Lierda WB11 Series FSK Transmissive Modules Hardware Design Manual

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Document revision history

Version	Date of change	Proposer	Auditor	Changes
Rev1.0	23-07-14	NXL	LXY	initial version
Rev2.0	23-08-22	NXL	LXY	Modify sensitivity; modify receive current

Safety Instructions

It is the user's responsibility to follow the relevant regulations of other countries and the specific environmental regulations for the use of wireless communication modules and equipment. By observing the following safety principles, you can ensure your personal safety and help to protect the product and the working environment from potential damage. We are not liable for damages related to the customer's failure to comply with these regulations.

	Safety on the road comes first! When you are driving, do not use hand-held mobile terminal devices unless they have a hands-free function. Please stop the car before making a call!
	Please turn off your mobile devices before boarding the airplane. The wireless function of mobile devices is prohibited on board to prevent interference with the aircraft's communication system. Ignoring this reminder may lead to flight safety or even violate the law.
	When in a hospital or health care setting, note if there are restrictions on the use of mobile devices.RF interference can cause medical equipment to malfunction, so it may be necessary to turn off the mobile device.
	The mobile device does not guarantee a valid connection in all circumstances, for example if the mobile device is out of credit or the SIM is invalid. When you are in an emergency situation, please remember to use the emergency call and make sure that your device is switched on and in an area with sufficient signal strength.
	Your mobile device receives and transmits RF signals when it is switched on, which can cause RF interference when in close proximity to TVs, radios computers or other electronic devices.
	Keep the mobile terminal unit away from flammable gases. Turn off the mobile device when you are near gas stations, oil depots, chemical plants, or explosive workplaces. It is a safety hazard to operate electronic devices in any place where there is a potential explosion hazard.

Applicable Module Selection

No.	Module Model	Eigenfunction	Band	Sizes(mm)	Module Introduction
1	L-LRNWB11-86PI4		863-928MHz	22×18×2.6	

LIST

Table Index

Graphical Index

1 Introductory

This document defines the standard application development specifications for the lierda WB11 series FSK Transmissive Module, describing its hardware interface, electrical characteristics, application methods and mechanical specifications.

This document can help users quickly understand the hardware interface specifications, electrical and mechanical characteristics of the module and other related information, and combined with other corresponding documents, can quickly master the application development method of the WB11 series module.

2 Product Overview

Figure 2.1 WB11 Module Schematic

WB11 series FSK transmitting modules have the characteristics of reliability and high speed, which can be widely used in wireless intelligent public network and other fields.

2.1 Key Features

Parameters	Clarification
Operating Frequency	863~928MHz
Modulation Method	◆Supports GFSK modulation ◆Supports FSK modulation
Receiver Sensitivity	◆-116dBm@BER0.1%/4.8kbps ◆-113dBm@BER0.1%/9.6kbps ◆-112dBm@BER0.1%/20kbps
Maximum Transmit Power	Typ.18.5dBm
Communications Interface	UART
Communications Rate	20~80 kbps (Typ. 20kbps,40kbps,80kbps)
Supply Voltage	DC2.4V~3.6V(Typ.3.3V)
Transmit Current	Avg.130mA(@18.5dBm)

Receiving Current	Avg.22mA
Sizes	22.0mm*18.0mm*2.6mm
Applicable Scenarios	Smart microinverter, smart meter, smart home, sensor network, smart street light, etc.

2.2 Function Block Diagram

Figure 2.2 shows the hardware functional block diagram of the module.

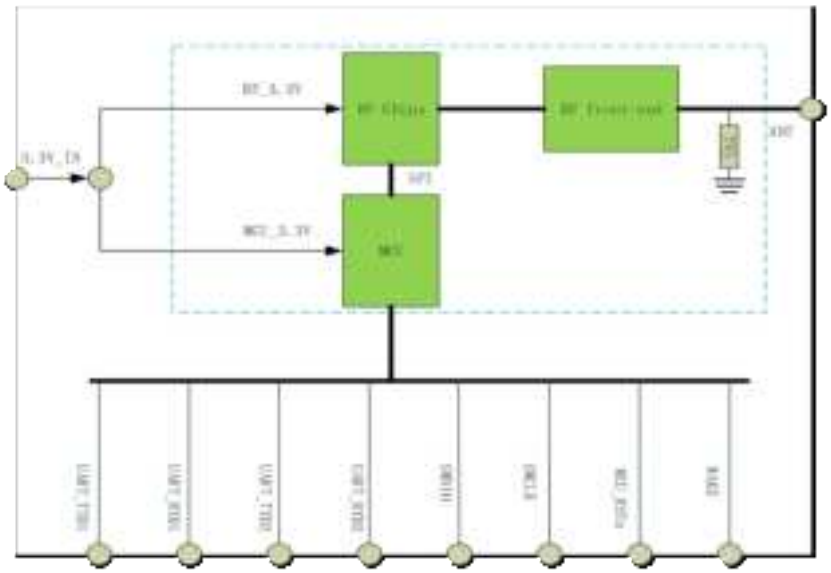

Figure 2.2 Block diagram of WB11 module hardware functions

2.3 Pinouts

Figure 2.3 shows the pin layout of the module, refer to "2.4 Module Pin Description" for detailed pin description.

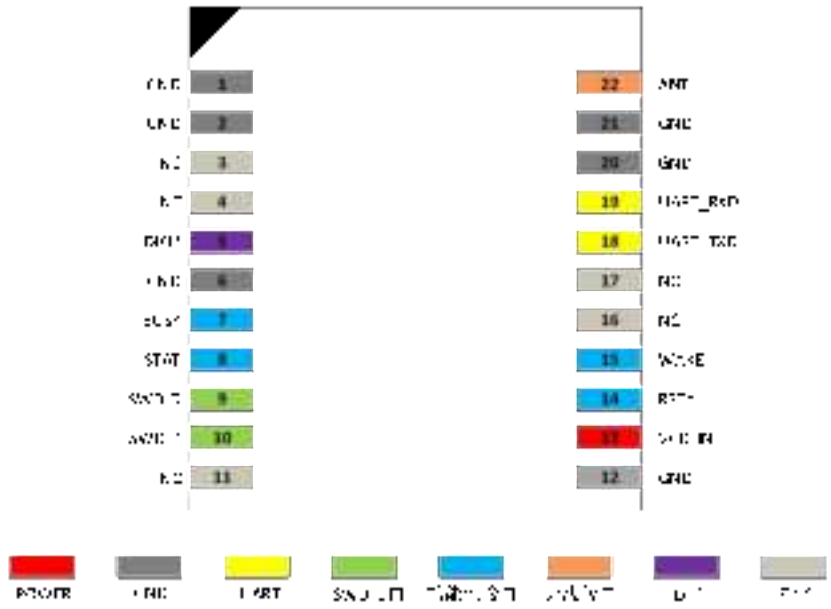

Figure 2.3 Pinouts

2.4 Module Pin Description

2.4.1 UART

Table 2-1 UART Pin Description Table

Pin Name	Pin No.	Clarification	Pin Type	DC Characteristics	Note
UART_RXD	19	Data Serial Port	I	R_{pu} = 20kΩ(typ.)	RX internal pull-up, data serial port, baud rate 115200, parity bit NONE data bit 8 stop bit 1
UART_TXD	18	Data Serial Port	O	-	

2.4.2 Power

Table 2-2 Power Supply Pin Description Table

Pin Name	Pin No.	Clarification	Pin Type	DC Characteristics	Note
VCC	13	Module power input	PI	V_{min}= 2.4V V_{type}= 3.3V V_{max}= 3.6V	Performance is impacted with non-3.3V supply
GND	1,2,6,20,21	Ground	G	-	-

2.4.3 SWD Interface

Table 2-3 SWD Pin Description Table

Pin Name	Pin No.	Clarification	Pin Type	DC Characteristics	Note
SWCLK	10	SWD Clock Signals	I	-	-
SWDIO	9	SWD Data Signals	I/O	-	-

2.4.4 Functional interfaces

Table 2-4 Module Function Interface Description Table

Pin Name	Pin No.	Clarification	Pin Type	DC Characteristics	Note
DIO2	5	BER Test Pin	I/O	-	For BER testing Suspension recommended for user use
BUSY	7	UART status indication	O	-	Normally low High to indicate that the serial port is busy
STAT	8	UART Data Indication	O	-	Flat high, falling edge pulse to indicate that the serial port has data output, can be used as a wake-up user
RSTn	14	Reset pin	I	R_{pu}=40kΩ(typ.)	Internal pull-up, active low
WAKE	15	WAKE	I	-	Low power wake-up Internal pull-up, falling edge active
NC	3,4,11, 16,17	No electrical connections inside the module	-	-	-

2.4.5 Antenna Interface

Table 2-5 Antenna Pin Description Table

Pin Name	Pin No.	Clarification	Pin Type	DC Characteristics	Note
ANT	22	Antenna Pins	I/O	-	The input impedance of the customer's antenna should meet 50Ω.

Note

Pin type: "O"=Output, "I"= Input, "P"=Power, "G"=Ground

3 Working Characteristics

3.1 Operating mode

Table 3-1 Operating mode

Operating mode	Module Status
Normal Operating Mode	Networking status, user can initiate communication via serial commands
Low Power Mode	Low-power state, the user needs to wake up the module before initiating communication through serial commands.

3.2 Temperature Compensation

The module also has a temperature compensation function that will calibrate the frequency at different temperatures, which allows the module to communicate properly in the range of -40° C to 105° C.

3.3 Power

VDD is the power supply input of the whole module, and the performance of the power supply directly affects the performance of the module. When designing, we must choose a power supply that can provide at least 200mA of current to ensure that the input voltage to VDD will not be lower than the minimum operating voltage, so as to prevent the module from working abnormally due to voltage drop.

If the voltage difference between the input voltage and the power supply voltage of the module is not very large, it is recommended to choose LDO as the power supply, if there is a relatively large voltage difference between the input and output, then use DC-DC for power conversion, and at the same time need to pay attention to the EMI problems caused by DC-DC.

To ensure better power supply performance, the reference circuit for the VBAT input is as follows:

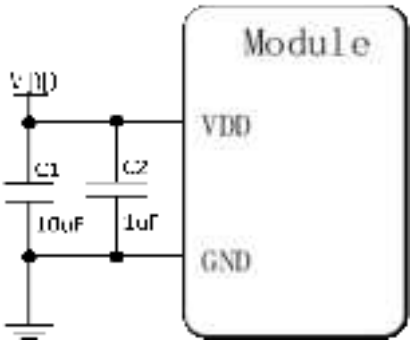

Figure 3.1 VBAT Input Reference Circuit

PCB design on the longer the VDD alignment, the wider the line width should be, the alignment needs to meet the current capacity of more than 200mA, it is recommended that the line width of more than 0.2mm (1 ounce copper thickness), the power supply part of the GND plane should be as complete as possible and more holes in the ground, and at the same time as much as possible close to the capacitors of the module's VDD pins.

3.4 Reset

The module will be reset when the reset pin (RSTn) is held low for more than 100us (T1), so the user can use an external key or IO to realize a low level continuous pulse to reset the module.

After the reset pin is pulled high, BUSY will be pulled high within 100ms (T2), and users need to wait for BUSY to go low before operating the module normally.

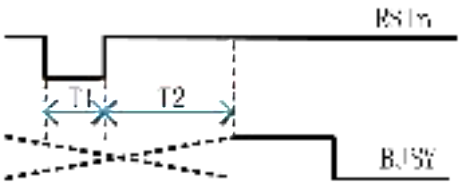

Figure 3.2 Reset Timing Diagram

4 Application Interfaces

4.1 UART

The module serial port (3.3V level, baud rate 115200bps) is used for command transmission and data transfer.

The following are instructions for using the serial port:

UART_TXD：The module sends data to the user device side;

UART_RXD：The module receives data from the user's device。

The connection between the external serial port and the module serial port is shown in the following figure：

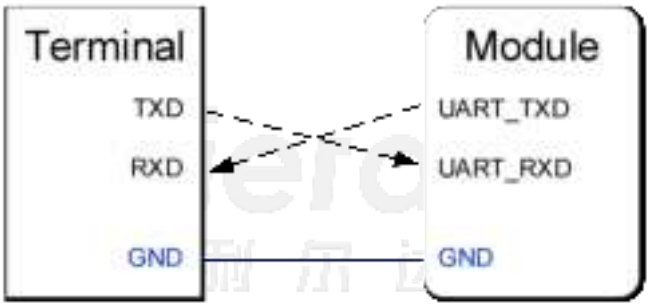

Figure 4.1 Module UART Connection Diagram

If the customer's serial port is not 3.3V level, you need to add a serial port level conversion circuit.

5 Parameters

5.1 Absolute maximum limit value

The fact that only the maximum load that can be withstood is given here does not imply that the device operates functionally without error under these conditions. Prolonged operation of the device under maximum conditions will affect the reliability of the device.

Table 5-1 Absolute maximum limit value

Main Parameters	Minimum Value	Maximum Value	Unit	Note
Supply Voltage(V_{CC})	-0.3	+3.6	V	
Input voltage on arbitrary IO and control pins	-0.3	V_{CC}+0.3	V	
Maximum RF Input Power	-	+0	dBm	ANT Pin
Contact static electricity level	-	±4	kV	ANT Pin
Maximum RF input voltage VSWR	-	3:1	-	ANT Pin

5.2 Operating Parameters

Table 5-2 Operating Ratings

Main Parameters	Minimum Value	Typical Value	Maximum Value	Unit	Note
Operating Voltage(V_{CC})	+2.4	+3.3	+3.6	V	
Operating Temperature	-40	-	+105	℃	
Storage Temperature	-40	-	+105	℃	

Table 5-3 Digital Logic Level Characterization

Main Parameters	Minimum Value	Typical Value	Maximum Value	Note
V_{IH}(V)	2.0	-	V_{CC}	MCU IO
V_{IL}(V)	-	-	0.8	MCU IO
V_{OH}(V)	2.4	-	-	MCU IO

V_{OL}(V)	-	-	0.45	MCU IO

5.3 RF Characterization

Table 5-4 RF Performance, Ppower Consumption Specification Parameters

Main Parameters	Minimum Value	Typical Value	Maximum Value	Unit	Note
Operating Frequency	863	-	928	MHz	-
Maximum Transmit Power	17.5	18.5	19.5	dBm	TX duty cycle＜1%
Transmit Current	125	130	140	mA	Maximum power emission, tested with a 50 ohm load
Receiver Sensitivity	-116.5	-116	-115.5	dBm	BER0.1%@4.8kbps
	-113.5	-113	-112.5	dBm	BER0.1%@9.6kbps
	-112.5	-112	-111.5	dBm	BER0.1%@20kbps
Receiver Current	-	22	25	mA	Continuous Receive State
Sleep Current	-	-	10	uA	-

Note

(1) The above test conditions are, temperature: 25℃, center frequency: 868MHz/915MHz, operating voltage: 3.3V;

(2) Users are allowed to configure and use the frequency band according to the local regulations of the terminal market, please be sure to comply with the local regulations, if the regulations do not allow the use of the frequency band, our company does not assume any responsibility; domestic terminal market applications, please refer to the "micropower short-range radio transmitting equipment catalog and technical requirements".

6 Mechanical Dimension

6.1 Mechanical Dimension Drawing

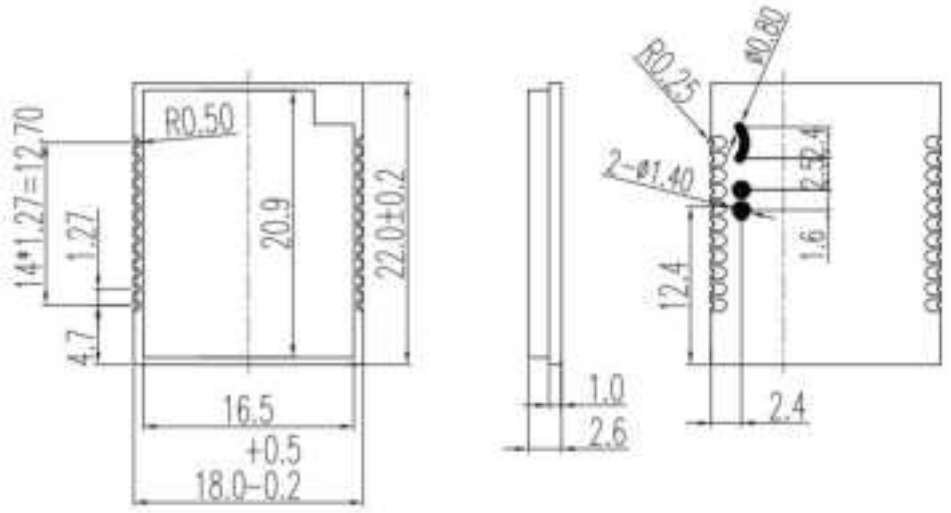

Figure 6.1 Mechanical Dimension Drawing

7 Production and Packaging Information

7.1 Production Welding

Stencil opening design

The thickness of the stencil on the base plate is selected in principle according to the type of packaging of the device on the board to be selected, need to focus on the following requirements:

Module pad locations can be locally thickened to 0.15~0.20mm to avoid void soldering.

Reflow soldering work instructions

(This work instruction is for lead-free work only and is for reference only.)

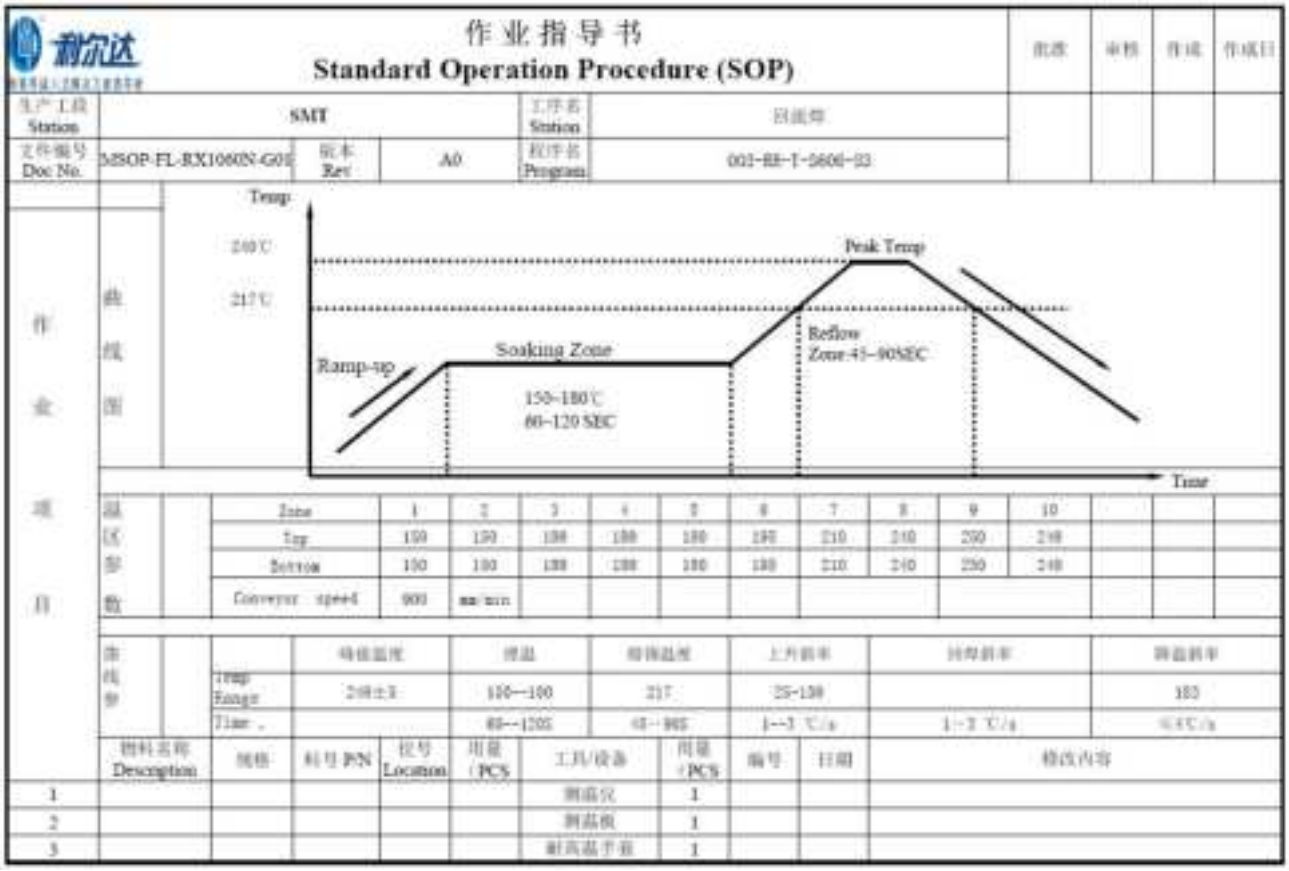

Figure 7.1 Reflow Soldering Work Instructions

7.2 Product Model Information Sheet

WB11 Series FSK Transmissive Module models are shown in the table below:

Table 7-1 Product Model Information Sheet

Order Model	Frequency	Packaging	Amount	Note
L-LRNWB11-86PI4	863~928MHz	Reel	500	-

Federal Communication Commission (FCC) Radiation Exposure Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

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: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

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 a 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2AOFDWB11-8P. Additionally, the following statement should be included on the label and in

the final product's user manual: "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 interferences, and

(2) this device must accept any interference received, including interference that may cause undesired operation."

The module is allowed to be installed in mobile and portable applications A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following

guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCCapplication filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations(e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable.(OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user.