芯海科技
CHIPSEA
Ticker Symbol: 688595

CSM92F42N

Datasheet

REV 1.1

Secret Level : Overt

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Revision History

Revision	Changes	Date
REV 1.0	Initial draft	2023/09/26
REV 1.1	Update the dimension information	2024/01/10

Contents

1. Module Overview

1.1 Description

The CSM92F42N module is a Bluetooth low power energy(Bluetooth LE) single-mode module based on the chip CST92F42 which designed by Chipsea. It supports all of Bluetooth standard 5.1 feature. It integrates Cortex™-M4F core, rich feature peripheral units, such as UART, ADC, I2S, SPI, I2C, DMA, Timer and so on. The module has the advantages of small size, low power consumption and high reliability, which is very suitable for IoT application scenarios such as industrial control, smart wearable devices, smart home, sports fitness, and so on.

The CSM92F42NIB module uses PCB onboard antenna, and the CSM92F42NIE module uses IPEX connector to connect the external antenna. The information provided in this document applies to both modules.

1.2 Features

- Basic features
  - ARM® Cortex™-M4 32-bit processor with FPU
  - Up to 512KB Flash, 64KB Data SRAM
  - Support OTA upgrade
- Bluetooth LE features
  - Support Bluetooth LE 5.1 standard
  - Operating frequency 2402~2480MHz
  - Four transmission speeds are supported
    - 1Mbps
    - 2Mbps
    - 500Kbps
    - 125Kbps
  - TX power -20 ~ +9dBm
  - Supports the CSA2# frequency hopping algorithm
- Power consumption
  - 2.8mA in running mode@32MHz
  - 3.3uA in deep sleep mode (64K RAM retention)
- Peripherals
  - Up to 16 general purpose GPIO
    - Pinmux freely configure all kinds of digital peripheral interface
    - All GPIO can be configured for wakeup and external interrupt
    - All GPIO output state can be retained in sleep mode
  - Rich digital peripherals such as 2*UART, 2*SPI, 3*I2C, I2S, 2*QSPI, 3*Timer and so on
  - 13-bits ADC, 7 single-end external input channel
  - Integrate 32MHz crystal
  - Support external 32.768KHz crystal to achieve high precision RTC
- Operating environment
  - Supply voltage range 1.8V~3.6V
  - Minimum supply current: 120mA
  - Operating temperature range: -40℃~85℃
- Package
  - SMT module
  - MSL3 level
  - Dimension: 10.5mm*16mm*2.3mm
- Certification
  - BQB
  - SRRC
  - CE
  - FCC
- Applications
  - Industrial control
  - Smart wearable devices
  - Smart home
  - IoT

1.3 Function Block Diagram

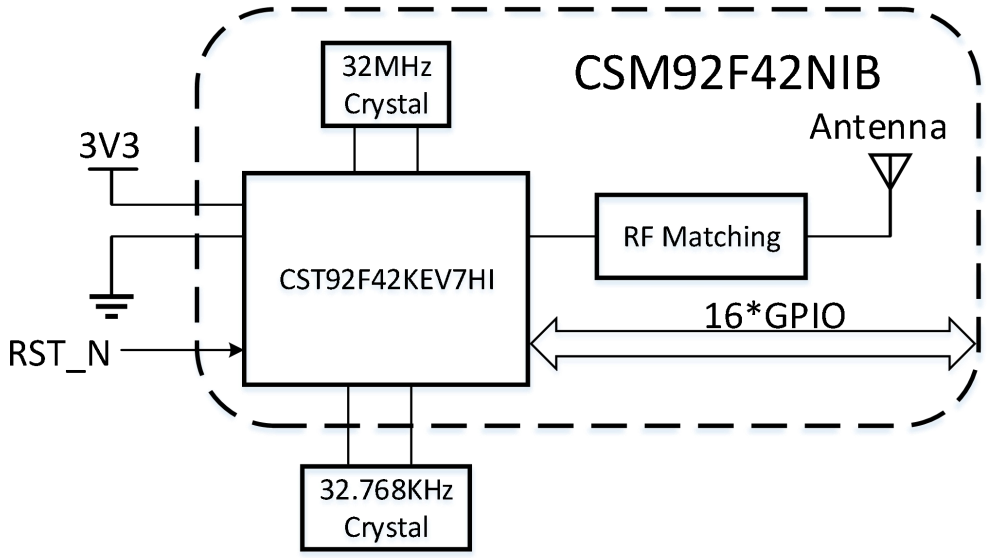

Figure 1.1 CSM92F42NIB module Function Block Diagram (PCB antenna)

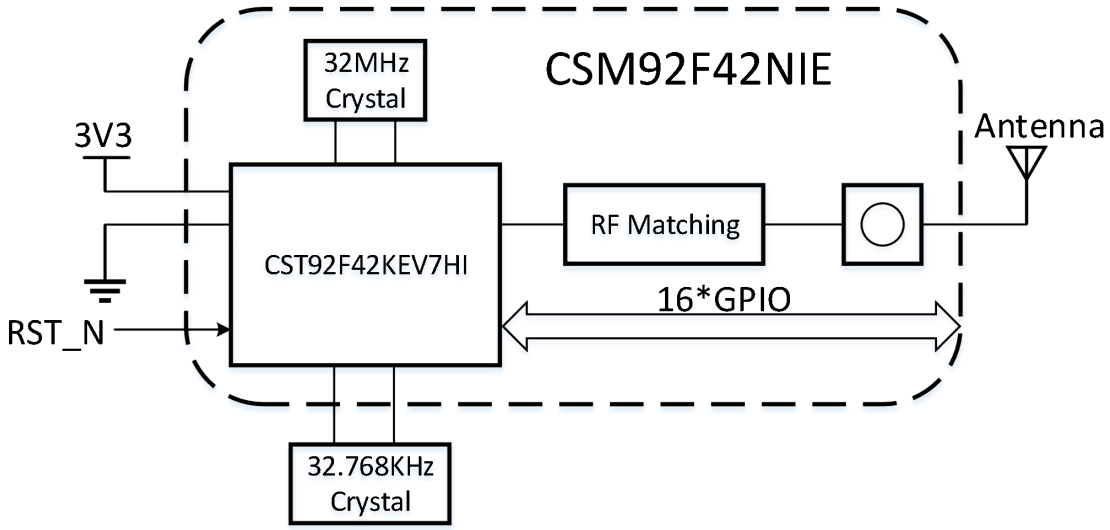

Figure 1.2 CSM92F42NIE module Function Block Diagram (IPEX external antenna)

2. Pin assignments

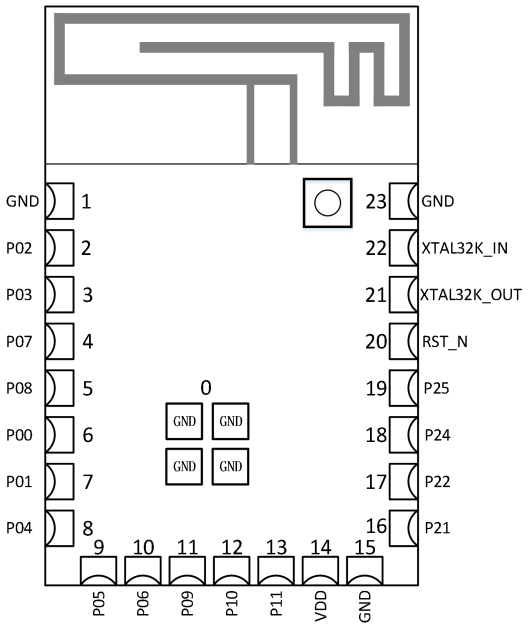

Figure 2.1 CSM92F42N module Pin assignments (Top View)

Pin No.	Pin name	Type	Description
0	GND	P	GND ground
1	GND	P	GND ground
2	P02	I/O	Digital GPIO 2
		AI	GPADC input 2
3	P03	I/O	Digital GPIO 3
		AI	GPADC input 3
4	P07	I/O	Digital GPIO 7
		AI	GPADC input 7
5	P08	I/O	Digital GPIO 8
		AI	GPADC input 0
6	P00	I/O	Digital GPIO 0
		I	SWD debug CLK
7	P01	I/O	Digital GPIO 1
		I/O	SWD debug data
8	P04	I/O	Digital GPIO 4
		I	ISP mode BOOT select pin, low level enter into ISP mode, default internal pull-up
9	P05	I/O	Digital GPIO 5

Pin No.	Pin name	Type	Description
		O	UART TX pin in ISP mode
10	P06	I/O	Digital GPIO 6
		I	UART RX pin in ISP mode
11	P09	I	Digital GPIO 9
		AI	GPADC input 1
12	P10	I/O	Digital GPIO 10
		AI	GPADC input 4
13	P11	I/O	Digital GPIO 11
		AI	GPADC input 5
14	VDD	P	Power supply 1.8V~3.6V
15	GND	P	GND ground
16	P21	I/O	Digital GPIO 21
17	P22	I/O	Digital GPIO 22
18	P24	I/O	Digital GPIO 24
19	P25	I/O	Digital GPIO 25
20	RST_N	I	Reset signal
21	XTAL32K_OUT	O	32K crystal oscillator output
22	XTAL32K_IN	I	32K crystal oscillator input
23	GND	P	GND ground

Table 2.1 CSM92F42N Pin Description

3. Electrical Specifications

3.1 Absolute Maximum Ratings

The module could be damaged by extra stress more than the absolute maximum ratings working conditions, please be sure the design follow this rule.

Ratings		Min	Max	Unit
Supply voltage(VDD)		-0.3	3.9	V
I/O pin voltage		-0.3	VDD	V
Output current sunk by I/O pin			18.6	mA
Output current source by I/O pin			18.6	mA
Total current into VDD power lines (source)			160	mA
Total current out of VSS ground lines (sink)			160	mA
Storage Temperature		-40	125	ºC
ESD	Human Body Mode	±2000	-	V
	Charge Device Mode	±1000	-	V
MSL			3	

Table 3.1 CSM92F42N Absolute Maximum Ratings

3.2 Ratings Recommend Operating Conditions

Ratings	Min	Typ	Max	Unit
Supply voltage (VDD)	1.8	3.3	3.6	V
External minimum power supply current (I_{VDD})	120			mA
Operation Temperature (T)	-40		85	ºC

Table 3.2 CSM92F42N Recommend Operating Conditions

3.3 DC Electrical Specification (3.3V, 25℃)

Parameter	Min	Typ	Max	Unit
Input low level voltage (V_{IL})	VSS		0.3*VDD	V
Input high level voltage (V_{IH})	0.7*VDD		VDD	V
I/O Weak pull-up equivalent resistor (R_{PU})		390		KΩ
I/O Weak pull-down equivalent resistor (R_{PD})		230		KΩ
RST_N Weak pull-up equivalent resistor (R_{PU})		20		KΩ
I/O pin capacitance (C_{in})			5	pF
Output low level voltage (V_{OL}@I_{IO}=1mA)		0.04		V
Output high level voltage (V_{OH}@I_{IO}=1mA)		3.23		V

Table 3.3 CSM92F42N DC Electrical Specification

Note: The IO output current capacity can be configured through the register, and there are 4 levels to choose from: 2mA, 4mA, 6mA, 12mA.

3.4 Power Current Consumption Characteristics (3.3V, 25℃)

Parameter	Conditions	Min	Typ	Max	Unit
Tx only run current (CPU Running from flash, Clock = 32MHz, clock source is XTAL32M)	0 dBm TX @ 1 Mbps Bluetooth LE mode		12.4		mA
	5 dBm TX @ 1 Mbps Bluetooth LE mode		14.5		mA
	9 dBm TX @ 1 Mbps Bluetooth LE mode		20.2		mA
	-5 dBm TX @ 1 Mbps Bluetooth LE mode		10.2		mA
	-20 dBm TX @ 1 Mbps Bluetooth LE mode		9.3		mA
Rx only run current (CPU Running from flash, Clock = 32MHz, clock source is XTAL32M)	Radio RX @ 1 Mbps Bluetooth LE mode, TX power≤5dBm		15.8		mA
	Radio RX @ 1 Mbps Bluetooth LE mode, TX power＞5dBm		15.5		mA
Run mode current (CPU Running from flash)	Clock = 64MHz, clock source is XTAL32M		3.8		mA
	Clock = 32MHz, clock source is XTAL32M		2.8		mA
	Clock = 16MHz, clock source is XTAL32M		2.5		mA
Low power mode current	Idle mode (All modules are alive, but CPU clock is gating)		1.46		mA
	Sleep mode (Power down most of module, such as CPU, Peripheral, 32K is alive, 64KB RAM retention, only gpio and sleep-timer can wake up chip)	4	6.3	10	uA
	Deep sleep mode (Power down most of module, such as CPU, Peripheral, 32K is not alive, 64KB RAM retention, only gpio can wake up chip)	1.5	3.3	6	uA
	Ultra sleep mode (Power down most of module, such as CPU, Peripheral, 32K is not alive, 64KB RAM power off, only gpio can wake up chip)	0.6	1.44	3.5	uA

Table 3.4 Power Current Consumption Characteristics

3.5 RF Characteristics

[Supply Voltage = 3.3V @ 25℃]

Parameter	Min	Typ	Max	Unit
Sensitivity, uncoded data at 1 Ms/s		-95(1)		dBm
Sensitivity, uncoded data at 2 Ms/s		-92.5(1)		dBm

Parameter	Min	Typ	Max	Unit
Senstivity, LE Coded (S=2)		-97.5(1)		dBm
Sensitibity, LE Coded (S=8)		-101(1)		
Maximum received signal	-		-1.5	dBm
RF output power control range	-20	0	9	dBm
Operating frequency range	2402		2480	MHz

Table 3.5 RF Characteristics

Note:

1. Because the RF signal is multiplied by the crystal signal, it is easy to be interfered by the crystal harmonic signal in some frequency points, resulting in the problem of reduced receiving sensitivity, such as 2480MHz, 2464MHz, 2448MHz, 2432MHz, 2416MHz. Usually the receiving sensitivity will be reduced by about 1~7dbm at these frequency points.

4. Module Schematic Diagram

5. Module Dimension Information

5.1 Module dimensions

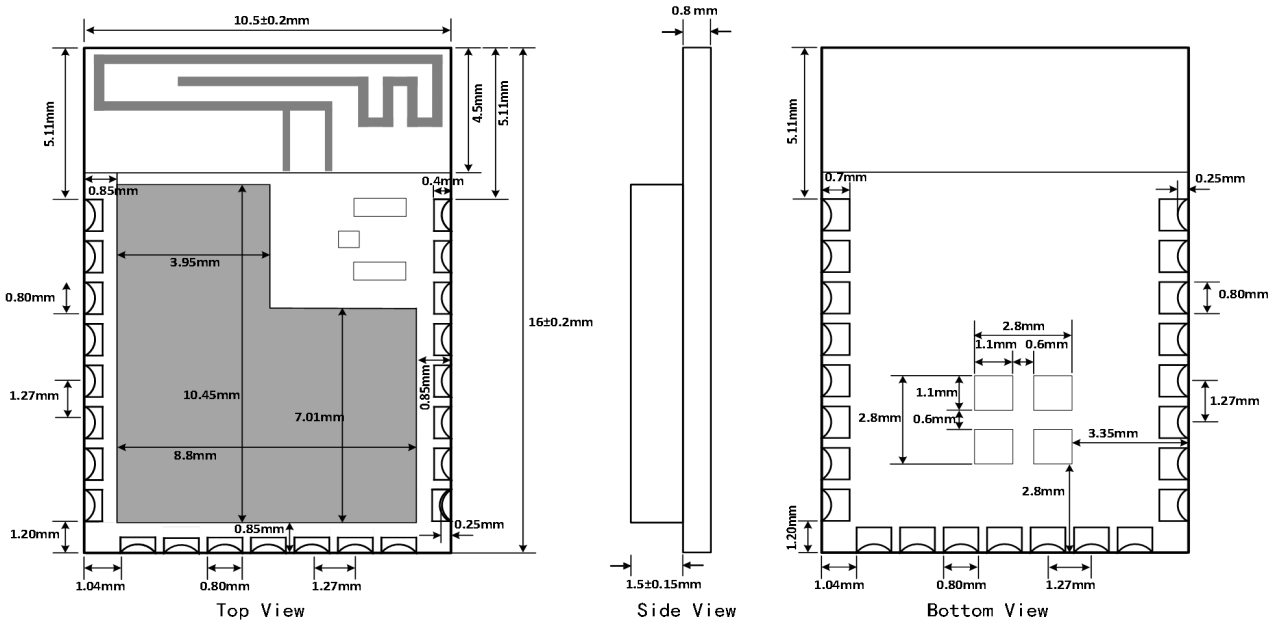

Figure 5.1 CSM92F42NIB module dimensions

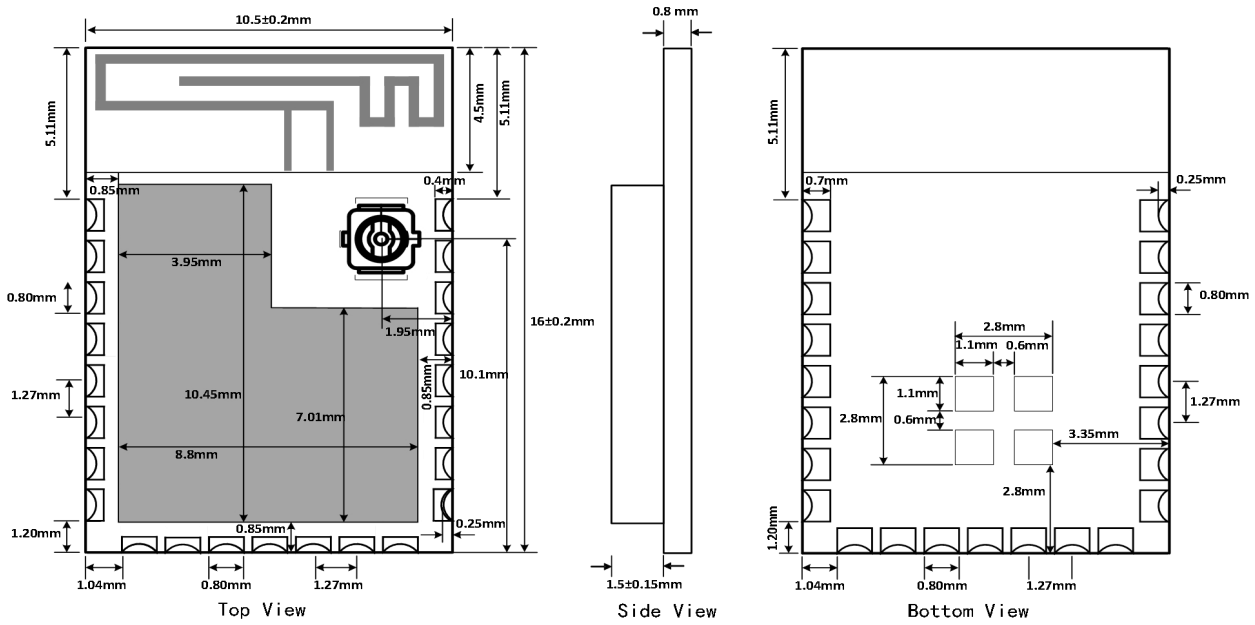

Figure 5.2 CSM92F42NIE module dimensions

Parameter	Dimension
Length	16mm±0.2mm
Width	10.5mm±0.2mm
Height	2.3mm±0.15mm
Thickness of PCB	0.8mm
Pin pitch	1.27mm
Bottom dimension of PAD	0.7mm*0.8mm

Table 5.1 Module dimensions

5.2 IPEX external antenna connector dimensions

The CSM92F42NIE module uses the third-generation IPEX external antenna connector.

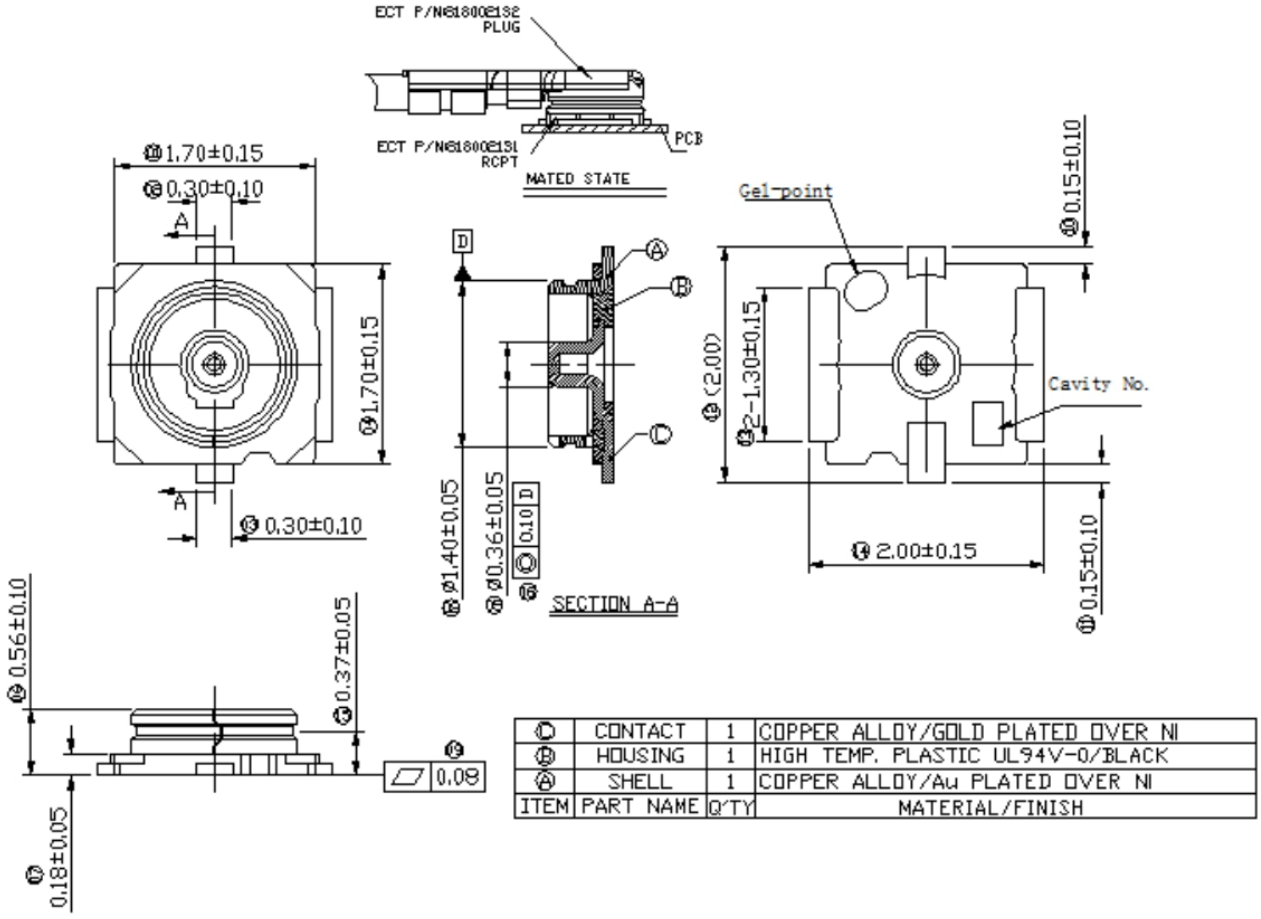

Figure 5.3 IPEX external antenna connector dimensions

6. Module Application Information

6.1 Module application schematic diagram

Figure 6.1 Module application schematic diagram

Note:

1) Y1, C2, and C3 are used to achieve high-precision RTC functions. When high-precision RTC functions are not required, Y1, C2, and C3 can be deleted.

2) SWD interface is used for SWD debugging and burning, ISP interface is used for burning. During module application, the ISP interface must be reserved for chip burning on the board.

3) Module PIN0 is the bottom EPAD and can not be welded to the base plate. If the user welds the pin to the base plate, make sure to use the appropriate amount of solder paste. For better performance, welding is recommended.

4) The module pre-burned the program, the program to achieve UART-BLE data transparent transmission function, in which PIN5 is communication UART_TX output, PIN4 is communication UART_RX input, PIN3 is the WAKEUP input (low level wake up), PIN2 is Bluetooth connection status output (Bluetooth is not connected high, Bluetooth is not connected, Bluetooth is not connected. Low level after connection), and PIN20 is the chip reset pin (active low level).

6.2 Recommended PCB package diagram

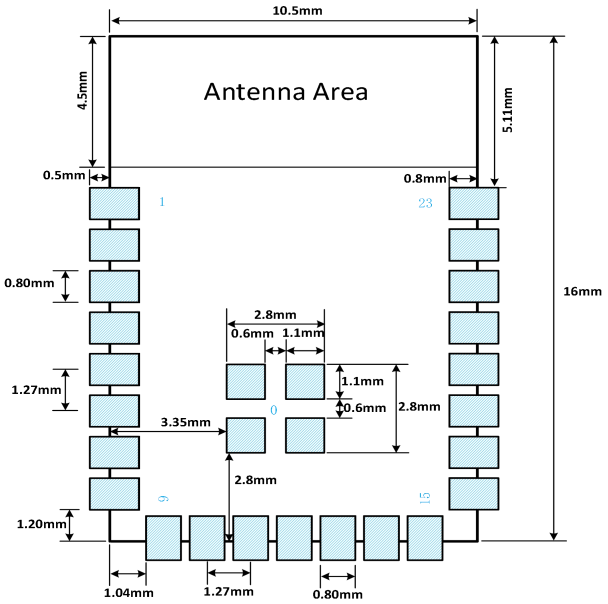

Figure 6.2 PCB package diagram

6.3 Application attention

1) The PCB under the module antenna area belongs to the clearance area, and copper is prohibited to avoid affecting the RF signal. Copper is recommended under non-antenna areas to improve system power integrity.

2) The antenna should be far away from other circuits to prevent the radiation efficiency from becoming low and affecting the normal use of other circuits.

3) If there are other wireless modules inside the product, it is necessary to plan the frequency reasonably, and pay attention to opening the distance between each other to reduce the influence of the same frequency interference and harmonic interference.

4) There are CMOS devices in the module, pay attention to anti-static during transportation and use.

5) The module is a precision device, the user is strictly prohibited to change the internal design.

7. Production processes

7.1 Reflow Soldering Temperature Curve

It is recommended that the module be reflow only once. Too many reflow soldering times may cause the module to fail to work or deteriorate performance.

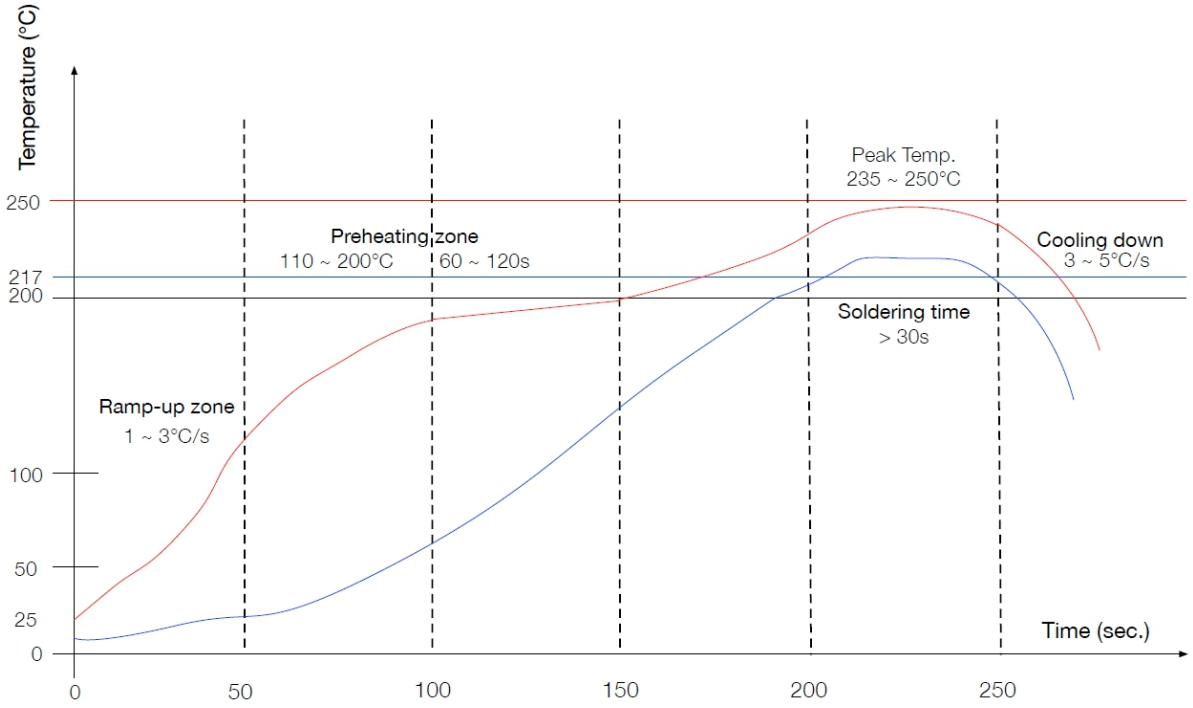

Figure 7.1 Reflow soldering temperature curve

Reflow zone	Description
Ramp-up zone	Temp. <150℃, Time 60 ~ 90s, Ramp-up rate 1 ~ 3℃/s
Preheating zone	Temp. 150 ~ 200℃, Time 60 ~ 120s, Ramp-up rate 0.3 ~ 0.8℃/s.
Reflow down zone	Peak Temp. 235 ~ 250℃ (<245℃ recommended), Time 30 ~ 70s.
Cooling down zone	Temp. 217 ~ 170℃, Ramp-down rate 3 ~ 5℃/s.

Table 7.1 Reflow temperature range

Note: Solder is lead-free solder of tin silver copper alloy. (Sn&Ag&Cu Lead-free solder (SAC305))

7.2 Storage specification

1. Sealed shelf life: 12 months in an environment where the temperature is less than 30 ℃ and the relative humidity is less than 60%.

2. The window time after unpacking: 168 hours. Beyond this time need to re-bake before use, baking requirements: 125±5℃, 24 hours.

3. After the target hardware PCB is unpacked, if the window time exceeds 168 hours, it also needs to be re-baked before use.

Note:

1) Window time: the time between the end of the final baking and the beginning of the next reflow welding, conforming to MSL3 level: less than or equal to 30℃/60% RH 168 hours of workshop life.

7.3 Ultrasonic vibration

Avoid exposing the module to the vibrations of ultrasonic devices such as ultrasonic welders or ultrasonic cleaners. The vibration of the ultrasonic equipment may resonate with the crystal vibration inside the module, resulting in crystal vibration failure, then resulting in the module failure or performance degradation.

8. Ordering Information

Part No.	Module Dimensions	Operating Temperature Range	Moisture Sensitivity Level	Packing Options	Packing quantity	Antenna Type
CSM92F42 NIB	10.5mm*16mm* 2.3mm	-40^{0}C ~85^{0}C	MSL3	Tray	1200	PCB onboard Antenna
CSM92F42 NIE	10.5mm*16mm* 2.3mm	-40^{0}C ~85^{0}C	MSL3	Tray	1200	IPEX external antenna

Federal Communication Commission (FCC) Radiation Exposure Statement
The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction Federal Communication Commission (FCC) Radiation.
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.
NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes 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.

Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES
The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.
The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2AGM5240192F42. Additionally, the following statement should be included on the label and in the final product's user manual: "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 interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation."

The module is allowed to be installed in mobile and portable applications A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application.
When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCCapplication filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.
This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations(e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable.(OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user.

CE 2402-2408MHz EIRP: 2.34dBm.

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