S831 USB WiFi Module

Product Specification

802.11a/b/g/n USB WiFi Module 1T1R

Version V1.1

History

Document Release	Date	Modification	Initials	Approved
Version V1.0	2022/04/25	First version		

S831 USB WiFi Module（802.11a/b/g/n）

1. Overview.

The S831 is a highly integrated single-chip 802.11a/b/g/n 1T1R WLAN with USB 2.0 multi-function. It combines a WLAN MAC, a 1T1R capable WLAN baseband and WLAN RF in a chip. The S831 provides a complete solution for a high-performance integrated wireless LAN controller. The S831 WLAN baseband implements Orthogonal Frequency Division Multiplexing (OFDM) with 1 transmit and 1 receive path and is compatible with the 802.11n specification. Features include one spatial stream transmission, short guard interval (GI) of 400ns, spatial spreading, and transmission over 20MHz and 40MHz bandwidth.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all 802.11b and 802.11g 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/IFFT paths, combined with BPSK, QPSK, 16QAM, and 64QAM modulation of the individual subcarriers and rate compatible punctured convolutional coding with coding rate of 1/2, 2/3, 3/4, and 5/6, provide higher data rates of 54Mbps and 150Mbps for 802.11g and 802.11n OFDM respectively.

A built-in enhanced signal detector, adaptive frequency domain equalizer, and a soft-decision Viterbi decoder help to alleviate multi-path effects and mutual interference in the reception of multiple streams. Robust interference detection and suppression are provided to protect against cordless phone, and microwave oven interference.

Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end. Selectable digital transmit and receive FIR filters are provided to meet transmit spectrum mask requirements and to reject adjacent channel interference, respectively.

The S831 WLAN Controller supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control function to obtain better performance in the analog portions of the transceiver.

The S831 WLAN MAC supports 802.11e for multimedia applications, 802.11i for security, and 802.11n for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as Legacy Power Save, and U-APSD, reduce the power wasted during idle time, and compensate for the extra power required to transmit OFDM. The S831-VC provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

S831 also integrates RF/PA/LNA/Balun/DPDT for both 802.11n to reduce the number of external components.

2. Features

General

- QFN40 5 x 5 mm
- 802.11a/b/g/n 1T1R WLAN chip

Host Interface

- Complies with USB2.0 for WLAN controller
- USB Multi-Function for both WLAN
- USB LPM and USB Selective Suspend supported

WLAN Controller

- CMOS MAC, Baseband PHY, and RF in a combo chip for 802.11a/b/g/n compatible WLAN
- Integrated Balun and DPDT
- Complete 802.11n solution for both 2.4GHz and 5GHz band
- 72.2Mbps receive PHY rate and 72.2Mbps transmit PHY rate using 20MHz bandwidth
- 150Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
- Backward compatible with 802.11b/g devices while operating in 802.11n mode
- 802.11a/b/g/n compatible WLAN
- 802.11e QoS Enhancement (WMM)
- 802.11i (WPA, WPA2). Open, shared key, and pair-wise key authentication services
- WPA3 supported
- FW security supported

WLAN MAC Features

- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- PHY-level spoofing to enhance legacy compatibility
- Power saving mechanism
- Multi MACID support with Fast Channel switch
- Channel management and co-existence
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth
- WiFi Direct supports wireless peer to peer applications
- Supports Wake-On-WLAN via Magic Packets and Wake-up frame

WLAN PHY Features

- 802.11n OFDM
- One Transmit and one Receive path (1T1R)
- 20MHz and 40MHz bandwidth transmission

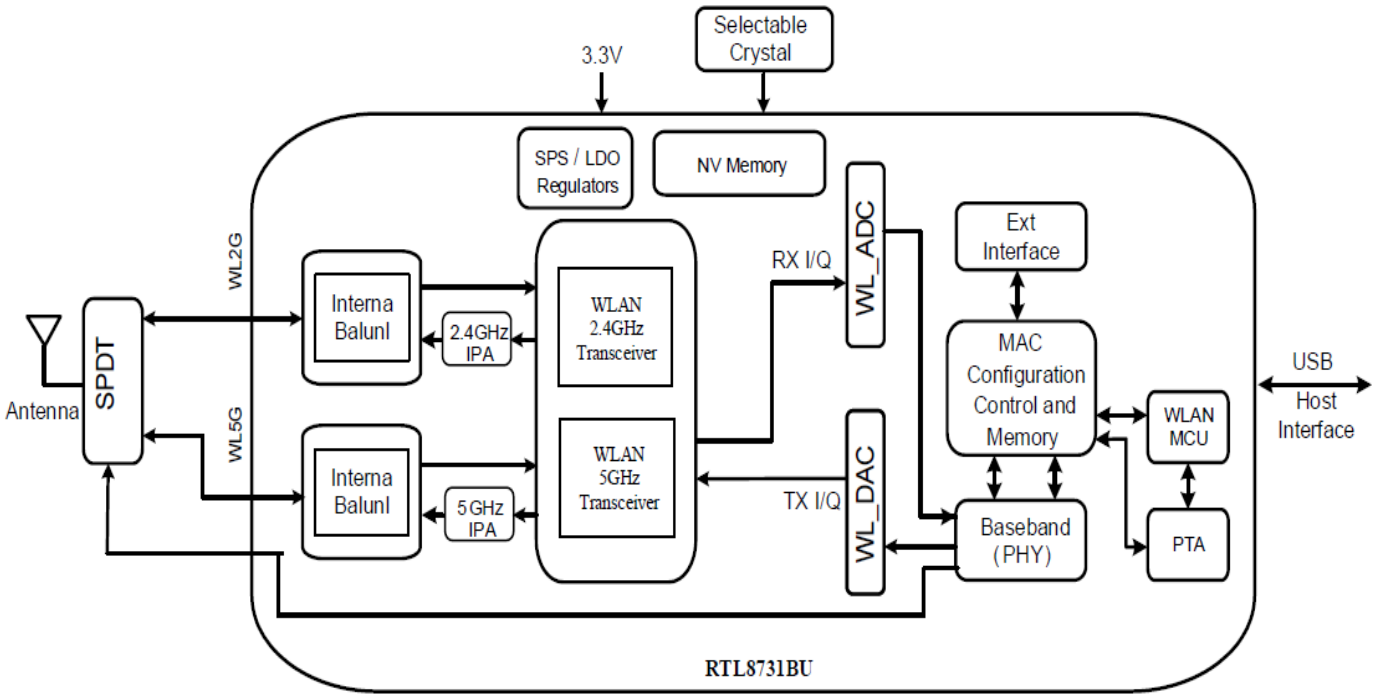
S831 USB WiFi Module（802.11a/b/g/n）

- Support 2.4GHz and 5GHz band channels
- Short Guard Interval (400ns)
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, 64QAM modulation. Convolutional Coding Rate: 1/2, 2/3, 3/4, and 5/6
- Maximum data rate 54Mbps in 802.11g; and 150Mbps in 802.11n
- Switch diversity for DSSS/CCK
- Packet based hardware antenna diversity
- Selectable receiver FIR filters
- Programmable scaling in transmitter and receiver to trade quantization noise against increased probability of clipping
- Fast receiver Automatic Gain Control (AGC)
- On-chip ADC and DAC

Peripheral Interfaces

- General Purpose Input / Output (14 pins)
- XTAL frequency 40MHz
- Support XTAL or external clock input

3. Application Diagram

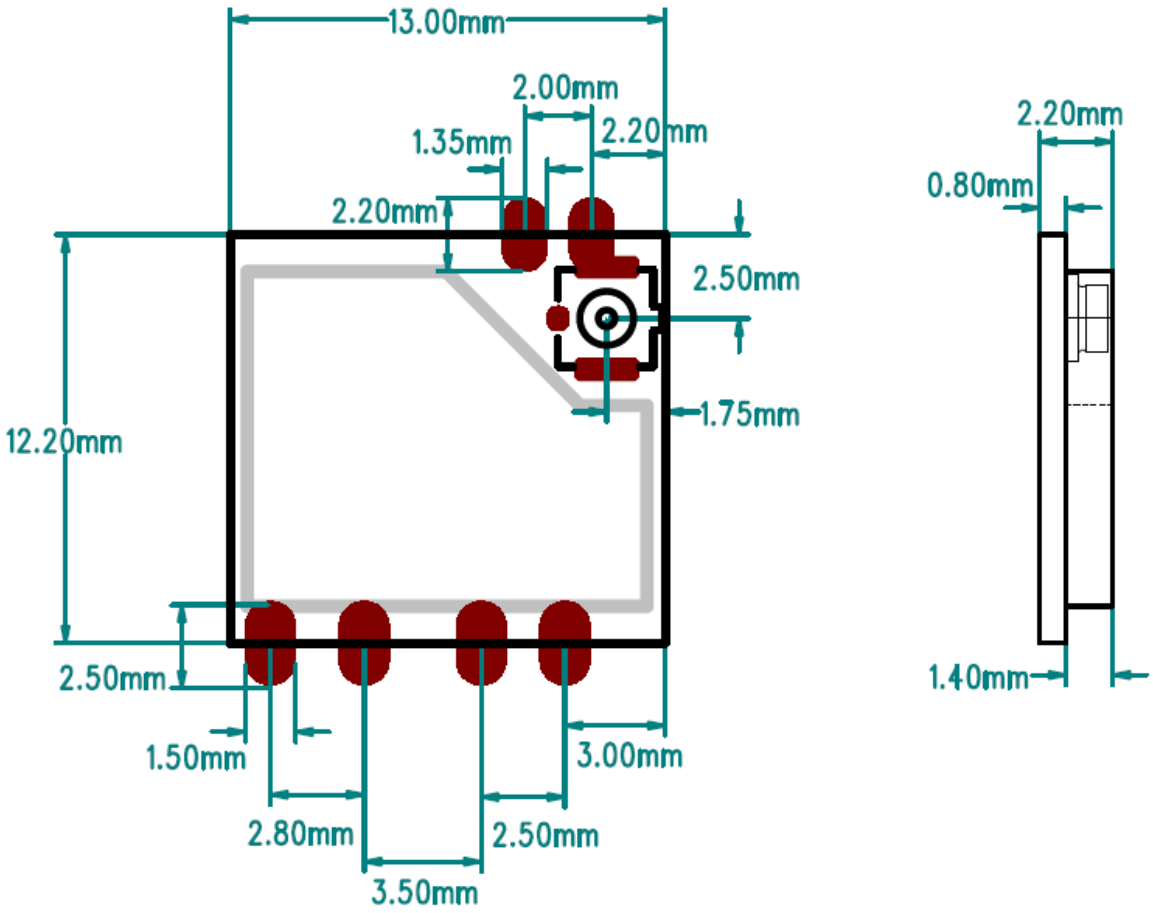


4. Order Information

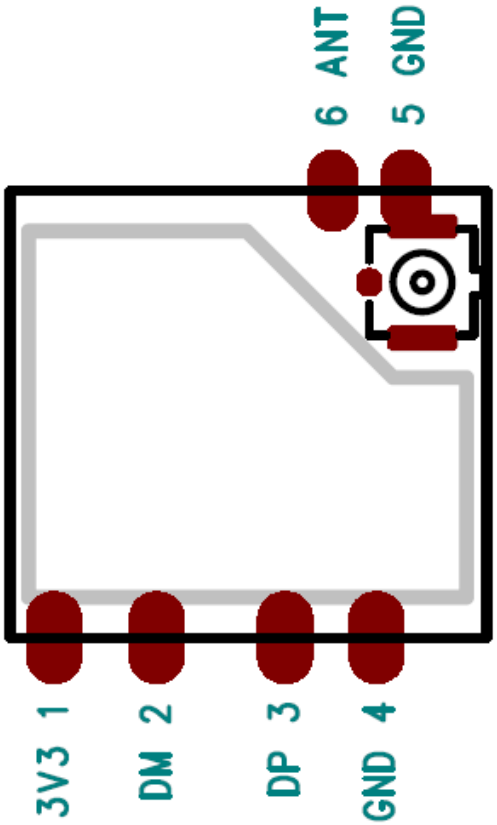
Module name	Part number	Description
S831-WI-NS	**S831-WI-NS**	S831 USB 双频（a/b/g/n）WiFi 模块，带天线扣，不带屏蔽罩
S831-WI-WS	**S831-WI-WS**	S831 USB 双频（a/b/g/n）WiFi 模块，带天线扣，带屏蔽罩
S831-NI-NS	**S831-NI-NS**	S831 USB 双频（a/b/g/n）WiFi 模块，不带天线扣，不带屏蔽罩
S831-NI-WS	**S831-NI-WS**	S831 USB 双频（a/b/g/n）WiFi 模块，不带天线扣，带屏蔽罩

5. Dimensions (Units: mm) (tolerance ±10%)

(Note: Without shield cover, module height is around 1.8mm, including chip + PCB board thickness)



6. Pin Definition



7. Pin Description

Pin	Function	Type	Description
1	3V3	POW	Module Power Supply
2	DM	I/O	USB_DAT-
3	DP	I/O	USB_DAT+
4	GND	GND	GND
5	GND	GND	GND
6	ANT	I/O	WiFi 2.4GHz and 5GHz RF TX/RX

8. Specifications

8.1 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Operation Voltage	3.0	3.3	3.6	V
Operation Temperature	0		70	℃

8.2 Current consumption

Parameter	Test Item	TX Power	Current	Unit
WiFi TX	2.4G,11b, CCK,1Mbps	20dBm	400	mA
	2.4G,11b, CCK,11Mbps	20dBm	300	mA
	2.4G,11g, OFDM, 6Mbps	21dBm	385	mA
	2.4G,11g, OFDM, 54Mbps	19dBm	135	mA
	2.4G,11n,HT20, MCS0	20dBm	355	mA
	2.4G,11n,HT20, MCS7	18dBm	130	mA
	2.4G,11n,HT40, MCS0	19dBm	280	mA
	2.4G,11n,HT40, MCS7	17dBm	120	mA
	5G, 11g, OFDM, 6Mbps	18dBm	380	mA
	5G, 11g, OFDM, 54Mbps	16dBm	140	mA
	5G,11n,HT20, MCS0	17dBm	380	mA
	5G,11n,HT20, MCS7	15dBm	130	mA
	5G,11n,HT40, MCS0	17dBm	300	mA
	5G,11n,HT40, MCS7	15dBm	115	mA
WiFi RX	-	-	90	mA
Stop TX/RX	-	-	84	mA

8.3 WiFi 2.4G WLAN

Parameter	Test Item	Typical Value	CH1	CH7	CH13	Unit
Output Power	11b,CCK, 1Mbps	20±1dBm,EVM<-19dB	20.15	20.19	20.21	dBm
	11b,CCK,11Mbps	20±1dBm,EVM<-15dB	20.20	20.11	20.15	dBm
	11g,OFDM, 6Mbps	20±1dBm,EVM<-26dB	20.37	20.22	20.17	dBm
	11g,OFDM,54Mbps	19±1dBm,EVM<-30dB	19.32	19.25	19.21	dBm
	11n, HT20 MCS0	20±1dBm,EVM<-26dB	20.22	20.07	20.09	dBm
	11n, HT20 MCS7	18±1dBm,EVM<-32dB	18.27	18.12	18.06	dBm
	Test Item	**Typical Value**	**CH3**	**CH7**	**CH11**	**Unit**
	11n, HT40 MCS0	20±1dBm,EVM<-26dB	20.33	20.17	20.09	dBm
	11n, HT40 MCS7	18±1dBm,EVM<-31dB	18.19	18.09	18.00	dBm

8.4 WiFi 2.4G WLAN Receiver Characteristic

Parameters	Test Item	CH1	CH7	CH13	Unit
Receive Sensitivity	11b, CCK,1M , <-83dBm@8%PER	-100	-100	-100	dBm
	11b,CCK, 11M ,<-76dBm@8%PER	-90	-90	-90	dBm
	11g, OFDM,6M , <-82dBm@10%PER	-95	-95	-95	dBm
	11g, OFDM,54M , <-65dBm@10%PER	-78	-78	-78	dBm
	11n, HT20 MCS0, <-82dBm@10%PER	-94	-94	-94	dBm
	11n, HT20 MCS7, <-64dBm@10%PER	-76	-76	-76	dBm
	Test Item	**CH3**	**CH7**	**CH11**	**Unit**
	11n, HT40 MCS0,<-82dBm@10%PER	-92	-92	-92	dBm
	11n, HT40 MCS7,<-64dBm@10%PER	-73	-73	-73	dBm

8.5 WiFi 5G 发射指标 WLAN Transmitter Characteristics

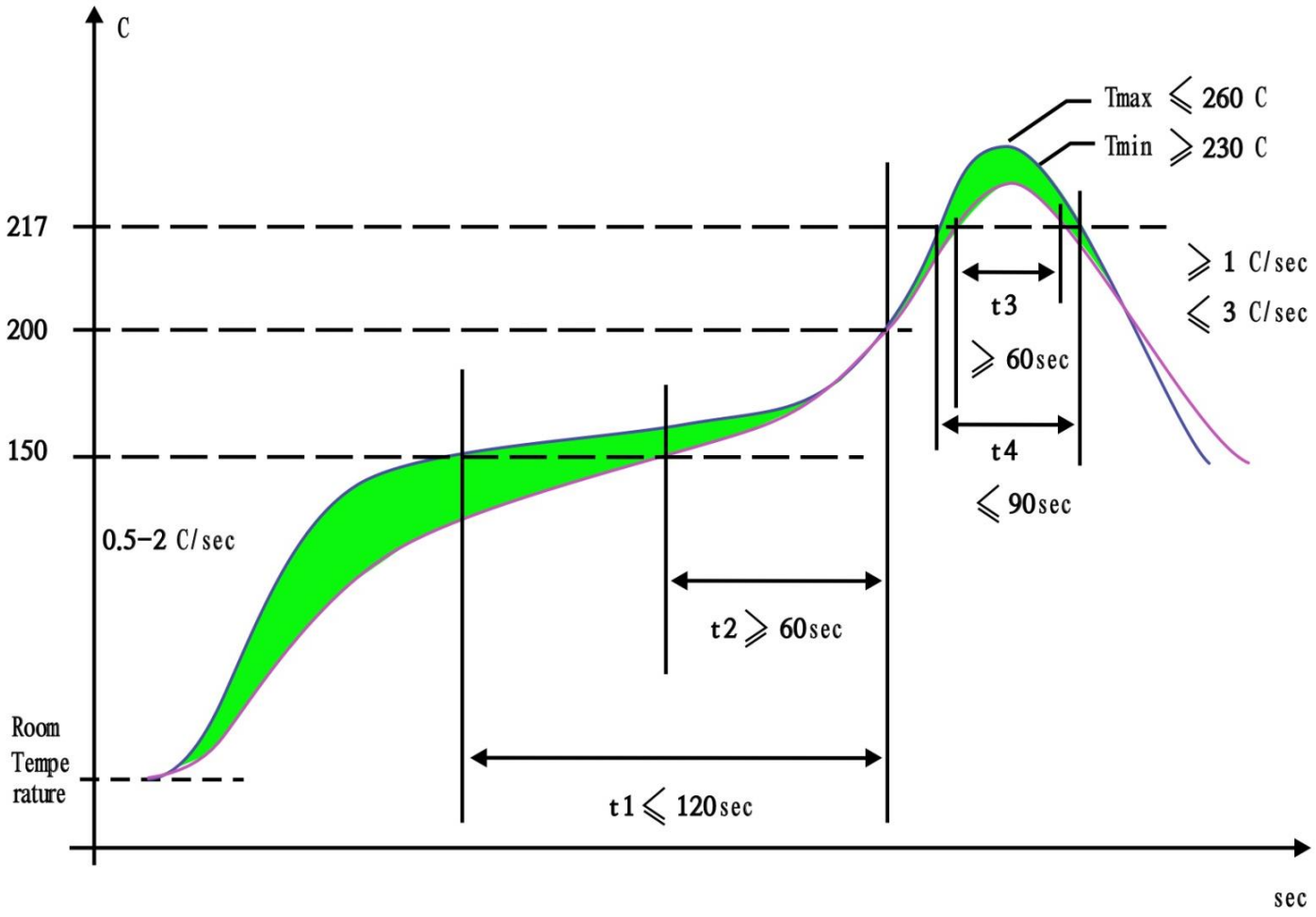
Parameter	Test Item	Typical Value	CH36	CH100	CH165	Unit
Output Power	11a,OFDM,6Mbps	19±2dBm,EVM<-20dB	19.20	19.27	19.07	dBm
	11a,OFDM,54Mbps	17±2dBm,EVM<-27dB	17.23	17.42	17.12	dBm
	11n, HT20 MCS0	19±2dBm,EVM<-20dB	19.11	19.09	18.90	dBm
	11n, HT20 MCS7	16±2dBm,EVM<-29dB	16.23	16.32	16.08	dBm
	Test Item	**Typical Value**	**CH38**	**CH110**	**CH159**	**Unit**
	11n, HT40 MCS0	17±2dBm,EVM<-21dB	19.28	18.98	18.96	dBm
	11n, HT40 MCS7	15±2dBm,EVM<-30dB	16.17	16.07	15.92	dBm

8.6 WiFi 5G WLAN

Parameters	Test Item	CH36	CH100	CH165	Unit
Receive Sensitivity	11a, OFDM,6M , <-82dBm@10%PER	-94	-94	-94	dBm
	11a, OFDM,54M , <-65dBm@10%PER	-78	-78	-78	dBm
	11n, HT20 MCS0, <-82dBm@10%PER	-94	-94	-94	dBm
	11n, HT20 MCS7, <-64dBm@10%PER	-76	-76	-76	dBm
	Test Item	**CH38**	**CH110**	**CH159**	**Unit**
	11n, HT40 MCS0,<-79dBm@10%PER	-90	-90	-90	dBm
	11n, HT40 MCS7,<-61dBm@10%PER	-72	-72	-72	dBm

9. Lead-free reflow soldering process parameter requirements

- The lead-free reflow soldering process curve is shown in the following figure.



The lead-free reflow soldering process parameters are shown in the table below.

Zones	Time	Heating rate	Peak temp	Rate of temperature drop
preheating(40～150℃)	60～150s	≤2.0℃/s	-	-
heating(150～200℃)	60～120s	< 1.0℃/s	-	-
reflow(> 217℃)	60～90s	-	230-260℃	-
cooling(Tmax～180℃)	-	-	-	1.0℃/s≤Slope≤4.0℃/s

Explanation:

- The reflow soldering curve provided is for reference only, and the client needs to make corresponding adjustments according to the actual production situation.

The temperature resistance standard of the package body refers to the IPC/JEDEC J-STD-020D standard, and the temperature measurement method of the package body refers to the JEP 140 standard.

According to the IPC/JEDEC J-STD-020D standard, the package body temperature measurement method follows the requirements of the JEP 140 standard.

The lead-free device package body temperature resistance standards in IPC/JEDEC 020D are shown in the table below.

Package Thickness	Volume mm3 <350	Volume mm3 350~2000	Volume mm3 >2000
< 1.6mm	260℃	260℃	260℃
1.6mm～2.5mm	260℃	250℃	245℃
> 2.5mm	250℃	245℃	245℃