Bluetooth Module Datasheet

Model: AR-6501T

Version: V1.0

2022-7-29

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Release Record

Version	Release Date	Comments
V1.0	2022-07-29	Init

List of Contents

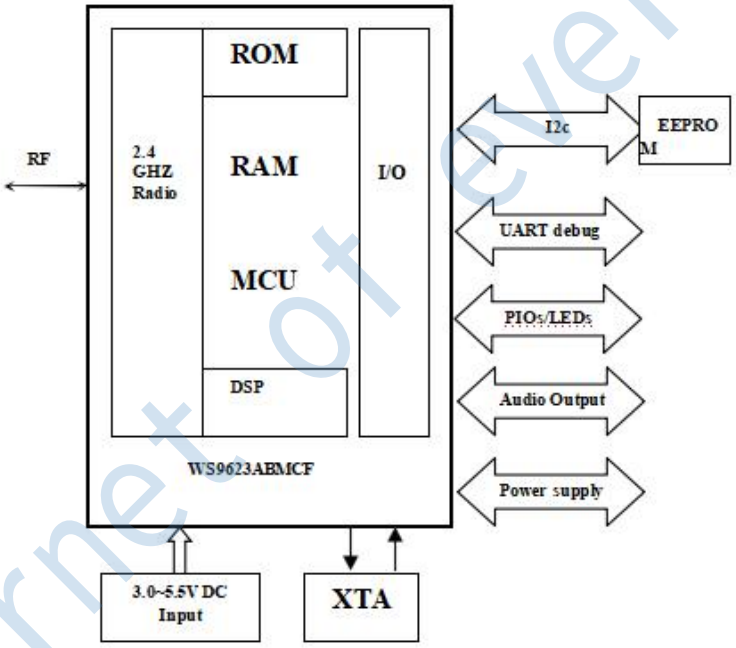
1 Introduction and Block Diagram

1.1 General Introduction

Every connect introduces the pioneer of the Bluetooth 4.1+EDR modules AR-6501T which is a cost effective audio sink device for wireless speakers based on Vimicro ws9623 series and ws9625 series which is headset solution. It consists of 128MHz high performance CPU processor, SRAM, via ROM, Bluetooth baseband controller, Modem, RF, Audio CODEC, PMU, etc.

The protocol stack is stored in the on-chip ROM. It is fully compliant with all the mandatory features of BT V4.1+EDR Spec. .

1.2 Block Diagram



2 Main Features and Applications

2.1 Key Features

- Fully qualified Bluetooth v4.1+EDR feature including eSCO and AFH.
- Allows full speed data transfer, mixed voice and data, and full piconet operation, including all EDR packet types.
- Audio transcoders for A-law, u-law and linear voice from host and A-law, u- law and CVSD voice over air.
- Good performance for RF characteristics.
- Dual Microphone inputs.

- Advanced multi-point support
- Internal 512KB via ROM.
- Internal 4M bit SPI flash.
- Support UART interface for HCI communication
- Powered by 3.0~5.5V Li-lon battery, charged by 3.0~6.5V adapter or USB.

2.2 Application Area

- Wireless speakers and Wireless headset

3 Technical Specifications

3.1 General Specification

Model Name	AR-6501T
Product Description	Bluetooth 4.1 Class2 Module
Bluetooth Standard	Bluetooth 4.1
Dimension	21mm x 14.7mm x 2.0mm
Operating Conditions	
Voltage	3.0~5.5V
Temperature	-20～+80℃
Storage Temperature	-40～+85℃
Electrical Specifications	
Frequency Range	2402～2480MHz
Maximum RF Transmit Power	4dBm
Receive Sensitivity	-85dBm

3.2 Electrical Characteristics

3.2.1 Absolute Maximum Rating

Rating	Minimum	Maximum
Storage temperature	-40℃	+85℃

3.2.2 Recommended Operating Conditions

Operating Condition	Minimum	Typical	Maximum
Operating temperature	-20℃	+20℃	+80℃
Supply voltage: VBAT	+3.0V	+3.7V	+5.5V
Supply Voltage: VCHGER	3.0V	5.0V	6.5V

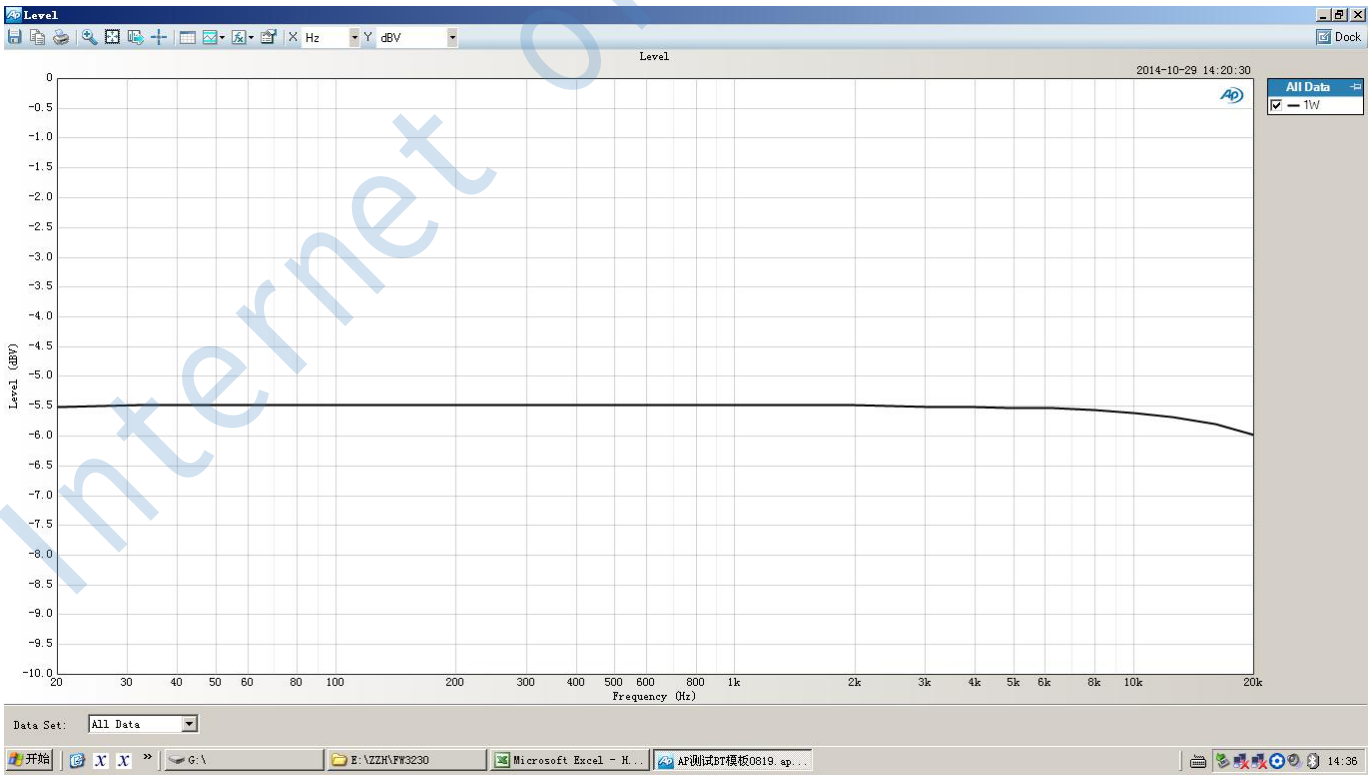
3.2.3 Audio Features

Test condition：模块供电 VBAT=3.7V，输入 1KHz 0dB 信号，外接 16Ω负载，ws9623 差分立体声输出

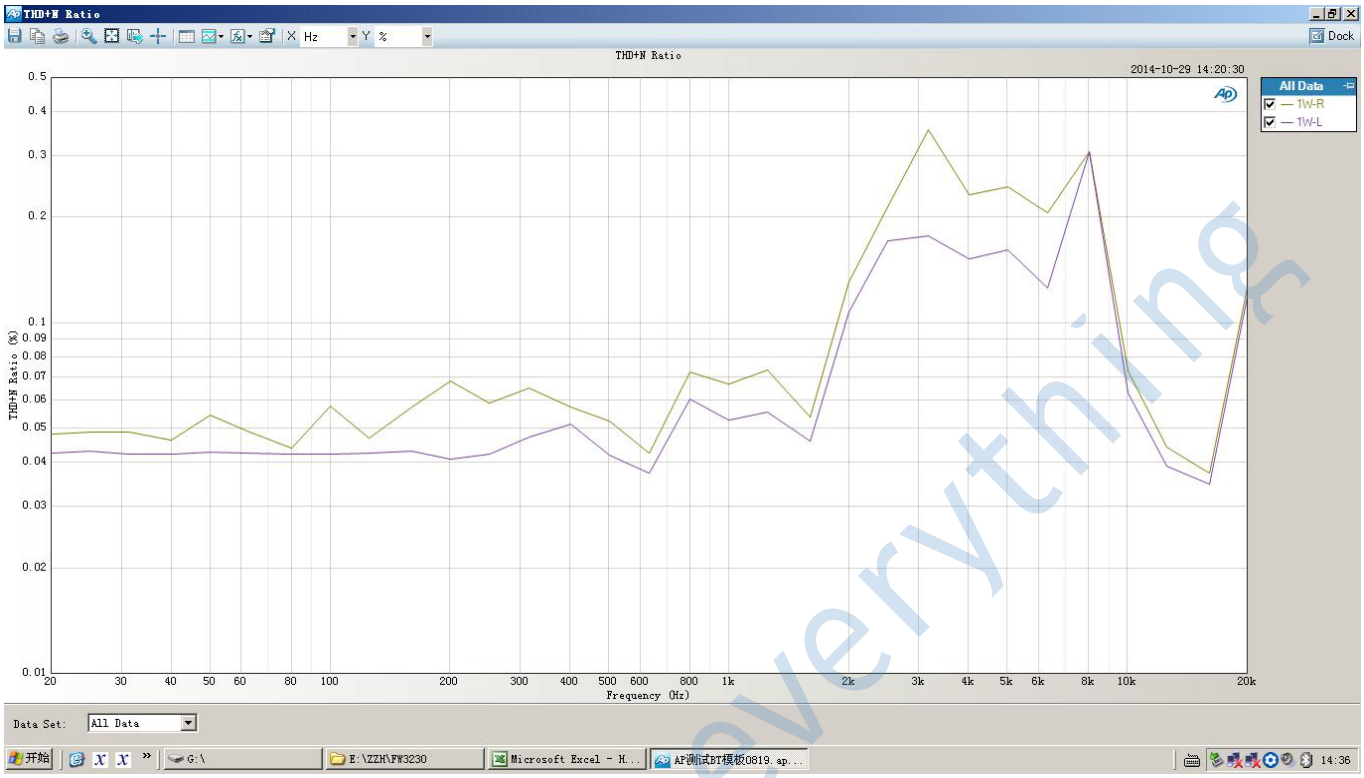
	Value
Output power	17.5mW
Output level	530mV
THD	0.07%
SNR(A-weighted)	91dB
Cross-talk: Left to Right	-86dB
Cross-talk: Right to Left	-64dB
Balance	0.2dB

3.3 Frequency Response

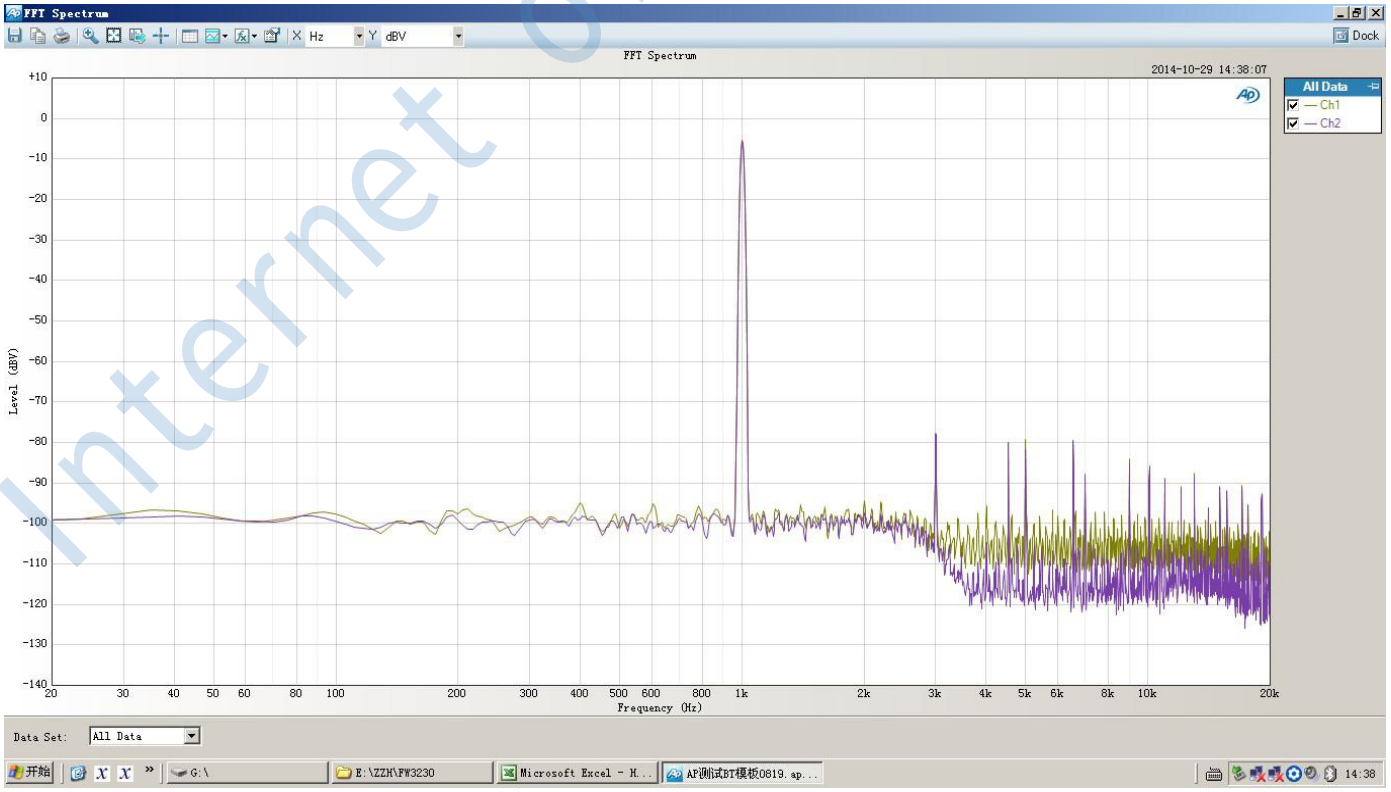
Max Level:



THD+N



FFT



3.4 RF Characteristic

Transmitter			
Radio Characteristics Temperature=+20℃			
TRM/CA/01/C(Output Power)） PASS			
Hopping ON	**Low**	**Med**	**High**
Average Power	2.61	2.99	3.11
Maximum Power	2.62	3.01	3.12
Minimum Power	2.6	2.97	3.09
Peak Power	3.29	3.7	3.82
Packets Tested	10	10	10
Packets Failed	0	0	0
Result	Pass	Pass	Pass
TRM/CA/03/C(Power Control) PASS			
Hopping OFF	**Low**	**Med**	**High**
Maximum Power	3.8	4	5
Minimum Power	- 5.6	- 5.7	- 3.2
Maximum Step	3.7	3.8	3.2
Minimum Step	2.8	2.6	2.1
Packets Tested	6	6	6
Packets Failed	0	0	0
Result	pass	pass	pass
TRM/CA/08/C(Initial Carrier) PASS			
Hopping ON	**Low**	**Med**	**High**
Average offset	41.5	42.4	42.1
Max +ve Offset	44.8	45.5	43.5
Min –ve Offset	39	39.8	40.6
Packets Tested	10	10	10
Packets Failed	0	0	0
Result	Pass	Pass	Pass
TRM/CA/09/C(Carrier Drift) PASS			
Hopping ON - Low Channel	**DH1**	**DH3**	**DH5**
Drift Rate/50uS	4.69	- 5.12	6.97
Maximum Drift	- 7	- 8	- 7
Average Drift	- 4	- 4	- 3
Packets Tested	30	30	30
Packets Failed	0	0	0

Result	Pass	Pass	Pass
Hopping ON - Med Channel	**DH1**	**DH3**	**DH5**
Drift Rate/50uS	- 4.52	5.49	- 6.43
Maximum Drift	- 7	- 6	- 7
Average Drift	- 5	- 2	- 5
Packets Tested	30	30	30
Packets Failed	0	0	0
Result	Pass	Pass	Pass
Hopping ON - High Channel	**DH1**	**DH3**	**DH5**
Drift Rate/50uS	- 5.02	- 5.67	5.82
Maximum Drift	8	- 7	- 6
Average Drift	- 1	0	- 2
Packets Tested	30	30	30
Packets Failed	0	0	0
Result	Pass	Pass	Pass
TRM/CA/01/C(Modulation Characteristics)			
Hopping OFF	**Low**	**Med**	**High**
F1 Average	159.4	161.5	163.6
F1 Maximum	164.8	166.8	166.6
F1 Packets Failed	0	0	0
F2 Average	151.2	151.3	151.1
F2 Maximum	142.8	142.2	141.6
F2 pass rate	100.00%	100.00%	100.00%
F1/F2 Ratio	0.94	0.93	0.92
Total Packets Tested	20	20	20
Overall Result	Pass	Pass	Pass

Receiver

Radio Characteristics Temperature=+20℃				
RCV/CA/01/C(Single Sensitivity) （-90.0dBm） PASS				
Hopping OFF	**Low**	**Med**	**High**	**Any**
Overall BER	0.0210%	0.0290%	0.0520%	0.0380%
Overall FER	6.8030%	8.7340%	14.9300%	10.5430%
Packets Sent	7408	7408	7408	7408
Packets Received	7238	7188	7075	7185
Bit Errors	323	448	798	597

Frame Errors	504	647	1106	781
CRC errors	323	417	755	536
Length errors	11	10	20	22
Lost Packets	170	220	333	223
Result	Pass	Pass	Pass	Pass
RCV/CA/01/C(Multi Slot Sensitivity) （-90.0dBm）PASS				
Hopping OFF	**Low**	**Med**	**High**	**Any**
Overall BER	0.0490%	0.0170%	0.0400%	0.0430%
Overall FER	40.6780%	37.4580%	67.6270%	44.2370%
Packets Sent	590	590	590	590
Packets Received	559	560	517	558
Bit Errors	712	259	676	648
Frame Errors	240	221	399	261
CRC errors	187	191	325	228
Length errors	25	0	5	1
Lost Packets	31	30	73	32
Result	Pass	Pass	Pass	Pass
RCV/CA/06/C(Maximum Input Level) PASS				
Hopping OFF	**Low**	**Med**	**High**	
Overall BER	0.0060%	0.0200%	0.0140%	
Overall FER	35.4210%	31.4520%	25.2700%	
Packets Sent	7408	7408	7408	
Packets Received	4780	5091	5544	
Bit Errors	67	219	170	
Frame Errors	2624	2330	1872	
CRC errors	3	11	7	
Length errors	1	2	1	
Lost Packets	2620	2317	1864	
Result	Pass	Pass	Pass	

3.5 Main components list

NO.	Description	Manufacture	Manufacturer P/N
1	IC BT WS9623	VIMICRO	WS9623ABMDF
	IC BT WS9623	VIMICRO	WS9623ABSDF
	IC BT WS9625	VIMICRO	WS9625ABMDF

	IC BT WS9625	VIMICRO	WS9625ABSDF
2	Crystal 26M 8.5PF 10PPM	HOSONIC	E3SB26.0000F8ES11M
	Crystal 26M 8.5PF 10PPM	TXC	7M26000314
	Crystal HSX321S Series 26MHz 9pF 10ppm SMD 3229	H.ELE	X3S026000B91H-NZ

4 Module series information

4.1 Mono Series

AR-6501T-23MD:based on the ws9623ABMDF

AR-6501T-25MD:based on the ws9625ABMDF

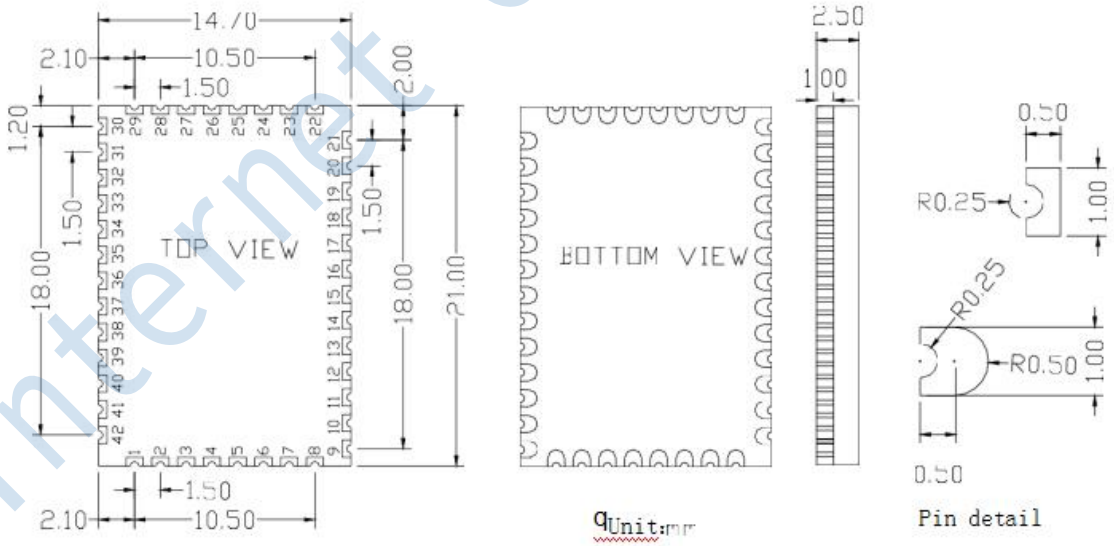
4.2 Stereo Series

AR-6501T-23SD:based on the ws9623ABSDF

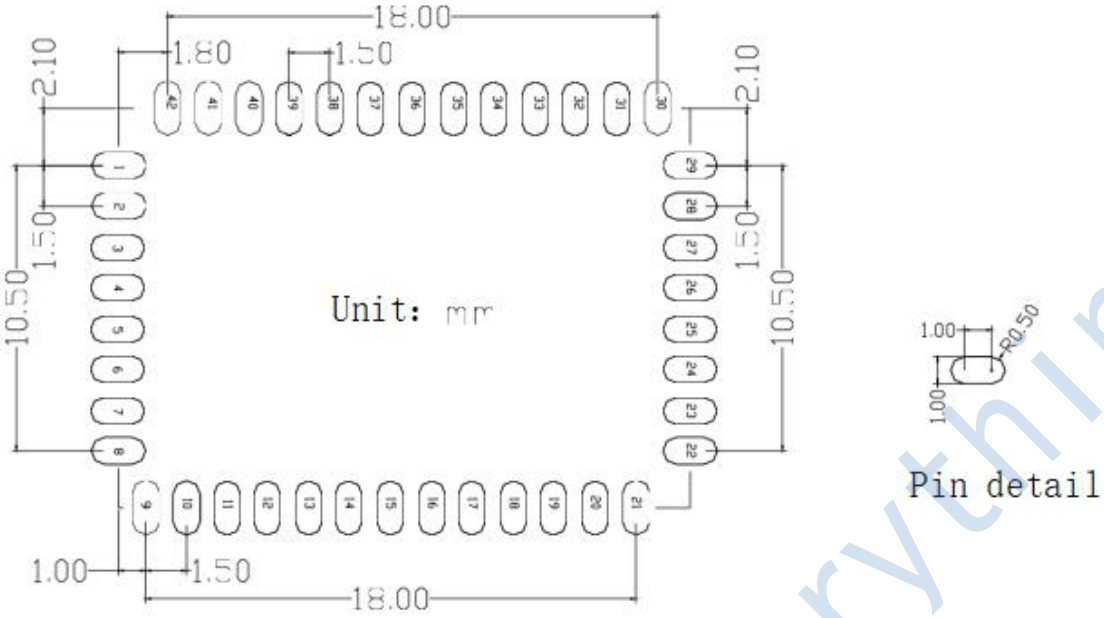
AR-6501T-25SD:based on the ws9625ABSDF

5 Module Package Information

5.1 Pinout Diagram and package dimensions



Mechanical Dimensions



Recommended PCB layout footprint

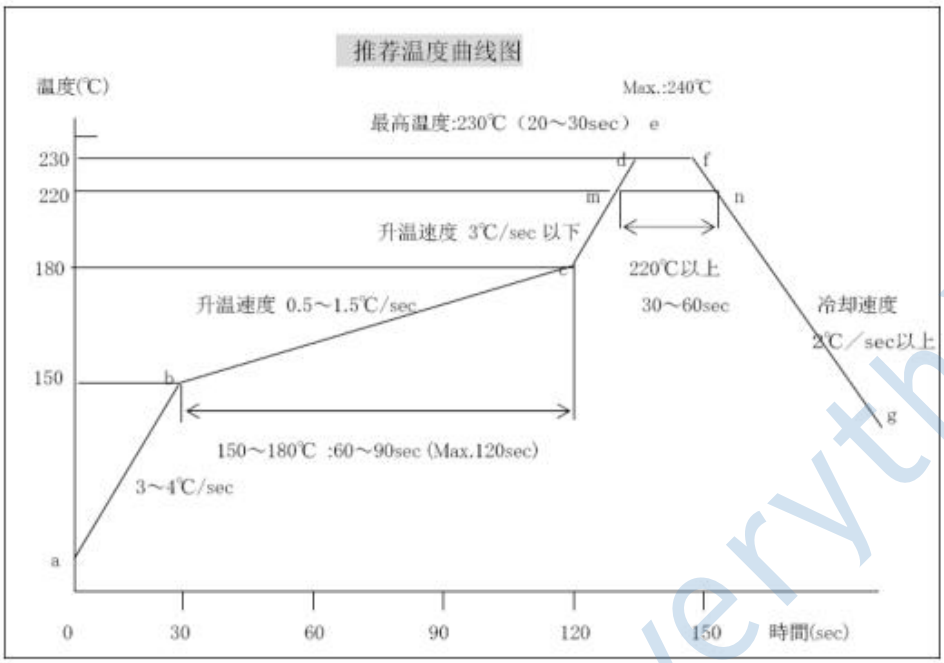
5.2 Module Pin descriptions

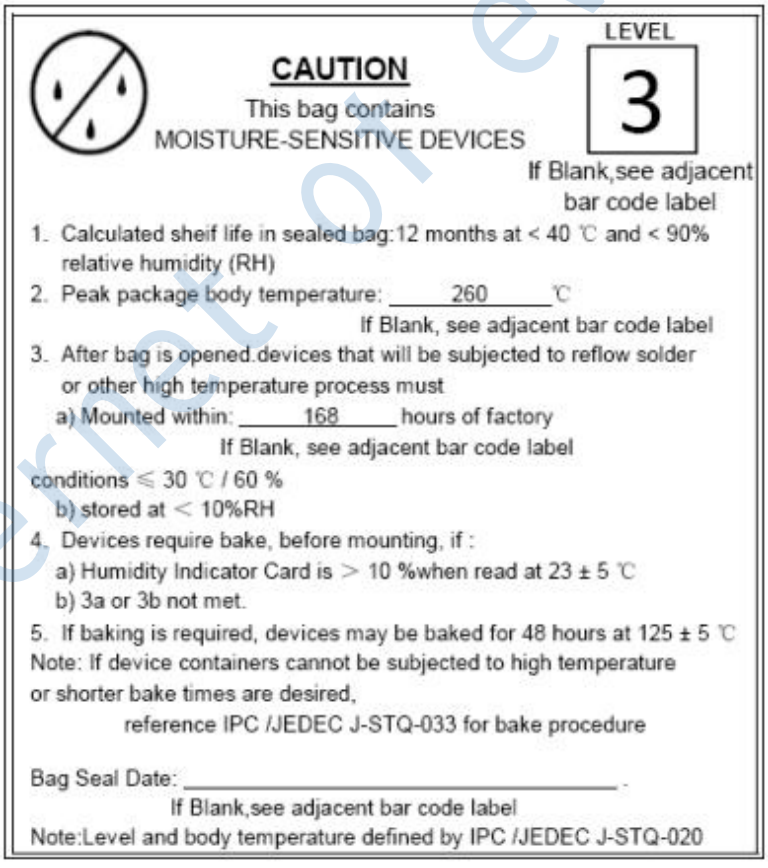
Pin NO.	Pin Name	Pin Type	Description
1	NC	NC	Not connected
2	GPIOA	Bi-direction	General purpose IO
3	GPIOB	Bi-direction	LED4 driver, active high Alternative function H:Test mode; L:Application
4	GND	VSS	Ground
5	VBAT	Battery positive terminal	Power supply input for 3.0~5.5V
6	DVDD33	Power	3.3V output for digital IO
7	GND	VSS	Ground
8	VCHG	Charger voltage input	Internal charger input for charging
9	RST	Power	Set charging current
10	PWR	Power	High level (BAT voltage) means button is turned on
11	SPK_LP	Analog output	Stereo: Headphone left channel output positive. Use the pin for single-end application. Mono:No connected.
12	SPK_LN	Analog output	Stereo: Headphone left channel output negative. Don't use the pin for single-end application. Mono:No connected.
13	SPK_RP	Analog output	Stereo: Headphone right channel

			output positive. Don't use the pin for single-end application. Mono:Headphone channel output positive. Use the pin for single-end application.
14	SPK_RN	Analog output	Stereo: Headphone right channel output positive. Don't use the pin for single-end application. Mono:Headphone channel output negative. Don't use the pin for single-end application.
15	AGND	VSS	GND for audio
16	MIC_BIAS	Analog output	Microphone bias voltage output
17	MIC_LP	Analog input	Microphone left channel input, positive end.
18	MIC_LN	Analog input	Microphone left channel input, negative end.
19	MIC_RP	Analog input	Microphone right channel input, positive end.
20	MIC_RN	Analog input	Microphone right channel input, negative end.
21	GPIO15	Bi-direction	LED3 driver, active high Alternative function H:Test mode; L:Application
22	GPIO14	Output	LED2 driver, active high
23	GPIO13	Output	LED1 driver, active high
24	GPIO12	Bi-direction	General purpose IO.
25	GPIO11	Bi-direction	General purpose IO.
26	GPIO10	Bi-direction	General purpose IO.
27	GPIO9	Bi-direction	General purpose IO.
28	GPIO8	Bi-direction	General purpose IO.
29	GPIO7	Bi-direction	General purpose IO.
30	GPIO6	Bi-direction	General purpose IO.
31	GPIO5	Bi-direction	General purpose IO.
32	GPIO4	Bi-direction	General purpose IO.
33	GPIO3	Bi-direction	HCI RX data General purpose IO.
34	GPIO2	Bi-direction	General purpose IO.
35	GPIO1	Bi-direction	HCI TX data General purpose IO.
36	GND	VSS	Ground
37	RF	Analog input/output	RF input/output
38	GND	VSS	Ground
39	NC	NC	Not connected

40	NC	NC	Not connected
41	NC	NC	Not connected
42	NC	NC	Not connected

6 Recommended Reflow Temperature Profile





The module Must go through 125℃ baking for at least 9 hours before SMT AND IR reflow process!

若拆封后未立即上线，瑞迪通讯建议让下次上线前务必以 125℃烘烤 9 小时以上！

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