



芯海科技
CHIPSEA

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CSM92F41N

Datasheet

REV 1.1



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Revision History

Revision	Changes	Date
REV1.0	Initial draft	2025/06/06
REV1.1	Update the module dimensions and PCB package diagram	2025/06/24

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1. Module Overview

1.1 Description

The CSM92F41N module is a Bluetooth low power energy(Bluetooth LE) single-mode module based on the chip CST92F41 which designed by Chipsea. It supports all of Bluetooth standard 5.3 feature. It integrates a 32-bit ARM® Cortex™-M4F core, rich feature peripheral units, such as GPIO、UART、ADC、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 CSM92F41NCB module uses PCB onboard antenna, and the CSM92F41NCE 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™-M4F 32-bit processor , maximum main frequency is 64MHz
 - Up to 512KB Flash, 80KB Data SRAM
 - Support OTA upgrade
- Bluetooth LE features
 - Support Bluetooth LE 5.3 standard
 - Operating frequency 2402~2480MHz
 - Two transmission speeds are supported
 - 1Mbps
 - 2Mbps
 - TX power -30~+8dBm
- Power consumption
 - 1.6mA in running mode@32MHz
 - 0.8uA in deep sleep mode
- Peripherals
 - Flexible GPIO
 - Up to 21 general purpose GPIO
 - 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, 1*I2C, 4*Timer and so on
 - 12-bits ADC, 5 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

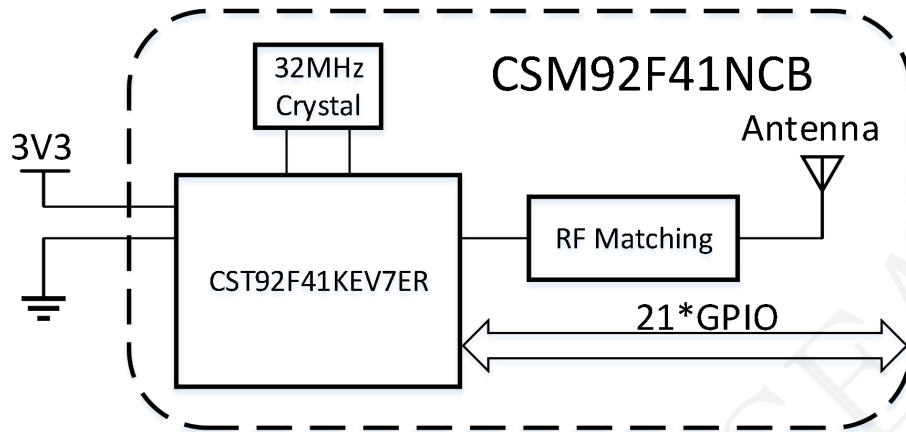


Figure 1.1 CSM92F41NCB module Function Block Diagram (PCB antenna)

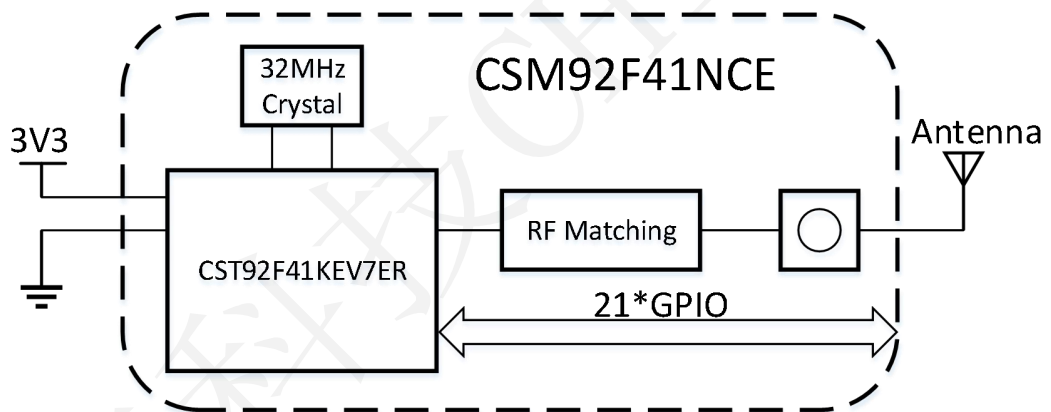


Figure 1.2 CSM92F41NCE module Function Block Diagram (IPEX external antenna)

2. Pin assignments

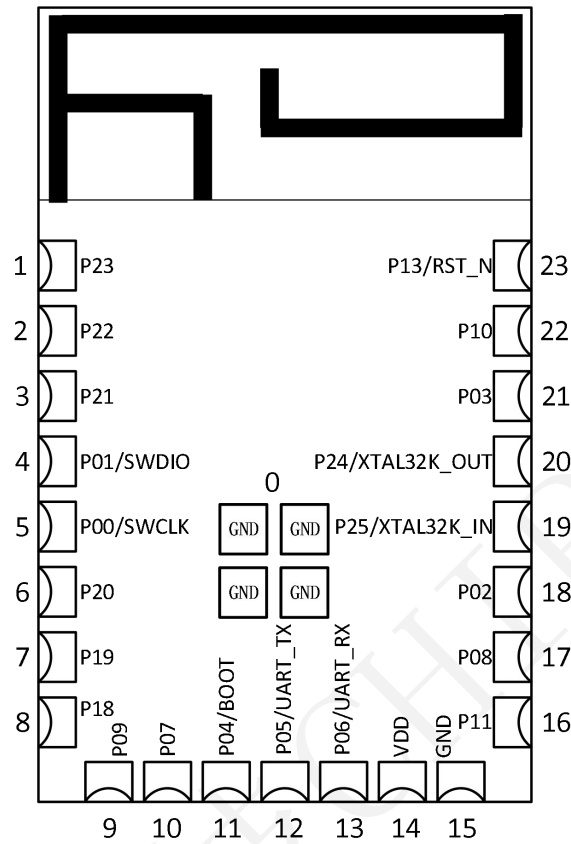


Figure 2.1 CSM92F41Nmodule Pin assignments (Top View)

Table 2.1 CSM92F41N Pin Description

Pin No.	Pin name	Type	Description	Note
0	GND	P	GND ground	
1	P23	Digital	Digital GPIO	Note1
2	P22	Digital	Digital GPIO	Note1/3
3	P21	Digital	Digital GPIO	Note1/3
4	P01/SWDIO	Digital	Digital GPIO	Note1
		Digital	SWDIO	
5	P00/SWCLK	Digital	Digital GPIO	Note1
		O	SWCLK	
6	P20	Digital	Digital GPIO	Note1
7	P19	Digital	Digital GPIO	Note1
8	P18	Digital	Digital GPIO	Note1
9	P09	Digital	Digital GPIO	Note1
10	P07	Digital	Digital GPIO	Note1
		Analog	GPADC input 3	

11	P04/BOOT0	Digital	Digital GPIO/BOOT	Note1
12	P05/UART_TX	Digital	Digital GPIO UART_TX	Note1
13	P06/UART_RX	Digital	Digital GPIO UART_RX	Note1
14	VDD	P	Power supply 1.8V~3.6V	
15	GND	P	GND ground	
16	P11	Digital	Digital GPIO	Note1
		Analog	GPADC input 5	
17	P08	Digital	Digital GPIO	Note1
		Analog	GPADC input 4	
18	P02	Digital	Digital GPIO	Note1
		Analog	GPADC input 1	
19	P25/XTAL32K_IN	Digital	Digital GPIO	Note1
		Analog	32K crystal oscillator input	
20	P24/XTAL32K_OUT	Digital	Digital GPIO	Note1
		Analog	32K crystal oscillator output	
21	P03/ADC2	Digital	Digital GPIO	Note1
		Analog	GPADC input 2	
22	P10	Digital	Digital GPIO	Note1
23	P13/RST_N	Digital	Digital GPIO/RST_N input	Note1/2

Note 1: Through PINMUX, multiple pin selection configurations can be performed for digital peripherals, but digital peripherals cannot be mapped to any GPIO.

Note 2: By default, P13 has the GPIO function. Users can configure the pin to RESET function through the software. To ensure the Reset function, the pull down time of RST_N pin should be greater than 40us.

Note 3: Except for P21 and P22, all other GPIO pins support anti-backflow function.

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.

Table 3.1 CSM92F41N Absolute Maximum Ratings

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	°C
ESD	Human Body Mode	±2000		V
	Charge Device Mode	±1000		V
MSL			MSL3	

3.2 Ratings Recommend Operating Conditions

Table 3.2 CSM92F41N 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	°C

3.3 DC Electrical Specification (3.3V, 25°C)

Note: The RST_N pin can be configured as a GPIO, when used as a GPIO, the pull-up resistor is determined by the GPIO configuration.

Table 3.3 DC Electrical Specification (3.3V, 25°C)

Parameter		Conditions	Min	Typ	Max	Unit
Input low voltage(V _{IL})			VSS		0.3*VDD	V
Input high voltage(V _{IH})			0.7*VDD		VDD	V
Pull-up equivalent resistor (R _{PU})	gpio_pl_ctrl[1:0]=00	VDD=3.3V		5		kΩ
	gpio_pl_ctrl[1:0]=01			11		kΩ
	gpio_pl_ctrl[1:0]=10			293		kΩ
	gpio_pl_ctrl[1:0]=11			4060		MΩ
Pull-down equivalent resistor (R _{PD})		VDD=3.3V		116		kΩ
I/O pin capacitance					5	pF
Output low level voltage (V _{OL})		I _{IO} =1mA, VDD=3.3V, gpio_drv_ctrl=0		0.05		V

Output high level voltage (V_{OH})		$I_{IO}=1mA$, $VDD=3.3V$, $gpio_drv_ctrl=0$		3.23		V
Output sink current for low level output (I_{OL})	$gpio_drv_ctrl=0$	$VDD=3.3V$, $V_{OL}=0.3*VDD$		14.68		mA
	$gpio_drv_ctrl=1$			38.35		mA
Output source current for high level output (I_{OH})	$gpio_drv_ctrl=0$	$VDD=3.3V$, $V_{OH}=0.7*VDD$		9.87		mA
	$gpio_drv_ctrl=1$			25.6		mA

3.4 Power Current Consumption Characteristics(3.3V, 25°C)

Table 3.4 Power Current Consumption Characteristics (3.3V, 25°C)

Parameter	Conditions	Min	Typ	Max	Unit
Tx mode current (CPU Running from flash, Clock = 32MHz, clock source is XTAL32M)	0 dBm TX @ 1 Mbps Bluetooth LE mode		9.6		mA
	5 dBm TX @ 1 Mbps Bluetooth LE mode		12.8		mA
	8 dBm TX @ 1 Mbps Bluetooth LE mode		16.1		mA
	-5 dBm TX @ 1 Mbps Bluetooth LE mode		8.1		mA
	-18 dBm TX @ 1 Mbps Bluetooth LE mode		5.9		mA
Rx mode current (CPU Running from flash, Clock = 32MHz, clock source is XTAL32M)	Radio RX @ 1 Mbps Bluetooth LE mode		8		mA
Run mode current (CPU Running from flash)	Clock = 64MHz, clock source is XTAL32M		2.7		mA
	Clock = 32MHz, clock source is XTAL32M		1.6		mA
	Clock = 16MHz, clock source is XTAL32M		1.4		mA
Low power mode current	Sleep mode (80KB RAM retention, wake on by GPIO and sleep-timer)		2.2		mA
	Sleep mode (16KB RAM retention, wake on by GPIO and sleep-timer)		1.2		uA
	Deep sleep mode (No RAM retention, only gpio can wake up chip)		0.8		uA

3.5 RF Characteristics

Table 3.5 RF Characteristics

[Supply Voltage = 3.3V @ 25°C]

Parameter	Min	Typ	Max	Unit
Receive sensitivity @1Mbps BLE		-97		dBm
Receive sensitivity @2Mbps BLE		-94		dBm
Maximum input signal level			0	dBm
RF output power control range	-30	0	8	dBm
Operating frequency range	2402		2480	MHz

4. Module Schematic Diagram

The schematic diagram of the circuit inside the module is as follows.

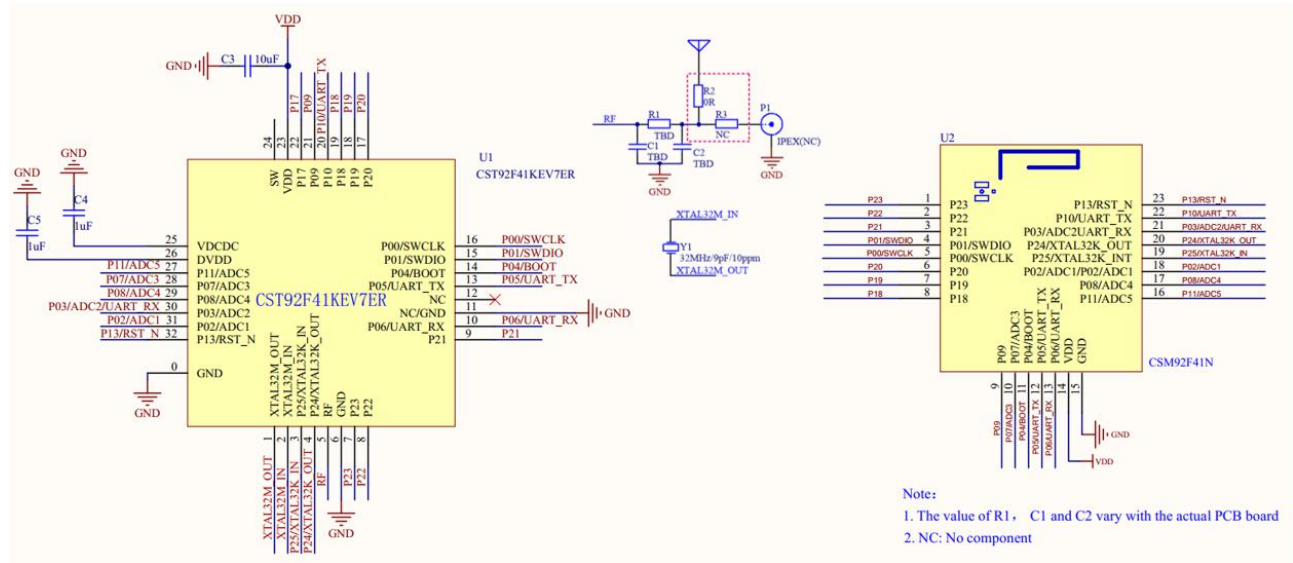


Figure 4.1 Module schematic diagram

5. Module Dimension Information

5.1 Module dimensions

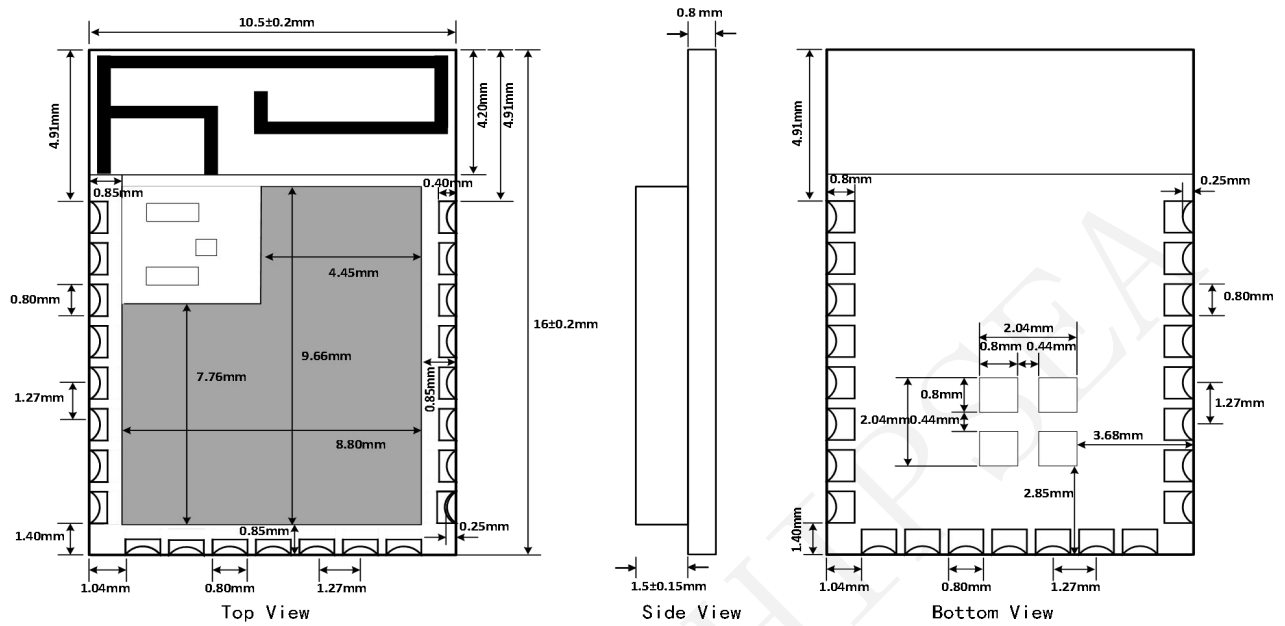


Figure 5.1 CSM92F41NCB module dimensions

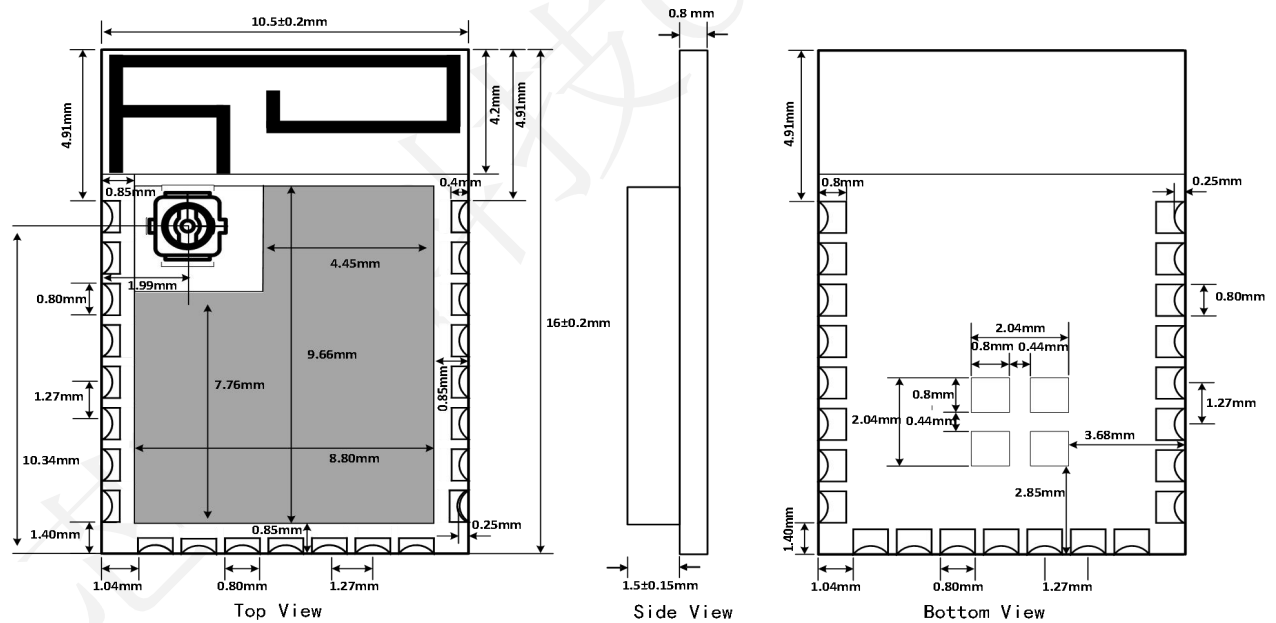


Figure 5.1 CSM92F41NCE module dimensions

Table 5.1 Module dimensions

Parameter	尺寸信息
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	0.8mm*0.8mm

5.2 IPEX external antenna connector dimensions

The CSM92F41NCE module uses the third-generation IPEX external antenna connector.

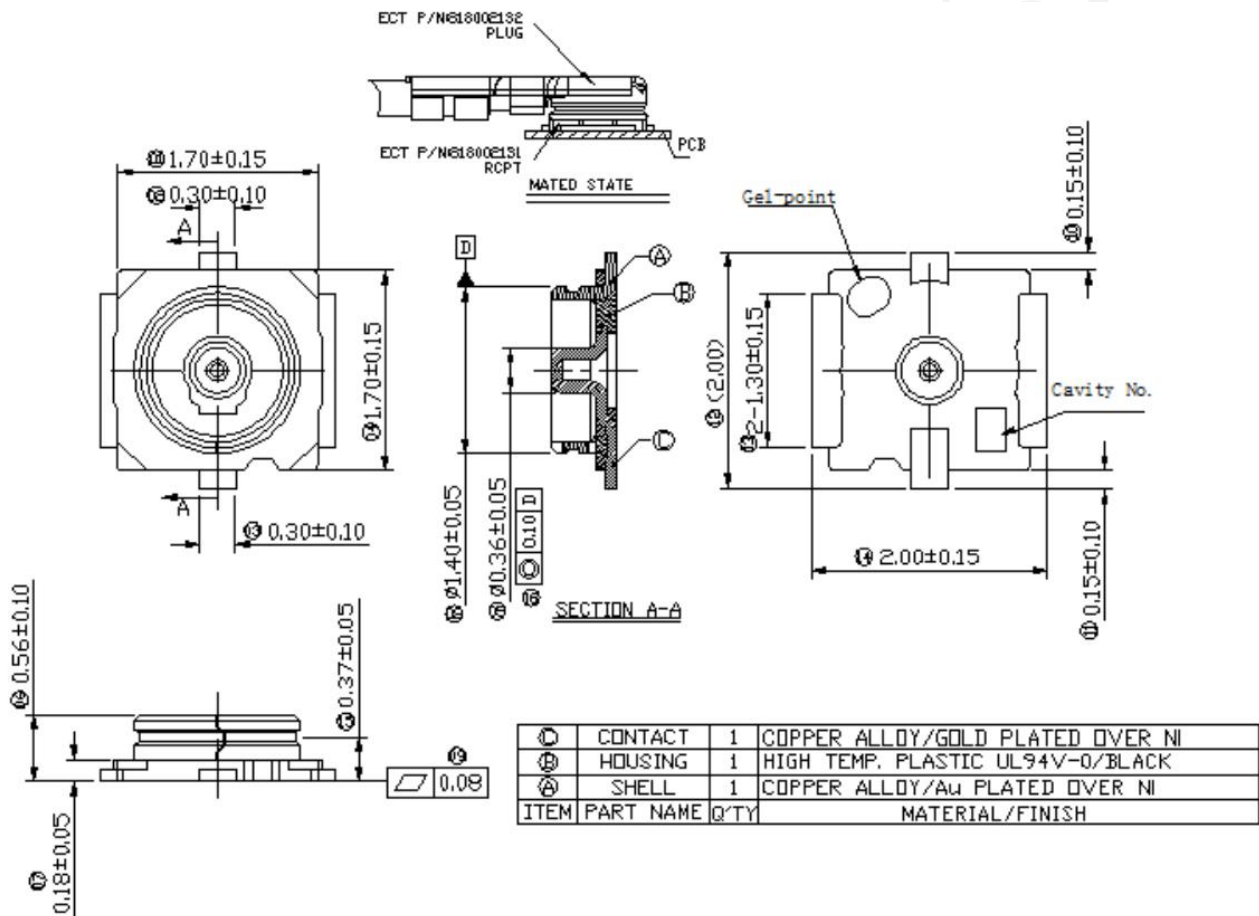


Figure 5.3 IPEX external antenna connector dimensions

6.1 Module application schematic diagram

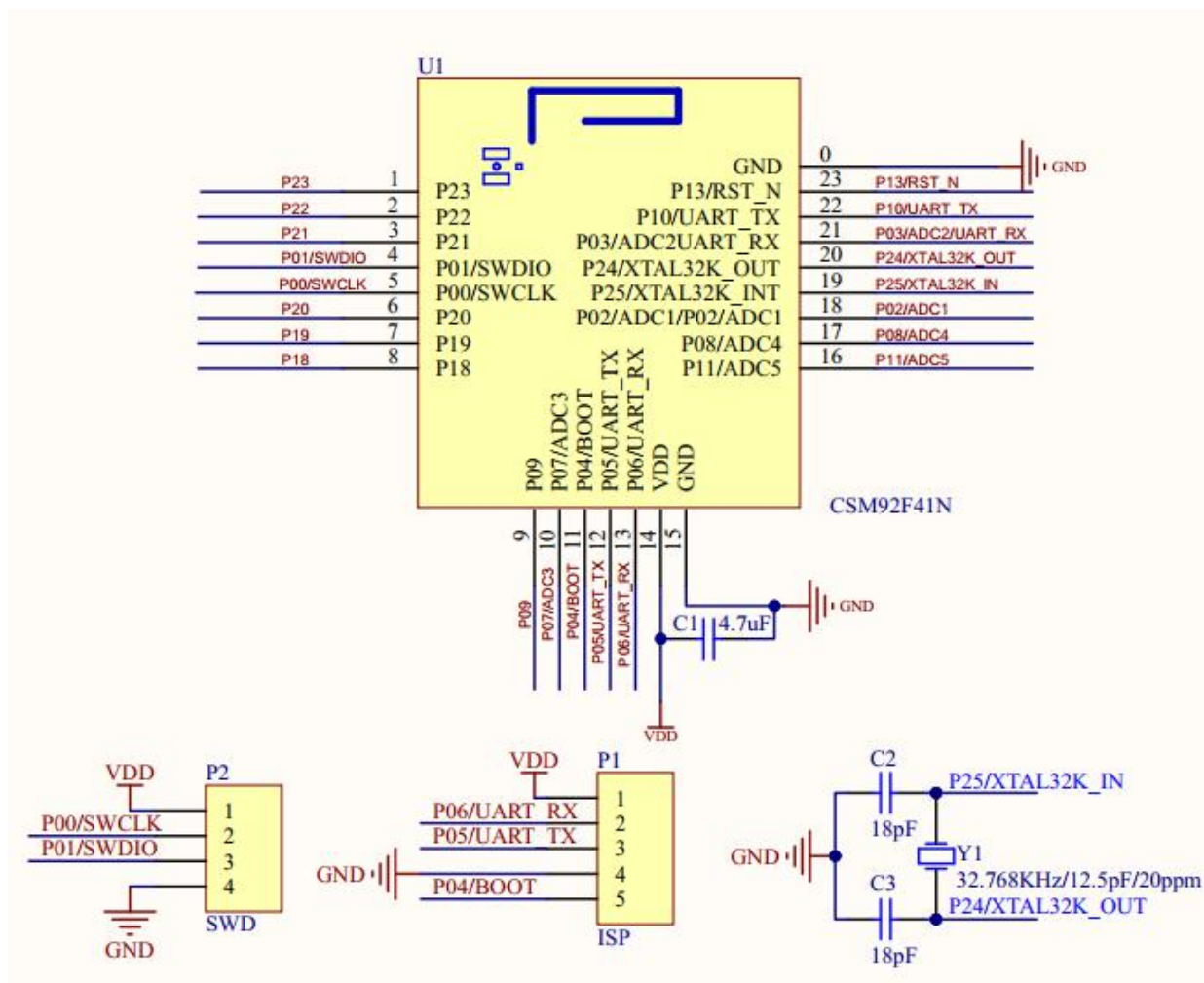


Figure 6.1 Module application schematic diagram

- 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 PIN22 is communication UART_TX output, PIN4 is communication UART_RX input, PIN17 is the WAKEUP input (low level wake up), PIN16 is Bluetooth connection status output (Bluetooth is not connected high, Bluetooth is not connected, Bluetooth is not connected. Low level after connection), and PIN23 is the chip reset pin (active low level).

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.

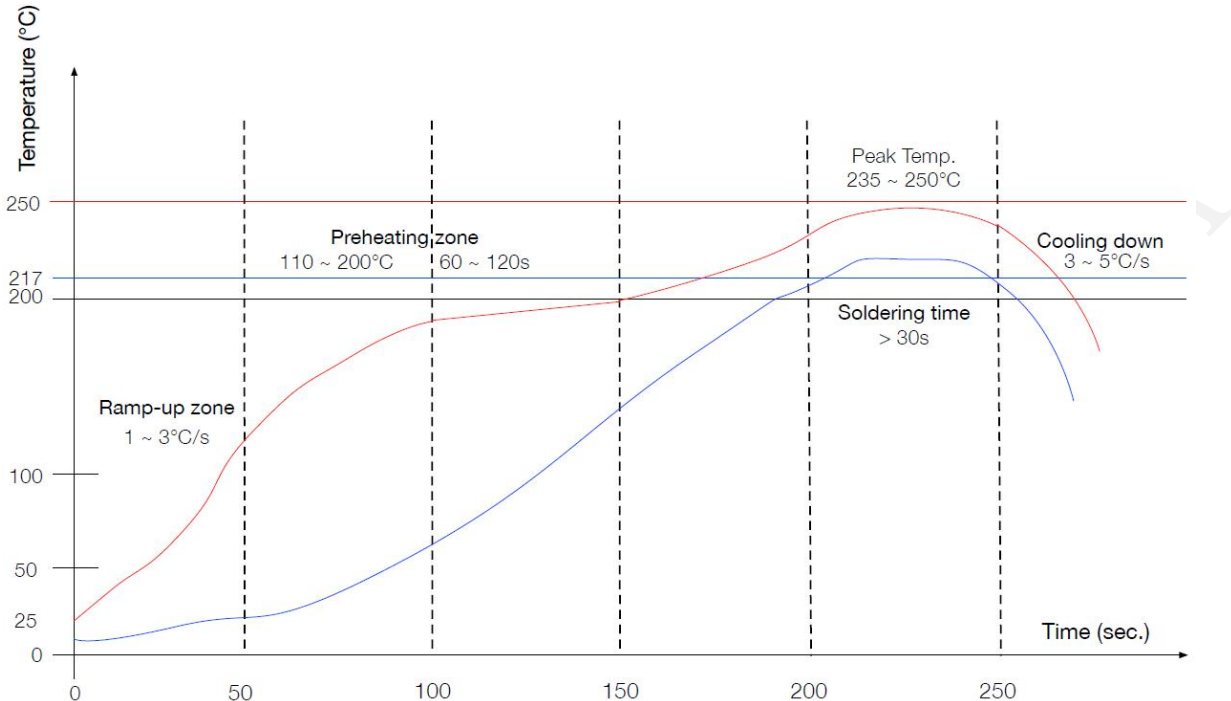


Figure 7.1 Reflow soldering temperature curve

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

Part No.	Module Dimensions	Operating Temperature Range	Moisture Sensitivity Level	Packing Options	Packing quantity	Antenna Type
CSM92F41 NCB	10.5mm*16mm *2.3mm	-40°C ~85°C	MSL3	T&R	1200	PCB onboard Antenna
CSM92F41 NCE	10.5mm*16mm *2.3mm	-40°C ~85°C	MSL3	T&R	1200	IPEX external antenna

FCC Warnings

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 radiofrequency 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.

Federal Communication Commission (FCC) Radiation Exposure Statement When using the product, maintain a distance of 5mm from the body to ensure compliance with RF exposure requirements.

FCC 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: 2AGM5250792F41. 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 FCC application 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.

1. Do not use the device in the environment at too high or too low temperature, never expose the device under strong sunshine or too wet environment.

The suitable temperature for the product and accessories is -40℃~85℃.

2. RF exposure information: This device is a low-power radio transmitter and receiver. As recommended by international guidelines, the device meets applicable national SAR limits of 2.0W/kg (10g). 10g SAR: meets low-power exclusion level, SAR test is not required.

3. Frequency range and RF power:

Bluetooth -2.00 dBm

4. This product can be used across EU member states.

5. EU Regulatory Conformance



Hereby, CHIPSEA TECHNOLOGIES (SHENZHEN) CORP. declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

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