MXCHIP®

Datasheet

EMB1082 BLE Module

Built-in ultra-low Cortex-M4F BLE MCU
BT 5.0 core specification, ultra-high integration,
rich peripherals, environment for high temperature

version：2.3　　Date：2022-09-28　　Number: DS0135CN

Abstract

- **Input Voltage：1.8V~3.3V**
- **Operating Temperature：** -40℃ to +105℃
- **Processor：ARM Cortex-M4 Processor Core**
  - Main Frequency up to 40MHz (basic edition)
  - Main Frequency up to 40MHz (advanced edition)
  - SWD/JTAG simulation debugger interface
- **Memory**
  - 160K bytes SRAM
  - 4Kbits eFuse
  - 512 bytes Flash
- **Bluetooth Basic feature**
  - Support BT 5.0 core specification
  - Max RF data rate: 1Mbps
  - Max TX power: 7dBm
  - RX Sensitivity: -96 dBm
  - Support GAP, ATT/GATT, SMP, L2CAP
  - Support Bluetooth Mesh
- **Bluetooth Advanced feature**
  - Include basic edition Bluetooth feature
  - Max RF date rate: 2Mbps
  - Support Bluetooth feature: Advertising Extensions
  - Support Bluetooth feature: Long Range Mode
  - Ultra BLE feature, supporting a variety of BLE status
- **Rich Peripherals**
  - 17 x GPIO，Key Scan
  - 2 x SPI，2 x I2C, 2 x UART
  - 8 x PWM，8 x Timer
  - 8 x Comparators
  - IR transceiver
  - 400ksps, 12bit, 4 channel ADC
  - Low power RTC

- **Interface and Dimension**
  - Maintain pin compatibility with similar package modules
  - RF Interface: PCB antenna, or IPEX connector antenna
  - 16mm x 24mm, stamp hole or pin
- **Application Functions**
  - Support AliOS and MXOS operating system
  - Support Tmall Genie Bluetooth mesh access
  - Support MXCHIP VBS9010 Smart Home Genie Bluetooth Mesh access
  - Mass production firmware for typical applications
- **Typical applications**
  - smart home appliances
  - switch panel
  - Especially suitable for lighting applications, high temperature resistant
- **Ordering Code**

Ordering Code	Note
EMB1082-P	Basic Edition, PCB Antenna
EMB1082-E	Basic Edition, IPEX connector
EMB1082-PG7A	Advanced., PCB Antenna
EMB1082-EG7A	Advanced, IPEX connector

Ordering Code

For example, **EMB 1 08 2 -P G 7 A -XXX**

Product Series

EMW=IoT Wi-Fi Module

Product Type

1=Welding type wireless module

Typical target applications and features

08=IOT Application 8 Series

Dimensions, enhancements

16mm x 24mm, 2 x 8pin 2.0 Spacing double row stamp hole or pin

RF Interface

P=2.4GHz On-Board PCB Antenna

E=2.4GHz External Antenna IPEX Connector

Flash capacity（omit）

G = 512K bytes Flash

Operation temperature(omit)

7 = Industrial temperature range, -40°C~105°C

Master serial

A = advanced edition

Option

TR = tape and reel（default package is tray）

For a list of all relevant features (such as packaging, minimum order quantity, etc.) and other information, please contact the nearest MXCHIP sales point and agent.

Accessories

Order Code	Description
MXKIT-Base	Development board for all EMB1082 modules
MXKIT-Core-1082	The development board core board for the EMB1082, used with MXKIT-Base
FX-1082	EMB1082 production fixture with accompanying test board：MXKIT-Base, MXKIT-Core-1082

Version Update Instructions

Date	Version	Update Contents
2018-10-23	1.0	Initial Version
2019-03-25	1.1	Update power consumption parameters
2020-04-03	2.0	Updated content to MXCHIP new documentation standards
2020-04-16	2.1	Update package information
2021-12-15	2.2	Update dimensions
2022-09-28	2.3	Add advanced edition module parameters

Copyright Notice

Catalog

Table Catalog

Figure Catalog

1. Introduction

EMB108x series modules are mainly used in IoT data communication. Through the rich peripheral interface to achieve data acquisition and control, and through the built-in Bluetooth controller to communicate with other Bluetooth devices, not only can directly interact with cell phones, but also through the gateway to access data to the IoT cloud service platform. This series of modules are used in a wide range of IoT products through a variety of different form factors, interface forms, and antenna interfaces.

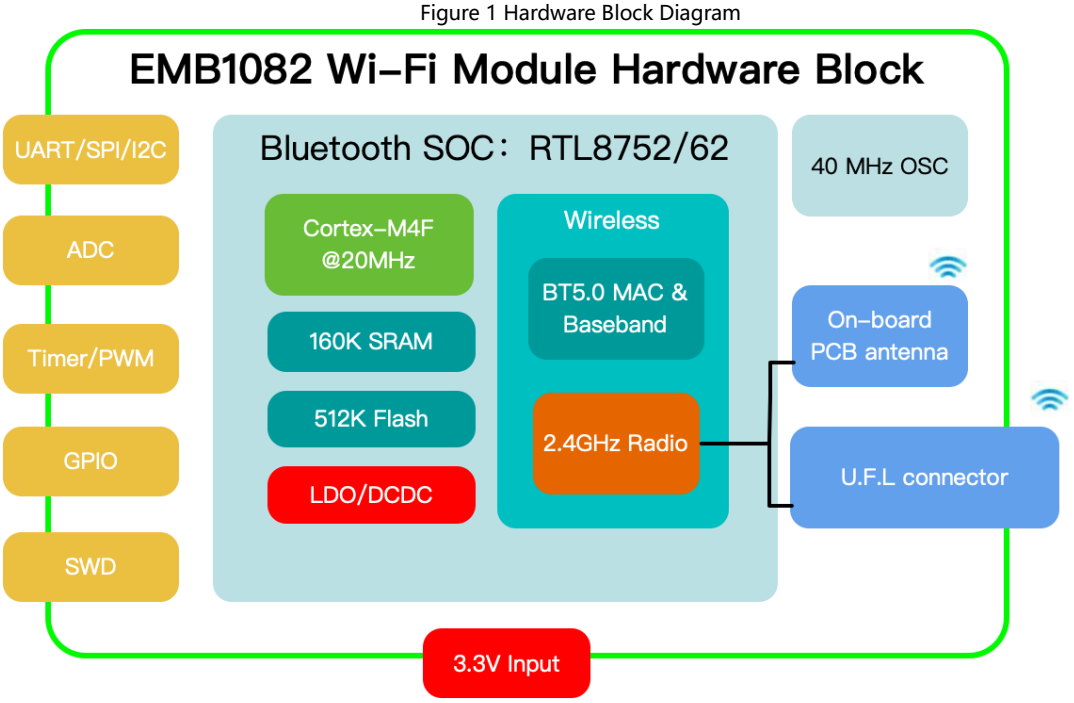
The EMB1082 module is built with an ultra-high integration Bluetooth microcontroller, RTL8752 or RTL8762, which integrates a Cortex-M4F core at up to 40MHz, 160K bytes of SRAM, 512K bytes of Flash storage, and a Bluetooth controller that supports the Bluetooth 5.0 core specification. The processor supports multiple low power modes for Bluetooth beacon, tag, sensor, button and other applications. The module provides both pin and stamp hole interface for flexible installation. The module uses high temperature resistant components and white PCB ink, suitable for application in high temperature lighting scenarios.

Shanghai MXCHIP provides MXOS software platform to support the development of EMB1082 series modules, providing efficient development environment, including Tmall Genie access protocol, MXCHIP VBS9010 (Smart Home Genie) Bluetooth mesh system access SDK, and various sample programs and typical applications.

The following figure shows the hardware block diagram of the EMB1082 module, which mainly includes

- Bluetooth microcontroller RTL8752/RTL8762
- On-board antenna, or IPEX external antenna connector
- Power and communication interface
- Built-in high temperature crystal

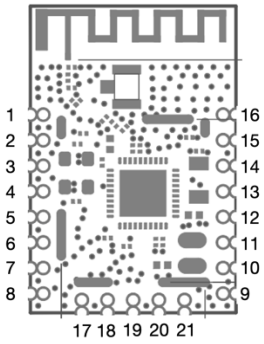
Figure 1 Hardware Block Diagram



2. Pin Definition

2.1. Pin Arrangement

Figure 2 Pin Arrangement



2.2. Pin Definition

Table 1 Pin definition

Pin Number	Name	Type (1)	Default Function	GPIO(3)	ADC	Note
1	RESET	I				Hardware reset pin, active low
2	P2_5	IO	-	GPIO_21	ADC_5	
3	NC		-			
4	P4_3	IO	-	GPIO_31		
5	P4_2	IO	-	GPIO_30		
6	P4_1	IO	-	GPIO_29		
7	P4_0	IO	-	GPIO_28		
8	V_{BAT}	S	-			
9	VSS	S	-			
10	P3_2	IO	-	GPIO_26		
11	P0_3	IO	LOG_UART TX			Used to output debug information, do not use it for other functions. The default internal pull-up, but if the pin is grounded and then powered up or reset the module, both can make the module enter serial burn-in mode.
12	32K_XI	A/IO	-	GPIO_26		No 32K crystal installed, used as
13	32K_XO	A/IO	-	GPIO_27		No 32K crystal installed, used as
14	P2_4	IO		GPIO_20	ADC_4	
15	P3_1	IO	UART_RX			After using LOG_UART TX to put the module into serial burn mode, it can
16	P3_0	IO	UART_TX			
17	P0_5	IO	-	GPIO_5		
18	P1_0	IO	SWD_IO			Used for emulation debugging, burning firmware.
19	P1_1	IO	SWD_CLK			

20	P0_1[2]	IO	-	GPIO_0		
21	P0_0[2]	IO	-	GPIO_1		

(1). S indicates power supply pins, I/O indicates GPIO pins, A identifies analog pins.

(2). Inside the module, if the firmware provided by MXCHIP is burned, the firmware detects the pin level and enters a specific operating mode when the module is booted.

- QC mode: the user serial port outputs the module's self-test information for production verification
- ATE mode: ATE command can be sent through the user serial port for testing RF parameters.

All specific modes of operation and access for the module are shown in Table 2.

Table 2 Module operating mode selection

Firmware operation mode	P0_3 (LOG_UART_TX)	P0_1	P0_0
	Default state: 1	Default state: 1	Default state: 1
Normal	1	x	1
ISP	0	x	x
ATE	1	0	0
QC	1	1	0

All GPIO functions can be configured to various functions with the built-in multi-switch (PINMUX), Error! bookmark self-reference is invalid. All configurable functions are shown.

Table 3 IO interface multiple function

0	IDEL	25	reserved	50	SPIO.CLK (master only)	75	KEY COL 17
1	reserved	26	reserved	51	SPI0 MO (master only)	76	KEY-COL 18
2	reserved	27	UART2_TX	52	SPI0_MI (master only)	77	KEY_COL_19
3	reserved	28	UART2_RX	53	SPI2W_DATA (master only)	78	KEY_ROW_0
4	reserved	29	UART1_TX	54	SPDW_CLK (master only)	79	KEY_ROW_1
5	I2C0 CLK	30	UART1 RX	55	SPI2W.CS (master only)	80	KEY ROW 2
6	I2C0 DAT	31	UART1_CTS	56	reserved	81	KEY_ROW_3
7	I2C1 CLK	32	UART1 RTS	57	reserved	82	KEY ROW 4
8	I2C1_DAT	33	IRDA_TX	58	KEY_COL_0	83	KEY_ROW_5
9	PWM2_P	34	IRDA RX	59	KEY COL 1	84	KEY ROW 6
10	PWM2_N	35	UART0 TX	60	KEY COL 2	85	KEY ROW 7
11	PWM3_P	36	UART0 RX	61	KEY COL 3	86	KEY ROW 8
12	PWM3-N	37	UART0_CTS	62	KEY_COL_4	87	KEY_ROW_9
13	PWM0	38	UART0_RTS	63	KEY_COL_5	88	KEY_ROW_10
14	PWM1	39	SPI1_SS_N_0 (master only)	64	KEY_COL_6	89	KEY_ROW_11
15	PWM2	40	SPI1_SS_N_1 (master only)	65	KEY COL 7	90	DWGPIO
16	PWM3	41	SPI1_SS_N_2 (master only)	66	KEY_COL_8		
17	PWM4	42	SPI1 CLK (master only)	67	KEY COL 9		
18	PWM5	43	SPI1_MO (master only)	68	KEY_COL_10		
19	PWM6	44	SPI1_MI (master only)	69	KEY_COL_11		
20	PWM7	45	SPI0_SS_N_0 (slave)	70	KEY_COL_12		
21	reserved	46	SPI0_CLK (slave)	71	KEY COL 13		

22	reserved	47	SPI0_SO (slave)	72	KEY_COL_14		
23	reserved	48	SPI0 SI (slave)	73	KEY COL 15		
24	reserved	49	SPI0_SS_N_0 (master only)	74	KEY_COL_16		

3. Electrical Parameter

3.1. Absolute Maximum Parameters

Operation of the module outside of its absolute maximum ratings may result in permanent damage. At the same time, long-term exposure to the maximum rated conditions will affect the reliability of the module.

Table 4 Absolute Maximum Parameter: Voltage

Symbol	Note	Min	Max	Unit
V_{BAT}–V_{SS}	Voltage	–0.3	3.6	V
V_{IN}	Input voltage on any other pin	V_{SS}–0.3	V_{BAT}+0.3	V

3.2. Operating Voltage and Current

Table 5 Operating parameters: rated voltage and current (Basic edition)

Symbol	Note	Conditions	Specification			
			Min.	Typical	Max.	Unit
V_{BAT}	Voltage		1.8	3	3.3	V
I_{VBAT}	Power down	V_{BAT}=3V		450		nA
I_{VBAT}	Deep LPS	V_{BAT}=3V		2.5		μA
I_{VBAT}	RX Current	V_{BAT}=3V		14.6		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 0dBm		15.6		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 4dBm		18.8		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 7.5dBm		21.8		mA

Table 6 Operating parameters: rated voltage and current (Advanced editon)

Symbol	Note	Conditions	Specification			
			Min.	Typical	Max.	Unit
V_{BAT}	Voltage		1.8	3	3.3	V
I_{VBAT}	Power down	V_{BAT}=3V		450		nA
I_{VBAT}	Deep LPS	V_{BAT}=3V		2.5		μA
I_{VBAT}	RX Current	V_{BAT}=3V		7.3		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 0dBm		7.9		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 4dBm		9.6		mA
I_{VBAT}	TX Current	V_{DD}=3.3V，TX power: 7.5dBm		11.3		mA

3.3. General I/O interface

Table 7 DC current: digital I/O

Symbol	Note	Conditions	Specification			
			Min.	Typical	Max.	Unit
V_{IH}	Input high voltage	V_{BAT}=3.3V	2	3.3	3.6	V
V_{IL}	Input low voltage	V_{BAT}=3.3V	-	0	0.9	V
V_{OH}	Output high voltage	V_{BAT}=3.3V	2.97	-	3.3	V

Symbol	Note	Conditions	Specification			
			Min.	Typical	Max.	Unit
V_{OL}	Output low voltage	V_{BAT}=3.3V	0	-	0.33	V
R_{PH}, R_{PL}	Strong pull/weak pull	V_{BAT}=3.3V		10/100		KOhm
R_{PH}, R_{PL}	Strong pull/weak pull (P2_0~P2_7, P5_0)	V_{BAT}=3.3V		5/50		KOhm
I_O	driving capability				8	mA
I_{IH}	Input high current				0.1	μA
I_{IL}	Input low current				0.1	μA

3.4. Temperature

Table 8 Temperature and humidity parameters

Symbol	Ratings	Max	Unit
T_{STG}	Storage temperature	–55 to +125	℃
T_{work}	Ambient Operating Temperature	-40 to 105	℃

3.5. ESD

Table 9 Electrostatic discharge parameters

Symbol	Name	Name	Level	Max.	Unit
V_{ESD}(HBM)	Electrostatic discharge voltage (Human body model)	TA= +25 °C comply with JESD22-A114	2	2000	V
V_{ESD}(CDM)	Electrostatic discharge voltage (Discharge equipment model)	TA = +25 °C comply with JESD22-C101	II	500	

3.6. RF parameter

Table 10 RF basic parameter

Item	Specification
Operating Frequency	2.402~2.480GHz
Wireless Standard	Bluetooth 5.0 core specification
Modulation Type	GFSK
Data Rates	UnCoded PHY：1Mbps， UnCoded PHY：2Mbps (advanced edition support) Coded PHY：500 Kbps or 125 Kbps (advanced edition support)
Antenna type	One U.F.L connector for external antenna

	PCB printed antenna

Table 11 RF transmitted parameter

Test item	datarate	Channel Frequency		
		CH0 (2402MHz)	CH19 (2440MHz)	CH39 (2480MHz)
POWER_AVERAGE@7.5dBm	LE	6.2	6.5	6.3
Frequency Drift Error	LE	1.4	2.5	-3.05
Carrier frequency offset and drift at NOC				
$\|Fn\|_{max}$	LE	2.9	4.9	4.0
|F0-Fn|	LE	2.6	4.4	3.7
|F1-F0|	LE	0.3	2.3	0.65
|Fn-F(n-5)| (n=6,7,8...k)	LE	2.3	3.3	3.5
Modulation characteristics				
$\Delta F1_{avg}$	LE	248	242	249
$\Delta F2_{avg}$	LE	241	231	248
$\Delta F2_{avg}/\Delta F1_{avg}$	LE	0.97	0.95	0.99

Table 12 RF received parameter

RX Characteristics	Min.	Typical	Max.	Unit
Input Level Sensitivity (FER≦30.8%)		-96		dBm
Maximum Input Level (FER≦30.8%)	-	-1	-	dBm

4. Antenna Information

EMB1082 has two specifications: PCB antenna and external antenna, please refer to the order code for order. IPX antenna connectors are not soldered on the modules using PCB antennas. By connecting an external antenna through an IPX connector, you can get better RF performance.

4.1. PCB antenna parameters and use

4.1.1. On-board PCB parameter

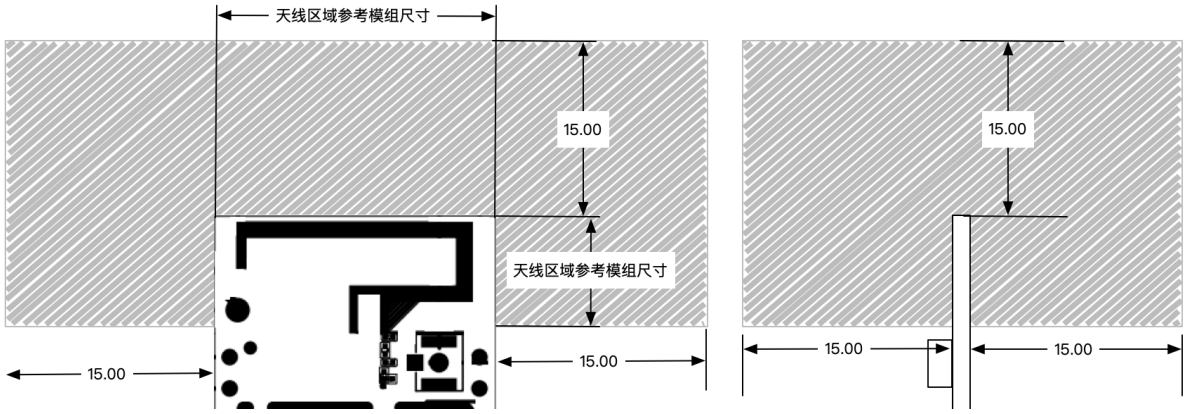
Table 13 On-board PCB parameter

Item	Min.	Typical	Max.	Unit
Frequency	2400		2500	MHz
Impedance		50		Ω
VSWR			2	
Gain	≤2dBi			
Efficiency	>54% or >-2.68dB			

4.2. PCB Antenna Clearance

When using PCB antenna in WIFI module, it is necessary to ensure that PCB and other metal devices are at least 16 mm away from the motherboard. The shaded areas in the figure below need to be far away from metal devices, sensors, interference sources and other materials that may cause signal interference.

Figure 3 Antenna minimum clearance area (unit: mm)

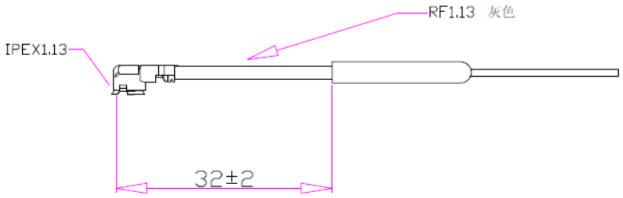


4.3. External antenna parameters and use

Users can choose different 2.4G antennas with different external dimensions and gains not greater than 2dBi according to the application environment.

The following is a copper tube antenna with an IPEX connector commonly used by MXCHIP:

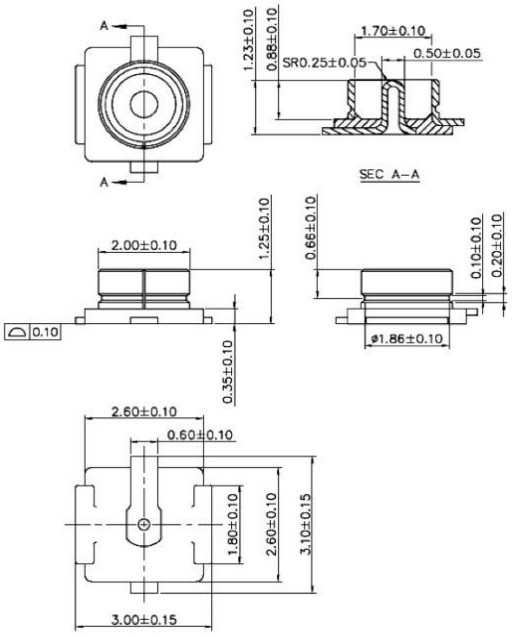
Figure 4 Copper tube antenna size



- Frequency range: 2400-2500 MHz
- Input impedance: 50 OHM
- VSWR: < 2.0
- Gain：2.0DBI
- Polarization: vertical
- Directivity: Omnidirectional
- Copper tube: 4.4 * 23mm
- Wire: 1.13 gray wire L-82mm

External antenna IPEX seat size:

Figure 5 Dimension drawing of external antenna connector

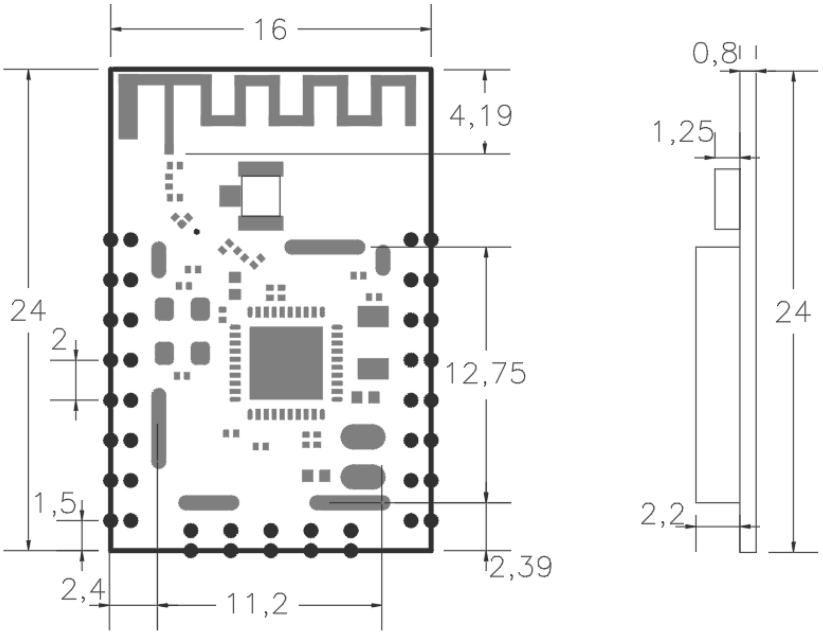


5. Dimensions and Production Guidance

5.1. Assembly Dimension Diagram

The EMB1082 has two rows of 8pin pins and one row of 5pin pins for a total of 21pins, the pins are combined in a stamped hole and pin package with a pin spacing of 2.0mm.

Figure 6 Dimension diagram (unit: mm, torlerance: ±0.1, outside: +0.2)



5.2. Recommended package diagram

It is recommended that SMT pads extend 0.3mm outward and SMT recommended stencil thickness 0.12mm-0.14mm.

Figure 7 DIP packaging dimension diagram (unit: mm, torlerance: ±0.1, outside: +0.2)

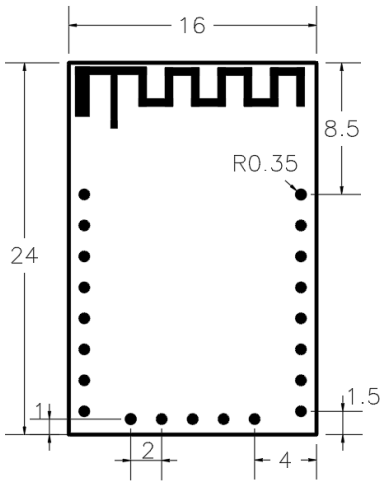
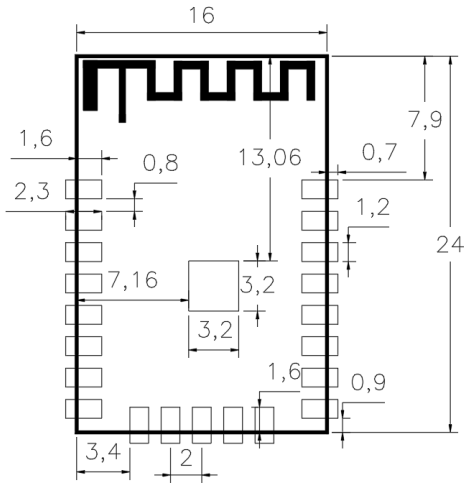


Figure 8 Stamp hole packaging dimension diagram (unit: mm, torlerance: ±0.1, outside: +0.2)



6. Production Guidelines

MXCHIP stamp port packaging module must be SMT machine patches, module humidity sensitivity grade MSL3, after unpacking more than a fixed time patches to bake module.

- SMT patches require instruments
  - Reflow bonding machine
  - AOI detector
  - 6-8mm suction nozzle
- Baking requires equipment:
  - Cabinet oven
  - Anti-static, high temperature tray
  - Antistatic and heat resistant gloves

The storage conditions of MXCHIP module are as follows:

- Moisture-proof bags must be stored in an environment with temperature < 30 degree C and humidity < 85% RH.
- A humidity indicator card is installed in the sealed package.

Figure 9 Humidity Card

After the module is split, if the humidity card shows pink, it needs to be baked.

The baking parameters are as follows:

- The baking temperature is 120℃±5℃ and the baking time is 4 hours.
- The alarm temperature is set to 130℃.
- SMT patches can be made after cooling < 36℃ under natural conditions.
- Drying times: 1 time.
- If there is no welding after baking for more than 12 hours, please bake again.

If the disassembly time exceeds 3 months, SMT process is forbidden to weld this batch of modules, because PCB gold deposition process, over 3 months, pad oxidation is serious, SMT patch is likely to lead to virtual welding, leak welding, resulting in various problems, our company does not assume the corresponding responsibility.

Before SMT patch, ESD (Electrostatic Discharge, Electrostatic Release) protection should be applied to the module.

SMT patches should be made according to the reflow curve. The peak temperature is 250℃.

In order to ensure the qualified rate of reflow soldering, 10% of the first patches should be taken for visual inspection and AOI testing to ensure the rationality of furnace temperature control, device adsorption mode and placement mode, and 5-10 patches per hour are recommended for visual inspection and AOI testing in subsequent batch production.

6.1. Precautions

- Operators of each station must wear static gloves during the entire production process.
- Do not exceed the baking time when baking.
- It is strictly forbidden to add explosive, flammable, or corrosive substances during baking.
- When baking, the module uses a high temperature tray to be placed in the oven to keep the air circulation between each module while avoiding direct contact between the module and the inner wall of the oven.
- When baking, please close the oven door to ensure that the oven is closed to prevent temperature leakage and affect the baking effect.
- Try not to open the door when the oven is running. If it must be opened, try to shorten the time for opening the door.
- After baking, the module should be naturally cooled to <36°C before wearing the static gloves to avoid burns.
- When operating, strictly guard against water or dirt on the bottom of the module.

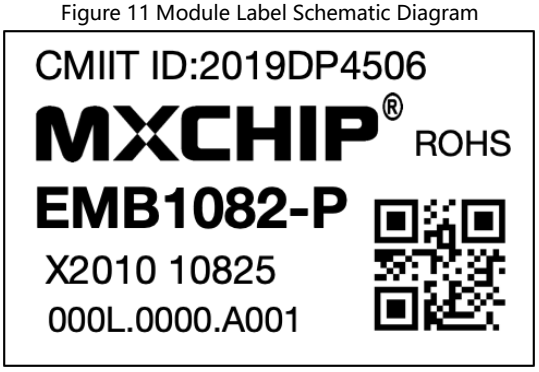
The temperature and humidity control level of MXCHIP factory module is Level3, and the storage and baking conditions are based on IPC/JEDEC J-STD-020.

6.2. Storage Condition

Figure 10 Storage Conditions Diagram

7. Label Information

Figure 11 Module Label Schematic Diagram



1. MXCHIP: Company Logo.
2. CMIIT ID: SRRC Model Authorization ID
3. Product Module: EMB1082-P
4. X2010: Production serial number
5. 10825: Product code
6. 000L.0000.A001: Firmware Number.
7. QR code: MAC Address.

Note: Due to production batches and versions, etc., the above label schematics are for reference only, please refer to the actual product.

Appendix: Sales and Technical support Information

If you need to consult or purchase this product, please call Shanghai MXCHIP Information Technology Co., Ltd. during office hours.

Office hours: Monday to Friday morning: 9:00-12:00, afternoon: 13:00-18:00

Contact Tel: +86-21-52655026

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Zip code: 200333

Email: sales@mxchip.com