

Full duplex
Simultaneously receive LoRa packets

Product Specification



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Note: Revision History

Revision	Date	Comment
V1.0	2021-11	First release
V1.1	2022-8	Add 915MHz TX Power Table

1. Description

This module is based on Semtech LoRaWAN concentrator reference design -- SX1302 Reference . It is a high performance LoRa/LoRaWAN module based on Semtech sx1302 and sx1250.

The sx1302 digital baseband chip is a massive digital signal processing engine specifically designed to offer breakthrough gateway capabilities in the ISM bands worldwide. The LoRa concentrator is a multi-channel high performance transmitter/receiver designed to simultaneously receive several LoRa packets using random spreading factors on random channels. Its goal is to enable robust connection between a central wireless data concentrator and a massive amount of wireless end-points spread over a very wide range of distances.

The sx1302 is a smart baseband processor for long range ISM communication. In the receiver part, it receives I and Q digitized bitstream from one or two receivers (sx1250 as an example), demodulates these signals using several demodulators, adapting the demodulators settings to the received signal and stores the received demodulated packets in a FIFO to be retrieved from a MCU. In the transmitter part, the packets are modulated using a programmable (G)FSK/LoRa modulator and sent to one transmitter (sx1250 as an example). Received packets can be time-stamped using a GPS input. The sx1302 has an internal control block that receives microcode from the MCU. The microcode is provided by Semtech as a binary file to load in the sx1302 at power-on .

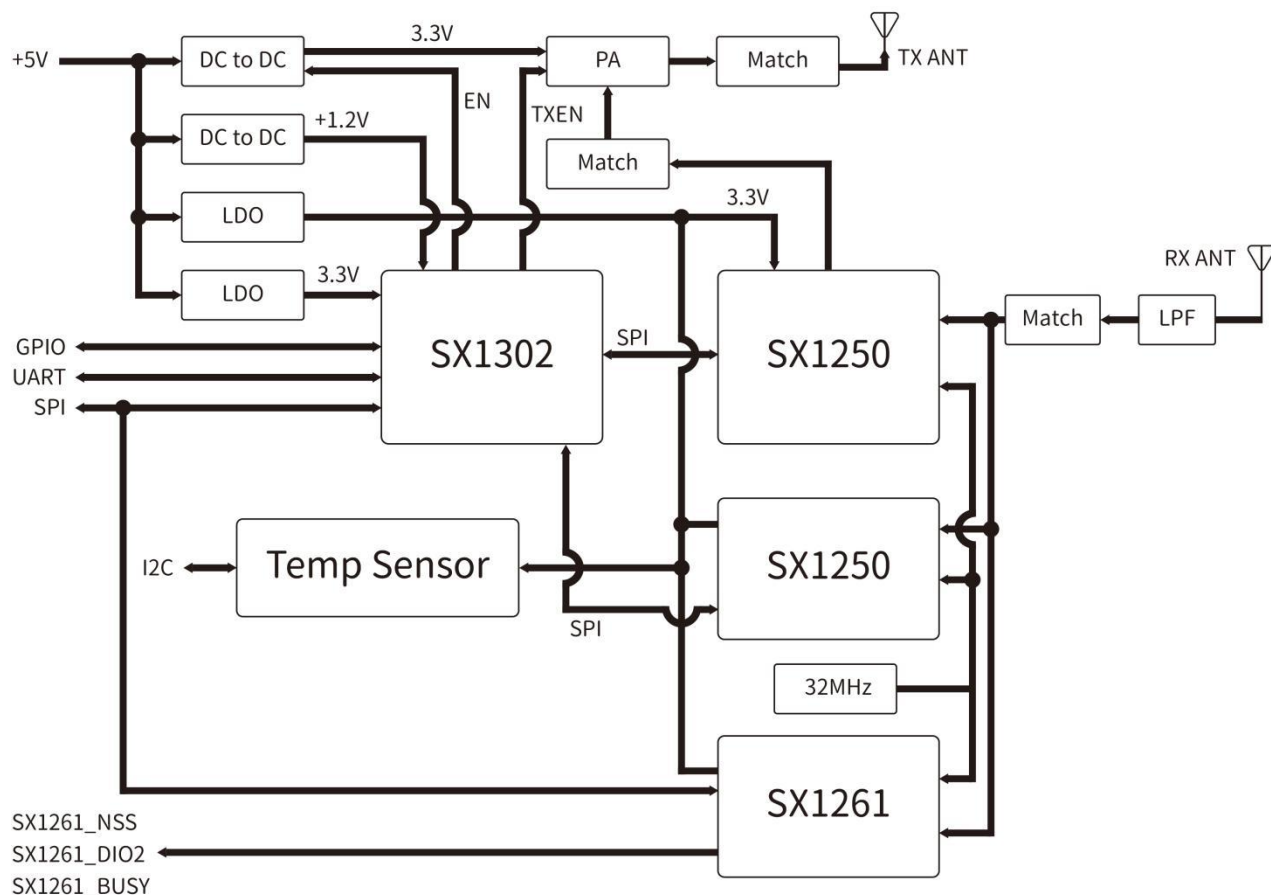
2. Features

- LoRa long range module technology
- Full duplex
- Simultaneously receive LoRa packets
- Dual digital Tx & Rx radio front-end
- Dynamic data-rate adaptation (ADR)
- Multi LoRa Spreading Factor
- Maximum 10 channels
- 8 x Multi SF LoRa channels (SF7 to SF12 with 125kHz Bandwidth)
- 1x LoRa channel (Bandwidth 125/250/500kHz)
- 1 x FSK channel

3. Application

- Smart city
- Smart Metering (Water, Electric, Gas meter)
- Agricultural Monitoring
- Irrigation control
- Internet of Things (IoT)
- M2M
- Wireless Sensors
- Wireless Alarm and Security Systems

4. Simple block diagram

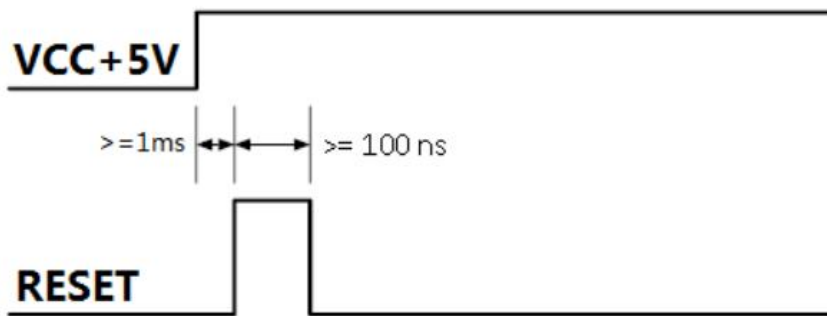


5. Electrical specifications

Parameter	Min	Typ.	Max	Unit	Condition
Working Condition					
Working voltage range	4	5.0	5.5	V	
Temperature voltage	-40		85	°C	
Current Consumption					
Receiving current		<40		mA	@9 channels all open
Transmitting current		<2000		mA	@32dBm
Parameter					
Frequency range		340	440	MHz	
		429	440	MHz	@433MHz
		470	490	MHz	@470MHz
		860.75	874.5	MHz	@868MHz
		902	928	MHz	@915MHz
Output power range	14		32	dBm	@868MHz
Receiving sensitivity		-134		dBm	@SF=10,,BW=125kHz

6. Interface specifications

➤ Power-up sequence



➤ SPI Timing

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
SPI						
SCK frequency	F_{SCK}		-	-	10	MHz
SCK high time	t_{ch}		50	-	-	ns
SCK low time	t_{cl}		50	-	-	ns
SCK rise time	t_{rise}		-	5	-	ns
SCK fall time	t_{fall}		-	5	-	ns
MOSI setup time	t_{setup}	From MOSI change to SCK rising edge.	10	-	-	ns
MOSI hold time	t_{hold}	From SCK rising edge to MOSI change.	20	-	-	ns
CSN setup time	t_{nsetup}	From CSN falling edge to SCK rising edge	10	-	-	ns
CSN hold time	t_{nhold}	From SCK falling edge to CSN rising edge, normal mode	40	-	-	ns
NSS high time between SPI accesses	t_{nhigh}		40	-	-	ns

➤ Reference Design

Hardware Abstraction Layer (HAL)

The control of the sx1302 by the MCU is made using a Hardware Abstraction Layer (HAL). The Hardware Abstraction Layer source code is provided by Semtech and can be adapted by the MCU developers. It is recommended to fully re-use the latest HAL as provided by Semtech on https://github.com/Lora-net/lora_gateway.

7. Power table

➤ 340MHz TX Power Table:

TX POWER(dBm)	pa_gain	pwr_idx	Current(mA)
3.3	1	1	24-120
4.7	1	2	24-122
5.5	1	3	24-129
7.1	1	4	24-139
8.2	1	5	24-146
9.7	1	6	24-157
11.4	1	7	24-180
14.8	1	9	24-228
17.8	1	11	24-294
22.6	1	14	24-480
24.2	1	15	24-565
26.1	1	16	24-689
27.7	1	17	24-837
30.5	1	19	24-1256
31.2	1	20	24-1320
31.4	1	22	24-1400

➤ 433MHz TX Power Table:

TX POWER(dBm)	pa_gain	pwr_idx	Current(mA)
11.84	1	1	24-190
13.68	1	2	24-214
14.89	1	3	24-224
16.98	1	4	24-255
18.89	1	5	24-280
19.87	1	6	24-320
21.72	1	7	24-360
24.78	1	9	24-460
26.96	1	11	24-535
29.98	1	14	24-770
30.49	1	15	24-840
30.8	1	16	24-930
31.03	1	17	24-1000
31.55	1	19	24-1180
31.53	1	20	24-1200
31.25	1	22	24-1200

➤ **868MHz TX Power Table:**

TX POWER(dBm)	pa_gain	pwr_idx	Current(mA)
7.35	1	1	26-370
9.21	1	2	26-400
10.19	1	3	26-418
12.19	1	4	26-446
13.18	1	5	26-470
14.65	1	6	26-506
16.31	1	7	26-560
18.71	1	9	26-659
21.43	1	11	26-780
24.09	1	14	26-1000
24.77	1	15	26-1150
25.41	1	16	26-1300
26.01	1	17	26-1460
27.17	1	19	26-1750
28.29	1	20	26-1800
29.88	1	22	26-1832

➤ **915MHz TX Power Table:**

TX POWER(dBm)	pa_gain	pwr_idx	Current(mA)
10.1	1	0	280-460
11.60	1	1	280-480
12.61	1	2	280-500
14.31	1	3	280-530
15.40	1	4	290-580
16.8	1	5	290-640
18.13	1	6	300-660
20.58	1	7	280-770
22.69	1	8	300-900
25.59	1	9	280-1200
26.74	1	10	280-1290
27.69	1	11	280-1410
28.81	1	12	280-1490
29.98	1	13	280-1830
30.89	1	14	290-1950
30.89	1	15	290-1950

If the product is transmitting for a long time, it is recommended to set the power below 27dB.

8. Pinout Description



Pin	Definition	Type	Description
1	VCC	Power (VCC)	Power Supply
2	VCC	Power (VCC)	Power Supply
3	GND	Power (GND)	Ground
4	SX1261_DIO1	Input/Output	DIO1 of SX1261
5	GPIO6	Input/Output	GPIO of SX1302
6	SX1302_UART_TX	Input/Output	UART TXD of SX1302
7	SX1302_UART_RX	Input	UART TXD of SX1302
8	HOST_CSN	Output	CSN of SX1302
9	HOST_MISO	Input	MISO of SX1302
10	HOST_MOSI	Input	MOSI of SX1302
11	HOST_SCK	Input	SCK of SX1302 (max 10 MHz clock)
12	GND	Power (GND)	Ground
	SX1302_RESET	Input	Reset of SX1302
14	PPS	Output	PPS of SX1302
15	SX1261_RESET	Output	RESET of SX1261
16	SX1261_NSS	Input	NSS of SX1261
17	SX1261_BUSY	Output	BUSY of SX1261
18	I2C_SCL	Input	SCL of STTS751
19	I2C_SDA	Input/Output	SDA of STTS751
20,21,23 ,24,26	GND	Power (GND)	Ground
22	RXANT	Input	connect 50 ohm antenna
25	TXANT	Output	connect 50 ohm antenna

9. Mechanical Dimension(Unit: mm)

