LR1302 LoRaWAN Gateway Module_SPI DataSheet

V1.0

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1 Overview

1.1 Description

The LR1302 module is a new-generation LoRaWAN® gateway module featuring a mini-PCIe form factor, low power consumption, and high performance. The LR1302 gateway module is based on the Semtech® SX1302 baseband LoRa® chip, which provides the potential capacity for long-range wireless transmission in gateway products. Compared with the previous SX1301 and SX1308 LoRa chips, the SX1302 chip offers higher sensitivity, lower power consumption, and a lower operating temperature. Additionally, the module supports 8-channel data transmission, enhancing communication efficiency and capacity. It also features a metal shielding layer to prevent external interference and provide a reliable communication environment.

Note: Differences between SPI and USB Versions
For the LR1302 LoRaWAN® Gateway Module SPI version, the Semtech SX1302 is connected to the host device via the SPI bus. For the LR1302 LoRaWAN® Gateway Module USB version, both the Semtech SX1302 and SX126x chips are connected to the STM32L412KBU6 microcontroller via the SPI bus with different Chip Select (CS) signals. The STM32L412KBU6 operates as a USB device, acting as a bridge between the host device and the SX1302/SX126x chips. The SX126x chip is primarily used for the Listen-Before-Talk (LBT) function in the gateway.

1.2 Features

- Equipped with Semtech SX1302 and SX1250 chips, suitable for EU868/US915 frequency bands.
- Mini-PCIe form factor with a standard 52-pin gold finger connector, facilitating easy integration with various gateway devices.
- Supports 8-channel data transmission and concurrent multi-node communication.
- Ultra-low operating temperature, eliminating the need for additional cooling and reducing the size of LoRaWAN® gateways.
- Utilizes the SX1250 TX/RX frontend, with sensitivity down to -139 dBm @ SF12 and TX power up to 26 dBm @ 3.3 V.
- Certified by CE, FCC, and RoHS, simplifying the certification process for end products.

1.3 Applications

Application areas:

- Smart Cities
- Agriculture
- Industrial Automation

Application programs:

- Development of LPWAN gateway devices.
- Development of any remote wireless communication applications.
- Learning and research of LoRa® and LoRaWAN® applications.

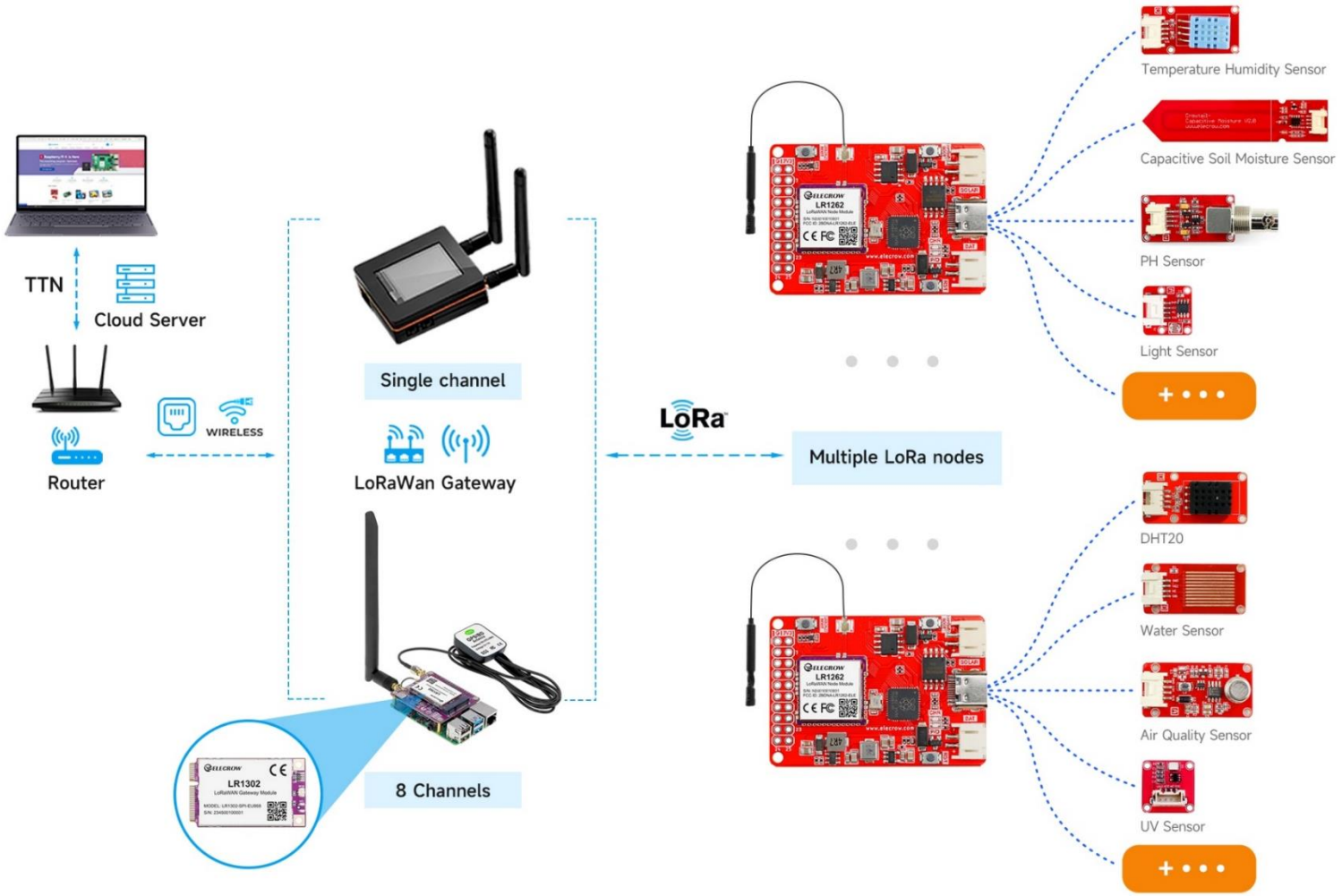

Figure 1 Network Topology Diagram

2 Dimensions

Figure 2 Dimensions Diagram

3 System Block Diagram

The LR1302 module is equipped with an SX1302 chip and two SX1250 chips. The SX1302 chip serves as the core radio frequency (RF) signal processor, responsible for the RF processing of LoRa signals. The SX1250 chips handle the related LoRa modulation and demodulation functions as well as filtering processes.

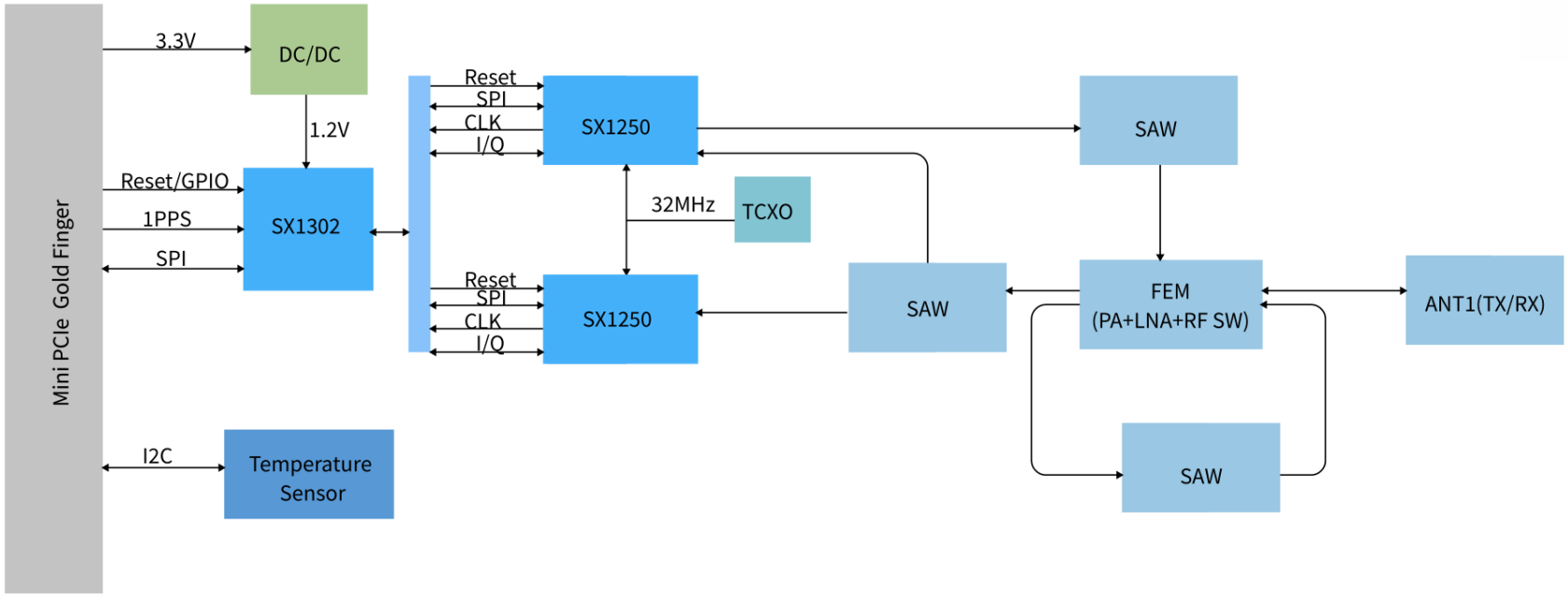

Figure 3 System Block Diagram

4 Hardware Overview

The hardware overview discusses the interfaces of the LR1302 module, its pin layout, and the corresponding functions and diagrams.

4.1 Module Pin Layout and Function

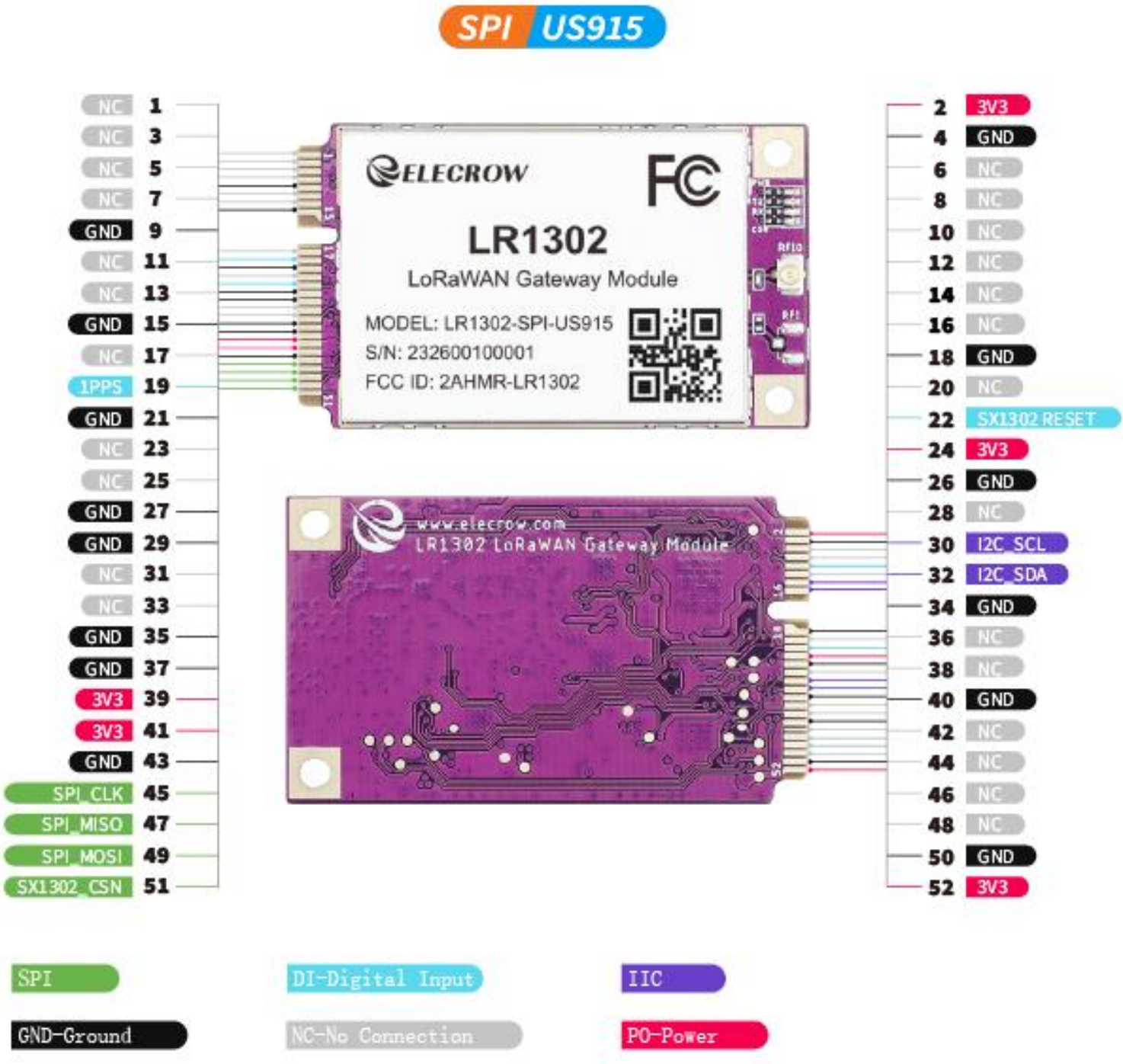

Figure 4 LR1302 Pin Definition Diagram

IO Parameter Definitions:

Type	Description
IO	Bidirectional Input/Output
DI	Digital input
DO	Digital output
PI	Power input

Pin Definition:

NO.	MINI-PCIE	LR1302PIN	IO TYPE	Description
1	WAKE#	NC		
2	3.3Vaux	3V3	PI	Auxiliary Power Input 3.3V
3	COEX1	NC		
4	GND	GND	Ground	Ground
5	COEX2	NC		
6	1.5V	NC		
7	CLKREQ#	NC		
8	UIM_PWR	NC		
9	GND	GND	Ground	Ground
10	UIM_DATA	NC		
11	REFCLK-	NC		
12	UIM_CLK	NC		
13	REFCLK+	NC		
14	UIM_RESET	NC		
15	GND	GND	Ground	Ground
16	UIM_VPP	NC		
17	RESERVED	NC		
18	GND	GND	Ground	Ground
19	RESERVED	1PPS	DI	GPS 1PPS
20	W_DISABLE#	NC		

21	GND	GND	Ground	Ground
22	PERST#	RESET	DI	SPI: Active High USB: Active Low (for SX1302 Reset)
23	PERn0	NC		
24	3.3V	3V3	PI	V_{DC} Power Input 3.3V
25	PERp0	NC		
26	GND	GND	Ground	Ground
27	GND	GND	Ground	Ground
28	1.5V	NC		
29	GND	GND	Ground	Ground
30	SMB_CLK	I2C_SCL	DI	I2C Clock Line for Temperature Sensor
31	PETn0	NC		
32	SMB_DATA	I2C_SDA	DIO	I2C Data Line for Temperature Sensor
33	PETp0	NC		
34	GND	GND	Ground	Ground
35	GND	GND	Ground	Ground
36	USB_D-	NC		
37	GND	GND	Ground	Ground
38	USB_D+	NC		
39	3.3V	3V3	PI	V_{DC} Power Input 3.3V
40	GND	GND	Ground	Ground
41	3.3V	3V3	PI	V_{DC} Power Input 3.3V
42	LED_WWAN#	NC		
43	GND	GND	Ground	Ground
44	LED_WLAN#	NC		
45	RESERVED	SPI_SCK	I/O	SPI Clock Signal
46	LED_WPAN#	NC		
47	RESERVED	SPI_MISO	DO	SPI MISO Signal
48	1.5V	NC		

49	RESERVED	SPI_MOSI	DI	SPI MOSI Signal
50	GND	GND	Ground	Ground
51	RESERVED	SX1302_CSN	DI	Chip Select Signal for SX1302
52	3.3V	3V3	PI	V_{DC} Power Input 3.3V

4.2 DC/DC Power Supply

The LR1302 module must be powered by a DC supply. The 3.3Vaux pin is powered by a direct current (DC) source to maintain stable voltage. During operation, the current consumed by the module may vary significantly according to the power consumption profile of the SX1302 chip. For more detailed information, please refer to the SX1302 数据表。

NO.	Pin Name	Pin Number	IO Type	Description
1	3V3_MAIN	2,24,39,41,52	PI	3.3V Power Input
2	GND	4,9,15,18,21,26,27, 29,34,35,37,40,43,50	/	Ground
3	VCORE12	5，23，40，56	PI	The SX1302 chip operates with a core working voltage of 1.2V.

4.3 SPI Interface

The Semtech SX1302 is connected to the main controller via the SPI bus.

NO.	Pin Name	LR1302 Pin Number	MINI_PCIE Pin Number	IO Type	Description	Voltage Domain
1	HOST_SCK	4	45	DI	SPI Clock Signal Input	3.3V
2	HOST_MISO	2	47	DO	SPI Data Output	3.3V
3	HOST_MOSI	3	49	DI	SPI Data Input	3.3V
4	HOST_CSN	1	51	DI	SPI Chip Select Signal Input	3.3V

The SX1302 System on Chip (SoC) controls two SX1250 chips via the SPI interface. The SPI interface uses a synchronous full-duplex protocol to access the configuration registers of the SX1302, allowing data to be transmitted in both directions simultaneously.

NO.	Pin Name	SX1302 Pin Number	SX1250 Pin Number	IO Type	Description	Voltage Domain
1	RADIO_A_MISO	33	16	DI	SPI Clock Signal Input	3.3V
2	RADIO_A_MOSI	67	17	DO	SPI Data Output	3.3V
3	RADIO_A_SCK	65	18	DI	SPI Data Input	3.3V
4	RADIO_A_CSN	68	19	DI	SPI Chip Select Signal Input	3.3V
5	RADIO_A_IQ0	44	13	I/O	Digital input/output pin, used for receiving and transmitting modulated signals.	3.3V
6	RADIO_A_IQ1	45	12	I/O		3.3V
7	RADIO_A_IQ2	49	5	I/O		3.3V
8	RADIO_A_IQ3	41	21	I/O		3.3V
9	RADIO_A_CLK_32M	43	14	DI	System Clock Input, with a frequency of 32MHz	3.3V
10	RADIO_A_CLK_O	48	11	DO	Output Clock Signal	3.3V
11	RADIO_A_NRESET	13	15	DI	Reset Signal	3.3V
12	RADIO_B_MISO	33	16	DI	SPI Clock Signal Input	3.3V
13	RADIO_B_MOSI	19	17	DO	SPI Data Output	3.3V
14	RADIO_B_SCK	21	18	DI	SPI Data Input	3.3V
15	RADIO_B_CSN	18	19	DI	SPI Chip Select Signal Input	3.3V
16	RADIO_B_IQ0	35	13	I/O	Digital input/output pin, used for receiving and transmitting modulated signals.	3.3V
17	RADIO_B_IQ1	36	12	I/O		3.3V
18	RADIO_B_IQ2	38	5	I/O		3.3V
19	RADIO_B_IQ3	32	21	I/O		3.3V

20	RADIO_B_CLK_32M	34	14	DI	System Clock Input, with a frequency of 32MHz	3.3V
21	RADIO_B_CLK_O	37	11	DO	Output Clock Signal	3.3V
22	RADIO_B_NRESET	28	15	DI	Reset Signal	3.3V

4.4 I2C Interface

The temperature sensor is connected to the main controller for communication via the I2C interface.

NO.	Pin Name	MINI-PCIE Pin Number	Digital Temperature Sensor (STTS751)	IO Type	Description	Voltage Domain
1	I2C_SCL	30	SCL(1)	DIO	Connected to the temperature sensor, the I2C clock line for the clock signal in I2C communication	3.3V
2	I2C_SDA	32	SDA(6)	DIO	Connected to the temperature sensor, the I2C data line for data transmission in I2C communication	3.3V

4.5 Antenna Interface

The LR1302 module reserves an antenna interface for independent transmission, which is available only on the U.FL (IPEX) connector.

NO.	Signal	IO Type	Description	Voltage Domain
1	RF	I/O	RF port, available only on the IPEX connector	3.3V

4.6 Control Signal Interface Definitions

4.6.1 LEDs (Light Emitting Diodes)

NO.	Signal	LEDs	SX1302 Signal	Color	Description
1	3V3_MAIN	Power LED	/	Green	The onboard LED lights up (green) when the input power supply VCC_3V3 is present.
2	RX_ON	TX_LED	GPIO4	Blue	When the module is in receive mode, this pin outputs a high level, and the onboard LED lights up (blue).
3	TX_ON	TX_LED	GPIO2	Green	When the module is transmitting data, this pin outputs a high level, and the onboard LED lights up (green).
4	CONFIG_OK	/	GPIO0	Red	When the module has successfully configured its parameters, this pin outputs a high level, and the onboard LED lights up (red).

4.6.2 RESET Signal

The MINI-PCIE interface includes a RESET input signal, which is active high and used to reset the radio operation as specified by the SX1302 standard.

NO.	Pin Name	MINI-PCIE Pin Number	IO Type	Description	Voltage Domain
1	P_RESET	22	DI	Reset control pin	3.3V
2	SX1302_RESET	/	DI		3.3V

4.6.3 GPS_PPS

The SX1302 SoC communicates with the MiniPCIe interface via a 1PPS (Pulse Per Second) interface. The LR1302 module includes a GPS_PPS input for received packets with timestamps.

NO.	Pin Name	MINI-PCIE Pin Number	SX1302 Pin Number	IO Type	Description	Voltage Domain
1	GPS_PPS	19	8	DI	GPS precise time signal for time synchronization and accurate timing	3.3V

5 Technical Specifications

NO.	Item	EU868	US915
1	Frequency	863-870MHz	902-928MHz
2	RX Sensitivity	-125.5dBm@125K/SF7	-125.5dBm@125K/SF7
3		-139.5dBm@125K/SF12	-139.5dBm@125K/SF12
4	TX Power	26.5 dBm (with 3.3V power supply)	25.5 dBm (with 3.3V power supply)
5	Bandwidth	125kHz、250kHz 和 500kHz	
6	Channels	8 channels	
7	Spreading Factor	SF7-SF12	
8	LEDs (Light Emitting Diodes)	Power: Green Config: Red	
9		TX: Green RX: Blue	
10	Power Consumption (SPI Version)	Standby：5.5mA TX Power：380 mA RX Power：38 mA	
11			
12			
13	Power Consumption (USB Version)	Standby：20.5mA TX Power：400 mA RX Power：54.1 mA	
14			
15			
16	Form Factor	Mini-PCIe, 52-pin gold fingers	
17	Antenna Connector	IPEX-1	
18	Operating Temperature	-40°C to 85°C	
19	Dimensions	30 mm (width) × 50.95 mm (length)	
20	Certification	CE	FCC

6 Electrical Characteristics

6.1 Power Supply Range

NO.	Feature	Min.	Typ.	Max.	Unit
1	VCC	3.0	3.3	3.6	V

6.2 Power Consumption

NO.	Version	Mode	EU868	US915	Unit
1	Power Consumption (SPI Version)	Standby	5.5	5.5	mA
		TX Max Power	380	380	mA
		RX Power	38	38	mA
2	Power Consumption (USB Version)	Standby	20.5	20.5	mA
		TX Max Power	400	400	mA
		RX Power	54.1	54.1	mA

7 Environmental Characteristics

NO.	Condition	Parameter	Min.	Typ.	Max.	Unit
1	Absolute Conditions	Storage Temperature	-40	/	+85	°C
2	Operating Conditions	Operating Temperature	-30	/	+85	°C

8 Application Information

8.1 Package Information

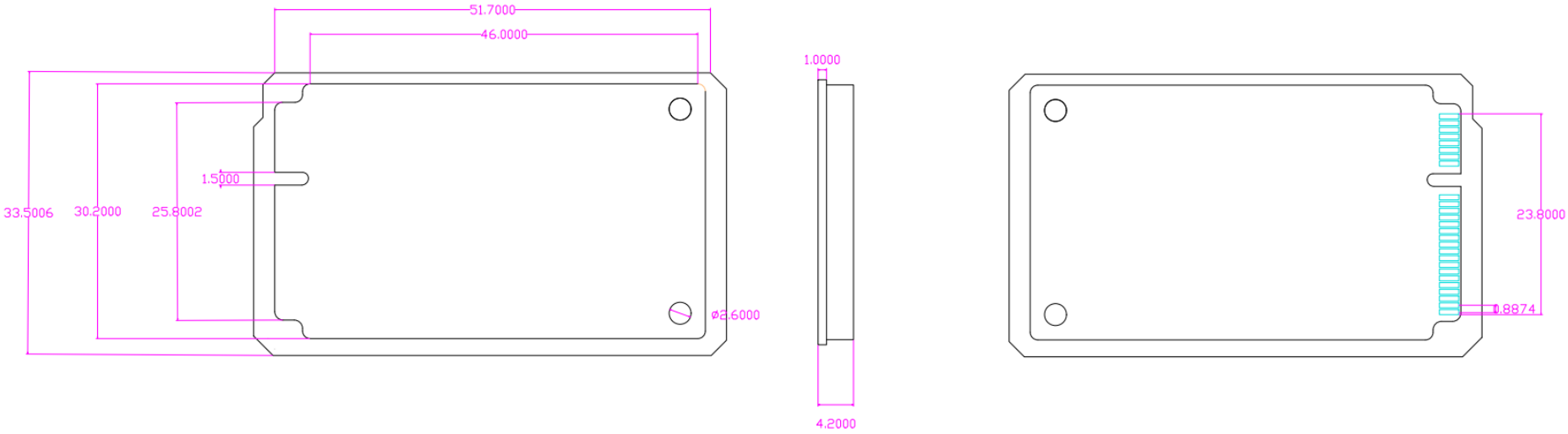

Figure 5 Package Outline Drawing (Unit:mm)

8.2 Land Pattern

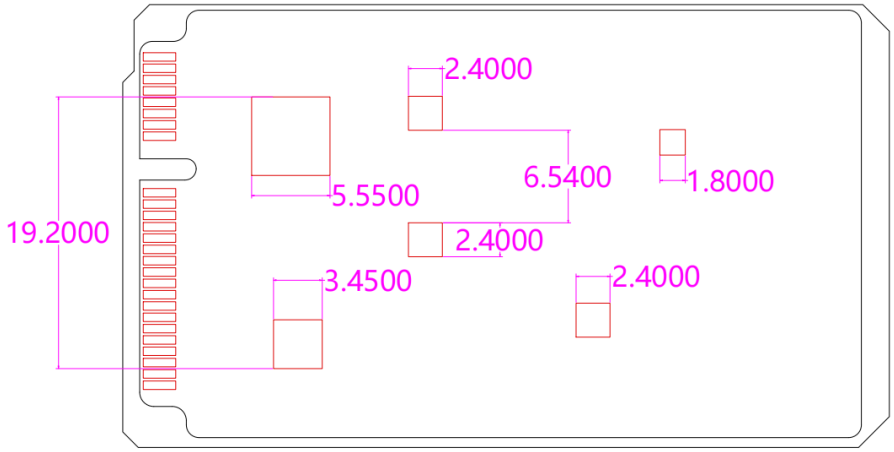

Figure 6 PCB Layout (Unit:mm)

8.3 Package Marking

9 Related Documents and Ordering Information

9.1 Related Documents

- **LR1302 LoRaWAN Gateway Module SPI EU868 Product Link**
- **LR1302 LoRaWAN Gateway Module SPI US915 Product Link**
- **SX1302 Datasheet**
- **LR1302 LoRaWANGatewayModuleWIKI**

9.2 Ordering Information

SKU	Product Name	Product Image
CRT01266M003	LR1302 LoRaWAN Gateway Module SPI US915	
CRT01266M001	LR1302 LoRaWAN Gateway Module SPI EU868	
CRT01265M	LR1302 868M/915M LoRaWANHat for RPI	
DIS01447T	Pi Terminal	

10 Certifications

11 Revision History

Date	Version	Release Notes
2025/4/2	V1.0	Initial Release