MXCHIP® | Global leading IOT operating system-MiCO
TEL:021-52709556
Email:sales@mxchip.com

Application Note | **Guide for user design**

Version：V1.0 **Date：2016-5-31** **AN0009E**

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Introduction

This note lists the matters need attention in each stage of designing and manufacturing while using MXCHIP module. In order to achieve rapid mass production, application designers need learn this note first. Consider and avoid all possible problems which may happen during designing, manufacturing, firmware programming and testing ahead of time.

Applicative module type:

- EMW3162 series

To note stage:

- Hardware designing
- Firmware programming
- Production SMT
- OTA upgrading

Basic features of module:

- Globally unique MAC ID for each module
- Two antenna designing types:

  PCB printed antenna and external one using U.F.L RF connector

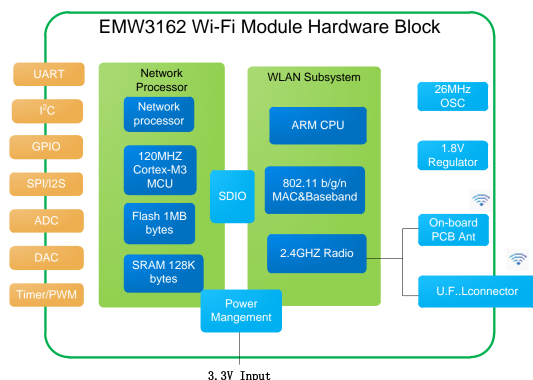
- Support 802.11 b/g/n and WLAN
  - Support WIFI Direct
  - Support Easylink
  - Working temperature: -40°C to +85°C

EMW3162 top view：

EMW3162 model list

Module model	Antenna type	Description
EMW3162-P	PCB printed Antenna	Default
EMW3162-E	External antenna to IPX	Optional

Hardware block：



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1. Hardware design attention

1.1 Mechanical dimensions

EMW3162 mechanical dimension of vertical view:

Figure 1 Vertical view

EMW3162 mechanical dimension of side view:

Figure 2 side view

1.2 Recommended package design

The figure showed below is the recommended package design MXCHIP suggested while designing the baseplate.

The solder window has the same size of the pad.

EMW3162 applies two solutions for hand-soldering: DIP and half-hole footprint.

The solder window has the same size of the pad. The stencil aperture that suggested for SMT is 0.12mm-0.14mm. The solder paste suggested is SAC305 and lead free.

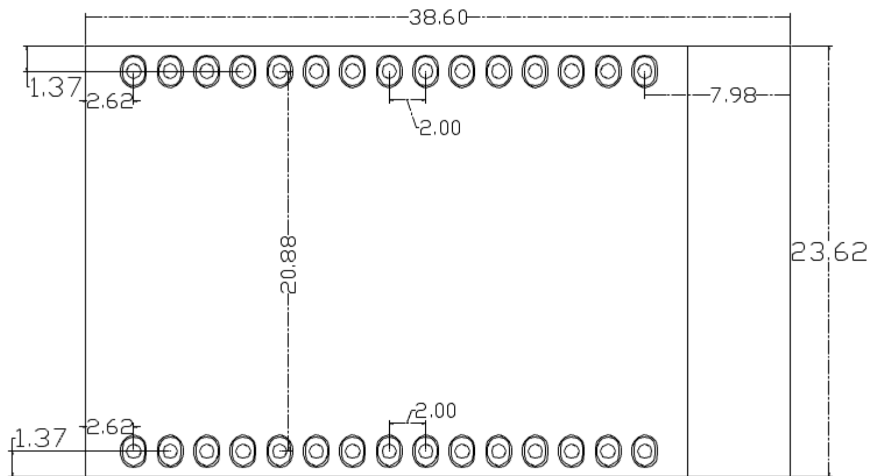

Figure 3 Recommended Package for DIP

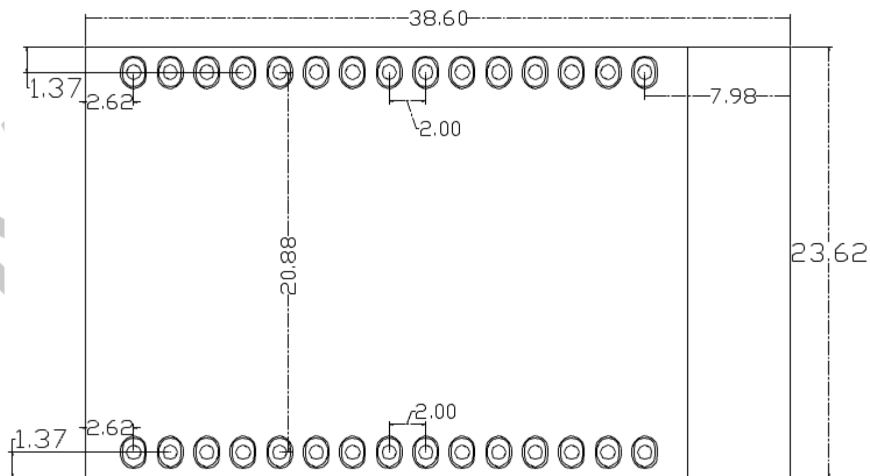

Figure 4 Recommended Package for SMT

1.3 DC power design

Peak current of EMW3162 is about 320mA. The DC/DC power chip MXCHIP recommended should be whose maximum output current is over 600mA. DC/DC gets more superiority on power conversion than LDO.

When using DC/DC power chip, except for the requirements of output voltage (3.3V) and maximum current (600mA), application designer should pay more attention on the arrangement of wires. For instance, device should be compact enough, the ground of input and output should be well connected and the feedback signal should be far away from the inductance and the Schottky diode. Please refer to the datasheet of DC/DC power chip for more information.

When using LDO power chip, application designer need notice on the maximum current (600mA) and heat dissipation.1.4 Recommended circuit design

1.4 Recommended circuit design

Recommended circuit design for EMW3162:

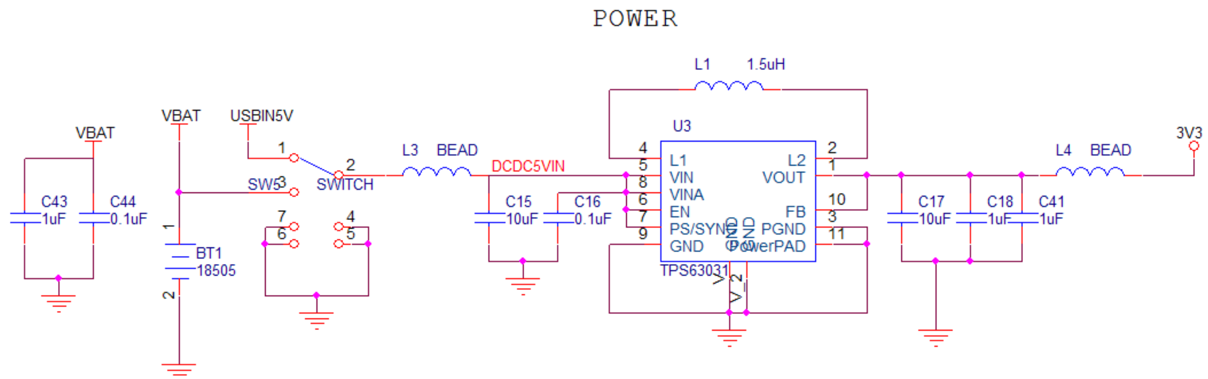

Figure 5 Power Conversion Design

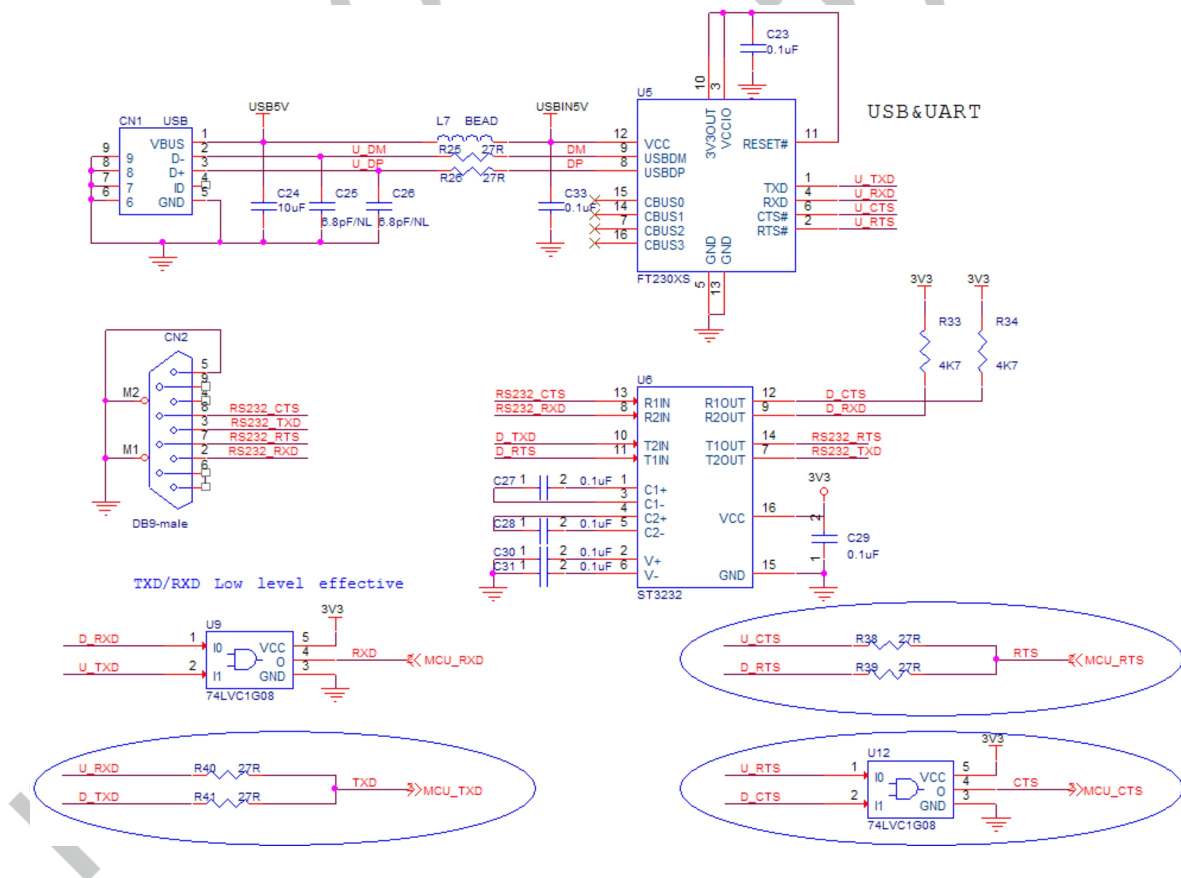

Figure 6 USB to Serial Design

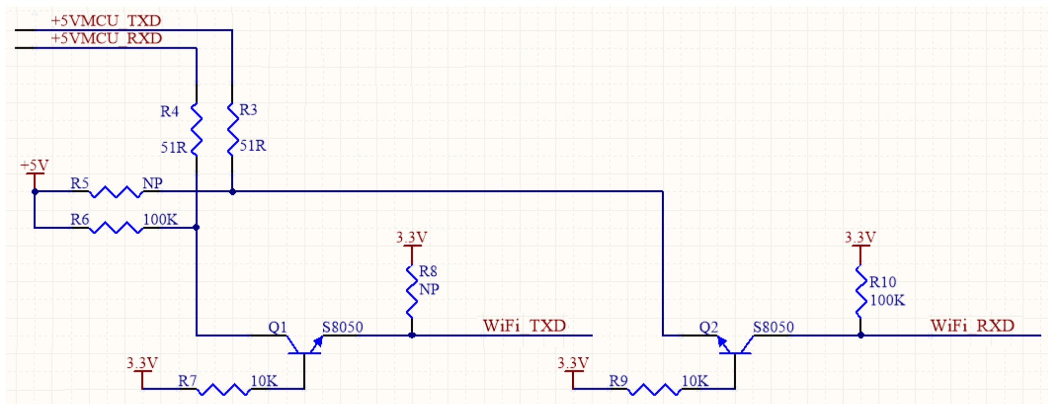

Figure 7 5V UART to 3.3V UART Conversion Design

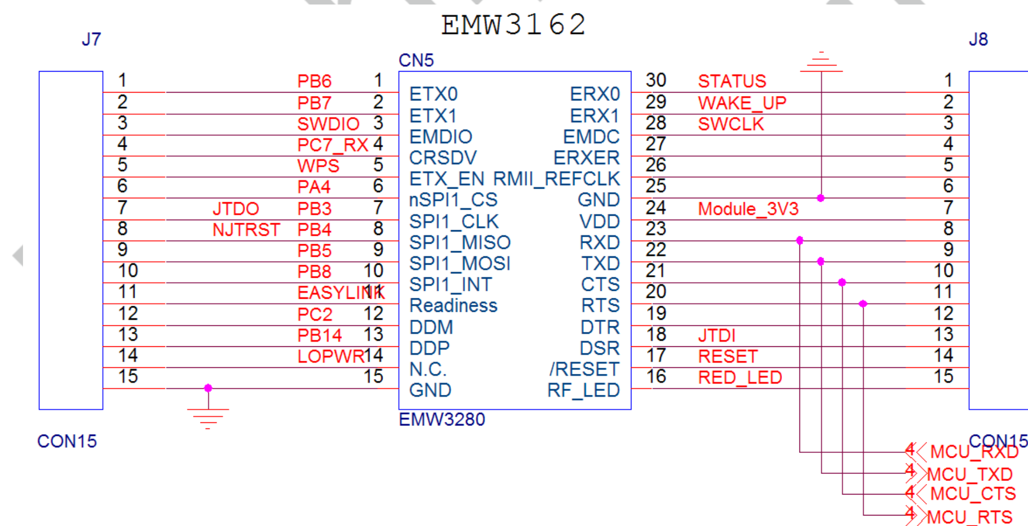

Figure 8 WiFi module Recommended Design

1.5 RF design

1.5.1 PCB antenna design

When integrating the WiFi module with on board PCB printed antenna, make sure the area around the antenna end the module protrudes at least 15mm from the mother board PCB and any metal enclosure. The area under the antenna end of the module should be keep clear of metallic components, connectors, sensors, traces and other materials that can interfere with the radio signal.

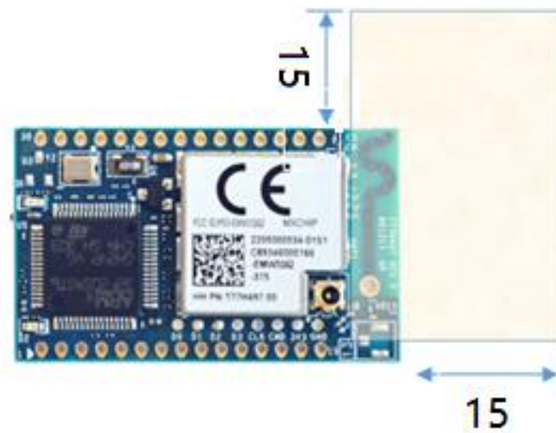

Figure 9 Minimum Size of Keep-out Zone Around Antenna

Areas on the mother board MXCHIP recommended showed below can reduce the noise to PCB antenna and radio signal.

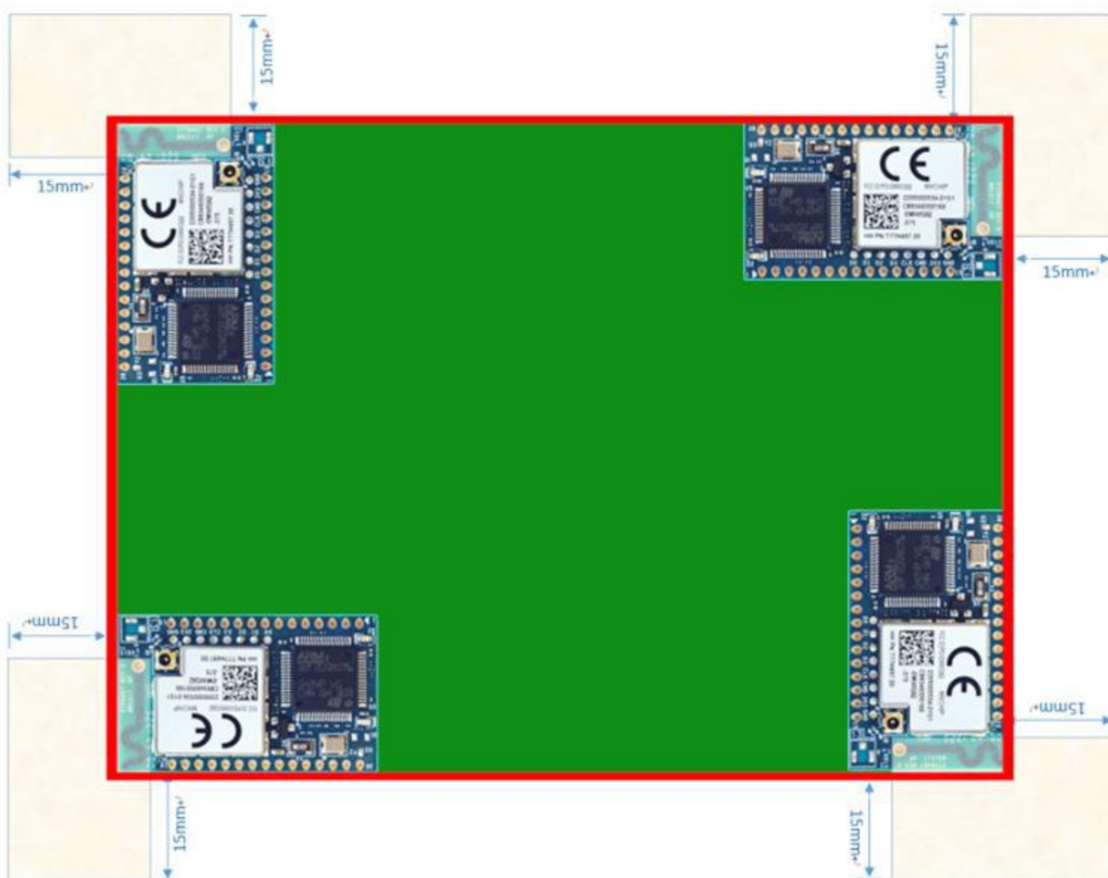

Figure 10 Module Position Recommended on Mother Board

1.5.2 T U.F.L RF Connector

Make sure the connector is matched when choosing the external antenna.

Mechanical dimensions of U.F.L RF connector shows as followed.

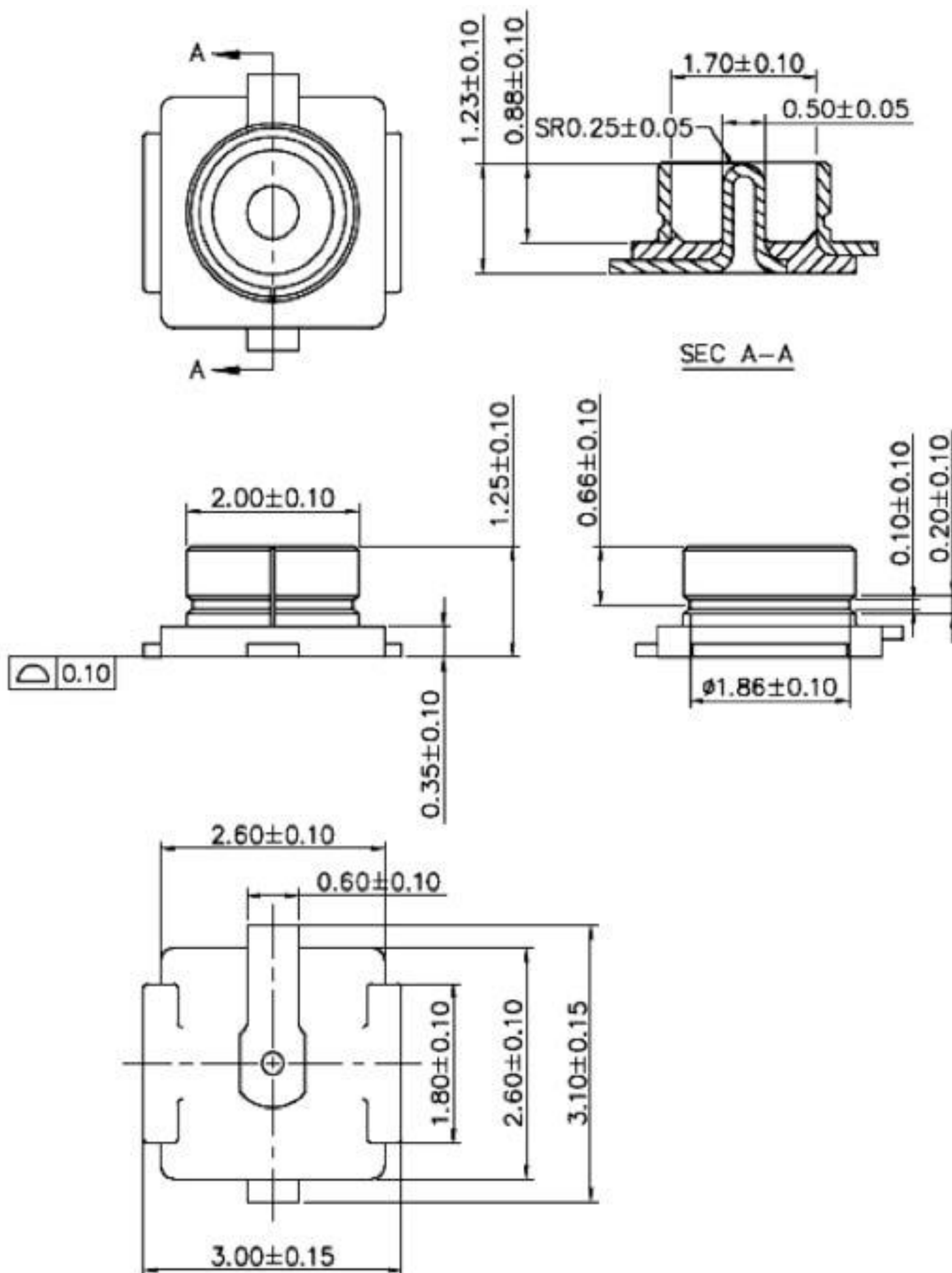

Figure 11 U.F.L Connector Size

1.6 ESD design

ESD grade of module: Human Body Model (HBM) sensitivity is 2000V, Charged Device Model (CDM) sensitivity is 500V. If a higher ESD level is required, the pins that may be connected to the outside should be reserved place for the ESD protection device.

If the module connects the mother board by outside leads, application designers should notice the EMI problems. Using shield cable or reserving the position for common mode choke to solve this problem.

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2. Firmware programming and warehousing detection method

2.1 Receiving Inspection Device List

Equipment list shows below:

Equipment	**Quantity**
PC	1 (pcs)
Fixture	1 (pcs)
EMB-380-S2 Development Board	1 (pcs)

Table 1 Warehousing Detection Equipment List

Application software and firmware:

Application software and firmware:

FT230XS drivers on PC, download link:

http://www.ftdichip.com/Drivers/VCP.htm

FWUpdate.exe" from online disk website, download link:

http://pan.baidu.com/s/1o73xE1G

Programming firmware should be confirmed by both MXCHIP FAE and guests. Its size is 1Mbytes.

The set of the four toggle switches on EMB-380-S2 development board:

Figure 12 Development Board Switch Settings

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2.2 Installing drivers for transforming USB to Serial

Open the file “software for transforming USB to Serial” and double click “CDM V2.08.30 WHQL Certified” to install it. Doing steps as followed.

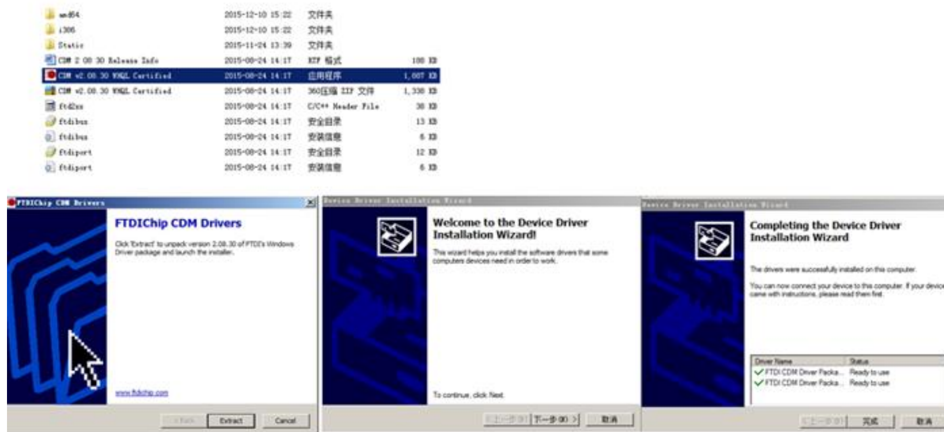

Figure 13 Installing Drivers for Transforming USB to Serial

2.3 Connection

PC connects to EMB-380-S2 development board by USB data line. Red led lights if connected.

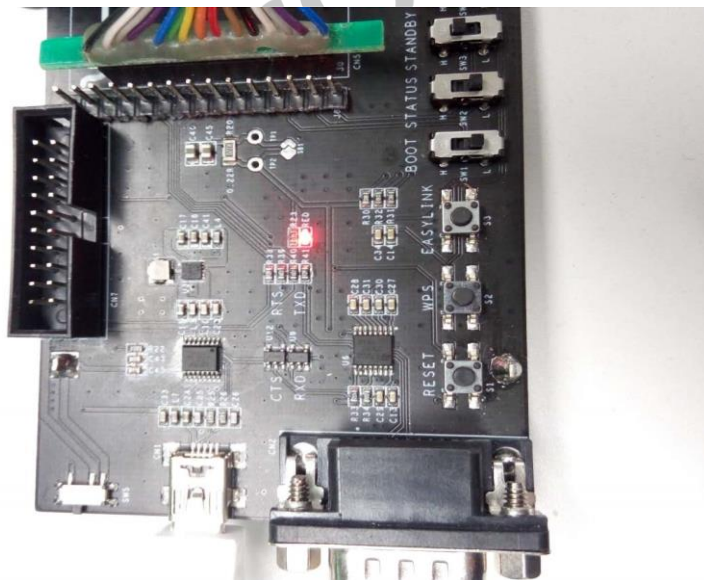

Figure 14 Power Led

2.4 Firmware programming

Find the COM number where EMW3081 connect with PC in “device manager”:

(Note : COM number must use Enhanced COM Port)

Figure 15 COM Name in Device Manager

Decompress "FWUpdate-3162.rar" and open the file "FWUpdate.exe". Upload the firmware prepared already. Set COM as "COM 1". Take "test" for example.

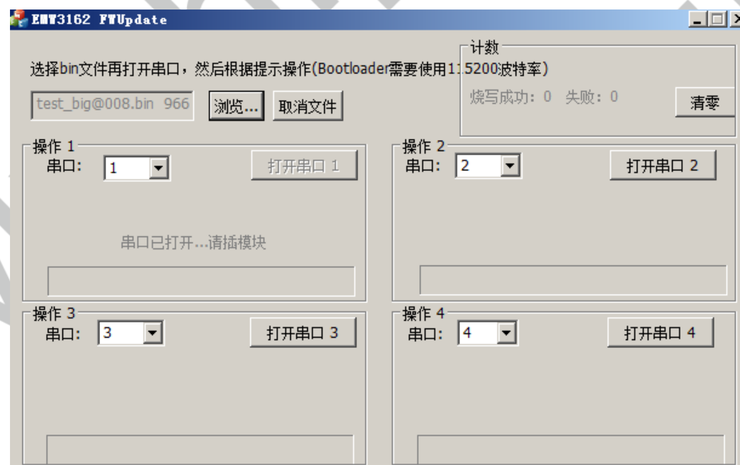

Figure 16 FWUpdate.exe

Place module on fixture and lead the antenna right side. Module auto programs after pressing down the fixture.

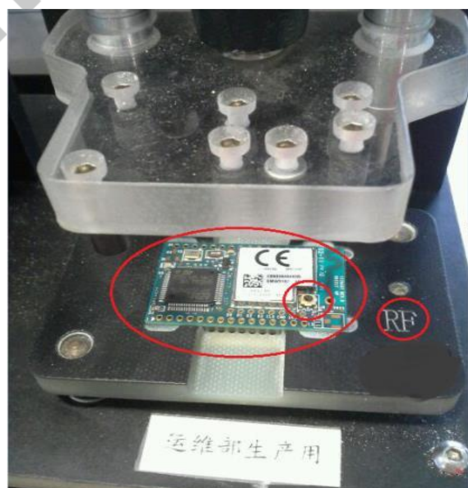

Figure 17 Place Module

Make sure power supply is sustained while programming.

Figure 18 Programming

Program over after the screen shows "Succeed...Please change the module".

Figure 19 Programming Over

2.5 Testing

Download the testing software "teraterm-4.74".

Download link: http://pan.baidu.com/s/1pKleKCr

Set "BOOT", "STATUS" switch as "L" and other switches as "H". Place the module on the fixture.

Figure 20 Switch Setting

Open the text "3162 testing method". Decompress and open the file "teraterm-4.74.rar".

Click "Setup" and choose the right serial port. Set serial baud rate as "115200".

Press down the handle. It enters testing mode when the serial port shows as followed.

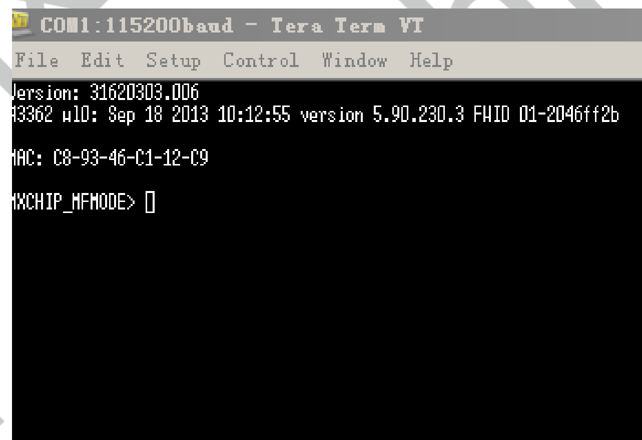

Figure 21 Testing Success

Type command: ssid~, and click "ENTER". It indicates success when the serial port shows as followed.

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```
MXCHIP_MFMODE> Version: 31620303.006
43362 wl0: Sep 18 2013 10:12:55 version 5.90.230.3 FWID 01-2046ff2b

MAC: C8-93-46-C1-12-C9

MXCHIP_MFMODE> ssid
Scan AP Success:
  SSID: MXCHIP_41C6D4, RSSI: -73
  SSID: HZzongheng, RSSI: -77
  SSID: HTTP, RSSI: -57
  SSID: EasyLink_967081, RSSI: -66
  SSID: huzhigao, RSSI: -63
  SSID: mxchip, RSSI: -48
  SSID: mxchip_phone, RSSI: -56
  SSID: William Xu, RSSI: -58
  SSID: 11, RSSI: -61
  SSID: WiFi-FV, RSSI: -66
  SSID: 9494, RSSI: -81
  SSID: fast1110, RSSI: -63
  SSID: , RSSI: -48
  SSID: fast_case, RSSI: -58
  SSID: ssid, RSSI: -58
  SSID: maojian_t, RSSI: -67
  SSID: GM, RSSI: -62
  SSID: Xiaomi.Router, RSSI: -49
  SSID: wangsq_test, RSSI: -57
AP Connect Success
DHCP Get IP Success, IP address: 192.168.31.172
ping reply from AP, delay 168 ms
ping reply from AP, delay 11 ms
ping reply from AP, delay 111 ms
ping reply from AP, delay 11 ms
ping reply from AP, delay 50 ms
```

Figure 22 Testing Success

2.6 Statements

- MXCHIP has the obligation to guarantee there is no quality problem for the module delivered at each batch.

- If problems are found while sampling module, customer has the right to require MXCHIP to give a timely replacement.

- If problems are found after welding the module on mother board without any warehousing detection, MXCHIP is only responsible for the compensation of module.

- MXCHIP has the obligation to assist solving various technical problems, without retaining any MVA/BIN file of customer.

- Customer has the obligation to record every firmware version during the firmware developing work and use the proper firmware for production.

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3. SMT matters

3.1 Note for stencil aperture

The recommended stencil aperture: 0.12mm (0.1~0.15mm), laser polishing hole.

The recommended solder paste is SAC305 and lead free.

The recommended extend length of welding pad: 0.15mm. It can enhance the adhesive ability of solder as shown below.

It can check the right position of the module by eyes if using SMT line without AOI testing to reduce the risk of cold solder joint..

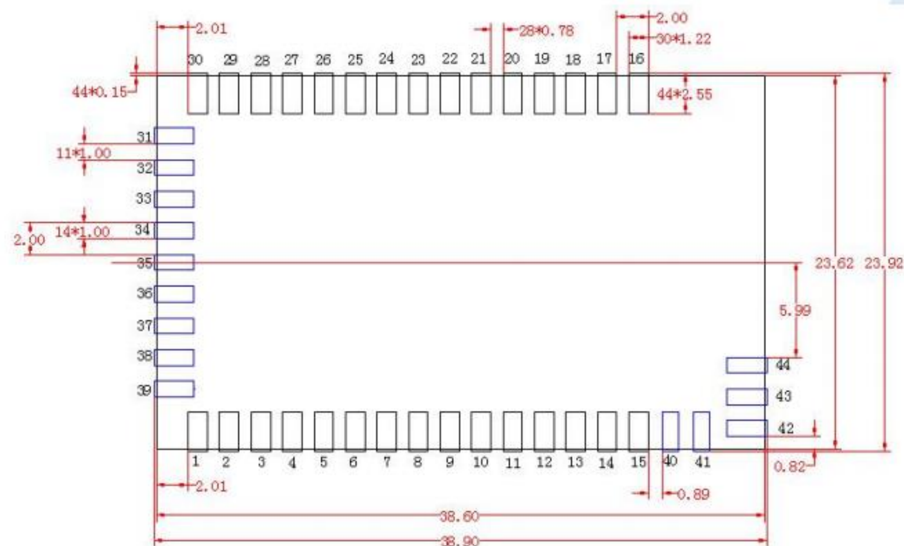

Figure 23 Recommended Stencil Aperture

3.2 Recommended reflow profile

Reflow times <= 2 times.

Peak temperature < 250°C.

Controlling the temperature according to the temperature curve can reduce the risk of welding.

Recommended reflow profile:

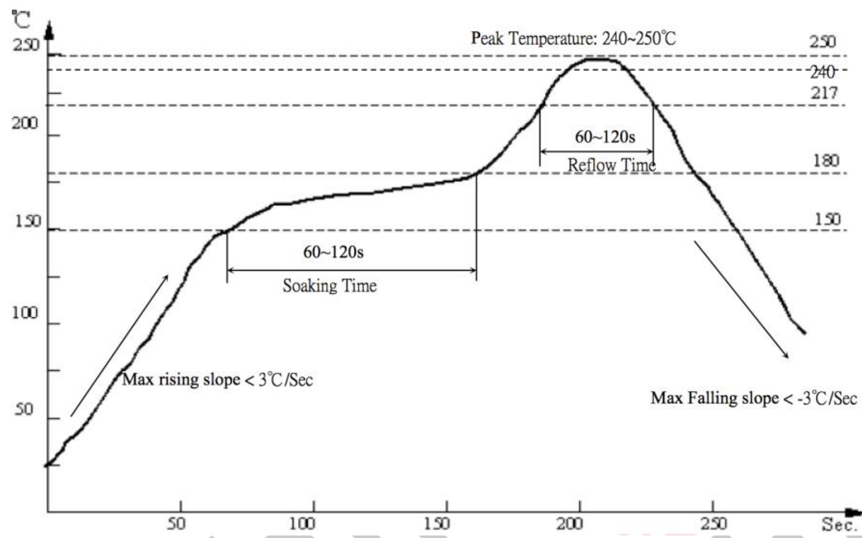

Figure 24 Reflow soldering temperature curve

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4. Mass production testing and firmware upgrading

In addition to considering the product features, application designer need to think over how to do test and upgrade firmware when developing.

4.1 Mass production test

Avoid finding problem after installing the PCB boards in machine

4.1.1 EMSP command way

Connect the module to the MCU of the mother board by serial port and use the EMSP command.

Choose one triggering way---- set one combination key, to send the test command from the MCU. The test command could be one EMSP command used to scan the APs around or connect one specified AP. The way can test both of the serial function and the RF function.

4.1.2 Limited development firmware

Connect the module to the MCU of the mother board by serial port. Add the test command in the firmware when developing. The test command could be one command from serial port used to scan the APs and return the results by serial port. The way can test both of the serial function and the RF function by using the same triggering way.

4.1.3 Full development firmware

Full development works for the whole application of the project.

Test method could be flexible in the way. It can set a specific way to test every function of the module. The application determines the specific test details.

4.2 Upgrading

Upgrading by OTA is recommended. OTA-over the air, is one wireless upgrading way.

The upgrading method is offered by MXCHIP. Several application cases are provided as referenced.

Firmware could be upgraded to the latest version by OTA with this upgrading method applied.

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5. Firmware encrypt

In order to make sure the firmware could not be modified after programming in the module, firmware must be encrypted with the bootloader drivers and the chip ID MXCHIP offered.

Bootloader driver is used to drive the device in the module and integrated with one AES encryption way. The application part of the firmware must be combined with the bootloader driver to generate one MVA/bin file after adding the chip ID details which can be used to identify MXCHIP module. Check the official website for more information.

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6. Sales and technical support information

If you need to buy this product, please call MXCHIP during the working hours.
(Monday ~ Friday : A.M. 9:00~12:00; P.M. 1:00~6:00)
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Post Code: 200333
Email: sales@mxchip.com
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