

Wio-LR1121 Module

LoRa® Wireless Module - Powered by Semtech LR1121

Datasheet

1 Introduction

Wio-LR1121 is a multi-band LoRa® connectivity module designed for Internet of Things (IoT) LoRaWAN applications. It supports sub-GHz, 2.4GHz ISM, and 2.1GHz satellite S-band communications. The module features a compact size and an ultra-low power design, integrating a TCXO (temperature-compensated crystal oscillator) and an RF switch, is suitable for global use in smart homes, agricultural sensors, building automation, smart cities, asset tracking, retail store sensors, smart metering, and environmental monitoring.

1.1 Feature

- **Low Power Consumption:**
 - as low as 1.35uA sleep current
 - Sub-GHz: 20.33dBm@124.5mA/3.3V
 - 2.4G: 11.23dBm@30.72mA/3.3V
- **Low Cost and High performance**
- **Small Size:** 17*12*2.6mm @24Pins SMT
- **RF Interface:** IPEX port; SMT PIN.
 - Wio-LR1121 (With IPEX)
 - Wio-LR1121-N (With Pin)
- **Supports multiple frequency bands:**
 - Sub-GHz: 20.33dBm @ 863-928MHz
 - 2.4GHz: 11.23dBm @ 2.4-2.5GHz
- **Receive Sensitivity:**
 - SubG: SF7,BW=125K,RXboost=1: -126dBm
 - SubG: SF7,BW=125K,RXboost=0: -124dBm
 - SubG: SF12,BW=125K,RXboost=1: -140dBm
 - SubG: SF12,BW=125K,RXboost=0: -138dBm
 - 2.4G: SF7,BW=406K,RXboost=1: -115.5dBm
- **Operating Temperature:** -40°C to 85°C
- **SPI Interface**
- **Certifications:** CE,FCC

2 Description

The LR1121 module, based on the Semtech LR1121, is designed for IoT applications, supporting (G)FSK and LoRa® modulations with a 7.8 to 500 kHz bandwidth in LoRa® mode. It features an SPI interface for MCU communication, a DC-DC power scheme, and a high-precision TCXO for RF reference frequency, with VTCXO as the TCXO voltage supply. Available in two variants—Wio-LR1121 with IPEX interface and Wio-LR1121-N with SMT Pin—both support 20.33dBm output power in the 862-930MHz and 11.23dBm output power in the 2.4-2.5GHz.

3 Pin Definition

Number	Name	Type	Description
1	GND	GND	Ground
2	2.4G RF	RF	2.4G 和 Sband RF 通道
3	GND	GND	Ground
4	LR_NSS	I/O	SPI NSS
5	LR_SCK	I/O	SPI SCK
6	LR_MOSI	I/O	SPI MOSI
7	LR_MISO	I/O	SPI MISO
8	LR_BUSY	I/O	LR1121: DIO0/ BUSY
9	GND	GND	Ground
10	GND	GND	Ground
11	DIO8	I/O	Multi-purpose digital I/O
12	DIO9	I/O	Multi-purpose digital I/O ,INT引脚
13	GND	GND	Ground
14	RST	I/O	Ground
15	GND	GND	Ground
16	GND	GND	Ground
17	GND	GND	Ground
18	GND	GND	Ground
19	GND	GND	Ground
20	VDD_RF	Power	Supply voltage for LoRa®

21	VDD_RF	Power	Supply voltage for LoRa®
22	GND	GND	Ground
23	SUBG_RF	RF	SUBG RF 通道
24	GND	GND	Ground

4 Electrical Characteristics

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

4.1 Absolute Maximum Rating

Item	Description	min	max	unit
VDD	LoRa® supply voltage	-0.3	+3.6	V
TA	Ambient temperature	-40	+85	°C

4.2 Normal Working Conditions

Item	Description	min	max	unit
VDD	LoRa® supply voltage	+1.8	+3.6	V

4.3 Digital I/O Characteristics

Item	Description	min	max	unit
VIH	Input high voltage	0.7*VDD	VDD+0.3	V
VIL	Input low voltage	-0.3	0.3*VDD	V
VOH	Output high voltage	0.9*VDD	VDD	V
VOL	Output low voltage	0	0.1*VDD	dBm

4.4 Module Specifications

ITEMs	Parameter	Specifications	Unit
Structure	Size	17(L) X 12(W) X 2.6(H)	mm
	Package	24 pin Module	
Electrical Characteristics	power supply	3.3V typical	V
	Sleep current	1.35	uA
	Operation current (Transmitter)	124.5mA @ LoRa® 915 TX 22dBm 31mA@ LoRa® 868 TX 14dBm 30.7mA@ LoRa® 2.4G TX 13dBm	mA
	Operation current (Receiver)	7.8mA@ LoRa® SF12 125kHz sub-GHz	mA
		6.7mA@LoRa® SF12 125kHz 2.4GHz/S-band	
	Output power	20.4dBm max @LoRa®	dBm
		11dBm max @ 2.4G	

	Sensitivity RxBoost ON	-126dBm @SubG,BW=125KHz, SF = 7 -140dBm @SubG, BW=125KHz, SF = 12 -118dBm @2.4G,BW=125KHz, SF = 7 -132.5dBm @2.4G ,BW=125KHz, SF = 7	dBm
	Sensitivity RxBoost OFF	-124dBm @SubG,BW=125KHz, SF = 7 -138dBm @SubG, BW=125KHz, SF = 12	dBm
Peripheral Interface	SPI/GPIOS		

5 Application Information

5.1 Package Information

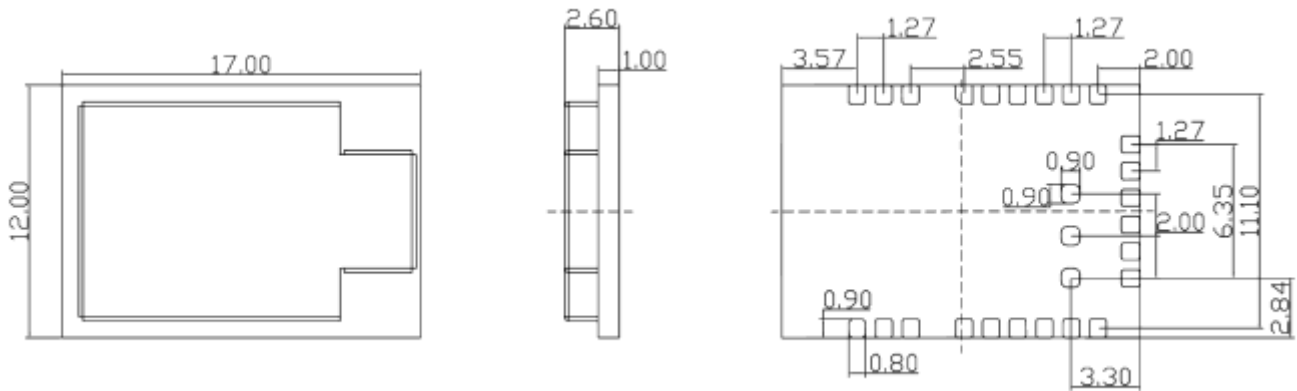


Figure 1 Package Outline Drawing

Eagle Library:

<https://files.seeedstudio.com/products/SenseCAP/Wio-WM1110/Eagle Library MODULE-LORAMODULE-WM1110-A.zip>

Kicad Library:

<https://files.seeedstudio.com/products/SenseCAP/Wio-WM1110/Kicad Library MODULE-LORAMODULE-WM1110-A.zip>

5.2 External Interface of the Module

- DIO9 is the generic IRQ line
- The output impedance of the RF is 50 Ω and compatible with IPEX and SMT-Pin.
- Busy is used as a busy signal indicating that the module is ready for new command only if this signal is low.

5.3 Reference Design Based on LR1121 Module

The following is a typical reference design using the LR1121 module. Just connect the module to the host MCU according to the reference design.

Antenna design considerations: The antenna interfaces are designed with a 50 Ω impedance. It is recommended that users reserve a π -type matching network for each antenna output.

6 Reflow Soldering Parameters

Item	value	Unit
Heating rate	1~3	°C/Sec
Cooling rate	2~4	°C/Sec
Heating rate of preheating zone	0.5~1	°C/Sec
Preheating zone length MIN	70	Sec
Preheating zone length MAX	120	Sec
Preheating temperature MIN	150	°C
Preheating temperature MAX	190	°C
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 MAX	5	Sec
Suggested liquefaction zone threshold	218	°C
Low point temperature of reflux zone	240	°C
High point temperature in the reflux zone	250	°C
Absolute peak temperature	260	°C

7 Ordering Information

Technical Support: sensecap@seeed.cc

Sales: iot@seeed.cc

8 FCC Requirement

V0.1 2025-4-28 First release Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

“ Contains Transmitter Module FCC ID:Z4T-WIO-LR1121Or Contains FCC ID: Z4T-WIO-LR1121 ”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1. The module is limited to OEM installation ONLY
2. The OEM integrators is responsible for ensuring that the end-user hasno manual instructions to remove or install module
3. The module is limited to installation in mobile or fixed applications,according to Part 2.1091(b)
4. The separate approval is required for all other operatingconfigurations, including portable configurations with respect to configurations

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part 15C : 15.247 requirement,Only if the test result comply with FCC part 15C : 15.247 requirement, then the host can be sold legally.

Product Specification subjective to this standard

For 2.4G

Operation Frequency:	2403MHz~2479MHz
Modulation Type:	FSK
Number of Channel:	76
Antenna Type & Gain:	FPC Antenna: 2.53dBi Spring Antenna: 2.55dBi Fiberglass Antenna: 5.03dBi

For 915M

Operation Frequency:	903MHz~914.2MHz
Modulation Type:	FSK
Number of Channel:	8
Antenna Type & Gain:	FPC Antenna: -2.1dBi Spring Antenna: 2.25dBi Fiberglass Antenna: 8dBi