

LoRaWAN Module

MS25LS02

Datasheet

V 1.0.0

Applicable Product Model
ME25LS02-LLCC68
ME25LS02-SX1262

Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Vinle	2025.04.22	First Edit

ME25LS02-LLCC68/SX1262+nRF54L15

High-performance,ultra-low-power,ultar-long-range,smallsize,IPEX+PCB,Support BLE5.4/LoRaWAN multi-protocol



The ME25LS02 is a highly-performance, ultra-long-range,ultra-low power, Small size, support BLE5.4/LoRaWAN and other multi-protocols, and has a large storage capacity of 256KB RAM and 1.5MB Flash. The ME25LS02 has better reception sensitivity, with BLE as low as -104dBm and LoRa as low as -125dBm, and , the maximum power of BLE is +8dBm and the maximum power of LoRa is 22dBm, which is available for longer transmission distances. the power supply voltage of the module is 3.3V, and there are abundant GPIOs. and has a completely open-source development platform, which supports customers' secondary development and customisation needs.

- Features

 - ARM Cortex M33& RISC-V Dual Core MCU
 - Low power, dual low power chip combination
 - BLE 5.4, support BLE Long-range
 - Abundant IO ports, USB, Uart, I2C, etc
 - With a completely open-source development platform, which supports customers' secondary development and customisation needs.
- Application

 - Agricultural automation
 - Asset tracking
 - inventory management
 - livestock tracking

■ Key parameter

Chip Model	LLCC68/SX1262+nRF54L15	Antenna	PCB +IPEX
Module size	25x15x3.2mm	GPIO	27
Flash	1.5MB	RAM	256KB
Receiving Sensitivity	BLE: -96dBm, 1Mbps -104dBm, 125Kbps LoRa:-125dBm	Transmission Power	BLE:-40--+8dBm LoRa:22dBm
Current(TX)	156mA	Current(RX)	15mA

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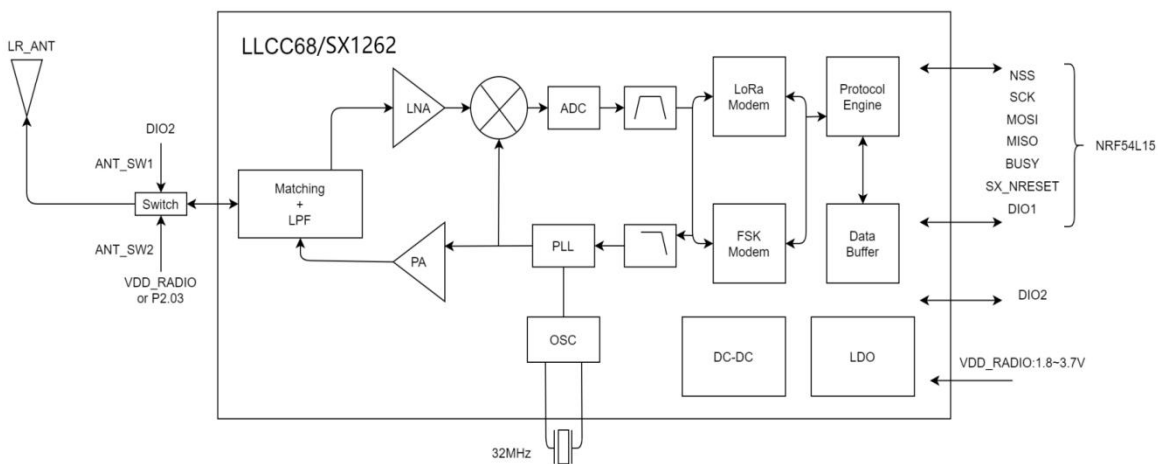
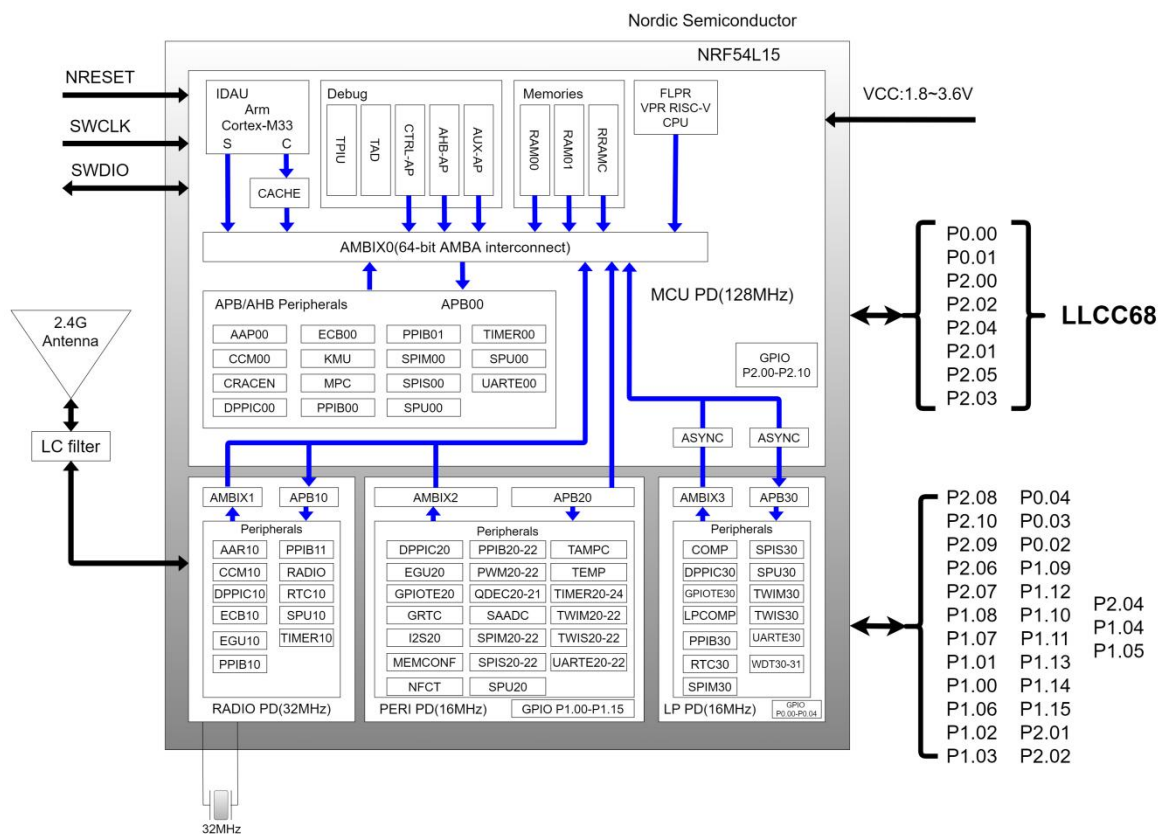
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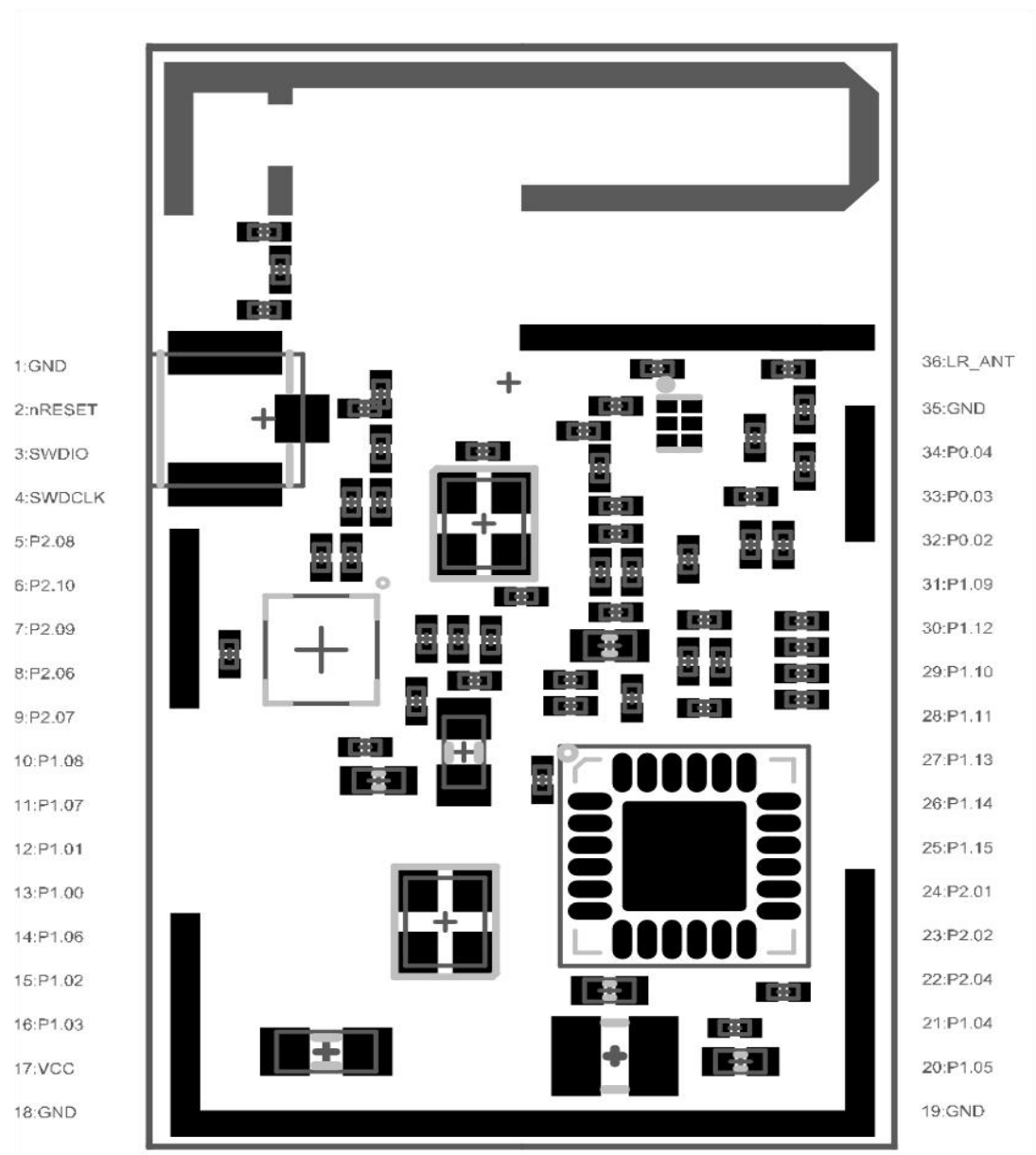
1 Block Diagram



2 Electrical Specification

Parameter	Values	Notes
Operating Voltage	1.7V-5.5V	Type voltage 3.3V
Working Temperature	-40℃~+85℃	Storage temperature is -40℃~+125℃
Opearting Frequency	LoRa: 150MHz - 960MHz BLE: 2.4GHz	LoRa: optional 868MHz/915MHz, Default set is 868MHz
Transmission Power	BLE: -20 ~ +8dBm LoRa: +22dBm	Configurable
Current(RX)	15mA	Max receiving current
Current(TX)	156mA	Max transmission current
Module Dimension	25*15*3.2mm	
Quantity of IO Port	27	GPIOs、I2C、I2S、PWM、UART etc.

3 Pin Description

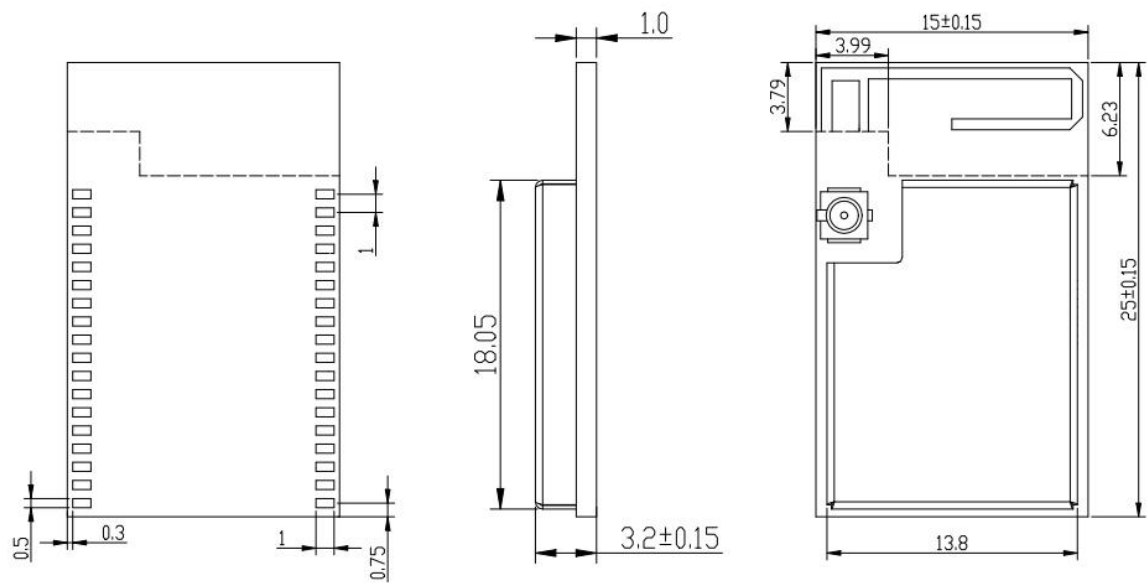


TopView

4 Pin Definition

Symbol	Type	Definition	Notes
VCC	Positive power supply	Power supply, 1.7V-3.6V, with this pin	Normal 3.3V
GNS	Negative power supply	Grounded	
LR_ANT	External antenna pin	LoRa antenna RF pin	
SWCLK/SWDIO	I/O, Debug pin	I/O pin multiplexing, debug pin. During debugging, only connect this pin with the power and ground pins:	
P0.02 - P0.04 P0.13 -P0.14 P1.00 - P1.15 P2.01 - P2.02 P2.04 P2.06 - P2.10	GPIO	General IO port	P2.01: LoRa_SCK P2.02: LoRa_MOSI P2.04: LoRa_MISO
nRESET	Reset	Reset	MCU reset pin

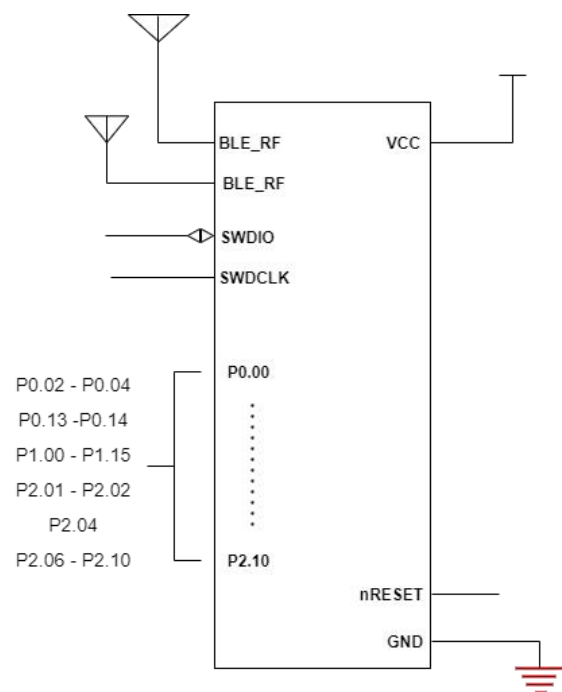
4.1 Mechanical Drawing



* (Default unit: mm Default tolerance: ±0.15)

5 Module Connection Description

5.1 Connection diagram



5.2 Power supply

The chip-sets operating voltage range is 1.8V-3.6V, to ensure normal use, the power supply voltage shall be 3.3V as far as possible.

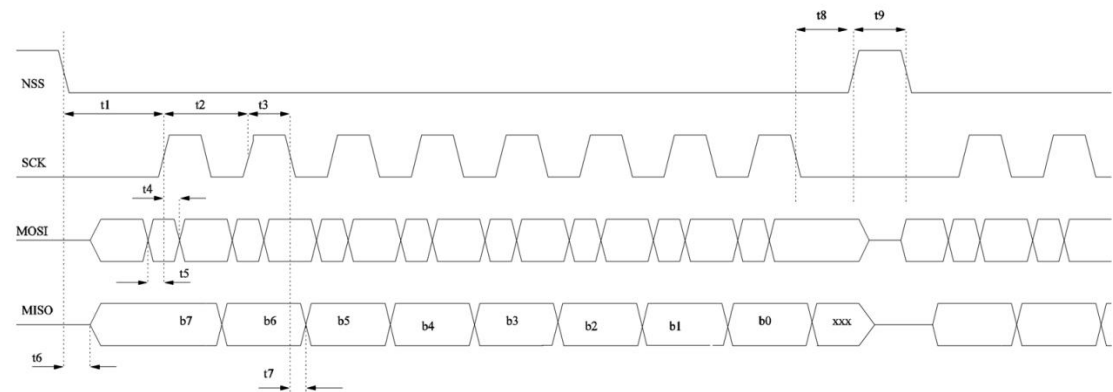
5.3 SPI Interface character

The SPI runs on an external SCK clock, allowing it to reach 16MHz.
Transmission is initiated when the NSS pin level goes low. When NSS is high, MISO is in a high impedance state.

SPI Timing Requirements (The chip implements only the Slave side function.)

Symbol	Description	Minimum	Typical	Maximum	unit
t1	NSS falling edge to SCK setup time	32	-	-	ns
t2	SCK period	62.5	-	-	ns
t3	SCK high time	31.25	-	-	ns
t4	MOSI to SCK hold time	5	-	-	ns
t5	MOSI to SCK setup time	5	-	-	ns
t6	MOSI to SCK setup time	0	-	15	ns
t7	SCK falling to MISO delay	0	-	15	ns
t8	SCK to NSS rising edge hold time	31.25	-	-	ns
t9	NSS high time	125	-	-	ns
t10	NSS falling edge to SCK setup time when switching from SLEEP to STDBY_RC mode	100	-	-	s
t11	NSS falling to MISO delay when switching from SLEEP to STDBY_RC mode	0	-	150	s

Active Timing



5.3.1 DIO with IRQ control

Commands Controlling the Radio IRQs and DIOs(At least one DIO is required for IRQ, and BUSY cable is also required to be used compulsorily)

Command	Operate code	Parameters	Description
SetDioIrqParams	0x08	IrqMask[15:0], Dio1Mask[15:0], Dio2Mask[15:0], Dio3Mask[15:0],	Configure the IRQ and the DIOs attached to each IRQ
GetIrqStatus	0x12	-	Get the values of the triggered IRQs
ClearIrqStatus	0x02	-	Clear one or several of the IRQs
SetDIO2AsRfSwitchCtrl	0x9D	Enable	Configure radio to control an RF switch from DIO2
SetDIO3AsTcxoCtrl	0x97	tcxoVoltage, timeout[23:0]	Configure the radio to use a TCXO controlled by DIO3

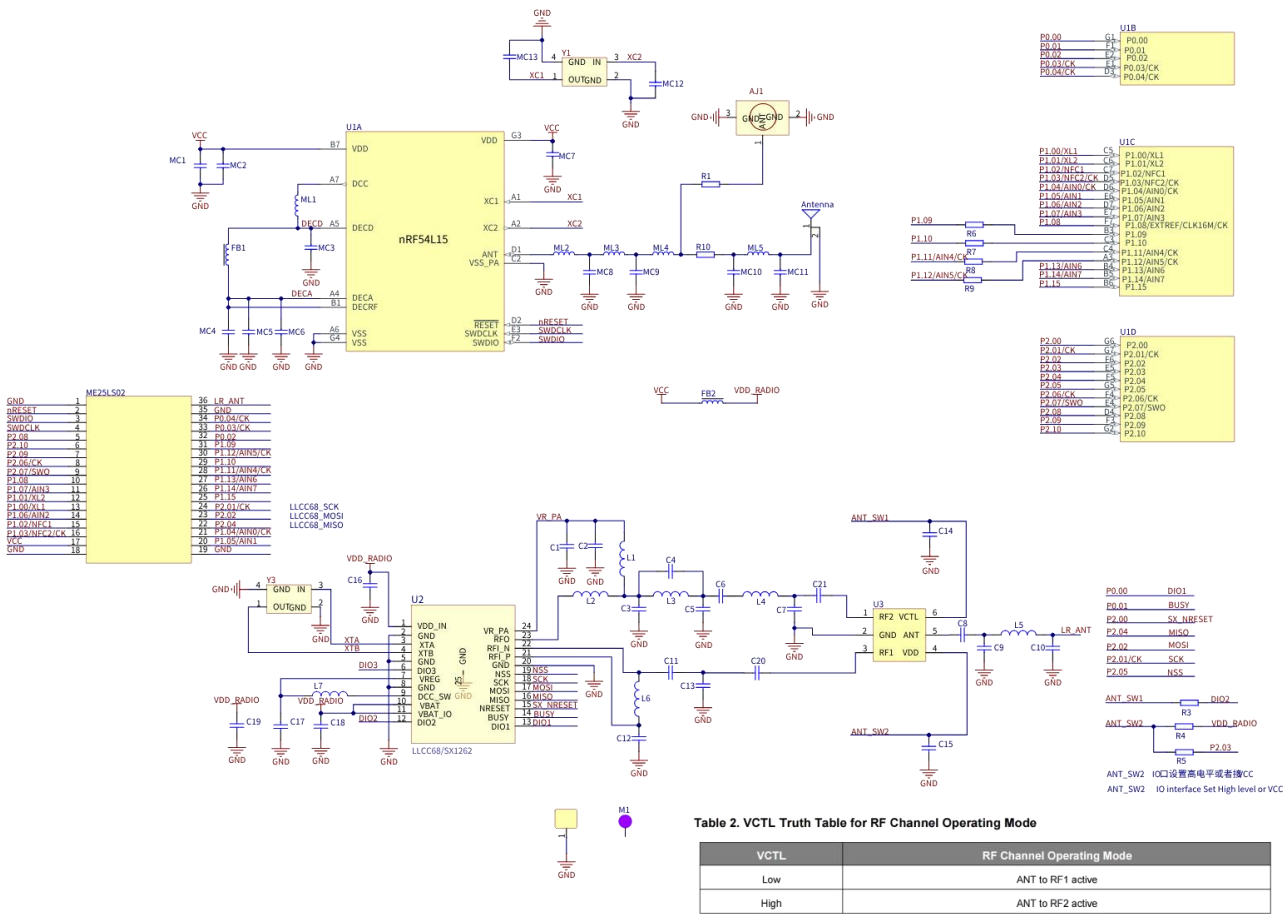
5.3.2 Module internal TX, RX mode control

ANT_SW1 for detecting TX and RX level pin

- 1) When ANT_SW2 detects a high level, the mode is TX mode.
- 2) When ANT_SW2 detects a low level, the mode is RX mode.

Mode	DIO2(ANT_SW1)
TX	1
RX	0

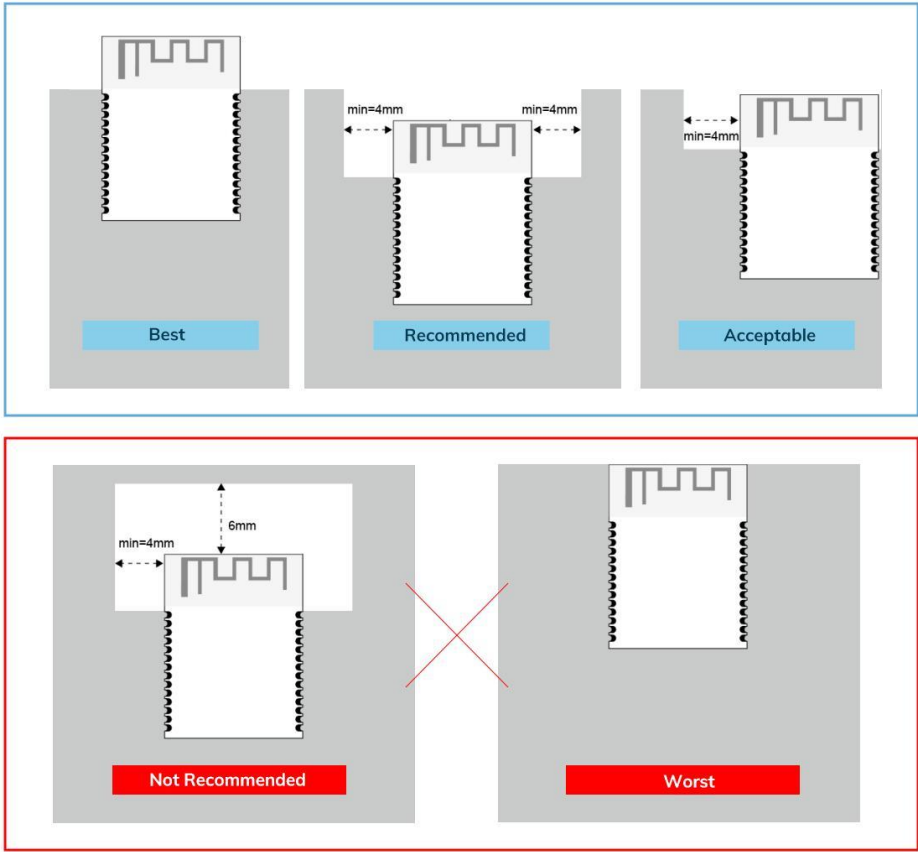
6 Electrical Schematic



* **Note:** If you need a different LoRa solution, please contact the business for instructions.

7 PCB Layout

Module antenna area couldn't have GND plane or metal cross line, couldn't place components nearby. It is better to make hollow out or clearance treatment or place it on the edge of PCB board.



设置格式[吴]: 居中

设置格式[吴]: 行距: 单倍行距

Layout notes:

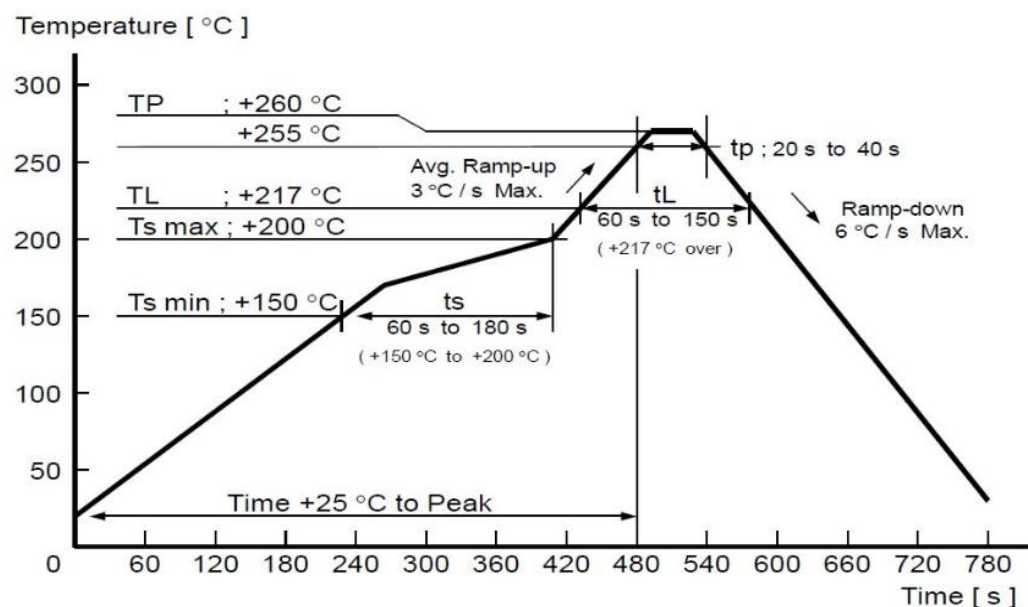
删除[吴]:

- 1) Preferred Module antenna area completely clearance and not be prevented by metals, otherwise it will influence antenna's effect (as above DWG. indication).
- 2) Cover the external part of module antenna area with copper as far as possible to reduce the main board's signal cable and other disturbing.
- 3) It is preferred to have a clearance area of 4 square meter or more area around the module antenna (including the shell) to reduce the influence to antenna.
- 4) Device should be grounded well to reduce the parasitic inductance.
- 5) Do not cover copper under module's antenna in order to avoid affect signal radiation or lead to transmission distance affected.
- 6) Antenna should keep far from other circuits to prevent radiation efficiency reduction or affects the normal operation of other lines.
- 7) Module should be placed on edge of circuit board and keep a distance away from other circuits.
- 8) Suggesting to use magnetic beads to insulate module's access power supply.

8 Reflow and Soldering

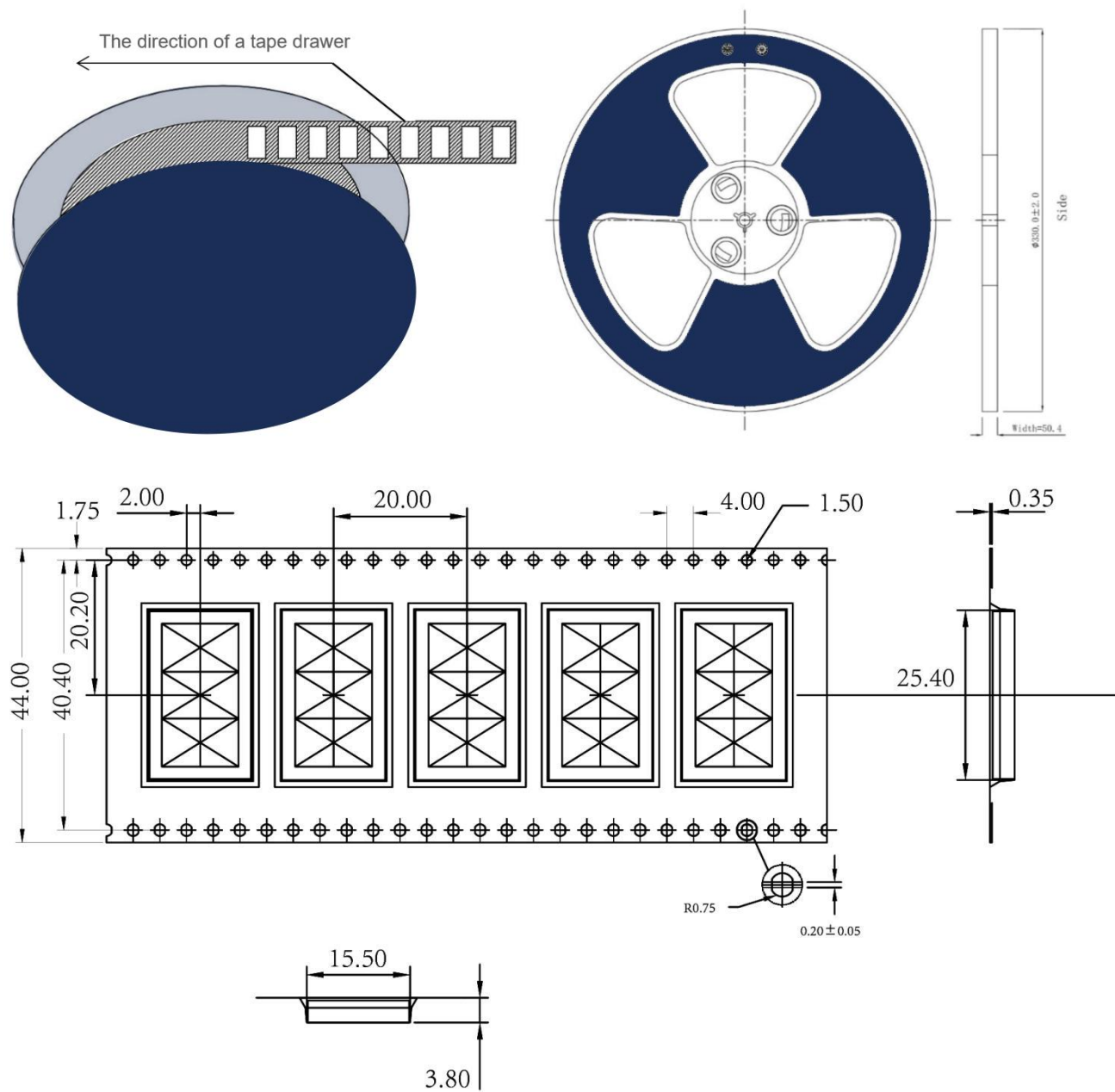
- 1) Do SMT according to above reflow oven temperature deal curve. Max. Temperature is 260°C;

Refer to IPC/JEDEC standard; Peak TEMP<260°C; Times: ≤2 times, suggest only do once reflow soldering on module surface in case of SMT double pad involved. Contact us if special crafts involved.



- 2) For module SMT, it is recommended to make a local step steel mesh with a thickness of 0.13-0.15mm and a pin length of 1-1.3mm.
- 3) After unsealing, it cannot be used up at one time, should be vacuumed for storage, couldn't be exposed in the air for long time. Please avoid getting damp and soldering-pan oxidizing. If there are 7 to 30 days interval before using online SMT, suggest to bake at 65-70 °C for 24 hours without disassembling the tape.
- 4) Before using SMT, please adopt ESD protection measure.

9 Package Information



* (Default unit: mm Default tolerance: ±0.1)

Packing detail	Specification	Net weight	Gross weight	Dimension
Quantity	700PCS	1050g	TBD	W=44mm, T=0.35mm

* **Note:** Default weight tolerance all are within 10g (except the special notes)

FCC Warning

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.

FCC warning:

Any Changes or modifications not expressly approved by the party responsible for compliance 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.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that

specifically establish the bands of operation, the power, spurious emissions, and operating

fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15

Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host

manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a PCB Antenna, , and the antenna use a permanently attached

Antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The Manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module

Explanation: The module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects:

layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the Layout of trace design,, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that Permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person’ s body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an Uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is:2BDJ6-ME25LS02.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an“omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the Installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a PCB Antenna, , and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating“Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2BDJ6-ME25LS02."

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: Topband can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter

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Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSA18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

● Contact Us

Shenzhen Minewsemi Co., Ltd. is committed to swiftly delivering top-quality connectivity modules to our customers. For assistance and support, please feel free to contact our relevant personnel, or contact us as follows:

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