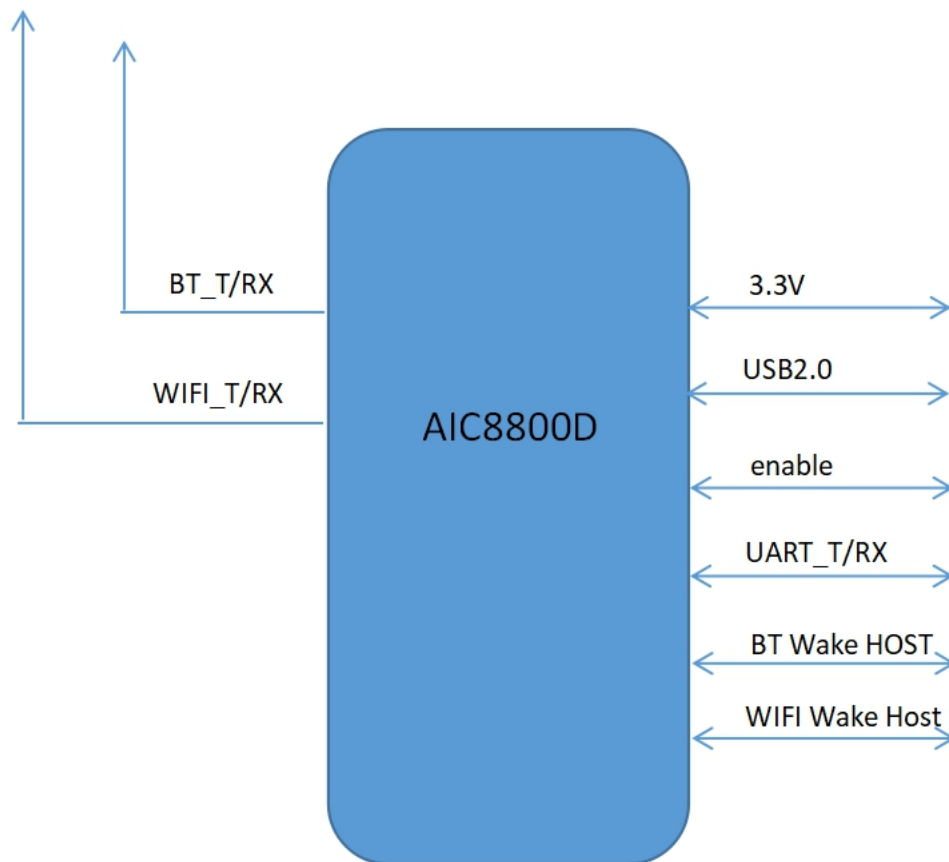
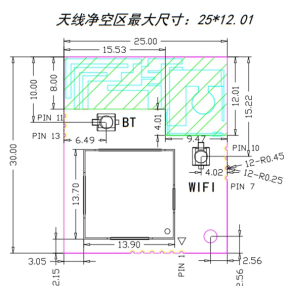
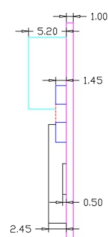


Figure 1 SKI.WB800DU1.9 Block Diagram

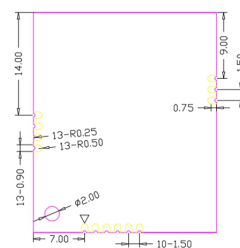
4. Package Outline and Mounting (外形及安裝尺寸)



模组俯视图

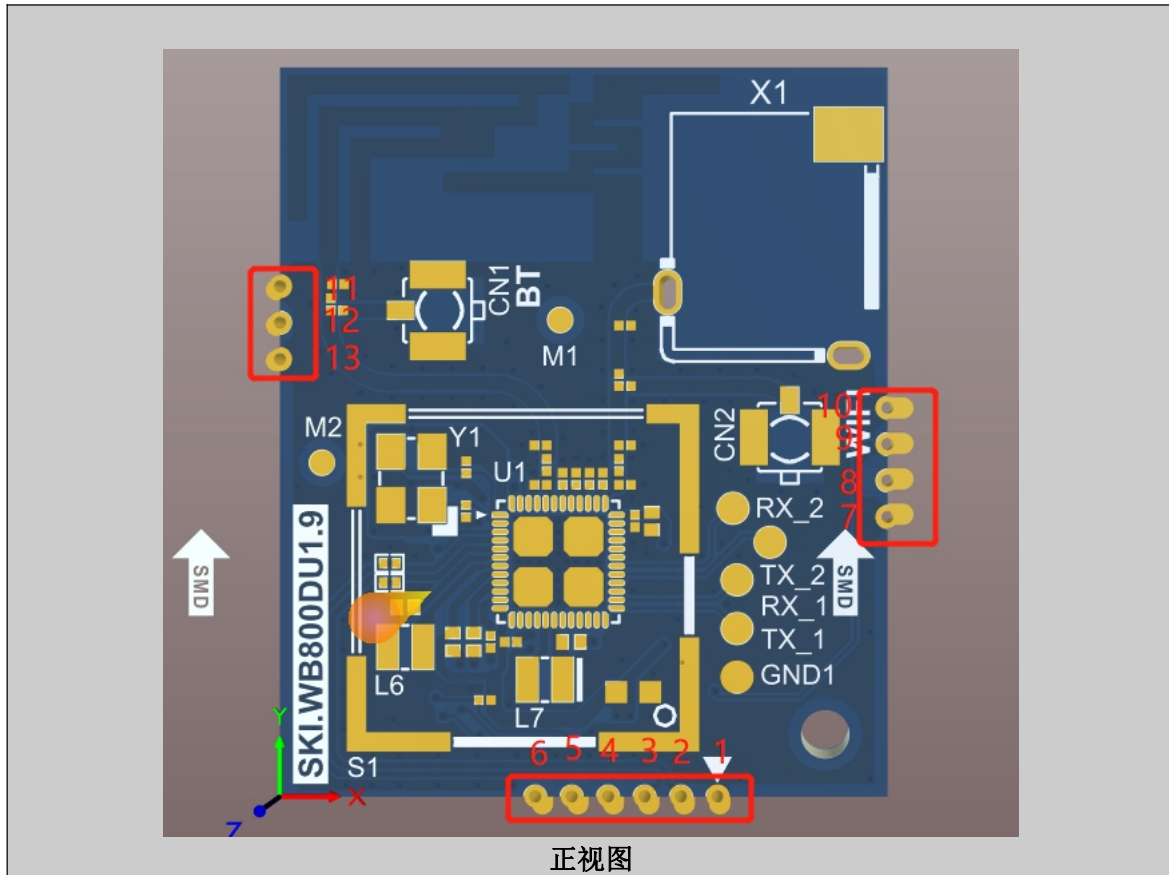


模组侧视图



模组底视图

5. Pin Definition (引脚定义)



PIN	SYMBOL	DESCRIPTION
1	GND	Ground\地
2	DP	WLAN/BT USB2.0 DP Signal\WLAN/BT USB2.0 差分正电压信号
3	DM	WLAN/BT USB2.0 DM Signal\WLAN/BT USB2.0 差分负电压信号
4	3.3V	3.3V
5	Enable	Wi-Fi 使能, 低电平有效,默认高电平
6	WIFI_Wake_Host	WIFI 唤醒主机, 高电平有效, 默认低电平
7	GND	Ground\地
8	NC	NC\悬空
9	BT_Wake_Host	BT 唤醒主机, 高电平有效, 默认低电平
10	GND	Ground\地
11	GND	Ground\地
12	NC	NC\悬空
13	GND	Ground\地

6. Product Pictures（实物图片）

模组料号	正视图	背视图	备注
002.029.0000799			
002.029.0000878			

丝印说明:

- (1) 红色方框内的字符为产品 PCB 型号;
- (2) 黄色方框内的字符为产品周期号;
- (3) 其他为非关键字符, 无须管控。

本产品的型号核准代码标识在产品后标牌上。

7. Key Materials（关键物料）

序号	关键件名称	型号	规格/材料	备注
1	集成电路	AIC8800D	QFN48	
2	PCB	SKI.WB800DU1.9	FR-4,2LAY	
3	晶体振荡器	2.3.3.260001003	26MHz	

8. General Requirements（一般要求）

No.	Feature	Description
8-1	Operation Voltage 工作电压范围	3.3V±0.3
8-2	Current Consumption 最大电流	600mA
8-3	Ripple 纹波*	≤120mV@3.3v
8-4	Operation Temperature 工作温度范围	0°C to +40°C
8-5	Antenna Type 天线类型	Internal antenna
8-6	Interface	High Speed USB 2.0 Interface
8-7	Storage Temperature 存储温度	-40°C to +125°C

*纹波: 定义是主板给模组供电处的纹波要求

9. Electrical Characteristics (电气特性)

除非另有说明，电气规范试验都在下列条件下进行：

环境条件温度：25℃±5℃；

电源电压：模块输入电压 3.3V (±10%)；

The Test for electrical specification was performed under the following condition unless otherwise specified.

Ambient condition Temperature :25℃ ± 5℃；

Power supply voltages: 3.3V (±10%) input power at the Module;

According to country code, channel 12, 13 would be disabled in North America.

9.1 IEEE 802.11b Section

Items	Contents				
Specification	IEEE802.11b				
Mode	CCK				
Channel	CH1 to CH13				
Data rate	1, 2, 5.5, 11Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels(Calibrated)					
17dBm Target (For Each antenna port) @ 11b/11Mbps	15.0	17.0	19.0	dBm	
2. Spectrum Mask @ target power					
1) fc ±11MHz to ±22MHz	-	-	-30	dBr	
2) fc > ±22MHz	-	-	-50	dBr	
3 Constellation Error(EVM)@ target power					
1) 1Mbps	-	-	-10	dB	
2) 2Mbps	-	-	-10	dB	
3) 5.5Mbps	-	-	-10	dB	
4) 11Mbps	-	-	-10	dB	
4. Frequency Error	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5 Minimum Input Level Sensitivity (each chain)					
1) 1Mbps (FER ≤8%)	-	-	-83	dBm	
2) 2Mbps (FER ≤8%)	-	-	-80	dBm	
3) 5.5Mbps (FER ≤8%)	-	-	-79	dBm	
4) 11Mbps (FER ≤8%)	-	-	-76	dBm	
6 Maximum Input Level (FER ≤8%)	-10	-	-	dBm	

9.2 IEEE 802.11g Section

Items	Contents				
Specification	IEEE802.11g				
Mode	OFDM				
Channel	CH1 to CH13				
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels					
15dBm Target (For Each antenna port) @ 11g/54Mbps	12.0	14.0	16.0	dBm	
2. Spectrum Mask @ target power					
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dBm	
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dBm	
3) at $f_c > \pm 30\text{MHz}$	-	-	-40	dBm	
3 Constellation Error(EVM)@ target power					
1) 6Mbps	-	-	-5	dB	
2) 9Mbps	-	-	-8	dB	
3) 12Mbps	-	-	-10	dB	
4) 18Mbps	-	-	-13	dB	
5) 24Mbps	-	-	-16	dB	
6) 36Mbps	-	-	-19	dB	
7) 48Mbps	-	-	-22	dB	
8) 54Mbps	-	-	-25	dB	
4 Frequency Error	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5 Minimum Input Level Sensitivity (each chain)					
1) 6Mbps (PER $\leq 10\%$)	-	-	-85	dBm	
2) 9Mbps (PER $\leq 10\%$)	-	-	-84	dBm	
3) 12Mbps (PER $\leq 10\%$)	-	-	-82	dBm	
4) 18Mbps (PER $\leq 10\%$)	-	-	-80	dBm	
5) 24Mbps (PER $\leq 10\%$)	-	-	-77	dBm	
6) 36Mbps (PER $\leq 10\%$)	-	-	-73	dBm	
7) 48Mbps (PER $\leq 10\%$)	-	-	-69	dBm	
8) 54Mbps (PER $\leq 10\%$)	-	-	-65	dBm	
6 Maximum Input Level (PER $\leq 10\%$)	-20	-	-	dBm	

9.3 IEEE 802.11n HT20/40 Section(2.4GHz)

Items	Contents				
Specification	EEE802.11n HT20/40@2.4GHz				
Mode	OFDM				
Channel	HT20:CH1 to CH13 HT40:CH3 to CH11				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
2. Power Levels					
14dBm Target (For Each antenna port) @ 2.4G/MCS7	12.0	14.0	16.0	dBm	
3. Spectrum Mask @ target power					
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB	
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB	
3) at $f_c > \pm 30\text{MHz}$	-	-	-45	dB	
4. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-28	dB	
5. Frequency Error	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
6. Minimum Input Level Sensitivity (each chain)			HT20	HT40	
1) MCS0 (PER $\leq 10\%$)	-	-	-82	-79	dBm
2) MCS1 (PER $\leq 10\%$)	-	-	-79	-76	dBm
3) MCS2 (PER $\leq 10\%$)	-	-	-77	-74	dBm
4) MCS3 (PER $\leq 10\%$)	-	-	-74	-71	dBm
5) MCS4 (PER $\leq 10\%$)	-	-	-70	-67	dBm
6) MCS5 (PER $\leq 10\%$)	-	-	-66	-63	dBm
7) MCS6 (PER $\leq 10\%$)	-	-	-65	-62	dBm
8) MCS7 (PER $\leq 10\%$)	-	-	-64	-61	dBm
7. Maximum Input Level (PER $\leq 10\%$)	-20	-	-	dBm	

9.4 IEEE 802.11ax HE20/40 Section(2.4GHz)

Items	Contents				
Specification	IEEE802.11ax HE20/40@2.4GHz				
Mode	OFDMA				
Channel	HE20:CH1 to CH13 HE40:CH3 to CH11				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9				
TX Characteristics	Min.	Typ.	Max.	Unit	
1. Power Levels (Calibrated)					
1) For antenna port (MCS9)	10.0	12.0	14.0	dBm	
2. Spectrum Mask @VHT20/VHT40/VHT80 target power					
1) at fc +/-11MHz/21MHz/41MHz	-	-	-20	dBm	
2) at fc +/-20MHz/40MHz/80MHz	-	-	-28	dBm	
3) at fc +/-30MHz/60MHz/120MHz	-	-	-40	dBm	
3. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-27	dB	
9) MCS8	-	-	-30	dB	
10) MCS9	-	-	-32	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5.Minimum Input Level Sensitivity			HE20	HE40	
1) MCS0 (PER ≤10%)	-	-	-82	-79	dBm
2) MCS1 (PER ≤10%)	-	-	-79	-76	dBm
3) MCS2 (PER ≤10%)	-	-	-77	-74	dBm
4) MCS3 (PER ≤10%)	-	-	-74	-71	dBm
5) MCS4 (PER ≤10%)	-	-	-70	-67	dBm
6) MCS5 (PER ≤10%)	-	-	-66	-63	dBm
7) MCS6 (PER ≤10%)	-	-	-65	-62	dBm
8) MCS7 (PER ≤10%)	-	-	-64	-61	dBm
9) MCS8(PER ≤10%)	-	-	-59	-56	dBm
10) MCS9(PER ≤10%)	-	-	-57	-54	dBm
6. Maximum Input Level (PER ≤10%)	-30	-	-	-	dBm

9.5 Bluetooth Specification

9.5.1 BR Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	GFSK				
	Min.	Typ.	Max.	Unit	Remark
TX Characteristics					
1.Output Average Power	-	4	-	dBm	
2.Modulation Characteristics					
1)Delta f1(Avg)	-	157	-	kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)	-	121	-	kHz	
3)Delta f2/ Delta f1	-	0.85	-	kHz	
3.Initial Carrier Frequency Tolerance	-	±20	-	kHz	
4. Carrier Frequency Drift					
1) One Slot packet drift (DH1)	-	±15	-	kHz	
2) Three Slot packet drift (DH3)	-	±15	-	kHz	
3) Five Slot packet drift (DH5)	-	±15	-	kHz	
4) Max Drift Rate	-	±15	-	kHz/50us	
RX Characteristics					
1. Receiver Sensitivity (BER<0.1%)	-	-92	-	dBm	
2. Maximum usable signal (BER<0.1%)	-	-5	-	dBm	

9.5.2 EDR Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	π/4-DQPSK 、8PSK				
	Min.	Typ.	Max.	Unit	Remark
TX Characteristics					
1.Relative Transmit Power	-	4	-	dBm	
1) π/4-DQPSK	-	-1.5	-	dBm	
2) 8PSK	-	-1.5	-	dBm	

2. Frequency Stability					
1) Omega-i	-	±4	-	kHz	
2) Omega-0	-	±4	-	kHz	
3) Omega-0 + Omega-i	-	±4	-	kHz	
3. Modulation Accuracy					
1) RMS DEVM					
π/4-DQPSK	-	±9	-	%	
8PSK	-	±9	-	%	
2) Peak DEVM					
π/4-DQPSK	-	±28	-	%	
8PSK	-	±21	-	%	
3) 99% DEVM					
π/4-DQPSK	-	±15	-	%	
8PSK	-	±12	-	%	
RX Characteristics					
1. Receiver Sensitivity (BER<0.01%)					
1) π/4-DQPSK	-	-91	-	dBm	
2) 8PSK	-	-85	-	dBm	
2. Maximum usable signal (BER<0.1%)					
1) π/4-DQPSK	-	-5	-	dBm	
2) 8PSK	-	-5	-	dBm	

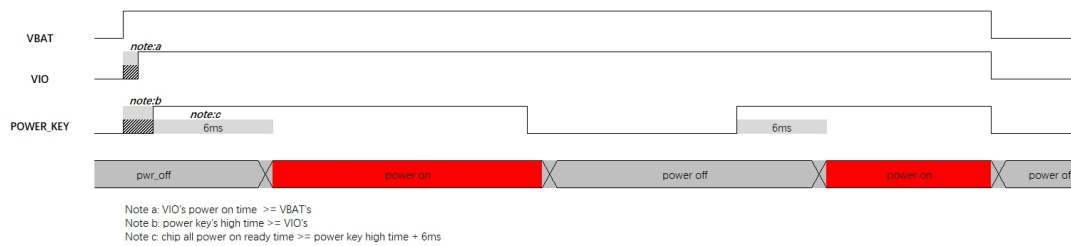
9.5.3 LE Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH39				
	Min.	Typ.	Max.	Unit	remark
TX Characteristics					
1. Output power at NOC	-	4	-	dBm	
2. Modulation Characteristics					
1)Delta f1(Avg)	225	-	275	kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)	185	-	-	kHz	
3)Delta f2/ Delta f1	0.8	0.94	-	Hz/Hz	
3. Carrier frequency offset and drift					
1) Frequency Offset	-150	-	150	kHz	
2) Frequency Drift	-50	-	50	kHz	
3) Max Drift Rate	-20	-	20	Hz/us	
4.In-band Spurious Emissions					

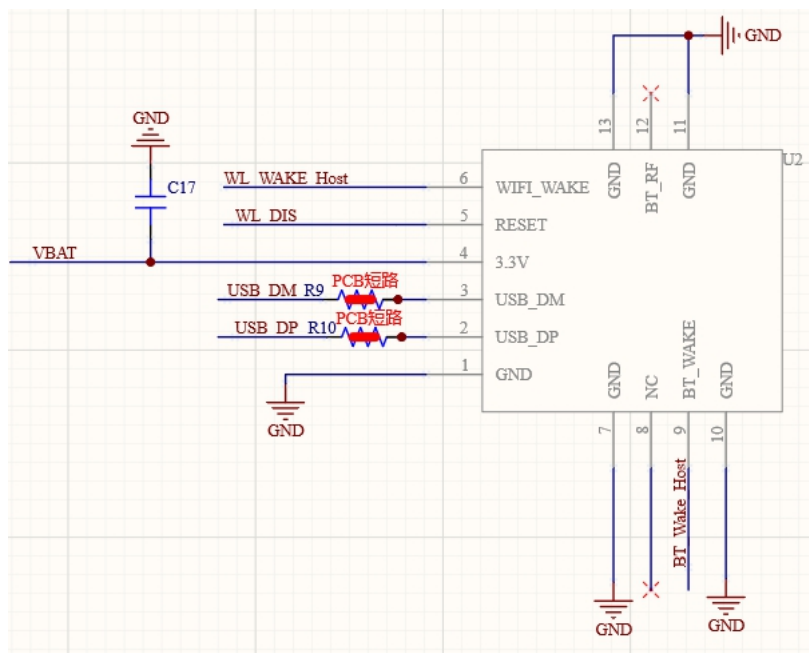
1) $\pm 2\text{M}$ offset	-	-	20	dBm	
2) $> \pm 3\text{MHz}$ offset	-	-	30	dBm	
RX Characteristics					
1. Receiver Sensitivity (BER<30.8%)	-	-95	-	dBm	
2. Maximum usable signal (BER<30.8%)	-	-5	-	dBm	

10. Reference Design (参考设计)

10.1 Timing specification (时序规范)

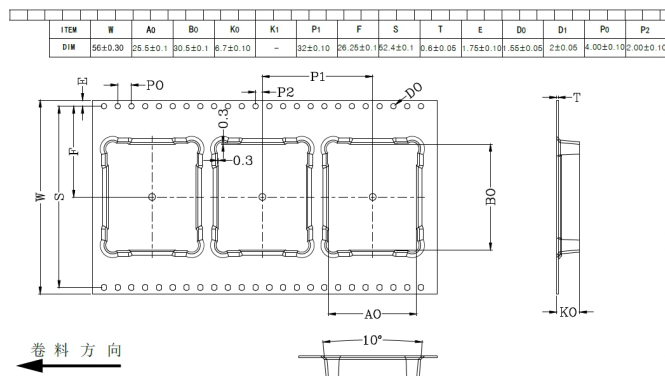


10.2 Reference schematic (参考原理图)

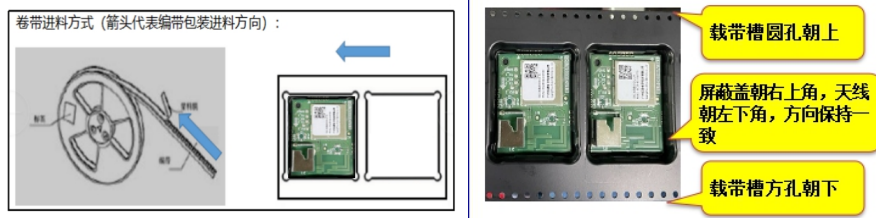


11. Package (包装)

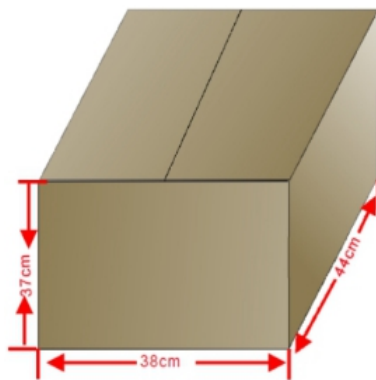
(1) 编带包装



(2) 编带方向



(3) 外箱图纸示意图



(4) 包装要求信息

一盒装 280pcs, 一箱装 6 盒共 1680pcs。

12. 存储、生产

12.1 存储要求

本产品的湿敏特性为 4 级（MSL4），出厂时以真空密封袋包装。产品搬运、存储、加工过程必须遵循 IPC/JEDEC J-STD-033。在环境温度低于 40 摄氏度，空气湿度小于 90% 的情况下，真空包装下产品可存放 12 个月。在产品存放有效期内，如发现真空包装有漏气、湿敏卡变色达到烘烤标准、开封暴露时间超过 72H，需要烘烤后使用。

12.2 生产参数

炉温最高不能超过 250℃，推荐是 240℃。

推荐 SMT 焊炉温曲线如下图所示。

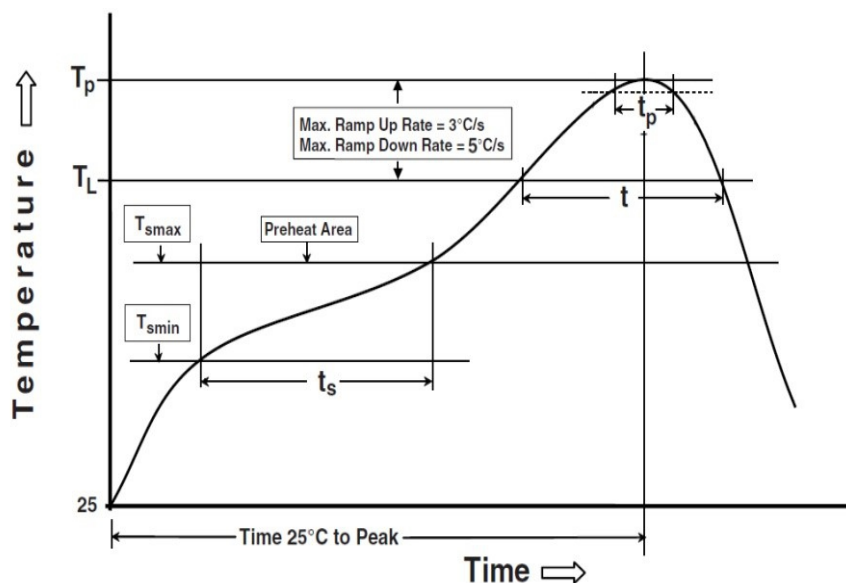


图 6-1 炉温曲线推荐图

炉温参数	最小值	典型值	最大值	单位
预热区最低温度 Tsmin	150			℃
预热区最高温度 Tsmax			200	℃
预热上升时间 ts	80		120	s
回流焊区升温速率(TL 到 Tp)			3	℃/s
回流焊区低温 TL		220		℃
回流焊区峰值温度 Tp	235	240	250	℃
回流焊峰值温度时间 tp(Tp 波动 5℃ 范围)			30	s
回流焊区冷却降温速率 (Tp 到 TL)	-5	-3	-1	℃/s
回流时间 t	40		60	s

表 16-2 炉温曲线参数

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. 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 turning the equipment off and on, the user is encouraged to try to correct the interference by one 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with [part 15](#), [part 2](#) requirements for Modular Approval.

Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

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.

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.

Antenna Type and Gain

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module. Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

Antenna Specification list below:

Antenna Type	Frequency Bands	Max. Antenna Gain (dBi)
External Antenna (BT)	2.4GHz	1.68
External Antenna (WiFi)	2.4GHz	1.97

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: 2AR82-WB800DU19”. The FCC ID can be used only when all FCC compliance requirements are met.

The end product shall bear the following 15.19 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.

Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new certification.

Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all conditions above are met, further transmitter test 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 can not 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 can not be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

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 host integrator must follow the integration instructions provided in this document and ensure that the composite-system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB 996369.

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment