RF-BM-2755P1 And RF-BM-2755P1I CC2755P10

Multi-Protocol Wireless Module with Power Amplifier

Hardware Specification

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1 Device Overview

1.1 Description

RF-BM-2755P1 and RF-BM-2755P1I are wireless connectivity modules based on TI CC2755P10. It integrates a 48 MHz crystal and a 32.768 kHz crystal, up to 1 MB programmable flash, and 162 KB SRAM making it possible in many complex applications. Its 96 MHz ARM® Cortex®-M33 core can operate at an extremely low current at flexible power modes. Its multiprotocol 2.4 GHz RF transceiver is compatible with Bluetooth® 6.0 Low Energy of Channel Sounding, and 2.4 GHz Proprietary. It features a small size, robust connection distance, and rigid reliability. And the modules enable long-range and low-power applications using 20 dBm high-power with best-in-class transmit current consumption. The 1.27-mm half-hole pitch stamp stick makes the module more convenient for application and development. RF-BM-2755P1 has a high-performance PCB antenna, while RF-BM-2755P1I has an IPEX connector or a half-hole RF out interface option for the different needs of external antennas. The Edge AI NPU, HSM, and 1MB flash memory enable these modules to operate in the emerging intelligent industry.

1.2 Key Features

- RF Features
  - Bluetooth® 6.0 Low Energy for Channel Sounding
  - Matter
  - ZigBee® 3.0
  - Proprietary
  - Multi-Protocol
- TX power: up to +20 dBm
- RF sensitivity
  - -103.5 dBm sensitivity @ 125 kbps GFSK
  - -97.0 dBm sensitivity @ 1 Mbps GFSK
  - -103.0 dBm sensitivity @ IEEE 802.15.4(2.4 GHz)
- Low Power Consumption
  - RX current: 6.1 mA
  - TX current at 0 dBm: 7.7 mA
  - TX current at +10 dBm: 24.5 mA
  - TX current at +20 dBm: 143 mA
  - Active mode MCU 96 MHz (CoreMark®): 6.8 mA
  - Standby: 0.9 μA (low power mode, RTC on, full SRAM retention)
  - Shutdown: 160 nA
- Microcontroller
  - Powerful 96 MHz ARM® Cortex®-M33 with FPU (floating point unit), TrustZone®-M supportm and CDE (custom datapath extension) for machine learning acceleration
  - Algorithm Processing Unit (APU) (96 MHz)
    - Mathematical accelerator for efficient vector and matrix operations
    - Bluetooth® Channel Sounding post-processing support for IFFT and advanced super-resolution algorithms such as Multiple Signal classification (MUSIC)
- Memory
  - 1 MB of in-system programmable flash
  - 162 KB of SRAM
  - 32 KB of System ROM with secure boot root of trust (RoT) and a serial (SPI/UART) bootloader
  - Serial wire debug (SWD)
- Support OTA upgrade
- Wide Operation Range
  - Power supply: 1.71 V ~ 3.8 V
  - Operating temperature: -40 °C to +85 °C
  - Storage temperature: -40 °C to +125 °C
- Wide Peripherals

- 21 GPIOs, digital peripherals can be routed to multiple GPIOs:
  - 2 SWD IO pads, multiplexed with GPIOs
  - 19 DIOs (analog or digital IOs)
- All GPIOs with wakeup and interrupt capabilities
- 3 × 16-bit and 1 × 32-bit general-purpose timers, quadrature decode mode support
- Real-time clock (RTC)
- Watchdog timer
- System timer for radio, RTOS, and application operations for Bluetooth® channel sounding Post processing
- 12-bit ADC, up to 1.2MSPS, eight external inputs
- Temperature sensor and battery monitor
- 1× low-power comparator
- 2× UART with LIN capability
- 2× SPI
- 1× I2C
- 1× I2S

• Security Vault
- Hardware Security Module (HSM) with proprietary controller and dedicated memories supporting accelerated cryptographic operations and secure key storage:
  - AES (up to 256 bits) crypto accelerator
  - ECC (up to 521 bits), RSA (up to 3072 bits) public key accelerator
  - SHA-2 (up to 512 bits) accelerator
  - True random number generator
  - HSM firmware update support
  - Differential power analysis (DPA) countermeasures for AES and ECC
- Separate AES 128-bit cryptographic accelerator (LAES) for latency-critical link-layer operations
- Secure boot and secure firmware updates
- Secure boot root of trust (RoT)
- Cortex®-M33 TrustZone-M, MPU, memory firewalls for software isolation
- Voltage glitch monitor (VGM)

• Dimension: 22.50 mm × 15.55 mm × 2.1 mm (± 0.2)

1.3 Applications

• Medical
- Blood glucose monitors, blood pressure monitor, CPAP machine, electronic thermometer
- Medical sensor patches
- Electric toothbrush, wearable fitness & activity monitor

• Building automation
- Motion detector, electronic smart lock, door and window sensor, garage door system, gateway
- HVAC
- Fire safety system
- IP network camera

• Lighting

• Factory automation and control

• Electronic shelf label

• Grid infrastructure
- Smart meters
- Grid communications
- Energy harvesting

• Communication equipment
- Wired networking
- wireless LAN or Wi-Fi access points, edge router, Core Router, Small Business Switch

• Personal electronics
- Connected peripherals – consumer wireless module, pointing devices, keyboards, and keypads
- Gaming – electronic and robotic toys

- Wearables (non-medical) – smart trackers, smart cloth

1.4 Functional Block Diagram

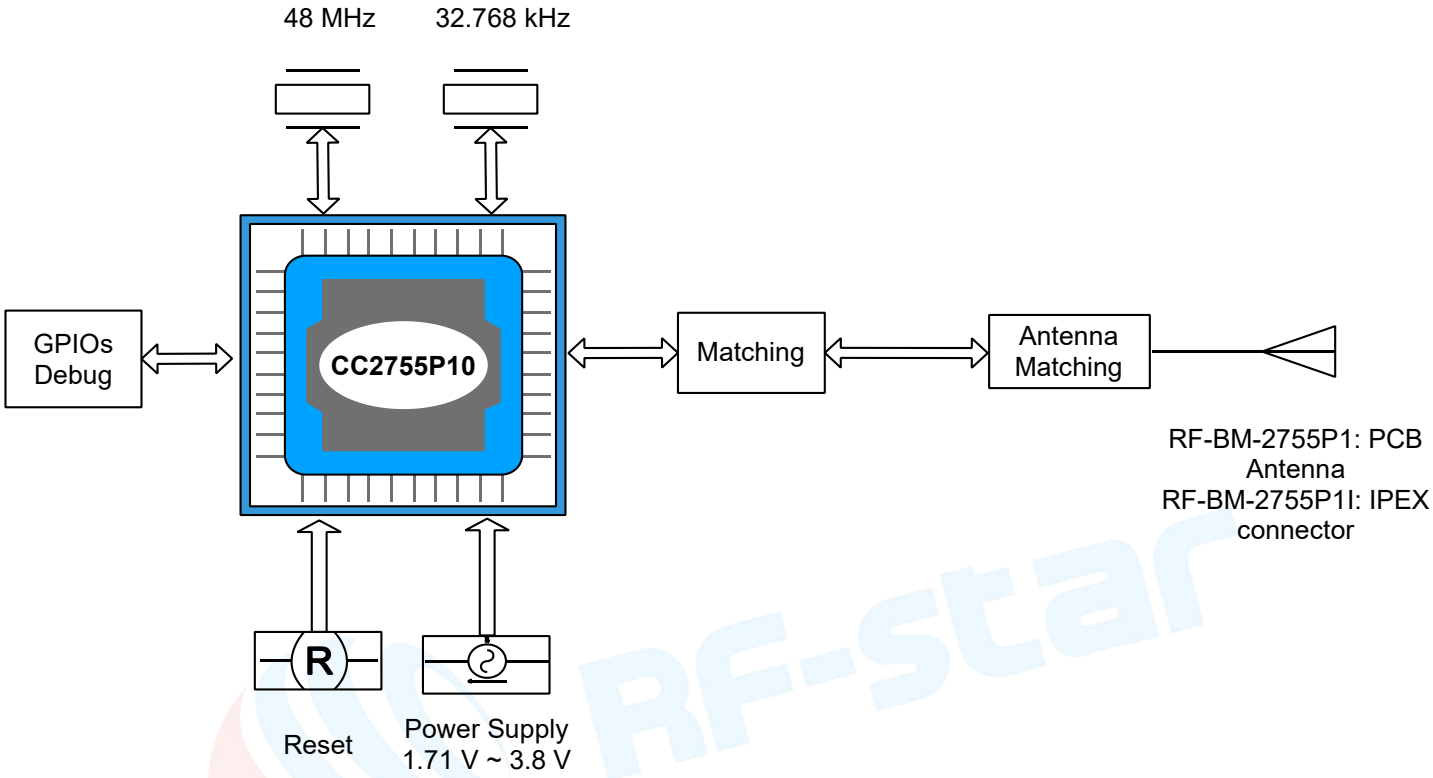


Figure 1. Functional Block Diagram of RF-BM-2755P1(I)

1.6 Part Number Conventions

The part numbers are of the form of RF-BM-2755P1(I) where the fields are defined as follows:

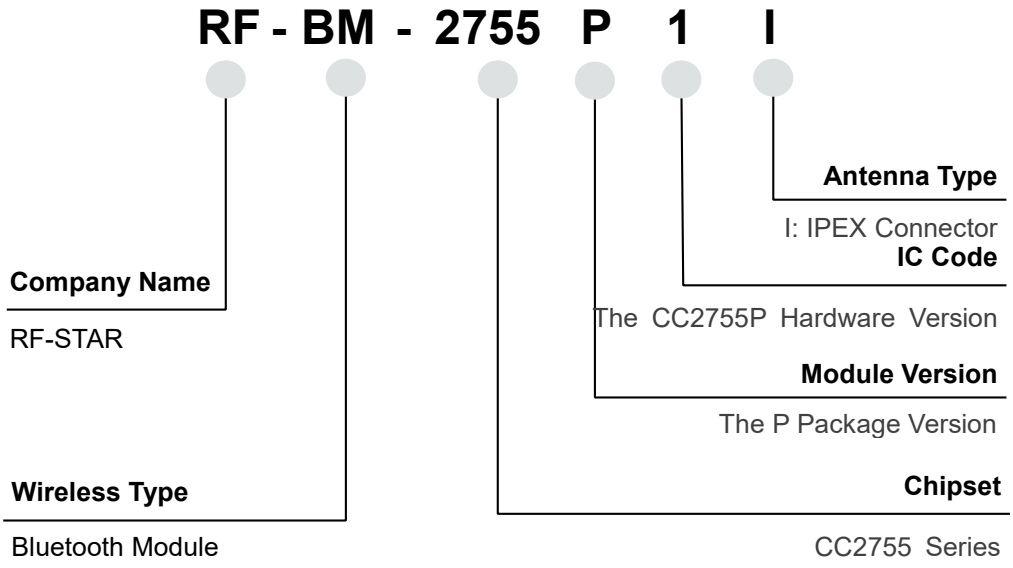


Figure 2. Part Number Conventions of RF-BM-2755P1(I)

Table of Contents

2 Module Configuration and Functions

2.1 Module Parameters

Table 1. Parameters of RF-BM-2755P1(I)

Chipset	**CC2755P10**
Supply Power Voltage	1.71 V ~ 3.8 V, 3.3 V is recommended
Frequency	2360 MHz ~ 2500 MHz
Maximum Transmit Power	+20.0 dBm
Receiving Sensitivity	-103.5 dBm sensitivity @ 125 kbps GFSK -97.0 dBm sensitivity @ 1 Mbps GFSK -103.0 dBm sensitivity @ IEEE 802.15.4(2.4 GHz)
GPIO	21
Flash	1 MB
ROM	162 KB
SRAM	32 KB of System ROM with secure boot root
Power Consumption	RX current: 6.1 mA TX current at 0 dBm: 7.7 mA TX current at +10 dBm: 24.5 mA TX current at +10 dBm: 143 mA Active mode MCU 96 MHz (CoreMark®): 6.8 mA Standby: 0.9 μA (low power mode, RTC on, full SRAM retention) Shutdown: 160 nA
Support Protocol	Bluetooth® 6.0 Low Energy for Channel Sounding, Matter, ZigBee® 3.0, Proprietary, Multi-Protocol
Crystal	48 MHz, 32.768 kHz
Package	SMT packaging (1.27-mm half-hole pitch stamp stick)
Dimension	22.50 mm × 15.55 mm × 2.35 mm (±0.2)
Type of Antenna	RF-BM-2755P1: PCB antenna RF-BM-2755P1I: IPEX connector or RF ANT pin
Operating Temperature	-40 ℃ ~ +85 ℃

Storage Temperature	-40 ℃ ~ +125 ℃

2.2 Module Pin Diagram

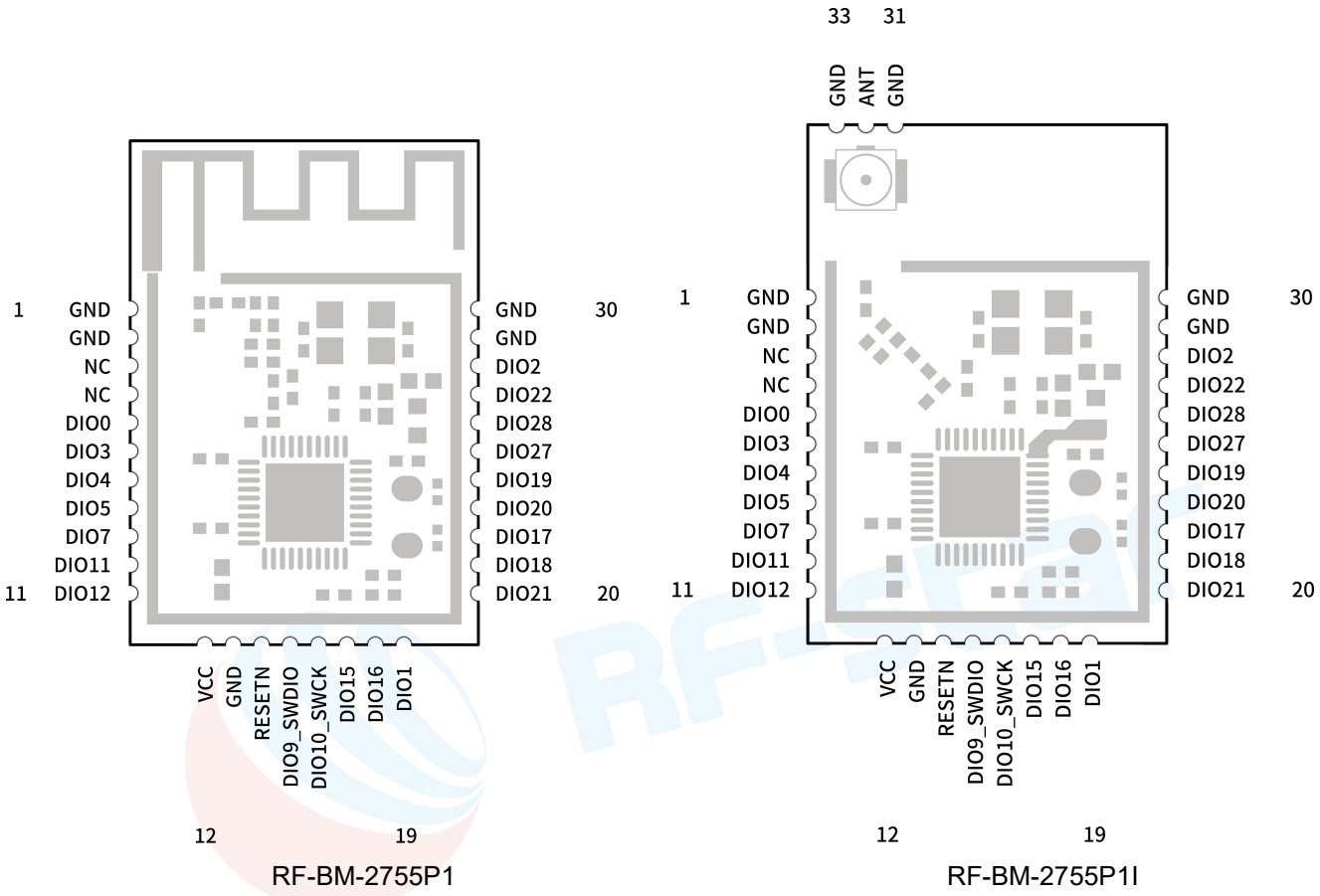


Figure 3. Pin Diagram of RF-BM-2755P1(I)

2.3 Pin Functions

Table 2. Pin Functions of RF-BM-2755P1(I)

Pin	Name	Chip Pin	Function	Description
1	GND	GND	Ground	Ground
2	GND	GND	Ground	Ground
3	NC	NC	NC	None Connect
4	NC	NC	NC	None Connect
5	DIO0	DIO0	Digital	GPIO
6	DIO3	DIO3	Digital	GPIO, high-drive capability
7	DIO4	DIO4	Digital	GPIO
8	DIO5	DIO5	Digital	GPIO

9	DIO7	DIO7	Digital	GPIO
10	DIO11	DIO11	Digital	GPIO
11	DIO12	DIO12	Digital	GPIO
12	VCC	VCCS	VCC	Power supply: 1.71 V ~ 3.8 V, recommended to 3.3 V
13	GND	GND	GND	Ground
14	RESET	RSTN	Digital	Reset, active low. Internal pullup.
15	DIO9_SWDIO	DIO9_SWDIO	Digital	GPIO, SWD interface: mode select or SWDIO (JTAG_TMSC), high-drive capability
16	DIO10_SWDCK	DIO10_SWDCK	Digital	GPIO, SWD interface: clock(JTAG_TCKC), high-drive capability
17	DIO15	DIO15	Digital	GPIO
18	DIO16	DIO16	Digital	GPIO
19	DIO1	DIO1	Digital	GPIO
20	DIO21	DIO21_A4	Digital or Analog	GPIO, analog capability
21	DIO18	DIO18_A7	Digital or Analog	GPIO, analog capability, high-drive capability
22	DIO17	DIO17_A8	Digital or Analog	GPIO, analog capability, high-drive capability
23	DIO20	DIO20_A5	Digital or Analog	GPIO, analog capability
24	DIO19	DIO19_A6	Digital or Analog	GPIO, analog capability
25	DIO27	DIO27_A1	Digital or Analog	GPIO, analog capability
26	DIO28	DIO28_A0	Digital or Analog	GPIO, analog capability
27	DIO22	DIO22_A3	Digital or Analog	GPIO, analog capability
28	DIO2	DIO2	Digital	GPIO, analog capability, high-drive capability
29	GND	GND	Ground	Ground
30	GND	GND	Ground	Ground
31	GND	GND	Ground	Ground, for RF-BM-2755P1I only
32	ANT	ANT	RF	External ANT output pin, for RF-BM-2755P1I only
33	GND	GND	Ground	Ground, for RF-BM-2755P1I only

3 Specifications

3.1 Recommended Operating Conditions

The 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 3. Recommended Operating Conditions of RF-BM-2755P1(I)

Items	Condition	Min.	Typ.	Max.	Unit
Operating Supply Voltage	/	1.71	3.3	3.8	V
Operating Temperature	/	-40	+25	+85	℃

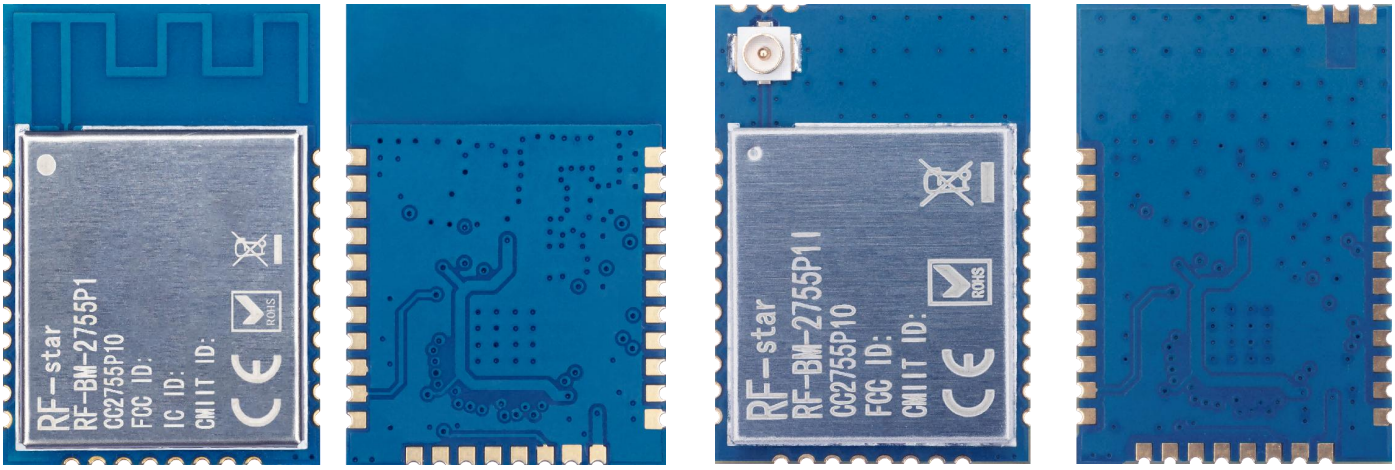
3.2 Handling Ratings

Table 4. Handling Ratings of RF-BM-2755P1(I)

Items	Condition	Min.	Typ.	Max.	Unit
Storage Temperature	Tstg	-40	+25	+125	℃
Human Body Model	HBM		±1000		V
Moisture Sensitivity Level			3		
Charged Device Model			±250		V

5 Application, Implementation, and Layout

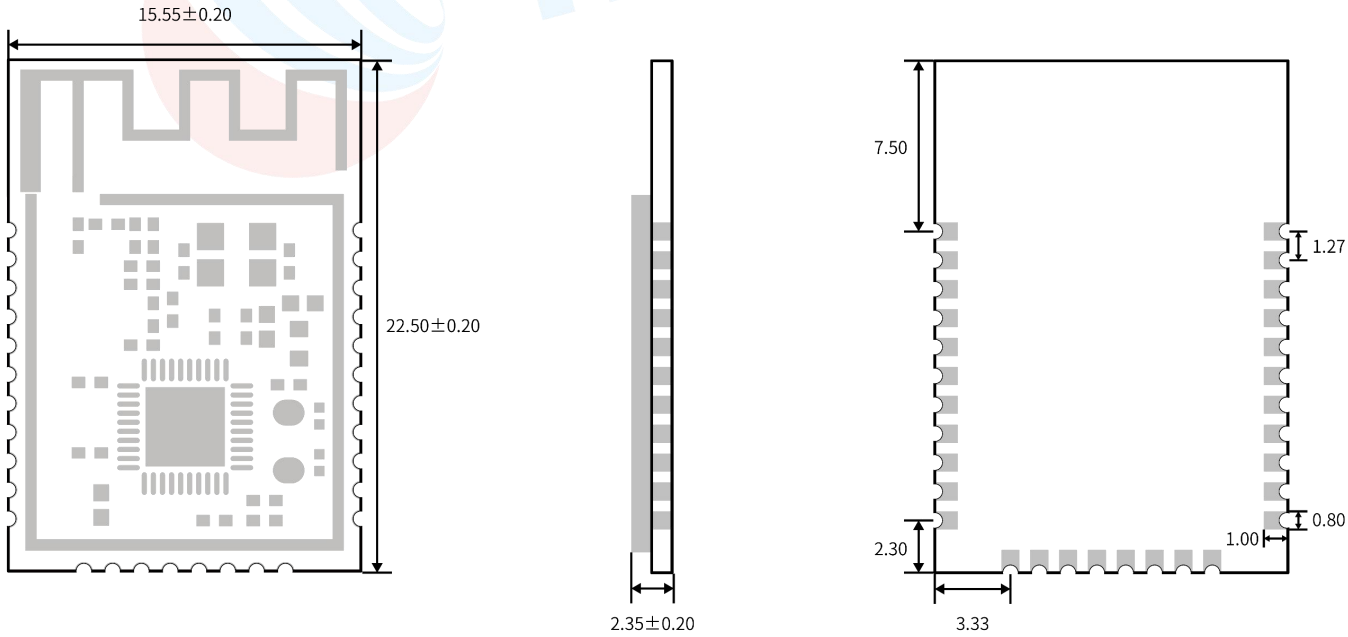
5.1 Module Photos



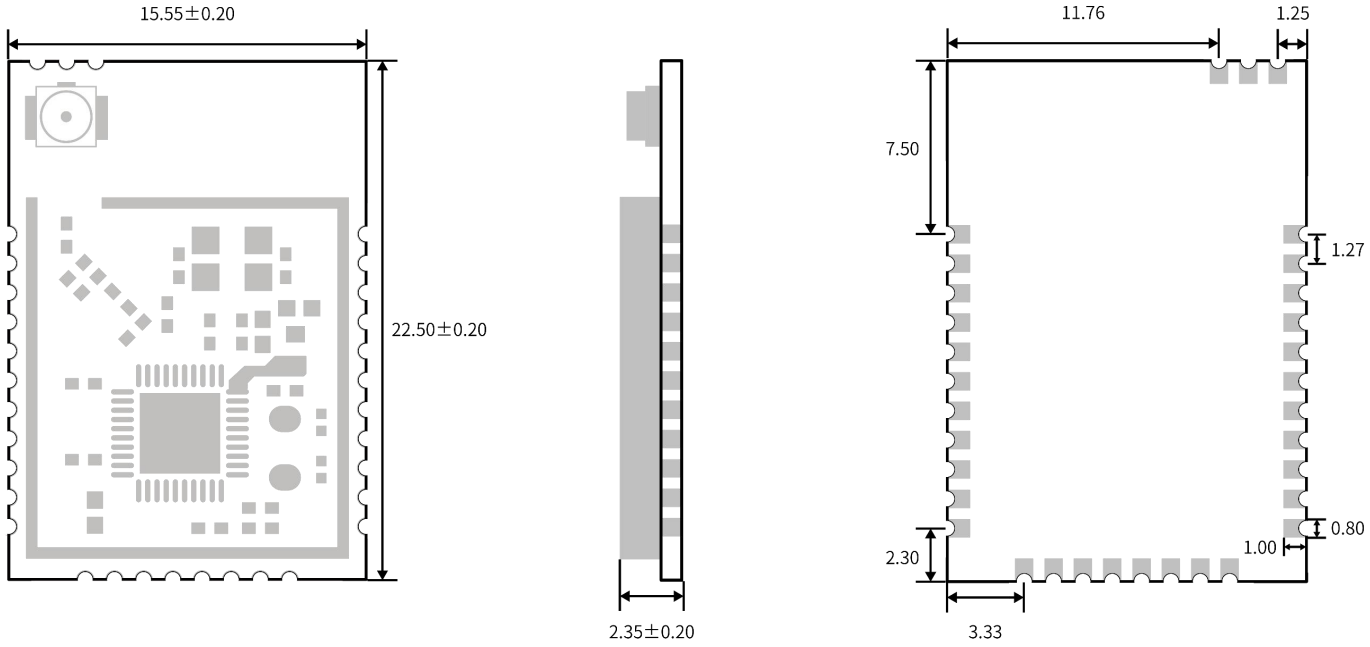
RF-BM-2755P1 RF-BM-2755P1I

Figure 3. Photos of RF-BM-2755P1(I)

5.2 Recommended PCB Footprint



RF-BM-2755P1



RF-BM-2755P1I

Figure 4. Recommended PCB Footprint of RF-BM-2755P1(I)

5.3 Antenna

5.3.1 Antenna Design Recommendation

1. 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.
2. The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.
3. The recommendation of antenna layout.

   The inverted-F antenna position on PCB is free-space electromagnetic radiation. The location and layout of the antenna are key factors 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 best to hollow out the antenna position in the following figure to ensure that the S11 of the module is minimally affected.

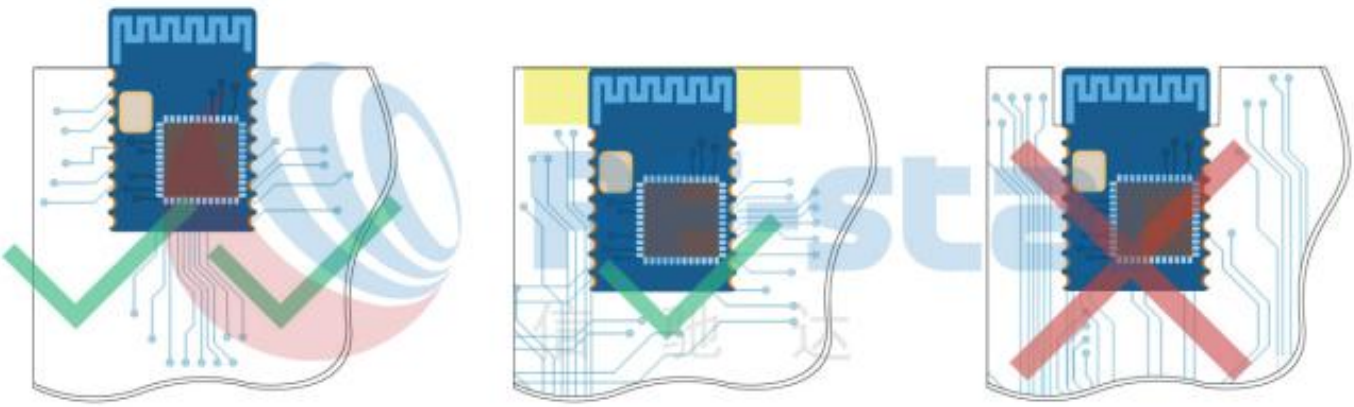


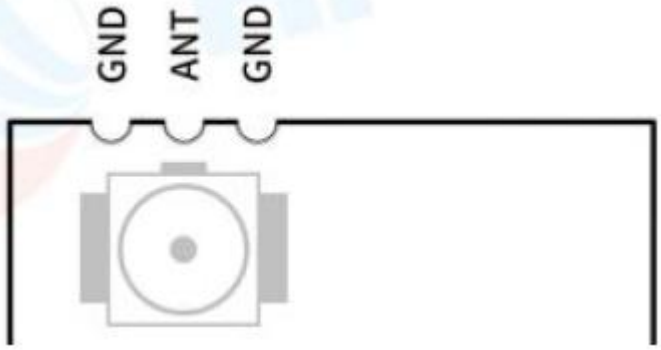
Figure 4. Recommendation of Antenna Layout

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

5.3.2 Antenna Output Mode Modification

RF-BM-2755P1I has two antenna output modes. One is an IPEX connector and the other is a stamp half-hole output (ANT pin, see pin function table for details).

The default delivery is the ***IPEX connector***, and the capacitor connected to the IPEX is welded. If you want to use the external antenna by the ANT pin, just connect the external antenna to the ANT pin. Pls kindly refer to the reference design as above.



5.3.3 External Antenna Design Recommendation of the Half-Hole ANT Pin

1. A Π-type matching circuit is reserved for the antenna, and 50 Ω impedance control is performed on the RF traces. The traces are as short as possible, and 135° or arc traces are used as much as possible. No vias are used to change layers. More GND vias are placed around the RF traces.

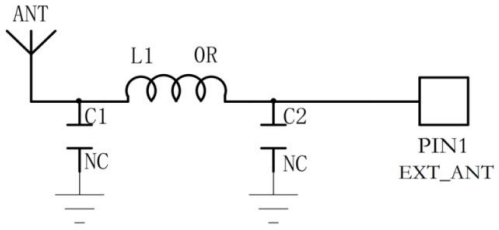


Figure 5. Reference Design of the External Antenna

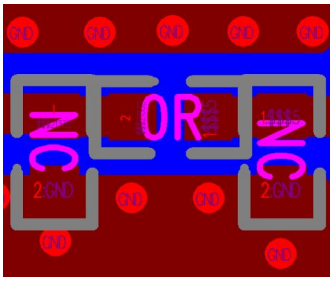


Figure 6. Reference Design of the External Antenna Traces

2. The RF trace width and copper-clad spacing can be calculated by SI9000 software, and the impedance is controlled to 50 Ω according to the actual board thickness, number of layers, plate, dielectric thickness, dielectric constant, copper thickness, line width, line spacing, and solder mask thickness.

   Example: FR4 is a double-layer board with a thickness of 1.0 mm. Through calculation, the width of the trace is 0.8254 mm, and the spacing between traces and copper is 0.22 mm.

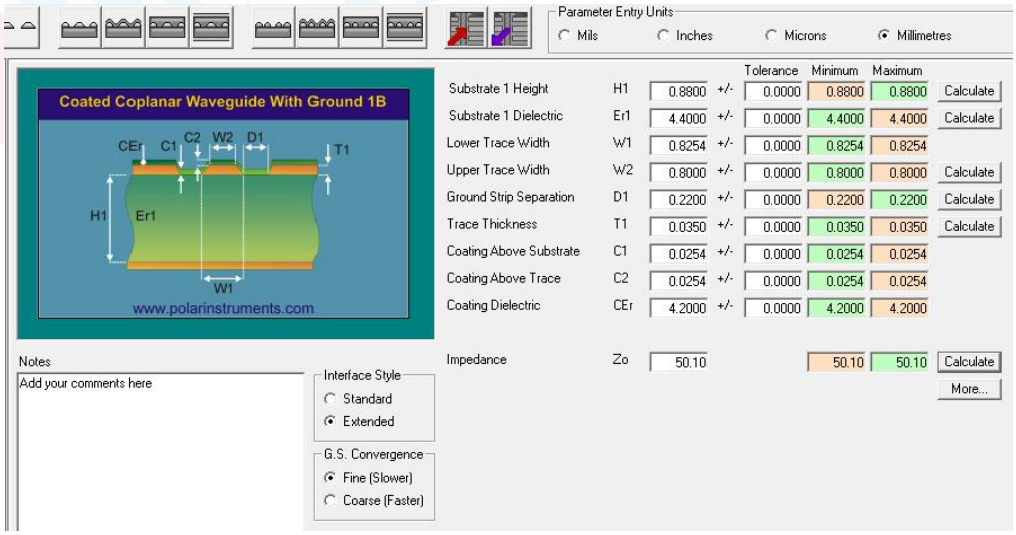


Figure 7. SI9000 Impedance Calculation Diagram

5.3.4 IPEX Connector Specification

RF-BM-2755P1I module is integrated with the IPEX version 1 antenna seat, the specification of the antenna seat is as follows:

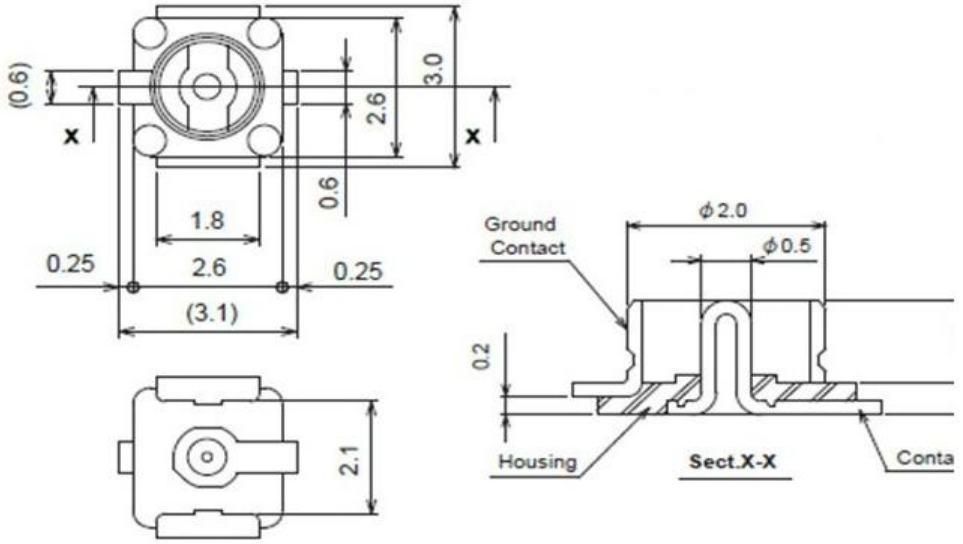


Figure 8. Specification of Antenna Seat

The specification of the IPEX wire end is as follows:

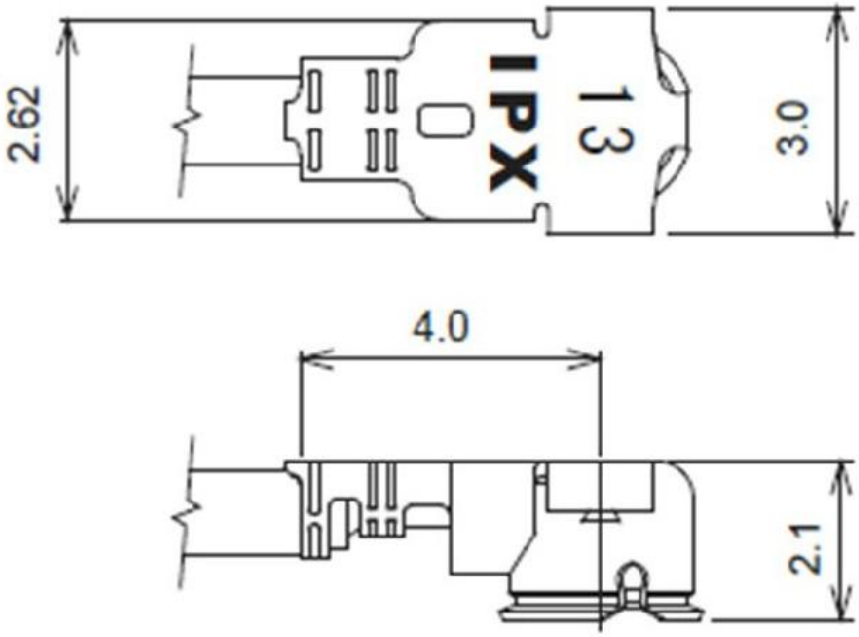


Figure 9. Specification of IPEX Wire

5.4 Basic Operation of Hardware Design

1. It is recommended to offer the module a DC stabilized power supply, a tiny power supply ripple coefficient, and 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 a stable power supply and no frequently fluctuating 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 the 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 the 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 the 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 degree.
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 physical layer, for example, USB 3.0.

5.5 Trouble Shooting

5.5.1 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 the 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 the seaside are poor.
3. The signal attenuation will be very obvious if there is metal near the antenna or if the module is placed inside the metal shell.
4. The incorrect power register set or the high data rate in the 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 modules or the poor quality of antenna will affect the communication distance.

5.5.2 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 a stable power supply and no frequently fluctuating 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.

5.5.3 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's reliability.
3. If the extension wire or feeder wire is of poor quality or too long, the bit error rate will be high.

5.6 Electrostatics Discharge Warnings

The module will be damaged by the discharge of static. RF-star suggests 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 the module, even causing failure.

5.7 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 5. 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

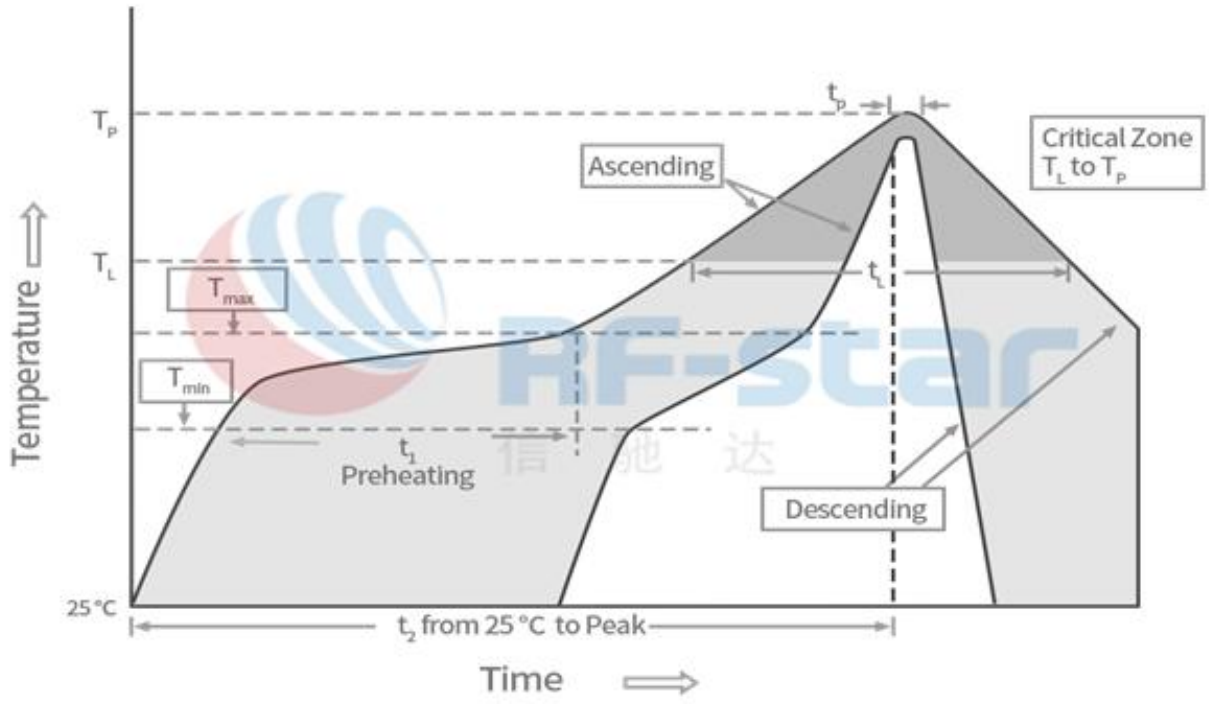


Figure 10. Recommended Reflow for Lead-Free Solder

6 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.

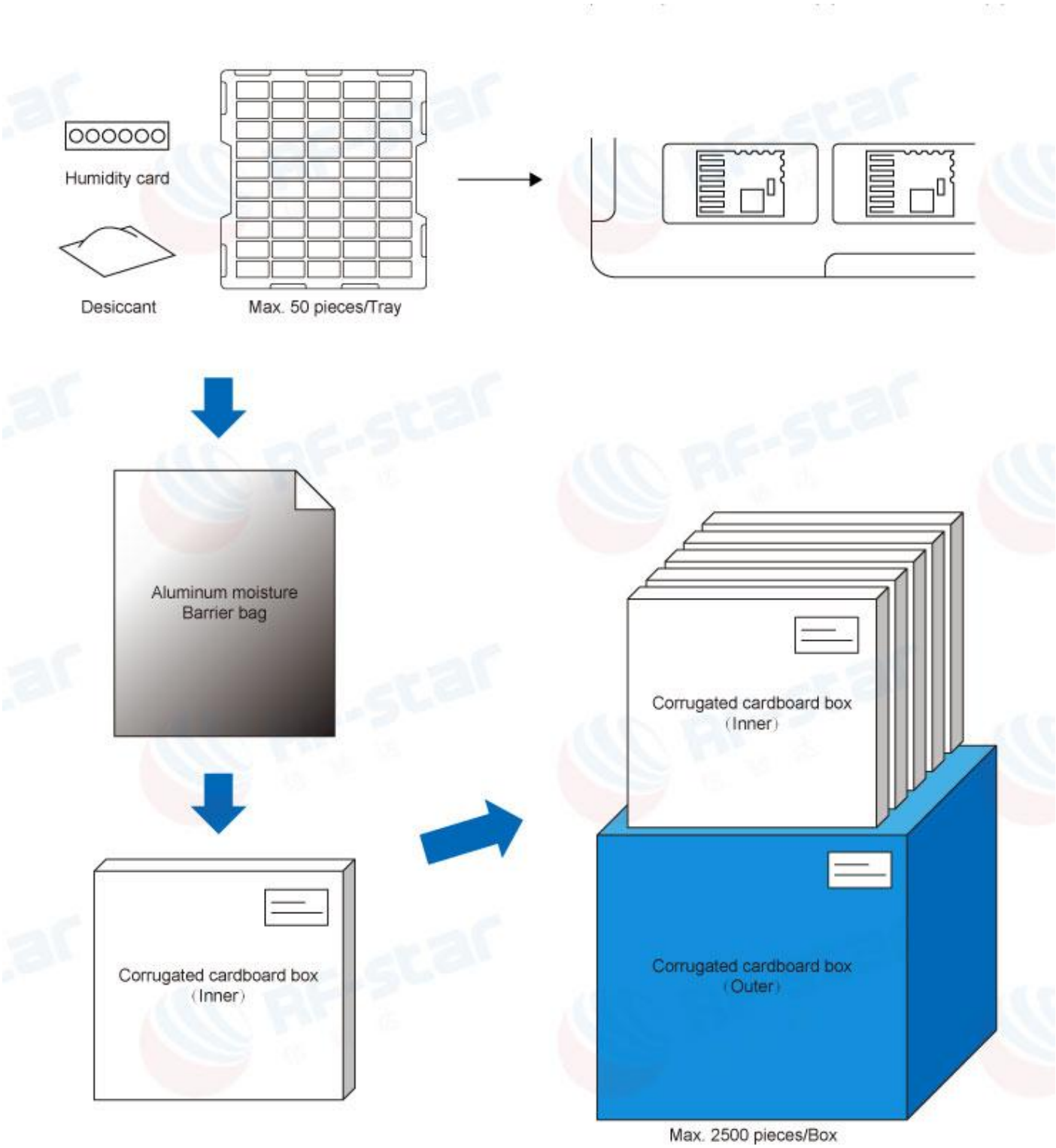


Figure 11. Default Package by Tray

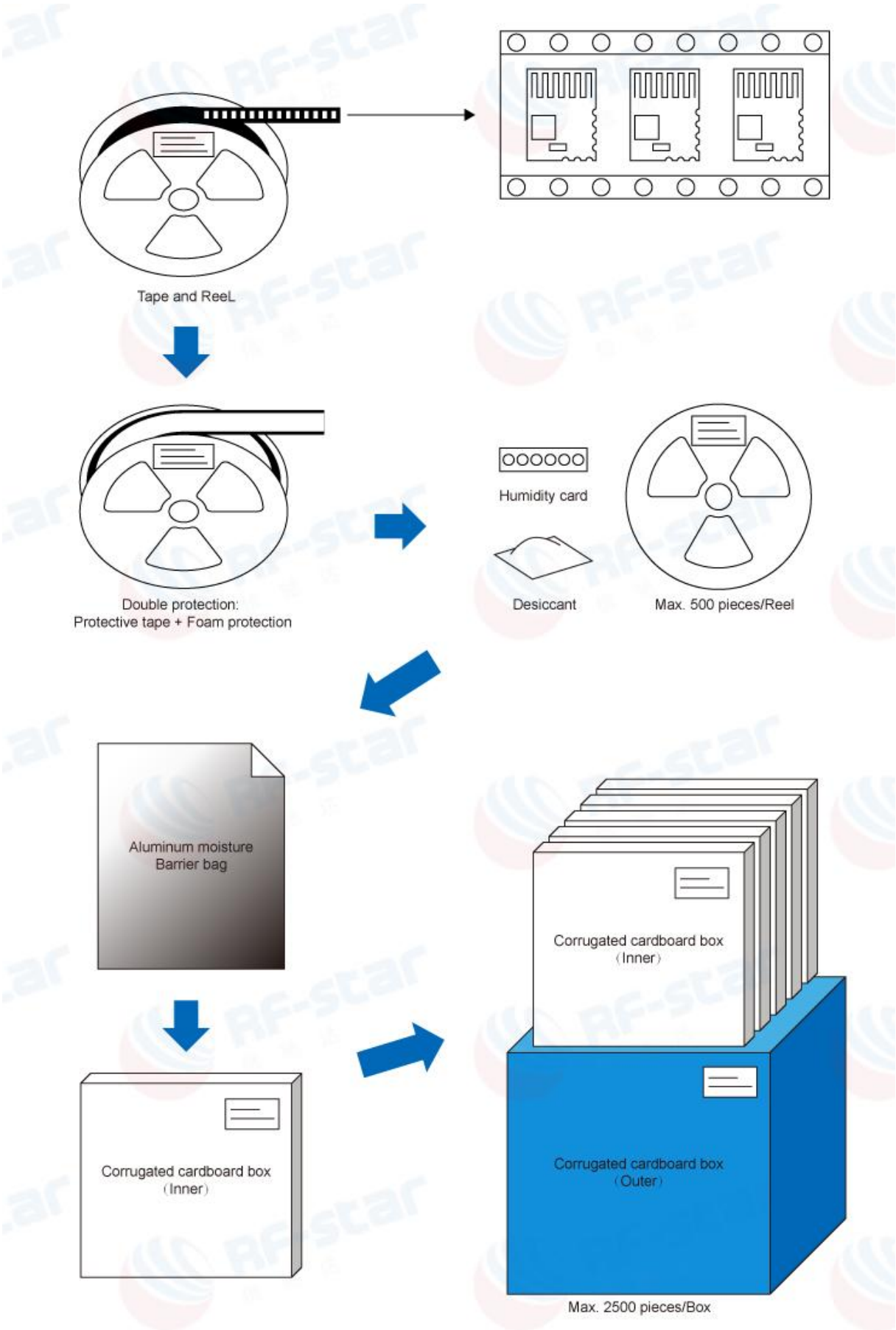


Figure 12. Package by Tape & Reel

7 Revision History

Date	Version No.	Description
2026.07.30	V1.0	The initial version is released.

Note:

1. The document will be optimized and updated from time to time. Before using this document, please make sure it is the latest version.
2. To obtain the latest document, please download it from the official website: www.rfstariot.com and www.szrfstar.com.

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