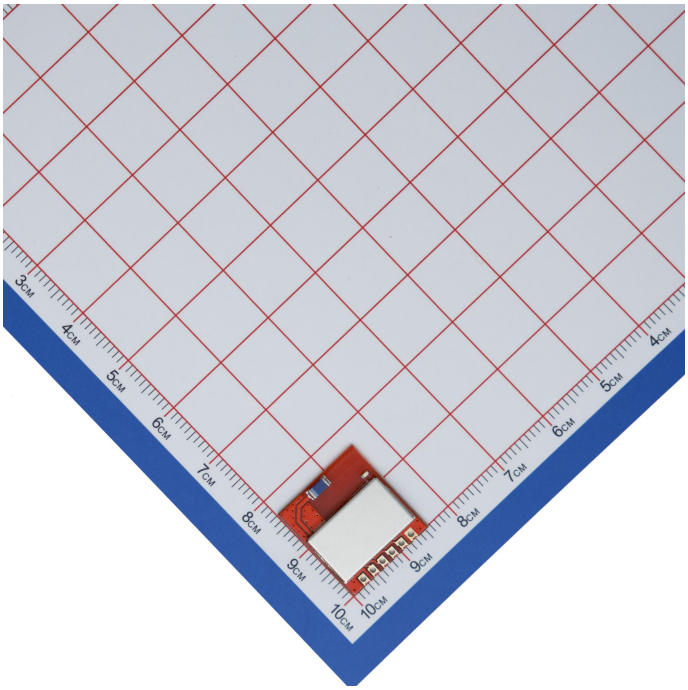
Ling-TR5mini-T Wireless UART Module Datasheet



Item	Content
Product Model	Ling-TR5mini-T
Document Version	V1.4
Release Date	2026-07-02
Brand	FNRF

fnrfjeck@gmail.com

Contents

fnrfjeck@gmail.com

1 Product Overview

Ling-TR5mini-T is a compact 2.4 GHz wireless UART transceiver module using GFSK modulation and an integrated ceramic antenna. It connects to an MCU or other serial device through a UART TTL interface. It is suitable for short-range wireless UART communication, remote control, data acquisition, smart-home applications, and embedded-device communication.

The module supports configuration of Net ID, RF channel, transmit power, UART baud rate, and other parameters through PC software or UART commands. Modules at both ends must use matching Net ID, RF channel, and UART communication parameters for normal wireless communication.

The wireless link is half-duplex, and the module switches automatically between transmit and receive. The system communication flow should use master-slave polling, request-response, or another mechanism that prevents simultaneous bidirectional transmission.

2 Features

- Operates in the 2.4 GHz band and supports configuration of 128 RF channels.
- GFSK modulation, suitable for short-range wireless UART data communication.
- Integrated ceramic antenna, suitable for compact SMD applications.
- UART TTL interface for convenient MCU serial connection.
- Supports Net ID software grouping and RF-channel hardware frequency grouping.
- Supports transmit-power configuration with 7 selectable levels.
- Supports sleep control; quiescent current is approximately 6 uA in sleep mode.
- Default power-on parameters can be used directly for communication testing between two modules.

3 Typical Applications

- Wireless UART Communication
- Remote-Control Products
- Data Acquisition
- Industrial Control
- Robot Control
- Smart Home
- Smart Kitchen and Bathroom Appliances
- Short-Range Wireless Connections for Embedded Devices

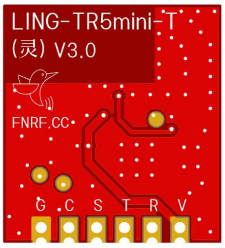
fnrfjeck@gmail.com

4 Technical Specifications

Parameter	Minimum	Typical	Maximum	Unit	Condition/Description
Operating Voltage	2.2	3.3	3.6	V	VCC to GND.
Operating Band	2400	-	2527	MHz	Range corresponding to RF channels 0-127. Actual operating frequencies must comply with local regulations.
Number of RF Channels	-	128	-	channels	Default channel: 0x53.
Default Frequency	-	2483	-	MHz	RF channel 0x53, corresponding to decimal 83.
Modulation	-	GFSK	-	-	Wireless-link modulation.
RF Air Data Rate	-	250	-	kbps	Different from the UART baud rate.
Communication Distance	-	Approx. 50	-	m	Reference value for open line-of-sight conditions. Actual distance depends on the antenna, power supply, enclosure, installation, and interference.
Receiver Sensitivity	-	-88	-	dBm	Typical specification value.
Transmit Power	-8	-	10	dBm	7 configurable levels.
Transmit Current	-	10.8	-	mA	At 0 dBm transmit power.
Receive Current	-	7.2	-	mA	Receive state.
Sleep Current	-	6	-	uA	Communication is unavailable in sleep mode.
UART Baud Rate	600	9600	115200	bps	The parameter table supports 8 settings; the default is 9600 bps.
Configuration-Mode UART	-	9600, 8N1	-	-	Fixed after SET is pulled low to enter configuration mode.
RF Packet Payload	-	-	7	Byte	A single RF packet carries up to 7 bytes of user data.
Package Type	-	SMD	-	-	SMD package.
Module Thickness	-	3.00	-	mm	Including shield can.

fnrfjeck@gmail.com

5 Pin Assignment



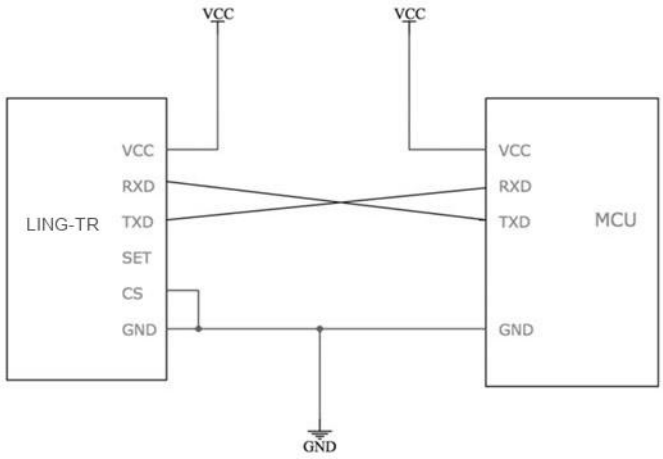
Bottom View

Pin Marking	Pin Name	Type	Function	Description
V	VCC	Power	Positive Supply	2.2-3.6 V; typical 3.3 V.
R	RXD	Input	Module Data Input	Connect to MCU TXD; UART TTL level.
T	TXD	Output	Module Data Output	Connect to MCU RXD; UART TTL level.
S	SET	Input	Parameter Configuration Enable	Low level selects configuration mode; floating or high level selects communication mode.
C	CS	Input	Active/Sleep Control	Low level: active; floating or high level: sleep.
G	GND	Power	Power Ground	Common ground with the MCU or external serial device.

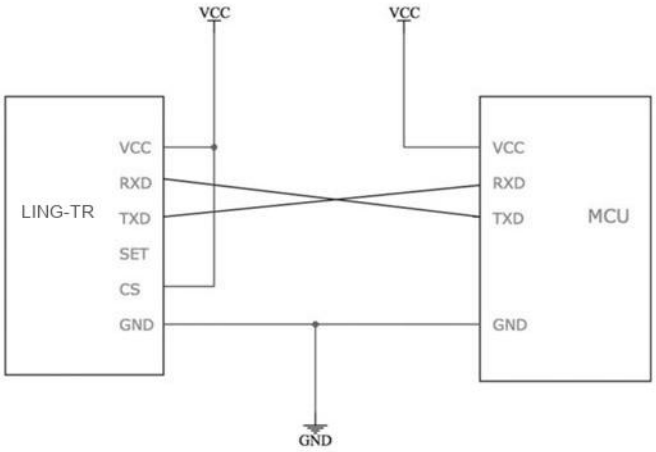
6 Operating Modes

Mode	CS Pin	SET Pin	UART Status	Module Status
Comm. Mode	low	High Level or Floating	Operates at the configured communication baud rate	Wireless UART communication available.
Config. Mode	low	low	Fixed at 9600 bps, 8N1	Module parameters can be read or written; the blue LED remains on.
Sleep Mode	High Level or Floating	Any	Communication unavailable	Sleep current is approximately 6 uA.

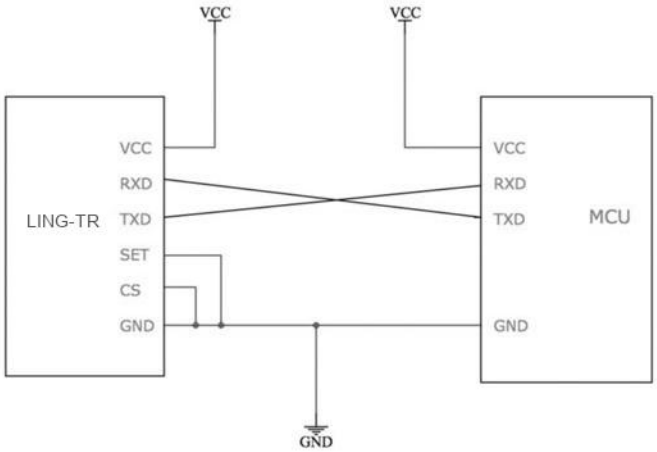
After configuration is complete, drive SET high to return the module to communication mode, then wait about 0.5s before testing communication.



Communication Mode



Sleep Mode



Configuration Mode

fnrfjeck@gmail.com

7 Quick Connection

Module Pin	Connection Target	Description
VCC	3.3 V Supply	The supply must be stable. Place a decoupling capacitor close to the module.
GND	System Ground	Must share ground with the MCU or USB-UART tool.
RXD	MCU TXD / USB-UART TXD	The module receives external UART data.
TXD	MCU RXD / USB-UART RXD	The module outputs received UART data.
CS	MCU I/O or GND	Active at low level; connect to low level for continuous operation.
SET	MCU I/O or Pull-Up/Floating	Low level enters configuration mode; keep high or floating during communication.

For initial testing, use two modules and a UART DEMO tool. First complete PC serial-tool transmit/receive testing with factory defaults, then port the application to the MCU.

8 Parameter Configuration Protocol

8.1 Configuration-Mode Entry Conditions

To enter configuration mode, CS and SET must both be low. In configuration mode, the module UART automatically uses 9600 bps, 8 data bits, no parity, and 1 stop bit.

8.2 Parameter Configuration Frame Structure

The parameter-configuration frame is 18 bytes long. The configuration-command frame header is AA 5A; the module response frame header is AA 5B.

Byte Position	Field	Attribute	Description
1	0xAA	Fixed	Command byte.
2	0x5A	Fixed	Configuration-command byte.
3-4	Product ID	Read Only	Product model ID; not settable.
5-6	Net ID	Read/Write	Net ID; both communicating modules must match.
7	NC	Reserved	Reserved field.
8	RF Power	Read/Write	Transmit-power setting; 7 levels, 0-6.
9	NC	Reserved	Reserved field.
10	Baud	Read/Write	UART baud-rate parameter, 0-7.
11	NC	Reserved	Reserved field.
12	RF Channel	Read/Write	RF channel, 0-127, corresponding to 2400-2527 MHz.
13-15	NC	Reserved	Reserved field.
16	Length	Fixed	Fixed at 0x12, i.e., 18 bytes.
17	NC	Reserved	Reserved field.
18	CheckSum	Checksum	Sum of the first 17 bytes, low 8 bits.

8.3 Configuration Command Examples

```
AA 5A 00 00 12 34 00 01 00 04 00 53 00 00 00 12 00 B4
```

Field	Example Value	Description
Frame Header	AA 5A	Parameter-configuration command.
Net ID	12 34	Net ID.
RF Power	01	Transmit-power level.
Baud	04	UART baud rate: 9600 bps.
RF Channel	53	Hexadecimal 0x53, decimal 83, corresponding to 2483 MHz.
Length	12	18 bytes.
CheckSum	B4	Low 8 bits of the sum of the first 17 bytes.

After receiving the configuration command, the blue LED flashes once and the module returns response data. The response frame header changes from AA 5A to AA 5B. Product ID returns the factory default number; all other fields follow the response format.

```
AA 5B 4C 05 12 34 00 01 00 04 00 53 00 00 00 12 00 06
```

8.4 Parameter Query Command

```
AA 5C 00 00 00 00 00 00 00 00 00 00 00 00 12 00 18
```

The parameter-query response frame header is AA 5D; all other field formats match the configuration-command response.

8.5 Version-Number Query Command

```
AA 5D 00 00 00 00 00 00 00 00 00 00 00 00 00 00 07
```

Example version response:

```
01 00 00 20 24 04 23 05
```

8.6 Restore Factory-Default Parameters Command

```
AA 5A 00 00 00 00 00 00 00 04 00 53 00 00 00 12 00 6D
```


fnrfjeck@gmail.com

9 Parameter Lookup Tables

9.1 Transmit-Power Parameters

Parameter Value	Corresponding Transmit Power
0	10dBm
1	6dBm
2	3dBm
3	2dBm
4	1dBm
5	0dBm
6	-8dBm

9.2 UART Baud-Rate Parameters

Parameter Value	UART Baud Rate
0	600bps
1	1200bps
2	2400bps
3	4800bps
4	9600bps
5	19200bps
6	38400bps
7	115200bps

fnrfjeck@gmail.com

9.3 RF Channel

Item	Description
Channel Range	0-127
Frequency Mapping	2400-2527MHz
Default Channel	0x53, corresponding to 2483 MHz
Usage Recommendation	Channels 0 and multiples of 16 are not recommended, such as 0x00, 0x10, and 0x40.

For multiple module groups, configure different Net IDs and RF channels. Net ID is software grouping and RF channel is frequency grouping; use both for system group management.

10 Data Communication Behavior

After receiving UART data at RXD, the module starts RF packet transmission. The wireless side repackages data internally; each RF packet carries up to 7 bytes. Therefore, the receiver TXD output may have nonuniform intervals between bytes; this is part of the module's RF packetization and receive-output behavior.

The module can transparently transmit ASCII or HEX data when the UART baud rate, Net ID, RF channel, and other parameters match at both ends.

Because the module does not guarantee application-layer packet boundaries, the MCU application should define an explicit frame format. Include fields such as a frame header, address or device ID, length, sequence number, data field, and CRC, and use ACK, retransmission, and duplicate-packet filtering as appropriate.

11 Timing Parameters

Item	Typical	Description
Power-On Initialization Time	Approx. 260 ms	Wait for initialization to complete after power-on before communicating.
SET Entry Time	Approx. 5.5 ms	Time required to enter configuration mode after SET is pulled low.
SET Exit Time	Approx. 265 ms	After SET is driven high to exit configuration mode, wait for the module to resume communication.
CS Entry Time	Approx. 5.5 ms	Reference time to enter sleep after CS is driven high or left floating.
CS Exit Time	Approx. 6.3 ms	Reference time to return from sleep to active state after CS is pulled low.

These timing parameters are for system-design reference. Validate them in the actual application with the MCU program, UART baud rate, data volume, response mechanism, and field environment.

12 MCU Reception Recommendations

Do not rely solely on the UART idle interrupt of an STM32, GD32, or similar MCU to determine the end of a packet, because module output byte intervals can be nonuniform and the MCU idle-interrupt interval is usually baud-rate dependent.

Use one of the following methods:

- UART interrupt plus timer timeout: reset the timer after each byte; treat the packet as complete after about 10 ms with no new data.
- DMA plus UART idle interrupt plus timer: after the idle interrupt, continue timing; process the DMA buffer only after confirming no new data for 1-10 ms.
- Application-layer frame format: use frame header, length, and CRC to determine a complete packet instead of relying only on timing gaps.

Set the timeout based on baud rate, data length, MCU task scheduling, and actual test results.

fnrfjeck@gmail.com

13 Power Supply, PCB, and Antenna Considerations

13.1 Power-Supply Design

- The module supply range is 2.2–3.6 V; typical is 3.3 V.
- Place a decoupling capacitor close to VCC/GND and keep the supply path short, wide, and low impedance.
- Do not share a long, narrow supply path with motors, relays, buzzers, high-current loads, or noisy DC-DC converters.
- When range is short, communication is abnormal, or occasional packet loss occurs, first use an oscilloscope at the module VCC/GND pins to check transient voltage drop and ripple. A multimeter may not capture transmit-time voltage drop.

13.2 UART and Logic Levels

- RXD/TXD are UART TTL interfaces. Confirm the logic-level compatibility of the MCU or USB-UART tool against the module supply voltage.
- Do not connect 5 V UART logic directly. For a 5 V host system, evaluate level shifting or a compatible design.
- Keep UART traces as short as possible and away from switching-supply inductors, relays, motor wiring, high-current traces, and the antenna area.

13.3 Antenna and Installation

- The module integrates a ceramic antenna. Keep the antenna area as clear as possible during installation.
- Avoid large metal areas, copper pours, batteries, shield cans, high-speed traces, DC-DC inductors, and other strong interference sources near the antenna.
- 2.4 GHz communication range is affected by the enclosure, hand-held orientation, metal structures, installation direction, and co-channel environments such as Wi-Fi and Bluetooth.
- Validate communication range and stability in the final enclosure, at the final installation position, and with the actual power supply.

14 Recommended Debugging Procedure

1、Use two modules and a UART DEMO tool to complete PC serial-tool transmit/receive testing with default parameters.

2、Confirm that Net ID, RF channel, and UART baud rate match at both module ends.

3、Confirm that CS is low for active operation and that SET is high or floating during communication.

4、Confirm that UART TXD/RXD are cross-connected and that GND is common.

5、Before MCU integration, send short test packets first, then gradually increase data volume and application-protocol complexity.

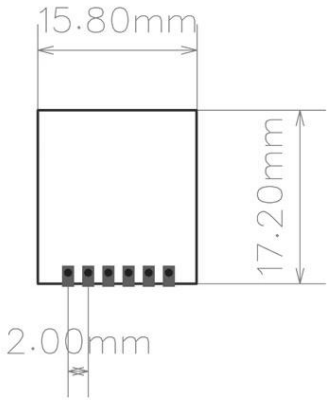
6、If communication is abnormal, first test the module separately from the customer's PCB using the UART DEMO tool, then investigate the customer's power supply, antenna, layout, and program.

15 LED Indication

State	LED Indication
Configuration State	Blue LED on continuously.
Active State	LED off.
Receiving or Transmitting Data	LED flashes.

fnrfjeck@gmail.com

16 Dimensions



Thickness	3.00 mm, including shield can

17 Certification and Compliance Statement

For FCC, CE, or other regional certifications, rely on formal certificates, test reports, and final product conditions. Certification-related statements in module documentation do not replace product-level certification assessment.

When exporting 2.4 GHz products to different regions, confirm permitted bands, transmit power, antenna type, spurious emissions, and product-certification boundaries against local regulations. Changes to antenna, enclosure structure, installation method, or application environment may affect final test results.

18 Ordering and Technical Support

Technical documentation, configuration software, and test tools are available from the Fengniao Wireless website:

WWW.FNRF-TECH.COM

For technical consultation, refer to the contact details in this document footer.

Appendix Quick Start

Data Transmission and Reception Test

After receiving the module, no parameter configuration is required. Once the circuit is connected correctly, UART communication can begin directly. Use the UART demo below to quickly begin data-transmission and reception testing.

UART DEMO (Test Board)