E106-868G27P

LoRa Gateway Mini PCIe modules with SPI and USB interface

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Abstract

This is a technical data sheet of E106-868G27P LoRa gateway modules. The module is a complete and cost efficient LoRa gateway solution offering up to 10 programmable parallel demodulation paths. It targeted at smart metering fixed networks and Internet of Things applications with up to 5000 nodes per km2 in moderately interfered environment.The module have the industry standard PCI Express Mini Card form factor, which enables easy integration into an application board and is also ideal for manufacturing of small series.

Contents

1. Functional description

1.1. Overview

E106-868G27P comprises complete and cost efficient LoRa gateway module in the industry standard PCI Express Mini Card form factor, which enables an easy integration into an application board and it is also ideal for manufacturing of small series.

E106-868G27P module support 868MHz for Europ.

E106-868G27P module support up to -142 dBm sensitivity with SX1255/7 Tx/Rx front-end and max 27dBm TX power.

Typical applications are Smart Metering , Security Sensors Network, Agricultural Monitoring, Internet of Things (IoT) .

1.2. Product features

Module	Frequency	SPI	GPS PPS
E106-868G27P	868MHz	YES	YES

Table 1: E106-868G27P main features summary

1.3. Block diagram

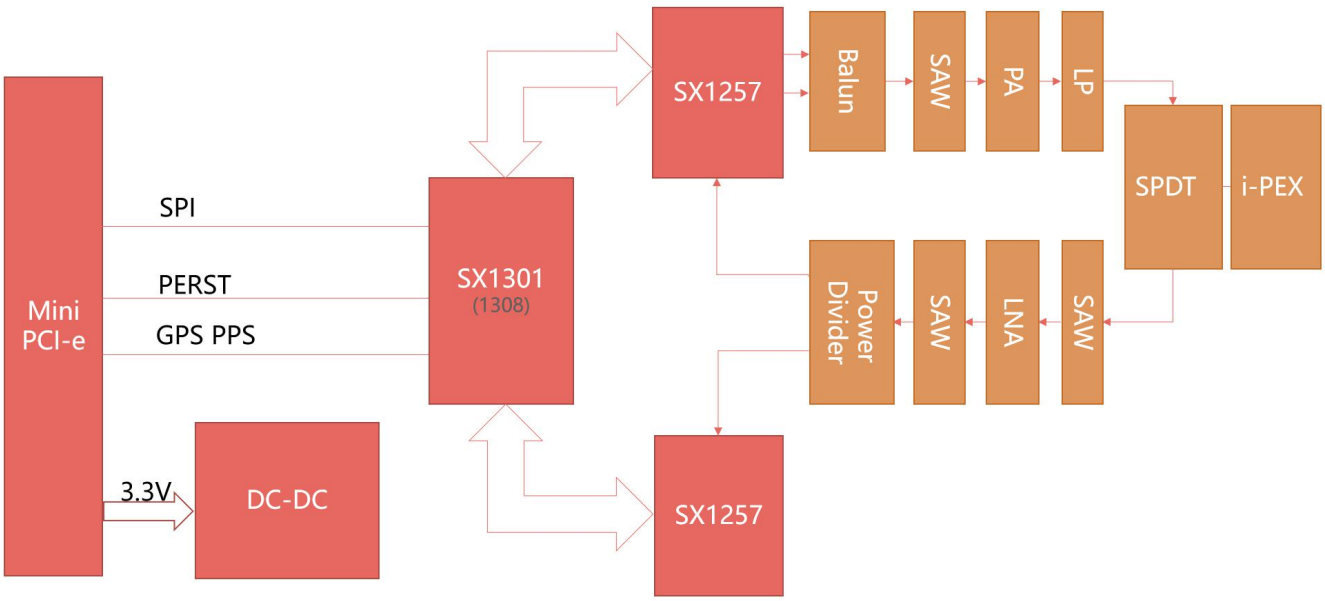


Figure 1: E106-868G27P block diagram

As described Figure 1, each E106-868G27P module integrates one SX1301 chip and two SX1255/7 and other chip for RF signal, which represents the core of the device, providing the related LoRa modem and processing functionalities. Additional signal conditioning circuitry is implemented for PCI Express Mini Card compliance, and one U.FL connectors are available for easy antennas integration.

1.4. Product description

E106-868G27P module provides LoRa gateway multi-mode technology:

- E106-868G27P is mainly designed for operation in Europe and other countries.

1.5. Supported features

Feature	Description
TRX Indication	Module has two on-board LEDs to indication the status of TX or RX, the LEDs are controlled by PA_EN and LNA_EN respectively.
Multichannel	10 programmable parallel demodulation paths,up to 8 RX channel and 1 TX channel for 125K LoRa.
SPI Interface	The SPI interface gives access to the configuration register of SX1301 via a synchronous full-duplex protocol.
GPS PPS Input	GPS PPS input for received packets time-stamped.

Table 2: Some of the main features supported by E106-868G27P module

2. Interfaces

2.1. Module supply input

E106-868G27P module must be supplied through the 3.3Vaux pins by a DC power supply. The voltage must be stable, because during this operation the current drawn from 3.3Vaux can vary significantly, based on the power consumption profile of the SX1301 chip(see SX1301 DS).

2.2. Antenna RF interfaces

The modules have one RF interfaces over a standard U.FL connectors (Hirose U.FL-R-SMT) with a characteristic impedance of 50. The RF port (ANT1) supports both Tx and Rx, providing the antenna interface.

2.3. SPI interface

A SPI interface is provided on the PCIe_SCK, PCIe_MISO, PCIe_MOSI, PCIe_CSN pins of the system connector. The SPI interface gives access to the configuration register of SX1301 via a synchronous full-duplex protocol. Only the slave side is implemented.

2.4. RESET

E106-868G27P includes the RESET active-high input signal to reset the radio operations as specified by the SX1301 Specification.

2.5. GPS_PPS

E106-868G27P includes the GPS_PPS input for received packets time-stamped.

3. Pin definition

3.1. Pin assignment

No	PCI Express Mini Card	E106-XXXG27P	Voltage domain	I/O	Description	Remarks
1	WAKE#	NC		N/A		Internally not connected
2	3.3Vaux	3.3Vaux	3.3Vaux	I	MPCI supply	Connect to external 3.3 V supply.
3	COEX1	GPIO4		I/O		Internally connect to SX1301
4	GND	GND	GND	N/A	Ground	Internally not connected
5	COEX2	GPIO3		N/A		Internally connect to SX1301
6	1.5V	NC		N/A		Internally not connected
7	CLKREQ#	GPIO2		N/A		Internally connect to SX1301
8	UIM_PWR	NC		N/A		Internally not connected
9	GND	GND	GND	N/A	Ground	Connect to ground
10	UIM_DATA	NC		N/A		Internally not connected
11	REFCLK-	NC		N/A		Internally not connected
12	UIM_CLK	NC		N/A		Internally not connected
13	REFCLK+	NC		N/A		Internally not connected
14	UIM_RESET	NC		N/A		Internally not connected
15	GND	GND	GND	N/A	Ground	Connect to ground
16	UIM_SPU	GPIO1		N/A		Internally connect to SX1301
17	UIM_IC_DM	NC		N/A		Internally not connected
18	GND	GND	GND	N/A	Ground	Connect to ground
19	UIM_IC_DP	GPS_PPS		N/A		GPS 1 pps input
20	W_DISABLE1#	GPIO0		N/A		Internally connect to SX1301
21	GND	GND	GND	N/A	Ground	Connect to ground
22	RERST#	RESET		I	MPCI reset input	Active high for SX1301 reset.
23	PERn0	NC		N/A		Internally not connected
24	3.3Vaux	3.3Vaux	3.3Vaux	I	MPCI supply	Connect to external 3.3 V supply.
25	PERp0	NC		N/A		Internally not connected
26	GND	GND	GND	N/A	Ground	Connect to ground
27	GND	GND	GND	N/A		Connect to ground
28	1.5V	NC		N/A		Internally not connected
29	GND	GND	GND	N/A	Ground	Connect to ground
30	SMB_CLK	NC		N/A		Internally not connected

No	PCI Express Mini Card	E106-XXXG27P	Voltage domain	I/O	Description	Remarks
31	PETn0	NC		N/A		Internally not connected
32	SMB_DATA	NC		N/A		Internally not connected
33	PETp0	NC		N/A		Internally not connected
34	GND	GND	GND	N/A	Ground	Connect to ground
35	GND	GND	GND	N/A	Ground	Connect to ground
36	USB_D-	NC		N/A		Internally not connected Pull-up, pull-down and series resistors as required by *USB 2.0 specifications* [6] are part of the USB pin driver and need not be provided externally.
37	GND	GND	GND	N/A	Ground	Connect to ground
38	USB_D+	NC		N/A		Internally not connected Pull-up, pull-down and series resistors as required by *USB 2.0 specifications* [6] are part of the USB pin driver and need not be provided externally.
39	3.3Vaux	3.3Vaux	3.3Vaux	I	MPCI supply input	Connect to external 3.3 V supply. See 4.2.2 for detailed electrical specs.
40	GND	GND	GND	N/A	Ground	Connect to ground
41	3.3Vaux	3.3Vaux	3.3Vaux	I	MPCI supply input	Connect to external 3.3 V supply.
42	LED_WWAN#	NC		N/A		Internally not connected
43	GND	GND	GND	N/A	Ground	Connect to ground
44	LED_WLAN#	NC		N/A		Internally not connected
45	Reserved	PCIe_SCK		I/O	Host SPI interface	Max 10MHz clock
46	LED_WPAN#	NC		N/A		Internally not connected
47	Reserved	PCIe_MISO		I/O	Host SPI interface	
48	1.5V	NC		N/A		Internally not connected
49	Reserved	PCIe_MOSI		I/O	Host SPI interface	
50	GND	GND	GND	N/A	Ground	Connect to ground
51	W_DISABLE2#	PCIe_CSN		I/O	Host SPI interface	
52	3.3Vaux	3.3Vaux	3.3Vaux	I	MPCI supply input	Connect to external 3.3 V supply. See 4.2.2 for detailed electrical specs.

Table 3: E106-868G27P system connector pin assignment

4. Electrical specifications

Stressing the device above one or more of the ratings listed in the Absolute Maximum Rating section may cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating Conditions sections (chapter 4.1) of the specification should be avoided. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Operating condition ranges define those limits within which the functionality of the device is guaranteed.

Where application information is given, it is advisory only and does not form part of the specification.

4.1. Absolute maximum rating

Limiting values given below are in accordance with the Absolute Maximum Rating System (IEC 134).

Symbol	Description	Condition	Min.	Max.	Unit
3.3Vaux	Module supply voltage	Input DC voltage at 3.3Vaux pins	–0.3	3.6	V
RESET	MPCI reset input	Input DC voltage at RESET input pin	–0.3	3.6	V
SPI	SPI interface	Input DC voltage at SPI interface pin	–0.3	3.6	V
GPS_PPS	GPS 1 pps input	Input DC voltage at GPS_PPS input pin	–0.3	3.6	V
ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT1		10:1	VSWR
Tstg	Storage Temperature		–40	85	°C

Table 4: Absolute maximum ratings

The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection devices.

4.1.1. Maximum ESD

Parameter	Min	Typical	Max	Unit	Remarks
ESD sensitivity for all pins except ANT1			1000	V	Human Body Model according to JESD22-A114
ESD sensitivity for ANT1			1000	V	Human Body Model according to JESD22-
ESD immunity for ANT1			4000	V	Contact Discharge according to IEC 61000-
			8000	V	Air Discharge according to IEC 61000-4-2

Table 5: Maximum ESD ratings

E106-868G27P module is electrostatic sensitive devices and require special precautions when handling. See section 7.2 for ESD handling instructions.

4.2. Operating conditions

Unless otherwise indicated, all operating condition specifications are at an ambient temperature of 25°C.

Operation beyond the operating conditions is not recommended and extended exposure beyond them may

affect device reliability.

4.2.1. Operating temperature range

Parameter	Min.	Typical	Max.	Unit	Remarks
Normal operating temperature	–20	+25	+65	°C	Normal operating temperature range (fully functional and meet 3GPP specifications)
Extended operating temperature	–40		+85	°C	Extended operating temperature range (RF performance may be affected outside normal operating range, though module is fully functional)

Table 6: Environmental conditions

4.2.2. Supply/power pins

Symbol	Parameter	Min.	Typical	Max.	Unit
3.3Vaux	Module supply operating input voltage[14]	3.00	3.30	3.60	V

Table7: Input characteristics of Supply/Power pins

Input voltage at **3.3Vaux** must be above the normal operating range minimum limit to switch-on the module.

4.2.3. Current consumption

Mode	Condition	Min	Typ	Max	Unit
Idle-Mode	All of the chip on the board enter idle mode or shutdown.	60	100		uA
Active-Mode (TX)	The power of TX channel is 20dBm and 3.3V supply.		360		mA
Active-Mode (RX)	TX disabled and shutdown PA.		490		mA

Table 8: Module 3.3Vaux supply current consumption

4.2.4. LoRa RF characteristics

E106-868G27P LoRa RF characteristics are specified in the SX1255/7*series Data Sheet* .

5. Mechanical specifications

E106-868G27P module is fully compliant to the 52-pin PCI Express Full-Mini Card Type F2 form factor, with top-side and bottom-side keep-out areas, with 50.95 mm nominal length, 30 mm nominal width and all the other dimensions as defined by the PCI Express Mini Card Electromechanical Specification [9] except for the card thickness (nominal value is 3.7 mm), as described in Figure 2. E106-868G27P module weight is about 9.7 g.

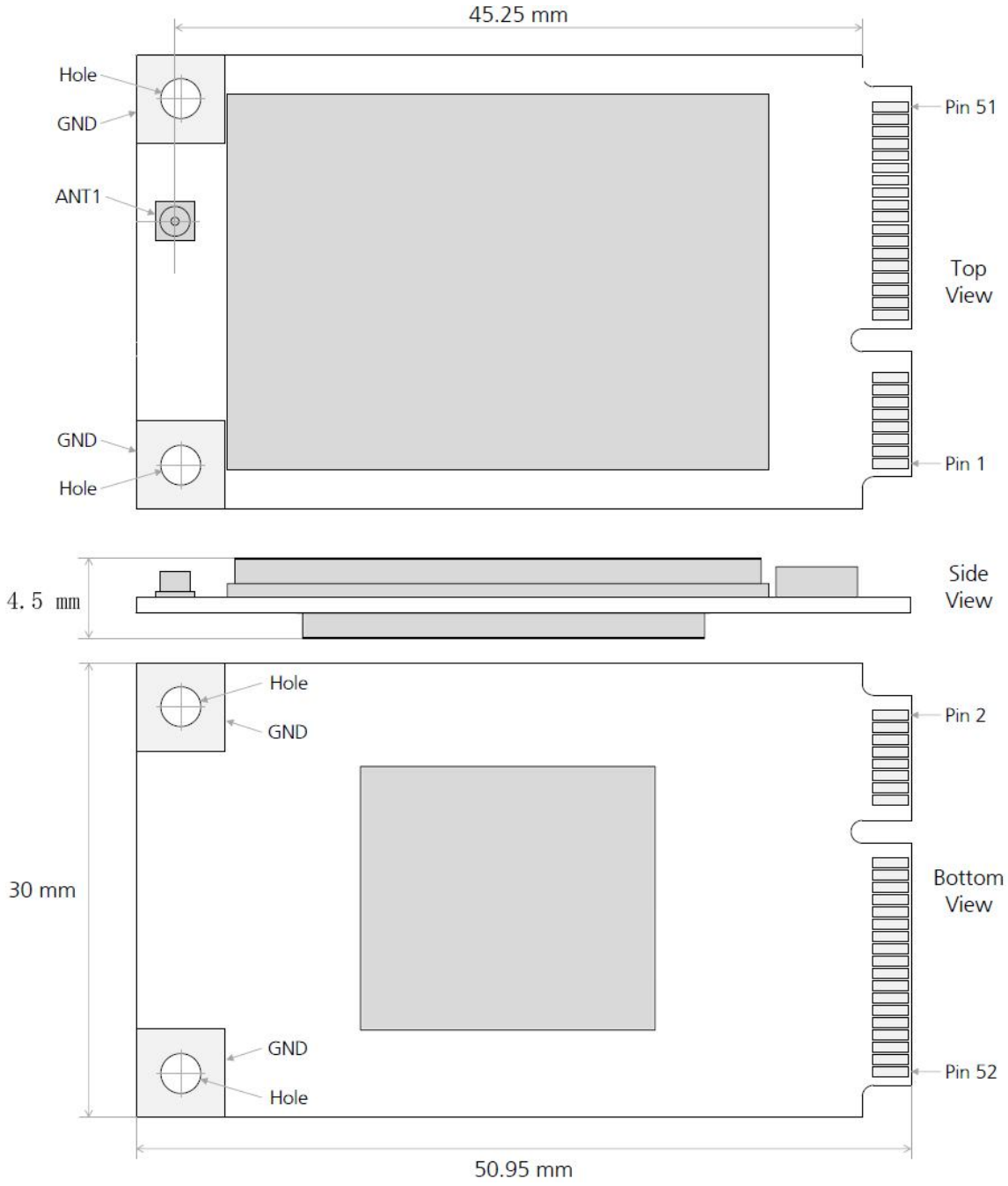
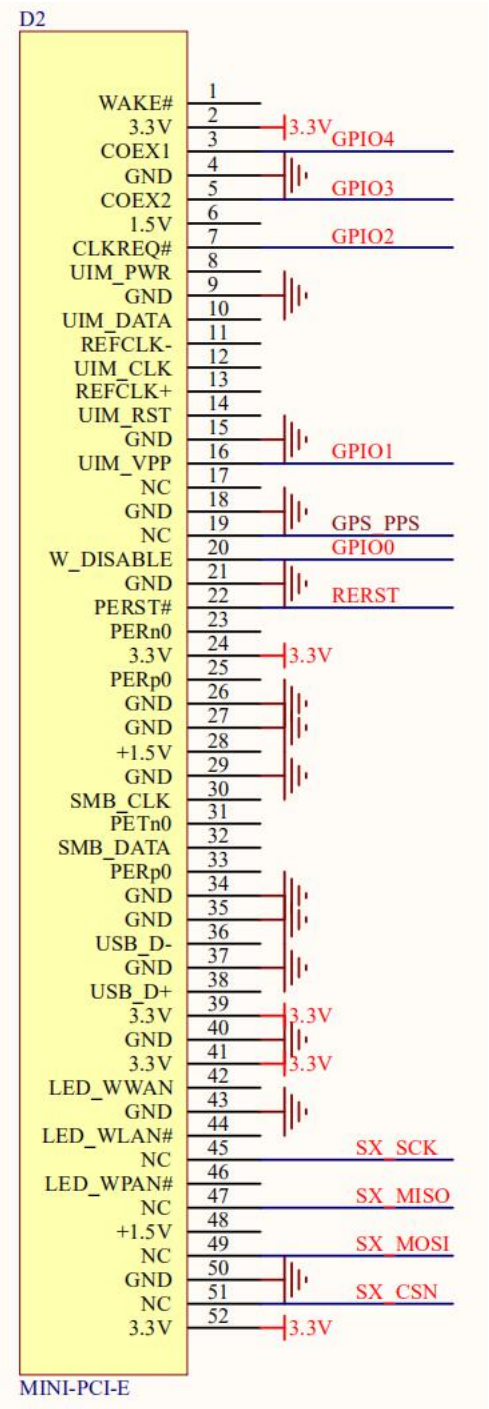


Figure 2: E106-868G27P mechanical dimensions (top view, side view, bottom view)

For further details regarding mechanical specifications see the *PCI Express Mini Card Electromechanical Specification* [9].

6. Inner schematic

E106-868XG27P module refer Semtech's reference design of SX1301, add a 4 chancel SPDT to switch SPI of SX1301 to PCI edge connector or FT2232H ,which convert SPI to USB2.0 interface.


D2
WAKE# 1
3.3V 2
COEX1 3
GND 4
COEX2 5
1.5V 6
CLKREQ# 7
UIM_PWR 8
GND 9
UIM_DATA 10
REFCLK- 11
UIM_CLK 12
REFCLK+ 13
UIM_RST 14
GND 15
UIM_VPP 16
NC 17
GND 18
NC 19
W_DISABLE 20
GND 21
PERST# 22
PERn0 23
3.3V 24
PERp0 25
GND 26
GND 27
+1.5V 28
GND 29
SMB_CLK 30
PETn0 31
SMB_DATA 32
PERp0 33
GND 34
GND 35
USB_D- 36
GND 37
USB_D+ 38
3.3V 39
GND 40
3.3V 41
LED_WWAN 42
GND 43
LED_WLAN# 44
NC 45
LED_WPAN# 46
NC 47
+1.5V 48
NC 49
GND 50
NC 51
3.3V 52
3.3V
GPIO4
GPIO3
GPIO2
GPIO1
GPS_PPS
GPIO0
RERST
3.3V
3.3V
3.3V
SX_SCK
SX_MISO
SX_MOSI
SX_CSN
3.3V
MINI-PCI-E

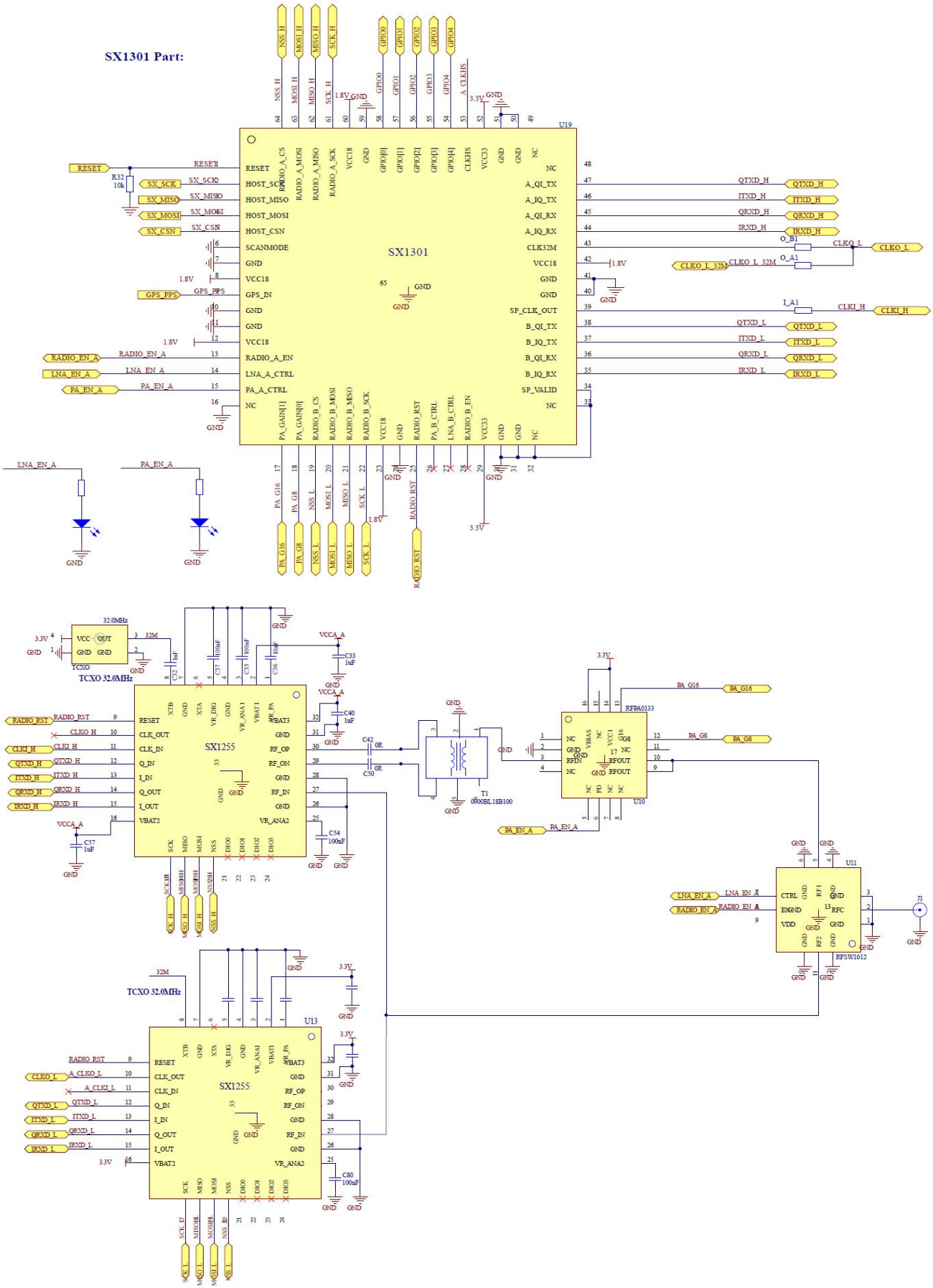


Figure 3: E106-868G27P inner schematic.

For further details regarding schematic please refer “SX1301DVK_e286v02a_sch_layout” from Semtech.

7. Reference application

Figure 4 shows the minimum application schematic of E106-868G27P module. Uses at lest 3.3V/1A DC power, connect SPI interface or USB interface to the main processor. If uses SPI interface SPDT_SEL should be tied to GND otherwise just let this pin open.

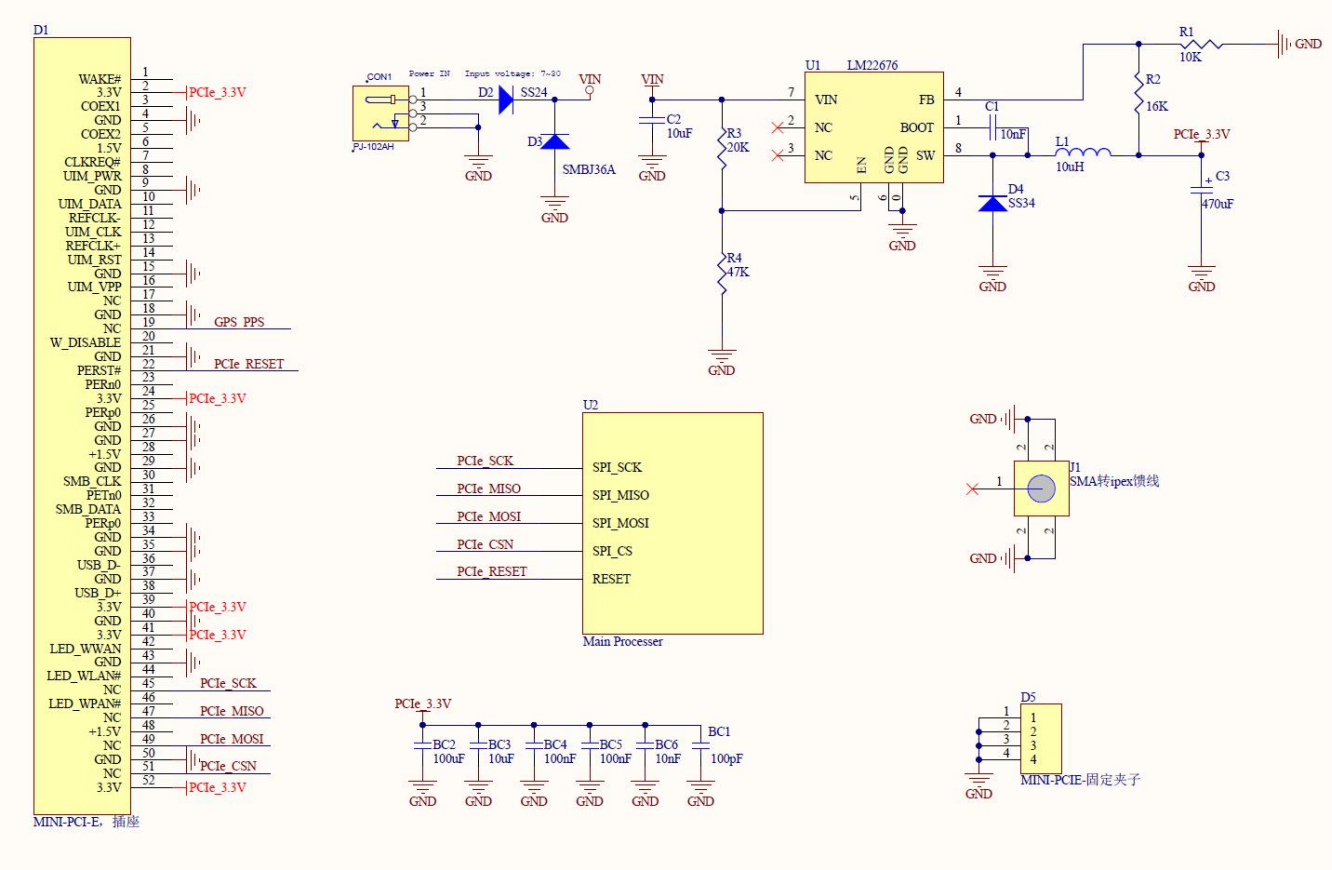


Figure 4: E106-868G27P reference minimum schematic.

8. Revision history

Version	Date	Description	Issued by
1.00	2019/5/31	Initial version	Liyanling
1.10	2019/9/6	version update	Liyanling

9. About us

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