MXCHIP® | Global leading IOT operating system-MiCO

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User Manual of EMW3239

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
2016-9-23	0.1	Initial document
2016-9-29	0.2	Add reference circuit Add description of pin function and design consideration Add position figure of PCB
2016-12-2	0.3	Add Module downloading method
2016-12-6	0.4	Add module testing method
2016-12-8	0.5	Update format and other problem

Content

Figure Content

Table 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:

EMW3239

Phase of attention:

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

Basic Characteristics:

- Each module has a unique MAC address;
- PCB antenna and external antenna;
- Support Bluetooth classic and BLE;
- Maximum instantaneous current 360mA@3.3V;
- Testing mode inside;
- OTA inside;
- Secondary reflow soldering at SMT
- Working temperature: -30℃ to +70℃

EMW3239Top View

Figure 1.1 Top View of EMW3239-P

Figure 1.2 Top View of EMW3239-E

EMW3239

Module type	Antenna type	Illustration	Manufacture
EMW3239-P	On-board PCB Antenna	Default	Dongguan Aosiya Antenna Technology Co.,Ltd
EMW3239-E	IPEX brass pipe Antenna	Optional	Dongguan Aosiya Antenna Technology Co.,Ltd

Antenna Parameter

Parameter	EMW3239-E	EMW3239-P
Antenna Type	Brass pipe Antenna	PCB Antenna
Frequency	2400-2500(MHz)	2400-2500(MHz)
Impedance	50ohm	50ohm
VSWR	<2	<2
Antenna gain	2dBI	2dBI
Radiation pattern	Omnidirectional	Omnidirectional
Polarization	Vertical	Vertical

1.1 Pin arrangement

EMW3239 has 41 pins in two rows (1x20 and 1x21) with 0.8mm pitch. Stamp hole package interface design is used in EMW3239 (as shown in figure 3) to simplify debugging and disassembling for developers, as well as offering varied selection. Also it is benefit for SMT patch and hand-welding.

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 4 Pin Arrangement

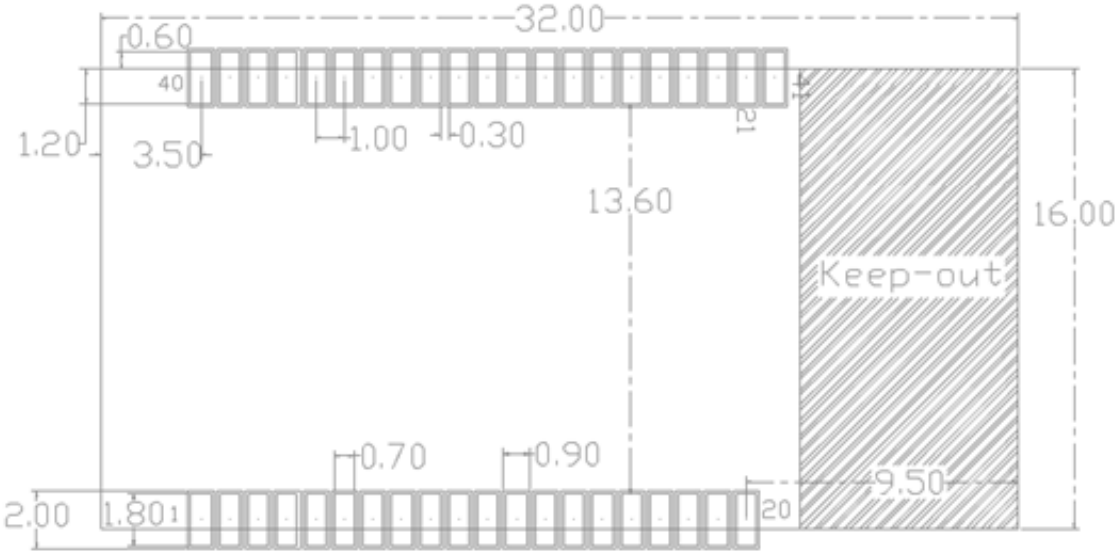

Figure 5 Package Size of EMW3239

1.2 Pin Definition

1.2.1 EMW3239 Pin Definition

Table 1 Pin Definition of EMW3239

Pins	Name	Type	I/O Level	Multi-select Function				User
1	-	-	-					NC
2	PB2	I/O	FT	GPIO			BOOT1	√
3	-	-	-					NC
4	PB15	I/O	FT	SPI2_MOSI	GPIO	TIM12_CH2	I2S2_SD	√
5	PB12	I/O	FT	SPI2_NSS	GPIO	CAN2_RX	I2S2_WS	√

Pins	Name	Type	I/O Level	Multi-select Function				User
6	PB13	I/O	FT	SPI2_SCK	GPIO	CAN2_TX	I2S2_CK	√
7	PB14	I/O	FT	SPI2_MISO	GPIO	TIM12_CH1		√
8	PC6	I/O	FT	UART6_TXD	GPIO	TIM3_CH1	I2S2_MCK	×***DEBUG_OUT（Unusable）***
9	PA15	I/O	FT	GPIO	JTDI	TIM2_CH1	USART1_TXD	×（EasyLink）
10	VBAT	S	-	VBAT				×
11	-	-	-					NC
12	PC7	I/O	FT	UART6_RXD	GPIO	TIM3_CH2	I2S2_CK	×***DEBUG_IN（Unusable）***
13	NRST	I/O	FT	RESET				×
14	PC0	I	TC	GPIO			WAKEUP	√
15	-	-	-					NC
16	PC13	I/O	FT	GPIO				√
17	PB8	I/O	FT	I2C1_SCL	GPIO	TIM4_CH3	CAN1_RX	√
18	PB9	I/O	FT	I2C1_SDA	GPIO	TIM4_CH4	CAN1_TX	√
19	PB10	I/O	FT	GPIO		TIM2_CH3	I2S2_CK	√
20	GND	S	-	GND				×
21	GND	S	-	GND				×

Pins	Name	Type	I/O Level	Multi-select Function				User
22	-	-	-					NC
23	-	-	-					NC
24	-	-	-					NC
25	PA14	I/O	FT	SWCLK				×
26	PA13	I/O	FT	SWDIO				×
27	PB3	I/O	FT	GPIO		TIM2_CH2	USART1_RXD	√
28	-	-	-					NC
29	PB7	I/O	FT	UART1_RXD	GPIO	TIM4_CH2	I2C1_SDA	√ ***USER_UART_RX***
30	PB6	I/O	FT	UART1_TXD	GPIO	TIM4_CH1	I2C1_SCL	√ ***USER_UART_TX***
31	PB4	I/O	FT	GPIO	JTRST	TIM3_CH1		√
32	-	-	-					NC
33	PA10	I/O	FT	USB_ID	GPIO	TIM1_CH3		√
34	PA5	I/O	TC	GPIO			ADC1_5	√
35	PA11	I/O	FT	USB_DM	GPIO	TIM1_CH4	UART1_CTS	√
36	PA12	I/O	FT	USB_DP	GPIO	TIM1_ETR	UART1_RTS	×（BOOT）
37	PB0	I/O	FT	GPIO			ADC1_8	×（STATUS）
38	PA4	I/O	TC	GPIO			ADC1_4	√
39	VDD	S	-	3.3V				×
40	VDD	S	-	3.3V				×
41	ANT	-	-	ANT				×

Illustration:

1. Pin 10, pin 39 and pin 40 should be connected to VDD 3V3, pin 20 and pin 21 should be connected to ground;
2. Pin 8 and pin 12 could only be used in secondary write, ATE or QC automatic detection;
3. Pin 29 and pin 30 is used as serial communication in bootloader mode for users;
4. S stands for power supply, I stands for input pins and I/O stands for input and output pins;
5. FT= 5V tolerant, The maximum voltage should be less than VCC when set as analog input/output or clock oscillation circuit;
6. TC= 3.6V as convention input/output voltage;
7. SWD(pin 25, pin 26) is used to debug and download firmware instead of JTAG;
8. Pins are not available for users with signature “X” while pins with signature “ √ ” is available for users;
9. For other information please contact technical support.

2. Considerations in Hardware Design

2.1 Mechanical Size

Mechanical size of EMW3031(Unit: mm)

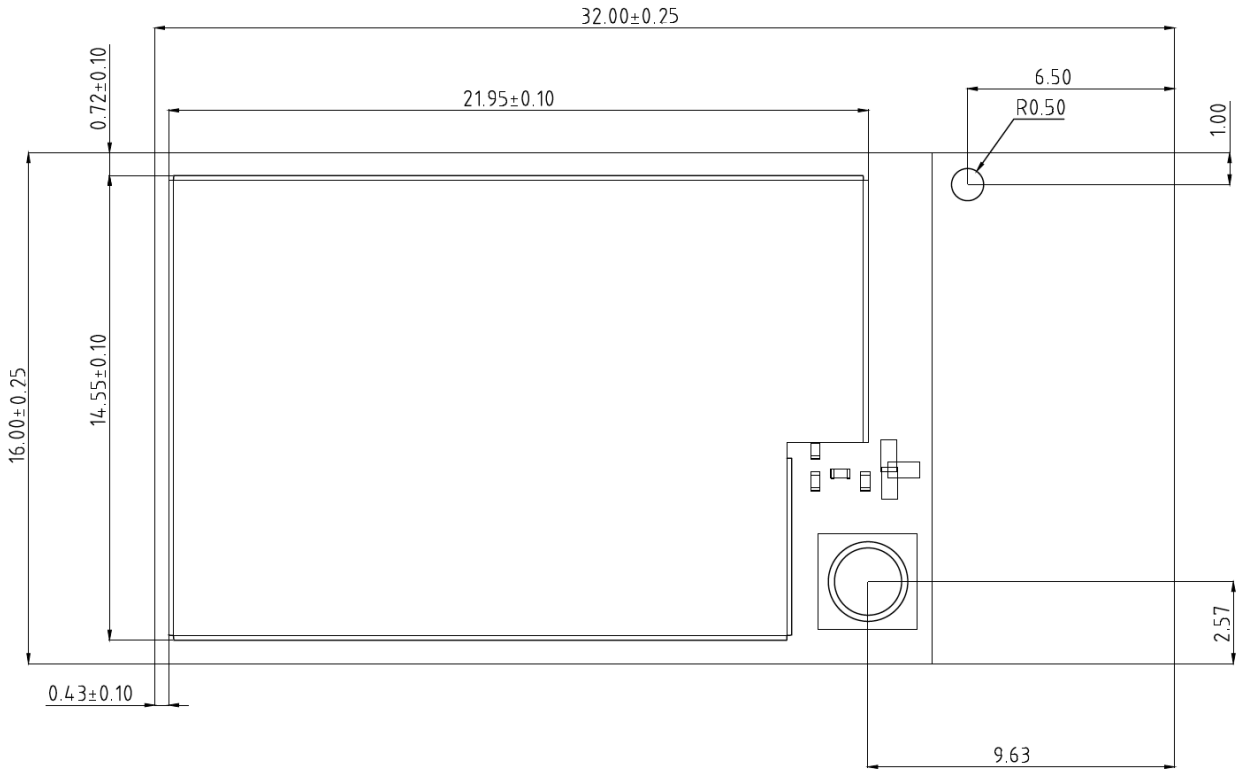

Figure 2.1 Top View of Mechanical Size

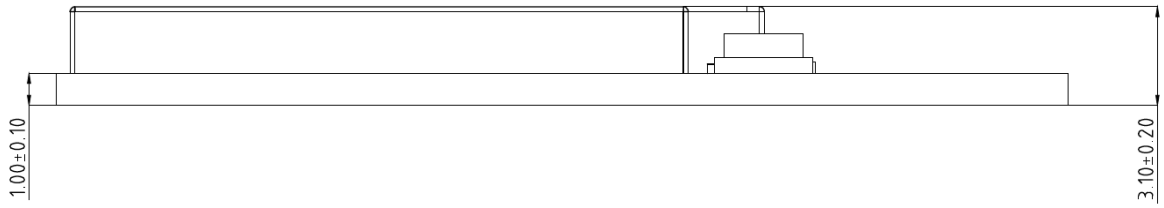

Figure 2.2 Side View of Mechanical Size

2.2 Reference Package Design

Solder mask openness has the same size with land, as shown in figure2.3（Unit: mm）

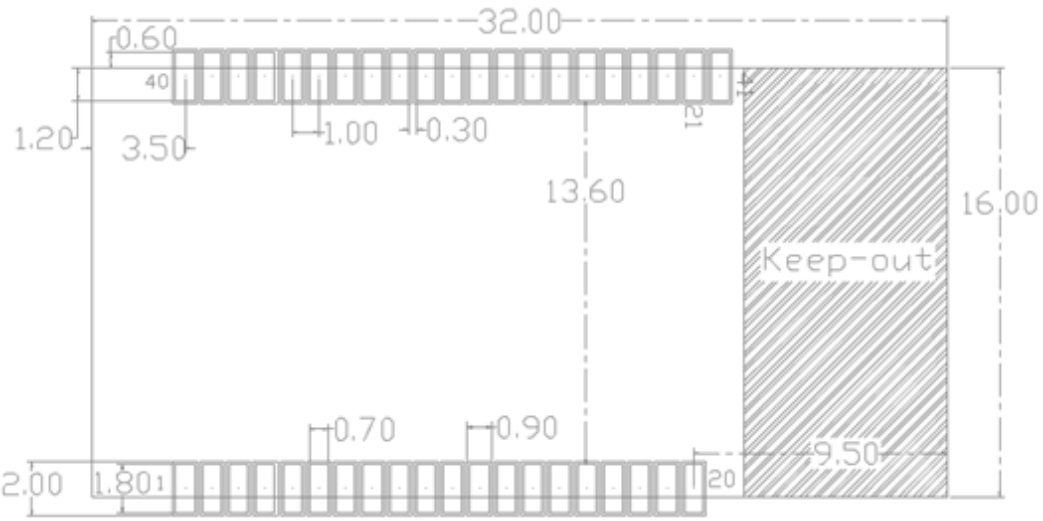

Figure 2.3 SMT Package

2.3 DC Power Design

Peak current of the module is approximately 360mA. 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 is1.7V * 360mA=612mW, PowerDisspation 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 Pin Function

Set module in different mode by combo PIN 36（BOOT）, PIN37（STATUS）, PIN9(ELINK).

Table 2.1 Switch Mode

BOOT	STATUS	ELINK	FUNCTION
H	/	/	NORMAL WORK
L	H	L	ATE
L	L	H	QC
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.

- Reset pin

Pin 13 is reset pin triggered by low 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.

- **SPI**

Pin 4~7could be used as off-chip SPI port. Maximum transport rate could be 25Mbps with host and slave mode, duplex mode and simplex mode.

- **I2C**

Standard mode (100kbps), fast mode (400 kbps), high speed mode (1Mbps) is supported in I2C.

- **SWDIO/SWCLK**

Module supports with one standard SED port without external pull-up or pull-down resistance. Pin 25 and Pin 26 supports with online debugging and upgrading with J-FLASH or used as GPIO.

- **GPIO**

EMW3239 has 25group of GPIO that could be reused as other pins.

- **UART**

Module has one current control UART communications and one normal UART communication. Pin 29 and Pin 30 are used as serial port of users (Test information, download and communication). Pin 8 and Pin 12 is debugging ports (running log print). Please make sure Wi-Fi RX and TX is connected to host RX and TX.

- **VBAT**

VBAT supports for RTC，PIN10 is clock source which requires power supply 3.3V. External output compensation calibration in 512HZ could be used in RTC. RTC has programmable alarm and programmable period interruption wake-up from stop mode to standby mode.

Power supply of EMW3239 is from 2.6V to 3.6V. Low voltage working mode is from 2.6V to 3.0V with battery. Common working mode is from 3.0V to 3.6V. Rated power is only used as pressure test parameter. Permanent damage would be caused if the device works in this condition.

- Others

Pin floating is not allowed in EMW3239. Pin39 and pin 40 is power supply input that could be added a 10uF ceramic capacitors closing to two pins. Power supply is 2.6V to 3.6V. Module could be breakdown if the voltage is over 3.6V.

Typical PCB design is shown in figure 2.6.

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.

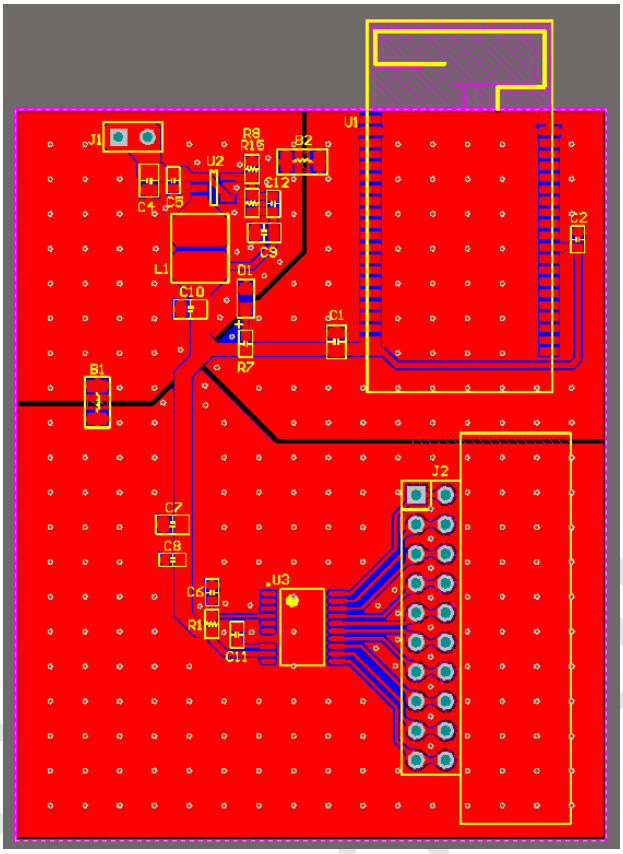

Figure 2.4 PCB Design

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. P1 to P8 should connect to ground with copper. PCB part below antenna could be hollowed up.

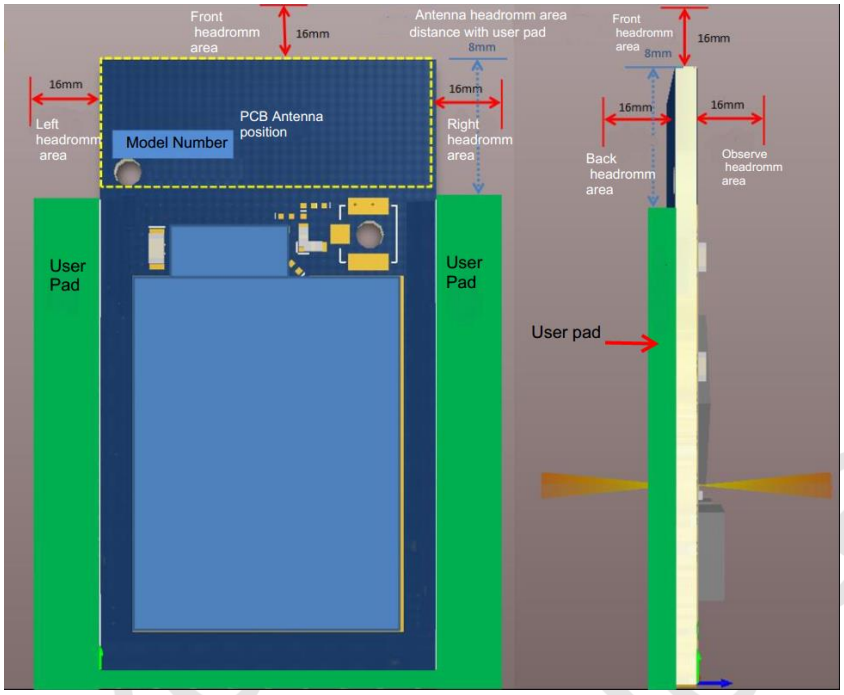

Figure 2.5 Minimum PCB Clearance Area

In order to reduce the influence from metal components to PCB antenna and wireless signal, it is better to mount EMW3239 on four parts.

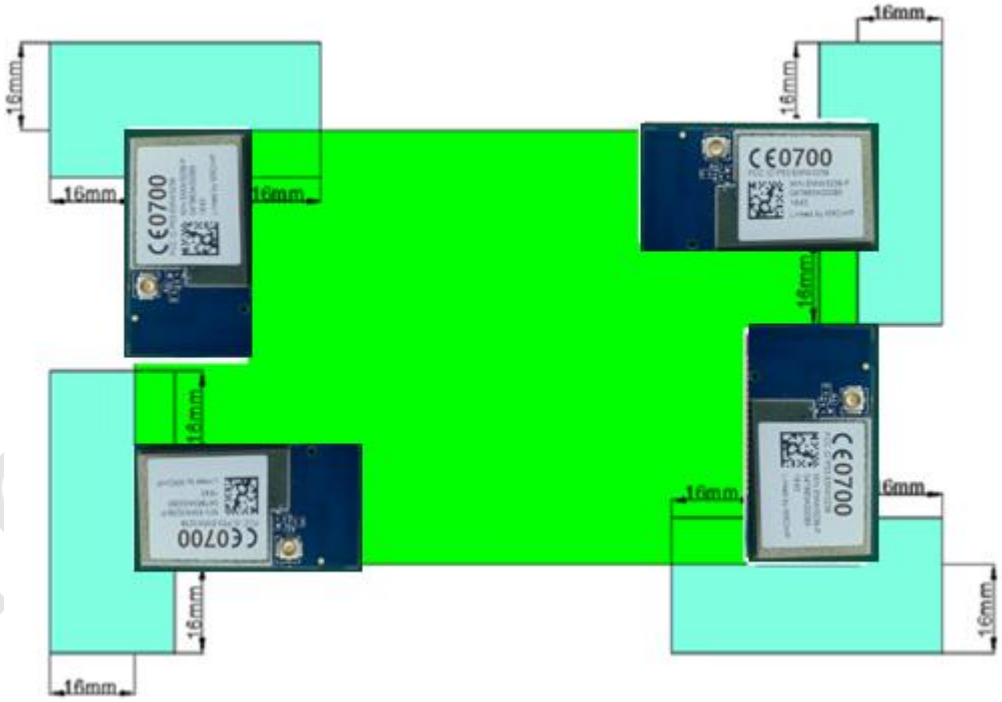

Figure 2.6 Position of the Module

2.5.2 External Antenna

Size of external antenna is shown in figure 2.7. Make sure the correct size with suppliers before buying the

connectors of antenna.

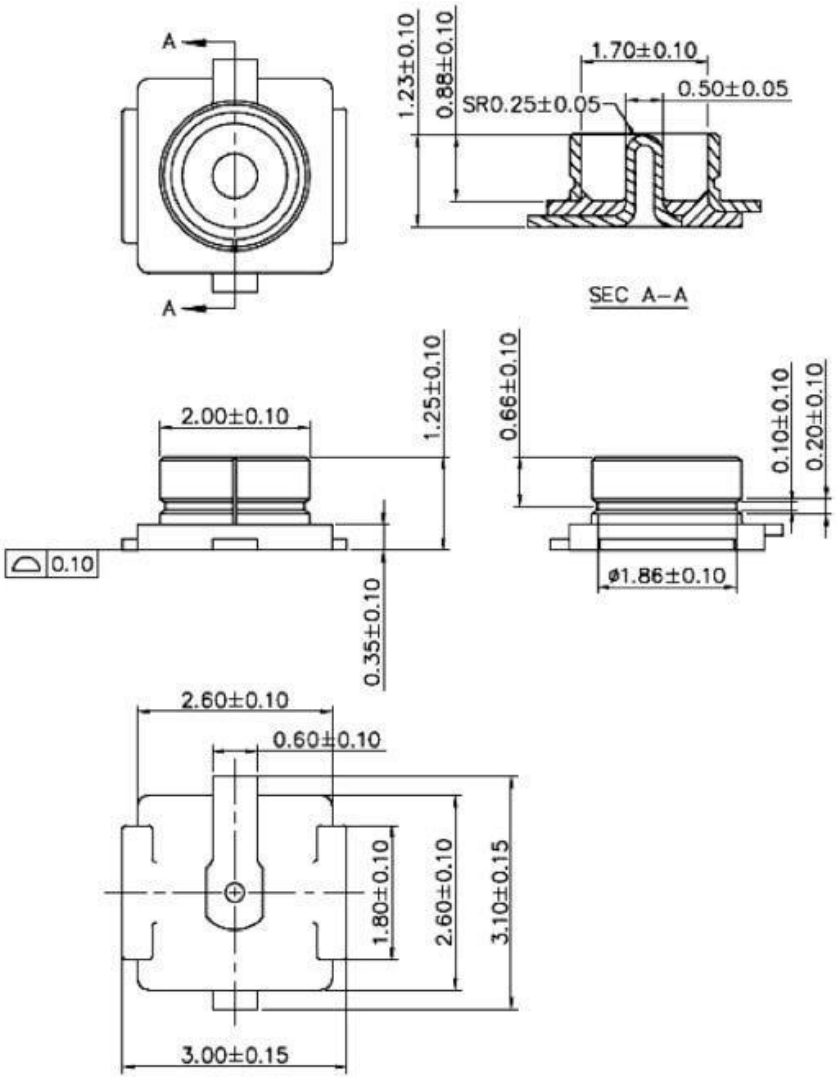

Figure 2.7 Size of External Antenna

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 3.1Device List

Device	Quantity
PC	1
Tools of downloading firmware	1
EMW3239	1
Micro USB	1
Downloading Software	1
Testing Software	1

Download website is shown in table 3.2.

Table 3.2Download Websites

Name	Function	Websites
FWUpdate	Download	http://pan.baidu.com/s/1kVEwnNh
MicoQcAutoCheck4.0	Test	http://pan.baidu.com/s/1kVEwnNh
CP210x_VCP_Windows	USB Drever	http://www.silabs.com/products/mcu/Pages/SoftwareDownloads.aspx

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

3.2 Switch set up in Downloading Mode

3 switches on develop board of EMW3239 are shown in figure 3.1. Set Easylink as high, STATUS as high and BOOT as L.

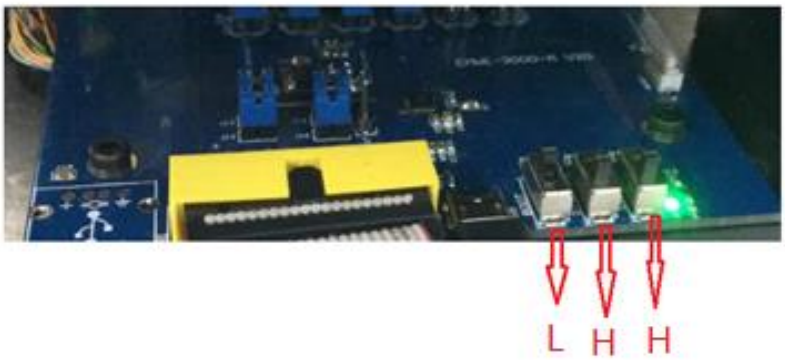

Figure 3.1Switch Set Up

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.

3.3 System Connection

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

Figure 3.2Power Light

3.4 Serial Port Selection

Find COM number of develop board connect to PC, such as COM4 in figure 3.3. (Note: Enhanced COM Port must be used in serial number).

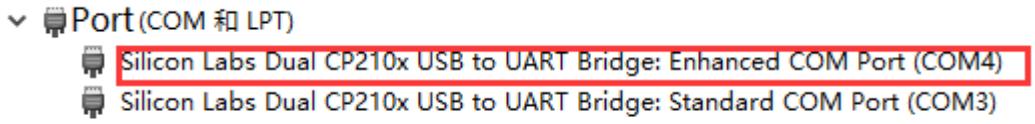

Figure 3.3 Name in Device Manager

3.5 J-Flash

Install ‘Setup_JLink_V600i.exe’.

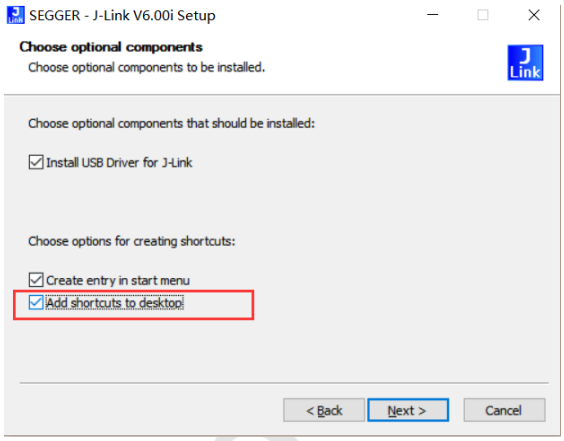

Figure 3.4 Install J-Flash

'JFlash V6.00' would be found after installing.

Figure 3.5 J-Flash signature

3.6 J-Flash Set Up

Use 'ALT+F7' or open 'Options' then click 'project settings'. Select 'SWD' in Target Interface, 'ST STM32F412RG' in MCU, 'Start application' in Production.

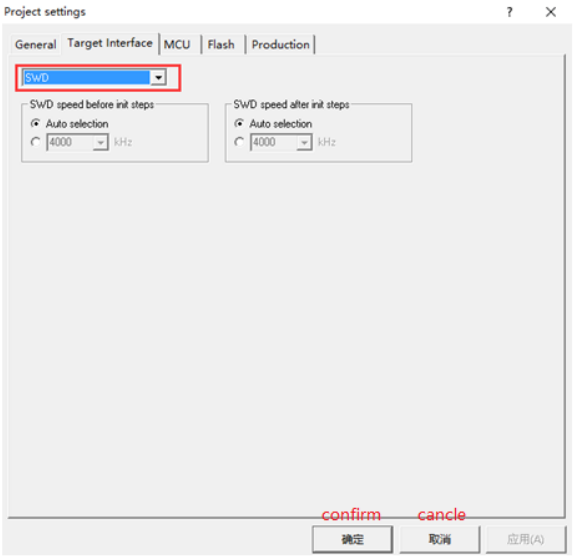

Figure 3.6 Target Interface Set Up

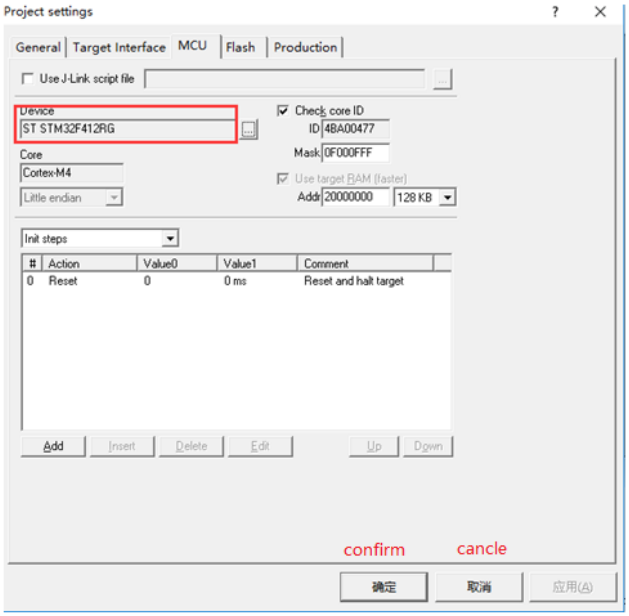

Figure 3.7 MCU Set Up

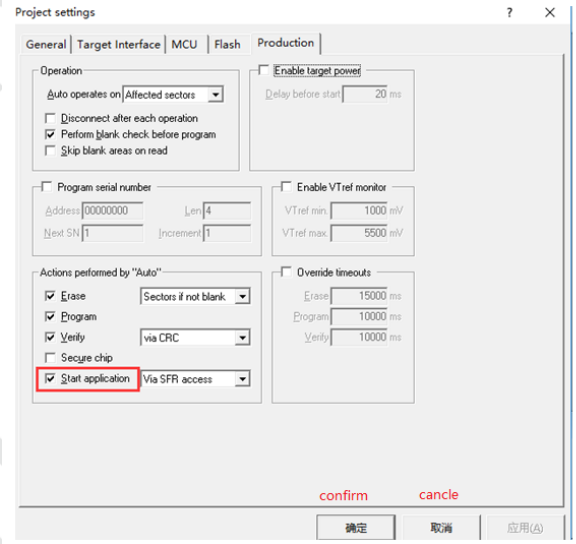

Figure 3.8 Production Set Up

Click ‘OK’ after set up. There would be no more set up in following downloading if save the set up.

3.7 Testing

3.7.1 Environment Set Up

Turn on 5 routers that randomly located around test module in a range of 2 to 5 meters.

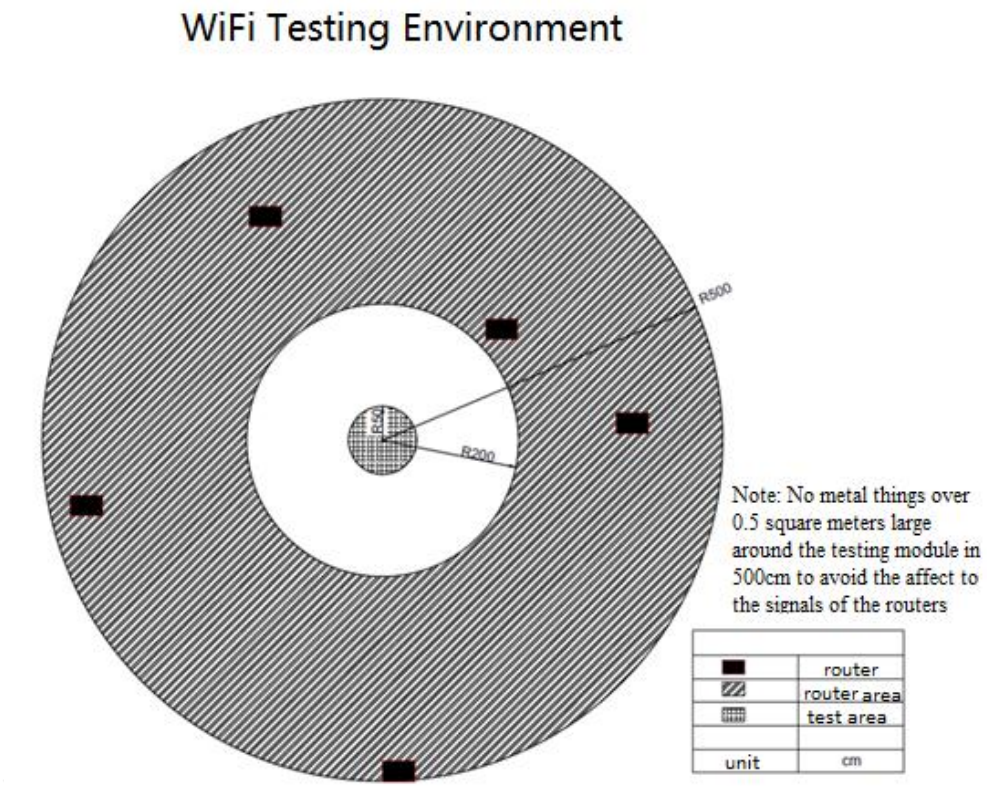

Figure 3.9 Position of Routers

3.8 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.

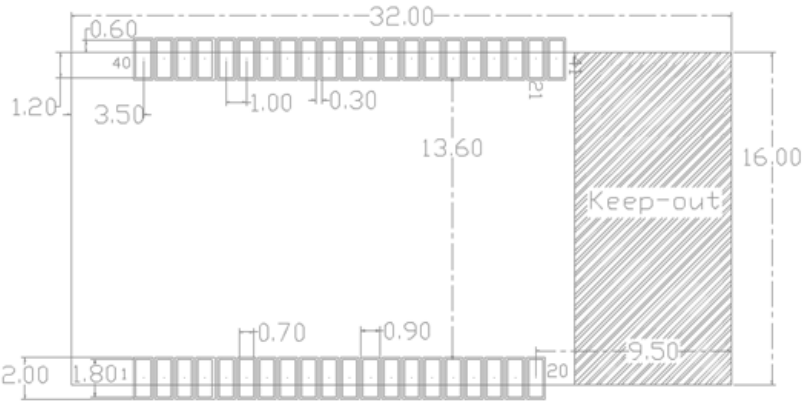

Figure 4.1 Stencils size

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℃

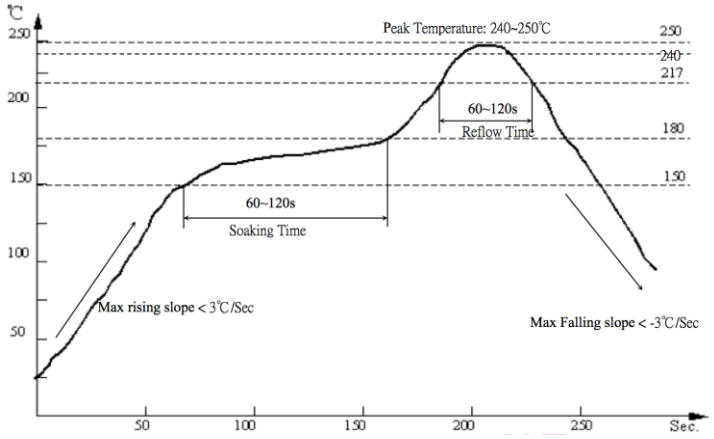

Figure 4.2 Temperature Curve of Secondary Reflow

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 Half Secondary Development of Firmware

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

5.1.2 Complete Secondary Development of Firmware

Application of customer is based on secondary development of module.

Testing method is variable in complete secondary development mode. 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.

Postcode：200333

Email: sales@mxchip.com

7. FCC Statement

When this modular approved transmitter is integrated into a final host device, and the FCC ID is not visible from the outside, than the host device must be labeled with an auxiliary label stating "**Contains FCC ID: P53-EMW3239**".

Following statement shall be placed on the final host device:

"**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.**"

When the device is so small or for such use that it is not practicable to place this statement on it, the statement shall be placed in a prominent location in the instruction manual supplied to the user.

The user manual or instruction manual for an intentional or unintentional radiator shall caution the user that c**hanges or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

In addition, Class B digital devices shall have following statement in the user manual:

"**NOTE: This equipment 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 radiate 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."

Important Notes:

After integrating this modular approved transmitter according to these instructions in this manual, following points have to be considered:

- The end-product incl. this modular approved transmitter must comply with the FCC regulations. The host manufacturer/integrator is required to show compliance with 15B (§15.107 + 15.109) while the module is installed and operating. In addition, the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15 C) are still compliant (fundamental and out-of-band emission). Verify that there are no additional unintentional emissions other than what is permitted in 15B or emissions compliant with the transmitter rule. Any additional non-compliant emissions are unintentional which means that the host is not compliant.

- Additional antennas may be used with this modular approved transmitter, provided they are from same type, have equal or less gain and have identical in- and outband characteristics as the certified ones. Other antenna types or antennas with higher gain require appropriate equipment authorization.

- Due to its output power the integration is strictly limited into mobile/fixed categorized host devices and the user manual of the host device has to include appropriate RF exposure information/warning.

- Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

- This modular approved transmitter is approved for stand-alone configurations only. For simultaneous transmission with additional transmitters follow the FCC Multi-transmitter policy.