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EMB1061 Hardware Design Guide

Abstract

This document lists the consideration in each step during designing product with MXCHIP module. In order to achieve rapid mass production, Users should be familiar with the document to pre-consider and avoid problems effectively in designing, producing, programming and testing.

More Help

For more products information please visit: http://mxchip.com/

For more development data please go to MiCO developer bbs: http://mico.io/

For more Fogcloud data please go to Fogcloud developer center: http://easylink.io/

Version Record

Date	Version	Details
2017-7-11	V1.0	Initial release

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Figure Content

1. Introduction

This document lists the consideration in each step during designing product with MXCHIP module. In order to achieve rapid mass production, Users should be familiar with the document to pre-consider and avoid problems effectively in designing, producing, programming and testing.

Suitable module type:

EMB1061

Phase to attention:

- Hardware design;
- Firmware downloading;
- Firmware testing;
- SMT;

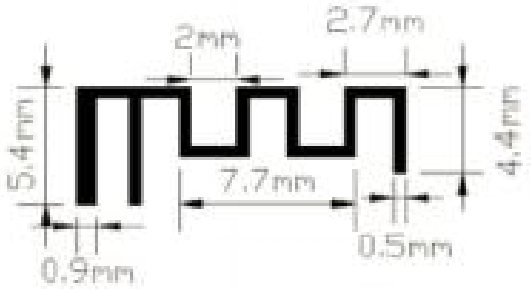
Top view of EMB1061

Figure 1.1. Top view of EMB1061

EMB1061

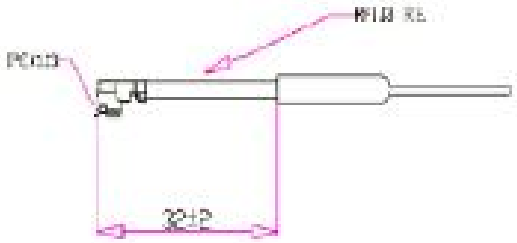
Module type	Antenna Type	Illustration
EMB1061-P	On-board PCB	Default
EMB1061-E	IPEX	Optional

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



ANT MESSAGE	
Frequency	2.4GHz-2.5GHz
Impedance	50oHM
VSWR	<2
Gain	<2DBI
Polarization	Vertical
Radiation	Omnidirectional

EMB1061-P



频率范围 Frequency Range	2400-2500
输入阻抗 Impedance	50 OHM
驻波比VSWR	＜2.0
增益 Gain	2.0DBI
极化 Polarization	垂直
方向性Radiation	全向

EMB1061-E

Hardware Block

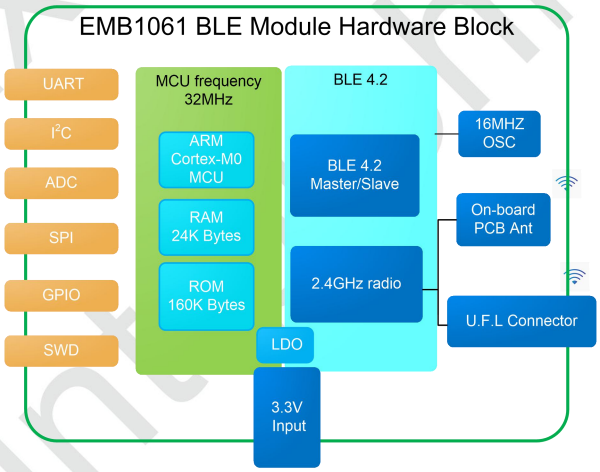


Figure 1.2 Hardware Block

2. Hardware Design Guide

2.1 Mechanical Size

Mechanical size of EMB1061 (Unit: mm)

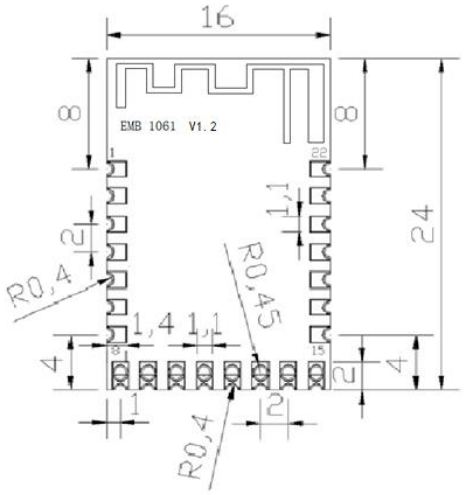
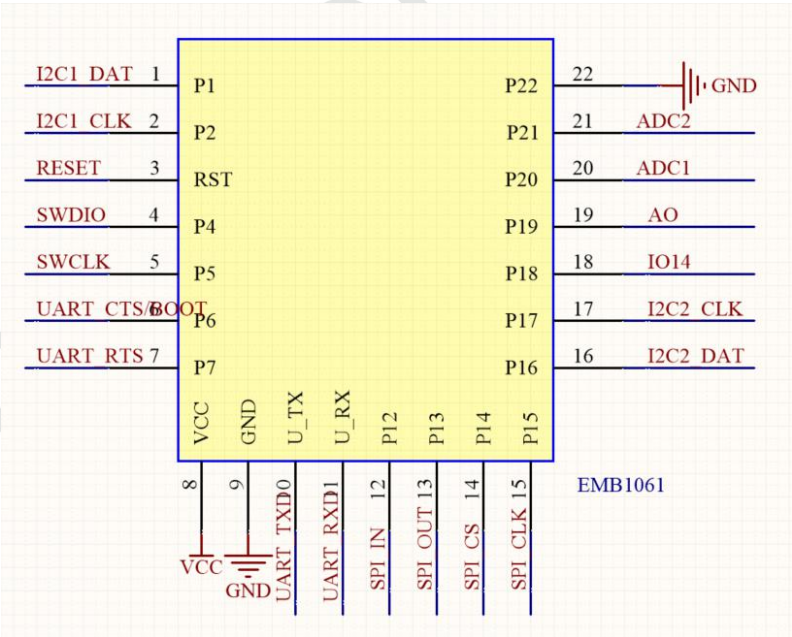


Figure 2.1 Top View of Mechanical Size (Unit:mm)

EMB1061 Package Definition



2.1.1 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

NO.	Name	Pin of ST SOC	Type	Main function	Alternative function
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
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	

2.2 Reference PCB Package Design

Figure 2.1 is the reference module package design for baseplate PCB design.

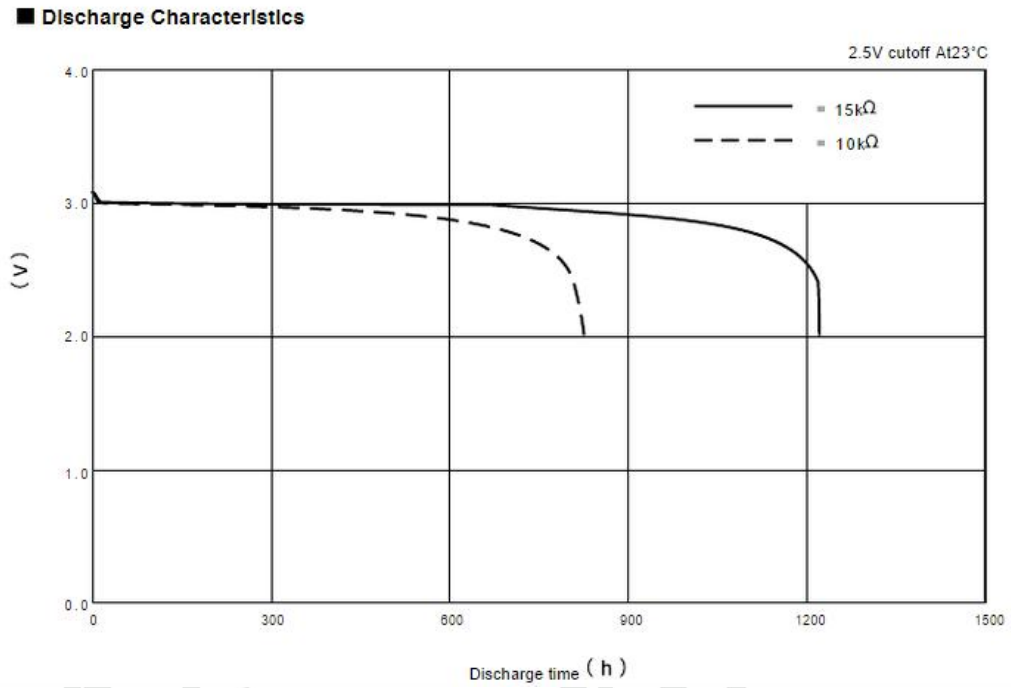
Solder mask openness can be the same size with EMB1061's pad. EMB1061's PCB thickness is 1.0mm.

2.3 DC Power Design

EMB1061's operation voltage is 1.7~3.6V with typical voltage 3.3V. The peak current of the module is about 10mA.

If powered by battery, please pay attention to the max voltage and minimal discharge voltage. For coin cell, the typical voltage is 3.0V, and the minimal discharge voltage is 2.0V, and in practice it usually end up discharging at about 2.5V. For example, CR2032 coin cell, the discharge characteristics is as below picture. When choosing

battery, please check whether its discharge characteristics is suitable for EMB1061.



If using DC-DC, DC-DC's output voltage should be 3.3V, and it's max current should be above 20mA. PCB route should be particularly aware for DC/DC power supply. Compact element, excellent connection between input and output ground, long distance between feedback signal and inductance and Schottky diode are required for route. Details about the requirements should refer to the datasheet of DC/DC device.

Maximum output current and dissipate heat should be aware for the using of LDO. For example, voltage drop is 1.7V when voltage reduces from 5V to 3.3V. If the current is 100mA, power consumption is 1.7V * 100mA=170mW. Power Dissipation is a parameter of LDO, which should be over 170mW.

2.4 RF Design

2.4.1 On-board PCB Antenna Design

There should not be components, or ground, or circuit 15mm away from EMB1061′ s PCB antenna.

Figure 2.2 Minimum PCB Clearance Area

In order to reduce the influence from metal components to PCB antenna and wireless signal, it is better to mount EMB1061 on these areas, as shown in figure 2.3.

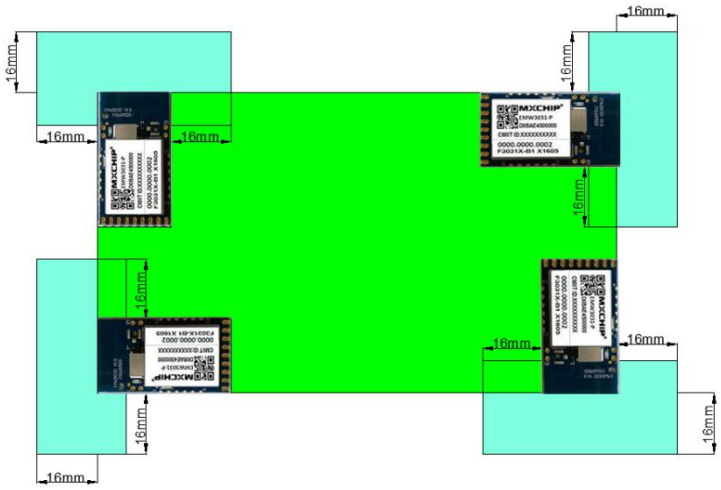


Figure 2.3 Position of the Module

2.4.2 External Antenna

Size of connector for external antenna is shown in figure 2.4. Make sure the correct size with suppliers before buying the connectors of antenna.

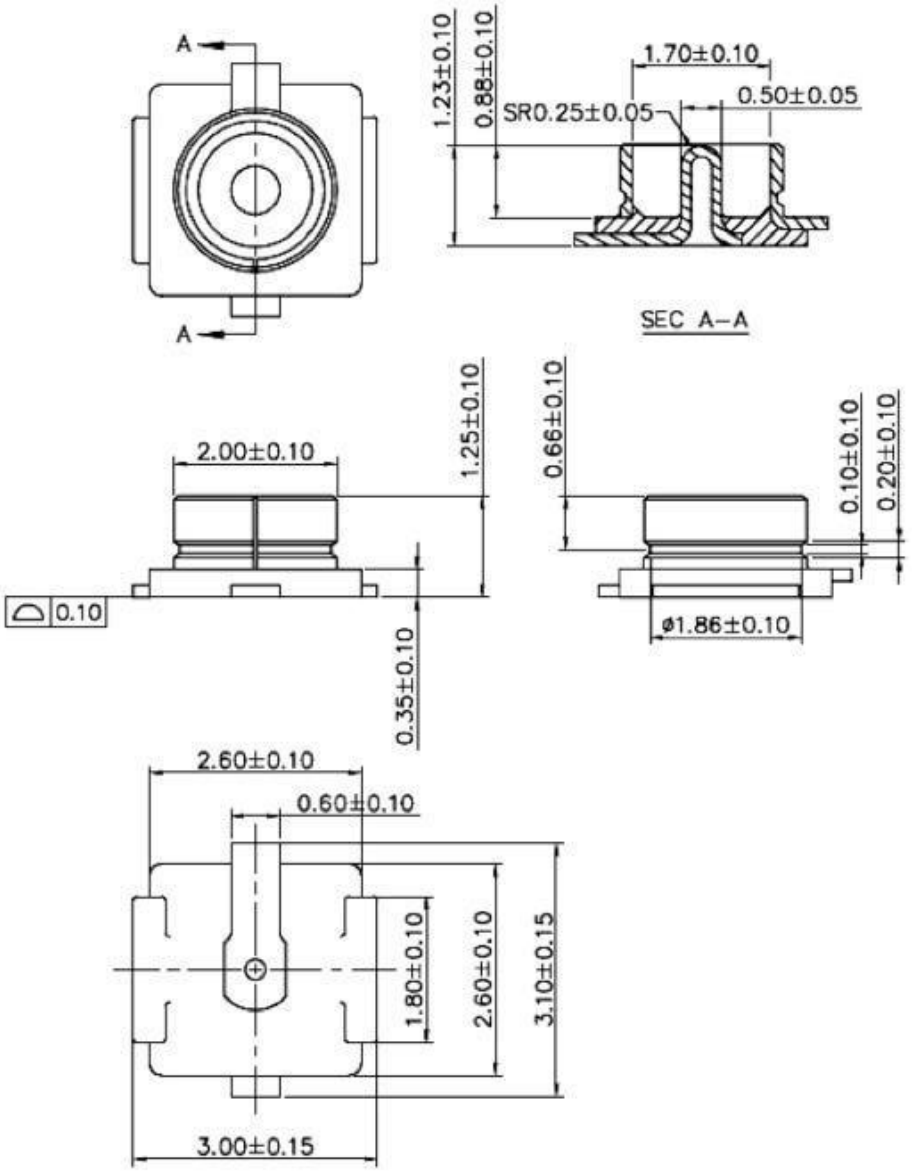


Figure 2.4 Size of connector for external antenna

2.5 ESD Design

ESD level of the module: Human body model (HBM) is 2000V, charged device model (CDM) is 500V. Position of ESD protected components should be reserved if the products require higher ESD requirement.

3. Downloading Firmware

1. Unzip the package and install the USB driver "CDM 2.08.30 WHQL Certified_64".

2.Power supply to the development board through USB interface. View its corresponding serial port number from device Manager. 3. Enter BOOTLOADER mode. After confirming that the module is powered (a red LED lights up next to the USB port), hold down the BOOT button and reset the module through the Reset button, then release the BOOT button. If the operation succeeds, EMB1061 enters BootLoader mode. 4. Open firmware upgrade tool software, select module EMB1061, select user serial port number and fix A document.

5. Select the firmware file to upgrade (click the firmware button), and if everything is normal, you will see the upgrade button brighten. Indicates that you can upgrade. Hover over the firmware button to see the absolute path of the firmware that has been selected. As shown in the figure:

6. Click the upgrade button and a dialog box will pop up to prompt the user to confirm that the module is now in BootLoader mode. Click OK to start the upgrade, as shown in figure:

7. After a successful upgrade, the module will automatically Reset and run from the latest firmware. If there is an error in the upgrade process, the tool will pop up an error prompt, according to which the user can further process.

4. Important Statement

MXCHIP has a duty to make sure there is no quality problem when sell the module to customers.

Customers have the rights to ask MXCHIP to exchange goods if the product has quality problem.

If the customer find the problem after welding the module on board without testing at the beginning, MXCHIP is only responsible for the compensation of the module part.

MXCHIP would help customers solve technical problem in developing firmware without save any MVA/bin file. Customers should save different development vision and download relative vision in module before producing.

5. SMT

5.1 Stencils

Stencils thickness is suggested to be 0.12mm (0.1~0.15mm) with Laser grinding. Recommended solder paste: No lead SAC305.

Stencils size is shown in figure 5.1, pad holes extend 0.15mm in order to improving solder wicking. Solder mask's width should be 0.1mm wider than stencil's paste layer, like Pin1 of Figure 5.1. So that if there is no AOI testing, you can check whether the module is placed well by eye to reduce the Pseudo Soldering.

There is EMB1061's PCB lib in mxchip.com, and you can use it directly.

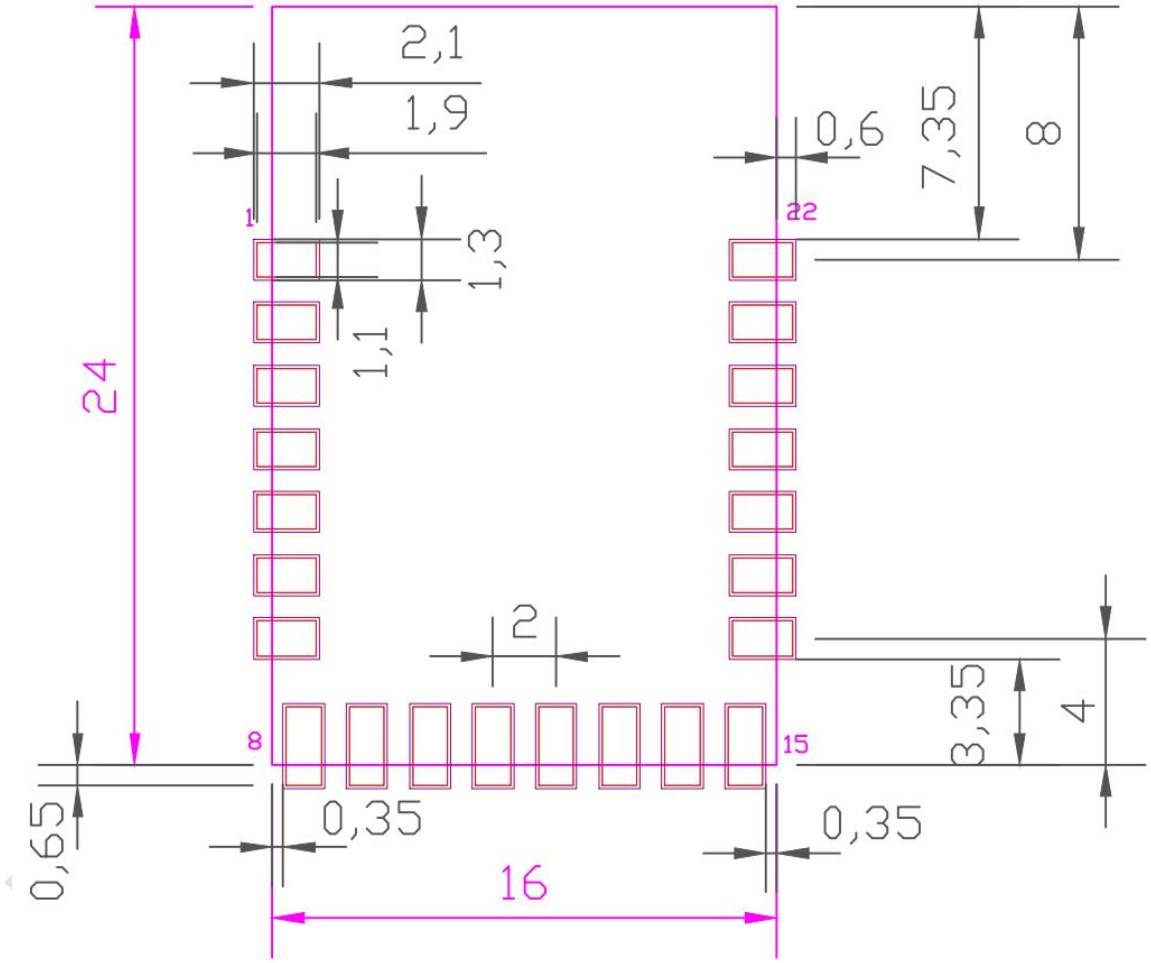


Figure 5.1 Stencils size

5.2 Temperature Curve of Reflow

Pseudo soldering could be reduced by control the furnace with temperature curve of secondary reflow, as shown in figure 5.2.

Secondary reflow times should be less than twice.

1. Max Rising Slope : 3℃/sec
2. Max Falling Slope: -3 ℃/sec
3. Preheat Time(150℃~200℃): 60sec~120sec
4. Over 217℃ Time:40sec~70sec
5. Peak Temp.240℃~250℃

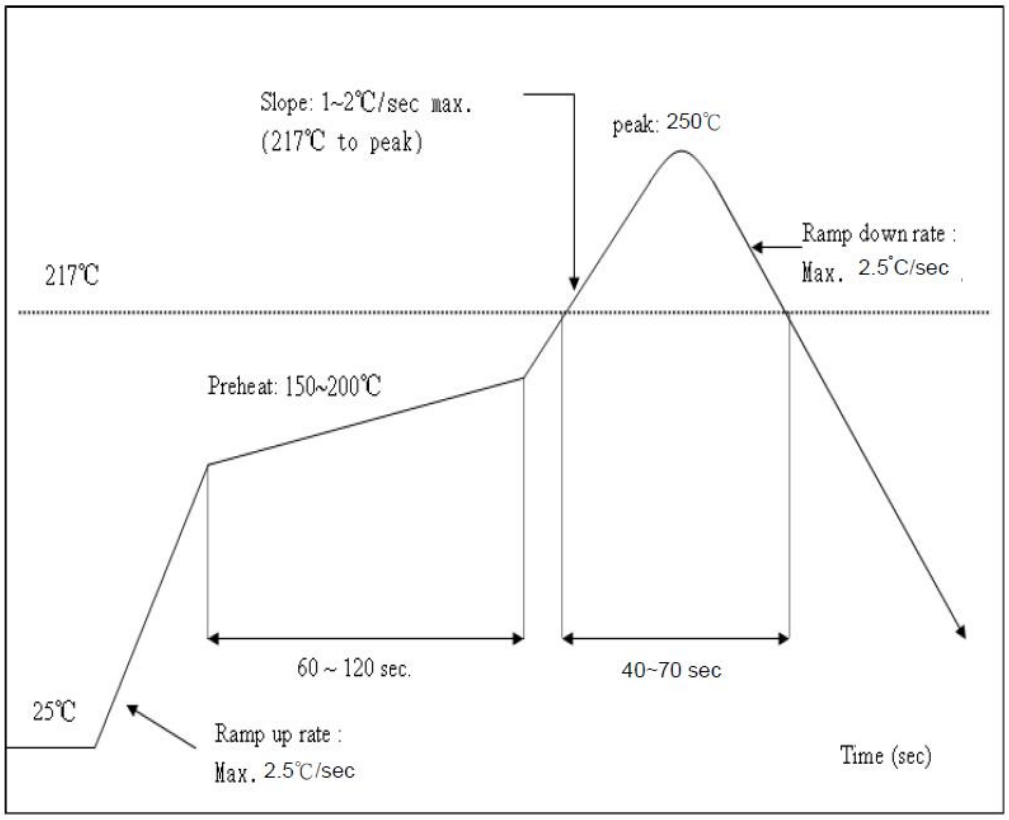
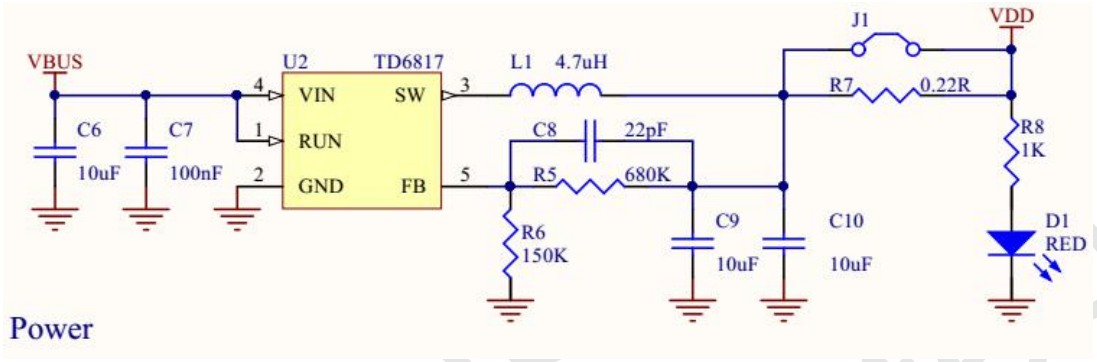


Figure 5.2 Temperature Curve of Secondary Reflow

6. reference design

Power source circuit



USB to UART

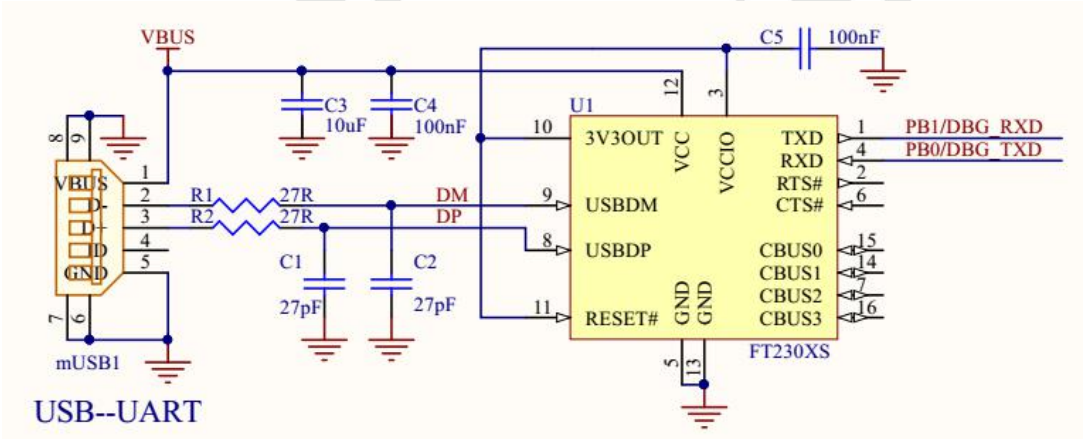


Figure 12 USB to UART

external interface circuit

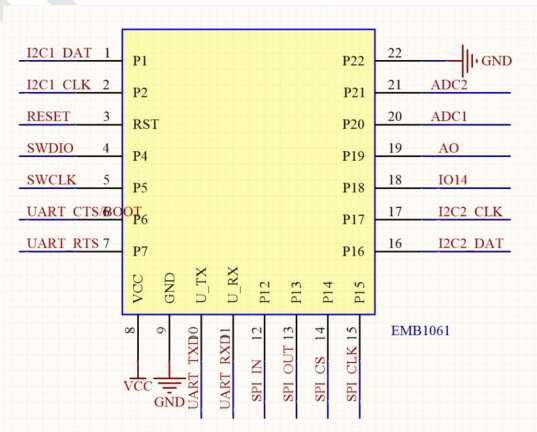


Figure 13 External Interface Circuit of EMB1061

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.

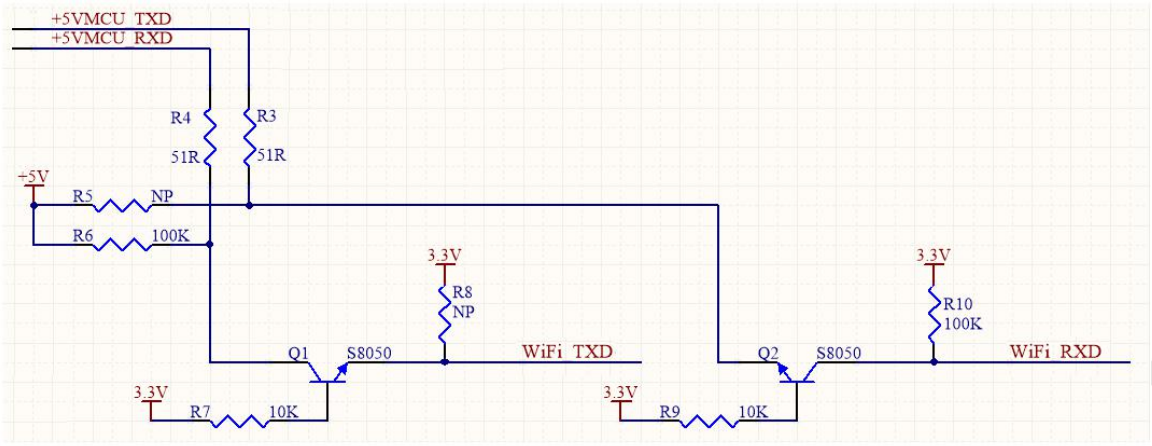


Figure 14 3.3V UART- 5V UART Convert Circuit

7. 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

Telephone: +86-21-52655026

Contact address: 9th Floor, No.5, Lane2145 JinshaJiang Road Putuo District, ShangHai.

Postcode：200333

Email: sales@mxchip.com

FCC Regulations:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This device has been tested and found to comply with the limits for a Class B digital device , pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiated radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user‘s authority to operate the equipment.

RF Exposure Information

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module. 20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains Transmitter Module FCC ID: P53-EMB1061 ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.