

NSL76-S1 Hardware Design guide

V01

Document information

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Abstract	NSL76-S1 hardware design guide

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This document contains a detailed description of the NSL76-S1 module design guide and specification.

1. General description

The NSL76-S1 incorporates SX1276 and Renesas MCU R7FS124773A01CNB, and is well suited for node in the LoRa network of IOT.

Benefit from the powerful functions and performance of SX1276, the NSL76-S1 could operate in both (G)FSK and LoRa mode.

1.1 Simplified Block Diagram

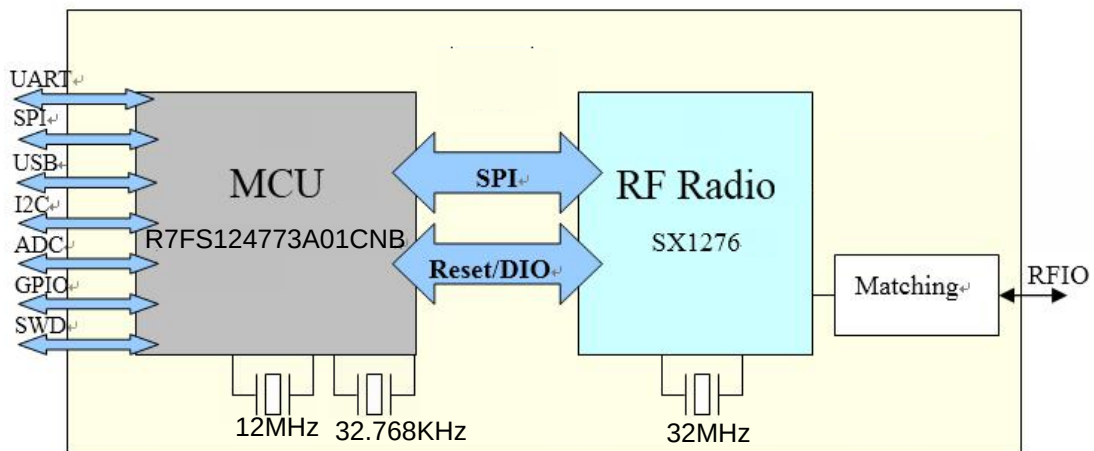


Figure 1 Block Diagram of NSL76-S1

1.2 Pin description

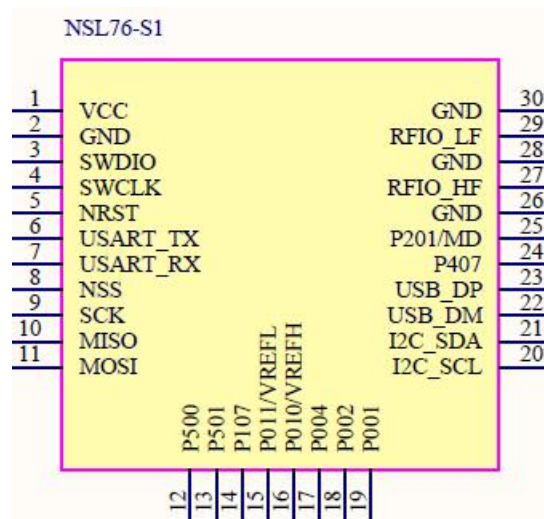


Figure 2 Pin definition

Table 1 Pin description

N0.	Name	Type	Description
1	VCC	S	Power supply for the Module
2	GND	S	Ground
3	SWDIO	I/O	Serial wire debug_SWDIO ; or GPIO P108 from MCU
4	SWCLK	I/O	Serial wire debug_SWCLK ; or GPIO P300 from MCU
5	NRST	-	Bidirectional reset pin for MCU, internal 10K resistor pull-up to VCC.
6	USART_TX	I/O	USART_TX/; or GPIO P112 from MCU;
7	USART_RX	I/O	USART_RX; or GPIO P104 from MCU;
8	NSS	I/O	SPI0A_NSS, or GPIO P103 from MCU;
9	SCK	I/O	SPI0A_SCK, or GPIO P102 from MCU;
10	MISO	I/O	SPI0A_MISO, or GPIO P100 from MCU;
11	MOSI	I/O	SPI0A_MOSI, or GPIO P101 from MCU;
12	P500	I/O	GPIO P500 from MCU;
13	P501	I/O	GPIO P501 from MCU;
14	P107	I/O	GPIO P107 from MCU;
15	P011	I/O	GPIO P011 from MCU; or reference ground pin for the A/D converter
16	P010	I/O	GPIO P010 from MCU; or reference voltage supply pin for the A/D converter
17	P004	I/O	GPIO P004 from MCU
18	P002	I/O	GPIO P002 from MCU

19	P001	I/O	GPIO P001 from MCU
20	I2C_SCL	I/O	Clock of I2C bus, or GPIO P400 from MCU
21	I2C_SDA	I/O	DATA of I2C bus, or GPIO P401 from MCU
22	USB_DM	I/O	D– I/O pin of the USB on-chip transceiver
23	USB_DP	I/O	D+ I/O pin of the USB on-chip transceiver.
24	P407	I/O	GPIO P407 from MCU;
25	P201/MODE	I/O	Operation mode (single-chip mode or SCI boot mode) selection, internal 10K resistor pull-up to VCC; or GPIO P201 from MCU;
26	GND	-	RF Ground
27	RFIO_HF	-	RF input/output port, 50ohm, high frequency band
28	GND	-	RF Ground
29	RFIO_LF	-	RF input/output port, 50ohm, Low frequency band
30	GND	-	RF Ground

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Stresses above the values listed below may cause permanent device failure. Exposure to absolute maximum ratings for extended periods may affect device reliability.

Table 2 Absolute Maximum Ratings

Item	Description	min	max	unit
VCCmr	Supply voltage	-0.3	+3.9	V
Tmr	Temperature	-55	+115	°C
Pmr	RF input level	-	+10	dBm

2.2 Operating Range

Table 3 Operating Range

Item	Description	min	max	unit
VCCop	Supply voltage	+1.8	+3.6	V
Top	Temperature	-40	+85	°C
Pop	RF input level	-	+10	dBm

2.3 Module Specifications

Unless otherwise specified, all the specification below is tested under below conditions:

VCC=3.3V, Frequency of Low band=470MHz, Frequency of high band=920MHz, room temperature.

Table 4 Module Specifications

ITEMS	Parameter	Typical Specifications	Unit
Mechanical Specificaion	Size	23(W) X 25(L) X 1.8(H)	mm
	Package	30 pins, SMT	
Electrical Specification	power supply	3.3V type	V
	StandBy current	4.5mA	mA
	TX current	120mA @20dBm, High band	mA
		90mA @17dBm, High band	mA
		45mA @14dBm, Low band	mA
	RX current	13.5mA @BW125kHz, Low band	mA
		13.8mA @BW125kHz, High band	mA
	Programmable Data rate	300bps~50Kbps (Multi SF loRa to FSK)	
RF specification	RF interface	RFIO single end, 50 ohm	
	Programmable Operatigng frequency	137~175 MHz (Band 169M)	MHz
		410~525 MHz (Band 434/470M)	
		779~787 MHz (Band 780M)	
		862~1020 MHz (Band 868/915M)	
	Output power @20dBm	18.5dBm for High band	dBm
	Output power @14dBm	13.5dBm for Low band	dBm
	Frequency deviation	<4 KHz for Low band	KHz
		< 8KHz for High band	
	Sensitivity	-138dBm @SF12, BW125kHz	dBm
		-133dBm @SF10, BW125kHz,	
		-125Bm @SF7, BW125kHz,	
	Harmonics (LF)	<-50dBm below 1GHz	dBm
		<-50dBm above 1GHz	
	Harmonics (HF)	<-40dBm at 2 nd harmonics	dBm
		<-50dBm at higher order harmonics	
Interface	RF interface	RFIO	
	USART	USART_TX, USART_RX	
	SPI	NSS, SCK, MOSI,MISO	
	USB	USB_DM, USB_DP	
	I2C	I2C_SCL, I2C_SDA	

	ADC	P407, P100~P103, P0XX, P5XX of MCU can be used as ADC input.
	GPIOs	The Pins described above not used can be used as GPIO
	SWD	SWDIO, SWDCK
	NRST	Bidirectional reset pin for MCU with inside 10K pull-up resistor.

3. Hardware design introduction

3.1 Package Information

The NSL76-S1 is available in a 30-lead SMD package as shown in Figure 9 below:



Figure 3 Package outline

Figure 4 show the recommended land pattern for layout.

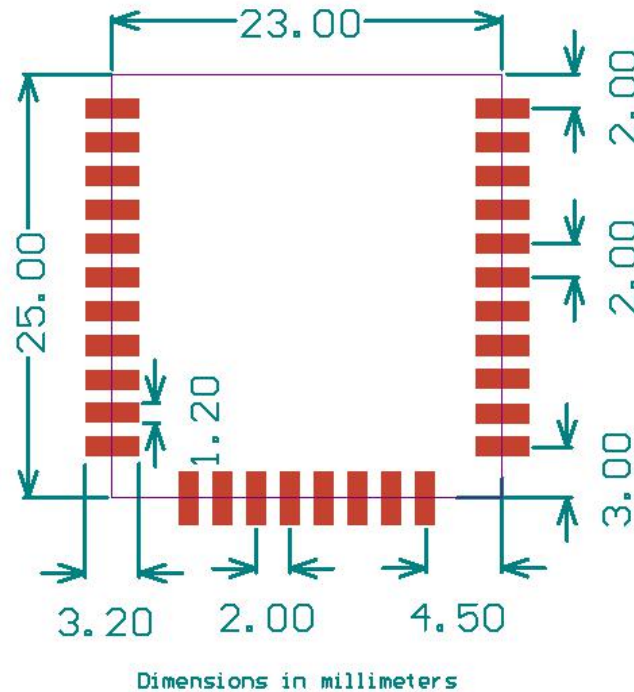


Figure 4 Recommended land pattern (Top view)

3.2 Interface of Module

Except that several essential GPIOs and one group of SPI would be used for internal transceiver control, all the spare GPIOs and interface of the MCU are pinned out of the module, which includes USART, SPI, I2C, USB and/or GPIOs. This is very useful and important for customer to extend their design with these abundant GPIOs and interfaces. For more details of interface, please refer to Table 1 Pin description and datasheet of R7FS124773A01CNB.

3.3 Reference design

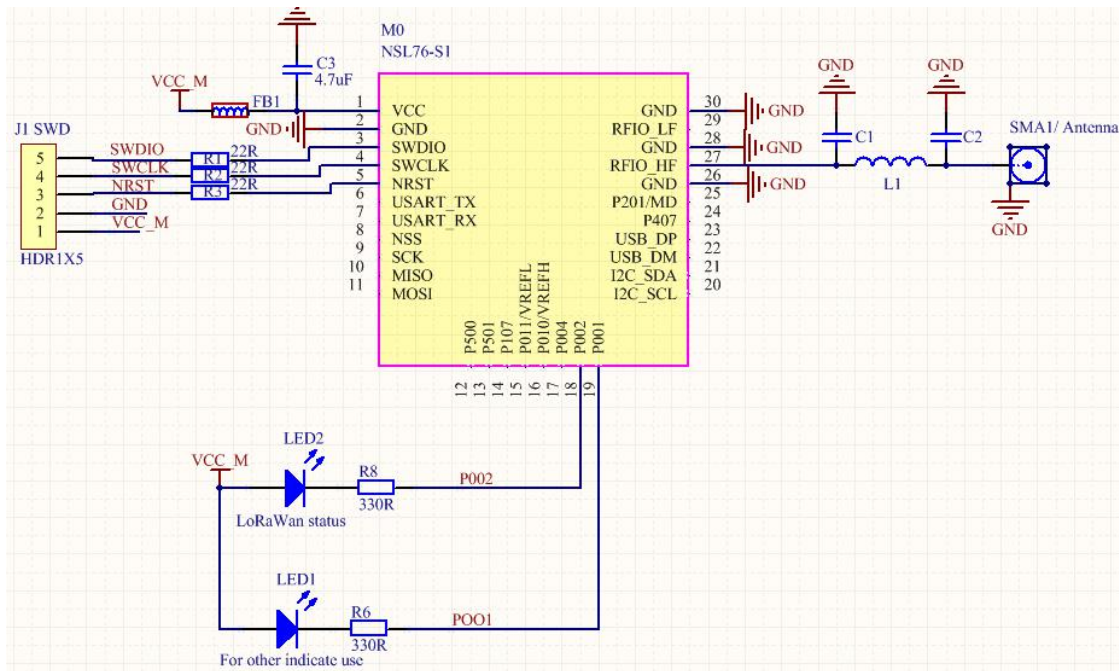


Figure 5 NSL76-S1 Reference design for 920MHz LoRaWan application

With very small BOM list, we can easily start a design for LoRaWan application with NSL76-S1 module, only need essential Power supply, programming interface, and external antenna. User even don't need to care about the RF circuit design inside the module.

The only thing need pay attention is an antenna matching network (pi-network L1,C1,C2) is highly suggested for the antenna, in case that a non-standard 50 ohm antenna is applied.

The Pin 26, Pin 28, Pin 30 should be well grounded.

Simply add you own peripheral according to the different application case if needed, the spare USB, UART, SPI, I2C and other GPIOs can be used.

FCC Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

--Reorient or relocate the receiving antenna.

--Increase the separation between the equipment and receiver.

--Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

--Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device must operate with a minimum distance of 20 cm between the radiator and user body.

Note 1: Compliance of this device in all final host configurations is the responsibility of the Grantee. OEM integrators are responsible to satisfy RF exposure requirements. SAR evaluation is valid for fixed applications.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: The device must not transmit simultaneously with any other antenna or transmitter.

Note 4: To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, Nextan Pte Ltd shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

Note 5: FCC ID label on the final system must be labeled with "Contains FCC ID: 2AMUN-NSL76-S1"

The transmitter module must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the host product. Nextan Pte Ltd is responsible for the compliance of the module in all final hosts.

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