

Design Considerations of EMW3031

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.

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Version Record

Date	Version	Details
2016-8-26	V0.1	Initial document
2016-9-26	V1.0	Formal document
2016-11-15	V1.1	Modify pin figures
2017-11-28	V1.2	Modify module height

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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:

EMW3031

Phase to attention:

- Hardware design;
- Firmware downloading;
- Firmware testing;
- SMT;
- Online update.

Basic Characteristics:

- Each module has a unique MAC address;
- PCB antenna and external antenna;
- Supportable with 802.11b/g/n
- Supportable with Station, Soft AP, Station+ Soft AP
- Supportable with easylink
- Working temperature: -30°C to +85°C

Top view of EMW3031



Figure 1.1. Top view of EMW3031

EMW3031

Module type	Antenna Type	Illustration
EMW3031-P	On-board PCB	Default
EMW3031-E	IPEX	Optional

Hardware Block

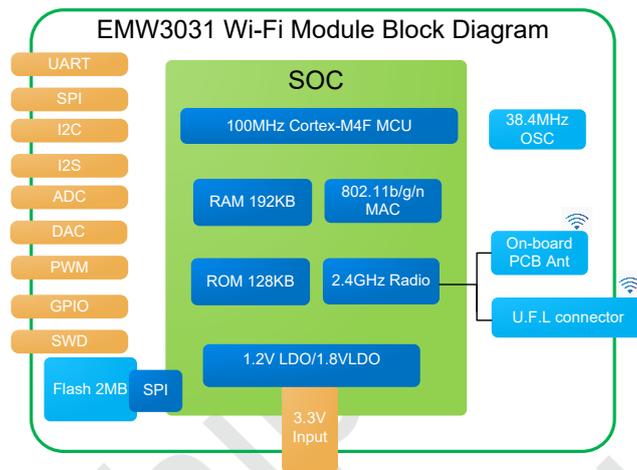


Figure 1.2 Hardware Block

2. Considerations in Hardware Design

2.1 Mechanical Size

Mechanical size of EMW3031(Unit: mm)

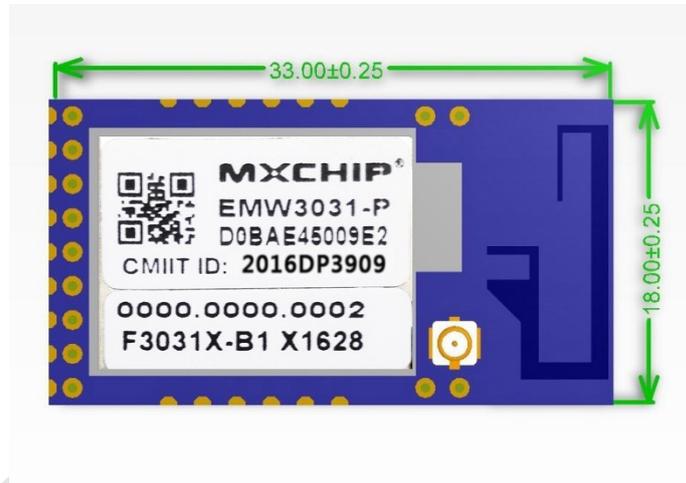


Figure 2.1 Top View of Mechanical Size

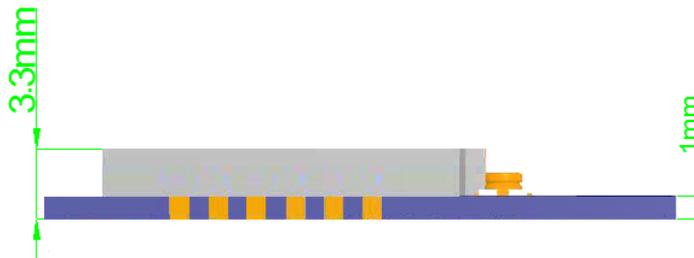


Figure 2.2 Side View of Mechanical Size

2.2 Reference Package Design

Figure 2.3 is the reference module package design for baseplate PCB design that suggested by MXCHIP. Pin 9 to Pin 17 are stamp hole and compatible with DIP that including basic function. A1 to A4 and B1 to B4 are LGA pins.

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. SAC305 (non-lead) is suggested to be used as solder paste.

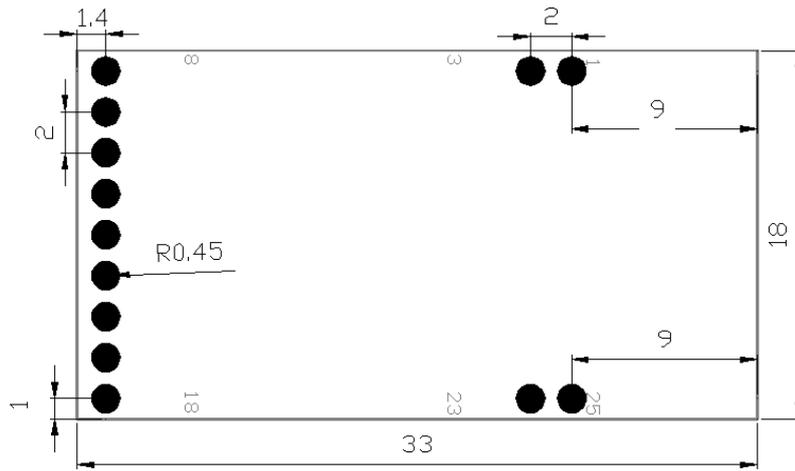


Figure 2.3 DIP Package

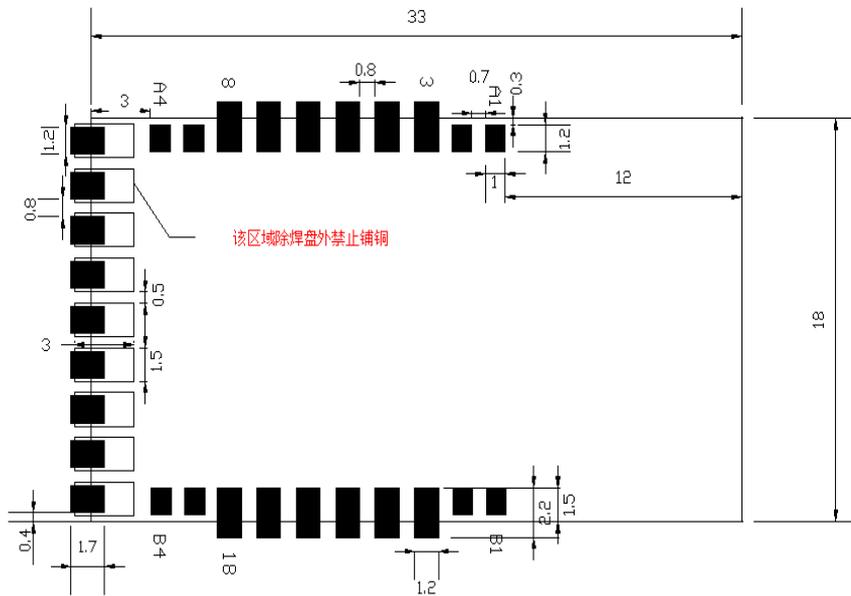


Figure 2.4 Recommend SMT Package

2.3 DC Power Design

Peak current of the module is approximately 300mA. DC/DC with maximum output current 600mA is suggested as power supply. DC/DC is better than LDO in low power consumption.

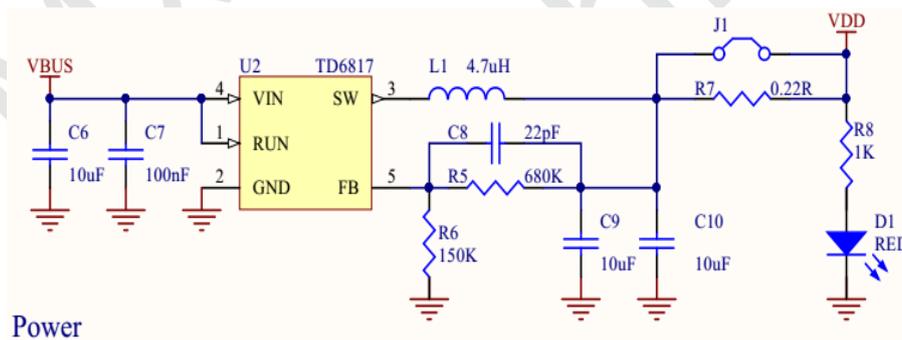
Route should be particularly aware for DC/DC power supply. Compact element, excellent connection between input and output ground, long distance between feedback signal and inductance and Schottky diode are required for route. Details about the requirements should refer to the datasheet of DC/DC device.

Maximum output current and dissipate heat should be aware for the using of LDO. voltage drop is 1.7V when voltage reduce from 5V to 3.3V. If the current is 300mA, power consumption is $1.7V * 300mA = 510mW$, PowerDissipation is a parameter on LDO datasheet which should be over 510mW (same methods are used to calculate other input voltage).

The problem rate about final product would be reduced by fully consideration of power design.

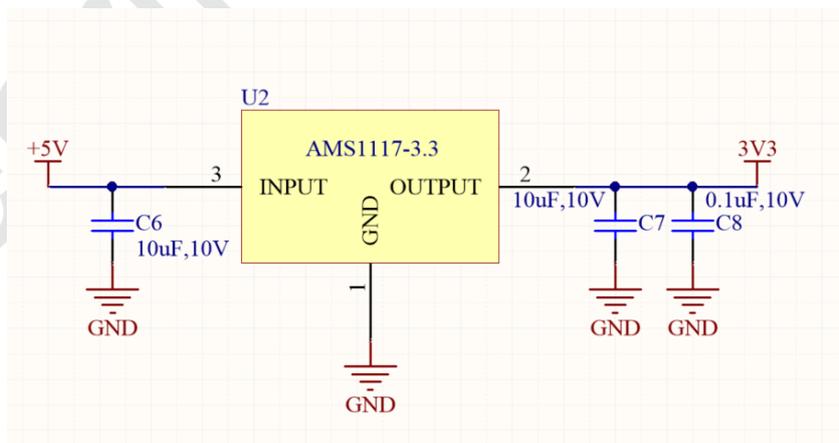
2.4 2.4 Reference Circuit Design and Illustration

EMW3031 reference circuit is shown in figure 2.5



Power

DC/DC 5V to 3.3V Conversion Circuit



LDO 5V to 3.3V Conversion Circuit

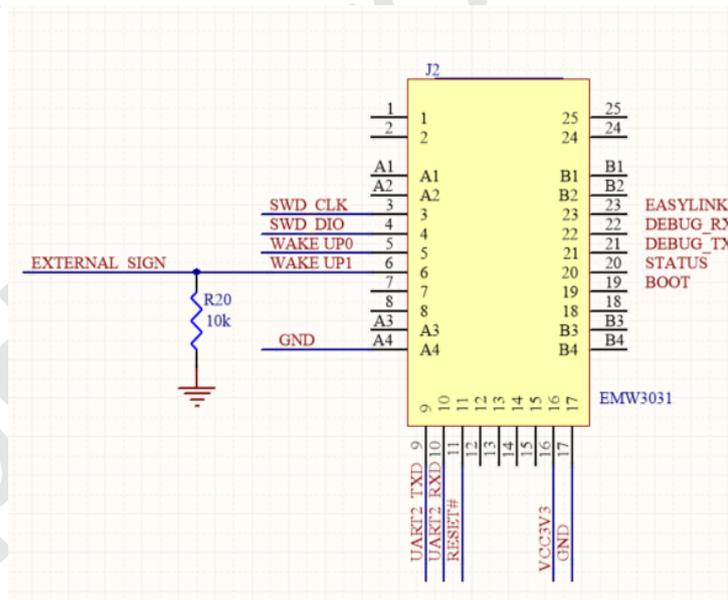
Figure 2.5 Power Conversion

BOOT	STATUS	ELINK	FUNCTION
H	/	/	NORMAL WORK
L	H	L	ATE
L	L	H	MFG
L	H	H	BOOTLOADER

Relative contents of the module are sent by pin UART2_TX. Mobile phone could connect to internet and have normal communication with app at NORMAL WORK. Module must in ATE mode when certificate with SRRC, FCC, CE. MFG mode could be used in product storage test. Module must in BOOTLOADER mode when update firmware by UART.

● **WAKE UP Pin**

Pin 5 is WAKE UP 0, Pin 6 is WAKE UP1. GPIOs are in high level voltage after initialize the module. Pin would be in low level voltage when the module is in STANDBY mode (current is approximately 42uA). An external rising edge trigger is necessary to wake up WAKE UP0 and WAKE UP1. Reference circuit is shown below:



● **Reset pin**

Pin 11 is reset pin triggered by high level voltage. Voltage must over 2.9V. Pin should be in dangling state when it is not working. There is weak pull-up resistor inside. Please make sure the pin is in high level voltage when the module is powered on.

● **BOR**

BOR voltage is 2.7V. When VCC is interfered by external factors or insufficient power supply, module would reset or stop working.

- **AD**

The 16-bit ADC is a successive approximation analog-to-digital converter which is supportable with PGA and amplification. ADC amplification could be 0.5x, 1x, 2x. PGA could be set as 4X, 8X, 16X, 32X. Maximum conversion rate could be 2MHz. Inside Vref 1.2V could be reference voltage. Outside Vref should be less than 1.8V. Sampling voltage range could be from $-V_{ref}/PGA$ to $+V_{ref}/PGA$.

The DAC module is a 10-bit voltage output digital-to-analog converter. Maximum conversion rate is 500kHz with two independent channels. Output signals could be single or difference single.

- **GPIO**

EMW3031 has 33 GPIOs. They could be set as pull-up, pull-down, tristate and interruption. Trigger could be voltage rise edge and falling edge. FUN1-5 from page 8 to 9 in datasheet could be used as reference. Maximum input and output current of single GPIO should be less than 4mA. Total of all I/O should be less than 20mA.

- **SPI**

EMW3031 is supportable with two independent SPI, maximum transport rate could be 25Mbps with host and slave mode. Data length could be set as 8, 16, 18, 32bit. Noise interfere should be aware if PCB layout is necessary.

- **I2C**

EMW3031 has two independent I2C, rate of standard mode is 100kbps, rate of fast mode is 400 kbps, rate of high speed mode is 2Mbps. High speed mode is downward compatible. EMW3031 supports with host-slave, multi-host-multi-slave and interruption.

- **I2S**

Module has two configurable I2S which is temporarily unsupported.

- **UART**

Module has two current control UART communications and one normal UART communication. Maximum baud rate is 921600. Pin 9 and Pin 10 are used as serial port of users (Test information, download and communication). Pin 21 and Pin 22 is debugging ports (default baud rate of running log print is 38400). Please make sure Wi-Fi RX and TX is connected to host RX and TX.

- **GND**

Pin 17 is DIP+SMT. Pin A4 is LGA. Electrical property of the pins is ground. Connect to ground if it is possible.

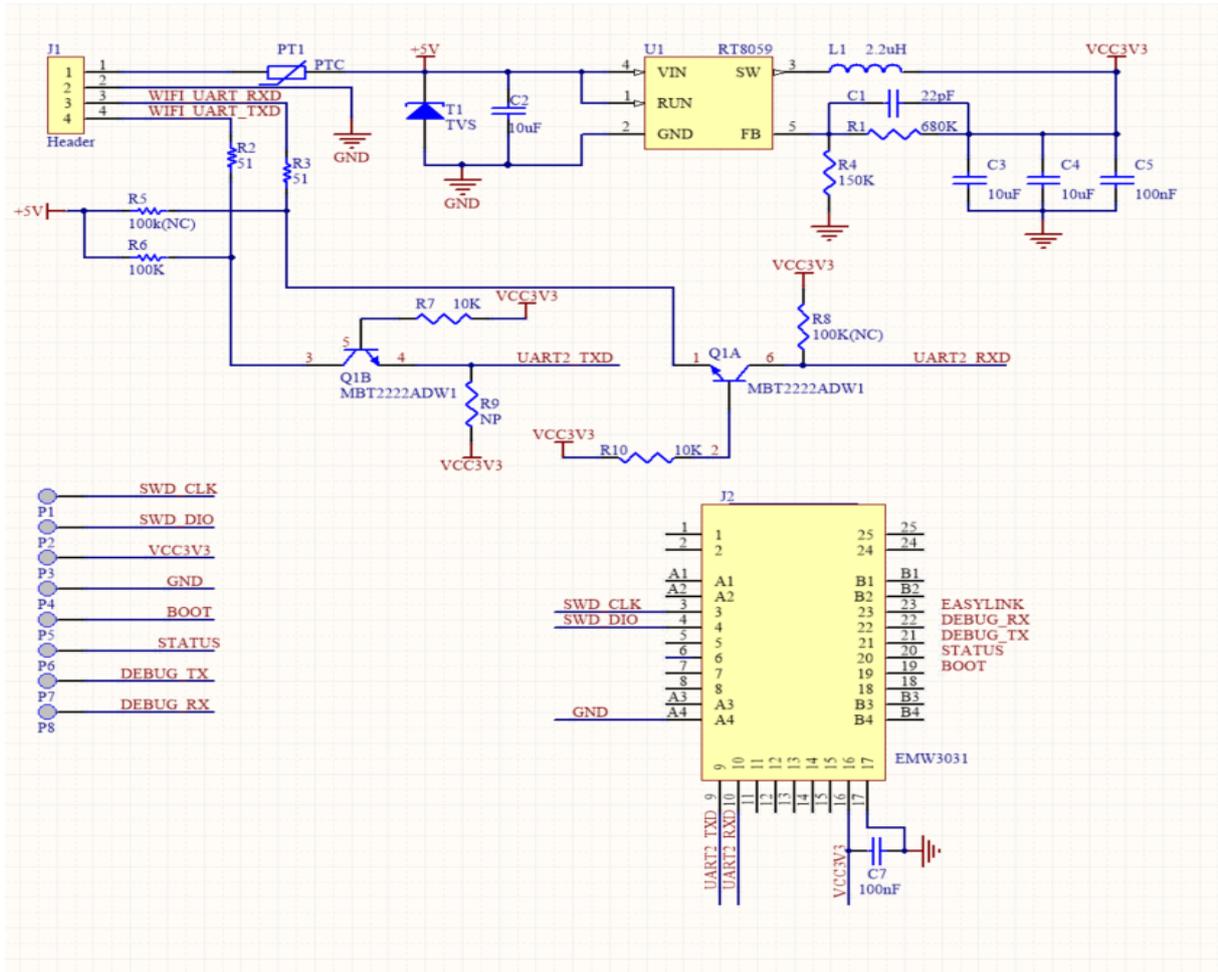
- **VCC_3V3**

Power supply range of EMW3031 is from 2.7V to 3.6V. 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.

- **SWD_CLK SWD_DIO**

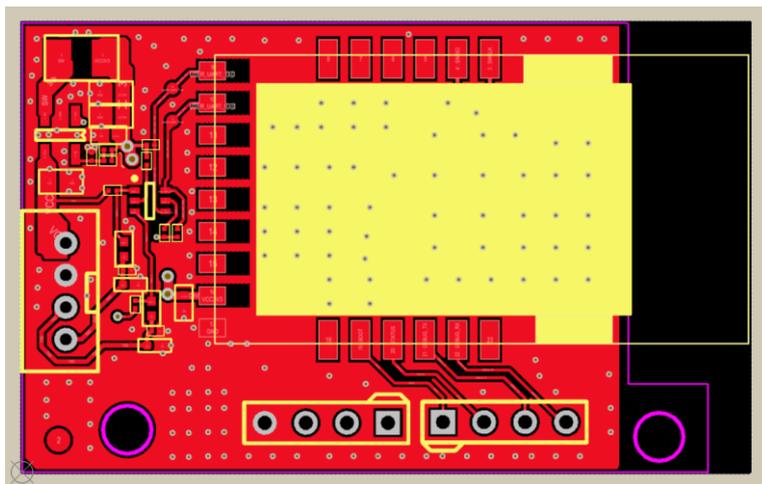
Module is supported with one standard SED port without external pull-up or pull-down resistance. Pin 1 and Pin 2 or Pin 3 and Pin 4 is supported with online debugging and update with FLASHPLUS or used as GPIO.

- Classic circuit



Classic reference circuit of serial communication in 5V

Pins that not be used should be set NC(Not Connected). Pin 9 and pin 10 communicate with external MCU. Pin16 and pin 17 is power supply input that could be added a 100uF ceramic capacitors closing to two pins. Power supply is 2.66V to 3.6V. Module could be breakdown if the voltage is over 3.6V. P1 to P8 should be floating in order to debugging and upgrading in the future. Q1 is conversion transistor that could be SS8050 or MBT2222ADW1. Rated current over 600mA such as RT8059, TD6817 or LDO could be chosen as DC-DC. Voltage input should be PTC or TVS in order to avoid input voltage unstable. SMD0805P100TF or SMFJ6.0A are reasonable choices.



Typical Design of PCB Top Layer

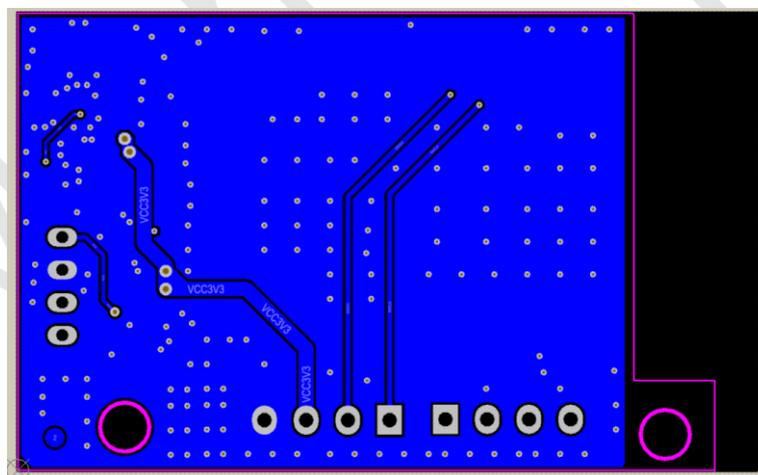


Figure 2.9 Reference of PCB Design

Illustration: In order to make sure the antenna performance, sufficient clearance zone should be designed in the antenna part. PCB part below antenna could be hollowed up. Copper, route, closing to metal element is not allowed if the structure needed. P1 to P8 should connect to ground with copper.

2.5 RF Design

2.5.1 On-board PCB Antenna Design

The main board PCB should be over 16mm far away from other metal components. Copper, route, closing to metal element is not allowed if the structure needed. The circuit for P1~P8 should be surrounded with ground and holes, to avoid interference signal. PCB part below antenna could be hollowed up.

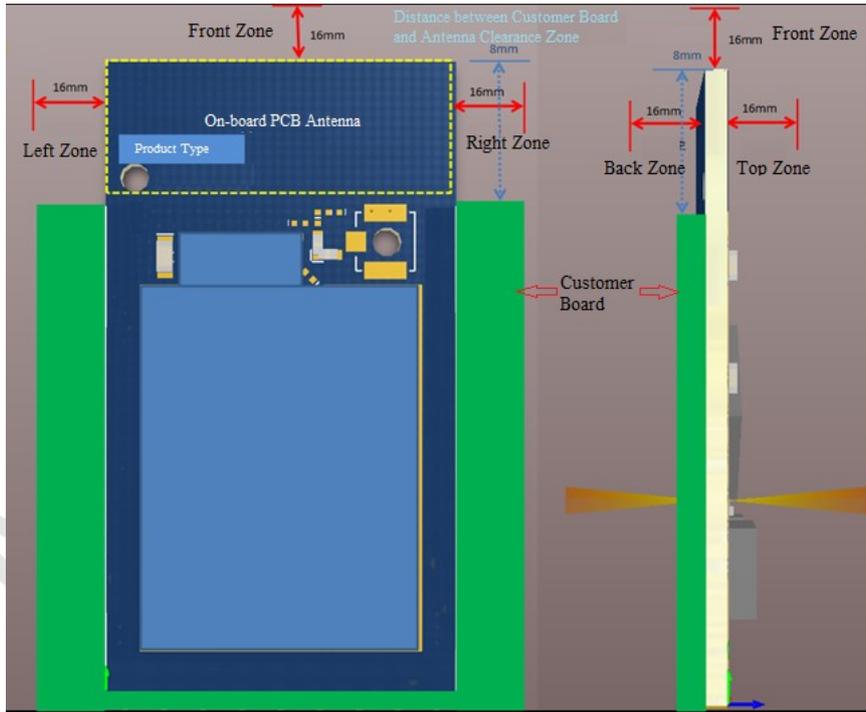


Figure 2.10 Minimum PCB Clearance Area

In order to reduce the influence from metal components to PCB antenna and wireless signal, it is better to mount EMW3031 on four parts, as shown in figure 2.11.

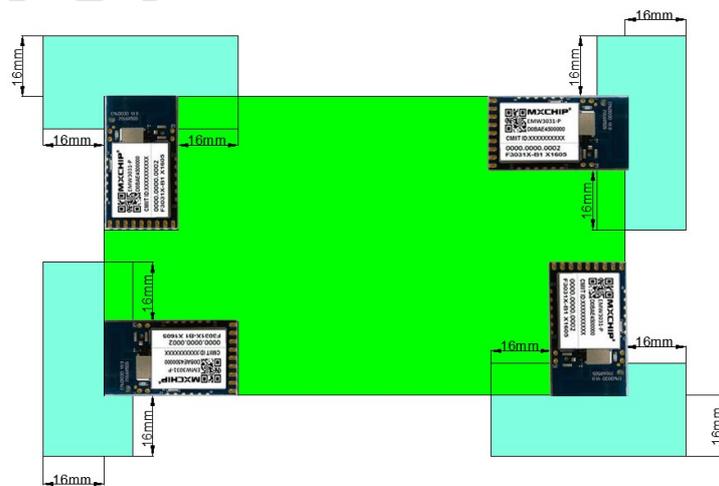


Figure 2.11 Position of the Module

2.5.2 External Antenna

Size of external antenna is shown in figure 2.12. Make sure the correct size with suppliers before buying the connectors of antenna.

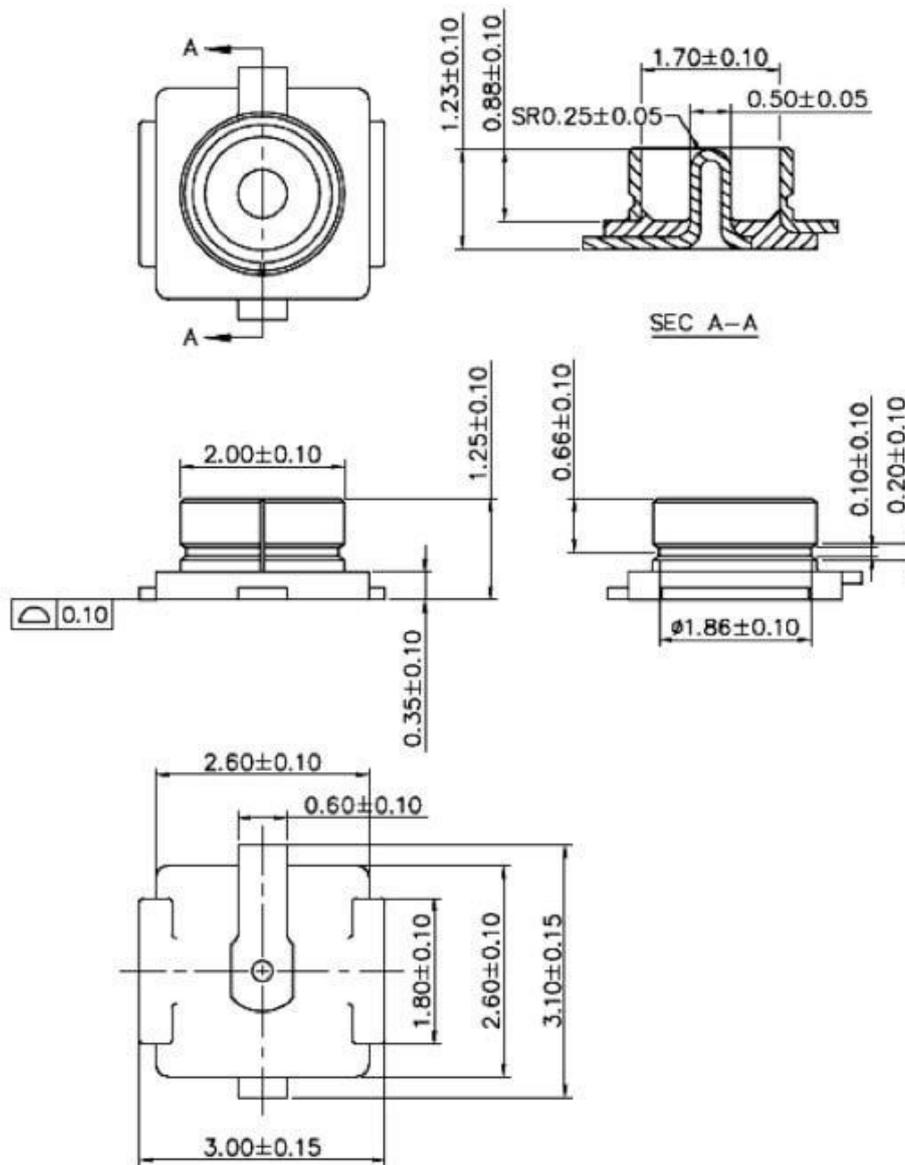


Figure 2.12 Size of External Antenna

2.6 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 such as pins connect to USB and SD-card.

EMI should be aware when the module operated by connecting external wire. Using shielding wire or reserving common mode choke could avoid EMI.

3. Downloading Firmware and Storage Test Method

3.1 Preparations

Table 3.1 Device List

Device	Quantity
PC	1
Tools of downloading firmware	1
Develop board compatible with EMW3031	1

PC driver is CP210x_VCP_Windows. Download from:

<http://www.silabs.com/products/mcu/Pages/SoftwareDownloads.aspx>

Or download full note from:

<https://yunpan.cn/c6yfZTicJydsA> Password: d166

Firmware program is sent by FAE of MXCHIP or client which is 600K (application code). 'Test.bin' is shown in this note.

3 switches on develop board of EMW3031 are shown in figure 3.1

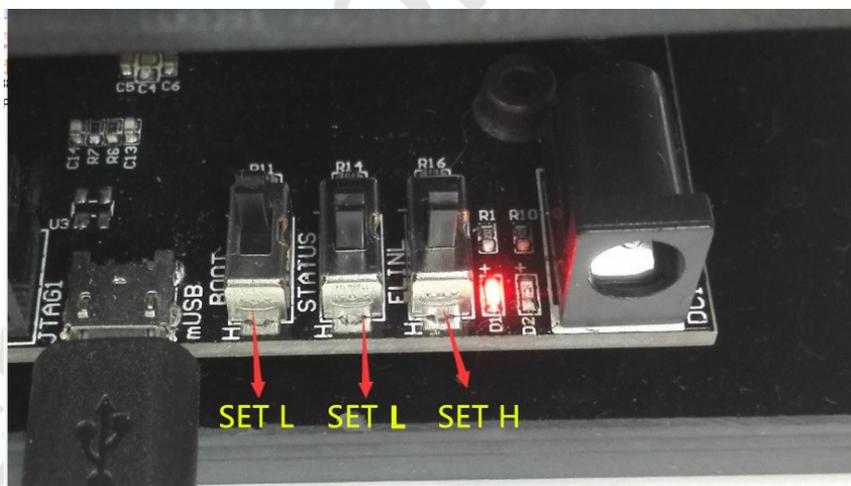


Figure 3.1 Switches of the develop board

Decompress file 'CP210X_VCP_WINDOWS.ZIP'. 32 or 64 is based on the computer operating system. It could be checked from device manager after installing.

3.2 System Connection

Module connects to develop board of EMW3031 with USB. Red light D1 on the develop board enable when connecting.

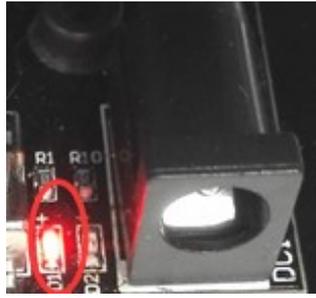


Figure 3.2 Power Light

3.3 Downloading Program

Find COM number of develop board connect to PC, such as COM10 in figure 2.3. (Note: Enhanced COM Port must be used in serial number).



Figure 3.3 Name of device in Device Manager

Open software FWUpdate V2.4.exe from config.rar as shown in figure 3.4. Choose file '031 5031.ini' and loading the firmware. Click open button after set COM 10.



Figure 3.4 FWUpdate.exe

Put the module on process equipment and make sure the positioning pin has a perfect contact with process equipment. The firmware would download automatically when press the process equipment down.

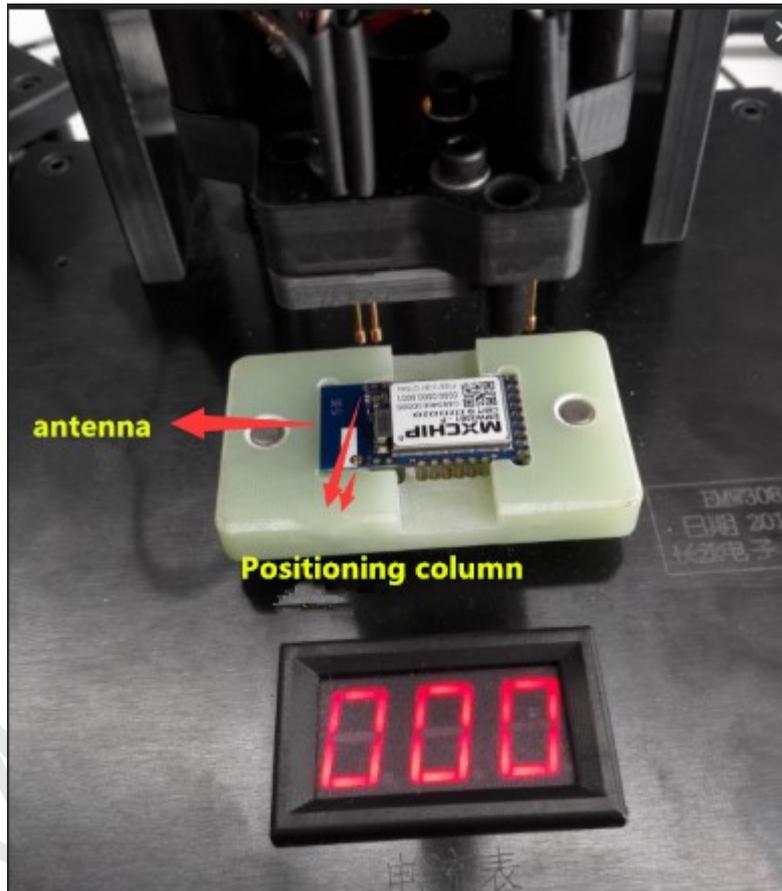


Figure 3.5 Module on Process Equipment

Power off is not allowed when the module is being downloading.



Figure 3.6 Downloading

Timer would count after successfully downloading firmware.



Figure 3.7 Download successfully

3.4 Test Program

Test software: 'MicoQcAutoCheck4.0'

Download from: <https://yunpan.cn/ckXs4yKKPnXbj>, password: 3528

Set 'BOOT' and 'STATUS' as 'L', 'ELINK' as 'H'.



Figure 3.8 Switch Set Up at Testing Mode

Open 'MicoQcAutoCheck4.0' and set process number, product type, quantity, configure SN, APP CRC, PID, BOOT vision, APP vision, drive vision, SSID number. Set information of serial number and baud rate at 921600.

Click 'log in' and 'start' after putting module on process equipment. 'Dialog' would test the normality of the module based on the set information. Normal module is shown in figure 3.9.

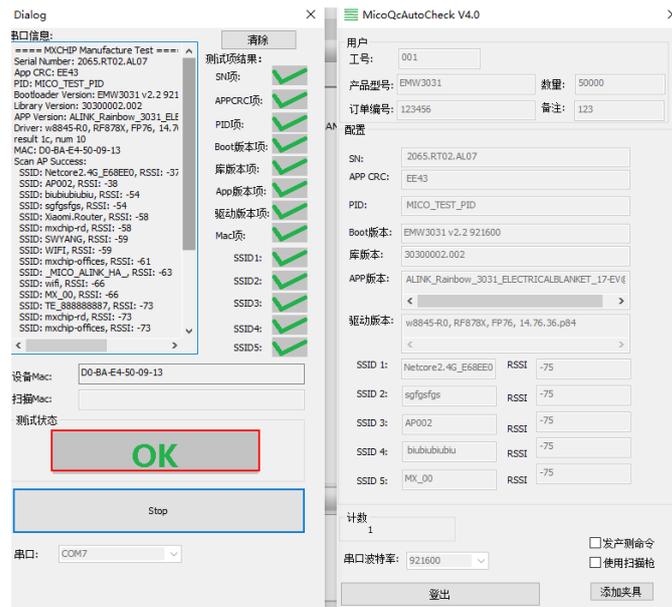


Figure 3.9 Test Successfully

Results are saved in file 'log'. Results of inferior module are not shown in the results.



Figure 3.10 LOG

Details about downloading firmware and testing is shown in file 'Downloading Firmware in EMW3031&5031.PDF'.

3.5 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.

4. SMT

4.1 Stencils

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

Stencils size is shown in figure 4.1, pad holes extend 0.15mm in order to improving solder wicking. If there is no AOI testing, check module by eye is available to reduce the Pseudo Soldering.

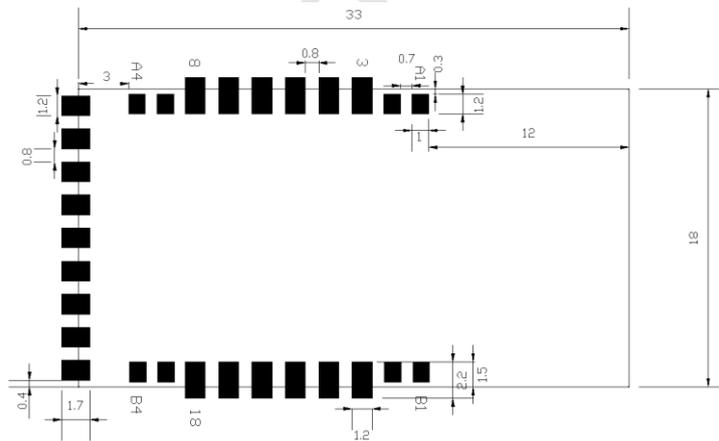


Figure 4.1 Stencils size

4.2 Temperature Curve of Secondary Reflow

Pseudo soldering could be reduced by control the furnace with temperature curve of secondary reflow, as shown in figure 4.2.

Secondary reflow times less than 2

Peak temperature: 250°C

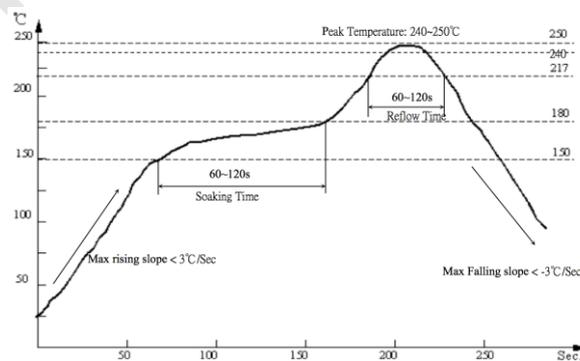


Figure 4.2 Temperature Curve of Secondary Reflow

5. Mass Production Test and Product Update

Customers should consider not only the function of product but also the testing method in mass production and update firmware on the product.

5.1 Module Test

In order to avoid inferior module and make sure the correct of downloading firmware, MXCHIP strongly suggests product testing before produce. Fully test is required after producing.

5.1.1 Test on the Whole Machine

Module connects the MCU from customer through serial port. In secondary development, test command could be added into firmware. For example, module could scan hotspot around itself and return the results from serial port by sending testing command through serial port.

Test mode could be set to detect the performance of the module. The default set up could be used as router for testing. Router is connected when the module powers on. Details about the test are decided by the application of customers.

5.2 Product Update

OTA is suggested in upgrading the product. OTA is a method to update by wireless.

If the product has bug or inferior, OTA is a better way to update the product.

Send the latest firmware to Cloud. Module would download the firmware into itself when connects to internet. Latest firmware would be updated after restart automatically.

6. 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.

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