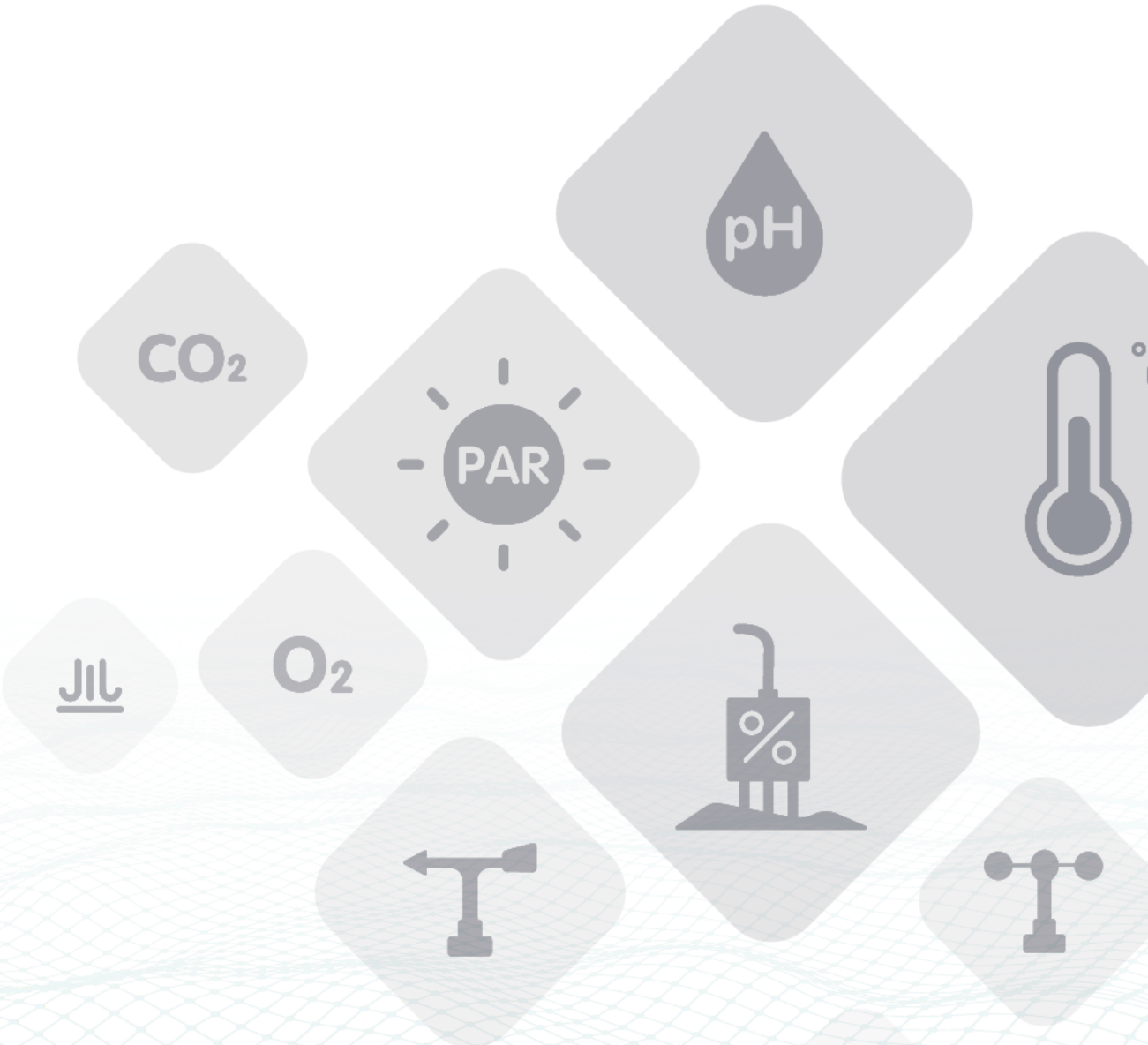
SENSECAP

Wio-SX1262 LoRa® Module

Version: V1.0



Content

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1. Introduction

Wio-SX1262 is a low-cost, ultra-low power, ultra-small size LoRa Pure RF module. The module is embedded with Semtech ultra-high performance LoRa wireless communication IC SX1262. The target application of this module is wireless sensor networks and other IoT devices, especially battery-powered low power consumption and long-distance occasions. Wio-SX1262 LoRa pure RF module is mainly suitable for long-distance, ultra-low-power applications such as wireless meter reading, sensor networks, and other low-power wide-area IoT scenarios.

This specification mainly describes the hardware information, hardware performance and application information of the module.

1.1 Features

- Low Power Consumption: as low as 1.62uA sleep current
- Low Cost and High performance
- Small Size: 11.6mm X 11mm * 2.95mm @12 pins SMT
- RF Interface: IPEX port, SMT Pin, default IPEX
- Support long-distance transmission:
  - TXOP=22dBm@862-930MHz
  - -136.73dBm sensitivity for SF12 with 125KHz BW, included line loss
- SPI Interface

1.2 Model Information

Part Number	TX Power (dBm)
Wio-SX1262	22@HF (862-930MHz) with IPEX

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2. Specification

The Wio-SX1262 module is equipped with the ultra-high-performance LoRa wireless communication IC, SX1262, making it ideal for designing various IoT nodes. It supports both (G)FSK and LoRa® modulations, with a bandwidth range of 7.8 to 500 kHz in LoRa® mode. The module provides an SPI communication interface for interaction with an external MCU. Its power distribution scheme supports two hardware options: DC-DC or a linear regulator LDO, and the Wio-SX1262 module utilizes the DC-DC design. Additionally, it features a high-precision active TCXO as its internal RF reference frequency, with DIO3 serving as the TCXO voltage power supply.

Schematic Diagram:

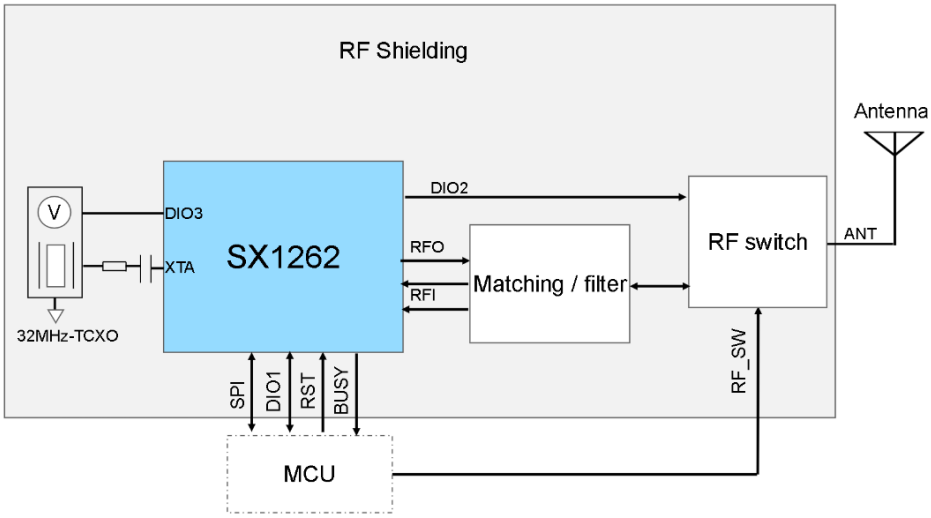

Figure 1 Wio-SX1262 Schematic Diagram

2.1 Pinout

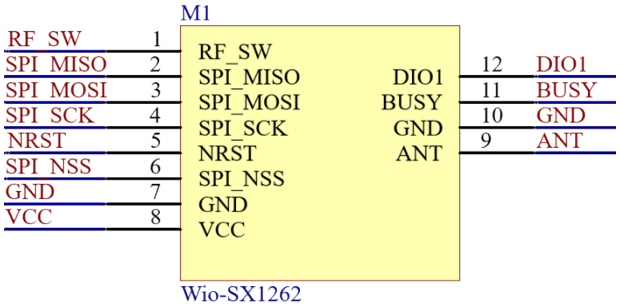

Figure 2 Wio-SX1262 Pinout

Number	Name	Type	Description

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1	RF_SW	I	External IO control internal gate RF switch Logic high=Enable Receiver mode, other time =low level
2	MISO	I/O	SPI_MISO
3	MOSI	I/O	SPI_MOSI
4	SCK	I/O	SPI_SCK
5	NRST	I	Reset signal, active low
6	NSS	I/O	SPI_NSS
7	GND	-	Ground
8	VCC	I	Supply voltage for the module
9	ANT	I/O	RF input/output, NC[1]
10	GND	-	Ground
11	BUSY	O	Busy indicator of IC SX1262
12	DIO1	I/O	Multi-purpose digital IO, DIO1 of IC SX1262
[1] The RF pin defaults to the IPEX interface and does not require soldering. If you need an RF SMT Pin version, please contact our sales team.			

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3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Reaching or exceeding the maximum ratings listed in the table below can cause equipment damage.

Item	Description	min	max	unit
VCCmr	Supply voltage	-0.5	+3.9	V
Tmr	Working temperature	-40	+85	℃
Tstore	Storage temperature	-40	+105	℃
Pmr	RF input level	-	+10	dBm

3.2 Operating Range

Item	Description	min	max	unit
VCCop	Supply voltage	+1.8	+3.6	V
Top	Working temperature	-40	+85	℃
Pop	RF input power	-	0	dBm

3.3 Module Specifications

Items	Parameter	Specifications	Unit
Structure	Size	11.6(W) X 11(L) X 2.95(H)	mm
	Package	12 pins, SMT	
Electrical Characteristics	Supply voltage	3.3V @typical	V
	Sleep current	1.62	uA
	SX1262 power distribution mode	DC-DC Mode	
	TCXO supply mode	By SX1262 DIO3	
	TCXO supply voltage	1.7~3.3	V
	Frequency range	HF@862-930	MHz
	Maximum operation current (Transmitter)	125mA @22dBm in 862-930MHz typical	mA
	Maximum operation current (Receiver)	7.6mA @BW125kHz, 862-930MHz typical	
	Output power	22dBm max @862-930MHz	dBm
	Receiver Sensitivity	@SF12, BW125kHz	dBm

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	included line loss	Frequency (MHz)	min	typical	max	
		862-930	-	-136.73	-136.73	
	Harmonics @HF	≤-45dBm above 1GHz				dBm
Interface	ANT	RF port of IPEX or SMT pin, default IPEX @50-ohm impedance				
	DIO1	Multi-purpose digital IO				
	Busy	Busy signal indicator				
	SPI	1 group of SPI, include 4 pins				
Other	DIO2	Multi-purpose digital IO, internally connected to RF switch Logic high=Enable Transmitter mode, other mode =low level				
	DIO3	DIO3 is used as TCXO voltage power supply configure through software, TCXO voltage should always be 200 mV less than the VCC to ensure proper operation				

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4. Typical RF Performance Test

4.1 Wio-SX1262 Performance Testing

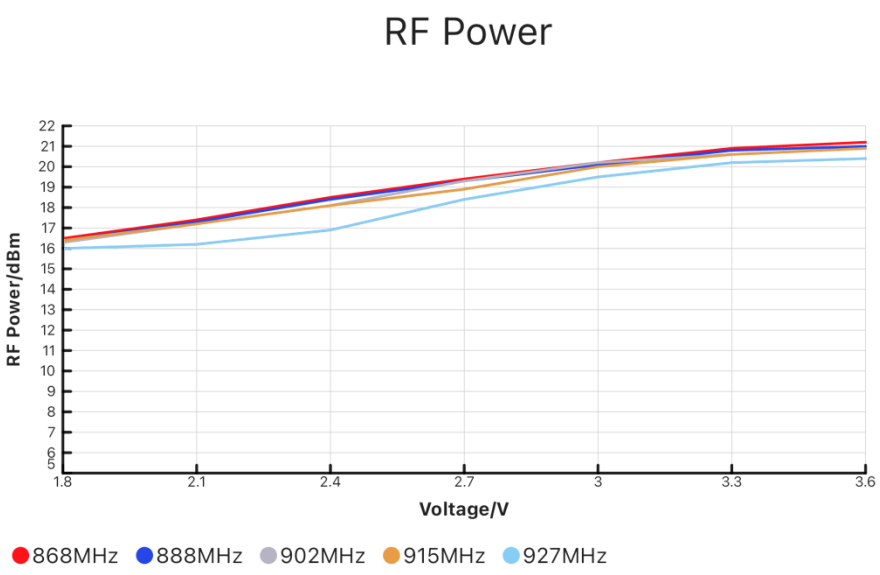

Figure 3 Max RF Power vs Voltage（868~927MHz）

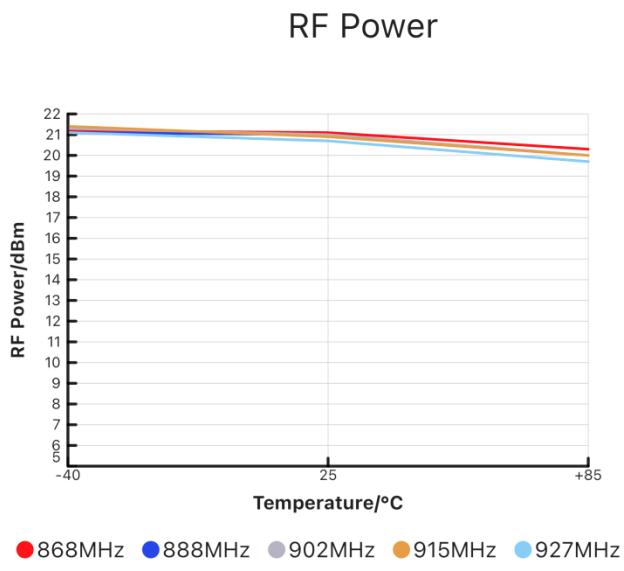

Figure 4 Max RF Power VS Temperature（868~927MHz）

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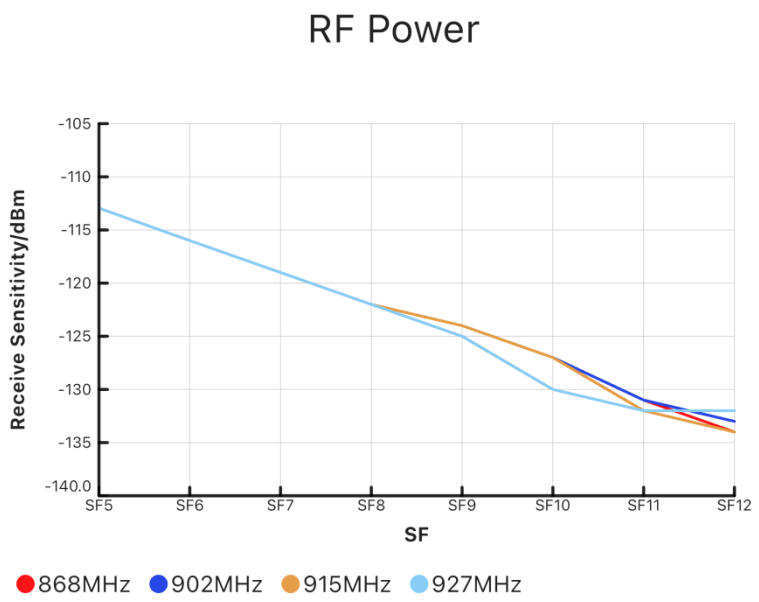

Figure 5 RF Receiver Sensitivity vs Spreading factor（868~927MH@BW125KHzz）

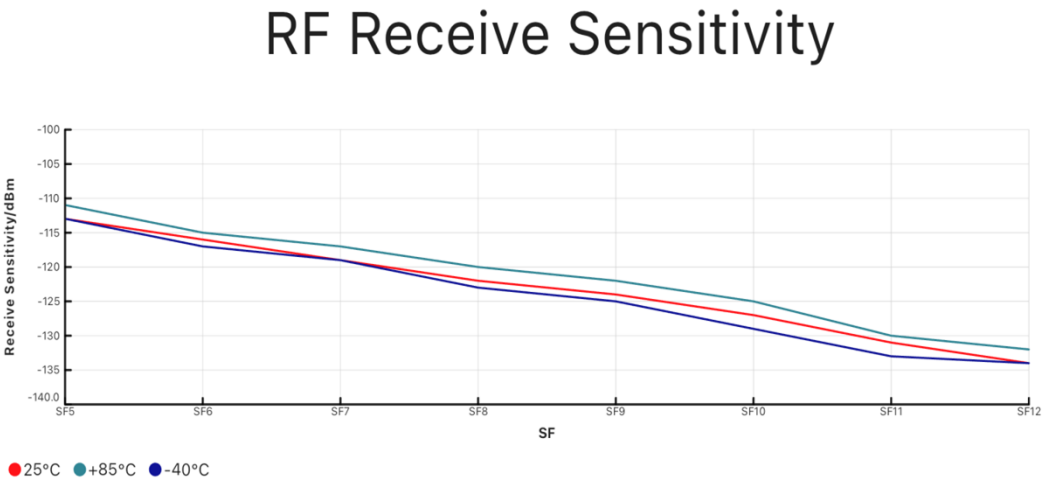

Figure 6 RF Receiver Sensitivity VS Temperature（868MHz@BW125KHz）

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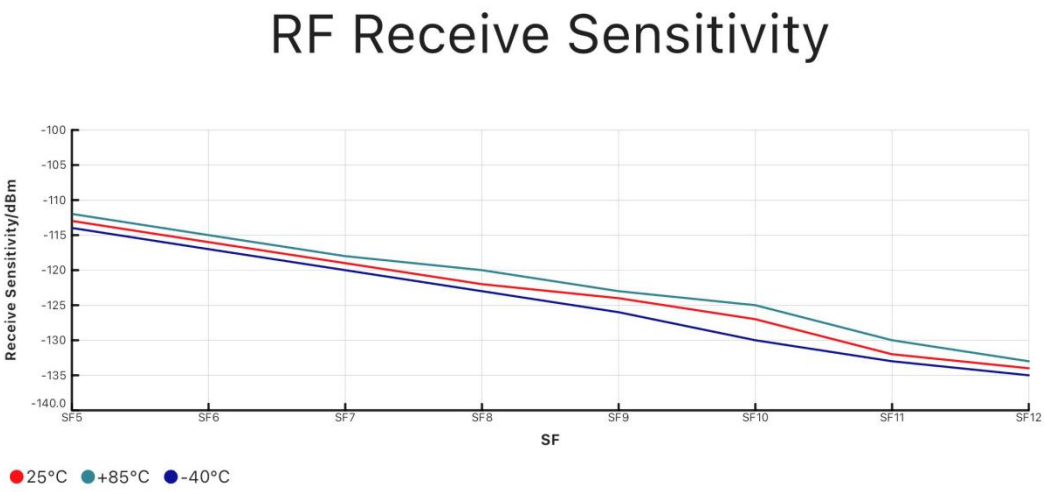

Figure 7 RF Receiver Sensitivity VS Temperature (915MHz@BW125KHz)

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5. Application Information

5.1 Package Information

Unless specified dimension tolerance, the dimension below will be with tolerance ±0.2mm, all the dimension unit is mm.
Wio-SX1262 has a 12-pins SMD package:

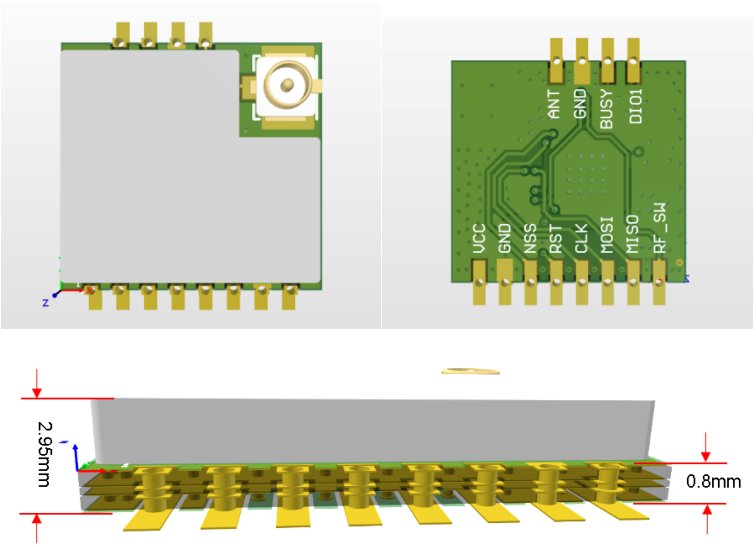

Figure 8 Wio-SX1262 Module Appearance

The following figure shows the recommended Layout package dimensions.

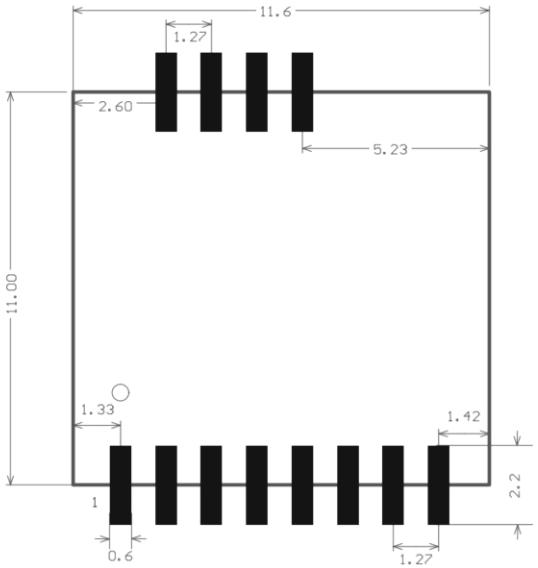

Figure 9 PCB Footprint

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5.2 External Interface of the Module

- A set of SPI used for internal RF transceiver control
- DIO1 is the generic IRQ line
- An External GPIO used for control internal gate RF switch
- Busy is used as a busy signal indicating that the module is ready for new command only if this signal is low.
- The output impedance of the RF is 50 Ω and compatible with IPEX and SMT-Pin. IPEX is the default, and RF SMT-Pin does not require soldering. If you need the RF SMT-Pin version, please contact our company.

5.3 Reference Design Based on Wio-SX1262 Module

The following is a typical reference design using the Wio-SX1262 module, just connect the module to the host MCU according to the reference design and send AT commands.

Antenna design considerations: The antenna interface is designed with a 50Ω impedance, and it is recommended that users reserve a π-type matching network for the antenna.

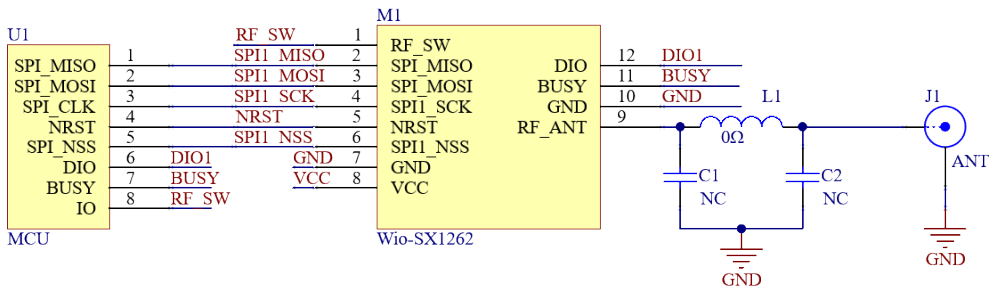

Figure 10 Reference Design Based on Wio-SX1262

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6. LoRaWAN Application Information

6.1 LoRaWAN Application

The topology of the LoRaWAN® network is a star network, and the gateway acts as a relay between nodes and network servers. The gateway is connected to the network server through a standard IP link, and the node device uses LoRa® or FSK to communicate with one or more gateways. Communication is bidirectional, although it is mainly upstream communication from the node to the network server.

The communication between the node and the gateway uses different frequencies and rates. The choice of rate is a compromise between power consumption and distance, and different rates do not interfere with each other. According to different spreading factors and bandwidths, the rate of LoRa® can be from 300bps to 50Kbps. In order to maximize battery life and network capacity, the network server manages the node's rate and output power through rate adaptation (ADR).

The node device may transmit on a random channel at any time and at any rate, as long as the following conditions are met:
1) The channel currently used by the node is pseudo-random. This makes the system more resistant to interference.
2) The maximum transmission time (dwell time of the channel) and duty cycle of the node depends on the frequency band used and local regulations.

Wio-SX1262 module is embedded with Semtech ultra-high performance and ultra-low power LoRa wireless communication IC SX1262. The current is only 1.62uA in sleep mode, this module is very suitable for various applications of LoRaWAN®.

6.2 Design LoRaWAN® wireless sensor based on Wio-SX1262

Wio-SX1262 pure RF module only a simple MCU is needed as the main controller to control Wio-SX1262 through SPI interface, thereby easily implementing the LoRaWAN® protocol. This helps customers quickly bring sensor products to the LoRaWAN® market.

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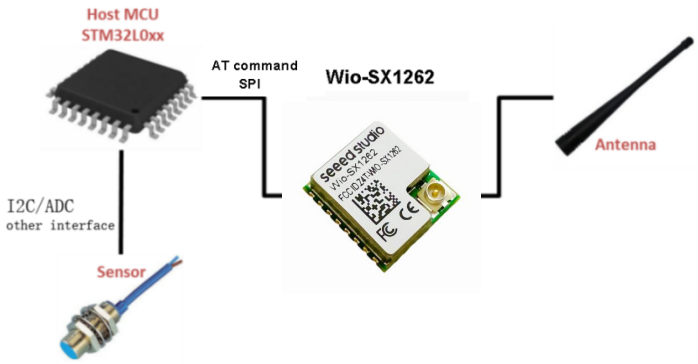

Figure 11 Design of LoRaWAN® wireless sensor based on Wio-SX1262 module

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7. Reflow Soldering Parameters

The design of the Wio-SX1262 module makes it very convenient for production, including soldering it to PCB boards using reflow soldering technology. A basic element is that users need to choose the appropriate solder paste and ensure that the solder paste meets the temperature requirements during the furnace passing process. Wio-SX1262 complies with the requirements of J-STD-020D1 standard for reflow soldering temperature.

Note: It is recommended that the module undergoes only one reflow soldering, and the temperature of the module should not exceed 260 ℃ during reflow soldering. The reflux period should not exceed 30 seconds.

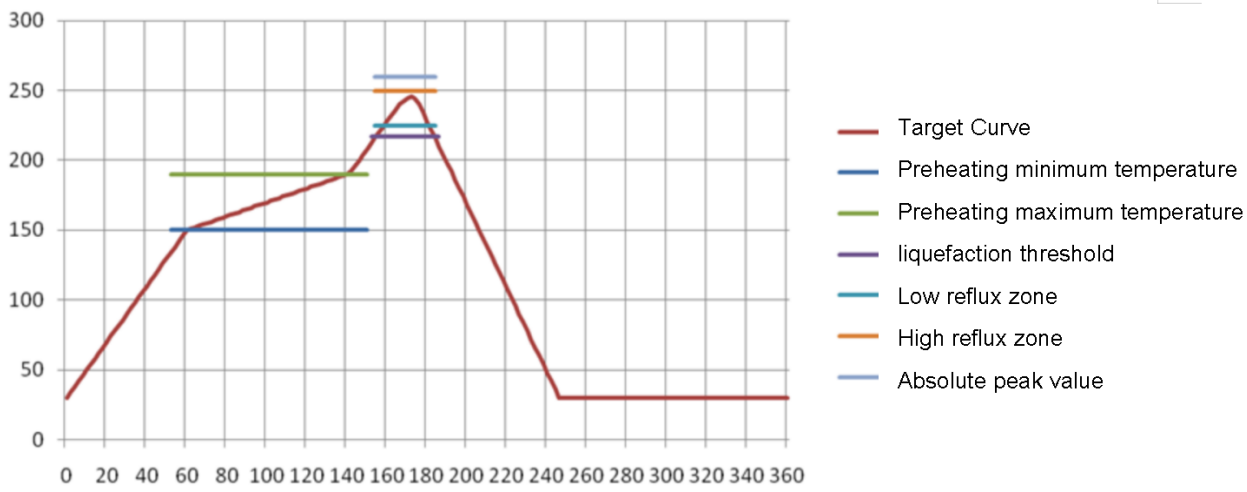

Figure 12 Reflow profile

Item	value	Unit
Heating rate	1~3	℃/Sec
Cooling rate	2~4	℃/Sec
Heating rate of preheating zone	0.5~1	℃/Sec
Preheating zone length MIN	70	Sec
Preheating zone length MAX	120	Sec
Preheating temperature MIN	150	℃
Preheating temperature MAX	190	℃
Residence time of solder paste above the liquefaction temperature MAX	70	Sec
Residence time of solder paste above the liquefaction temperature MIN	50	Sec
Residence time in the reflux zone	30	Sec
Peak temperature residence time	5	Sec

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MAX		
Suggested liquefaction zone threshold	218	℃
Low point temperature of reflux zone	240	℃
High point temperature in the reflux zone	250	℃
Absolute peak temperature	260	℃

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Conformity

FCC regulatory conformance：
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.
(2) This device must accept any interference received, including interference that may cause undesired operation.

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 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 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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC 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 20cm between the radiator & your body.

- English: "
This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference thatmay cause undesired operation of the device."

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: Z4T-WIO-SX1262". 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 limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

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

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.3

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer’s instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a FPC antenna or Dipole antenna or Spring antenna, and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects:
layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.
a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
d) Appropriate parts by manufacturer and specifications;
e) Test procedures for design verification; and
f) Production test procedures for ensuring compliance.
The module grantee shall provide a 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 the module grantee 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 grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.
Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).
Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: Z4T-WIO-SX1262.

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a FPC antenna or Dipole antenna or Spring antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID: Z4T--WIO-SX1262”

2.9 Information on test modes and additional testing requirements5

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.