

Datasheet

EMW3081

Embedded Wi-Fi Module

Version : 1.1

Date : 2017-8-17

No. : DS0013E

Product Overview

Features

- Supports IEEE 802.11b/g/n
- Integrated ARM Cortex-M3 processor and WLAN MAC/Baseband/RF
- Rich memory resources in Cortex-M3 series: 512KB SRAM / 2MB SDRAM / 2MB Flash
- Operating voltage : DC 3.3V
- Up to 72.2Mbps data rate in 20MHz bandwidth
- Up to 150Mbps data rate in 40MHz bandwidth
- Wi-Fi features
 - Supports IEEE 802.11b/g/n
 - Supports WPS
 - Supports Wi-Fi direct
 - Supports Station, Soft AP and Soft AP+Station modes
 - Supports EasyLink
 - Optimized TCP/IP protocol for IoT applications
 - PCB antenna or IPX antenna (optional)
- Peripherals:
 - 1x HS UART
 - 1x I2C
 - 1x SPI
 - 1x SWD
 - 4x PWM
 - Up to 15 GPIOs
- Operating temperature: -20°C to +85°C

Applications

- Smart lighting
- Smart transportation
- Smart home/ home appliance
- Instrument
- Health care and fitness
- Industrial automation
- Smart security
- Smart energy system

Module model

Part number	Antenna type	
EMW3081-P	PCB antenna	Default
EMW3081-E	IPX antenna	Optional

Hardware Block Diagram

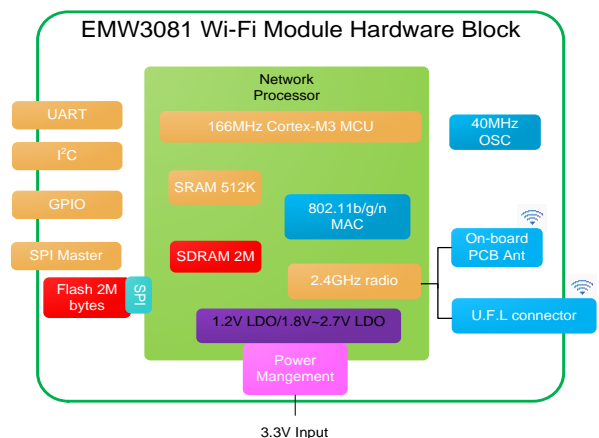


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1. Description

EMW3081 is a highly integrated embedded Wi-Fi module by MXCHIP. It integrates ARM Cortex-M3 processor, WLAN MAC/Baseband/RF, 512KB SRAM, 2MB SDRAM and 2MB SPI Flash. The operating voltage is 3.3V, and it has two kinds of packages: half-hole SMT and DIP package. Peripherals: 1x HS UART / 1x SPI /1x I2C / 4x PWM / Up to 15 GPIOs.

EMW3081 runs MiCO IoT operating system. MiCO contains TCP/IP protocol, security encryption algorithm, EasyLink smart configuration, and access protocol for Aliyun.

EMW3081 contains four main parts as showed in Figure 1:

- Cortex-M3 processor
 - WLAN MAC/BB/RF/ANT
 - Peripherals
 - Power management
- (1) Cortex-M3 CPU, up to 166MHz operating frequency, integrated 512KB SRAM, 2MB SDRAM, high speed UART, I2C, SPI, PWM, and GPIOs interfaces
 - (2) 2MB SPI Flash for customized firmware
 - (3) Supports PCB antenna or IPEX external antenna
 - (4) Operating voltage: DC 3.3V

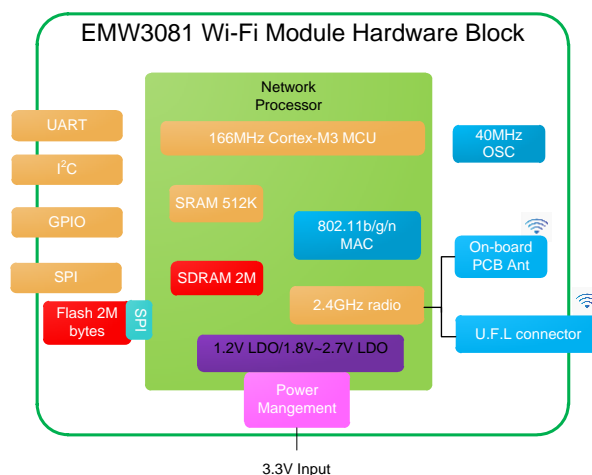


Figure 1. EMW3081 Hardware Block Diagram

1.1. Pinouts

EMW3081 supports half-hole and DIP packages. DIP package (showed in Figure 2) can reduce the quality risk of reflow soldering; half-hole package (showed in Figure 3) is easy for hand-soldering.

The size of solder window is the same as the pad. SMT recommended steel thickness is 0.12mm-0.14mm.

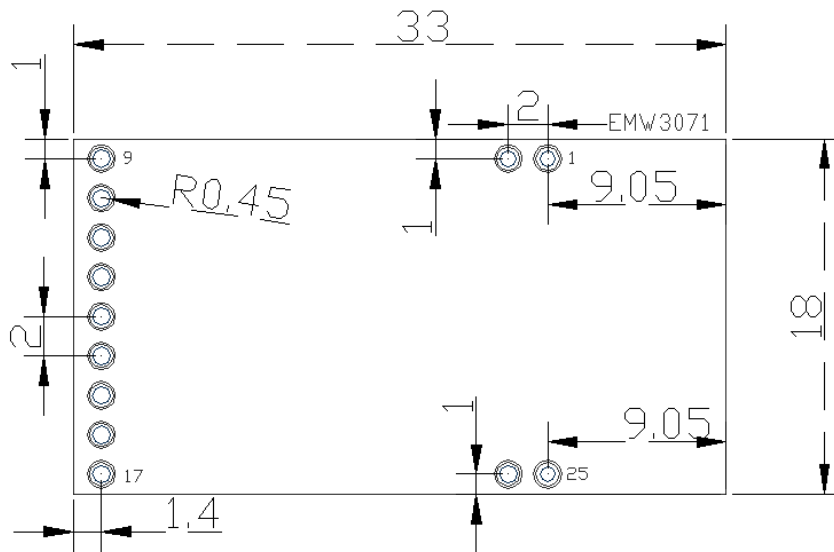


Figure 2. DIP package dimension

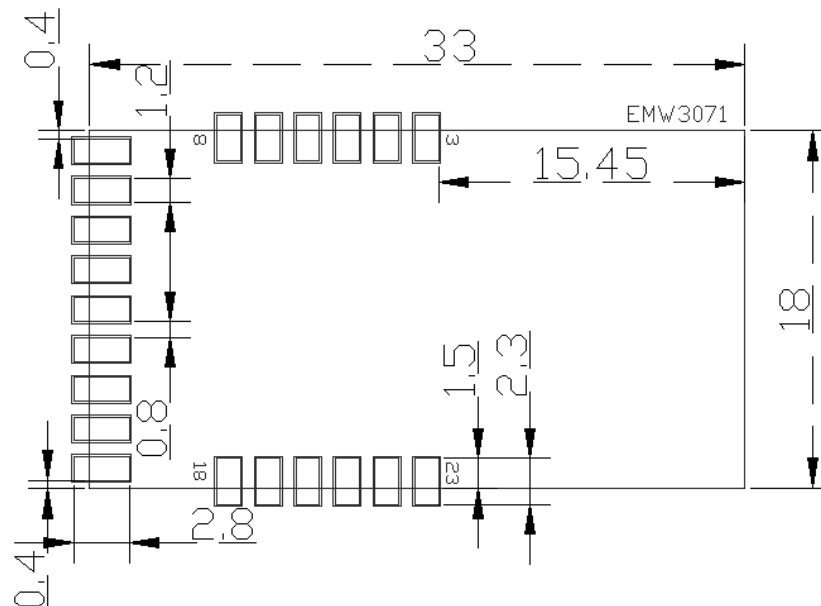


Figure 3. Half-hole package dimension

1.2. Pin Assignments

Table 1. EMW3081 Pin Assignments

Pins	Name	Type	Functions
1 , 3	PE4/SWCLK	I/O	SWCLK
2 , 4	PE3/SWDIO	I/O	SWDIO
5 , 6	NC		NC
7	PA3/UART0_RTS	I/O	USER_UART_RTS
8	PA5/UART0_CTS	I/O	USER_UART_CTS
9	PA7/UART0_TXD	I/O	USER_UART_TX
10	PA6/UART0_RXD	I/O	USER_UART_RX
11	CHIP_EN	I	CHIP_EN(<i>module enable, active high</i>)
12	PC0/SPI0_CS/PWM	I/O	SPI0_CS
13	PC3/SPI0_MISO/PWM	I/O	SPI0_MISO
14	PC2/SPI0_MOSI/PWM	I/O	SPI0_MOSI
15	PC1/SPI0_CLK/PWM	I/O	SPI0_CLK
16	VDD	S	<i>VDD</i>
17	GND	S	<i>GND</i>
18	NC		NC
19	PC4/I2C1_SDA/BOOT	I/O	<i>BOOT</i>
20	PC5/I2CI_SCL/STATUS	I/O	<i>STATUS</i>
21,24	PB0/DEBUG_TXD	I/O	DEBUG_OUT
22,25	PB1/DEBUG_RXD	I/O	DEBUG_IN
23	PB_3/ELINK	I/O	ELINK

- S: power supply and ground; I/O: GPIO pins;
- NC: Do not use this pin;
- I: Input ;

2. Electrical Parameters

2.1. Operating Ratings

Be noticed that when the input voltage is lower than the minimum rated voltage, EMW3081 may work abnormally.

Table 2. Recommended Operating Ratings

Symbol	Description	Condition	Detail			
			Min.	Typ.	Max.	Unit
VDD	Power supply		3.0	3.3	3.6	V

Voltage exceeding maximum ratings will cause hardware damage to the module, and working at the maximum ratings for a long time will affect the reliability of the module.

Table 3. Absolute Maximum Ratings

Symbol	Description	Min.	Typ.	Unit
VDD	Power supply	-0.3	3.6	V
VIN	Input voltage of GPIOs	-0.3	3.6	V

2.2. Power Consumption

Table 4. EMW3081 Power Consumption

Mode	Current (@3V3)	Description
Deep Sleep	16 uA	Waked up by Timer or GPIO
Sleep	19 mA	Keep Wi-Fi connection, no data transmission
Only CPU active	33 mA	CPU clock 166MHz , UART/SPI/I2C available , Wi-Fi disabled
11n RX mode	61 mA	CPU clock 166MHz , UART/SPI/I2C available , Wi-Fi working at 11n RX mode
11n TX @13dBm	260mA	CPU clock 166MHz , UART/SPI/I2C available , Wi-Fi working at 11n TX mode

Notice: the power consumption data may be different in different firmwares.

2.3. Operating Conditions

Table 5. Temperature and Humidity conditions

Symbol	Name	Range	Unit
TSTG	Storage Temperature	-40 to +85	°C
TA	Operating Temperature	-20 to +85	°C
Humidity	Non-condensing, relative humidity	<95	%

2.4. ESD

Table 6. ESD Parameters

Symbol	Name	Spec	Rank	Max.	Unit
V _{ESD(HBM)}	Electronics Static Discharge (Human Body Model)	TA= +25 °C JESD22-A114	2	2000	V
V _{ESD(CDM)}	Electronics Static Discharge (Charge Device Model)	TA = +25 °C JESD22-C101	II	500	

3. RF Parameters

3.1. Basic RF Parameters

Table 7. RF Parameters

Item		Description
Frequency Range		2.412~2.484GHz
Wi-Fi Wireless Standard		IEEE802.11b/g/n
Data Rate	20MHz	11b : 1,2, 5.5, 11Mbps 11g : 6, 9, 12, 18, 24, 36, 48, 54Mbps 11n : MCS0~7, 72.2Mbps
	40MHz	11n : MCS0~7, 150Mbps
Antenna Type		PCB antenna (Default) IPX external antenna (Optional)

3.2. TX Performance

3.2.1. IEEE 802.11b Mode Tx Parameters

Table 8. IEEE 802.11b Mode CCK_11 Tx Parameters

Channel	Output Power	EVM(%)	Frequency Offset
1	17.350	6.02	1.800
2	17.130	5.87	1.190
3	17.270	5.53	0.820
4	17.010	5.63	0.690
5	17.180	5.85	0.470
6	17.520	6.12	0.300
7	17.010	5.67	0.330
8	17.190	5.58	0.170
9	17.020	5.47	0.220
10	17.240	5.02	0.130
11	17.120	4.81	0.270
12	17.050	5.55	0.010
13	17.170	5.41	0.130

3.2.2. IEEE 802.11g Mode Tx Parameters

Table 9. IEEE 802.11g Mode OFDM_54 Tx Parameters

Channel	Output Power	EVM(dB)	Frequency Offset
1	16.060	-28.09	0.660
2	15.950	-28.61	0.670
3	15.660	-29.2	0.700
4	15.940	-28.33	0.720
5	15.190	-28.48	0.750
6	15.030	-29.05	0.770
7	14.610	-28.24	0.770
8	14.250	-28.55	0.810
9	14.540	-28.43	0.790
10	14.250	-28.07	0.830
11	15.080	-28.40	0.810
12	14.430	-29.59	0.830
13	15.890	-28.18	0.810

3.2.3. IEEE 802.11n-HT Mode Tx Parameters

Table 10. IEEE 802.11n-HT 20MHz Mode MCS7 Tx Parameters

Channel	Output Power	EVM(dB)	Frequency Offset
1	13.990	-31.45	1.140
2	14.160	-30.19	1.620
3	14.430	-30.41	1.580
4	14.120	-30.43	1.380
5	13.530	-30.62	1.380
6	14.070	-31.48	1.430
7	13.700	-30.28	1.160
8	13.930	-30.63	1.190
9	13.670	-30.20	1.120
10	13.010	-30.92	1.180
11	13.770	-30.40	1.140
12	13.830	-31.02	1.040
13	13.430	-31.24	1

Table 11. IEEE 802.11n-HT 40MHz Mode MCS7 Tx Parameters

Channel	Output Power	EVM(dB)	Frequency Offset
3	14.450	-30.69	1.270
4	14.260	-30.11	1.150
5	14.080	-30.53	1.040
6	14.020	-30.20	1.120
7	14	-30.11	1.050
8	13.820	-30.99	1.100
9	13.580	-30.10	1.150

3.3. RX Sensitivity

3.3.1. IEEE 802.11b Mode 20MHz Bandwidth

Table 12. IEEE 802.11b 20MHz Rx Sensitivity (dBm)

Channel \ Data Rate	11M	5.5M	2M	1M
IEEE spec	-76	-79	-80	-83
1	-86.500	-91.500	-93.500	-93.500
2	-87.500	-91.500	-93.500	-93.500
3	-87.500	-91.500	-93.500	-93.500
4	-87.500	-91.500	-93.500	-93.500
5	-87.500	-91.500	-93.500	-93.500
6	-87.500	-91.500	-93.500	-93.500
7	-87.500	-91.500	-93.500	-93.500
8	-86.500	-91.500	-93.500	-93.500
9	-87.500	-91.500	-93.500	-93.500
10	-87.500	-91.500	-93.500	-93.500
11	-87.500	-91.500	-93.500	-93.500
12	-87.500	-91.500	-93.500	-94.500
13	-87.500	-91.500	-93.500	-93.500

3.3.2. IEEE 802.11g Mode 20MHz Bandwidth

Table 13. IEEE 802.11g 20MH Rx Sensitivity (dBm)

Channel Data Rate	54M	48M	36M	24M	18M	12M	9M	6M
IEEE spec	-65	-66	-70	-74	-77	-79	-81	-82
1	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-90.500
2	-75.500	-76.500	-81.500	-84.500	-87.500	-89.500	-90.500	-90.500
3	-75.500	-76.500	-81.500	-84.500	-87.500	-89.500	-90.500	-90.500
4	-75.500	-76.500	-81.500	-84.500	-87.500	-89.500	-90.500	-90.500
5	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-90.500
6	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-91.500
7	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-90.500
8	-75.500	-76.500	-81.500	-83.500	-87.500	-87.500	-90.500	-90.500
9	-75.500	-76.500	-81.500	-83.500	-86.500	-89.500	-90.500	-90.500
10	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-90.500
11	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-90.500
12	-75.500	-76.500	-81.500	-83.500	-87.500	-89.500	-90.500	-91.500
13	-75.500	-76.500	-81.500	-83.500	-86.500	-88.500	-90.500	-91.500

3.3.3. IEEE 802.11n-HT Mode 20/40MHz Bandwidth

Table 14. IEEE 802.11n-HT20 Rx Sensitivity (dBm)

Channel Rate	MCS7	MCS6	MCS5	MCS4	MCS3	MCS2	MCS1	MCS0
IEEE spec	-64	-65	-66	-70	-74	-77	-79	-82
1	-72.500	-73.500	-75.500	-80.500	-82.500	-86.500	-88.500	-90.500
2	-72.500	-74.500	-75.500	-79.500	-83.500	-86.500	-88.500	-90.500
3	-72.500	-74.500	-75.500	-80.500	-83.500	-86.500	-88.500	-90.500
4	-72.500	-74.500	-75.500	-79.500	-82.500	-86.500	-88.500	-90.500
5	-72.500	-74.500	-75.500	-80.500	-83.500	-86.500	-88.500	-90.500
6	-72.500	-74.500	-75.500	-80.500	-82.500	-86.500	-88.500	-90.500
7	-72.500	-73.500	-75.500	-80.500	-83.500	-86.500	-88.500	-90.500
8	-72.500	-74.500	-75.500	-79.500	-82.500	-85.500	-87.500	-90.500
9	-72.500	-73.500	-74.500	-80.500	-82.500	-86.500	-88.500	-90.500

10	-72.500	-73.500	-75.500	-80.500	-82.500	-85.500	-88.500	-91.500
11	-72.500	-73.500	-74.500	-80.500	-82.500	-86.500	-87.500	-90.500
12	-72.500	-74.500	-75.500	-80.500	-83.500	-86.500	-88.500	-91.500
13	-72.500	-76.500	-75.500	-79.500	-82.500	-86.500	-88.500	-91.500

Table 15. IEEE 802.11n-HT40 Rx Sensitivity (dBm)

Rate Channel	MCS7	MCS6	MCS5	MCS4	MCS3	MCS2	MCS1	MCS0
IEEE spec	-64	-65	-66	-70	-74	-77	-79	-82
3	-69.500	-71.500	-71.500	-76.500	-79.500	-83.500	-85.500	-88.500
4	-69.500	-71.500	-72.500	-76.500	-79.500	-83.500	-85.500	-88.500
5	-69.500	-71.500	-72.500	-77.500	-79.500	-83.500	-85.500	-88.500
6	-69.500	-71.500	-72.500	-77.500	-79.500	-83.500	-85.500	-88.500
7	-69.500	-71.500	-72.500	-77.500	-79.500	-83.500	-85.500	-88.500
8	-69.500	-71.500	-72.500	-769.500	-79.500	-83.500	-85.500	-88.500
9	-69.500	-71.500	-72.500	-77.500	-80.500	-83.500	-85.500	-88.500

4. Antenna

4.1. Antenna Type

EMW3081 has PCB antenna model (Part number: EMW3081-P) and IPX antenna model (Part number: EMW3081-E).



Figure 2. EWM3081-P



Figure 3. EMW3081-E

4.2. PCB Antenna Forbidden Area

When using PCB antenna, make sure that metal and electrical components are at least 15mm away from the antenna.

The shadow area of Figure 6 should not contain any metal components, sensor, PCB ground.

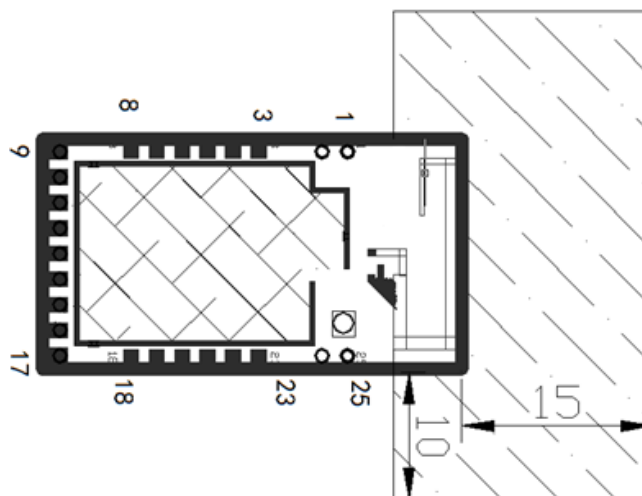


Figure 4. PCB antenna forbidden area (Unit: mm)

4.3. Connector for External Antenna

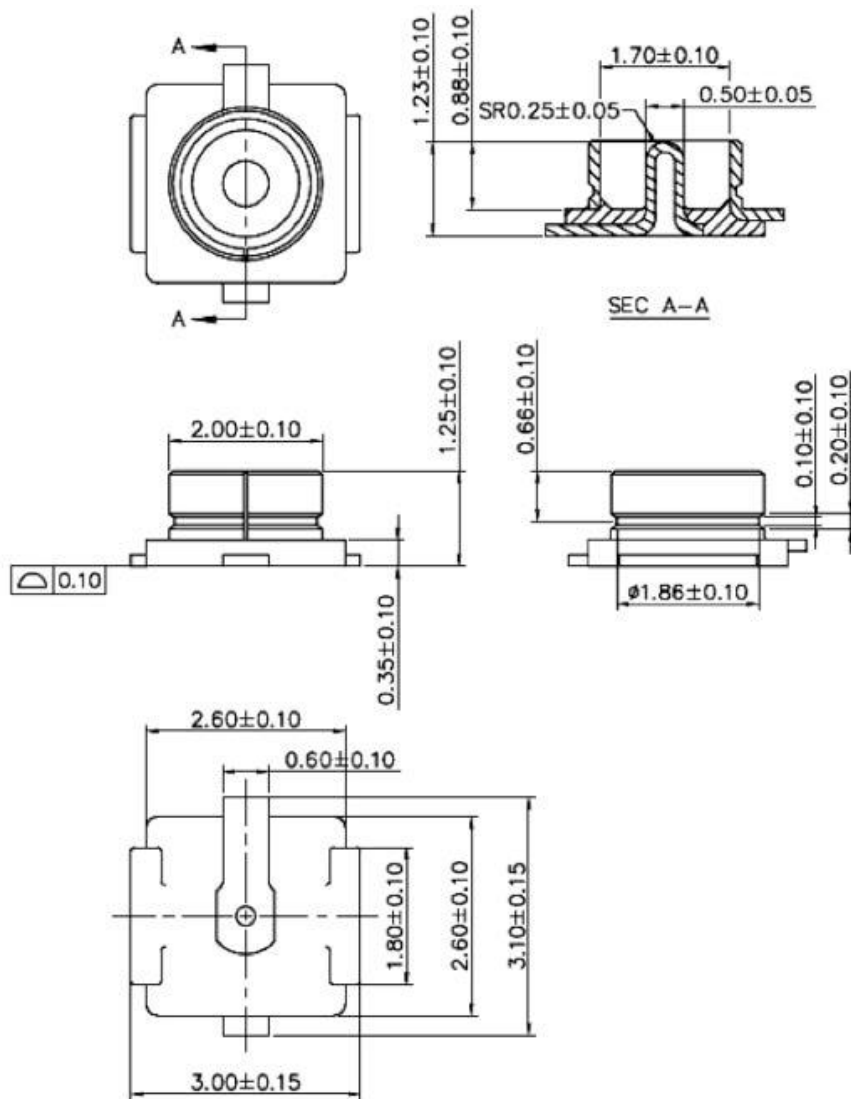


Figure 5. Dimension of connector for external antenna

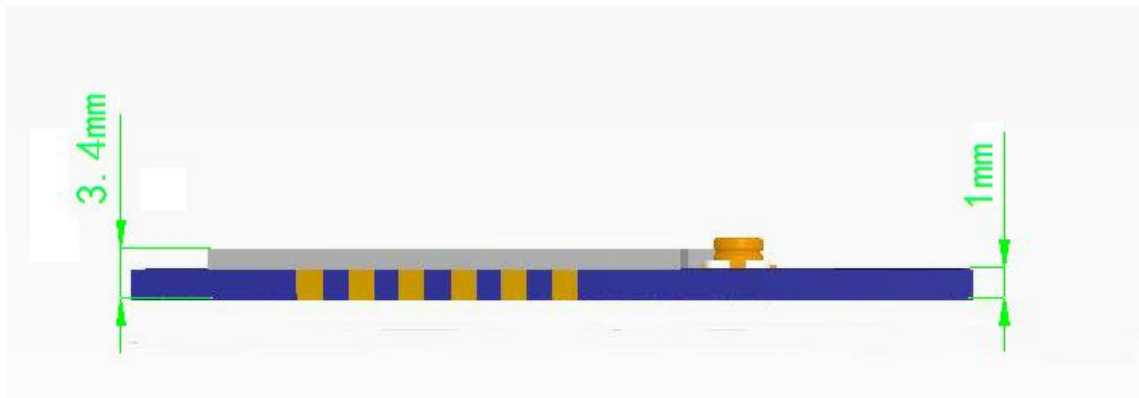
Recommended external antenna:

Part number F020-000X

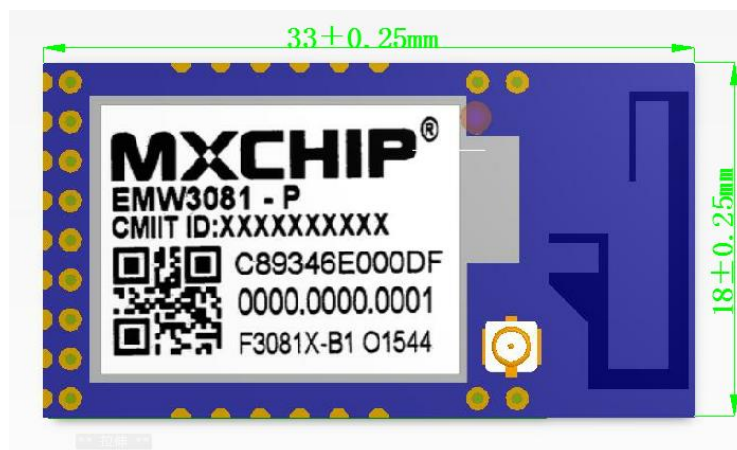
Gain: 2.0dBi

5. Assembly Information and Manufacturing Guidance

5.1. Mechanical Dimensions



Side view



Top view

Figure 6. EMW3081 Mechanical Dimensions (Unit: mm)

5.2. Use guidelines (Please read carefully)

- Stamps Wi-Fi modules from MXCHIP must be use soldered with SMT machine.
 - SMT need machine:
 1. Reflow soldering SMT machine
 2. The AOI detector

3. 6-8 mm diameter suction nozzle

▪ baking need equipment:

1. Cabinet baking box
2. The antistatic, high temperature resistant tray
3. The antistatic high temperature resistant gloves

● Storage conditions as follows

1. Moisture bag must be stored in a temperature < 30 ° C, humidity 85% RH of the environment.
2. Dry packaging products, the guarantee period should be from 6 months from the date of packing seal.
3. Sealed packaging is equipped with humidity indicator card.

● When opened, if the temperature and humidity indicator CARDS read 30%, 40%, 50%, three color ring are blue, to continue to bake for 2 hours for module;

● When opened, if the humidity indicator CARDS read 30% color ring into pink, need to continue to bake module 4 hours;

● When opened, if the humidity indicator CARDS read into 30%, 40%, color ring into pink, need to continue to bake for 6 hours module;

● When opened, if the humidity indicator CARDS read into 30%, 40%, 50% are pink color ring, need to continue to bake for 12 hours module;



● If opened the time more than 3 months, please pay attention to the SMT process welding this batch module, zedoary because PCB process, the resulting problems we do not assume corresponding responsibility.

● Please to ESD(static discharge ,static electricity discharge) protection module before SMT;

● Please according to the SMT reflow soldering curve, peak temperature 245 °C, reflow soldering temperature curve as shown in figure 10, section 5.5;

- For the first time in order to ensure the qualified rate of reflow soldering, first SMT please extraction 10% product to visual analysis, AOI inspection, to ensure that the furnace temperature control, device adsorption method, the rationality of the put way; Suggestions : when batch production per hour 5-10 pieces of visual analysis, AOI test.

5.3. The matters need attention

- In the entire production, Each station of the operator must wear anti-static gloves;
- When baking, no more than baking time;
- When roasting, it is forbidden to join explosive, flammable, corrosive substances;
- When baking, high temperature module application tray in the oven, keep the air circulation between each module, at the same time avoid direct contact with the oven wall module;
- Baking, please will bake the door is closed, the guarantee baking box sealing, prevent leakage, temperature influence the baking effect;
- Don't open the door, as far as possible when baking box running if must open, shortening the time of can open the door as far as possible;
- After baking, must be natural cooling modules to < 36 °C before wear anti-static gloves out, so as not to burn.
- Operation, forbidden module bottom touch water or dirt;
- Temperature and humidity control level for Level3, storage and baking conditions based on IPC/JEDEC J - STD - 020.

5.4. MSL/Storage Condition


	<p>CAUTION This bag contains MOISTURE-SENSITIVE DEVICES</p>	<p>LEVEL 3</p>
<small>If Blank, see adjacent bar code label</small>		
<p>1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)</p>		
<p>2. Peak package body temperature: <u>260</u> °C <small style="margin-left: 150px;">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 style="margin-left: 100px;">If Blank, see adjacent bar code label</small></p>		
<p style="margin-left: 40px;">≤ 30°C/60%RH, OR</p>		
<p>b) Stored at <10% RH</p>		
<p>4. Devices require bake, before mounting, if:</p>		
<p>a) Humidity Indicator Card is > 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><small>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</small></p>		
<p>Bag Seal Date: _____ <small style="margin-left: 150px;">If Blank, see adjacent bar code label</small></p>		
<p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>		

Figure 7. Storage Condition

5.5. Recommended Reflow Profile

Solder paste recommendations: SAC305, Lead -Free solder paste. Reflow times should be no more than twice.

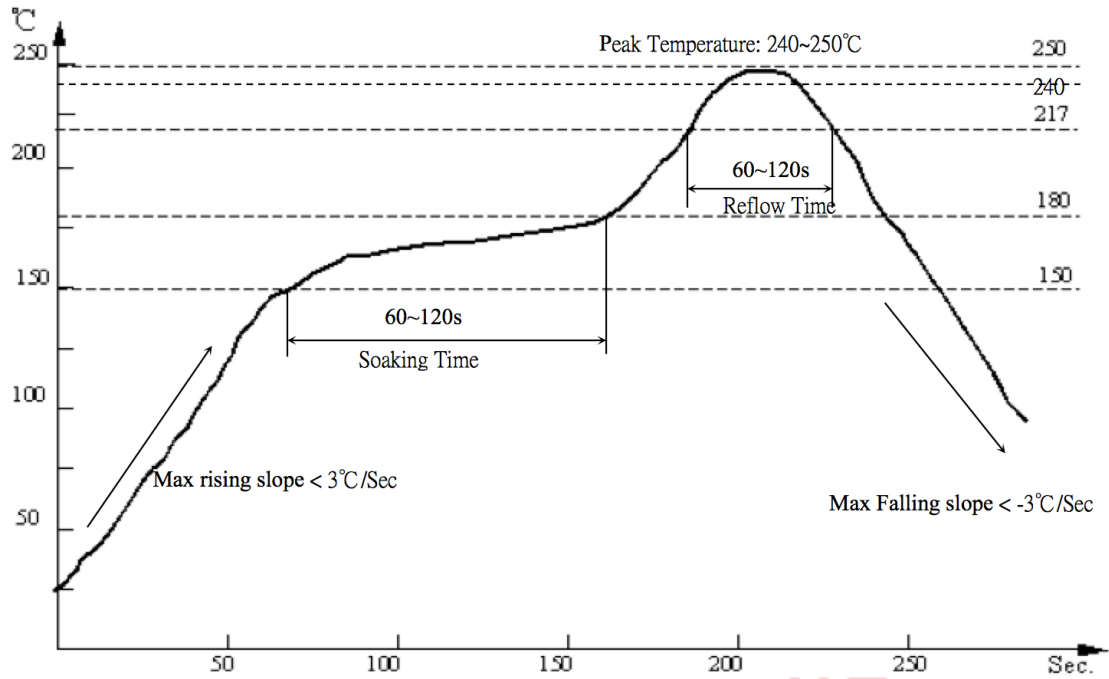


Figure 8. Temperature Curve

6. Reference Circuit

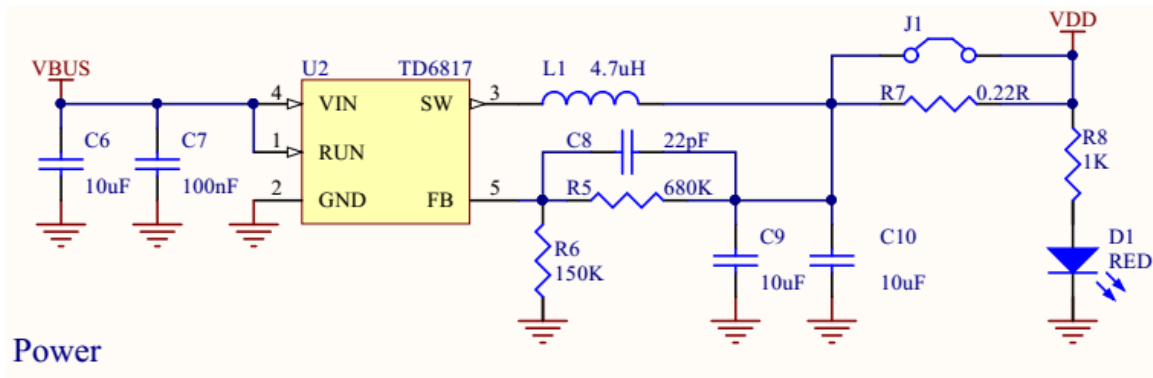


Figure 9. Power reference circuit

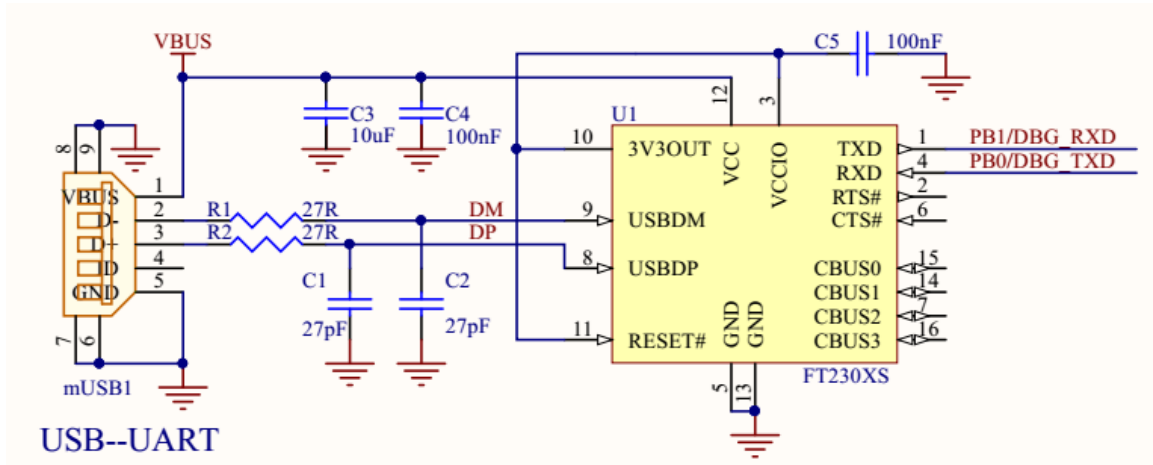


Figure 10. USB to serial reference circuit

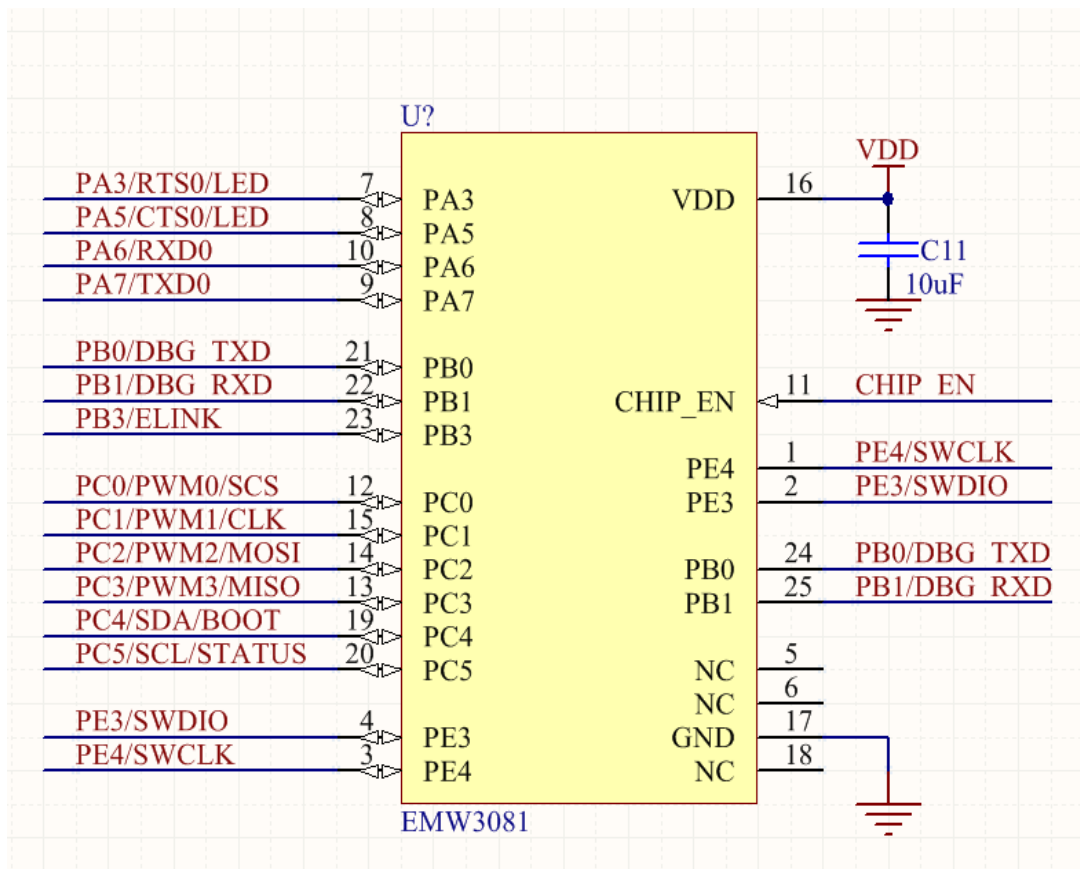


Figure 11. EMW3081 reference circuit

7. 5V UART- 3.3V UART conversion reference circuit

EMW3081 UART is 3.3V UART. If UART of user's chip is 5V, it is necessary to convert UART from 5V to 3V so that it can communicate with EMW3081. Please refer to Figure 14 for the conversion circuit.

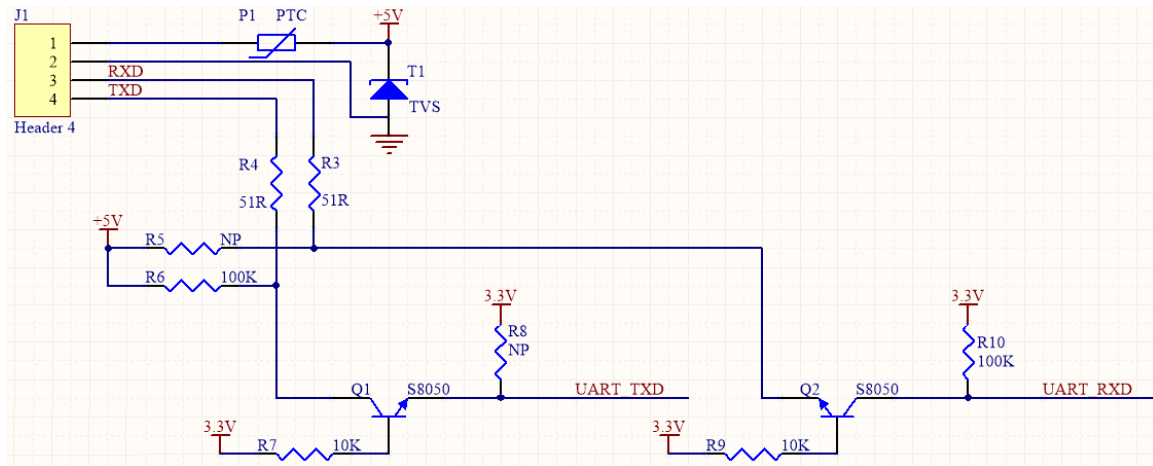


Figure 12. 5V UART- 3.3V UART conversion reference circuit

8. Sales Information and Technical Support

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9. Version history

Date	Version	Update
2015-9-11	0.1	Initial version
2015-9-21	0.2	1. Update "Product Overview " and "Features" 2. Update Section 1
2015-10-28	0.9	Change module part number to EMW3081. Pre-release
2015-12-21	1.0	1. Update operating voltage and power consumption. 2. Add NC pins 3. Update schematic 4. Update hardware block diagram
2017-8-17	1.1	Update module height and side view picture