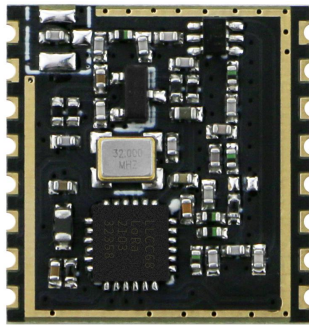# DreamLNK

High Sensitivity (-129dBm) Wireless LoRa Module

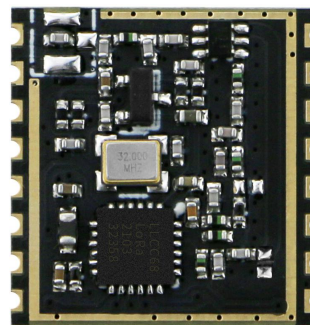433Mhz/868Mhz/915Mhz

SPECIFICATION

Model No.: DL-LLCC68-S

Version: V1.0

DL-LLCC68-S
433MHz

DL-LLCC68-S
868/915MHz

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Before using this module, please pay attention to the following important matters:

This module is an electrostatic sensitive product. Please operate it on an anti-static workbench during installation and testing.

This DL-LLCC68-S module uses an external antenna by default, which is intended to be embedded in your product or application, and does not provide a casing itself. The antenna can be a wire antenna or a standard UHF antenna. You can choose a specific antenna according to the actual situation.

Metal objects and wires should be kept away from the antenna as much as possible. If the product uses a metal shell, be sure to install the antenna outside the metal shell. Otherwise, the RF signal will be seriously attenuated, which will affect the effective distance.

Disclaimer:

This specification is just for your information, all the charts and pictures used in this specification are for reference only. The actual test shall prevail for details. We do not assume any responsibility for personal injury or property loss caused by user's improper operation.

This specification is subject to change due to the continuous improvement and upgrading of the product version, and the latest version specification shall prevail. DREAMLNK reserves the right of final interpretation and modification of all contents in this specification.

Date	Version	Formulation / Revision of Contents	Approved by
2021-1-1	V1.0	DL-LLCC68-S Standard Version RF Module	Fagan Xu

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1. Module Introduction

1.1 Brief Introduction

DL-LLCC68-S is a wireless module designed based on **Semtech**'s radio frequency chip **LLCC68**. It mainly adopts a new generation of LoRa™ modulation technology for ultra-long-distance spread spectrum communication. This LoRa module is compact in size, and has the characteristics of ultra-low receiving power consumption, strong anti-interference ability, and longer transmission distance than traditional modulation methods. It can be widely used in various wireless communication fields of the Internet of Things.

DL-LLCC68-S RF module has high receiving sensitivity of -129dBm@LoRa, ultra-low receiving current and dormant current, the transmit power can be configured through software, and the maximum power can reach +22dBm. Compared with traditional modulation technology, LoRa™ modulation technology has obvious advantages in anti-blocking and selection, which solves the problem of distance, anti-interference and power consumption that traditional design schemes cannot take into account at the same time.

1.2 Features

- Support (G)FSK, LoRa™ and other modulation methods;
- The chip supports a frequency range of 150~960MHz;
- Recommended frequency: 433/470MHz—433M module; 868/915MHz—868/915M module;
- The working voltage is 3.3V, the maximum output transmitting power is +22dBm, and the maximum working current is 130mA;
- It has low power consumption characteristics in the receiving state, the minimum receiving current is 4.5mA, and the standby current is 0.6mA;
- High receiving sensitivity: -129dBm@LoRa;
- Support fast Channel Activity Detection (CAD);
- Support spreading factor: SF5/SF6/SF7/SF8/SF9/SF10/SF11;
- Supported bandwidth: 125kHz, 250kHz, 500kHz

    Note: BW = 125kHz supports SF5-SF9

                  BW = 250kHz supports SF5-SF10

                  BW = 500kHz supports SF5-SF11 (please refer table 4 to know more)

1.3 Typical Application

- Wireless automatic meter reading (water meter, electric meter, gas meter)
- Ultra-long distance data communication
- Smart home system
- Intelligent security monitoring
- Smart building
- Industrial controllers, sensors
- Agricultural automation solutions
- Intelligent parking system
- Automotive industry applications
- Supply chain logistics

2. Technical Parameter

Parameter	Min.	Typical	Max.	Unit	Remarks
Operating conditions					
Working voltage & IO voltage range	1.8	3.3	3.7	V	To ensure maximum chip power, stable voltage should ≥3.1V
Working temperature range	-40	25	85	℃	
Current consumption					
Receiving current		4.5		mA	Adopts CAD working mode, Can effectively reduce the overall working current
Transmission current @433MHz		110 70 45		mA	@433MHz @ DCDC +22dBm +20dBm +17dbm
Transmission current @868MHz @915MHz		122 105 98		mA	@868MHz @915MHz @DCDC +22dBm +20dBm +17dbm
Standby current		0.6		uA	Save by register
RF parameters					
Recommended Frequency (Ensure best performance)	300	433	510	MHz	@433MHz
	800	868	915	MHz	@868MHz
	868	915	960	MHz	@915MHz

| Transmit power range	-9	22	22	dBm	Table 13-40 in Data Sheet: SetTxParams SPI Transaction
LoRa Receiving sensitivity		-129		dBm	@BW =250KH, SF=10, CR =4/5
FSK Receiving sensitivity		-125		dBm	@BR_F = 0.6 kb/s, FDA = 0.8 kHz, BW_F = 4 kHz
FSK Rate range	0.6		300	Kb/s	
LoRa Rate range	1.76		62.5	Kb/s	Min. for SF9, BW_L = 125 kHz Max. for SF5, BW_L = 500 kHz

Table 1: Technical Parameter

3. Pin Definitions
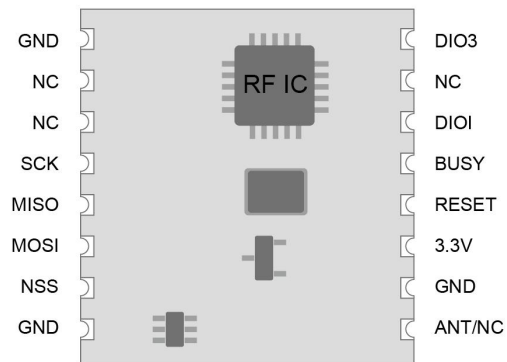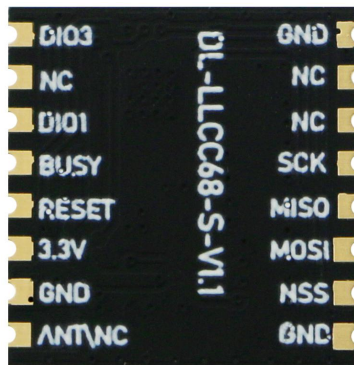
No	Definitions		Description
1	GND	PWR	Reliable grounding
2	NC		No connection
3	NC		No connection
4	SCK	I	SPI Serial Clock Input
5	MISO	O	SPI Master Input Slave Output
6	MOSI	I	SPI Master Output Slave Input
7	NSS	I	SPI Chip Select Input
8	GND	PWR	Reliable grounding
9	DIO3	IO	Value I/0, Configurable via software
10	NC		No connection
11	DIOI	IO	Value I/0, Configurable via software

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12	BUSY	O	The internal status indicator pin of the chip, which needs to be connected to the GPIO of the master MCU
13	RESET	I	Reset the initialization chip, to increase stability
14	3.3V	PWR	To maximize the chip function, 3.3V stable voltage is recommended
15	GND	PWR	Reliable grounding
16	ANT/NC		Antenna interface, 50Ω impedance, ground and via hole

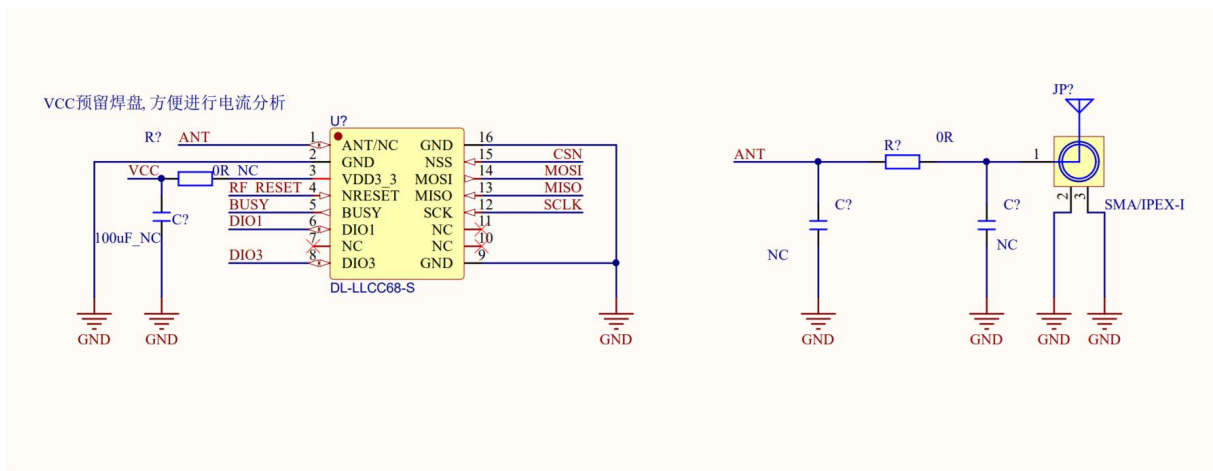**Table 2: Pin Definitions**

4. Module Size & SMT
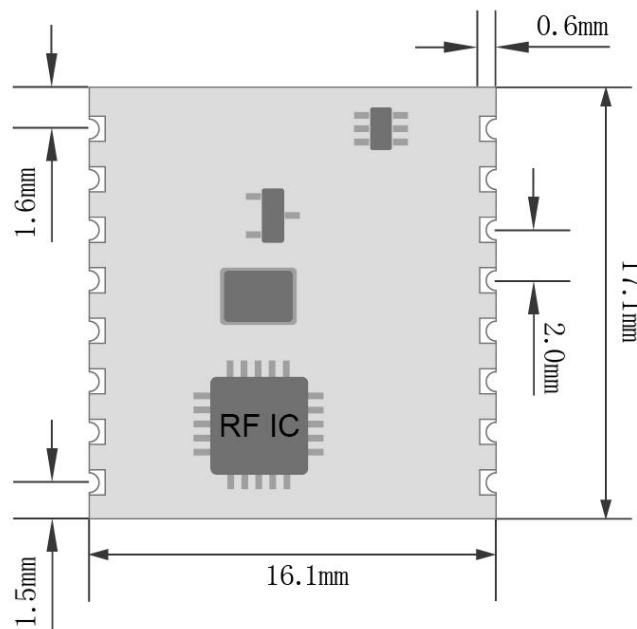
Please apply for module packaging from our technical support: SMT patch package, DIP in-line package file (refer to schematic diagram)

Package files format description:

* .ASC format can be opened with Protel99se;

* .DXF format can be opened with CAD;

* .PCB format can be opened with PADS software;

Module packaging: SMT placement (steel mesh thickness ≥1.2mm)

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5. Application Connection Diagram

Note: This schematic diagram is for your reference only. If you have any question, please contact us for more help.

6. Circuit Design

6.1 Power Supply Design
● Please pay attention to the power supply voltage of the device, exceeding the recommended voltage range may cause function abnormally and permanently damage;
● Try to use a DC stabilized power supply, and the power ripple coefficient should be as small as possible; the power load when transmitting the maximum power needs to be also considered;
● The module needs to be grounded reliably, and a good grounding can achieve better performance output and reduce the impact of RF on other sensitive devices.

6.2 RF Routing Design
● The module should be far away from RF interference sources, such as high-frequency circuit transformer, and it is forbidden to route the wires directly under the module, otherwise it may affect the receiving sensitivity;
● When using the on-board antenna, the antenna needs to be clear on both sides, and the ground should not be too close to the antenna at the same time, otherwise it will absorb the radiated energy;
● Route 50Ω impedance line, lay the ground and drill more ground holes;
● The PCBA space allows to reserve a π-type matching network, first connect it through a 0R resistor, otherwise the antenna is open.

6.3 Antenna Design

● There are many types of antennas, choose the appropriate antenna according to your needs;

● Choose a suitable placement position, according to the Antenna polarity, and it is recommended to be vertically upward;

● There should be no metal objects in the antenna radiation path, otherwise the transmission distance will be affected (such as a closed metal casing).

6.4 LLCC68 IO design

● When doing the hardware design, for the data packet mode (SPI transmission), the general SPI interface, RST, BUSY, DIO1 interfaces should be lead out to the GPIO of the MCU;

● DIO1 and DIO3 can be used to map the interrupt events of the chip via software, and we can query the interrupt source through functions, but not every mode is available. For details, please refer to the chip manual: 13.3 DIO and IRQ Control Functions

Chip Manual: Table 13-29: IRQ Registers (Interrupt Source)

● Regarding the electronic switch of the transceiver mode

The chip DIO2 is designed by hardware as the switch control of antenna switching (so there is no related TXEN RXEN pin, which is convenient for software and hardware design). In order to facilitate and simplify the software control, the DIO2 of the chip is used to automatically control the switching of the switch tube through the circuit inside the module, so when writing the software, please note that you need to use SetDIO2AsRfSwitchCtrl to enable automatic control.

7. Software Debugging Process

7.1 Transplant HAL interface (SPI interface, and pay special attention to verify that the reset function is normal);

7.2 Familiar with the chip register table and related API (Refer data sheet: 12.1 Register Table);

7.3 Enable DIO2 for internal automatic electronic switch control SetDIO2AsRfSwitchCtrl;

7.4 Make two verification PCB boards, according to the Demo Program, to complete the communication verification of transmitting and receiving;

7.5 It is recommended to use LoRa modulation. After communication normally set up, you need to optimize the modulation parameters, and change the spreading factor, bandwidth and other parameters according to your needs to control the code transmission time (related to the symbol time) and communication distance;

7.6 It can be set by the SetModulationParams function, and the commonly used debugging parameters are as follows:

Modulation Bandwidth (BW_L)	The higher the BW, the faster the modulation rate, but the larger the signal bandwidth will reduce the sensitivity of the receiver
Spreading Factor (SF)	The higher SF can increase the sensitivity of demodulation and increase the distance, the disadvantage is that it will greatly increase the transmission time
The Coding Rate (CR)	In the case of severe interference, it can increase the anti-interference, but the disadvantage is that the coding efficiency will be reduced and the baud rate will slow down. Under normal circumstances, the default CR = 4/5 can be used.
Low-Rate Optimization (LDRO)	When a single symbol time is equal to or greater than 16.38ms, low-rate optimization needs to be turned on

Table 3: Commonly Used Debugging Parameters

7.7 The maximum transmit power can be +22dbm, to ensure the largest link budget;

7.8 If low power consumption is required, CAD working mode (sleep-detection signal-sleep) can be used in the software to achieve low power consumption

Please refer Data sheet: 6.1.5 LoRa® Channel Activity Detection (CAD);

7.9 In LoRa mode, the corresponding table between the symbol time sent by the spreading factor and the bit rate of the actual payload is as follows:

BW / SF	125 kHz		250 kHz		500 kHz	
	Symbol time (ms)	Rate (kbps)	Symbol time (ms)	Rate (kbps)	Symbol time (ms)	Rate (kbps)
5	0.26	15.63	0.13	31.25	0.06	62.50
6	0.51	9.38	0.26	18.75	0.13	37.5
7	1.02	5.47	0.51	10.94	0.26	21.88
8	2.05	3.13	1.02	6.25	0.51	12.5
9	4.10	1.76	2.05	3.52	1.02	7.03
10	N/M		4.10	1.95	2.05	3.91
11	N/M		N/M		4.10	2.15

Table 4: Symbol time and bit rate

Note: The payload data refers to the data you actually transmit, but the actual transmission time includes not only the payload, but also the preamble, the header, its encoding rate, and the check digit of the payload.

Collective reference: 6.1.3 LoRa® Frame

8. Notice for module application

(1) This module is an electrostatic sensitive product. Please operate on an anti-static workbench during installation and testing;

(2) When installing the module, ensure that nearby objects keep a sufficient safe distance from the module to prevent short-circuit damage;

(3) Never allow any liquid substance to come into contact with this module, and this module should be used in a dry environment;

(4) Please Use an independent voltage stabilizing circuit to supply power to this module, and avoid sharing with other circuits. The tolerance of the power supply should not be less than 5%.

(5) The indicators of this module are accord to commonly used international standard. If special certifications needed, we can adjust certain indicators according to your needs.

9. Contact us

Shenzhen DreamLnk Technology Co., Ltd
★ Data collection, Smart home, Internet of Things applications, Wireless remote control technology, Remote active RFID, Antennas ★

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