

EMB1061

BLE module

Vision: 1.3

Date: 2018-12-03

Number: DS0080EN

Abstract

Features

- Based on an ultra-low power BLE SOC
 - ARM Cortex-M0 Core 32MHz
 - 24KB RAM
 - 160KB Flash
- Operating Voltage: 1.7V~3.6V
- Bluetooth Features
 - Support Bluetooth 4.2 (BLE single mode)
 - Max TX power: 8dBm
 - Min RX sensitivity: -87dBm
 - Support BLE Master/ Slave mode
 - Support broadcasting, data encryption, and adaptive frequency hopping
- Operating Temperature: -40°C to +105°C
- Antenna: PCB antenna or IPEX connector (Optional)

Application

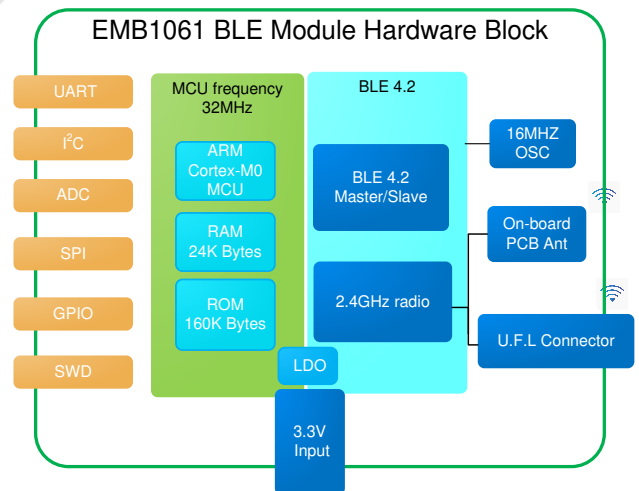
- Intelligent lighting
- Smart Home Application
- Wearables
- Smart healthcare

- Portable devices

Module Type

MXCHIP PN	Antenna Type	Package
EMB1061-P	PCB antenna	Tray
EMB1061-E	IPEX connector	Tray
EMB1061-P-TR	PCB antenna	Tape&reel
EMB1061-E-TR	IPEX connector	Tape&reel

Hardware Block



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Version history

Date	Vision	Details
2017-04-07	0.1	Initial release
2017-05-21	0.2	1. Update pin definition 2. Update power consumption 3. Update RF data
2017-07-04	1.0	Update pin definition
2017-07-05	1.1	Update RF data
2018-03-08	1.2	Update operation temperature
2018-12-03	1.3	Update part number and package

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1. Product Introduction

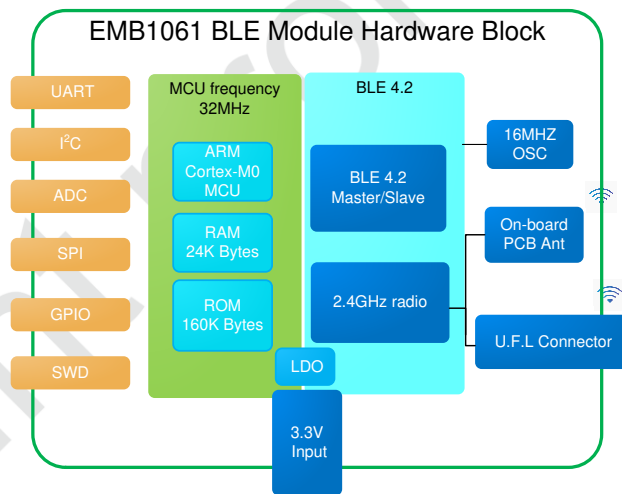
EMB1061 is an embedded BLE module by MXCHIP. It integrates a BLE4.2 single mode SOC, including ARM Cortex-M0 Core, BLE/2.4G Radio, 24KB RAM, 160KB Flash and rich peripherals. EMB1061 uses half-hole package which is easy for soldering.

Hardware diagram is shown below with three main parts:

- 32-bit Cortex-M0 Core
- BLE 2.4GHz RF
- Power management

With:

1. Up to 16MHz ARM Cortex-M0 MCU with 24KB RAM , 160KB FLASH, UART, I2C, SPI, ADC, Timer/PWM
2. RF part: support PCB antenna or IPEX connector
3. Power management: DC3.3V power supply, operating voltage range: 1.7V~3.6V



EMB1061 Hardware block

1.1 EMB1061 appearance



Figure 1 EMB1061 appearance

1.2 Pin Arrangement

EMB1061 has 22 pins, with 2.0mm pin pitch.

EMB1061 uses half-hole package (as shown in figure 2, figure3) , which could effectively reduce the quality risk of SMT re-flow.

Solder mask openness has the same size with land. The width of steel mesh is suggested to be 0.12mm to 0.14mm in SMT.

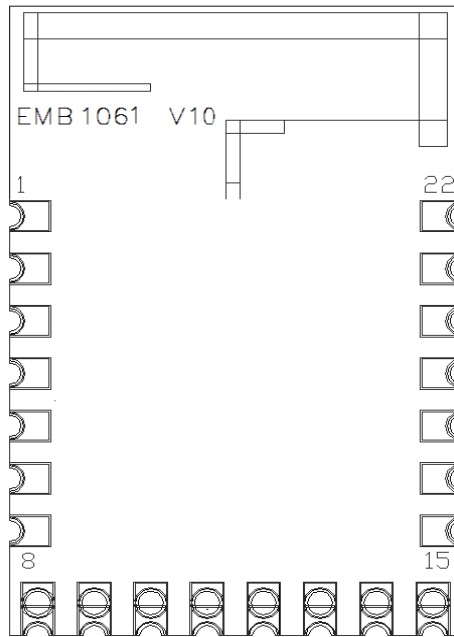


Figure 2 EMB1061 PIN assignment

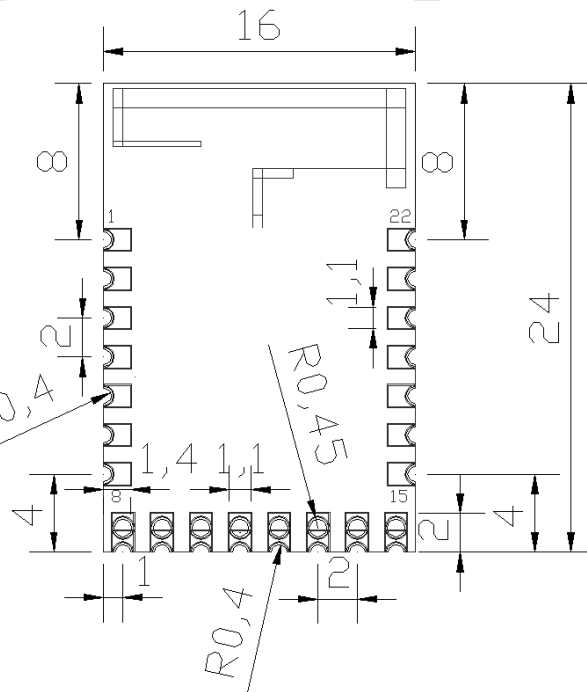


Figure 3 EMB1061 mechanical size

1.3 Pin Definition

1.3.1 EMB1061 Package Definition

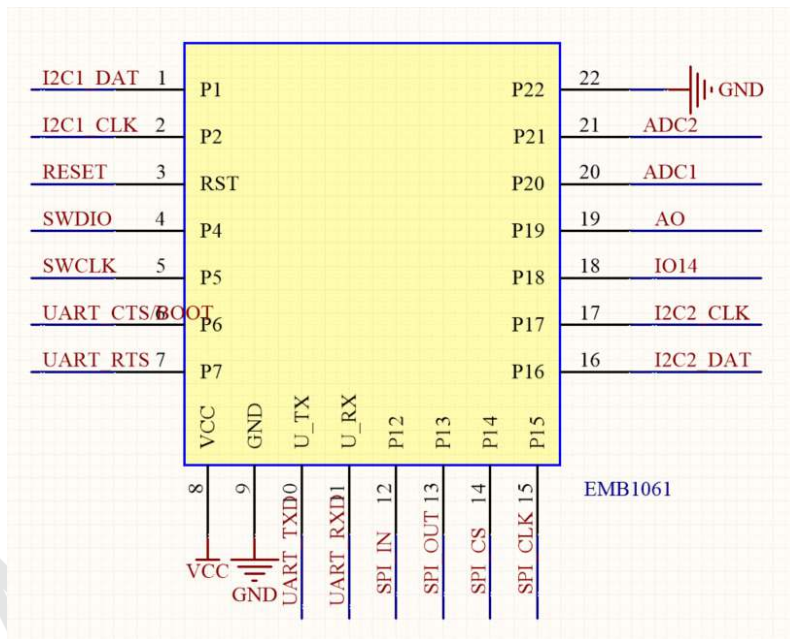


Figure 4 EMB1061 Package Definition

1.3.2 EMB1061 Pin Definition

Table 1 EMB1061 Pin Definition

NO.	Name	Pin of ST SOC	Type	Main function	Alternative function
1	I2C1 DAT	IO13	I/O	I2C1 DAT	GPIO13
2	I2C1 CLK	IO12	I/O	I2C1 CLK	GPIO12
3	RESET	RESETN	Input	Reset	
4	SWDIO	IO10	I/O	SWDIO	GPIO10
5	SWCLK	IO9	I/O	SWCLK	GPIO9
6	UART CTS/BOOT	IO7	I/O	UART CTS/BOOT	I2C2_DAT
7	UART RTS	IO6	I/O	UART RTS	I2C2_CLK
8	VCC	VBAT2	S	POWER_SUPPLY	
9	GND	GND	S	GND	
10	UART_TX	IO8	I/O	USER_UART_TX	SPI_CLK
11	UART_RX	IO11	I/O	USER_UART_RX	GPIO11
12	SPI IN	IO3	I/O	SPI IN	PWM1
13	SPI OUT	IO2	I/O	SPI OUT	PWM0
14	SPI CS	IO1	I/O	SPI CS	GPIO1
15	SPI CLK	IO0	I/O	SPI CLK	GPIO0

NO.	Name	Pin of ST SOC	Type	Main function	Alternative function
16	I2C2 DAT	IO5	I/O	I2C2 DAT	PWM1
17	I2C2 CLK	IO4	I/O	I2C2 CLK	PMW0
18	IO14	IO14	I/O	GPIO14	Analog Output
19	AO	ANATEST1	O	Analog Output	Analog Output
20	ADC1	ADC1	I	ADC1	ADC INPUT
21	ADC2	ADC2	I	ADC2	ADC INPUT
22	GND	GND	S	GND	

2. Electrical Parameters

2.1 Operating Conditions

EMB1061 would be unstable when input voltage is less than the lowest rated voltage.

Table 2 Range of input voltage

Symbol	Illustration	Condition	Details			
			Minimum	Typ	Maximum	Unit
VDD	Power Supply		1.7	3.3	3.6	V

There would be permanent damage in hardware if the device operates at the voltage over rated value. Meanwhile, reliability could be influenced when the device has a long-term operating at maximum voltage.

Table 3 Absolute maximum voltage rating

Symbol	Description	Minimum	Typ	Unit
VDD	Module input voltage	–	3.8	V
VIN	GPIO input voltage	–	3.8	V

2.2 Power Consumption

Table 4 EMB1061 Power Consumption

	Mode	Description	Average	Max
			TA=25°C	TA=25°C
EMB1061 Power consumption	CPU_HALT	CPU running halted, all peripherals keep running and can wake up CPU by interrupt/event.	2.49mA	2.63mA
	Advertisement (TIMER_SLEEP ON)	Advertise every 1.28s, keep in TIMER_SLEEP mode between the advertisement intervals.	19.53uA	8.43mA
	Connected	Keep connected with other BLE device, communicate every 50ms, and keep in TIMER_SLEEP mode between the communication intervals.	138.96uA	8.39mA
	Scanning	Scan every 1.28s, and kee in	568.75uA	8.26mA

	Mode	Description	Average	Max
			TA=25°C	TA=25°C
		TIMER_SLEEP mode between the scan intervals.		
	Sleep	TIMER_SLEEP ON CPU and all peripherals OFF, internal slow RC clock and wakeup pins ON Can be waked up by internal RTC or wakeup pins (IO9/10/11/12/13) . Wake up every 10s in this test.	3.54uA	2.76mA
	Standby	CPU and all peripherals OFF Wakeup pins ON Can be waked up by wakeup pins (IO9/10/11/12/13) .	375.98nA	2.68uA

Actual working current is variable at different operating mode.

2.3 Working Environment

Table 5 Temperature and humidity condition

Symbol	Name	Maximum	Unit
TSTG	Storage Temperature	-40 to +110	°C
TA	Operation Temperature	-40 to +105	°C
Humidity	Non-condensing, Relative humidity	95	%

2.4 Electrostatic Discharge

Table 6 Electrostatic Discharge Parameters

Symbol	Name	Details	Level	Maximum	Unit
V _{ESD} (HBM)	Electrostatic discharge voltage (Human Body Model)	TA= +25 °C , JESD22-A114	2	2000	V
V _{ESD} (CDM)	Electrostatic discharge voltage (Charged Device Model)	TA = +25 °C , JESD22-C101	II	500	

3. RF parameters

3.1 Basic RF parameters

Table 7 Radio-frequency standards

Name	Illustration
Working frequency	2.4GHz ISM band
Wi-Fi wireless standard	Bluetooth4.2
Modulation	FSK/GFSK
Data rate	250Kbps-2Mbps
Antenna type	PCB (Default) IPEX Connector (Optional)

3.2 FSK/GFSK Parameters

Table 8 FSK/GFSK mode parameters

Item	Notes
Modulation	FSK/GFSK
Frequency range	2.400GHz-2.4835GHz ISM band
Data rate	250Kbps-2Mbps

Table 9 FSK/GFSK mode RX parameters

RX parameter	Min	Typ.	Max	Unit
Sensitivity		-87		dBm
Frequency error	-10		+10	KHz

Table 10 FSK/GFSK TX parameters

TX Parameter	Min	Typ.	Max	Unit
Output power	-20	+2	+8	dBm
Occupied bandwidth		2		MHz

4. Antenna Information

4.1 Antenna Type

EMB1061 has two types of antenna: PCB antenna (EMB1061-P), IPEX connector (EMB1061-E).



Figure 5 EMB1061-P



Figure 6 EMB1061-E

4.2 PCB Antenna Clearance Zone

Main PCB should have a distance over 16mm with other metal elements when using PCB antenna in Wi-Fi device. Shadow parts in the figure below should keep away from metal elements, sensor, interference source and other material that could cause signal interference.

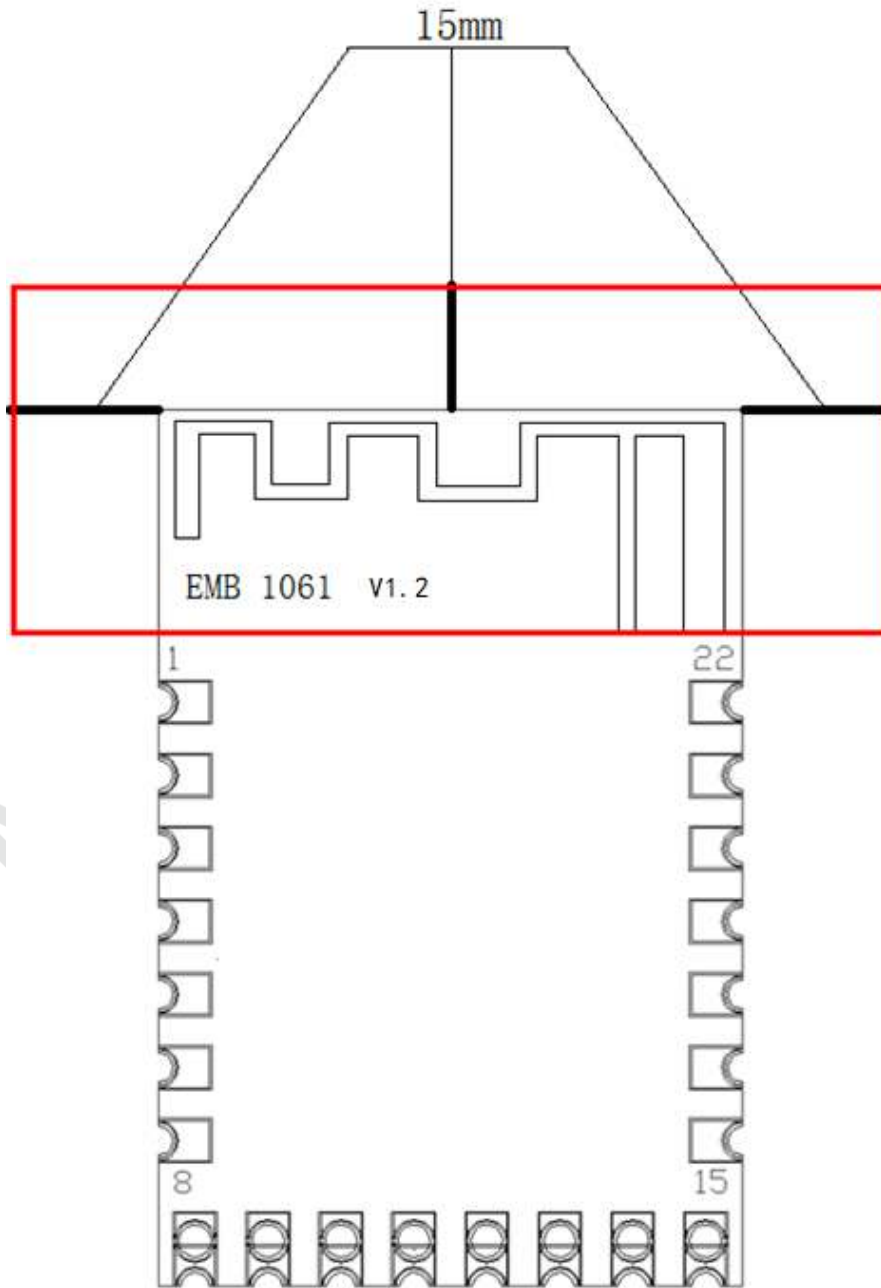


Figure 5 Minimum Clearance Zone of PCB Antenna (Unit: mm)

4.3 External Antenna Connector

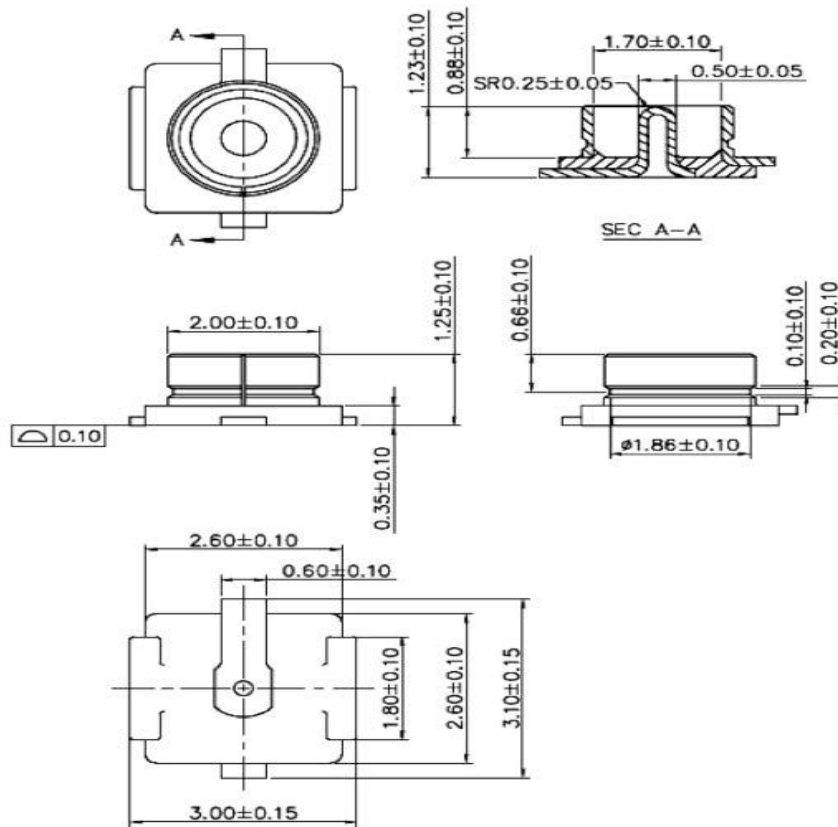


Figure 6 Size of External Antenna Connector

- (2) Anti-static and high thermos tolerant tray
- (3) Anti-static and high thermos tolerant gloves
- Conditions of product storage (Storage environment is shown in figure 8):
 - Moisture bag must be stored in temperature below 30 and humidity less than 85%RH.
 - Dry packaging products, the guarantee period should be from 6 months date of packing seal.
 - Humidity indicator card is in the hermetic package.



Figure 8 Humidity Card

- Humidity indicator card and drying situation:
 - 2 hours drying for module if the color ring at 30%, 40%, 50% in humidity indicator card is blue after unpacking;
 - 4 hours drying for module if the color ring at 30% in humidity indicator card is pink after unpacking;
 - 6 hours drying for module if the color ring at 30%, 40% in humidity indicator card is pink after unpacking;
 - 12 hours drying for module if the color ring at 30%, 40%, 50% in humidity indicator card is pink after unpacking.
- Drying parameters:
 - Drying temperature: $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$;
 - Alarm temperature: 130°C ;
 - SMT patch when the device cool down below 36°C in natural condition;
 - Dry times: 1;
 - Please dry again if the module is unsoldering in 12 hours after last drying.
- SMT is unsuitable if the module packed over 3 months. There would be serious oxidation of the pad because of immersion gold and cause false welding and lack of weld. Mxchip does not assume the

corresponding responsibility;

- ESD protection is required before SMT;
- SMT patch should on the basis of reflow profile diagram, maximum temperature 245°C, reflow profile diagram is shown in figure 10;
- In order to guarantee the reflow soldering qualification rate, vision and AOI detection should be done in 10% products for the first patch to make sure the rationality of temperature control, device adsorption mode and position. Detect 5 to 10 sample every hour in the following batch production.

5.3 Considerations

- Operator should wear anti-static gloves during producing;
- No more than drying time;
- Any explosive, flammable and corrosive material is not allowed to add in drying;
- Module should be put into oven with high thermotolerant tray. Ventilation should exist between each module and no direct contact with oven;
- Make sure oven is closed when drying to prevent temperature leaking;
- Reduce opening time or keep closing the door of the oven during drying;
- Use anti-static glove to take out module when its temperature below 36°C by natural cool down after drying;
- Make sure no water and dirt in the bottom of the module;
- Temperature and humidity control is level 3 for initial modules. Storage and drying conditions are based on IPC/JEDEC J-STD-020.

5.4 Storage Condition


	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 3 </div>
	If Blank, see adjacent bar code label	
<p>1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)</p>		
<p>2. Peak package body temperature: _____ 260 _____ °C <small style="margin-left: 150px;">If Blank, see adjacent bar code label</small></p>		
<p>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must</p>		
<p>a) Mounted within: _____ 168 _____ hrs. of factory conditions <small style="margin-left: 100px;">If Blank, see adjacent bar code label</small></p>		
<p style="margin-left: 40px;">≤ 30°C/60%RH, OR</p>		
<p style="margin-left: 40px;">b) Stored at <10% RH</p>		
<p>4. Devices require bake, before mounting, if:</p>		
<p style="margin-left: 20px;">a) Humidity Indicator Card is > 10% when read at 23 ± 5°C</p>		
<p style="margin-left: 20px;">b) 3a or 3b not met.</p>		
<p>5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C</p>		
<p style="margin-left: 40px;">Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure</p>		
<p>Bag Seal Date: _____ <small style="margin-left: 150px;">If Blank, see adjacent bar code label</small></p>		
<p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>		

Figure 9 Storage Condition

5.5 Temperature Curve of Secondary Reflow

Suggested solder paste type: SAC305, unleaded, solder paste thickness from 0.12 to 0.15, less than 2 times reflow.

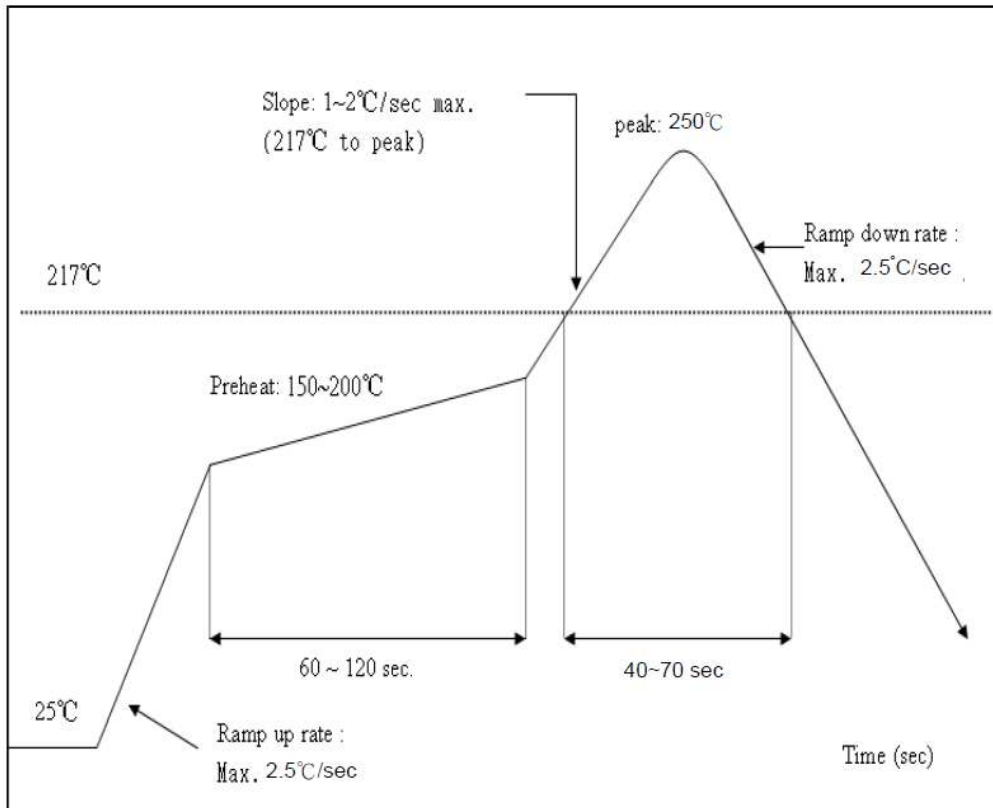


Figure 10 Temperature Curve of Secondary Reflow

6. Reference Circuit

Power source circuit is shown in figure 11, USB to UART is shown in figure 12, external interface circuit is shown in figure 13.

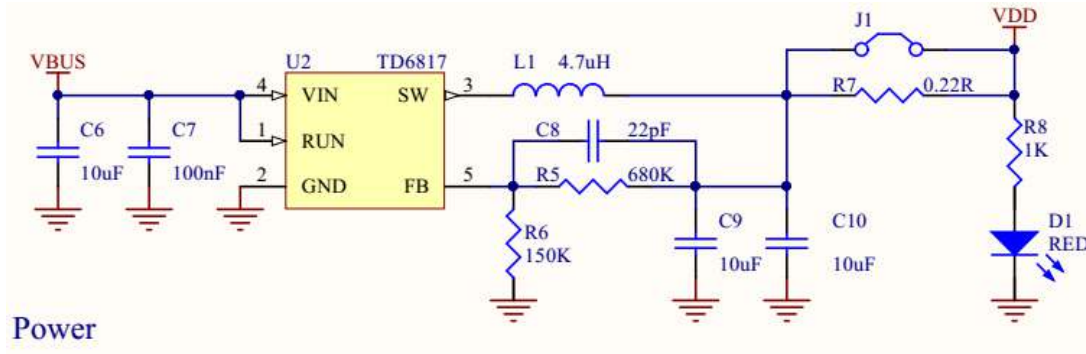


Figure 11 Power Source Circuit

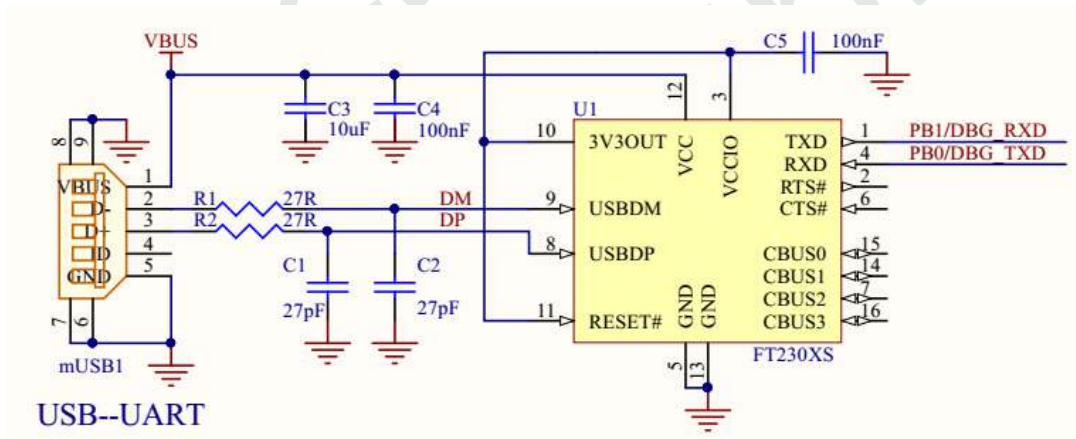


Figure 12 USB to UART

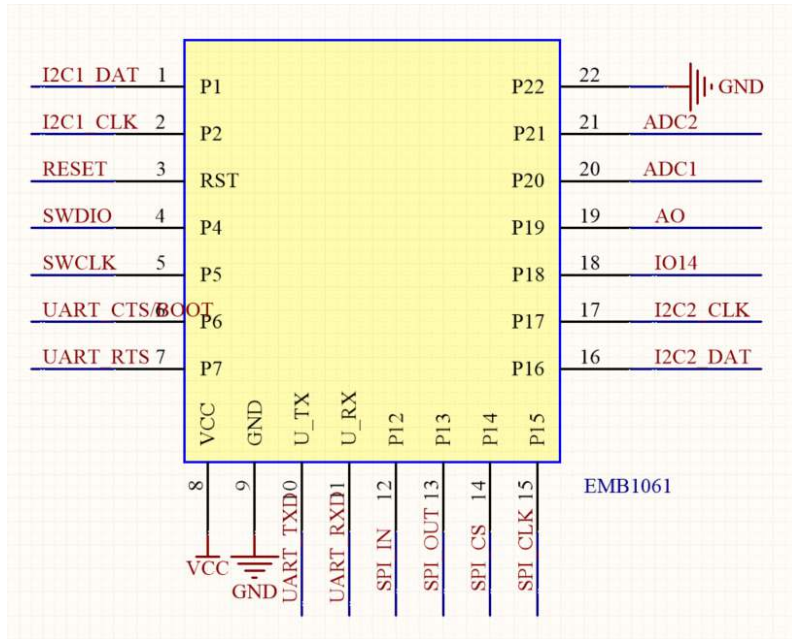


Figure 13 External Interface Circuit of EMB1061

Voltage of EMB1061 UART is 3.3V. 5V UART should convert to 3.3V UART for the users that have 5V chips. Convert circuit is shown in figure 14.

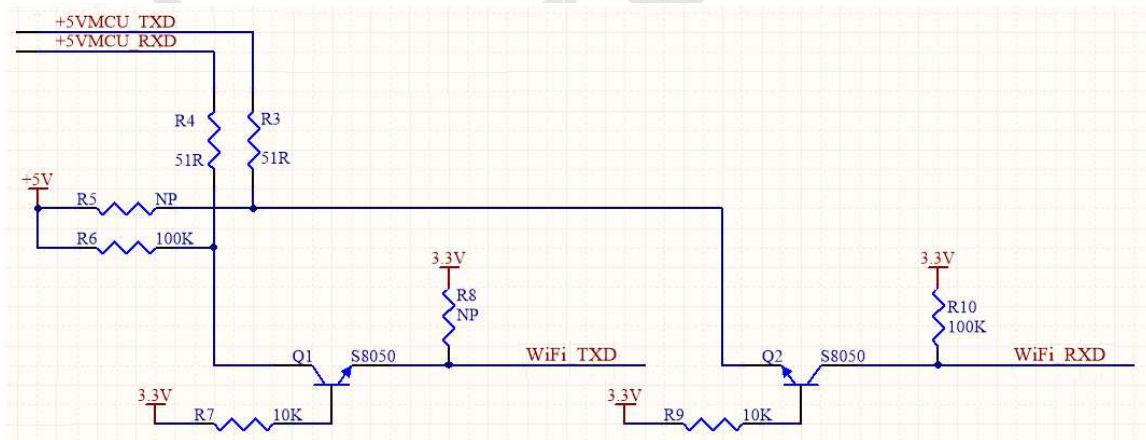


Figure 14 3.3V UART- 5V UART Convert Circuit

7. Module MOQ and Package Information

Table 16 Module MOQ and Package Information

PN	MOQ(pcs)	Package type
EMW1061-P EMW1061-E	2240	Tray
EMW1061-P-TR EMW1061-E-TR	800	Tape and reel

8. Sales Information and Technical Support

For consultation or purchase the product, please contact Mxchip during working hours:

From Monday to Friday, morning 9:00~12:00, afternoon 13:00~18:00

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