RF-WM-3235xxx CC3235S/SF Series
2.4 GHz & 5 GHz Dual-Band Wi-Fi Module

Version 1.0

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1 Device Overview

1.1 Module Series

Start your internet-of-things (IoT) design with CC3235S/SF series Wi-Fi Wireless modules. The SimpleLink™ Wi-Fi® RF-WM-3235xxx series of modules are a system-on-chip (SoC) solutions, that integrate two processors of an application processor ARM® Cortex®-M4 MCU and a network processor MCU with all Wi-Fi® and internet logical layers. RF-WM-3235xxx series modules are compatible with each other.

Table 1. Function Difference of RF-WM-3235xxx Series Modules

Model	Chipset	Flash	Antenna	Compatibility with TI Official Module
RF-WM-3235A1	CC3235SF	1 MB + External 4 MB	PCB Onboard antenna	CC3235AMODSF
RF-WM-3235B1			RF Pad	CC3235MODSF
RF-WM-3235A1S	CC3235S	External 4 MB	PCB Onboard antenna	CC3235AMODS
RF-WM-3235B1S			RF Pad	CC3235MODS

1.2 Description

RF-WM-3235A1/B1 are a series of RF modules based on TI lower-power SoC CC3235SF, while RF-WM-3235A1S/B1S based on CC3235S. CC3235S/SF are the ICs with built-in dual-band Wi-Fi connectivity respectively. The modules integrate a 40 MHz crystal, 32.768 kHz RTC clock, RF filters, diplexer, and on-chip Arm® Cortex®-M4 MCU with a user-dedicated 256 KB of RAM, an optional flash and the antenna output modes. It features 802.11 a/b/g/n: 2.4 GHz and 5 GHz support, fast scan, hostless mode for offloading template packet transmissions and application features of small size, and robust connection.

1.3 Key Features

- Multiple-core architecture, system-on-chip (SoC)
- 802.11 a/b/g/n: 2.4 GHz and 5 GHz
- Coexistence with 2.4 GHz Radios (CC13x2/CC26x2)
- Application microcontroller subsystem:
  - Arm® Cortex® -M4 core at 80 MHz
  User-dedicated memory:
    - 256 KB RAM
  - Flash:
    - 3235A1/B1: 1 MB + an external plug-in 4 MB Flash
    - 3235A1S/B1S: an external plug-in 4 MB Flash
  - 27 I/O pins with flexible multiplexing options
    - UART, I²S, I²C, SPI, SD, ADC, 8-bit

parallel interface
  - Timers and PWM
- Wi-Fi network processor subsystem:
  - Wi-Fi® core:
    - 802.11 a/b/g/n 2.4 GHz and 5 GHz
    - Modes:
      - Access Point (AP)
      - Station (STA)
      - Wi-Fi Direct® (only supported on 2.4 GHz)
    - Security:
      - WEP
      - WPA™/WPA2™PSK
      - WPA2 Enterprise
  - Internet and application protocols:
    - HTTPs server, mDNS, DNS-SD, DHCP
    - IPv4 and IPv6 TCP/IP stack
    - 16 BSD sockets
- Multilayered security features:
  - Separate execution environments
  - Networking security
  - Device identity and key
  - Hardware accelerator cryptographic engines (AES, DES, SHA/MD5, CRC)
  - Application-level security (encryption, authentication, access control)
  - Initial secure programming
  - Software tamper detection
  - Secure boot
  - Certificate signing request (CSR)
  - Unique per device key pair
- Application throughput:
  - UDP: 16 Mbps
  - TCP: 13 Mbps
  - Peak: 72 Mbps
- Power-Management Subsystem:
  - Integrated DC/DC converters support a wide range of supply voltage:
    - Single wide-voltage supply, VBAT: 2.3 V ~ 3.6 V
  - Advanced low-power modes:
    - Shutdown: 1 μA, hibernate: 4.5 μA
    - Low-power deep sleep (LPDS): 120 μA
    - Idle connected (MCU in LPDS): 710 μA
    - RX traffic (MCU active): 59 mA
  - TX traffic (MCU active): 223 mA

1.4 Applications

- HVAC Systems & Thermostat
- Video Surveillance, Video Doorbells, and Low-Power Camera
- Building Security Systems & E-locks
- Appliances
- Asset Tracking
- Factory Automation
- Medical and Healthcare
- Grid Infrastructure

1.4 Functional Block Diagram

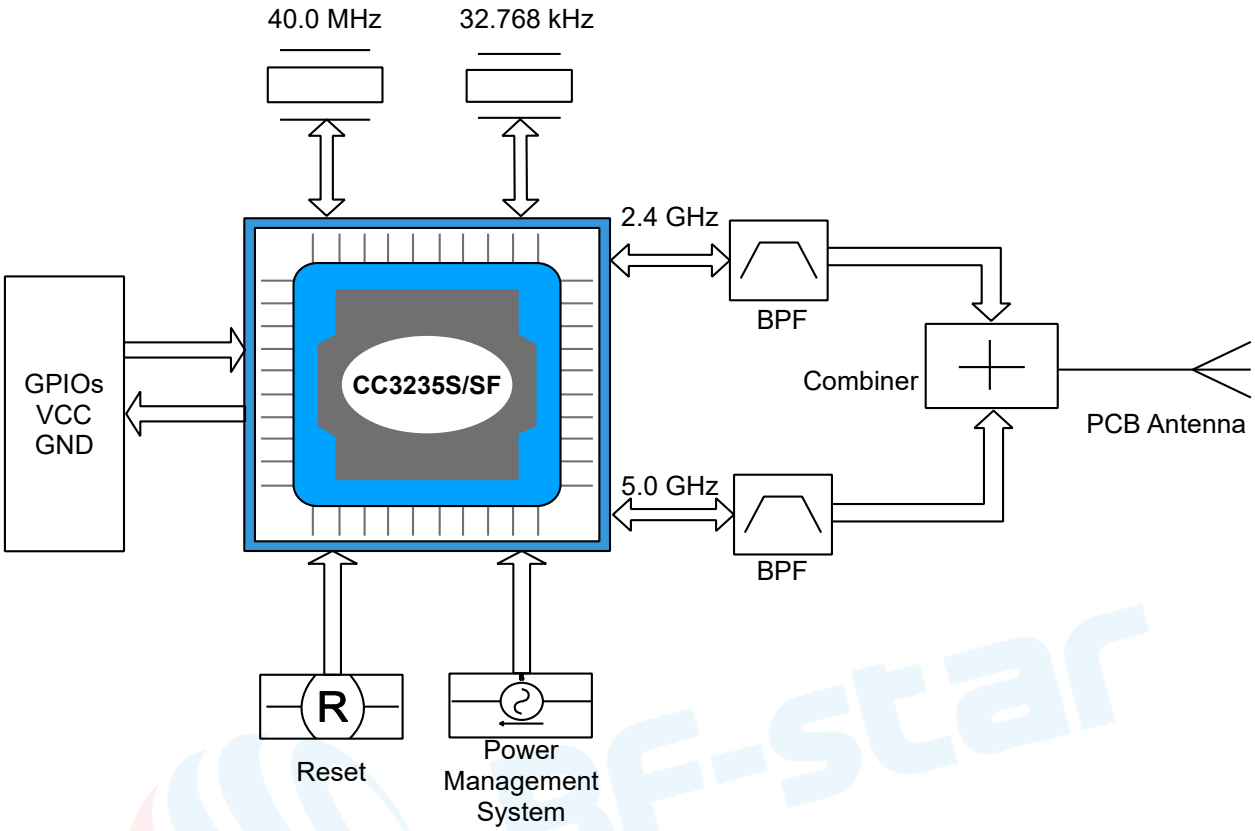

Figure 1. Functional Block Diagram of RF-WM-3235A1S

1.5 Part Number Conventions

The part numbers are of the form of RF-WM-3235xxx where the fields are defined as follows:

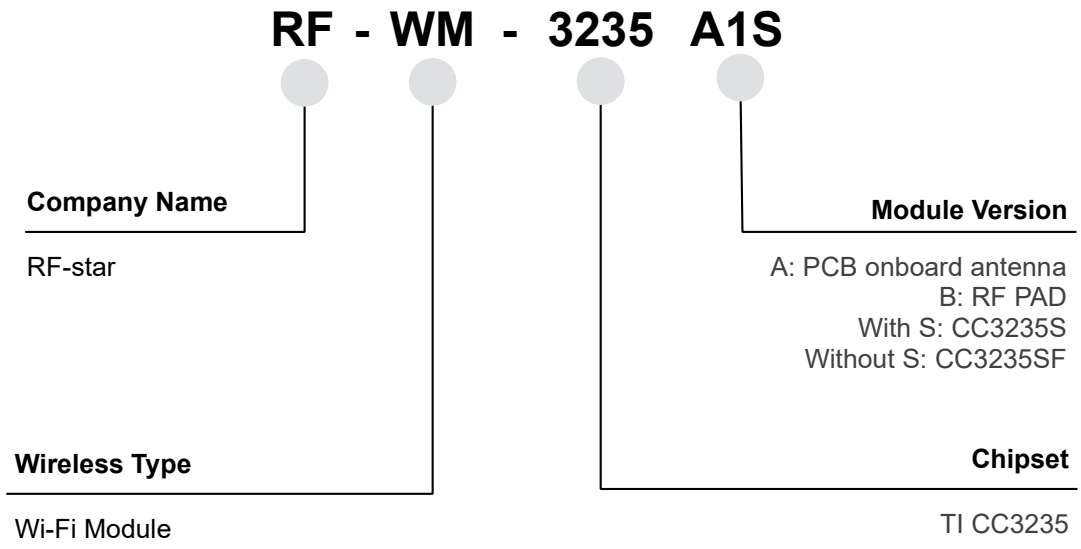

Figure 2. Part Number Conventions of RF-WM-3235A1S

Table of Contents

2 Module Configuration and Functions

2.1 Module Parameters

Table 2. Parameters of RF-WM-3235xxx

Chipset	RF-WM-3235A1/B1: CC3235SF RF-WM-3235A1S/B1S: CC3235S
Supply Power Voltage	2.7 V ~ 3.6 V, 3.3 V is recommended
Frequency	2.4 GHz, 5 GHz
Transmit Power	+18.0 dBm @ 2.4 GHz (1 DSSS) +18.1 dBm @ 5 GHz (6 OFDM)
Receiving Sensitivity	-96 dBm @ 2.4 GHz (1 DSSS) -92 dBm @ 5 GHz (6 OFDM)
GPIO	27
Power Consumption	Shutdown: 1 μA, hibernate: 4.5 μA Low-power deep sleep (LPDS): 120 μA Idle connected (MCU in LPDS): 710 μA RX traffic (MCU active): 59 mA TX traffic (MCU active): 223 mA
Crystal	40 MHz
Package	LGA packaging
Antenna	RF-WM-3235A1/A1S: PCB onboard antenna RF-WM-3235B1/B1S: RF pad
Communication Interface	UART, I²S, I²C, SPI, SD, ADC
Dimension	20.5 mm × 25.0 mm × 2.3 mm
Operating Temperature	-40 ℃ ~ +85 ℃
Storage Temperature	-55 ℃ ~ +125 ℃

2.2 Module Pin Diagram

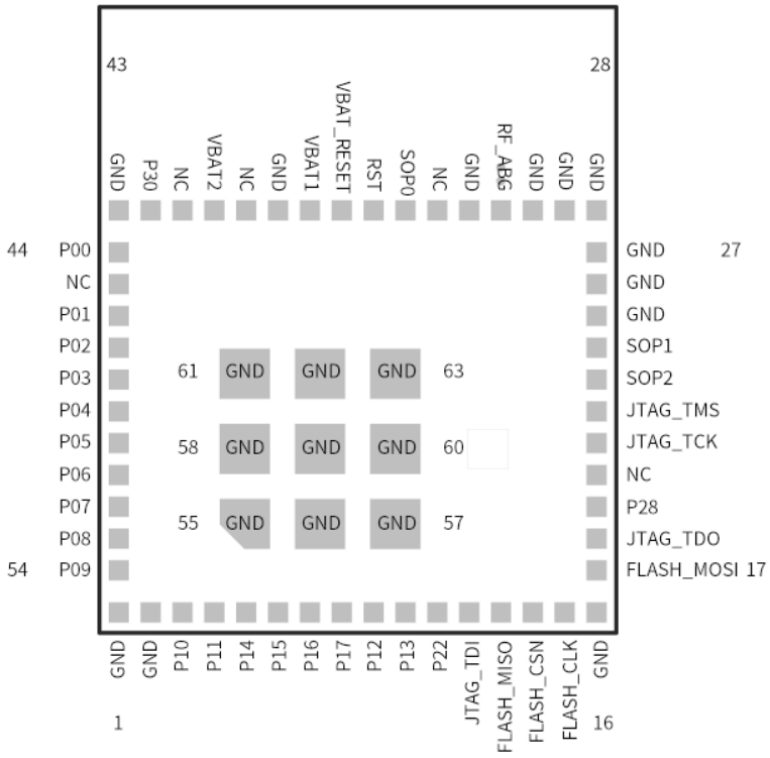

Figure 3. Pin Diagram of RF-WM-3235A1(S)

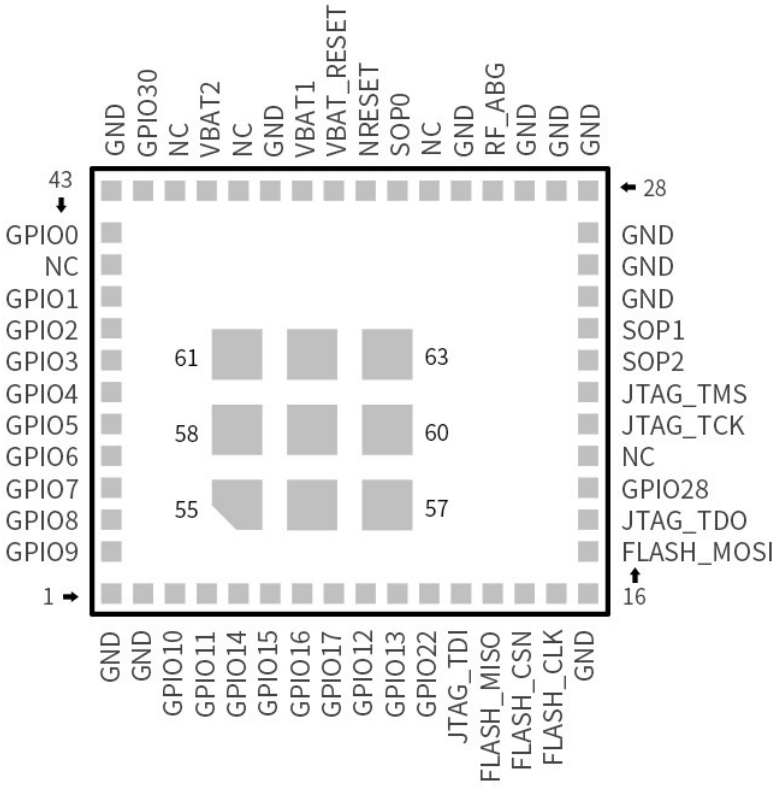

Figure 4. Pin Diagram of RF-WM-3235B1(S)

2.3 Pin Functions

Table 3. Pin Functions of RF-WM-3235xxx

Pin	Name	Function	Description
1	GND	GND	Ground
2	GND	GND	Ground
3	GPIO10	GPIO	GPIO
4	GPIO11	GPIO	GPIO
5	GPIO14	GPIO	GPIO
6	GPIO15	GPIO	GPIO
7	GPIO16	GPIO	GPIO
8	GPIO17	GPIO	GPIO
9	GPIO12	GPIO	GPIO
10	GPIO13	GPIO	GPIO
11	GPIO22	GPIO	GPIO
12	JTAG_TDI	TDI	JTAG interface: data input
13	FLASH_MISO	I	Serial flash interface: SPI data in
14	FLASH_CSN	CS	Serial flash interface: SPI chip select
15	FLASH_CLK	CLK	Serial flash interface: SPI clock
16	GND	GND	Ground
17	FLASH_MOSI	O	Serial flash interface: SPI data out
18	JTAG_TDO	TDO	JTAG interface: data output
19	GPIO28	GPIO	GPIO
20	NC	/	No Connect
21	JTAG_TCK	TCK	JTAG interface: clock
22	JTAG_TMS	TMS	JTAG interface: mode select
23	SOP2	SOP	Configuration sense-on-power
24	SOP1	SOP	Configuration sense-on-power and 5 GHz switch control
25	GND	GND	Ground

26	GND	GND	Ground
27	GND	GND	Ground
28	GND	GND	Ground
29	GND	GND	Ground
30	GND	GND	Ground
31	RF_ABG	RF Out	RF BG band: 2.4 GHz TX, RX RF BG band: 5 GHz TX, RX
32	GND	GND	Ground
33	NC	/	No Connect
34	SOP0	SOP	Configuration sense-on-power and 5 GHz switch control
35	NRESET	RESET	Master chip reset input. Active low input.
36	VBAT_RESET	RESET	VBAT reset input. Active low input.
37	VBAT1	Power	Power Supply: 2.7 V ~ 3.6 V, recommend to 3.3 V
38	GND	GND	Ground
39	NC	/	No Connect
40	VBAT2	Power	Power Supply
41	NC	/	No Connect
42	GPIO30	GPIO	GPIO
43	GND	GND	Ground
44	GPIO0	GPIO	GPIO
45	NC	/	No Connect
46	GPIO1	GPIO	GPIO
47	GPIO2	GPIO	Analog input (1.5 V max.) or GPIO
48	GPIO3	GPIO	Analog input (1.5 V max.) or GPIO
49	GPIO4	GPIO	Analog input (1.5 V max.) or GPIO
50	GPIO5	GPIO	Analog input (1.5 V max.) or GPIO
51	GPIO6	GPIO	GPIO
52	GPIO7	GPIO	GPIO

53	GPIO8	GPIO	GPIO
54	GPIO9	GPIO	GPIO
55	GND	/	Thermal ground
56	GND	/	Thermal ground
57	GND	/	Thermal ground
58	GND	/	Thermal ground
59	GND	/	Thermal ground
60	GND	/	Thermal ground
61	GND	/	Thermal ground
62	GND	/	Thermal ground
63	GND	/	Thermal ground

3 Specifications

3.1 Absolute Maximum Ratings

Table 4. Absolute Maximum Ratings

Identification	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{BAT} and V_{IO}	-0.5	3.3	3.8	V
	V_{IO} ~ V_{BAT} (differential)	V_{BAT} and V_{IO} should be tied together			V
RF Pins	/	-0.5	1.8	2.1	V
Operating Temperature	/	-40	25	85	℃
Storage Temperature	/	-55	25	125	℃

3.2 Recommended Operating Conditions

Functional operation does not guarantee performance beyond the limits of the conditional parameter values in the table below. Long-term work beyond this limit will affect the reliability of the module more or less.

Table 5. Recommended Operating Conditions of RF-WM-3235A1S

Items	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{BAT}, V_{IO} (shorted to V_{BAT})	2.7	3.3	3.6	V
Ambient thermal slew	/	-20	/	20	℃
MSL			3		

Notes:

(1) Operating temperature is limited by crystal frequency variation.

(2) To ensure WLAN performance, ripple on the supply must be less than ±300 mV.

(3) The minimum voltage specified includes the ripple on the supply voltage and all other transient dips. The brownout condition is also 2.3 V, and care must be taken when operating at the minimum specified voltage.

4 Application, Implementation, and Layout

4.1 Module Photos

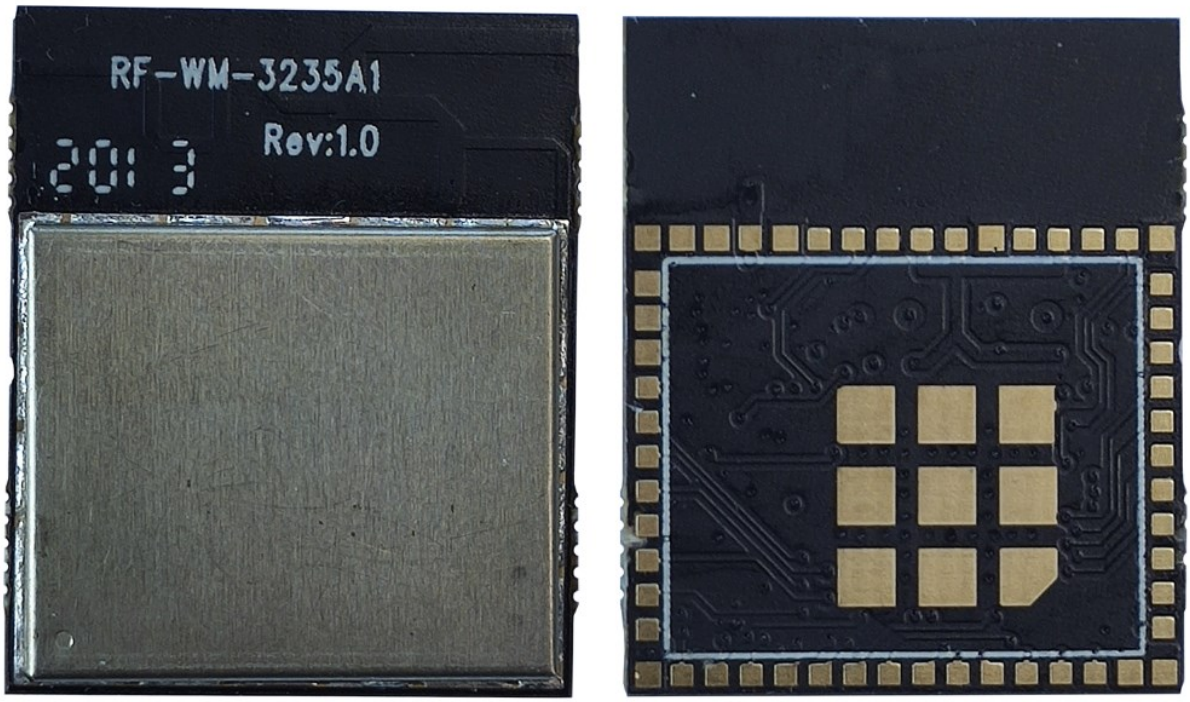

Figure 5. Photos of RF-WM-3235A1(S)

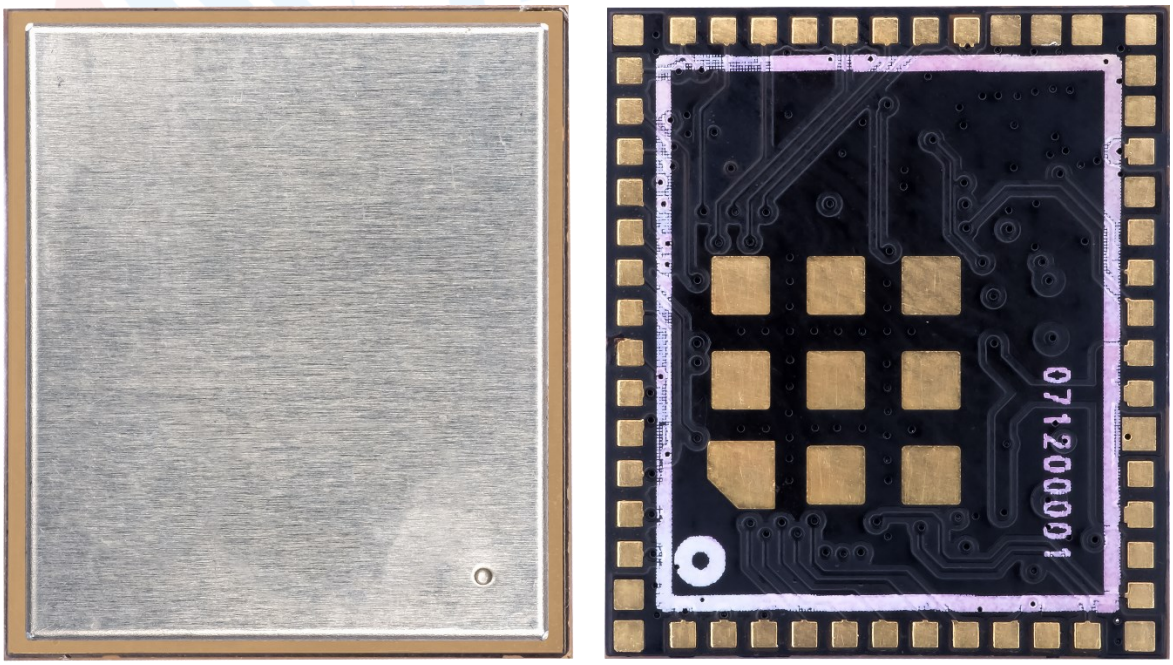

Figure 6. Photos of RF-WM-3235B1(S)

4.2 Recommended PCB Footprint

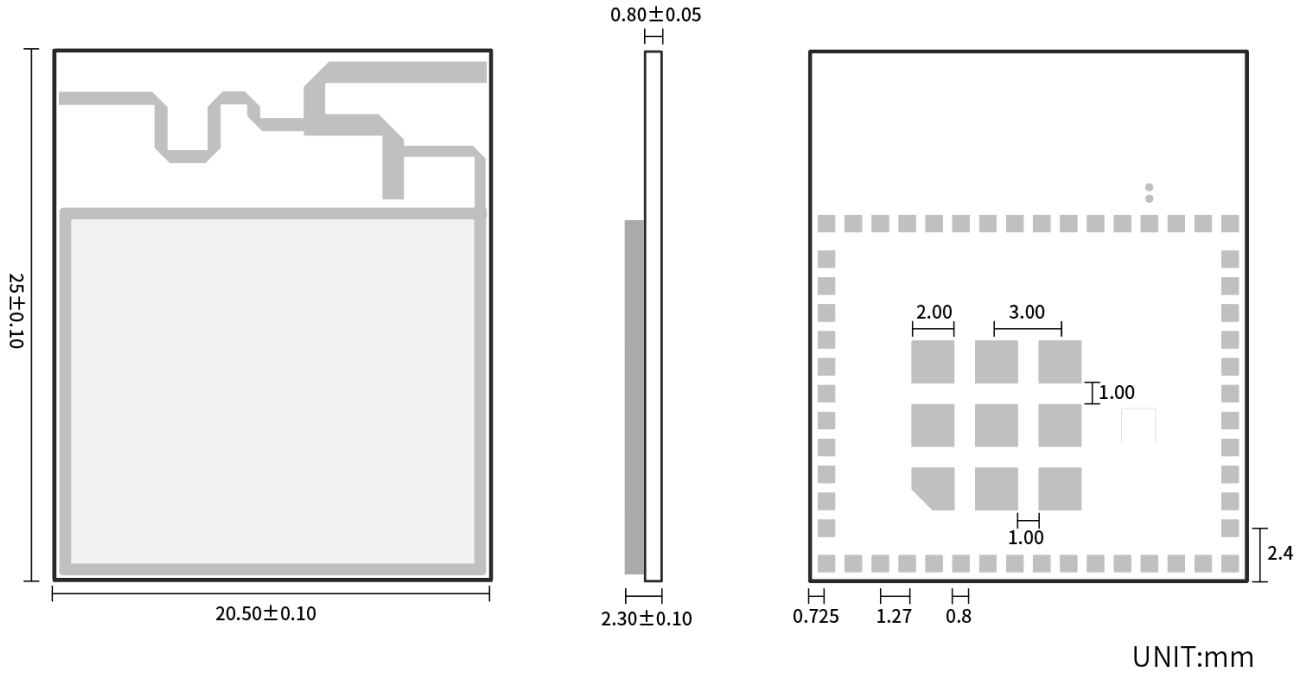

Figure 7. Recommended PCB Footprint of RF-WM-3235A1(S) (Top View) (mm)

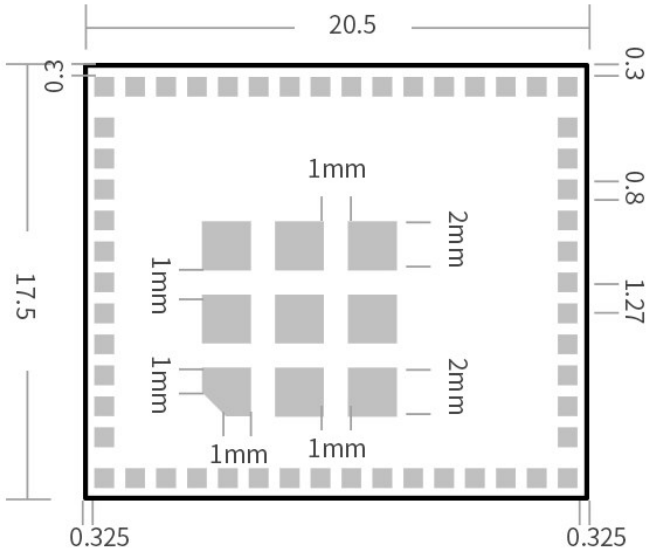

Figure 8. Recommended PCB Footprint of RF-WM-3235B1(S) (Top View) (mm)

4.3 Schematic Diagram

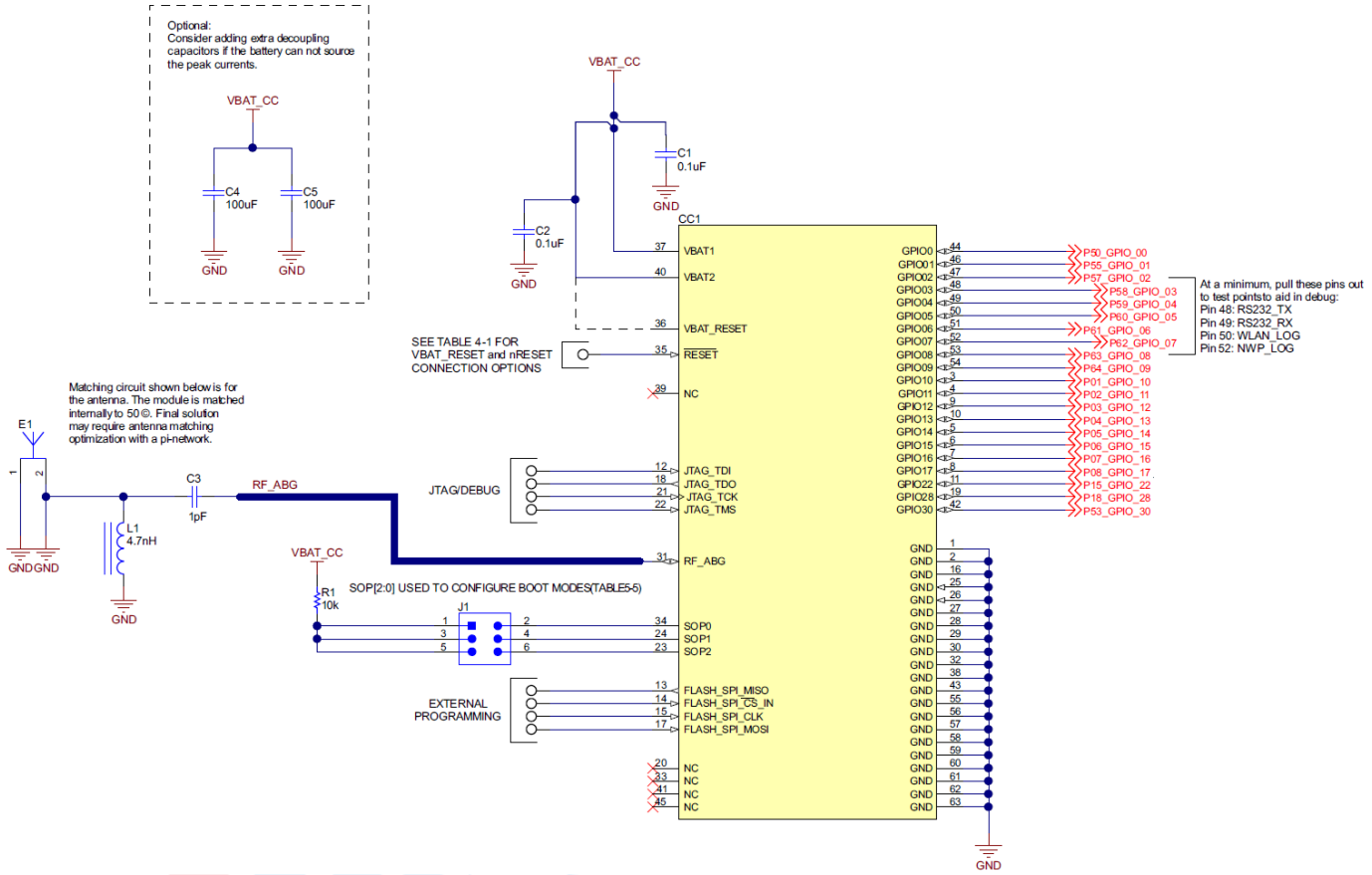

Figure 9. Schematic Diagram of RF-WM-3235A1S

4.4 Basic Operation of Hardware Design

1. It is recommended to offer the module with a DC stabilized power supply, a tiny power supply ripple coefficient and the reliable ground. Please pay attention to the correct connection between the positive and negative poles of the power supply. Otherwise, the reverse connection may cause permanent damage to the module;
2. Please ensure the supply voltage is between the recommended values. The module will be permanently damaged if the voltage exceeds the maximum value. Please ensure the stable power supply and no frequently fluctuated voltage.
3. When designing the power supply circuit for the module, it is recommended to reserve more than 30% of the margin, which is beneficial to the long-term stable operation of the whole machine. The module should be far away from the power electromagnetic, transformer, high-frequency wiring and other parts with large electromagnetic interference.
4. The bottom of module should avoid high-frequency digital routing, high-frequency analog routing and power routing. If it has to route the wire on the bottom of module, for example, it is assumed that the module is soldered to the Top Layer, the copper must be spread on the connection part of the top layer and the module, and be close to the digital

part of module and routed in the Bottom Layer (all copper is well grounded).

5. Assuming that the module is soldered or placed in the Top Layer, it is also wrong to randomly route the Bottom Layer or other layers, which will affect the spurs and receiving sensitivity of the module to some degrees;
6. Assuming that there are devices with large electromagnetic interference around the module, which will greatly affect the module performance. It is recommended to stay away from the module according to the strength of the interference. If circumstances permit, appropriate isolation and shielding can be done.
7. Assuming that there are routings of large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power routings), which will also greatly affect the module performance. It is recommended to stay away from the module according to the strength of the interference. If circumstances permit, appropriate isolation and shielding can be done.
8. It is recommended to stay away from the devices whose TTL protocol is the same 2.4 GHz and 5 GHz physical layer, for example: USB 3.0.
9. The antenna installation structure has a great influence on the module performance. It is necessary to ensure the antenna is exposed and preferably vertically upward. When the module is installed inside of the case, a high-quality antenna extension wire can be used to extend the antenna to the outside of the case.
10. The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.
11. The recommendation of antenna layout.

    The inverted-F antenna position on PCB is free space electromagnetic radiation. The location and layout of antenna is a key factor to increase the data rate and transmission range.

    Therefore, the layout of the module antenna location and routing is recommended as follows:

    （1） Place the antenna on the edge (corner) of the PCB.

    （2） Make sure that there is no signal line or copper foil in each layer below the antenna.

    （3） It is the best to hollow out the antenna position in the following figure so as to ensure that S11 of the module is minimally affected.

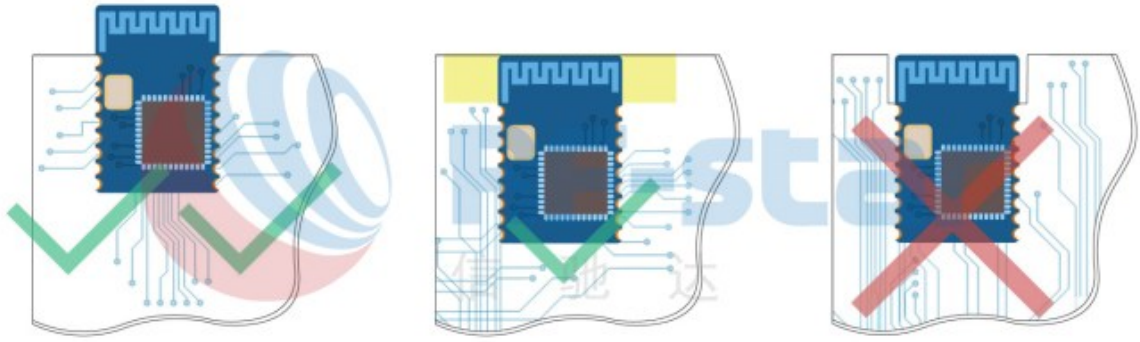

Figure 10. Recommendation of Antenna Layout

Note: The hollow-out position is based on the antenna used.

4.5 Trouble Shooting

4.5.1 Unsatisfactory Transmission Distance

1. When there is a linear communication obstacle, the communication distance will be correspondingly weakened. Temperature, humidity, and co-channel interference will lead to an increase in communication packet loss rate. The performances of ground absorption and reflection of radio waves will be poor, when the module is tested close to the ground.
2. Seawater has a strong ability to absorb radio waves, so the test results by seaside are poor.
3. The signal attenuation will be very obvious, if there is a metal near the antenna or the module is placed inside of the metal shell.
4. The incorrect power register set or the high data rate in an open air may shorten the communication distance. The higher the data rate, the closer the distance.
5. The low voltage of the power supply is lower than the recommended value at ambient temperature, and the lower the voltage, the smaller the power is.
6. The unmatchable antennas and module or the poor quality of antenna will affect the communication distance.

4.5.2 Vulnerable Module

1. Please ensure the supply voltage is between the recommended values. The module will be permanently damaged if the voltage exceeds the maximum value. Please ensure the stable power supply and no frequently fluctuated voltage.
2. Please ensure the anti-static installation and the electrostatic sensitivity of high-frequency devices.
3. Due to some humidity sensitive components, please ensure the suitable humidity during installation and application. If there is no special demand, it is not recommended to use at too high or too low temperature.

4.5.3 High Bit Error Rate

1. There are co-channel signal interferences nearby. It is recommended to be away from the interference sources or modify the frequency and channel to avoid interferences.
2. The unsatisfactory power supply may also cause garbled. It is necessary to ensure the power supply reliability.
3. If the extension wire or feeder wire is of poor quality or too long, the bit error rate will be high.

4.6 Electrostatics Discharge Warnings

The module will be damaged for the discharge of static. RF-star suggest that all modules should follow the 3 precautions below:

1. According to the anti-static measures, bare hands are not allowed to touch modules.

2. Modules must be placed in anti- static areas.
3. Take the anti-static circuitry (when inputting HV or VHF) into consideration in product design.

   Static may result in the degradation in performance of module, even causing the failure.

4.7 Soldering and Reflow Condition

1. Heating method: Conventional Convection or IR/convection.
2. Solder paste composition: Sn96.5 / Ag3.0 / Cu0.5
3. Allowable reflow soldering times: 2 times based on the following reflow soldering profile.
4. Temperature profile: Reflow soldering shall be done according to the following temperature profile.
5. Peak temperature: 245 ℃.

Table 6. Temperature Table of Soldering and Reflow

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63 / Pb37	Sn96.5 / Ag3.0 / Cu0.5
Min. Preheating Temperature (T_{min})	100 ℃	150 ℃
Max. Preheating Temperature (T_{max})	150 ℃	200 ℃
Preheating Time (T_{min} to T_{max}) (t_1)	60 s ~ 120 s	60 s ~ 120 s
Average Ascend Rate (T_{max} to T_p)	Max. 3 ℃/s	Max. 3 ℃/s
Liquid Temperature (T_L)	183 ℃	217 ℃
Time above Liquidus (t_L)	60 s ~ 90 s	30 s ~ 90 s
Peak Temperature (T_p)	220 ℃ ~ 235 ℃	230 ℃ ~ 250 ℃
Average Descend Rate (T_p to T_{max})	Max. 6 ℃/s	Max. 6 ℃/s
Time from 25 ℃ to Peak Temperature (t_2)	Max. 6 minutes	Max. 8 minutes
Time of Soldering Zone (t_P)	20±10 s	20±10 s

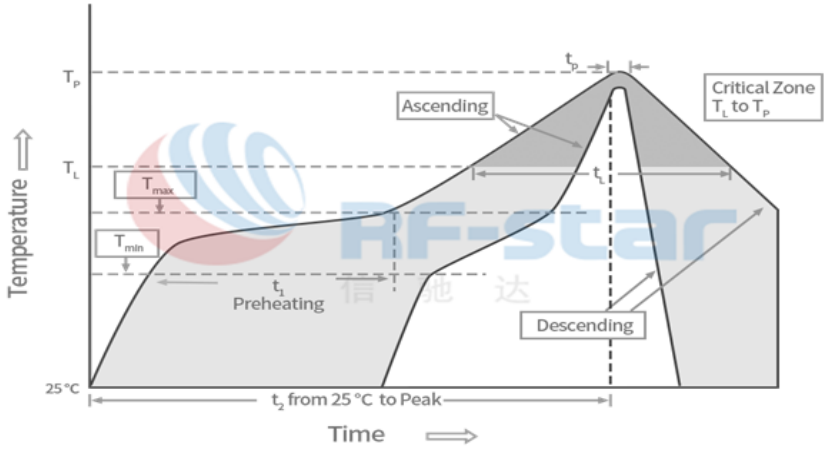

Figure 11. Recommended Reflow for Lead Free Solder

5 Optional Package Specification

The default package method is ***by tray***. If you need the modules to be shipped by tape & reel, pls contact us in advance.

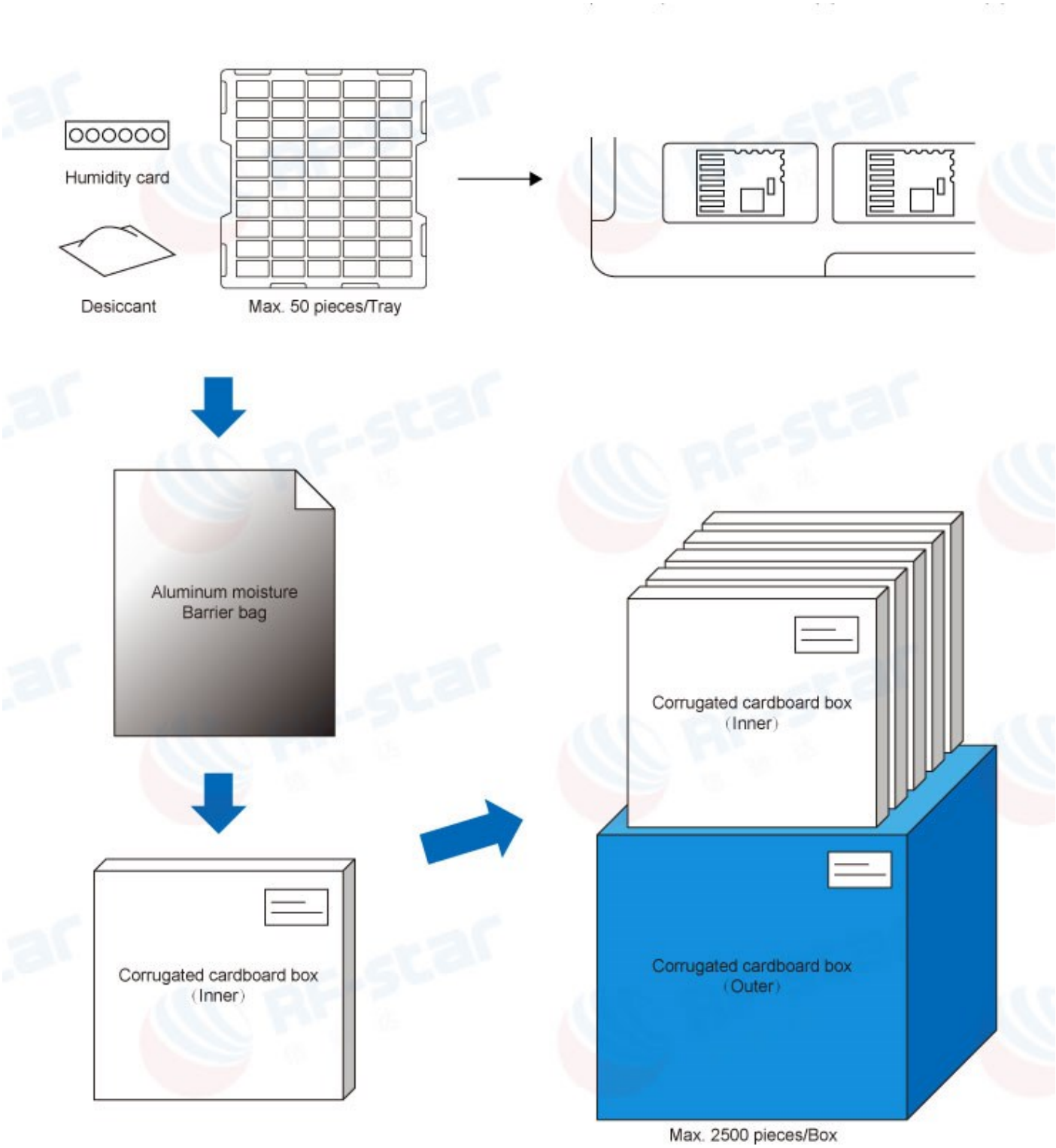

Figure 12. Default Package by Tray

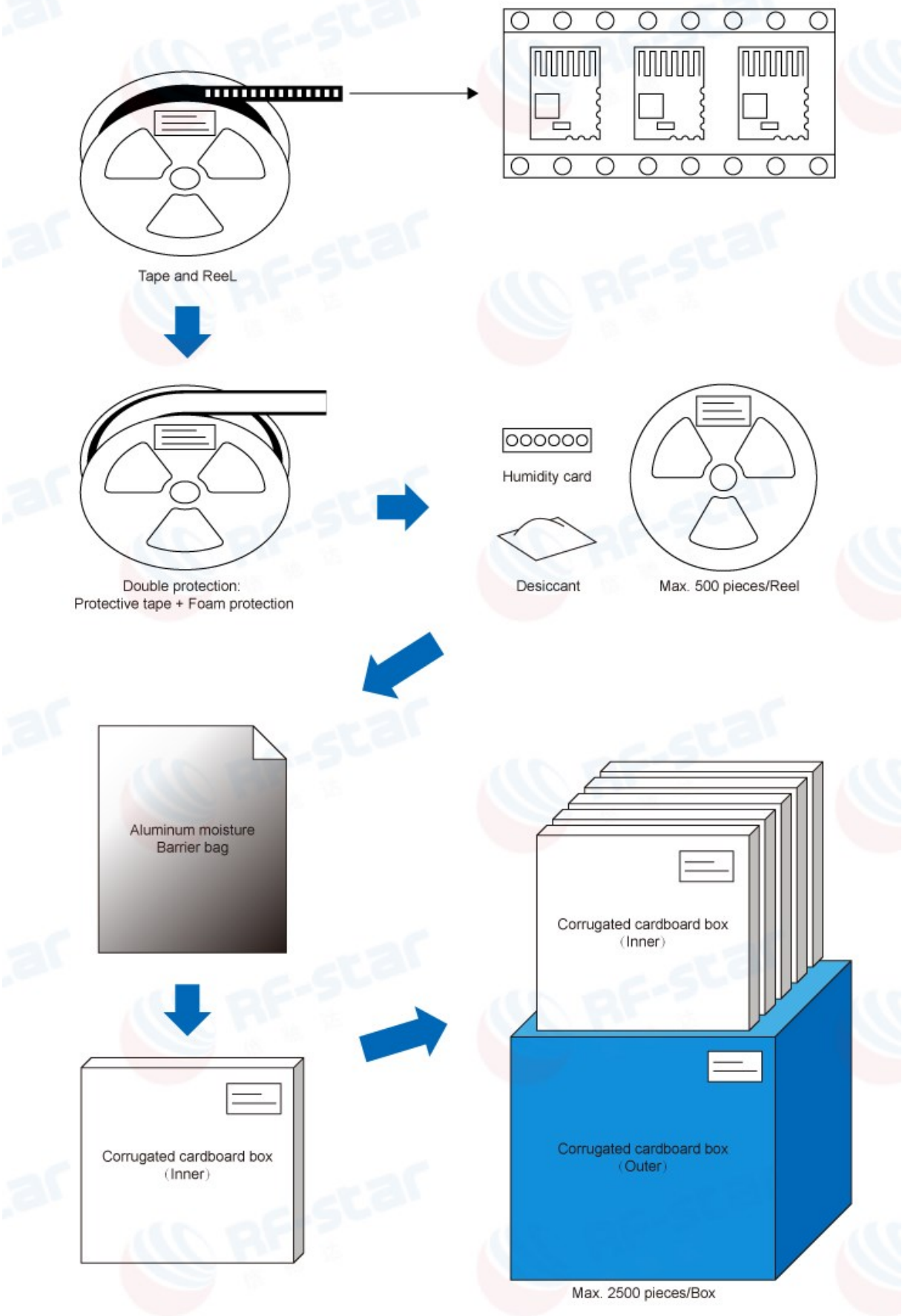

Figure 13. Package by Tape & Reel

6 Revision History

Date	Version No.	Description
2020.06.18	V1.0	The initial version is released.
2023.05.25	V1.0	Update MSL level. Update the Shenzhen office address.

Note:

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7 Contact Us

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