

## EMW3080(A)/EMW3080(B)

Embedded encryption security Wi-Fi module

Version: 1.8

Date: 2018-08-23

Number: DS0069EN

### Abstract

#### Features

- Support 802.11b/g/n, integrate ARM-CM4F, WLAN MAC/Baseband/RF
- 256KB RAM/ 2MB FLASH
- Working Voltage: DC 3.0-3.6V
- Maximum transmission rate up to 72.2 Mbps with 20 MHz bandwidth.
- Maximum transmission rate up to 150 Mbps with 40 MHz bandwidth.
- EMW3080B is the standard version; EMW3080A has hardware encryption to improve the security level of Cloud connection and firmware protection. Security level in accordance with CC EAL5+ AVA\_VAN5
- EMW3080(A) Hardware Encryption Features
  - Encrypt firmware of clients to prevent cracking
  - Digital signature is used in firmware to ensure integrity and legality, preventing being tampering or replaced in OTA.
  - Automatically generate private key to save the certificate issued from the cloud, the cloud can identify the legality of the device to prevent illegal, counterfeit, non-secure accessing.
  - Prevent hackers to obtain sensitive data and code
- Wi-Fi Features
  - Support 802.11b/g/n, HT-40
- Support Station, Soft AP, Station+Soft AP
- Support EasyLink, Alink, Joinlink
- Antenna: PCB or IPX (Optional)
- Peripherals:
  - 2x UART
  - 2x I2C
  - 1x SPI
  - 1x SWD
  - 6x PWM
  - Up to 13GPIOs
- Operating Temperature: -20°C to +85°C

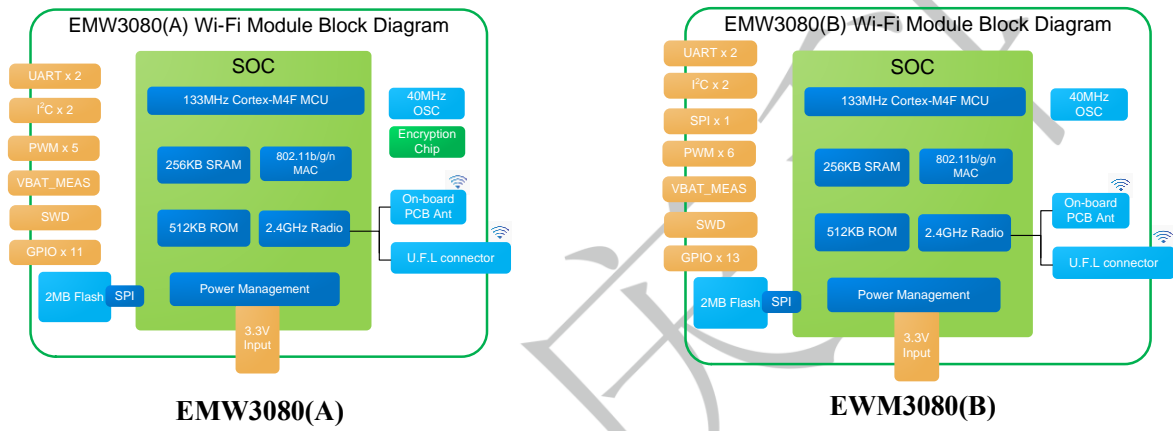
#### Application

- Intelligent lighting
- Intelligent Transportation
- Smart Home Application
- industrial automation
- Intelligent Security

#### Module Type

Type	Illustration
EMW3080(AP)	Hardware Encryption, PCB
EMW3080(AE)	Hardware Encryption, IPEX
EMW3080(BP)	No Hardware Encryption, PCB
EMW3080(BE)	No Hardware Encryption, IPEX

### Hardware Block



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## Version Illustration

Date	Vision	Details
2017-01-16	1.0	Initial document
2017-02-13	1.1	Update label, package, RF reference, encryption. Add BOOT/EASYLINK description
2017-03-06	1.2	Update LGA PCB package Update pin definition Update power consumption data
2017-3-27	1.21	Update PIN information
2017-3-31	1.22	Update Antenna Zone Diagram
2017-5-11	1.3	Update storage temperature
2017-7-11	1.31	Update the pin description of pin notes.
2018-05-28	1.7	Fix some errors and Update the value of intern resistor Update power consumption
2018-08-23	1.8	Add IO status information when boot up in section 1.3.2

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## 1. Product Introduction

EMW3080 is a cost-effective embedded Wi-Fi module released by MXCHIP with high integrating ARM CM4F, WLAN MAC/Baseband/RF. Maximum frequency 133MHz with 256KB SRAM and 2M FLASH. Power supply is DC 3.3V. Mounting mode is LGA SMT or DIP(Dual In-line Package). Peripherals: 2xUART / 1x SPI /2x I2C / 6x PWM / Up to 13 GPIOs.

EMW3080 runs MiCO 3.0 IoT operating system, supporting Micoder IDE. Provide fast, stable and secure end-to-end cloud links to users with integrate TCP/IP protocol stack, various security encryption algorithm, intelligent cloud such as MXCHIP easylink/Alink 1.1/Joinlink 3.0/Hilink/One Net/Gome/Suning, oversea cloud such as AWS/Ayla/Azure/IBM Watson/Google/Apple Homekit.

EMW3080 (A): Provide security encryption chip to the integrity and legality and cloud communication safety of client firmware.

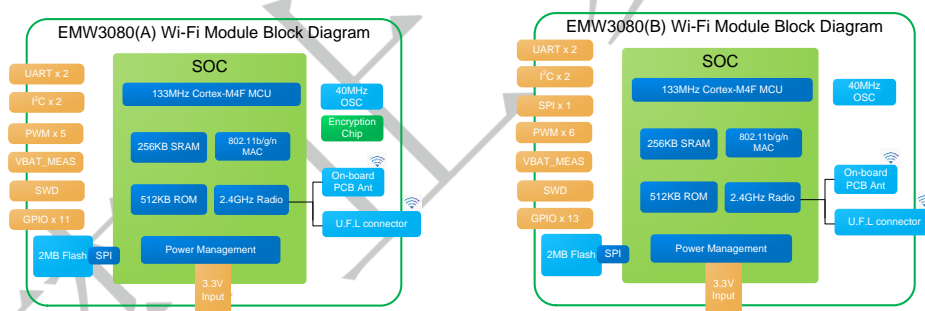
EMW3080 (B): Abundant peripherals and memory to supply most application and multi-cloud requirement.

Hardware diagram is shown below with four main parts:

- CM4F main core
- WLAN MAC/BB/RF/ANT
- Hardware encryption
- Power management

With:

1. ARM CM4F CPU with 133MHz maximum frequency and 256KB SRAM and 2M FLASH. Support high speed UART, I2C, SPI, PWM and multi-GPIO.
2. 2MB SPI Flash is used for custom firmware development
3. Support PCB antenna and IPEX
4. Input voltage: DC 3.3V



EMW3080 Hardware block

	EMW3080(A)	EMW3080(B)
<b>Encryption security chip</b>	Inside	External support
<b>CPU</b>	ARM CM4F	
<b>CPU Maximum Speed</b>	133MHz	133MHz
<b>SRAM</b>	256KB	256KB
<b>Flash (QSPI 100MHz)</b>	2MB (Support XIP CACHE running and decrypting)	
<b>UART (Up to 6Mbps)</b>	2	2
<b>I2C (400KHz)</b>	2	2
<b>SPI (31.25MHz)</b>	None	1
<b>PWM (Maximum 4MHz)</b>	5	6
<b>SWD debug port</b>	1	1
<b>Debug port</b>	1	1
<b>GPIO(Output current 4mA)</b>	11	13

## 1.1 EMW3080 Label Information



Figure 1 EMW3080 Label Information

### Label Information:

- CMIIT ID:2017DP1516 : SRRC approval number
- FCC ID:P53-EMW3080 :FCC certification information
- CE: CE authentication log
- EMW3080: Module type
- 047863100000: MAC address (Each module has a unique MAC address)
- F3080AP /F3080AE: Sub model type of module A, PCB antenna or IPEX
- F3080BP /F3080BE: Sub model type of module B, PCB antenna or IPEX
- X1701: production batch
- 0000.0000.AT08 : SN series number

## 1.2 Pin Arrangement

EMW3080 has SOH(snap off hole) package and DIP package, DIP package (as shown in figure 2) could effectively reduce the quality risk of second patch; SOH package (as shown in figure 3) is easy to debug, provide multi-choice for customers.

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.



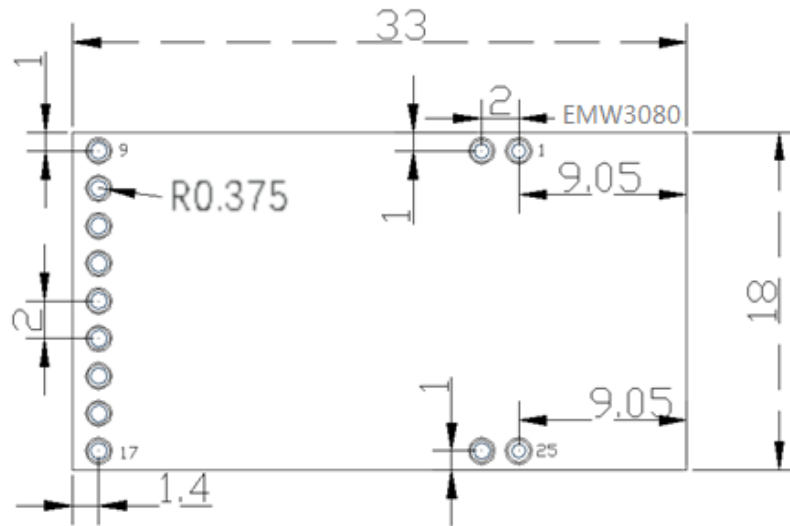
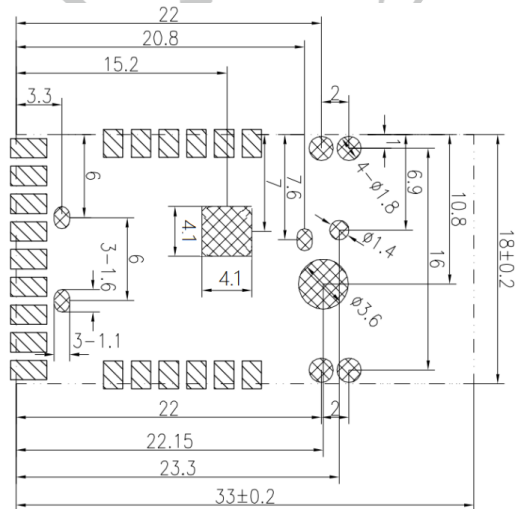
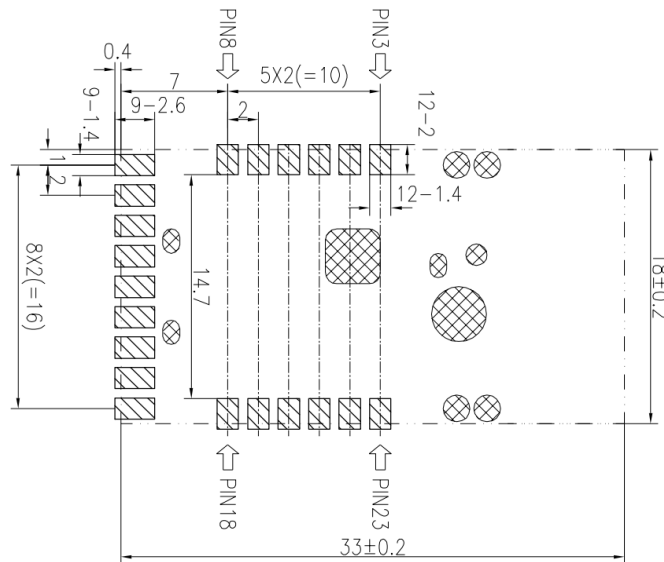


Figure 2 DIP Package Size



Note:



1. Shadow like this  means the soldering pad on customer's PCB.
2. Shadow like this  means where there should NOT be soldering pad on customer's PCB.

Figure 3 SOH Package Size

### 1.3 Pin Definition

#### 1.3.1 EMW3080 Package Definition

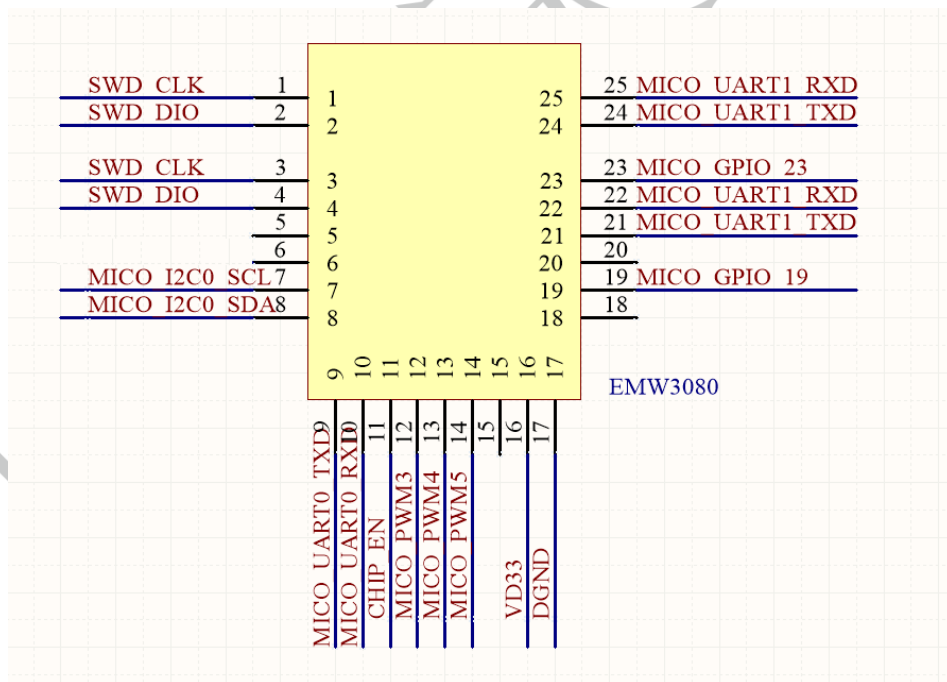


Figure 4 EMW3080 Package Definition

#### 1.3.2 EMW3080 Pin Definition

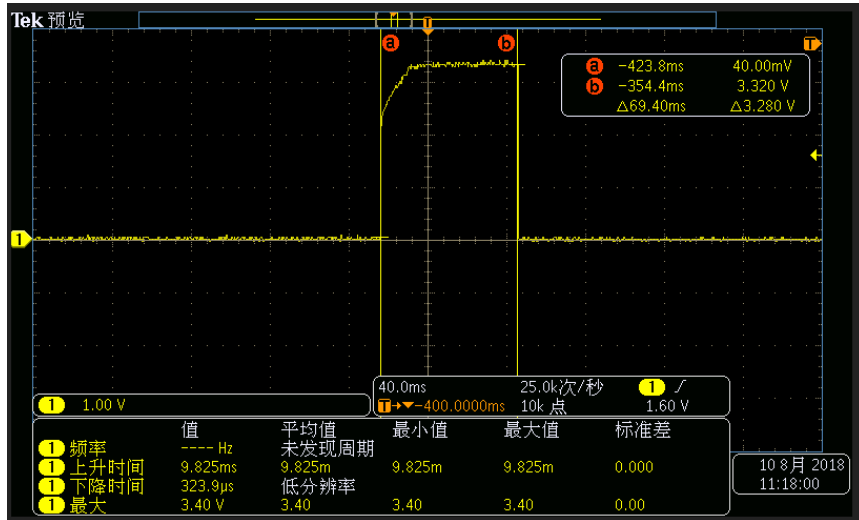
Table 1 EMW3080 Pin Definition

引脚号	FUNCTION1	FUNCTION2	FUNCTION3	FUNCTION4	FUNCTION5	FUNCTION6
1, 3	MICO_GPIO_1			MICO_PWM1		SWCLK
2, 4	MICO_GPIO_2			MICO_PWM2		SWDIO
5	NC					
6	NC					
7	MICO_GPIO_7	MICO_I2C0_SCL	MICO_UART0_RTS	MICO_PWM6	MICO_SPI1_MISO	

8	MICO_GPIO_8	MICO_I2C0_SDA	MICO_UART0_CTS		MICO_SPI1_CS	
9	MICO_GPIO_9	MICO_I2C1_SDA	MICO_UART0_TXD	MICO_PWM1	MICO_SPI1_MOSI	
10	MICO_GPIO_10	MICO_I2C1_CLK	MICO_UART0_RXD		MICO_SPI1_CLK	
11	CHIP_EN					
12	MICO_GPIO_12			MICO_PWM3		
13	MICO_GPIO_13			MICO_PWM4		
14	MICO_GPIO_14			MICO_PWM5		
15	NC					
16	VDD					
17	GND					
18	NC					
19	MICO_GPIO_19					
20	NC					
21, 24	MICO_GPIO_21	MICO_I2C0_SDA	MICO_UART1_TXD	MICO_PWM4		
22, 25	MICO_GPIO_22	MICO_I2C0_SCL	MICO_UART1_RXD	MICO_PWM5		
23	MICO_GPIO_23					

Notes:

- (1) **words in black color** is the common pins in both A and B, **words in blue color** is unique pins of B module. Compare to A module, EMW3080(B) has four pins: PIN 7, 8, 9, 10 with function: traffic control of UART, SPI function, PWM output and GPIO.
- (2) PIN 19 is used as BOOT, PIN23 is used as EASYLINK, please do not use pin 19 and 23 in hardware design. Please contact engineer of MXCHIP if it is necessary to use the two pins.
- (3) PIN21/24 should be in high voltage or NC when power on, please aware it when designing circuit.
- (4) If not used, please set the pin as NC, especially for CHIP\_EN.
- (5) Maximum I2C speed 400Kbps.
- (6) Support PWM in hardware, maximum speed 2MHz.
- (7) Please keep NC for unused pins.
- (8) Note that IOs are in floating mode while module boot up running ROM code, and the internal pull-up or pull-down will not take effect until boot code is running. The floating time will be affected by flash. So if the IO need be in a certain status while module boot up, an external pull-up or pull-down resistor is needed, and the resistance should be less than 100Kohm. Please refer to the below picture, the IO is set as low, and from a point to b point it's in floating mode and be pulled up by an external 100k resistor.



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## 2. Electrical Parameters

### 2.1 Operating Conditions

EMW3080 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		3.0	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	-0.3	3.6	V
VIN	GPIO input voltage	-0.3	3.6	V

### 2.2 Power Consumption

Table 4 EMW3080 Power Consumption

Mode	EMW3080 current		Note
	Average	Max	
Wi-Fi off	28.329mA	28.348mA	CPU idle
Wi-Fi off	3.45mA	3.453mA	CPU idle and in low power mode
Wi-Fi off	24.672mA	24.730mA	CPU run at full speed
Wi-Fi Initialize	114.119 mA	121.398 mA	Wi-Fi and MCU low power mode OFF
Wi-Fi Initialize	3.583 mA	11.7 mA	Wi-Fi and MCU low power mode ON
Wi-Fi keep connected with router	114.043 mA	147.086mA	Wi-Fi and MCU low power mode OFF
Wi-Fi keep connected with router	14.005 mA	172.128 mA	Wi-Fi and MCU low power mode ON
SoftAP mode	118.691mA	198.92 mA	

Monitor mode	114.734 mA	122.779mA	Monitor mode for WiFi configuration
Standby mode	10.445 uA	12.07 uA	MCU/RAM/Peripherals/RTC OFF, wake up by IO or internal Timer
Iperf mode	160.001mA	336.61mA	Wi-Fi and MCU low power mode OFF
Iperf mode	164.315mA	332.78mA	Wi-Fi and MCU low power mode ON

Actual working current is variable at different operating mode. Maximum operating current 300 mA .

## 2.3 Working Environment

Table 5 Temperature and humidity condition

Symbol	Name	Maximum	Unit
TSTG	Storage Temperature	-40 to +125	°C
TA	Operation Temperature	-20 to +85	°C
Humidity	Non-condensing, Relative humidity	95	%

## 2.4 Electrostatic Discharge

Table 6 Electrostatic Discharge Parameters

Symbol	Name	Details	Level	Maximum	Unit
V <sub>ESD</sub> (HBM)	Electrostatic discharge voltage (Human Body Model)	TA= +25 °C , JESD22-A114	2	2000	V
V <sub>ESD</sub> (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		2.412~2.484GHz
Wi-Fi wireless standard		IEEE802.11b/g/n
Data transmission rate	20MHz	11b: 1,2,5.5 和 11Mbps 11g : 6,9,12,18,24,36,48,54Mbps 11n : MCS0~7,72.2Mbps
	40MHz	11n: MCS0~7,150Mbps
Antenna type		PCB (Default) IPX (Optional)

#### 3.2 TX Performance

##### 3.2.1 Transmit performance of IEEE802.11b mode

Table 8 CCK\_11 transmit performance parameters of IEEE802.11b mode

Category	Content				
Mode	IEEE802.11b				
Channel	CH1 to CH13				
Rate	1, 2, 5.5, 11Mbps				
TX	Minimum	Typ.	Maximum	Unit	
1. Output power	14	16.5	18.5	dBm	
2. Spectrum template					
1) fc +/-11MHz to +/-22MHz	-	-	-30	dBr	
2) fc > +/-22MHz	-	-	-50	dBr	
3. Frequency offset	-15	-2	+15	ppm	

4. EVM( Peak EVM)					
1) 1~11Mbps	-	-	35%		
<b>RX Minimum receiving sensitivity</b>	<b>Minimum</b>	<b>Typ</b>	<b>Maximum</b>	<b>Unit</b>	
1Mbps (FER≤8%)	-	-98	-83	dBm	
11Mbps (FER≤8%)	-	-89	-76	dBm	

### 3.2.2 Transmit performance of IEEE802.11g mode

Table 9 OFDM\_54 transmit performance parameters of IEEE802.11g mode

Category	Content				
Mode	IEEE802.11g				
Channel	CH1 to CH13				
Rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
<b>TX</b>	<b>Minimum</b>	<b>Typ</b>	<b>Maximum</b>	<b>Unit</b>	
1. Output Power	12.5	14.5	16.5	dBm	
2. Spectrum template					
1) at fc +/- 11MHz	-	-	-20	dBr	
2) at fc +/- 20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz			-40	dBr	
3. Frequency offset	-15	-2	+15	ppm	
4. EVM( Peak EVM)					
6Mbps	-	-30	-5	dBm	
54Mbps	-	-31	-25	dBm	
<b>RX Minimum receiving sensitivity</b>	<b>Minimum</b>	<b>Typ</b>	<b>Maximum</b>	<b>Unit</b>	
6Mbps (FER≤10%)	-	-92	-82	dBm	



54Mbps (FER ≤ 10%)	-	-76	-65	dBm	
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### 3.2.3 Transmit performance of IEEE802.11n-HT20 mode

Table 10 MCS7 transmit performance parameters of IEEE802.11n-HT20 mode

Category	Content				
Mode	IEEE802.11n HT20				
Channel	CH1 to CH13				
Rate	MCS0/1/2/3/4/5/6/7, Maximum 72.2Mbps				
TX	Minimum	Typ	Maximum	Unit	
1. Output power	11.5	13.5	15.5	dBm	
2. Spectrum template					
1) at fc +/- 11MHz	-	-	-20	dBr	
2) at fc +/- 20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz			-45	dBr	
3. Frequency offset	-15	-2	+15	ppm	
4. EVM( Peak EVM)					
MCS0	-	-30	-5	dBm	
MCS7	-	-32	-27	dBm	
RX Minimum receiving sensitivity	Minimum	Typ	Maximum	Unit	
MCS0 (FER ≤ 10%)	-	-92	-82	dBm	
MCS7 (FER ≤ 10%)	-	-73	-64	dBm	

Table 11 MCS7 Transmit Performance of IEEE802.11n-HT 40MHz mode

Category	Content
----------	---------

Mode	IEEE802.11n HT40				
Channel	CH3 to CH11				
Rate	MCS0/1/2/3/4/5/6/7, Maximum 150Mbps				
<b>TX</b>	Minimum	Typ	Maximum	Unit	
1. Output power	11.5	13.5	15.5	dBm	
2. Spectrum template					
1) at $f_c \pm 22\text{MHz}$	-	-	-20	dBr	
2) at $f_c \pm 40\text{MHz}$	-	-	-28	dBr	
3) at $f_c > \pm 60\text{MHz}$			-45	dBr	
3. Frequency offset	-15	-2	+15	ppm	
4. EVM( Peak EVM)					
MCS0	-	-30	-5	dBm	
MCS7	-	-32	-27	dBm	
<b>RX Minimum receiving sensitivity</b>	Minimum	Typ	Maximum	Unit	
MCS0 (FER $\leq$ 10%)	-	-89	-79	dBm	
MCS7 (FER $\leq$ 10%)	-	-69	-61	dBm	

## 4. Antenna Information

### 4.1 Antenna Type

EMW3080 has two type of antenna: EMW3080(AP/BP) and EMW3080(AE/BE)



EMW3080 (AP)



EMW3080(BP)



EMW3080(AE)



EMW3080(BE)

### 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.

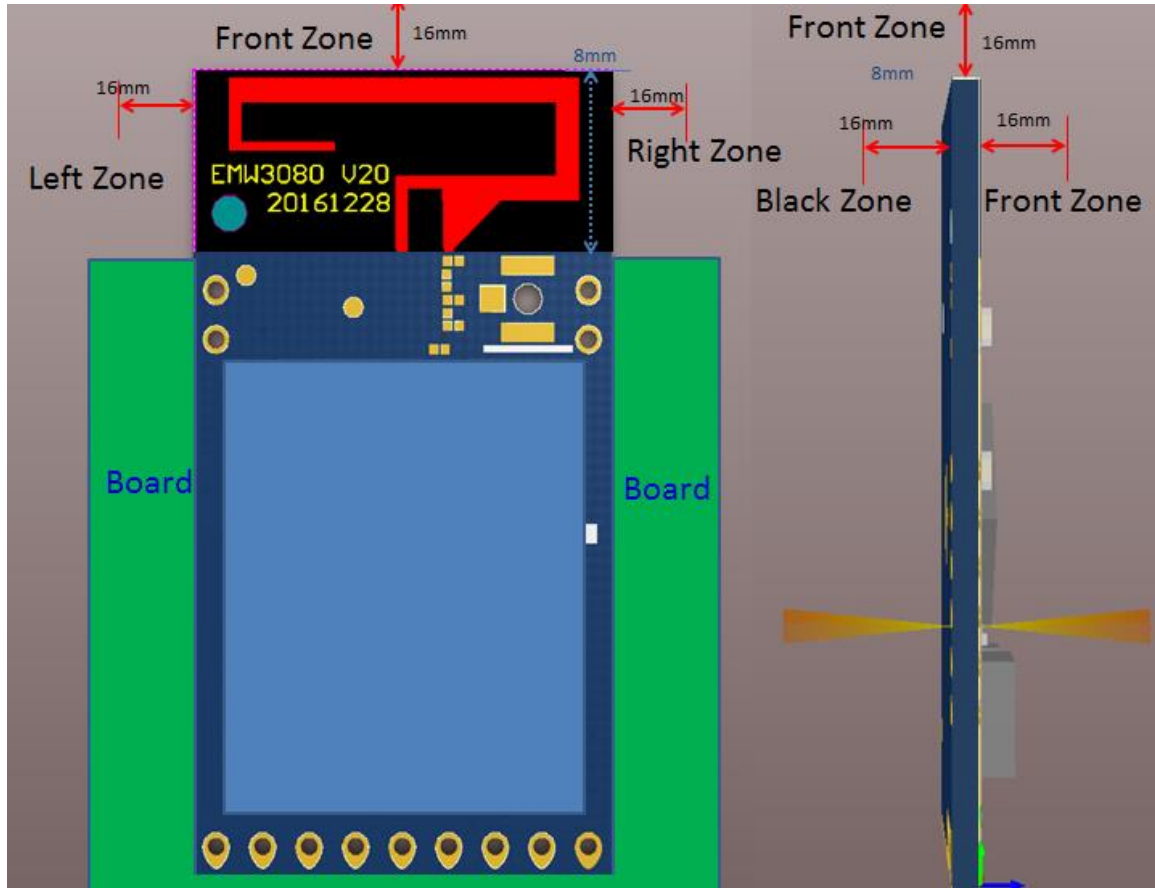


Figure 5 Minimum Clearance Zone of PCB Antenna (Unit: mm)

### 4.3 External Antenna Connector

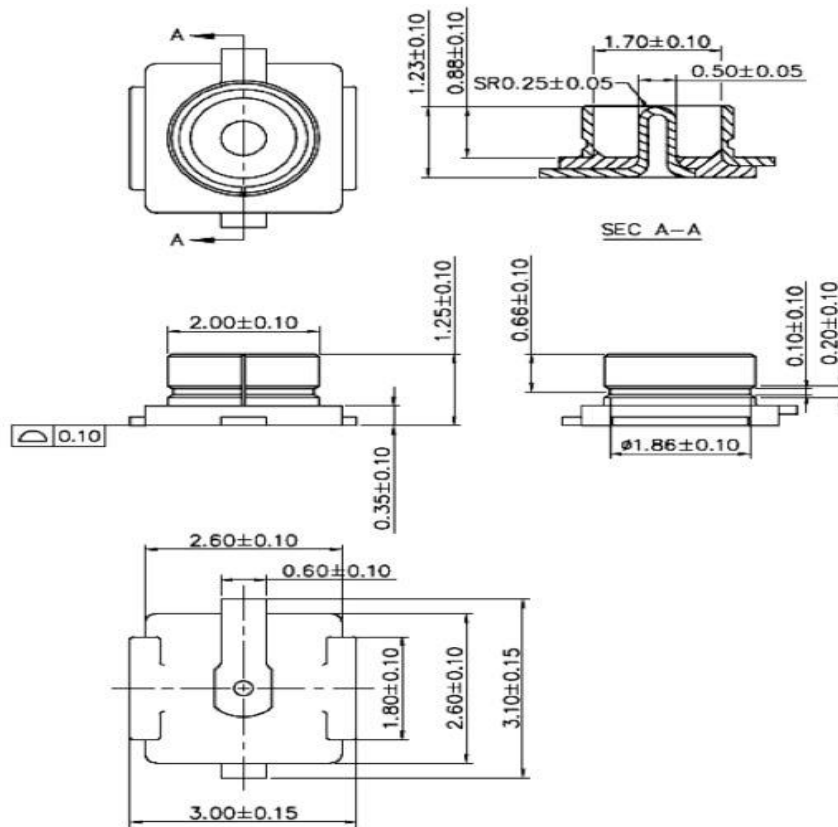


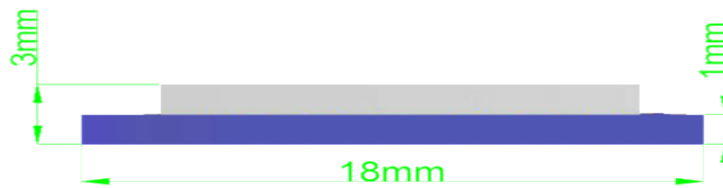
Figure 6 Size of External Antenna Connector

## 5. Assembly Information and Production Guidance

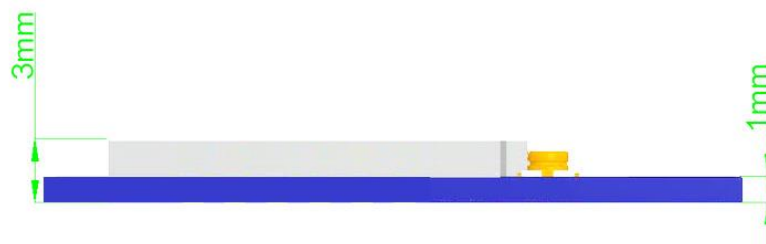
### 5.1 Assembly Size



Top View



Left Side View



Side View

Figure 7 EMW3080 Side View (Unit: mm)

## 5.2 Production Guidance (Important)

- The stamp hole package module produced by Mxchip must completely being patched by SMT machine in 24 hours after open firmware package. Otherwise the module should be re-package by vacuum pumping and drying before patch.
  - Devices for SMT patch:
    - (1) Reflow soldering machine
    - (2) AOI detector
    - (3) Suction nozzle with 6-8mm caliber
  - Device for drying:
    - (1) Cabinet type oven
    - (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:  $130^{\circ}\text{C}$ ;
  - SMT patch when the device cool down below  $36^{\circ}\text{C}$  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  $245^{\circ}\text{C}$ , 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  $36^{\circ}\text{C}$  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


	<b>CAUTION</b> <b>This bag contains</b> <b>MOISTURE-SENSITIVE DEVICES</b>	<b>LEVEL</b> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>3</b> </div>
	If Blank, see adjacent bar code label	
<p>1. Calculated shelf life in sealed bag: 12 months at &lt; 40°C and &lt; 90% relative humidity (RH)</p>		
<p>2. Peak package body temperature: <u>260</u> °C  <small>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: <u>168</u> hrs. of factory conditions  <small>If Blank, see adjacent bar code label</small></p>		
<p>≤ 30°C/60%RH, OR</p>		
<p>b) Stored at &lt;10% RH</p>		
<p>4. Devices require bake, before mounting, if:</p>		
<p>a) Humidity Indicator Card is &gt; 10% when read at 23 ± 5°C</p>		
<p>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>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>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.

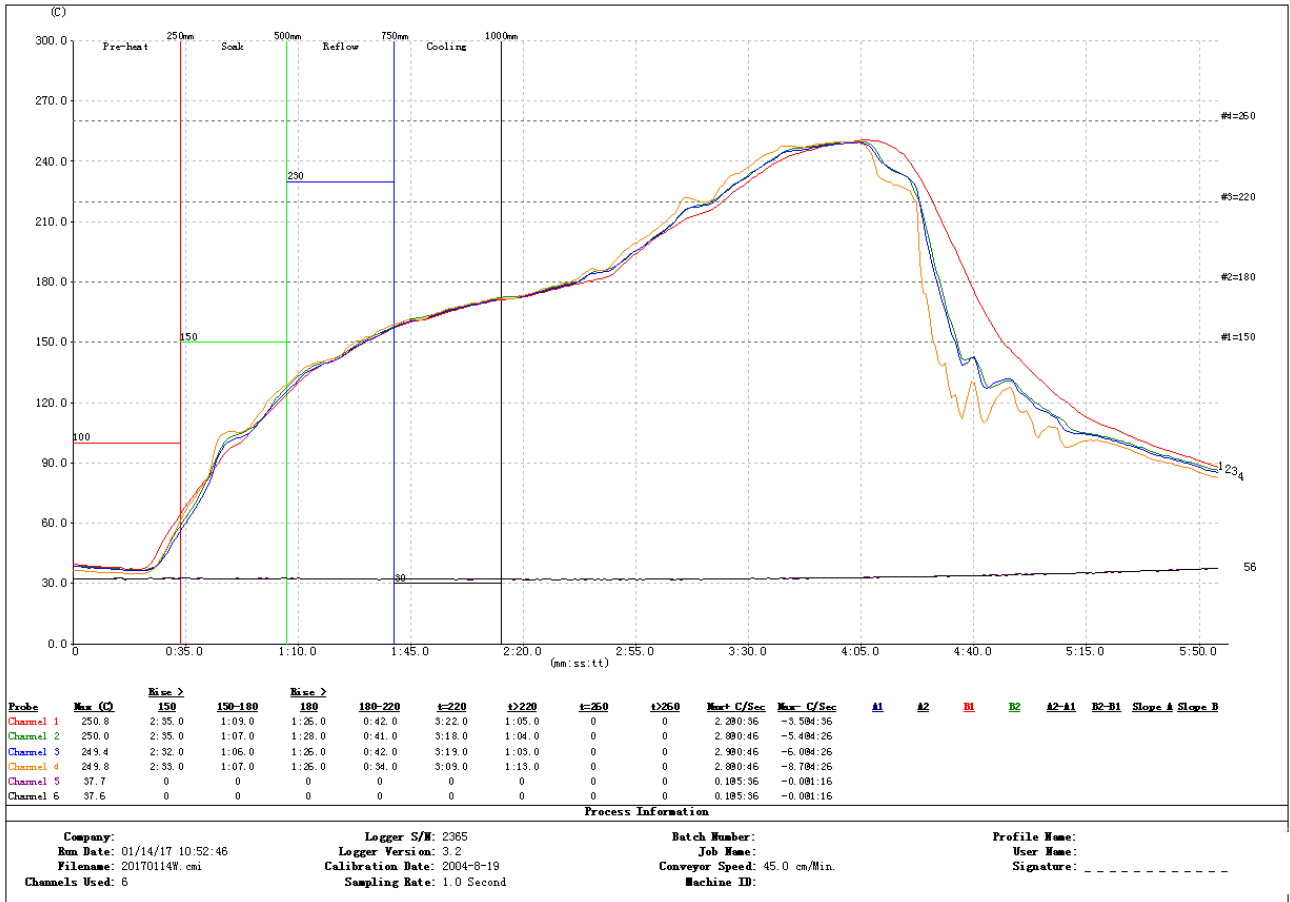


Figure 10 Temperature Curve of Secondary Reflow

## 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.

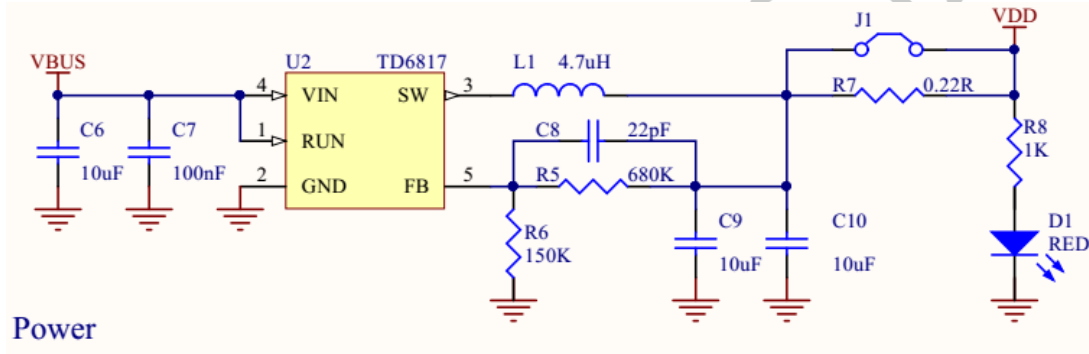


Figure 11 Power Source Circuit

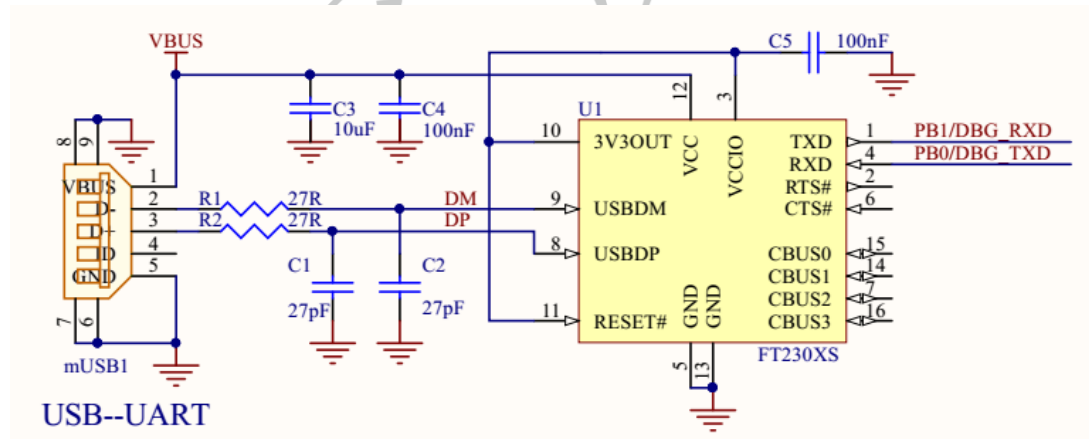


Figure 12 USB to UART

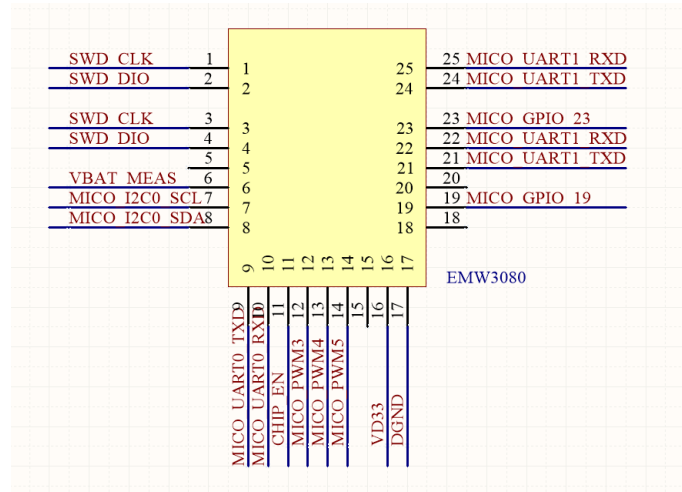


Figure 13 External Interface Circuit of EMW3080

Voltage of EMW3080 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.

Note: Inside module, pin 21 MICO\_UART1\_TXD has 100k weak pull-up resistor, as well as pin 22 MICO\_UART1\_RXD. MICO\_PWM3 has 100k pull-down resistor. CHIP\_EN has 100k pull-up resistor and 0.01uF earth capacity. Please pay special attention to the design schematics and PCB, allocate the pull-up and pull-down resistance according to the internal hardware.

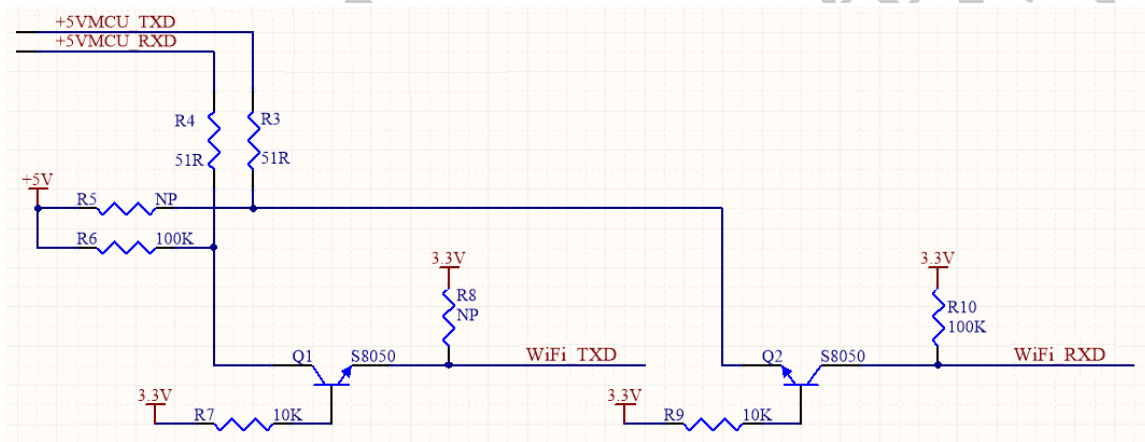


Figure 14 3.3V UART- 5V UART Convert Circuit

## 7. Module MOQ and Package Information

Table 16 Module MOQ and Package Information

Type	MOQ(pcs)	Shipping packing method (Tray/Tape)	Module storage quantity for each tray (pcs)	Tray number for each box	Module quantity for each box (pcs)
EMW3080(AP) EMW3080(AE) EMW3080(BP) EMW3080(BE)	1050 (2 boxes)	Tray	35	15+1	525

## 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

Telephone: +86-21-52655026

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

Postcode: 200333

Email: [sales@mxchip.com](mailto:sales@mxchip.com)