EWM104-BT5125(xxx) Datasheet

QCC5125 BLE5.1 DAC/I2S/SPDIF wireless Bluetooth audio module



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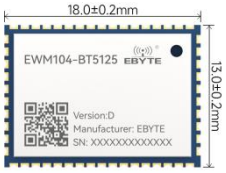
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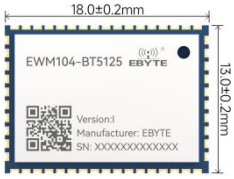
Chapter 1 Overview

1.1 Introduction

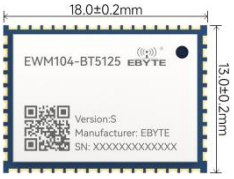
EWM104-BT5125(xxx) is a high-performance, low-power and cost-effective Bluetooth BLE5.1 audio module launched by our company. The main control uses Qualcomm's QCC5125 chip to provide the module with a system with on-chip Bluetooth, audio, and programmable application processors. It includes high-performance analog and digital audio codecs, Class AB and Class D headphone drivers, advanced power management, flexible interface protocols, and programmable input/output (PIO).



EWM104-BT5125(DAC)



EWM104-BT5125(I2S)



EWM104-BT5125(SPDIF)

1.2 Features and Functions

- Bluetooth 5.1 protocol;
- Qualcomm®Kaliimba DSP audio system;
- 32MHz Application Development Processor;
- Flexible QSPI flash programming platform;
- Fully programmable digital ANC;
- Support aptX, aptX HD, etc.;
- 192kHz 24-bit I2S and SPDIF interface with native MCLK support;
- Support for Qualcomm TrueWireless stereo and Qualcomm TrueWireless stereo enhancement;
- Integrated battery charger;
- Differential headphone output mode, support Class AB, Class D.

1.3 Application scenarios

- High-quality stereo headphones;
- gaming headsets;
- portable Bluetooth stereo speakers;
- TWS bluetooth earphones, bluetooth speakers, etc.

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Chapter 2 Specifications

2.1 Performance parameters

Main parameters:		performance			remark
		minimum	Typical	maximum	
Operating Voltage VCHG(V)		4.0	5	6.5	Permanently burns out the module over 6.5V
Operating Voltage: VBAT(V)		2.8	3.7	4.6	Permanently burns the module over 4.6V
Communication Level (V)		1.8	3.3	3.6	The level is determined by the VDD_PADS1 and the VDD_PADS3_7 level
Operating temperature (°C).		-40	20	+85	Industrial-grade design
Operating Frequency Band (MHz)		2402	-	2480	Bluetooth protocol standard frequency bands are supported
power consumption	Unconnected Current (mA)	2	-	25	Bluetooth is discoverable
	Connect the unplayed current (mA).	10	-	30	Bluetooth is connected but no music is playing
	Audio Output Status Current (mA)	10	-	35	Bluetooth is connected and music is playing
	Shutdown current (uA)		1.5		When only VBAT is powered
Maximum transmit power (dBm)		-	9	9	
Receiver Sensitivity (dBm)		-	-92.0	-	BDR

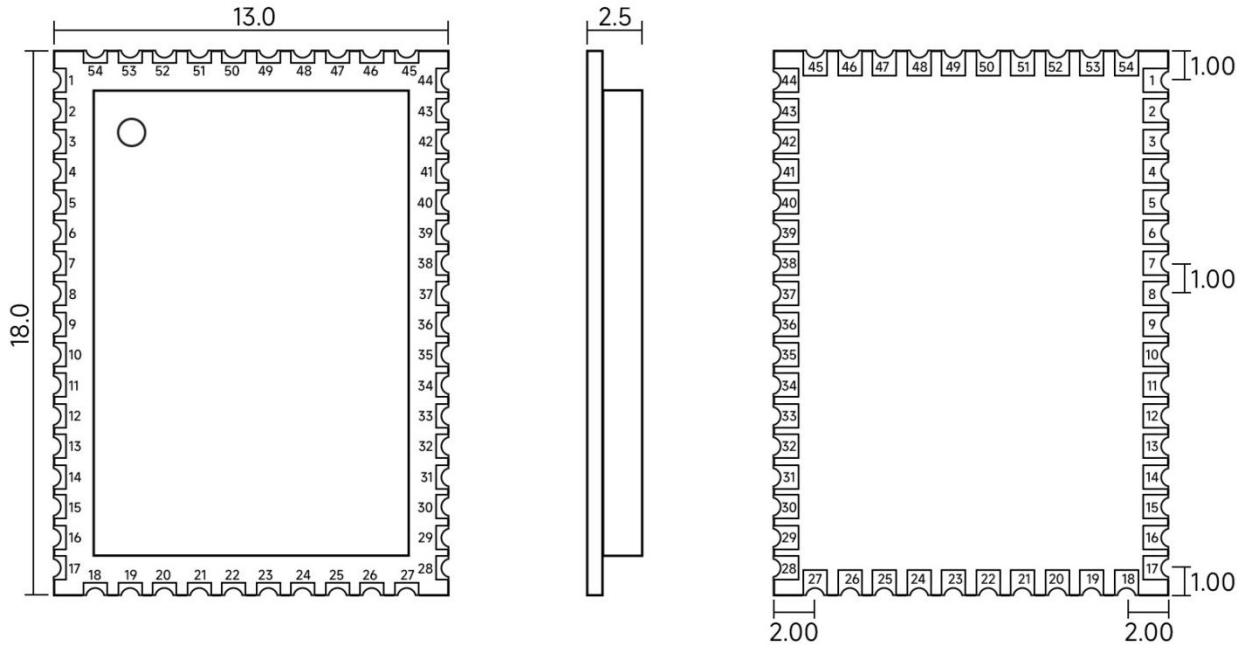
Main parameters:	description	remark
Reference distance	120m	Clear and empty, antenna height 2m
Crystal frequency	32MHz	
On-board Flash	32M-bit	
Encapsulation	SMD	
EWM104-BT5125 (DAC) output interface	DAC	
EWM104-BT5125 (I2S) output interface	I2S	
EWM104-BT5125 (SPDIF) output interface	SPDIF	
Communication interfaces	USB	
Interface mode	Stamp holes	Pitch 1.00mm
Dimensions	13*18mm	±0.2mm
Antenna interface	Stamp holes	The equivalent impedance is about 50 Ω

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weight	1.0g	±0.1g

2.2 Mechanical dimensions and pin definition



Pin sequence number	Pin name	Pin direction	Pin Usage
1	NC	-	
2	SPDIF_IN/PIO[19]	I/O	SPDIF Optical Audio Data Input, PIO[19]
3	I2S_SDATA/SPDIF_OUT/PIO[18]	I/O	I2S bit data output, SPDIF optical audio data output, PIO[18]
4	I2S_LRCK/PIO[17]	I/O	I2S Frame Clock Output, PIO[17]
5	I2S_SCK/PIO[16]	I/O	I2S bit Clock Output, PIO[16]
6	I2S_MCLK/PIO[15]	I/O	I2S System Clock Output, PIO[15]
7	VBAT_SENSE	Analog	Battery voltage detection
8	USB_DN	-	Full speed USB interface DN
9	USB_DP	-	Full speed USB interface DP
10	VCHG	P	Internal power regulator and charger voltage input, 4.0~6.5V
11	VCHG_SENSE	Analog	The charger input voltage detection pin, which is connected to the VCHG pin

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			when using an internal charger or without a charger.
12	CHG_EXT	Analog	External charger transistor current control.
13	SYS_CTRL/PIO[0]	I	Usually connected to a switch button. When the battery and/or charger still have power, but the software has left the device off or hibernating, start the device by pressing the button. In addition, it can be used as a PIO[0] digital input in normal operation.
14	VBAT	P	Battery power input, 2.8~4.6V
15	GND	G	GND
16	AIO[0]/LED[0]	Analog/DO	Analog/digital input, open-drain LED output,For the LED function, please refer to the LED function indicator diagram
17	AIO[1]/LED[1]	Analog/DO	Analog/digital input, open-drain LED output,For the LED function, please refer to the LED function indicator diagram
18	AIO[2]/LED[2]	Analog/DO	Analog/digital input, open-drain LED output,For the LED function, please refer to the LED function indicator diagram
19	AIO[4]/LED[4]	Analog/DO	Analog/digital input, open-drain LED output
20	AIO[5]/LED[5]	Analog/DO	Analog/digital input, open-drain LED output
21	GND	-	GND
22	1V8	P	1.8V power output
23	VDD_PADS1	P	1.8V/3.3V PIO voltage input
24	VDD_PADS3_7	P	1.8V/3.3V PIO voltage input
25	PIO[4]	I/O	Button, PIO[4], short press the previous song, long press Bluetooth connection, user programmable
26	PIO[3]	I/O	Button, PIO[3], short press to pause playback, long press to decrease volume, user programmable
27	PIO[6]	I/O	PIO[6]
28	PIO[5]	I/O	Button, PIO[5], short press a song, long press Bluetooth disconnect, user programmable
29	PIO[8]	I/O	PIO[8]
30	PIO[7]	I/O	PIO[7]
31	PIO[2]	I/O	Button, PIO[2], short press to play, long press to increase the volume, user programmable
32	PIO[1]	I/O	Reset, PIO[1]
33	NC	-	
34	SPK-RN	Analog	The DAC audio differential outputs the negative pole of the right channel
35	SPK-RP	Analog	DAC audio differential outputs the right channel positive
36	SPK-LN	Analog	DAC audio differential outputs left channel negative
37	SPK-LP	Analog	DAC audio differential outputs left channel positive
38	GND		GND
39	MIC_BIAS	Analog	Microphone bias voltage output, 1.5~2.1V
40	MIC2_N	Analog	Microphone audio differential input 2 negative
41	MIC2_P	Analog	Microphone audio differential input 2 positive
42	MIC1_N	Analog	Microphone audio differential input 1 negative
43	MIC1_P	Analog	Microphone audio differential input 1 positive

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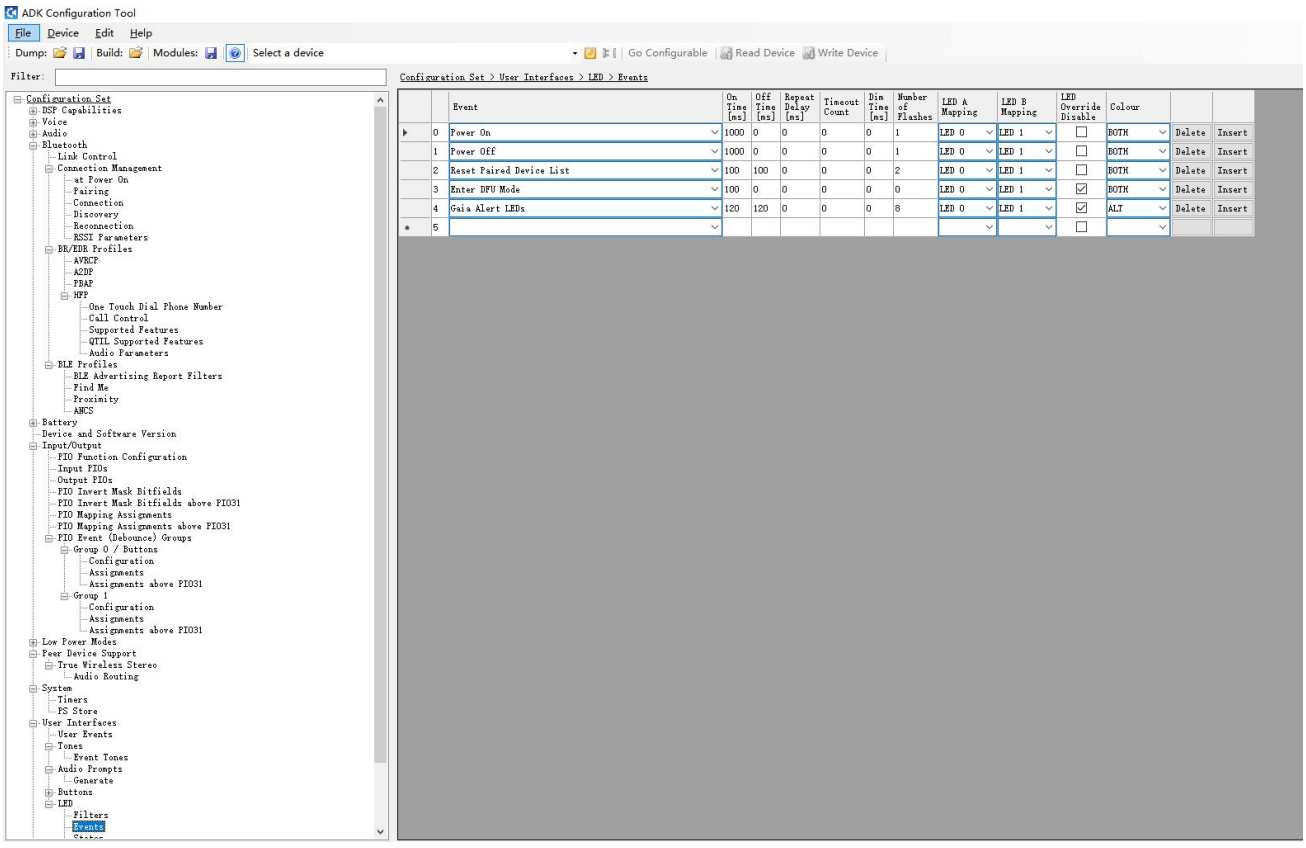
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44	GND	-	GND
45	GND	-	GND
46	ANT	-	Bluetooth antenna interface
47	GND	-	GND
48	PIO[54]	I/O	PIO[54]
49	PIO[53]	I/O	AUX Audio Input Insertion Detection, PIO[53]
50	PIO[52]	I/O	LED indicator, PIO [52], customer programmable
51	PIO[60]	I/O	PIO[60]
52	PIO[61]	I/O	PIO[61]
53	PIO[21]	I/O	LED indicator, PIO[21], customer programmable
54	PIO[20]	I/O	Audio Amplifier Enable, PIO[20]

Special Notes:

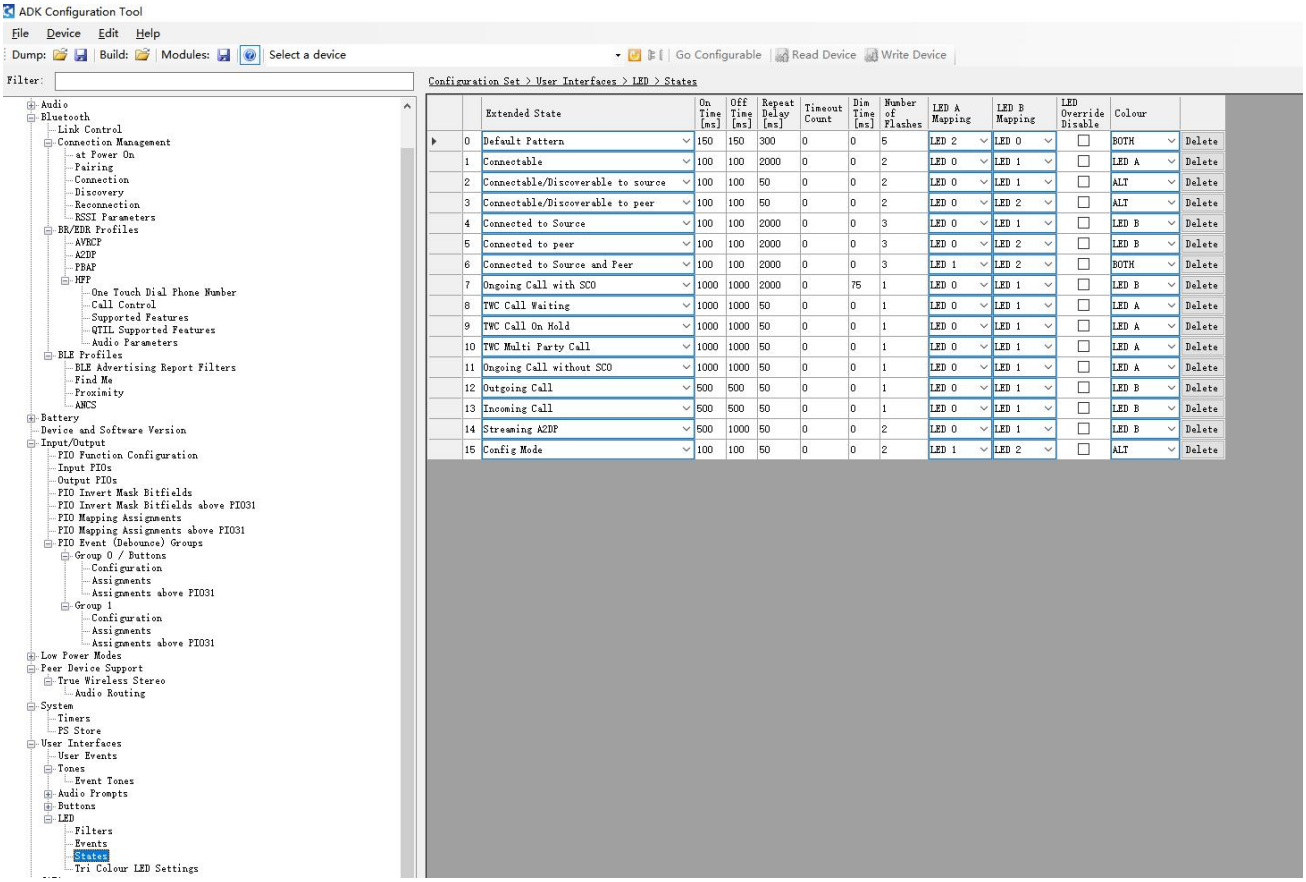
The function description of the above pins is only for the default program functions of our factory, if you need other functions, you can contact our company for customization, please refer to the official user manual of the QCC5125 for self-developed pin functions.

LED function indicator diagram is as follows:



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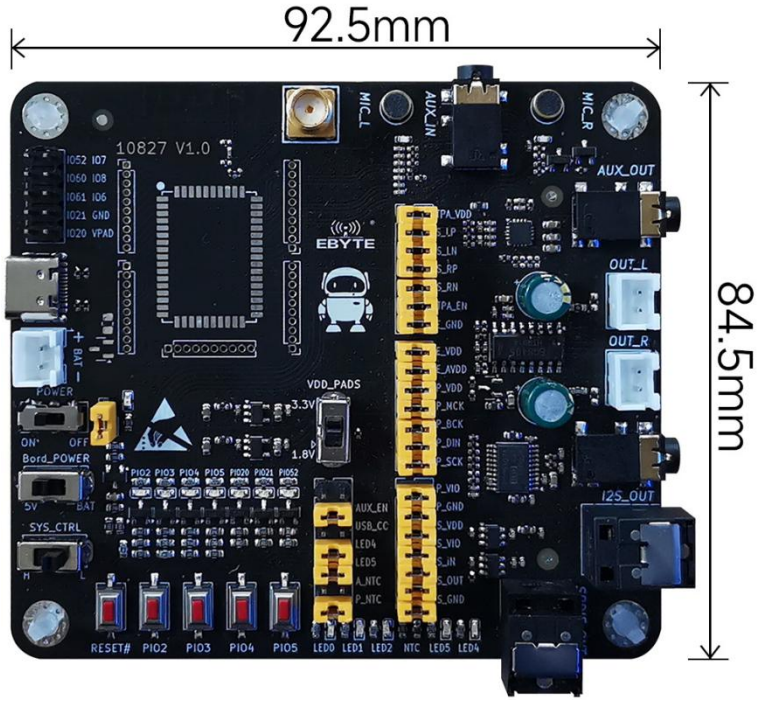


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Chapter 3 Quick Use

This quick use requires a combination of our test panels.



EWT104-BT5125 baseboard does not contain modules by default, customers can purchase modules for soldering according to their needs, here take the DAC firmware module as an example, after the module is welded to the baseboard, the power supply is provided through Type-C, after the power indicator lights up, put the SYS_CTRL DIP switch on the right side, Bluetooth pairing will be automatically turned on, and then the mobile phone will be connected to the module through Bluetooth to play music, and then the baseplate AUX_OUT interface will be connected to the speaker, and the mobile phone can be heard playing music.

The product details page will provide the serial port driver installation method and schematic diagram, for secondary development, you need to go to the Qualcomm official website to view:

https://www.qualcomm.com/products/internet-of-things/consumer/audio/qcc5100-series/qcc5125

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Chapter 4 Hardware circuit design and requirements

4.1 Hardware Design Requirements

- SYS_CTRL can not directly pull up the resistor to VBAT, SYS_CTRL control the power on and off of the Bluetooth chip, you must wait for the chip to be initialized after powering on before the boot can be turned on, and it cannot be simply delayed by the resistor capacitor (unstable). The relevant delay circuit can refer to the official user manual to recommend the circuit.
- The audio output and MIC input of the module are differential circuits, and the related hardware design can refer to our hardware design circuit.
- If you really have to pass under the module, assuming that the module is welded to the top layer, the top layer of the contact part of the module (all copper is poured and well grounded) must be close to the digital part of the module and the wire must be routed in the bottom layer;
- Assuming that the module is soldered or placed in the top layer, it is also wrong to route the cables at random in the bottom layer or other layers, which will affect the spurious and receiving sensitivity of the module to varying degrees.
- It is recommended to use USB or battery to supply power to the module, the ripple coefficient of the power supply should be as small as possible, and the module should be reliably grounded;
- Please note that the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended supply voltage, if the maximum value is exceeded, the module will be permanently damaged;
- When designing the power supply circuit for the module, it is often recommended to keep more than 30% of the margin, which is conducive to long-term stable operation.
- The module should be kept away from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference as much as possible;
- Assuming that there are devices with large electromagnetic interference around the module, it is recommended to stay away from the module appropriately according to the intensity of the interference, and if the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces (high-frequency digital, high-frequency analog, power cables) around the module that have large electromagnetic interference, it will also greatly affect the performance of the module, and it is recommended to stay away from the module appropriately according to the intensity of interference, and if the situation allows, appropriate isolation and shielding can be done;
- The module antenna must not be installed inside the metal case, which will greatly reduce the transmission distance.

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Chapter 5 Frequently Asked Questions

5.1 The transmission distance is not ideal

- When there is a straight-line communication barrier, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-channel interference will lead to an increase in the communication packet loss rate.
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- If there is a metal object near the module, or if it is placed in a metal shell, the signal attenuation will be very serious.
- At room temperature, the low voltage of the power supply is lower than the recommended value, and the lower the voltage, the smaller the generating power;

5.2 The module is easily damaged

- Please check the power supply to ensure that it is between the recommended supply voltage, if the maximum value is exceeded, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- Please ensure that the installation and use process is anti-static operation, and the electrostatic sensitivity of high-frequency devices;
- Please ensure that the humidity should not be too high during installation and use, and some components are humidity-sensitive devices;
- If there are no special needs, it is not recommended to use it at too high or too low temperatures.

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Chapter VI Welding Operation Instructions

6.1 Reflow soldering temperature

In reflow soldering, all temperatures refer to the core temperature of the package and are measured on the upward surface of the package (the leads are placed downward, i.e., the live worms are facing). If the temperature of the module is not measured in the direction of the live worm (the lead is placed upward, i.e., the dead worm is facing) in the reflow soldering, the measured Tp temperature is within ±2°C of the measured Tp temperature in the direction of the live worm, which still meets the requirements of Tc. Otherwise, the temperature curve should be adjusted to meet the requirements of Tc, and in order to accurately measure the actual peak temperature of the package body, it is recommended to use the method recommended by JEP140 to perform the furnace temperature test.

In order to obtain better welding results, it is recommended to control the constant temperature conditions at 25°C in the production workshop. When the temperature profile of the welded part needs to be re-profiled, the load-bearing fixture of the same construction should be reflowed or verified to have an equivalent thermal load.

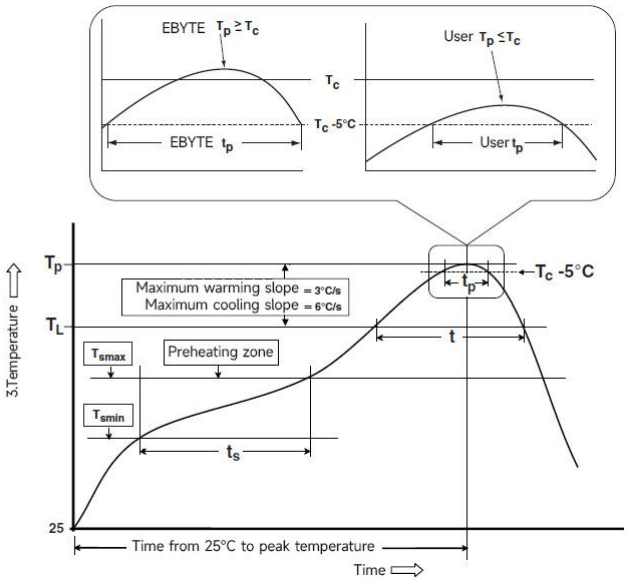
The reflow soldering curves in this document are some suggestions specifically for soldering only the Yibaite module, and cannot be used to confirm the actual assembly curve of the user. The actual production process of the user should be based on the specific production process, needs and circuit board design to develop the actual production assembly curve, and should not exceed the following table:

Reflow soldering curve characteristics		Assembled with lead process	Lead-free process assembly
Preheating/keeping warm	Minimum Temperature (Tsmin)	100℃	150℃
	Maximum Temperature (Tsmax)	150℃	200℃
	Time(Tsmin~Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL~Tp)		3 °C/sec, maximum	3 °C/sec, maximum
Liquid phase temperature (TL)		183℃	217℃
TL above the holding time		60~90 seconds	60~90 seconds
Peak temperature of the package Tp		The user must not exceed the temperature indicated on the product's "Moisture Sensitivity" label.	The user must not exceed the temperature indicated on the product's "Moisture Sensitivity" label.
The time (Tp) within 5°C of the specified grading temperature (Tc) is shown in the figure below		20 seconds	30 seconds
Cooling slope (Tp~TL)		6°C/sec, max	6°C/sec, max
The time from room temperature to peak temperature		6 minutes, the longest	8 minutes, the longest
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user			

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6.2 Reflow soldering curve



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Chapter VII Related Models

Product model	Chip scheme	Operating frequency	Test distance	Product dimensions	Form factor
		Hz	m	mm	
E83-2G4M03S	nRF5340	2.4G	170	16.0*16.0	Patches

Revision History

version	Date of revision	Revision Notes	Maintainers
1.0	2025-02-26	Initial release	Bin

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