

WS8408

SX1262 SPI Module

User Manual

- Supports LoRa™ modulation
- Maximum peak conducted output power is 10.5 dBm.
- Supports high air data rate, up to 300 kbps
- Supports data rates from 2.4 to 62.5 kbps under LoRa™ mode
- Dual RF interfaces optional: U.LF connector or stamp hole.
- 4-wire SPI communication interface

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1 Overview

1.1 Brief Introduction

The WS8408 is a wireless RF transceiver module designed based on Semtech's SX1262 RF chip. Utilizing the advanced LoRa™ modulation technology, this module offers lower power density and superior anti-interference performance compared to conventional FSK and GFSK modulation techniques, thereby enhancing communication reliability. Additionally, users can independently adjust the spreading bandwidth, spreading factor, and error correction rate.

1.2 Key features

Key features

The actual measured communication distance can reach up to 6 kilometers

Supported modulation methods: LoRa™

Support frequency band: 904-926 MHz

Maximum peak conducted output power is 10.5 dBm

In the LoRa™ mode, it supports data transmission rates ranging from 2.4 kbps to 62.5 kbps

The FIFO has a large capacity and supports a 256Byte data buffer

Supported spreading factors: 5 - 12

Supported encoding rates: 4/5, 4/6, 4/7, 4/8

4-line SPI communication interface, which can be directly connected to various microcontrollers for use

Wide voltage operating range: 1.8V - 3.7V(Typical voltage 3.3V)

Industrial-grade standard design, capable of withstanding long-term use within the temperature range of -40°C to 85°C.

Antenna Interface: IPX (U.FL) connector, matched for 50Ω external antenna

Foldable antenna with maximum antenna gain is 4dBi

1.3 Application

Application

Home security alarm

Smart Home

Industrial sensor

Wireless alarm security system

Building Automation Solution

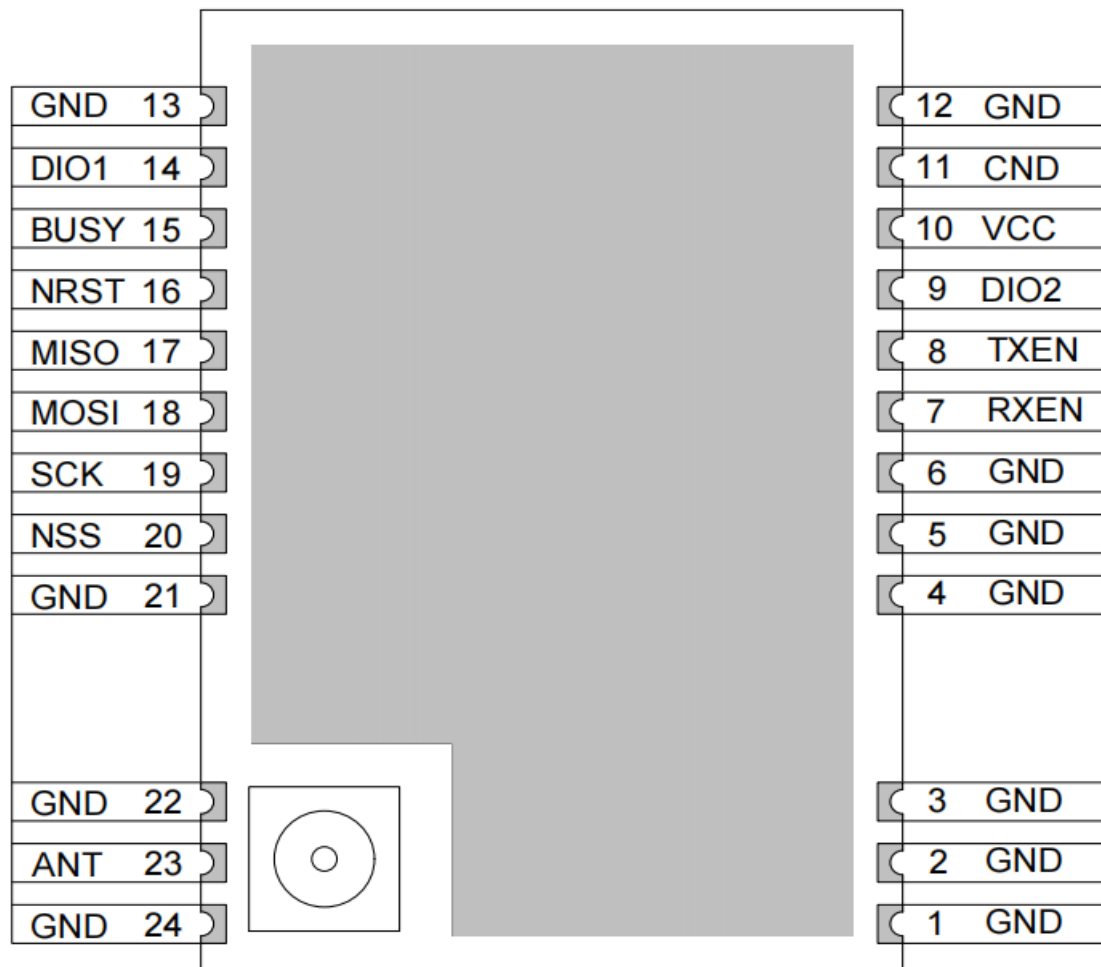
Wireless industrial-grade remote controller

Medical healthcare products

Application in the automotive industry

3 Hardware design

3.1 Pin definition



Pin number	Pin name	Type	Describe
1	GND	I	Power reference ground
2	GND	I	Power reference ground
3	GND	I	Power reference ground
4	GND	I	Power reference ground
5	GND	I	Power reference ground
6	GND	I	Power reference ground
7	RXEN	I	RF switch receiving control pin, connected to the external microcontroller's IO, with high level as the valid signal.
8	TXEN	O	RF switch transmit control pin, connected to the external microcontroller's IO or DIO2, with high level as the valid signal.
9	DIO2	I/O	Configurable general-purpose I/O ports (refer to the SX1262 manual)
10	VCC	I	Power supply voltage range: 1.8V - 3.7V (It is recommended to add ceramic filter capacitors externally)
11	GND	I	Power reference ground
12	GND	I	Power reference ground
13	GND	I	Power reference ground
14	DIO1	I/O	Configurable general-purpose I/O ports (refer to the SX1262 manual)
15	BUSY	O	Used for status indication (refer to the SX1262 manual)
16	NRST	I	Chip reset trigger input pin, with low level as the effective signal.
17	MISO	O	SPI data output signal
18	MOSI	I	SPI data input signal
19	SCK	I	SPI serial clock
10	NSS	I	SPI chip select signal
21	GND	I	Power reference ground
22	GND	I	Power reference ground
23	ANT	I/O	Radio frequency interface, stamp hole
24	GND	I	Power reference ground

For the pin definitions, software drivers and communication protocols of the module, please refer to the official SX1262 Datasheet of Semtech.

4 Software Design

4.1 Software programming

- This module is the SX1262 module;
- DIO1 and DIO2 are general-purpose I/O ports that can be configured for various functions. Among them, DIO2 can be connected to TXEN and not to the I/O ports of the MCU, and is used to control the RF switch for transmission. Refer to the SX1262 manual for details. If not in use, it can be left unconnected;
- Internal uses 32MHz Crystal. Recommended register configuration: 0x14 0x14;
- The differences between SX1262/SX1268 and LLCC68:
 1. The SX1262/SX1268 supports spread spectrum factors of SF5, SF6, SF7, SF8, SF9, SF10, SF11, and SF12;
 2. LLCC68 supports spread spectrum factors of SF5, SF6, SF7, SF8, SF9, SF10, and SF11.

5 Electrical and other parameters

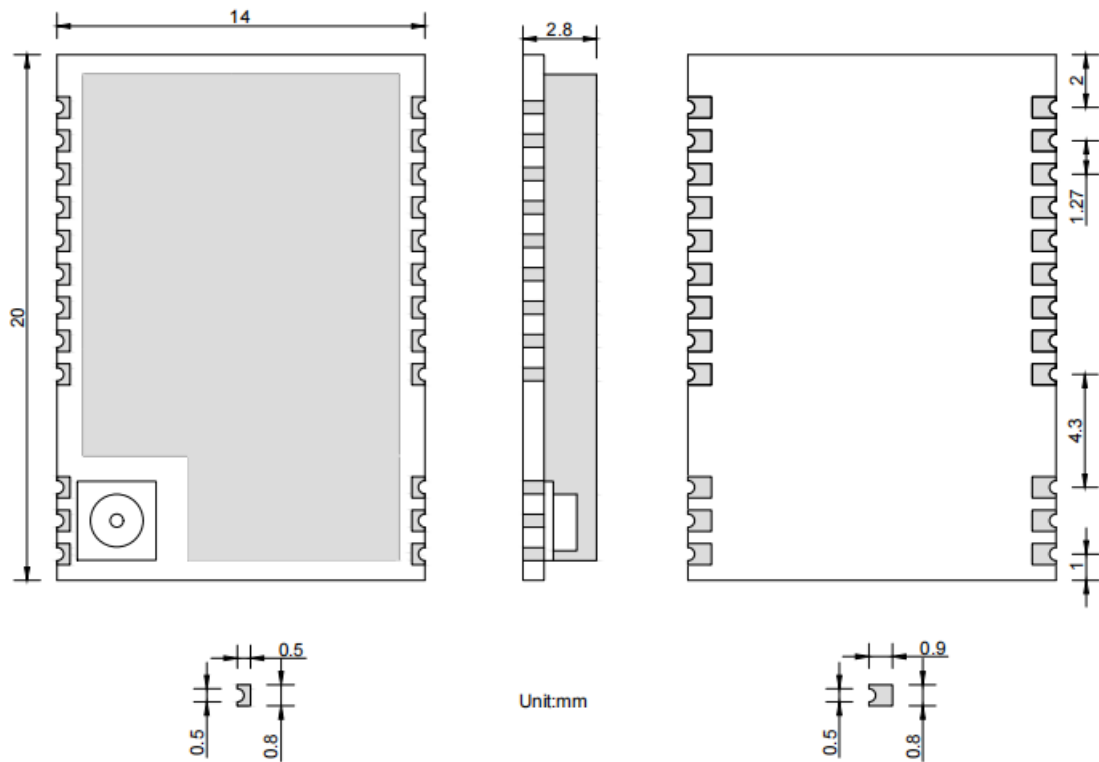
5.1 RF performance parameters

parameter		minimum value	typical value	maximum	unit	remarks
Working frequency band		904	915	926	MHz	
modulation system		-	LoRa™	-	-	
Air velocity	-	-	-	-	-	
@LoRa	LoRa™	2.4	-	62.5	kbps	User programming control
Maximum transmission power	/		9.5	10.5	dBm	
Receiving sensitivity			-148		dBm	BW_L=10.4kHz, SF=12, LORA™
Launch current			115		mA	Maximum transmission power instantaneous power consumption
Receive current			4.5		mA	
Cut off the current			180		nA	Software shutdown

5.2 Other parameters

Parameters	Description
Communication interface	4-wire SPI
Radio frequency interface	U.LF connector / stamp hole
Packaging method	Surface mount type
Interface method	1.27mm spacing stamp hole
Dimensions of the shape	20*14*2.8mm(With shielding cover)
Weight	g

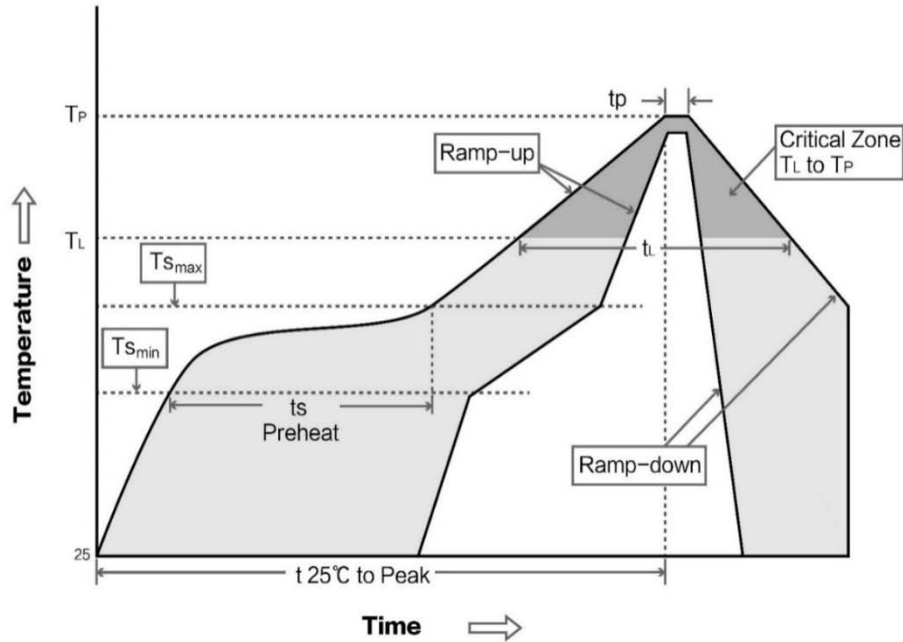
6 Module packaging size



- Recommended pad design: Length is $2 * 0.9\text{mm} = 1.8\text{mm}$, width is 0.8mm.

7 Production instructions

7.1 Reflow soldering curve graph



7.2 Reflow soldering temperature and time

Curve characteristics	Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Minimum preheating temperature	Preheat Temperature min (Tsmin)	100°C	150°C
Maximum preheating temperature	Preheat temperature max (Tsmax)	150°C	200°C
preheating time	Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average rising rate	Average ramp-up rate(Tsmax to Tp)	3°C/second max	3°C/second max
Liquid temperature	Liquidous Temperature (TL)	183°C	217°C
Time above liquidus	Time (tL) Maintained Above (TL)	60-90 sec	30-90 sec
Peak temperature	Peak temperature (Tp)	220-235°C	230-250°C
Average decline rate	Average ramp-down rate (Tp to Tsmax)	6°C/second max	6°C/second max
Time from 25°C to peak temperature	Time 25°C to peak temperature	6 minutes max	8 minutes max

8 FCC STATEMENT

Important Notice to OEM integrators

(Reference KDB 996369 D03 OEM Manual v01r01, KDB 996369 D04 Module Integration Guide v02)

1. Applicable FCC rules:

This device complies with part 15.247 of the FCC Rules. This module is limited to OEM installation ONLY.

2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).

3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed. Important Note notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Chengdu Silent Smart Technology Co., Ltd. that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2BB8U-WS8408 " .

The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	Antenna Connector	Peak Gain
External foldable rod antenna	SMA-K	4.0 dBi

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Information on test modes and additional testing requirements

- 1) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to retest all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
- 2) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.
- 3) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .
- 4) Additional testing, Part 15 Sub part B disclaimer: The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details. The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

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.

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 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

9 Contact information

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