



EMB-LR1280-mPCIe-4x Datasheet

Embit s.r.l.

Rev. 1.0

14/06/2021

Document information

Versions & Revisions

Revision	Date	Author	Comments
Preliminary	2021-02-09	Embit	
Rev 1.0	2021-06-14	Embit	Added programming pins configuration image

Index

1	Introduction	4
1.1	Specifications	4
1.2	Applications.....	5
2	Description	5
2.1	Block Diagram	5
2.2	SX1280 Module.....	6
2.3	Crypto Element.....	7
2.4	External Antenna Connection	7
3	Connections.....	8
3.1	Pin Out Description.....	8
3.2	Programming Pins Description	9
4	Electrical Characteristics	10
4.1	Absolute Minimum and Maximum Ratings.....	10
4.2	Operating Conditions	10
4.3	Power Consumption	11
4.4	RF Characteristics.....	11
5	Mechanical Characteristics	12
6	References	12
7	Disclaimer of liability.....	12
7.1	Handling Precautions	12
7.2	Limitations	13
7.3	Disclaimer of Liability	13
7.4	Trademarks	13

1 Introduction

EMB-LR1280-mPCIe-4x provides long range connectivity exploiting LoRa® spread spectrum modulation over the 2.4 GHz ISM band. Thanks to the intrinsic resilience of LoRa® modulation, the EMB-LR1280-mPCIe-4x can operate in hostile RF environments coexisting with other widespread technologies like Wi-Fi and Bluetooth®. It can operate worldwide being fully compliant with 2.4GHz frequency band regulation.

EMB-LR1280-mPCIe-4x is based on 4 Semtech® SX1280 long range radio transceivers to offer 3 channels for reception and 1 for transmission. The 3 simultaneous reception channels have configurable data rate and can achieve a sensitivity of up to -129dBm. The transmission output power can reach +12dBm.



Figure 1: EMB-LR1280-mPCIe-4x

1.1 Specifications

- Operating Voltage: 3.3V
- Current Consumption: 69mA (Tx@+12dBm); 80mA (Rx)
- Modulation: LoRa® Spread Spectrum, FSK, GFSK
- Operating Frequency: 2.4 GHz
- Frequency Range: 2400-2485MHz
- Operating Temperature: -40°C to +85°C
- RF Output Power: Up to +12 dBm

- Interfaces: Standard mPCIe
- Sensitivity: Down to -129 dBm
- Dimensions: 30.00×50.95×4.50 mm
- Features: On-board U.FL antenna connector,
4 LoRa® Channels
- Part Numbers: EMB-LR1280-mPCIe-4x

1.2 Applications

The device can be used in several applications where LoRa gateway is needed, such as:

- Internet Of Things (IoT)
- Automated Meter Reading
- Smart Cities
- Home and Building Automation
- Wireless Alarm and Security System
- Machine to Machine (M2M)
- Industrial Monitoring and Control
- Long Range Irrigation System.

2 Description

2.1 Block Diagram

The **EMB-LR1280-mPCIe-4x** block diagram:

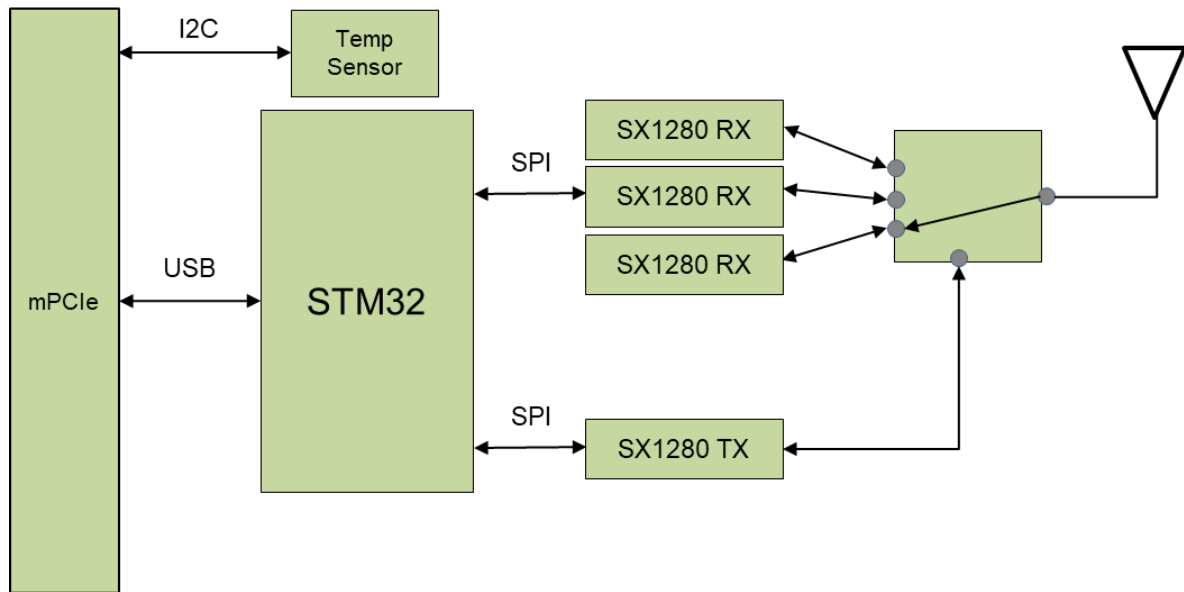


Figure 2: EMB-LR1280-mPCIe-4x block diagram.

2.2 SX1280 Module

The SX1280 provides ultra long range communication in the 2.4 GHz band with the linearity to withstand heavy interference. This makes them the ideal solution for robust and reliable wireless solutions. The level of integration, low consumption and ranging functions within the long range 2.4 GHz product line enable enhanced connectivity and provide additional functionality to a new generation of previously unconnected devices and applications.

Main features:

- **USB** link with the CPU
- **RF standard supported:** LoRa® 2.4GHz stack
- **Frequency band:** 2.4GHz
- **libloragw** is the HAL library of the SX1280 concentrator, that provides an API to configure the hardware, send and receive packets (developed by Semtech®).

- **packet_forwarder** is the application that allows the exchange of LoRa® 2.4GHz packet with a LoRa® 2.4GHz network server. It forwards RF packets received by the gateway to a server through an IP/UDP link, and emits RF packets that are sent by the server.
- **Sample Projects:**
 - Semtech® source code available gateway-2g4-hal
 - **helper programs:** util_pkt_logger, util_tx_test, util_tx_continuous

2.3 Crypto Element

The Crypto element is a high-security cryptographic device which combines world-class hardware-based key storage with hardware cryptographic accelerators to implement various authentication and encryption protocols.

It includes an EEPROM array which can be used for storage of up to 16 keys, certificates, miscellaneous read/write, secret data, and security configurations. Access to the various sections of memory can be restricted in a variety of ways and then the configuration can be locked to prevent changes.

It can be used as an Ecosystem control and Anti-Counterfeiting: it validates if a system or component is authentic and came from the OEM shown on the nameplate.

Access to the device is made through a standard I2C Interface at speeds of up to 1 Mb/s.

2.4 External Antenna Connection

The **EMB-LR1280-mPCIe-4x** has a U.FL connector for 2.4GHz antenna.

3 Connections

3.1 Pin Out Description

Number	Pin Name	Type	Description
1	WAKE#	NC	Not Connected
2	3.3Vaux	Power	3.3V
3	COEX1	NC	Not Connected
4	GND	Power (GND)	Ground
5	COEX2	NC	Not Connected
6	1.5V	I/O	Not Connected
7	CLKREQ#	NC	Not Connected
8	UIM_PWR	Input (NC)	HOST_MOSI
9	GND	Power (GND)	Ground
10	UIM_DATA	Output (NC)	HOST_MISO
11	REFCLK-	Input	PPS_SYNC
12	UIM_CLK	Input (NC)	HOST_SCK
13	REFCLK+	NC	Not Connected
14	UIM_RESET	Input (NC)	HOST_CS
15	GND	Power (GND)	Ground
16	UIM_VPP	NC	Not Connected
17	RES UIM_C8	NC	Not Connected
18	GND	Power (GND)	Ground
19	RES UIM_C4	NC	Not Connected
20	W_DISABLE#	NC	Not Connected
21	GND	Power (GND)	Ground
22	PERST#	Input	MCU_RESET
23	PERn0	NC	Not Connected
24	3.3Vaux	Power	3.3V
25	PERp0	NC	Not Connected
26	GND	Power (GND)	Ground
27	GND	Power (GND)	Ground
28	1.5V	NC	Not Connected
29	GND	Power (GND)	Ground
30	SMB_SCL	Input	I2C Clock Pin
31	PETn0	NC	Not Connected
32	SMB_SDA	Input/Output	I2C Data Pin

33	PETp0	NC	Not Connected
34	GND	Power (GND)	Ground
35	GND	Power (GND)	Ground
36	USB_D-	Input/Output	USB Differential negative signal pin
37	GND	Power (GND)	Ground
38	USB_D+	Input/Output	USB Differential positive signal pin
39	3.3Vaux	Power	3.3V
40	GND	Power (GND)	Ground
41	3.3Vaux	Power	3.3V
42	LED_WWAN#	Output (NC)	HOST_UART_CTS
43	GND	Power (GND)	Ground
44	BOOT0	Input	STM32 Boot0 pin
45	Reserved	NC	Not Connected
46	MCU_RESET	Input (NC)	STM32 Reset pin
47	Reserved	NC	Not Connected
48	1.5V	NC	Not Connected
49	Reserved	Input (NC)	HOST_UART_RXD
50	GND	Power (GND)	Ground
51	Reserved	Output (NC)	HOST_UART_TXD
52	3.3Vaux	Power	3.3V

Table 1: mPCIe Interface Pin Out.

3.2 Programming Pins Description

The pins as indicated in Figure 3 have the following functionality:



Figure 3: Programming pin configuration

Number	Pin Name	Type	Description
1	3V3_DIG	Power	Power supply
2	SWCLK	Input	Clock pin
3	GND	Power (GND)	Ground
4	SWDIO	I/O	Programming pin
5	NRST	Input	Reset pin
6	SWO	I/O	Programming pin

Table 2: Programming Pin Out

4 Electrical Characteristics

4.1 Absolute Minimum and Maximum Ratings

Parameter	Min	Max	Unit
Power Supply Voltage	-0.5	3.6	Vdc
Storage Temperature	-40	125	°C
Maximum RF Input Level		10	dBm

Table 3: Absolute minimum and maximum ratings.

4.2 Operating Conditions

Parameter	Min	Typ	Max	Unit
Power Supply Voltage (Vcc)	3.0	3.3	3.6	V
Operating Temperature range	-40	25	+85	°C
Logic Low Input threshold	-0.3		0.3*Vcc	V
Logic High Input threshold	0.7*Vcc		Vcc+0.3	V
Logic Low Output Level	0		0.4	V
Logic High Output Level	Vcc-0.6		Vcc	V

Table 4: Operating Conditions.

4.3 Power Consumption

Mode	Typ. value	Unit
Transmission @ +12dBm	69	mA
Transmission @ +10dBm	64	mA
Transmission @ +5dBm	58	mA
Reception	80	mA
Packet Forwarder (Rx + Tx @ +12.5dBm)	101	mA
Idle	52	mA

Table 5: Power Consumption.

4.4 RF Characteristics

Condition	Min.	Typ.	Max.	Unit
Output Power			+12	dBm
Receiver sensitivity SF12; BW=812.5KHz		-127.5		dBm
Receiver sensitivity SF7; BW=812.5KHz		-117		dBm

Table 6: Receiver Sensitivity.

5 Mechanical Characteristics

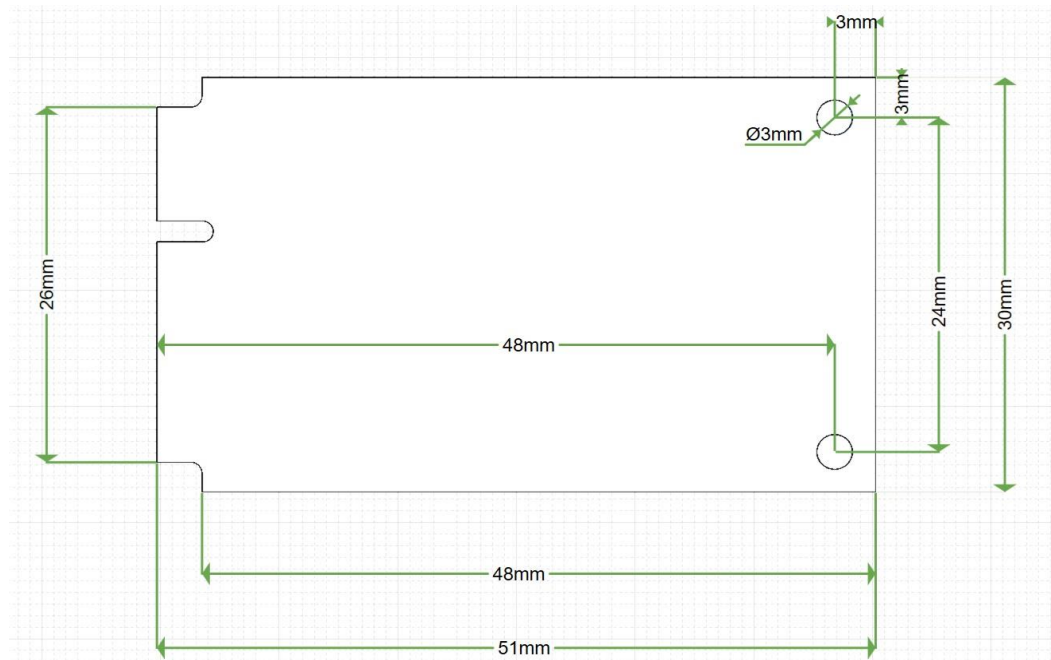


Figure 4: EMB-LR1280-mPCIe-4x mechanical dimensions.

6 References

[1] Semtech, SX1280 Datasheet from www.semtech.com

7 Disclaimer of liability

The user must read carefully all the documentation available before using the product. In particular, care must be taken in order to comply with the regulations (e.g., power limits, duty cycle limits, etc.).

7.1 Handling Precautions



This product is an ESD sensitive device. Handling precautions should be carefully observed.

7.2 Limitations

Every operation involving a modification on the internal components of the module will void the warranty.

7.3 Disclaimer of Liability

The information provided in this and other documents associated to the product might contain technical inaccuracies as well as typing errors. Regulations might also vary in time. Updates to these documents are performed periodically and the information provided in these manuals might change without notice. The user is required to ensure that the documentation is updated and the information contained is valid. Embit reserves the right to change any of the technical/functional specifications as well as to discontinue manufacture or support of any of its products without any written announcement.

7.4 Trademarks

Embit is a registered trademark owned by Embit s.r.l.

All other trademarks, registered trademarks and product names are the sole proprietary of their respective owners.