X-C13SM datasheet v1.0

Based on RISC-V SOC

Support Wi-Fi (802.11b/g/n) and BLE5.0 Wireless Standards

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1 Module Overview

1.1 Features

MCU

- 32-bit RISC-V single-core processor
- 160 MHz CPU
- 276 KB RAM
- 128 KB ROM
- 1 Kb eFuse

Wi-Fi

- IEEE 802.11 b/g/n-compliant
- Center frequency range of operating channel:2400MHz-2483.5MHz
- Supports 20 MHz bandwidth in 2.4 GHz band
- Transmit Power（Max 17dBm）
- Modulation method（DSSS、OFDM）
- 1T1R mode with data rate up to 150 Mbps
- Security Mechanisms（WEP/WPA-PSK/ WPA2-PSK/WPA3-SAE）
- Encryption（WEP64/WEP128/TKIP/AES）
- Support Wi-Fi STA/AP Mode
- Support UART Data Communication with Wi-Fi or BLE
- Support AP-Link and BLE-LINK Config
- Support Wireless and Remote Firmware Upgrade Function
- Support Software SDK for Develop
- Support PCB /IPEX Antenna Option

BLE

- BLE 5.0
- Center frequency range of operating channel:2400MHz-2483.5MHz
- Transmit Power（Max 8dBm）
- Receiver Sensitivity（-97 dBm）
- Advertising extensions

Hardware

- Peripherals: GPIO、SPI、UART、ADC、DAC、IR、LED、 PWM
- Support XTAL 24/32/38.4/40MHz
- 2MB SPI flash
- Operating voltage/Power supply：2.7~3.6 V
- Operating ambient temperature:
  Operating Temp: -40~85° C
  Storage Temp: -40~105° C
  Humidity/MSL: <85% / Level 3
- Operating Current:
  Peak (1ms for every 100ms): <350mA
  Average (STA, No data): 45mA
  Average (STA, Continuous TX): 60mA
  Average (AP): 70mA
  Standby: 310uA(Reset Pin set to low)
- Size： Figure 3

1.2 Description

X-C13SM is a fully self-contained small form-factor, single stream, 802.11b/g/n Wi-Fi and BLE baseband/MAC designs, which provide a wireless interface to any equipment with a serial or other interface for data transfer.

X-C13SM integrate MAC, base band processor, RF transceiver in hardware and all Wi-Fi protocol and configuration functionality and networking stack, embedded firmware to make a fully self-contained solution for a variety of applications.

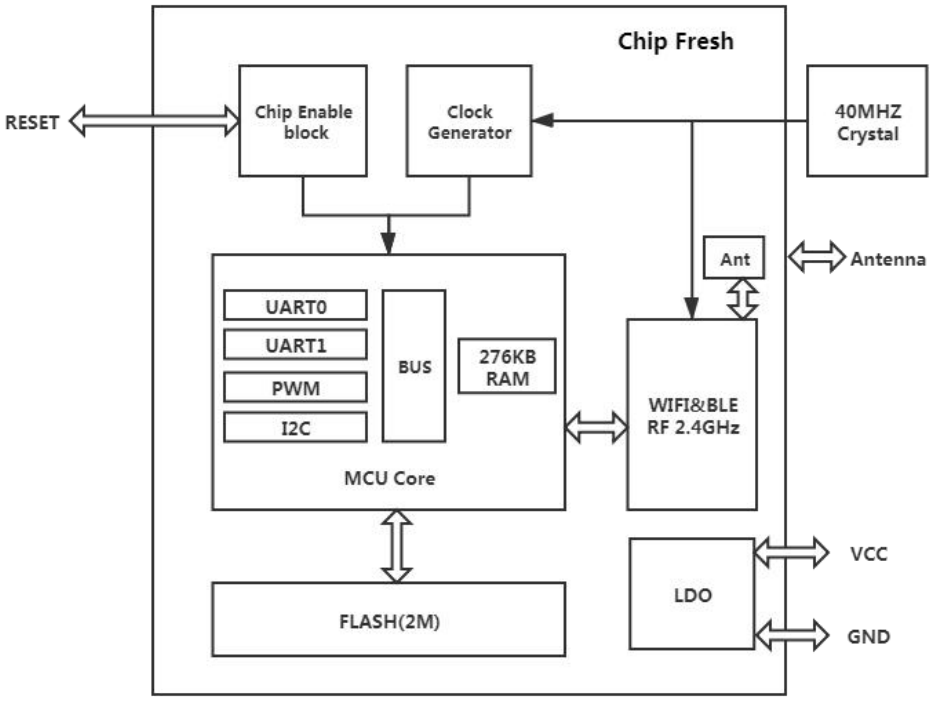

Figure 1. Block Diagram

1.3 Applications

- Light control
- Smart plug
- Industrial control
- Industrial sensors and controls
- Health Care
- Consumer Electronics
- Smart Agriculture
- Retail and Catering

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HISTORY

V 1.0	10-05-2021	First Version.

2 Hardware Introduction

2. 1 Pin Layout

- X-C13SM comes with a on-board PCB antenna, please refer to Figure 2.

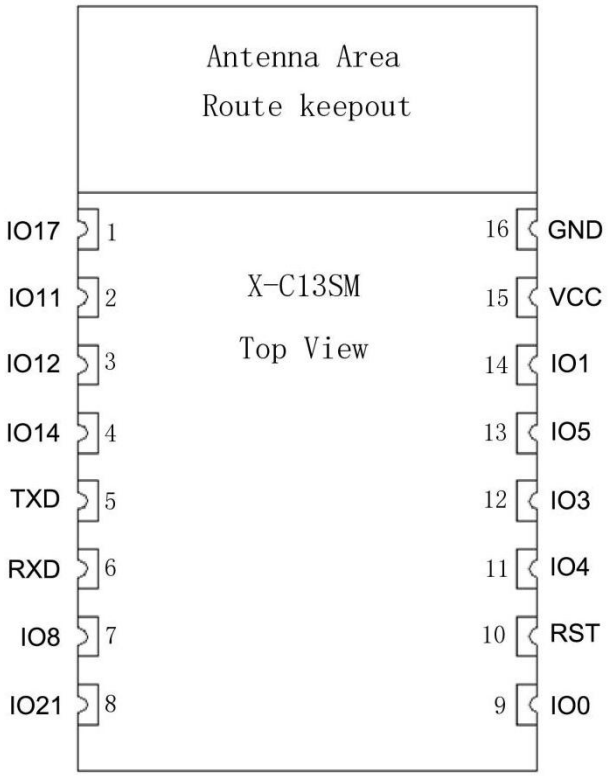


Figure 2. X-C13SM Pin Layout (Top View)

2. 2 Pin Description

The module has 16 pins. See pin definitions in Table 1.

Pin	Describtion	Type	Function
1	GPIO17	O	3.3V TTL UART1 Debug Output DEBUG-TX
2	GPIO11	I	3.3V TTL UART1 Debug Input DEBUG-RX
3	GPIO12	I/O	SPI,PWM,ADC
4	GPIO14	IPU/O	SPI,DAC,ADC
5	GPIO16	O,PU	3.3V TTL UART0 Communication Output UART-TX
6	GPIO7	I	3.3V TTL UART0 Communication Input UART-RX

7	GPIO8	IPD	Internal 10K pull-down resistor, Boot select: Low: boot from module flash. High: boot from external UART. This is used for factory firmware program, leave it unconnected for user application
8	GPIO21	IPU/O	SPI,PWM
9	GPIO0	IPU/O	SPI,PWM
10	RESET	I,PU	“Low” effective reset input.
11	GPIO4 Ready	O	“0” – Boot-up OK; “1” – Boot-up Fail;
12	GPIO3 Factory	IPU	press this button (“Low” > 4s) and loose to make the module recover to factory setting.
13	GPIO5 Link	IPU/O	“0” – Wi-Fi connect to router “1” – Wi-Fi unconncted
14	GPIO1	IPU/O	SPI,PWM
15	+3.3V 3V3	P	The maximum output current of the external power supply is recommended to be above 500mA.
16	Ground	P	GND

Table1. Pins Definition

2. 3 Physical Dimensions

- X-C13SM-1&X-C13SM-0 Physical Dimensions (Unit: mm),please refer to Figure 3:

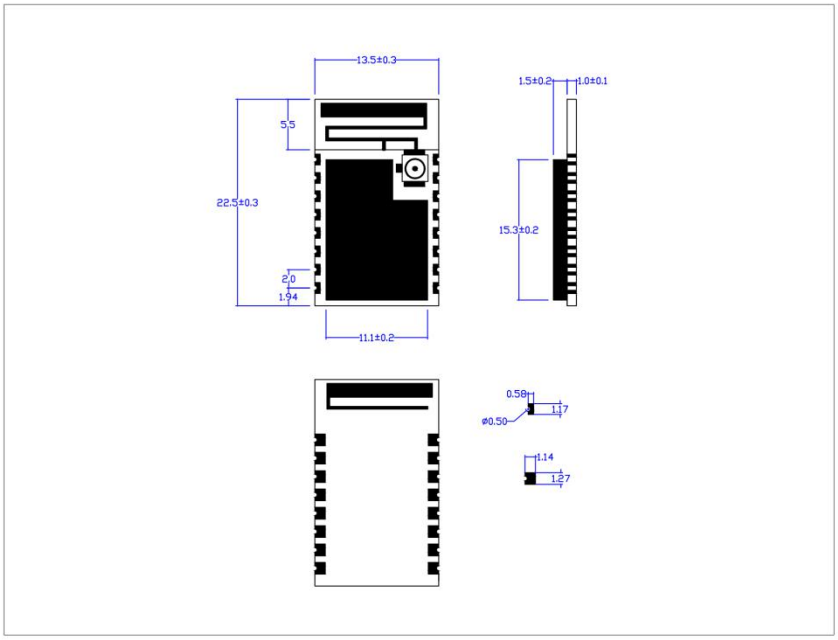


Figure 3. Physical Dimensions

2. 4 Ordering Information

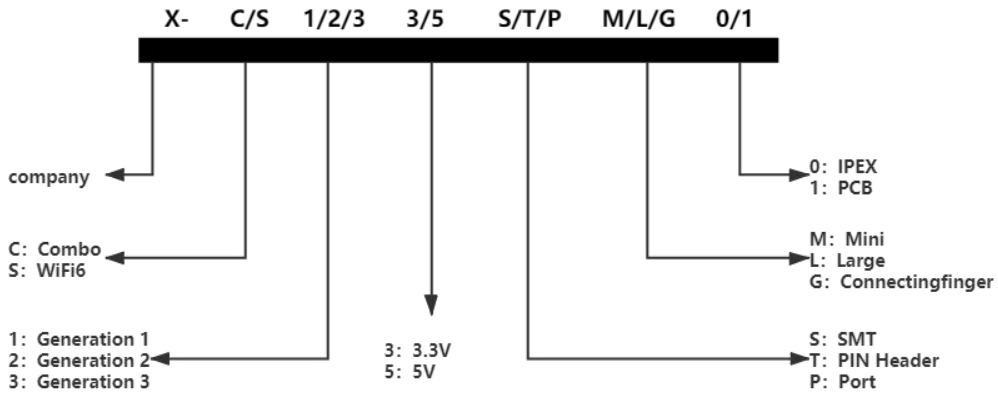


Figure 4. Ordering Information

2. 5 On-board Chip Antenna

X-C13SM-1 support internal on-board chip antenna option. When customer select internal antenna, you shall comply with following antenna design rules and module location suggestions:

- For customer PCB, module antenna area can't put componet or paste GND net;(See the following red arrow area)
- Antenna must away from metal or high components at least 20mm;
- Antenna can't be shieldedby any meal enclosure; All cover, include plastic, shall away from antenna at least 20mm;

suggest module better locate in following region at customer board, which to reduce the effect to antenna and wireless signal, and better consult ChipFresh technical people when you structure your module placement and PCB layout.

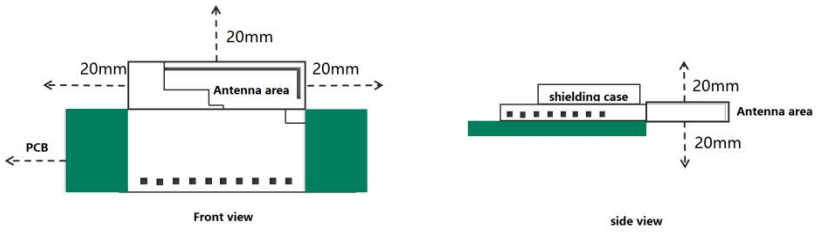


Figure 5. Suggested Module Placement Region

3 Dimensions of External Antenna Connector

X-C13SM-0 uses the first generation external antenna connector as shown in Figure 6.

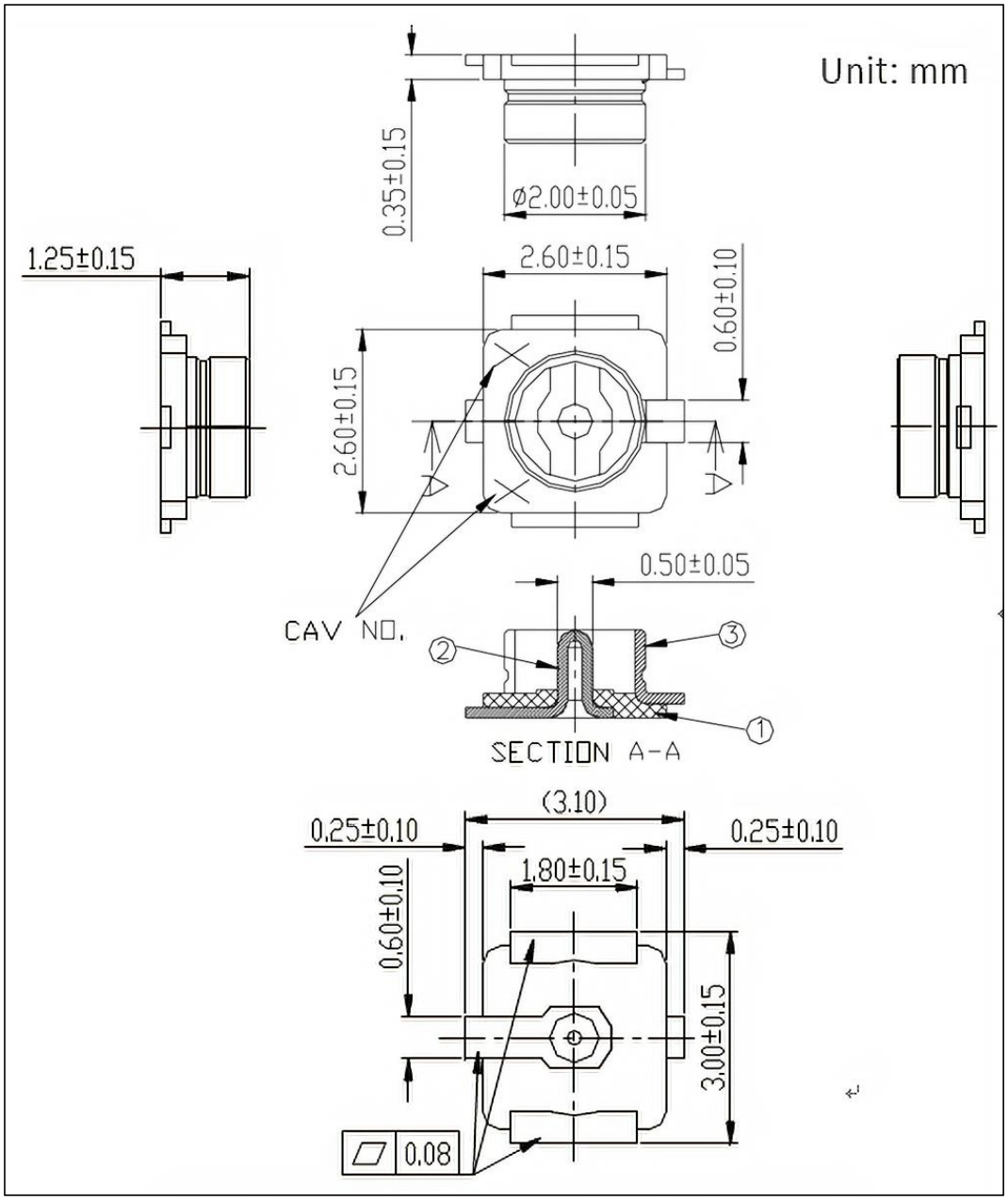


Figure 6. Dimensions of External Antenna Connector

4 Electrical Characteristics

4. 1 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Power supply voltage	VDD	-0.3	3.6	V
I/O PIN	-	-0.3	VDD+0.3	V
Storage temperature	-	-40	125	℃

Table2. Absolute Maximum Ratings

4. 2 Recommended Operating Conditions

Parameter	Symbol	Min	Type	Max	Unit
Power supply voltage	VDD	2.1	3.3	3.6	V
Operating ambient temperature	-	-40	-	85	℃

Table3. Recommended Operating Conditions

4. 3 ESD

Name	Description	Typ	Unit
ESD-HBM	Human body model class 2	+/- 2000	V
ESD-MM	Moisture sensitivity level	2	-
ESD-CDM	Charge device model	+/-500	V

Table4. ESD

4. 4 WiFi/BLE RF Standards

Class	Item	Parameters	Typ
Wi-Fi	Wireless standard	802.11 b/g/n	-
	Frequency range	2400MHz-2483.5MHz	-
	Transmit Power	802.11b@11Mbps	+17dBm ± 1.5dBm
		802.11g@54Mbps	+15dBm ± 1.5dBm
		802.11n@HT20, MCS7	+14dBm ± 1.5dBm
	Receiver Sensitivity	802.11b@1Mbps	-98dBm
		802.11b@11Mbps	-91dBm
		802.11g@6Mbps	-93dBm
		802.11g@54Mbps	-77dBm
		802.11n@MCS0	-93dBm
		802.11n@MCS7	-73dBm
BLE	Wireless standard	Bluetooth 5	-
	Frequency range	2400MHz-2483.5MHz	-
	Transmit Power	Max	8dBm
	Receiver Sensitivity	30.8% PER	-97 dBm

Table5. RF Standards

5 Peripheral Schematics

This is the typical application circuit of the module connected with peripheral components (for example, power supply, reset/factory button, led, and UART interface).

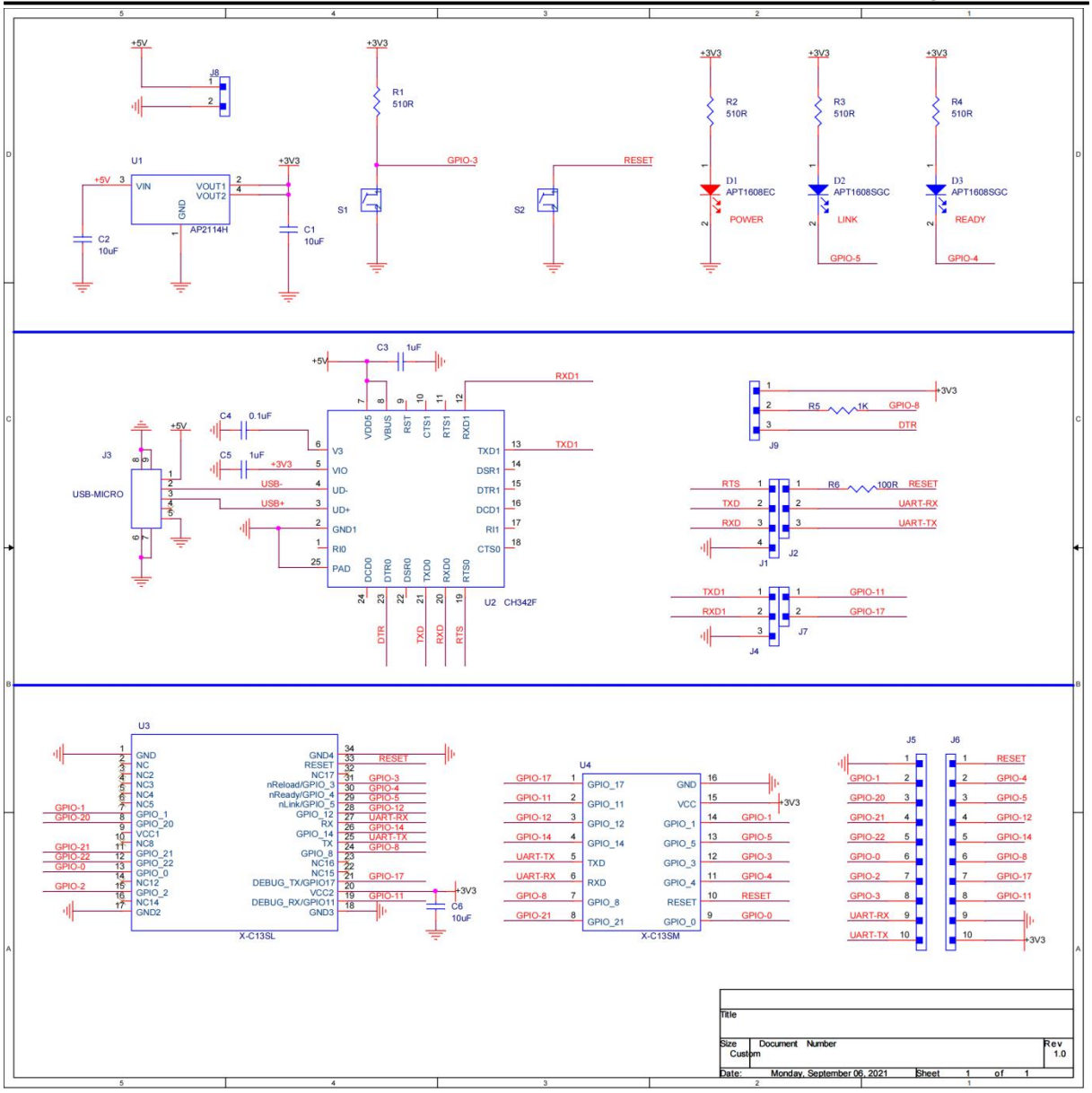
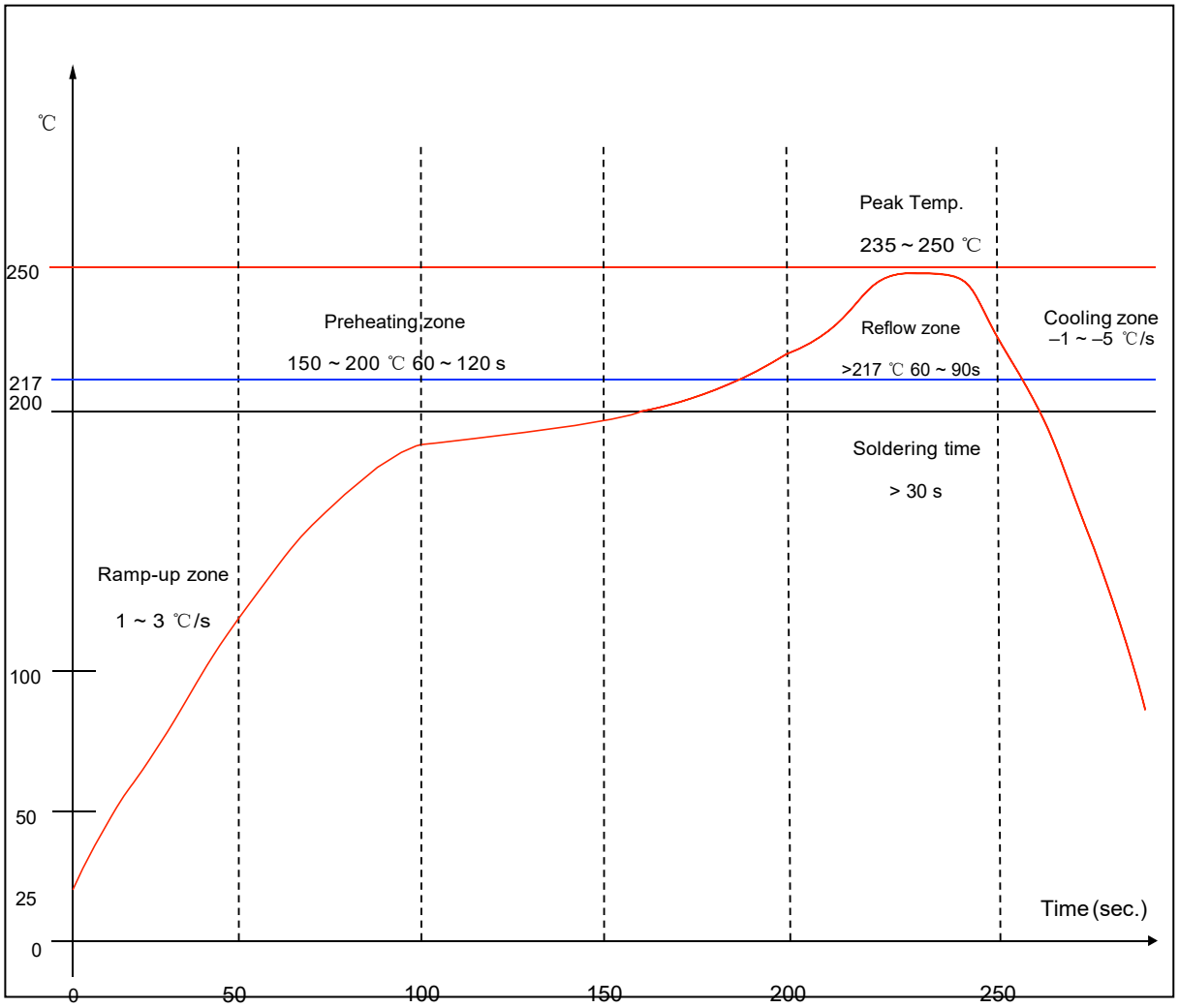


Figure 7. Peripheral Schematics

6 Product Handling

6. 1 Reflow Profile

Solder the module in a single reflow.



Ramp-up zone — Temp.: 25 ~ 150 ℃ Time: 60 ~ 90 s Ramp-up rate: 1 ~ 3 ℃/s

Preheating zone — Temp.: 150 ~ 200 ℃ Time: 60 ~ 120 s

Reflow zone — Temp.: >217 ℃ 7LPH: 60 ~ 90 s; Peak Temp.: 235 ~ 250 ℃ Time: 30 ~ 70 s

Cooling zone — Peak Temp. ~ 180 ℃ Ramp-down rate: –1 ~ –5 ℃/s

Solder — Sn-Ag-Cu (SAC305) lead-free solder alloy

Figure 8. Reflow Profile

6. 2 Storage Conditions

- Shelf life in sealed bag: 12 months, at <30℃ and <60% relative humidity (RH).
- Recommend to store at ≦10% RH with vacuum packing.
- The module is rated at the moisture sensitivity level (MSL) of 3.

6. 3 Device Handling Instruction (Module IC SMT Preparation)

- Baked required with 24 hours at 125+-5℃ before rework process.
- After bag is opened, devices that will be re-baked required after last baked with window time 168 hours.
- Recommend to oven bake with N2 supplied
- Recommend end to reflow oven with N2 supplied
- If SMT process needs twice reflow:
  (1) Top side SMT and reflow (2) Bottom side SMT and reflow
  Case 1: Wifi module mounted on top side. Need to bake when bottom side process over 168 hours window time, no need to bake within 168 hours
  Case 2: Wifi module mounted on bottom side, follow normal bake rule before process
  Note: Window time means from last bake end to next reflow start that has 168 hours space.

6.4 FCC Statement

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. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

A transmitter with a modular grant can be installed in different end-use products (referred to as a host, host product,or host device) by the grantee or other equipment manufacturer.
A host product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion.
To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational.
Since this may depend on the details of how the module is integrated with the host,the grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer.
Such Guidance can be given by the installation instructions to the host manufacturer.
This document shall instruct / inform
• OEM integrators to ensure that the end user has no manual instructions to remove or install the device.
• OEM that it is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.
• OEM with details how the module is integrated with the host (the grantee shall provide guidance to the host manufacturer for compliance with the Part 15B requirements)
• OEM how the final product is to be labeled
• OEM about details for ensuring compliance due to limitations of the module (No own power regulation)
• OEM about details for ensuring compliance with RF exposure requirements and the associated usage conditions for mobile and fixed-mount equipment configurations as applicable

Label and compliance information

• Host product manufacturers need to provide a physical or e-label stating “Contains Transmitter Module
• FCC ID: 2A3M5-X-C13SM” with their finished product.

Antennas

Antenna Specification are as follows:
Model No. X-C13SM-0 External Antenna Gain: 3dBi
Model No. X-C13SM-1 PCB antenna Gain: 2dBi

7 Contact Information

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