- 2.4GHz LoRa wireless module

- Obtained FCC ID＆CE-RED international certification

- supports ranging

- TCXO temperature-compensated crystal oscillator
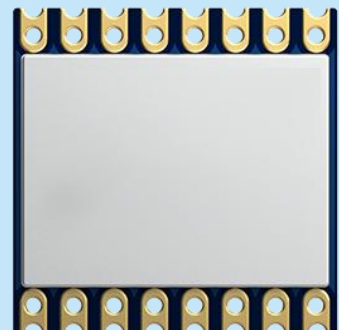
Product Specification

LoRa1280-TCXO   LoRa1281-TCXO   LoRa1280/1281

Catalogue

Note: Revision History

Revision	Date	Comment
V1.0	2018-11-1	First release
V1.1	2018-12-15	Update PIN definition
V1.2	2019-11-23	Update picture
V2.0	2020-11	Modify description
V2.1	2020-11	Update format
V2.2	2023-11	Update certification information

1. Overview

The LoRa128X series includes four modules: LoRa1280-TCXO, LoRa1281-TCXO, LoRa1280, and LoRa1281. Users can choose according to their application needs, with the specific differences as follows：

Module Model	Built-in Chip	Features	Certification Information
LoRa1280-TCXO	SX1280	★ Supports ranging with more precision; 0.5ppm industrial-grade TCXO temperature-compensated crystal oscillator	CE & FCC ID
Lora1281-TCXO	SX1281	Does not support ranging; 0.5ppm industrial-grade TCXO temperature-compensated crystal oscillator	CE & FCC ID
LoRa1280	SX1280	Supports ranging; 10ppm industrial-grade crystal oscillator	None
LoRa1281	SX1281	Does not support ranging; 10ppm industrial-grade crystal oscillator	None

This series of modules is designed based on the original sx1280/sx1281 radio frequency chip of Semtech in the United States. It uses LoRa modulation mode, which improves the short communication distance of ordinary 2.4GHz modules. The whole series of modules use a 10ppm industrial-grade crystal oscillator, and the LoRa1280-TCXO module is also specially equipped with a higher-precision industrial-grade 0.5ppm TCXO temperature-compensated crystal oscillator, which guarantees stable frequency output under harsh environments such as high and low temperature. It also has the "time of flight" function, which can realize RF ranging applications.

The high penetration performance of the 2.4GHz frequency band combined with the LoRa modulation enables the module to have high receiving sensitivity and environmental anti-interference ability. The whole series of modules are widely used in applications requiring long-distance 2.4GHz transmission.

2. Features

- Operating frequency range：2400-2500MHz
- Operating temperature range：-40~+85°C
- Data transfer rate：0.476-202 Kbps@LoRa
- Maximum output power：12.5dBm
- Packet communication mode (receiving FiFo 256 bytes)
- Dual certification by CE & FCC
- High precision crystal oscillator（0.5ppm TCXO/10ppm）
- Operating voltage range：1.8-3.7 V
- Sensitivity : -132dBm@LoRa
- LoRa FLRC FSK modulation

3. Applications

■ Wireless remote

■ Smart home

■ Tag reader

■ Toy control

■ Tire pressure monitoring

■ Health monitoring

4. Electrical Characteristics

★ The following parameters are obtained by connecting the instrument with a 50 ohm copper axis. @VCC=3.3V.

Parameter	Min.	Typ.	Max.	Unit	Condition
Operation Condition					
Working voltage	1.8	3.3	3.7	V	
Temperature range	-40		85	°C	
Current Consumption					
RX current		< 10		mA	@Lora1280/Lora1281
		< 12		mA	@Lora1280-TCXO
TX current		26	30	mA	@Vcc=3.3V,12.5dBm @Lora1280/Lora1281
		28	32	mA	@Vcc=3.3V,12.5dBm @Lora1280-TCXO
Sleep current		< 1		uA	
RF Parameter					
Frequency range	2400		2500	MHz	
Data rate	0.476		202	Kbps	@LoRa
	260		1300	Kbps	@FLRC
	125		2000	Kbps	@FSK
Output power	-18		12.5	dBm	@VCC=3.3V
Receiving sensitivity		-132		dBm	LoRa@0.476Kbps

5. Performance

Note: The power level in the following description is the display value of our DEMO board, and the module can also set other more levels through the register.

➢ The output power parameter indicators corresponding to the module under different power levels are shown in the following table：

Test conditions: @ANT connected to 50 ohm load Frequency: 2480MHz VCC=3.3V

| Register value	Power level	@Lora1280/Lora1281		@Lora1280-TCXO	
		Output power（dBm）	Tx Current(mA)	Output power（dBm）	Tx Current(mA)
13	9	12.2	29	12.2	30.5
10	8	9.6	24	9.6	25.5
7	7	6.9	19	6.9	20.5
4	6	3.25	15.5	4	17.1
1	5	0.3	12.8	0.9	14.3
-3	4	-4.1	10.3	-2.3	11.8
-6	3	-7.6	9.1	-5.7	10.6
-9	2	-10.4	8.4	-8.9	9.9
-12	1	-13.5	7.8	-12.6	9.3
-15	0	-16.5	7.4	-15.5	8.9

➢ Voltage VS TX power

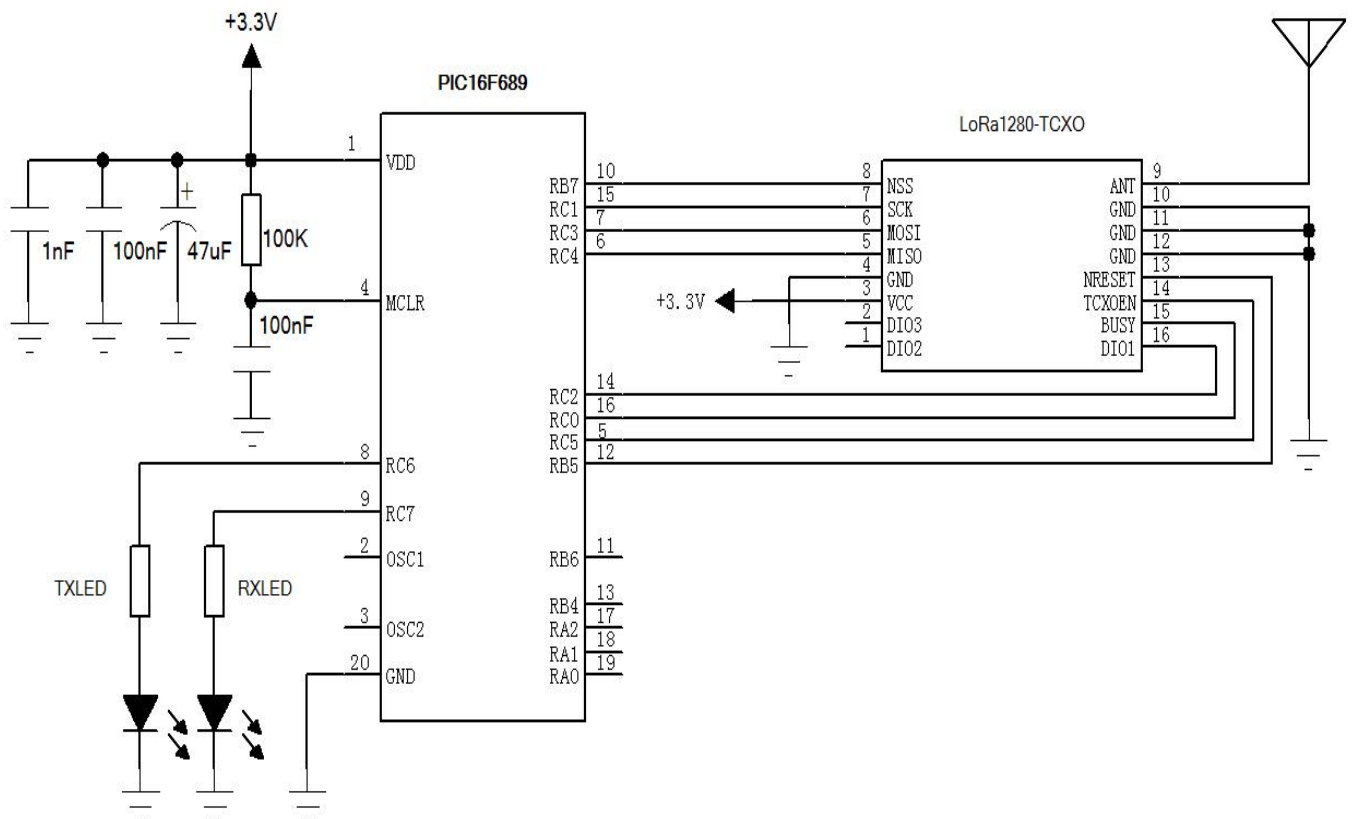Test conditions: @ANT connected to 50 ohm, Frequency: 2480MHz Power level = 9.
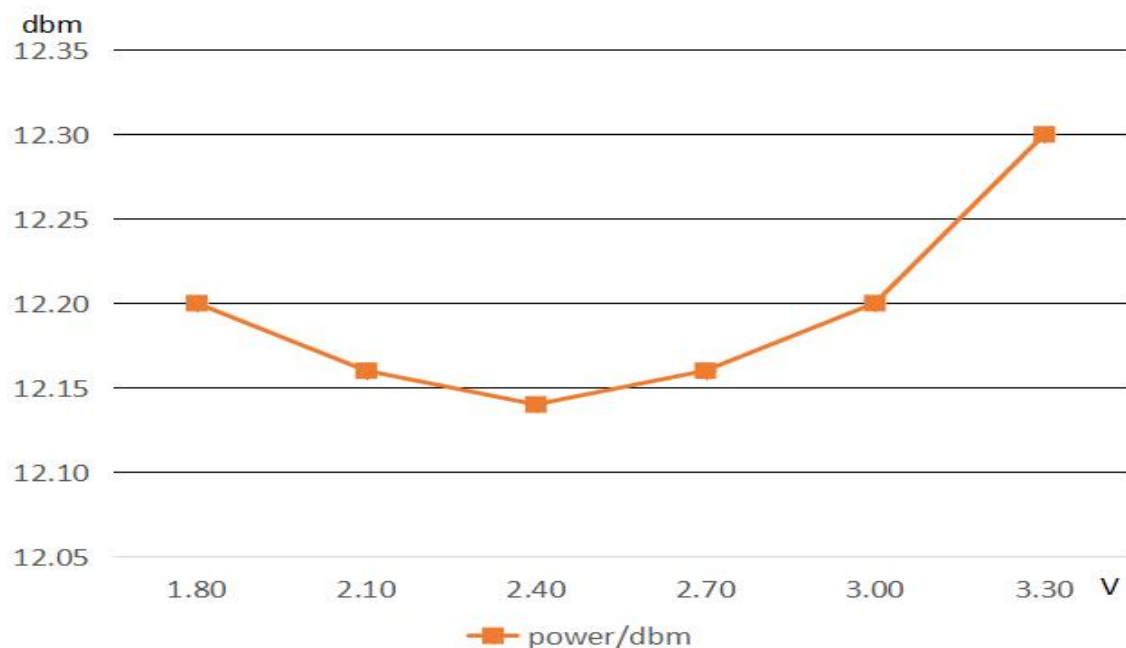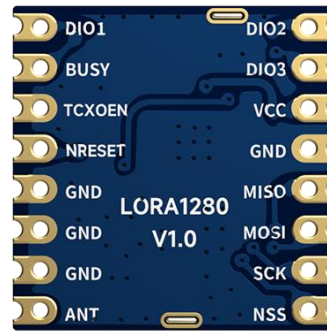
6. Typical application circuit

LoRa1280/LoRa1281 module:
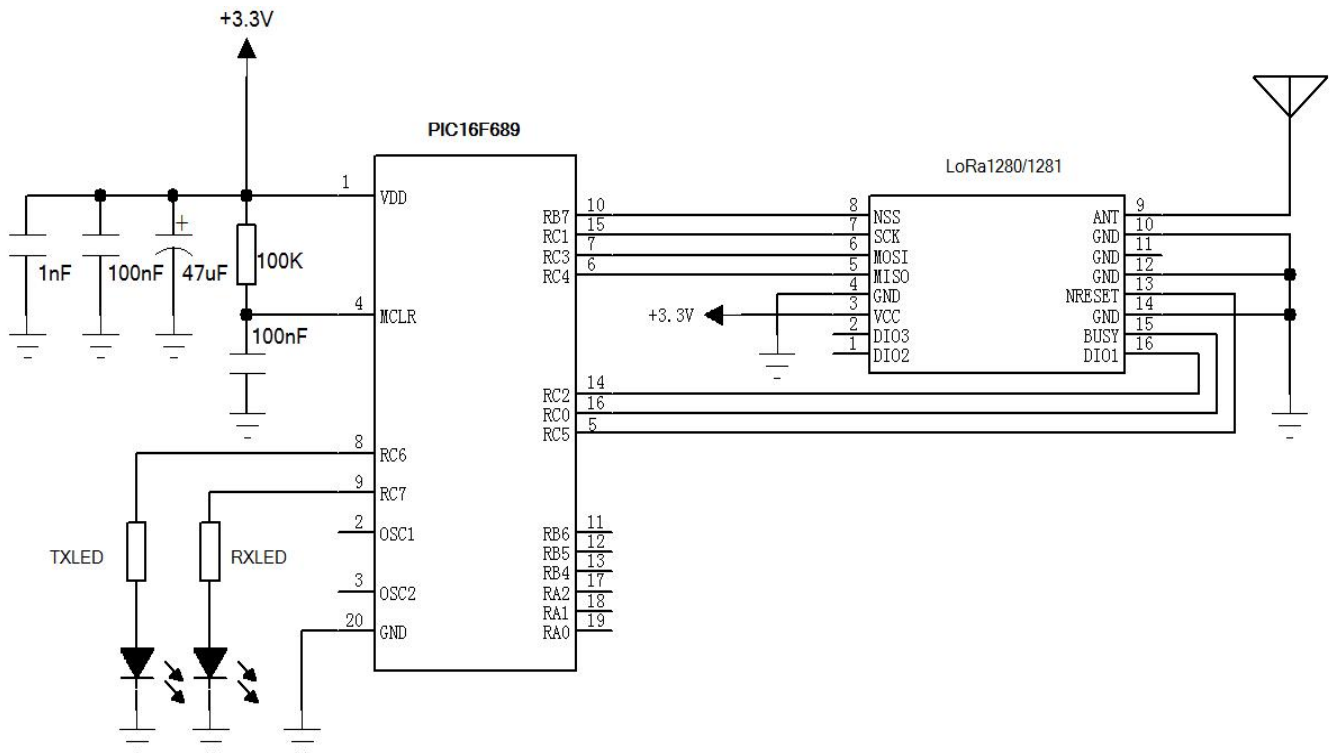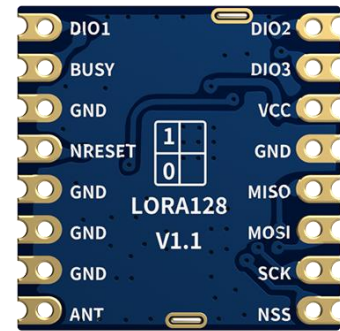

LoRa1280/LoRa1281-TCXO module：

7. Pin definition

LoRa1280/1281-TCXO   LoRa1280/1281

| Pin NO	Pin name	Description
1	DIO2	Directly connected to the chip pin, configurable general-purpose IO (see the chip SX1280/1281 specification for details)
2	DIO3	Directly connected to the chip pin, configurable general-purpose IO (see the chip SX1280/1281 specification for details)
3	VCC	Connected to the positive pole of the power supply (1.8-3.7V)
4	GND	Connected to the negative pole
5	MISO	SPI data output pin
6	MOSI	SPI data input pin
7	SCK	SPI clock input pin
8	NSS	Module chip select pin
9	ANT	Connect with 50 ohm coaxial antenna
10,11,12	GND	Connected to the negative pole
13	NRESET	Chip reset trigger pin, active low
Note: For Lora1280 and Lora1281 modules, PIN 14 is GND		
14	GND	Connected to the negative pole
Note: For Lora1280-TCXO module, PIN 14 is TCXOEN		
14	TCXOEN	Turn on TCXO: 1. Turn TCXOEN pin to high level before reset SX1280; 2. Delay at least 3ms to wait for the TCXO startup; 3. During the use of the 1280 module, TCXOEN must keep in high level; Turn off TCXO (if the module needs to enter sleep mode): 1. Call the SetSleep() function to make the module enter the sleep mode; 2. Delay at least 1ms to wait for module sleep; 3. Turn TCXOEN pin to low level to turn off TCXO;
15	BUSY	Status indicator pin (see SX1280/1281 specification for details)
16	DIO1	Directly connected to the chip pin, configurable general-purpose IO (see the chip SX1280/1281 specification for details）

8. Communication Antenna

The antenna is an important part of the communication system. Its performance directly affects the parameters of the communication system. The antenna impedance required by the module is 50 ohms. The universal antenna has wires and spring antenna, and can also be used for SMA adapter straight/elbow/folding rods, small suction cups, etc. Users can purchase antennas according to their own application environment. In order to make the module work optimally, it is recommended to use the antenna from our company.
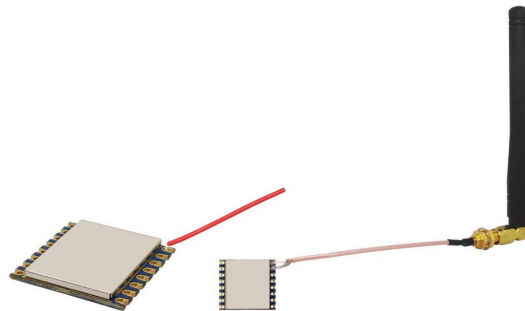
★ The following principles should be followed during antenna use to ensure the best communication distance of the module:

➢ The antenna should not be close to the ground surface, and the surrounding area should be kept away from obstacles;

➢ If the suck antenna is purchased, the lead wire should be straightened as much as possible, and the base should be attached to the metal object;
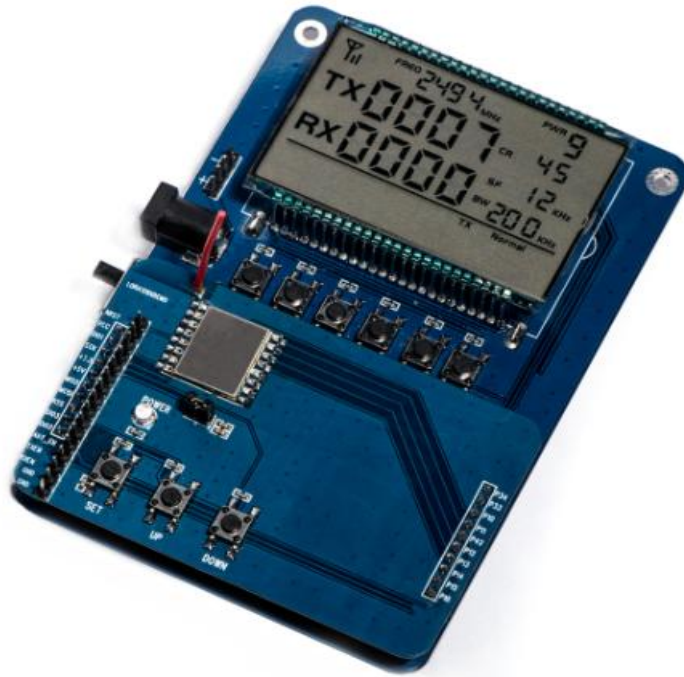
9.Mechanical Dimensions（Unit:mm）
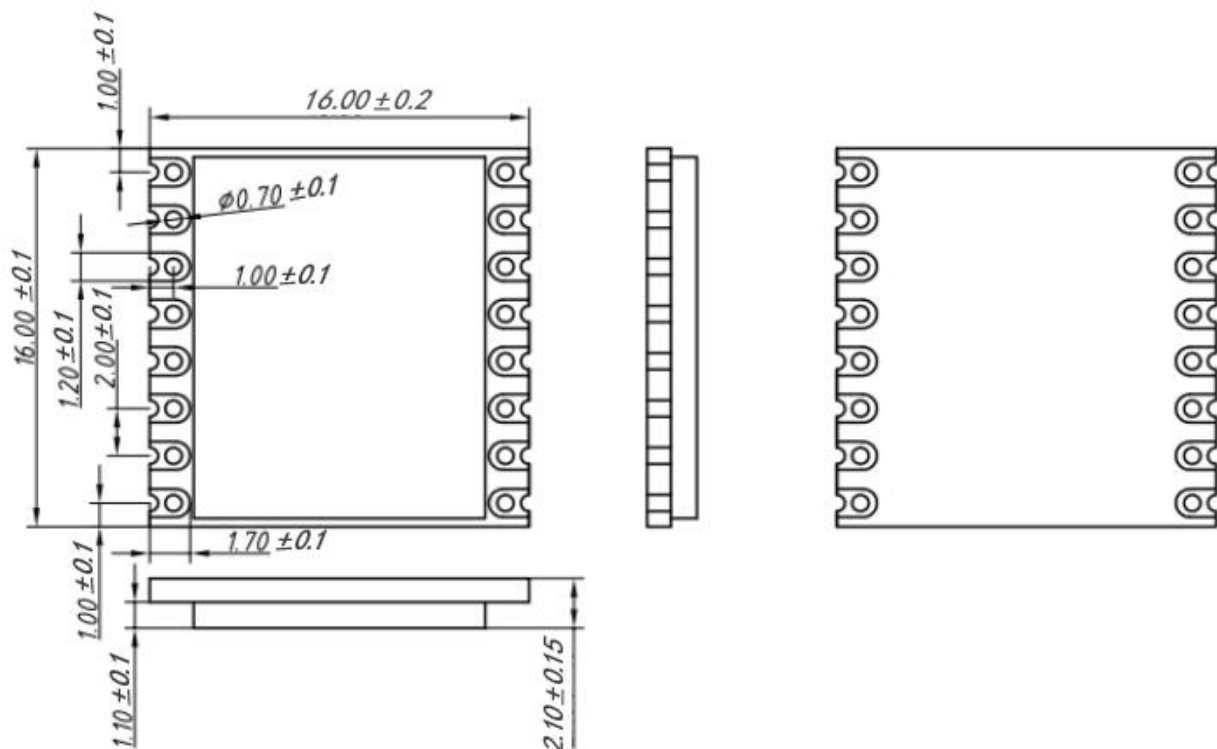
Appendix 1: Demo Board (Only communication DEMO, without ranging function)

Note: Please refer to the data "LoRa1280 Ranging Demo Board Specification.pdf" to see the ranging

DEMO operation.

The module is equipped with a standard DEMO board for customer to debug the program and test

distance.It shows as below:

The LCD Full Segment is as below:
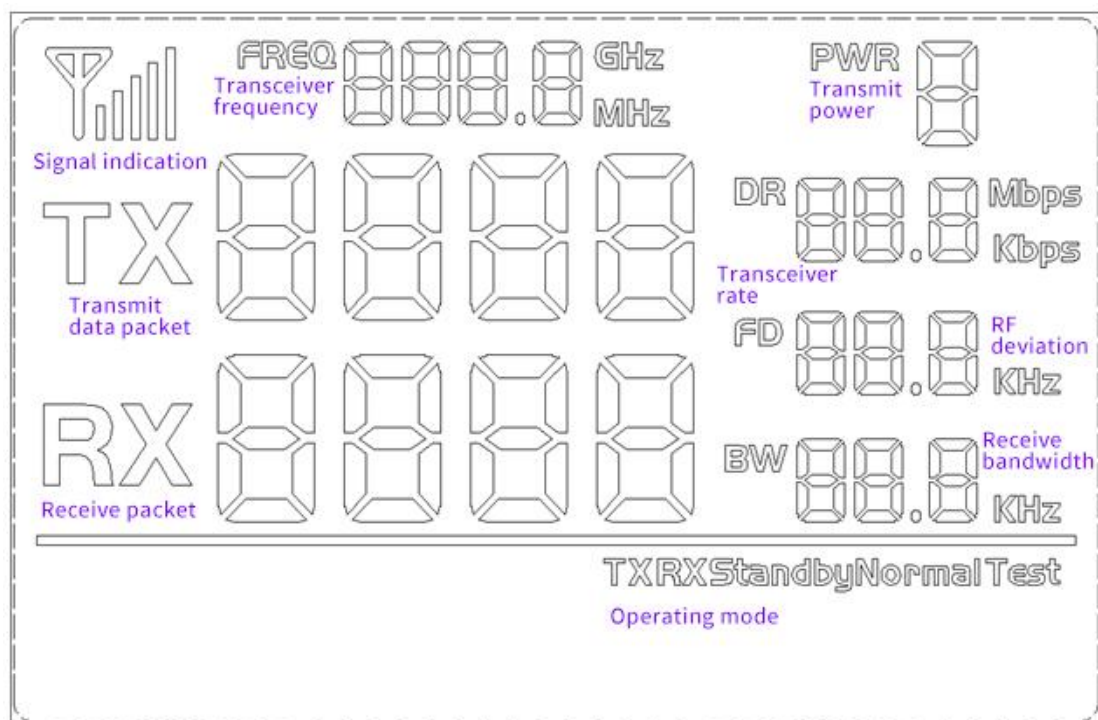
Users can set the parameters of the RF module such as working mode /frequency / transmitter power / transmission data rate through the buttons, and measure the wireless communication distance.

➢ **Working Mode:**

1) Normal transmission mode: Send data packets at regular intervals (in the setup mode, no data packets are sent temporarily);

2) Normal receiving mode: power-on enters the receiving state, receives the data packet, and re-issues the correctly received data packet;

3) Normal transmission mode: the module is in the normal state;

4) Constant acceptance mode: the module is in the normal receiving state (no data is forwarded);

5) Sleep mode: The RF module is in the standby state.

➢ **Button Operation:**

1) [SET] Button

Press the [SET] button to enter into setting mode; Or press the [SET] button to be out of the setting mode upon the last parameter is done.
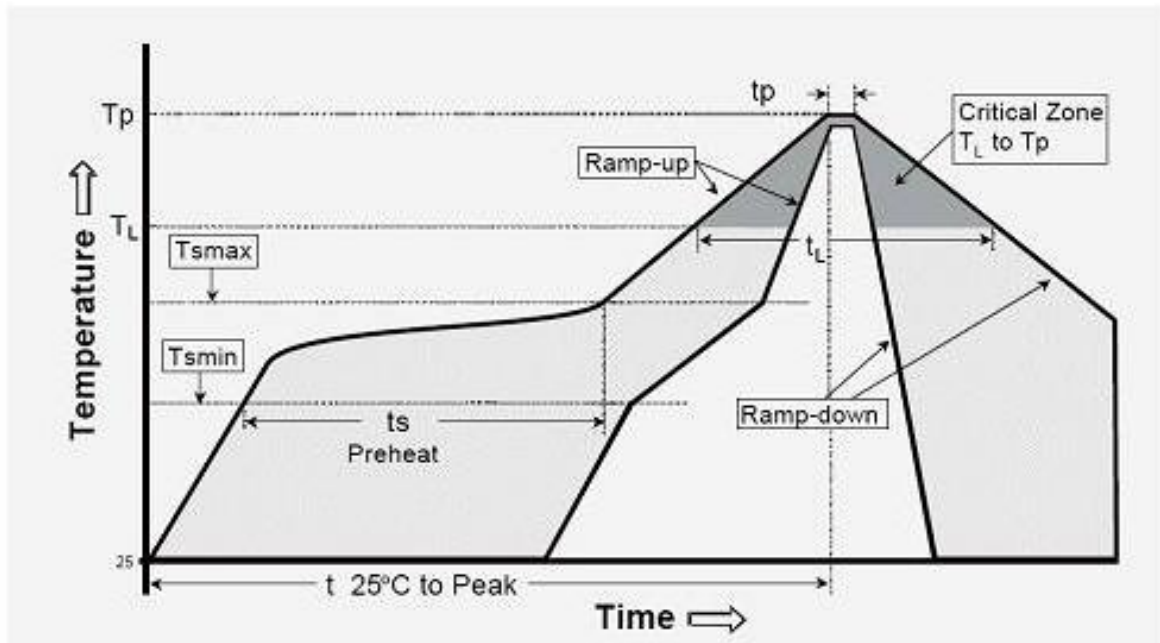
2) [UP/Down] Button

In the setting mode, press the button to modify the corresponding setting parameters.

Note: The DEMO board has FLASH memory inside, all the setting parameters will be saved automatically and keep unchanged even power-off.

Appendix 2：SMD Reflow Chart

We recommend you should obey the IPC related standards in setting the reflow profile:

IPC/JEDEC J-STD-020B the condition for lead-free reflow soldering	big size components （thickness >=2.5mm）
The ramp-up rate (Tl to Tp)	3℃/s (max.)
preheat temperature - Temperature minimum (Tsmin) - Temperature maximum (Tsmax) - preheat time (ts)	 150℃ 200℃ 60~180s
Average ramp-up rate(Tsmax to Tp)	3℃/s (Max.)
- Liquidous temperature(TL)	217℃
- Time at liquidous(tL)	60~150 second
peak temperature(Tp)	245+/-5℃