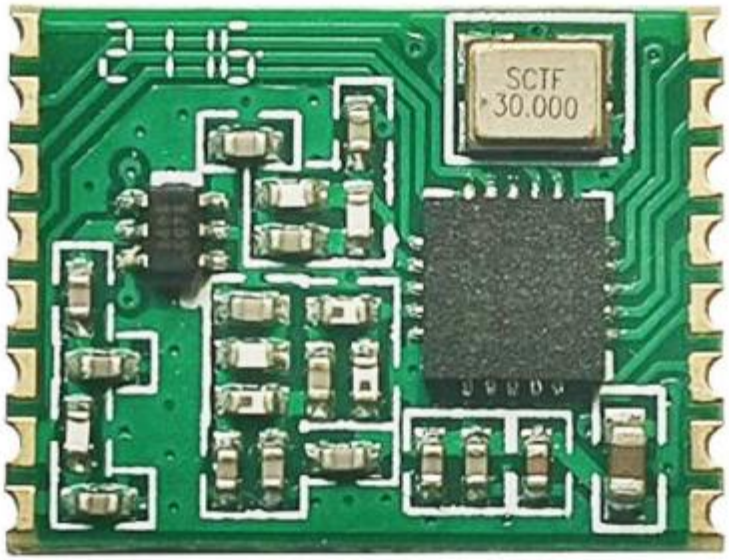
SI4463SxS Series wireless modules
Hardware specification

V1.1



contents

1. Overview

SI4463SxS series of wireless modules, is based on Silicon Labs of SI 4463 A high-performance wireless transceiver chip designed with compact size, low power consumption, and long range
Separate two-way wireless transceiver module.

Silicon Laboratories of Si 4463 The device is a high performance, low current RF transceiver covering 142 to 1050MHz _ Global major sub - GHz ISM frequency band and has features as low as –129dBm _ Excellent receiving sensitivity. Modules up to +20 dBm The output power and excellent high receiving sensitivity ensure that the A robust communications link budget is still available under working conditions. Modules can meet global regulatory standards: FCC , ETSI , Wireless MBus and ARIB . Working parameters of this module The configuration is very flexible, and the specific configuration file can be passed Silicon Labs on the website Wireless Development Suite (WDS) tool generation.

The module integrates all radio frequency related functions and devices. Users can use this module to easily develop stable performance without having an in-depth understanding of radio frequency circuit design.

Product main features:

- Frequency range=142–1050 MHz
- Best receiving sensitivity=–129 dBm
- Support modulation method
  - (G)FSK, 4(G)FSK, (G)MSK
  - OOK
- Maximum output power +20dBm

- Low receiving current

  13 mA receiving current

- Low power consumption mode

  - Shutdown mode 30nA
  - Sleep mode is less than 1uA

- Communication rate 100 bps to 500Kbps programmable configuration
- Wide supply voltage range 1.8 to 3.8 V
- TX and RX 64-byte FIFO
- Comply with IEEE 802.15.4g and WMBus standards
- Applicable to FCC Part 90 Mask D, FCC Parts 15.247, 15231, 15249, ARIB T-108, T-96, T-67, RCR STD-30, China Regulation

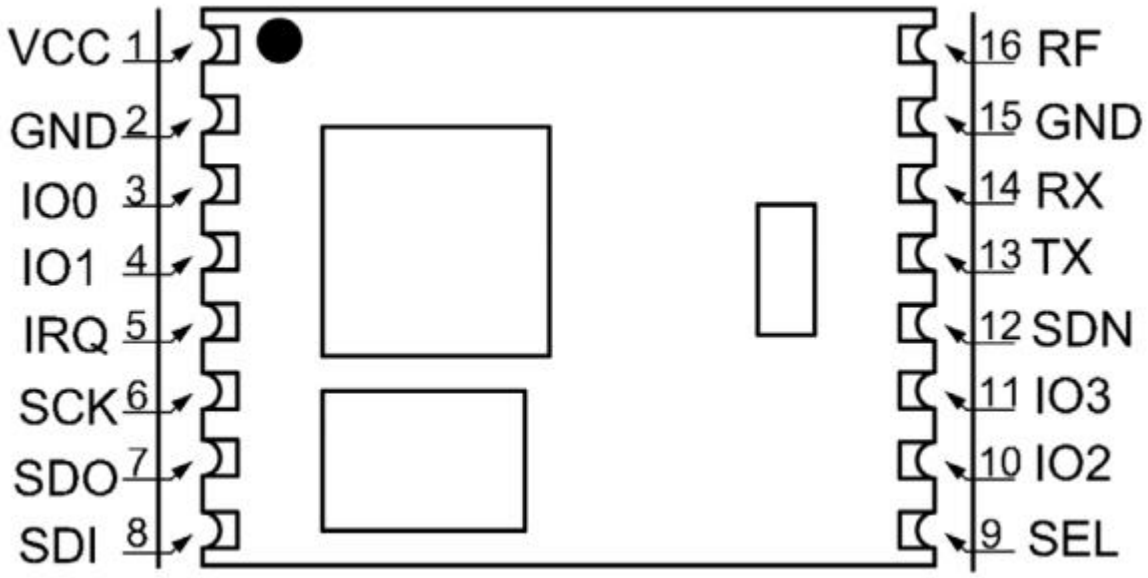
application:

- Logistics tracking, warehouse inspection, electronic labels, etc.
- substitute 232,485 perform wireless data communications
- Wireless data collection and control of industrial instruments
- AMR (water, electricity, gas) three meter reading
- Buildings and Housing (Smart Home) control
- Wireless remote control for consumer electronics products
- Wireless Alarm and Security Systems
- wireless sensor network

2. Main technical parameters

Technical index	parameter	Remark
voltage range	1.8～3.8V	generally 3.3V
Frequency Range	433MHz/868MHz/ 915MHz	The applicable frequency band is determined by the module model
Output Power	-37dBm to +20 dBm	Programmable configuration
Wireless speed	0.1 kbps ~ 500 Kbps @ FSK	Programmable configuration
Crystal frequency	30 MHz	Passive crystal oscillator
Modulation	(G)FSK	
Receive sensitivity	-127 dBm	500 bps , GFSK , BT = 0.5
Receive bandwidth	0.2 kHz ~ 850 kHz @ FSK	Programmable configuration
Emission current	80 mA	Transmit power = 20 dBm
receive current	13.7mA	
Sleep current	< 1uA	
Driver interface	SPI	standard 4 Wire SPI, SPI Clock: <=10MHz CPOL = 0, CPHA = 0
Antenna impedance	50 ohm	
Antenna connection method	Side stamp hole	
storage temperature	-55℃～+125℃	
Operating temperature	-40℃～+85℃	Industrial grade
Size	16.0x 12.0mm	

3. Pin location diagram



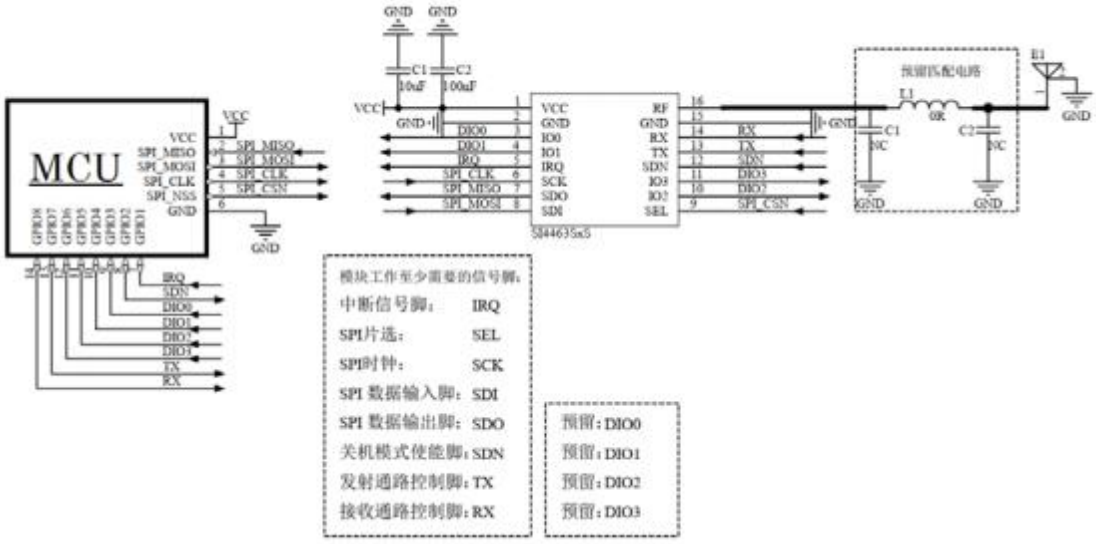
picture3-1 top view

4. Pin description

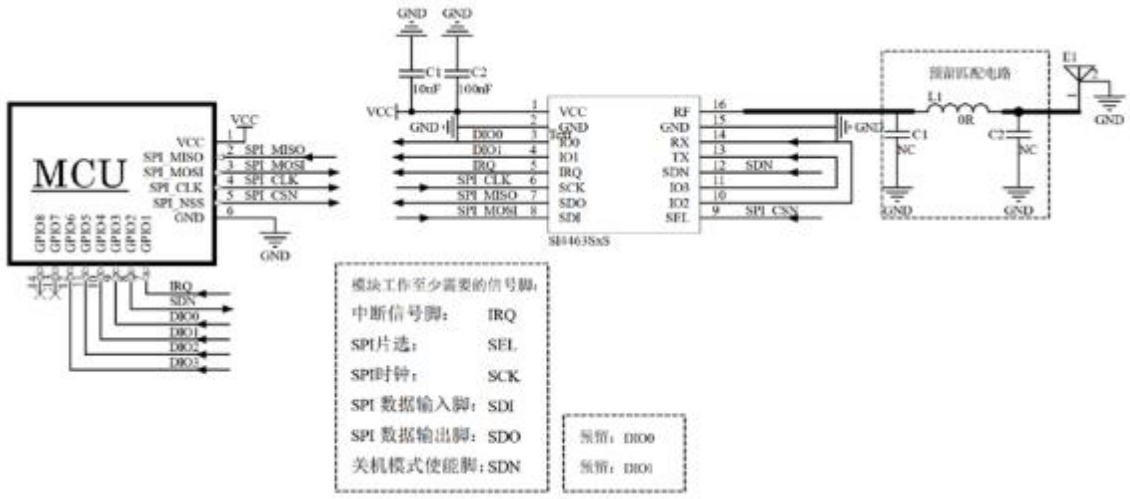
Number	Pin	Types	describe
1	VCC	power supply	Positive pole of power supply
2	GND	power supply	land
3	IO0	I/O	direct chip GPIO 1 number I/O pin, software configurable function
4	IO1	I/O	direct chip GPIO 1 number I/O pin, software configurable function
5	IRQ	O	chip NIRQ interrupt output signal, Outputs low level when an interrupt occurs
6	SCK	I	SPI interface SCLK clock input
7	SDO	O	SPI interface MISO data output
8	SDI	I	SPI interface MOSI data input
9	SEL	I	SPI Interface chip select input
10	IO2	I/O	direct chip GPIO 1 number I/O pin, software configurable function
11	IO3	I/O	direct chip GPIO 3 number I/O pin, software configurable function
12	SDN	I	Chip shutdown control pin SDN =0, this pin must be set low in all modes except shutdown mode SDN =1, the module will be completely shut down and the contents of the internal registers will be lost
13	Tx	I	Module RF switch transmission channel control pin, when transmitting TX =1; RX =0
14	RX	I	Module RF switch receiving channel control pin, when receiving RX =1; TX =0
15	GND	power supply	land
16	RF	I/O	RF Signal input/output, connect 50Ω antenna

5. Hardware design guidance and precautions

5.1 . Hardware connection diagram



picture5-1Programming to develop hardware connections (usingMCUcontrolRX \TXfoot)



picture5-2Programming to develop hardware connections (using modulesIO2, IO3controlRX\TXfoot)

5.2 , Power supply design and related precautions

1. Please pay attention to the correct connection of the positive and negative poles of the power supply. And ensure that the power supply voltage is within the recommended power supply voltage range. If it exceeds the maximum allowable power supply range of the module, it will cause the module to malfunction.

The module is permanently damaged; the filter capacitor of the module power pin should be as close as possible to the module power pin.

2. In the module power supply system, excessive ripples may be coupled to lines that are susceptible to interference through wires or ground planes. Such as antennas, feeders, clock lines, etc.

Sensitive signal lines can easily cause the module's radio frequency performance to deteriorate, so we recommend using LDO as the power supply for the wireless module.

3. Select LDO When installing a voltage stabilizing chip, you need to pay attention to the heat dissipation of the power supply and LDO Stable output current driving ability; considering the long-term stable operation of the whole machine, it is recommended to pre-

Keep More than 50% current output margin.

4. It is best to use one module separately. LDO Stable voltage power supply; If adopted DC - DC power supply chip, be sure to add one at the end LDO As isolation of module power supply, prevent

Prevent the noise of the switching power supply chip from interfering with the working performance of the radio frequency.

5. MCU If the communication line between the module and the module is used 5V level, must be connected in series 1K-5.1K resistor (not recommended, there is still a risk of damage).

6. Keep the RF module as far away from high-voltage devices as possible, because the electromagnetic waves of high-voltage devices will also have a certain impact on RF signals.

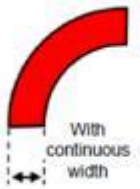
7. High-frequency digital traces, high-frequency analog traces, and high-current power traces should be kept away from the bottom of the module. If they have to pass under the module, they need to be placed on the module.

Blocky PCB Another layer of the bottom board, and ensure that the copper underneath the module is well grounded.

5.3 . Antenna design and guidance

5.3.1 stamp hole interface RF design

50 ohm characteristic impedance trace to connect to the base plate during design. Antenna on the PCB . Considering the attenuation of high-frequency signals, Need to pay attention to the bottom plate PCB The length of RF traces must be as short as possible. It is recommended that the longest trace length does not exceed 20 mm , and the trace width needs to maintain continuity;When you need to turn, try not to take sharp or right angles. It is recommended to take arcs.

The primary recommended turning method for RF cabling	
The second recommended RF wiring turning method	
A poor way to turn RF cables, not recommended	

In order to ensure that the impedance of the backplane RF trace is 50 Ohms, depending on the thickness of the board, Adjust according to the following parameters. The following simulation values are for reference only.

RF wiring adopts20mil line width	The plate thickness is When1.0mm , the distance between ground copper and trace is5.3mil
	The plate thickness is When1.2mm , the distance between ground copper and trace is5.1mil
	The plate thickness is At1.6mm , the spacing between ground copper and traces is5mil
RF wiring adopts25mil line width	The plate thickness is When1.0mm , the distance between ground copper and trace is6.3mil
	The plate thickness is When1.2mm , the distance between ground copper and trace is6mil
	The plate thickness is At1.6mm , the spacing between ground copper and traces is5.7mil
RF wiring adopts 30mil line width	The plate thickness is When1.0mm , the distance between ground copper and trace is7.6mil
	The plate thickness is When1.2mm , the distance between ground copper and trace is7.1mil
	The plate thickness is At1.6mm , the spacing between ground copper and traces is6.6mil

5.3.2 Built-in antenna

The built-in antenna refers to the one welded on PCB The antenna placed inside the product casing on the base plate, Specifically, it includes patch ceramic antennas, spring antennas, etc. When using the built-in antenna, The structure of the product and the installation position of the antenna have a great impact on the radio frequency performance. On the premise that the structure space of the product shell is sufficient , The spring antenna should be placed as vertically upward as possible; Copper cannot be laid around the base plate where the antenna is placed, or the circuit board under the antenna can be hollowed out, because metal has a strong ability to absorb and shield radio frequency signals.

It will seriously affect the communication distance. In addition, the antenna should be placed on the edge of the base plate as much as possible.

5.3.3 external antenna

External antenna means the module passes IPEX Extension cables, SMA and other standard radio frequency interfaces are installed outside the product shell, including rod antennas and suction cup antennas.

wire, fiberglass antenna, etc. External antennas are basically standard products. In order to better choose an antenna suitable for the module, the parameters of the antenna should be selected during the antenna selection process.

When choosing, you should pay attention to the following:

1. The working frequency of the antenna and the working frequency of the corresponding module should be consistent.

2. The input characteristic impedance of the antenna should be 50 ohm .

3. The size of the antenna interface should match the size of the antenna interface of the module.

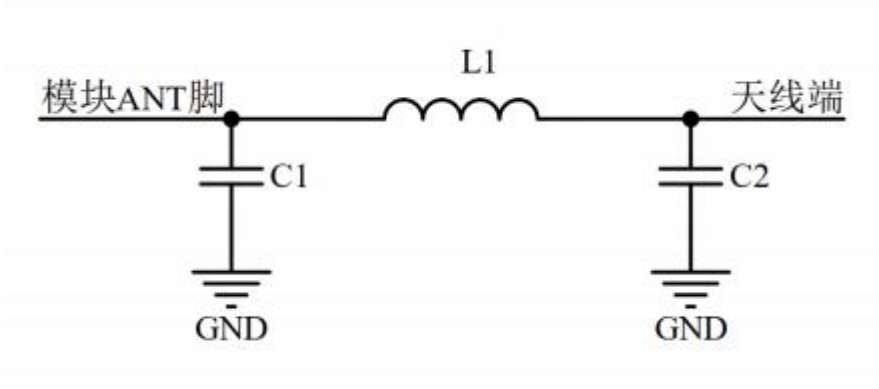
4. The standing wave ratio (VSWR) of the antenna is recommended to be less than 2, and the antenna should have a suitable frequency bandwidth (covering the frequencies used in the actual application of

specific products).

5.3.4 Antenna matching

Antennas are critical to the transmission distance of RF modules. In practical applications, To facilitate users' later antenna matching adjustments. It is recommended that users design the schematic diagram in lines and modules ANT A simple π-type matching circuit is reserved between the pin outputs. If the antenna is already standard 50Ω, Components L1 stick 0R resistor, device C1,C2 No welding is required, otherwise you need to use a network analyzer to measure the actual impedance of the antenna and match it to determine C1 ,L1,C2 The value of . module ANT feet to antenna end

The traces should be as short as possible. It is recommended that the longest trace length does not exceed 20mm . _



5-3 π type matching circuit

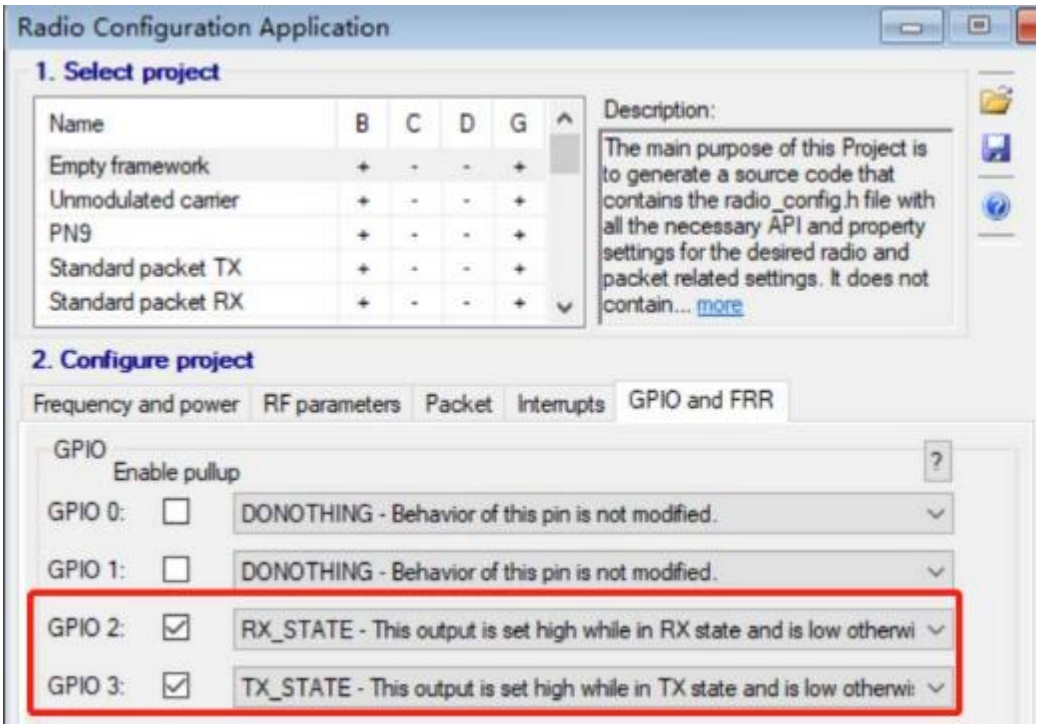
6. Precautions for programming development

1, module Tx, RX The pin is used to control the RF switch transceiver path inside the module. When used MCU When the port is controlled, the hardware connection method is as shown in the figure 5-1 school Show. Its control level logic is listed in the following table:

model	Tx pin	RX pin
emission	1	0
take over	0	1

2. To save money MCU available IO When changing the number of ports, you can also use the module itself IO mouth control Tx, RX, the hardware connection method is shown in the figure. 5-2 . this At this time, the GPIO 2 pin and GPIO 3 pin of the chip are used to control the switching logic of the RF transceiver path at the antenna end. When the module works normally to send and receive data, it is necessary to control the chip. GPIO 2 and GPIO 3 for configuration, Otherwise, the radio frequency channel switching is incorrect, which will result in very short communication distance. As shown below, use WDS Configuration tools, respectively

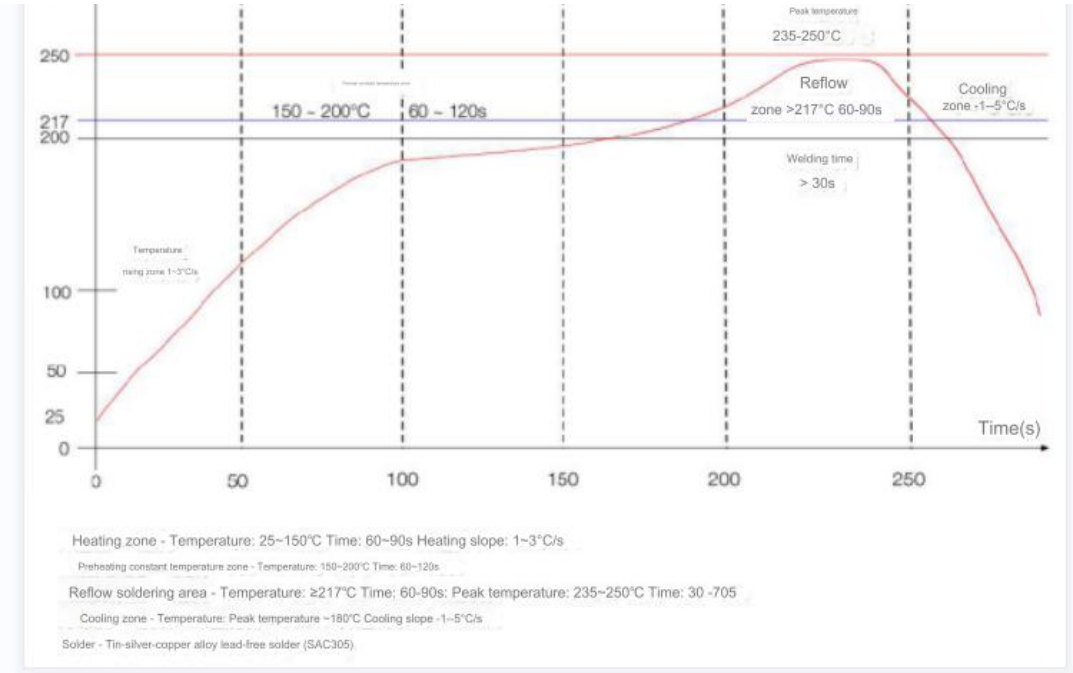
GPIO 2 is configured as RX_STATE _ _, GPIO 3 is configured as TX_STATE _ _ That' s it.



3. The receiving sensitivity of general RF chips is relatively poor at integer multiples of the working frequency of its crystal oscillator . It is recommended that users pay attention to avoid these when selecting working frequencies.

The mirror frequency point of the module crystal oscillator, That is, the integer multiple frequency point of the crystal oscillator frequency. The crystal oscillator frequency of this module is 30MHz .

7. Reflow soldering curve



8. Static electricity damage warning

The RF module is a high-voltage electrostatic sensitive device. To prevent static electricity from damaging the module

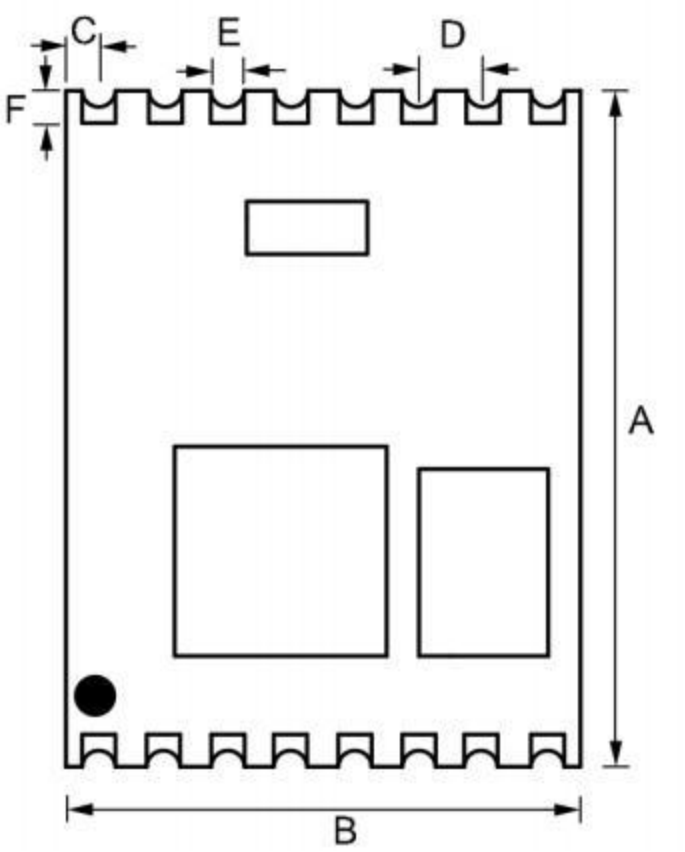
1, Strictly follow anti-static measures, and it is prohibited to touch the module with bare hands during the production process.

2, Modules should be placed in a placement area that prevents static electricity.

3. The anti-static protection circuit at the high-voltage input should be considered during product design.

9. Packaging information

Mechanical dimensions (unit: mm)



serial number	Dimensions(mm)	Error(mm)
A	16.0	±0.5
B	12.0	±0.5
C	0.7	±0.1
D	1.5	±0.1
E	1.0	±0.1
F	0.7	±0.1
G	1.0	±0.1
H	1.9	±0.2

10. Version update instructions

Version	Update content	Updated	principal
V1.0	first release	2018 Year 2 moon 8th	DropLin
V1.1	. Update layout . Add purchasing selection table	2021 Year 5 moon 26th	DropLin

11. Procurement selection table

Number	Model	Illustrate
1	SI4463S4S-V1-B1B	433MHz _ Band, B Version, tape packaging\pallet packaging
2	SI4463S4S-V1-C2A	433MHz _ Frequency band, C Version, Tape packaging\pallet packaging
2	SI4463S8S-V1-B1B	868MHz _ Band, B Version, tape packaging\pallet packaging
3	SI4463S8S-V1-C2A	868MHz _ Frequency band, C Version, Tape packaging\pallet packaging
4	SI4463S9S-V1-B1B	915MHz _ Band, B Version , Tape packaging\pallet packaging
5	SI4463S9S-V1-C2A	915MHz _ Frequency band, C Version, Tape packaging\pallet packaging

12. Statement

1. Due to product version upgrade or other reasons, The content of this document will be updated from time to time. Unless otherwise agreed, this document is only used as a guide.

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2. The company reserves the right of final interpretation and modification of all information provided, and is subject to change without prior notice.

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