

PMC51x LoRa Module Specification

PMC51x is a Mini-PCle LoRa module used as the LoRa radio component of the GD6 series LoRaWAN gateways. This document describes its functions, technical specifications, pin definitions, interface requirements, and model selection.

1. Product Overview

1.1 Positioning and GD6 Relationship

PMC51x is the LoRa radio component of GD6 and connects to the host through a Mini-PCle form factor. It is based on the Semtech SX1302 LoRa baseband chip, with a pin-compatible SX1303 option available for project customization. The module operates in half-duplex mode, communicates with the host over SPI, and supports the Semtech open-source Packet Forwarder.

The final digit in PMC514 and PMC518 identifies the radio-frequency family; it does not indicate the number of LoRaWAN channels:

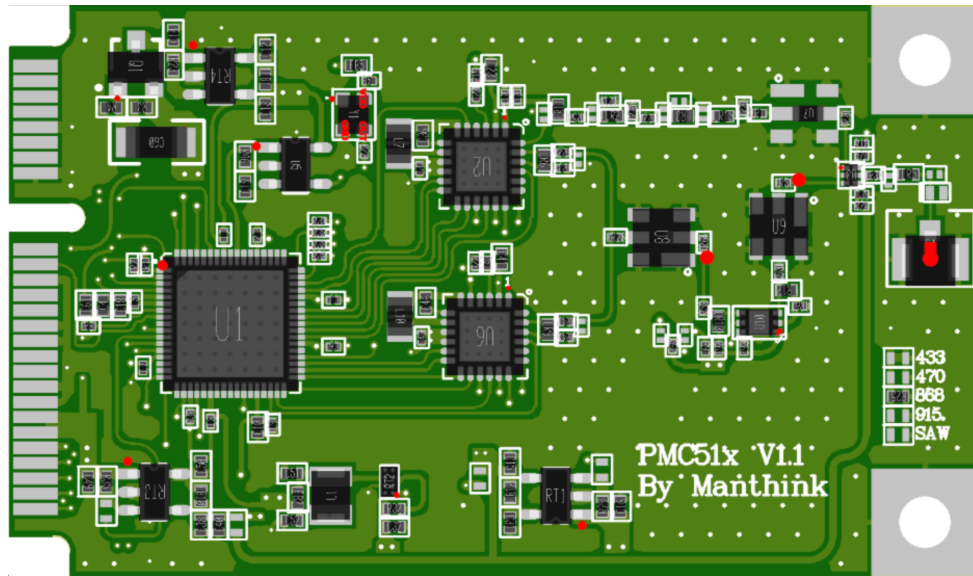
- **PMC514:** 400 MHz family, including EU433 and CN470.
- **PMC518:** 800 MHz and higher family, including EU868, AS923, AU915, US915, and KR920.

1.2 Key Features

- Standard Mini-PCle form factor for straightforward integration and replacement.
- SX1302 baseband with a customizable pin-compatible SX1303 option.
- SPI host interface and PPS timing input.
- EU433, CN470, EU868, AS923, AU915, US915, and KR920 regional standards.
- First-generation I-PEX antenna connector.
- Eight parallel receive paths with SF5-SF12 support.
- Receive sensitivity down to -141 dBm.
- One transmit path with up to 22 dBm output power.
- Built-in power-on reset sequencing to simplify host control.

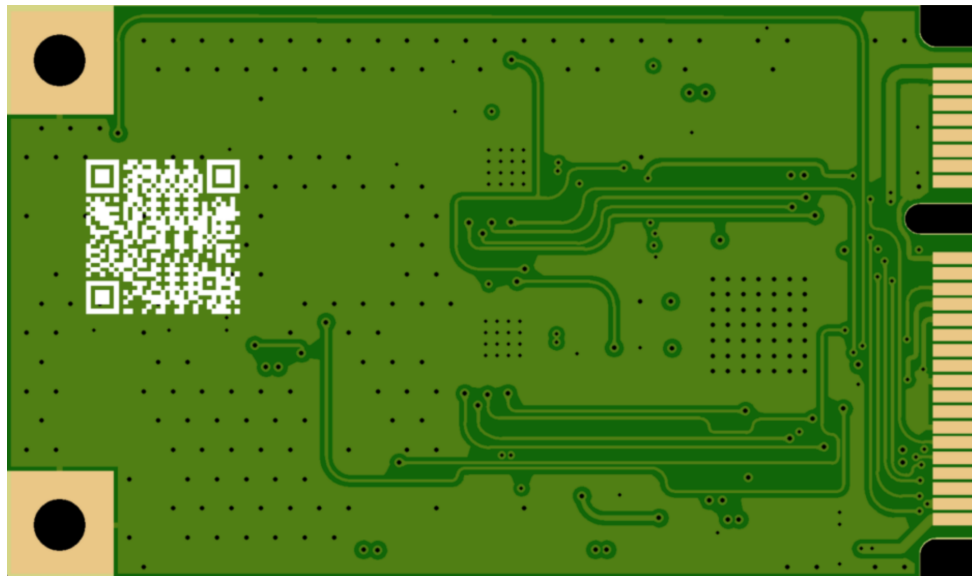
2. Product Views

2.1 Front View



PMC51x module front view

2.2 Bottom View



PMC51x module bottom view

3. Technical Specifications

3.1 Electrical and Mechanical Specifications

Item	Specification
Form factor	Mini-PCle
Dimensions	30.0 mm × 51.0 mm × 4.5 mm
Host interface	SPI
Operating mode	Half-duplex
Supply voltage	DC 3.3-5 V
Transmit current	< 120 mA
Receive current	< 60 mA
Operating temperature	-40 to +85 °C
Antenna connector	First-generation I-PEX

3.2 Radio Specifications

Item	Specification
Baseband chip	SX1302; customizable pin-compatible SX1303
Receive paths	8
Transmit paths	1
Spreading factors	SF5-SF12
Receive sensitivity	Down to -141 dBm
Maximum transmit power	22 dBm
EU433	433-434 MHz
CN470	470-510 MHz
EU868	863-870 MHz
AS923	920-928 MHz
AU915	915-928 MHz
US915	902-928 MHz
KR920	Configured according to KR920 regional parameters

4. Mini-PCle Pin Definition

4.1 Signal Types

Abbreviation	Meaning
PI	Power input
DI	Digital input
DO	Digital output
IO	Bidirectional digital signal
NC	Not internally connected
RESERVED	Reserved signal

4.2 Main Pins

Function	Pins	Description
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	Power ground
VCC_3V3	2, 24, 39, 41, 52	Power input
PPS	19	GPS PPS timing input
NRESET	22	Module reset, active high
RX_ON	42	Receive-state output connected to the onboard indicator
TX_ON	44	Transmit-state output connected to the onboard indicator
SX_SCK	45	SPI clock input
CFG_ON	46	Configuration-state output connected to the onboard indicator
SX_MISO	47	SPI data output
SX_MOSI	49	SPI data input
SX_CSN	51	SPI chip-select input

4.3 Complete 52-Pin Definition

Pin	Mini-PCle Name	Module Signal	Type	Description
1	WAKE#	RESERVED	DO	Reserved for pass-through variants; leave floating
2	3.3Vaux	VCC_3V3	PI	Power input
3	COEX1	NC	-	Not internally connected; leave floating
4	GND	GND	-	Power ground
5	COEX2	NC	-	Not internally connected; leave floating
6	1.5V	NC	-	Not used
7	CLKREQ#	NC	-	Not internally connected; leave floating
8	UIM_PWR	NC	-	Not used
9	GND	GND	-	Power ground
10	UIM_DATA	RESERVED	IO	Reserved for pass-through variants; leave floating
11	REFCLK-	RESERVED	DI	Reserved for pass-through variants; leave floating
12	UIM_CLK	RESERVED	IO	Reserved for pass-through variants; leave floating
13	REFCLK+	RESERVED	DO	Reserved for pass-through variants; leave floating
14	UIM_RESET	NC	-	Not used
15	GND	GND	-	Power ground
16	UIM_VPP	NC	-	Not internally connected; leave floating
17	RESERVED	NC	-	Not internally connected; leave floating
18	GND	GND	-	Power ground
19	RESERVED	PPS	DI	GPS PPS timing input; may be left floating when unused
20	W_DISABLE#	NC	-	Not internally connected; leave floating
21	GND	GND	-	Power ground
22	PERST#	NRESET	DI	Reset control, active high
23	PERn0	RESERVED	DI	Reserved; leave floating
24	3.3Vaux	VCC_3V3	PI	Power input
25	PERp0	NC	-	Not used
26	GND	GND	-	Power ground
27	GND	GND	-	Power ground

Pin	Mini-PCle Name	Module Signal	Type	Description
28	1.5V	NC	-	Not used
29	GND	GND	-	Power ground
30	SMB_CLK	NC	-	Not internally connected; leave floating
31	PETn0	RESERVED	DO	Reserved; leave floating
32	SMB_DATA	NC	-	Not internally connected; leave floating
33	PETp0	NC	-	Not used
34	GND	GND	-	Power ground
35	GND	GND	-	Power ground
36	USB_D-	RESERVED	IO	Reserved for pass-through variants; leave floating
37	GND	GND	-	Power ground
38	USB_D+	RESERVED	IO	Reserved for pass-through variants; leave floating
39	3.3Vaux	VCC_3V3	PI	Power input
40	GND	GND	-	Power ground
41	3.3Vaux	VCC_3V3	PI	Power input
42	LED_WWAN#	RX_ON	DO	Receive-state indicator connected to the onboard LED
43	GND	GND	-	Power ground
44	LED_WLAN#	TX_ON	DO	Transmit-state indicator connected to the onboard LED
45	RESERVED	SX_SCK	DI	SPI clock input
46	LED_WPAN#	CFG_ON	DO	Configuration-state indicator connected to the onboard LED
47	RESERVED	SX_MISO	DO	SPI data output
48	1.5V	NC	-	Not used
49	RESERVED	SX_MOSI	DI	SPI data input
50	GND	GND	-	Power ground
51	RESERVED	SX_CSN	DI	SPI chip-select input
52	3.3Vaux	VCC_3V3	PI	Power input

5. Interface Details

5.1 Power Interface

The module is powered through the Mini-PCIe VCC_3V3 pins and operates from DC 3.3-5 V. The host must provide a stable supply with enough headroom for the transmit peak current and should place decoupling capacitors close to the module. All GND pins must be connected reliably.

5.2 SPI Interface

The SPI signals are SX_SCK, SX_MISO, SX_MOSI, and SX_CSN. The host SPI controller must support full-duplex communication. Refer to the Semtech SX1302 data sheet for timing, electrical limits, and register-access procedures.

5.3 Control and Status Interfaces

Signal	Direction	Function
PPS	Input	External GPS PPS timing
NRESET	Input	Module reset, active high
RX_ON	Output	Receive operating state
TX_ON	Output	Transmit operating state
CFG_ON	Output	Configuration operating state

6. Signal Behavior

6.1 PPS

The PPS pin accepts a one-pulse-per-second signal from a GPS module so that packets can carry precise timestamps. The pin may be left floating when PPS is not used.

6.2 NRESET

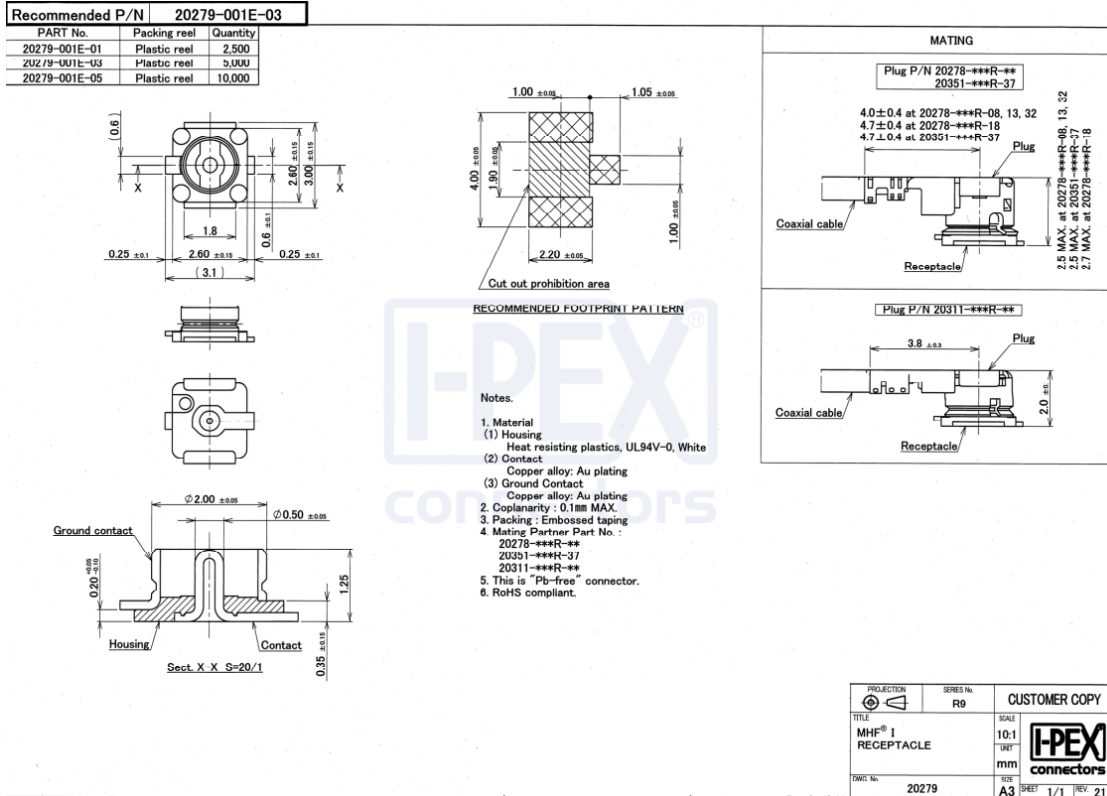
To reset the module, drive NRESET high for 0.05-0.2 s and then release it. Keep the reset trace short and shield it with an adjacent ground trace where practical to reduce the risk of unintended resets.

6.3 RX_ON, TX_ON, and CFG_ON

RX_ON is high while the module is receiving, TX_ON is high while it is transmitting, and CFG_ON indicates the configuration state. These signals are connected to onboard LEDs and are associated with SX1302 GPIOs.

7. Antenna Interface

The module uses a first-generation I-PEX antenna receptacle. Use a matching RF cable and antenna, and ensure that the antenna band matches the module model and deployment region. The RF routing and mechanical design should avoid applying lateral stress to the connector.



First-generation I-PEX receptacle dimensions and recommended footprint

8. Models and Regional Standards

Model	Frequency Family	Supported Regional Standards
PMC514-433-N	400 MHz	EU433
PMC514-470-N	400 MHz	CN470
PMC518-868-N	800 MHz and higher	EU868
PMC518-915-N	800 MHz and higher	AS923, AU915, US915, KR920

Select a model and regional configuration that comply with local regulations. The "4" or "8" in the model family identifies its frequency range; it does not indicate the number of receive or transmit channels.

9. Integration and Safety Notes

- Disconnect power before installing or removing the module.
- Apply ESD precautions and avoid touching RF components or the edge connector directly.
- Connect the correct antenna before transmission and verify that its band and impedance match the module.
- Do not use NC or RESERVED pins for undocumented functions.
- Ensure the host enclosure keeps the module within its -40 to +85 °C operating range.
- The final product's radio parameters, transmit power, and deployment region must meet applicable regulations and certification requirements.

10. Contact

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