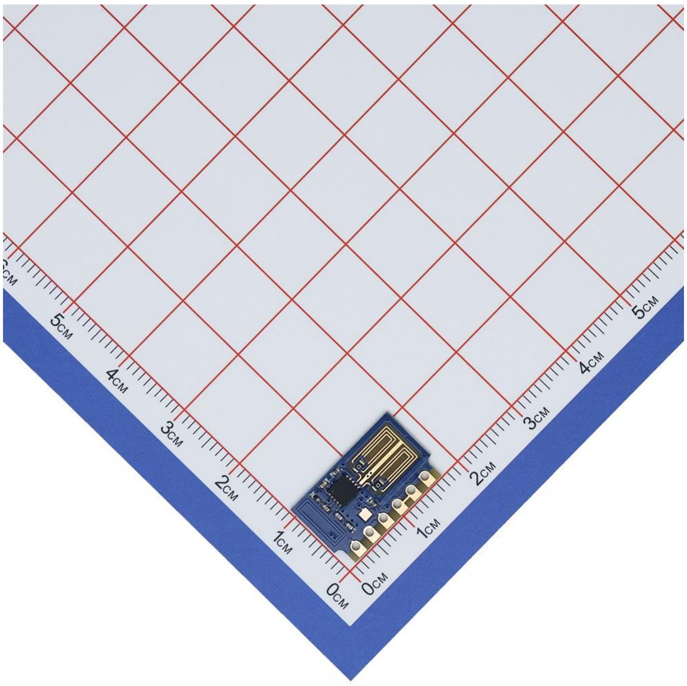
Wei-R3 Low-Power Receiver Module



Item	Details
Product Model	Wei-R3
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Brand	FNRF

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1 Product Overview

Wei-R3 is a low-power ASK/OOK superheterodyne receiver module for 315 MHz or 433 MHz operation. It uses an integrated RF receiver IC and a Q dielectric-resonator frequency-stabilization technology, and is suitable for single-live-wire switches, battery-powered equipment, and low-power wireless remote-control receivers.

The module provides SHUT sleep control, DAT data output, VCC/GND power pins, and an ANT antenna interface. DAT outputs demodulated digital pulses for connection to an MCU or decoder IC.

2 Key Features

- Wide 2.1-5.5 V supply range; 3.0 V typical.
- Typical operating current: 0.16 mA.
- Typical sleep current: 0.015 mA; wake-up time: approximately 1 ms.
- 315 MHz / 433 MHz options.
- ASK/OOK modulation; maximum data rate: 4.8 kbps.
- ESD rating: 2000 V.

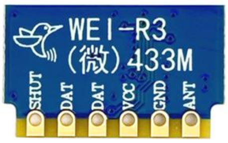
3 Typical Applications

- Single-live-wire switches
- Battery-powered remote-control receivers
- Low-power wireless doorbells
- Smart-home control
- Security alarms
- Wireless lighting control
- Small-appliance remote controls

4 Technical Specifications

Parameter	Min.	Typical	Max.	Unit	Condition / Description
Operating Frequency	-	315 / 433	-	MHz	Selected when ordering.
Operating Voltage	2.1	3.0	5.5	V	Between VCC and GND.
Operating Current	-	0.16	-	mA	Active receiving state.
Sleep Current	-	0.015	-	mA	Sleep state.
Wake-up Time	-	1	-	ms	Wake-up through SHUT.
Modulation	-	ASK/OOK	-	-	Remote-control reception.
Receiver Sensitivity	-	-100	-	dBm	Typical value.
Data Rate	-	-	4.8	kbps	Maximum value.
Receive Bandwidth	-	2.5	-	MHz	Typical receive bandwidth.
Antenna Impedance	-	50	-	Ω	External antenna at the ANT pin.
ESD	-	2000	-	V	ESD protection rating.
Dimensions	-	11 x 18 x 1.9	-	mm	W × L × H.
Operating Temperature	-35	-	75	°C	Verify for the complete-product environment.

5 Pin Assignment



Bottom View

Pin Name	Type	Function	Description
SHUT	Input	Sleep Control	Internally pulled down; active when floating or low, asleep when high. Wake-up time is approximately 1 ms.
DAT	Output	Data Output	Demodulated digital-pulse output.
DAT	Output	Data Output	Same function as the preceding DAT; connect either one.
VCC	Power	Positive Supply	2.1-5.5 V; 3.0 V typical.
GND	Power	Ground	System ground.
ANT	RF	Antenna	50 Ω antenna interface.

6 Output Interface and Sleep Control

DAT/D outputs digital pulses demodulated from ASK/OOK, not UART serial data. The MCU or decoder IC must decode high/low pulse widths according to the transmitter encoding protocol, such as common 1527 and 2262 remote-control encodings.

SHUT is internally pulled down. The module is active when SHUT is floating or low, and enters sleep when SHUT is high. Wake-up time is approximately 1 ms.

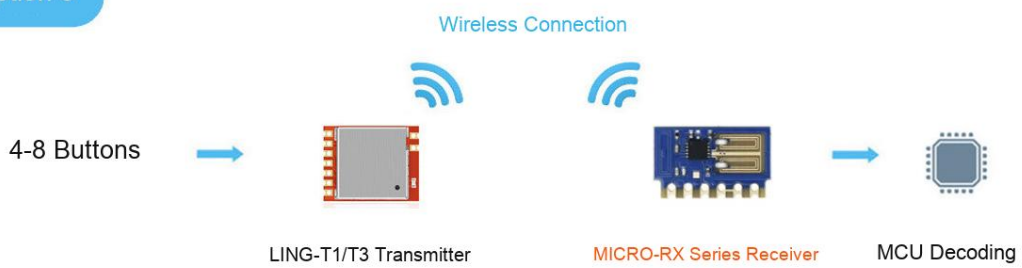
Item	Description
Data Output Type	Demodulated digital-pulse signal.
Connection Target	MCU input pin or decoder-IC input pin.
Decoding Method	Decode high/low pulse widths according to the transmitter encoding protocol.
Sleep Control	Drive the sleep-control pin high to enter sleep; the module is active when the pin is floating or low.
Frame Boundary	The MCU can record pulse widths with edge interrupts and determine the end of a frame by timeout.

7 Operation and Wiring

Option 1

Option 2

Option 3



7.1 Wiring

Module Pin	Connection Target	Description
VCC/V	Positive Supply	Connect within the supply range specified in the technical specifications.
GND/G	Negative Supply	Use common ground with the MCU or decoder IC.
DAT/D	MCU input or decoder-IC input	Receives the demodulated digital-pulse signal.
SHUT/S	MCU GPIO or fixed logic level	Active when floating or low; asleep when high.
ANT/A	Antenna for the corresponding	Keep the antenna trace short and direct, away from noise

Module Pin	Connection Target	Description
	band	sources.

7.2 Operating Steps

Step	Action	Description
1	Confirm Frequency	The transmitter and receiver frequency bands must match.
2	Connect Power	Check supply voltage, ripple, and common-ground connection.
3	Set Sleep Control	Keep the module active when reception is needed; drive high for sleep during standby.
4	Connect Data Output	Connect the data-output pin to an MCU input pin or decoder-IC input pin.
5	Verify Waveform	Use an oscilloscope or logic analyzer to verify output waveform amplitude and pulse widths.
6	Integrate Encoding	Decode the address code and key value according to the transmitter encoding protocol.

8 MCU Reception and Routine Recommendations

The data-output pin provides pulse signals. The MCU typically uses GPIO edge interrupts to record high/low durations and determines the end of a frame by receive timeout. The routine below shows only the reception framework; implement protocol decoding for the transmitter encoding format.

8.1 Pulse-Width Sampling Routine Framework

```
// Wei-R3 data-output reception example framework
// Principle: while the module is active, DAT/D outputs demodulated pulse signals.
//           The MCU records pulse widths on either-edge interrupts, then decodes a frame after no new edge arrives for a period.
// Note: synchronization headers, 0/1 pulse widths, and repeat-frame rules vary by transmitter encoding.
//       Implement RX_DecodeFrame() separately for the actual protocol.
#include <stdint.h>
#include <stddef.h>
#define RX_MAX_PULSE_COUNT 96
```

```
typedef struct {
    uint16_t level;       // Current pulse level: 0 = low, 1 = high.
    uint16_t width_us;    // Current-level duration in microseconds.
} RX_Pulse;
static RX_Pulse rx_pulses[RX_MAX_PULSE_COUNT];
static size_t rx_pulse_count = 0;
static uint32_t rx_last_edge_us = 0;
// Current time in microseconds, provided by the platform timer.
extern uint32_t Board_GetTimeUs(void);
// Controls the sleep pin: 0 = active, 1 = sleep.
extern void Board_SetRxSleepPin(uint8_t level);
// Restarts the receive-timeout timer; for example, invoke the timeout callback after 10-20 ms without a new edge.
extern void Board_RestartRxTimeoutTimer(uint16_t timeout_ms);
// Decodes one pulse frame for the actual encoding protocol, such as 1527, 2262, or a custom protocol.
extern void RX_DecodeFrame(const RX_Pulse *pulses, size_t count);
// Call before reception: drive the sleep-control pin low to activate the module.
void RX_StartReceive(void)
{
    Board_SetRxSleepPin(0);
    rx_pulse_count = 0;
    rx_last_edge_us = 0;
}
// Call during standby: drive the sleep-control pin high to put the module to sleep.
void RX_StopReceive(void)
{
    Board_SetRxSleepPin(1);
    rx_pulse_count = 0;
    rx_last_edge_us = 0;
}
// Either-edge interrupt callback for the data-output pin.
// level_after_edge is the level after the edge and is used to infer the preceding pulse level.
void RX_OnDataEdge(uint16_t level_after_edge)
{
    uint32_t now_us = Board_GetTimeUs();
    uint16_t width_us = (uint16_t)(now_us - rx_last_edge_us);
    // On the first entry, rx_last_edge_us may be 0; begin recording valid pulse widths from the second edge.
    if (rx_last_edge_us != 0 && rx_pulse_count < RX_MAX_PULSE_COUNT) {
        rx_pulses[rx_pulse_count].level = (uint16_t)(!level_after_edge);
```

```
        rx_pulses[rx_pulse_count].width_us = width_us;
        rx_pulse_count++;
    }
    rx_last_edge_us = now_us;
    // Refresh the timeout timer on every new edge.
    // Decode after timeout to avoid processing partial-frame data prematurely.
    Board_RestartRxTimeoutTimer(15);
}
// Receive-timeout callback: if no new edge arrives for a period, the current frame is considered complete.
void RX_OnRxTimeout(void)
{
    if (rx_pulse_count == 0) {
        rx_last_edge_us = 0;
        return;
    }
    // First pass the complete pulse sequence to the protocol layer; perform application actions only after successful decoding.
    RX_DecodeFrame(rx_pulses, rx_pulse_count);
    // Clear the receive state in preparation for the next frame.
    rx_pulse_count = 0;
    rx_last_edge_us = 0;
}
```

8.2 MCU Handling Recommendations

Item	Recommendation
Input-Pin Configuration	Configure the data-output pin for the MCU logic standard; avoid external strong pull-ups or pull-downs that affect the waveform.
Sleep Control	Use the MCU to explicitly control active and sleep states; avoid an indeterminate state.
Timing Resolution	Use a microsecond-resolution timer for pulse-width timing.
Repeat Frames	A held remote-control key may transmit consecutive frames; the application layer should handle repeat frames.
False-Trigger Immunity	Perform the control action only after the address code, key value, and pulse-width range all pass validation.

9 Power Supply Design Recommendations

Wei-R3 has a typical operating current of 0.16 mA and a typical sleep current of 0.015 mA. Place a 0.1 uF decoupling capacitor close to the module power pins. For products with long wiring, relays, motors, or switching power supplies, add TVS protection, reverse-polarity protection, and input filtering as required by the system.

Item	Recommendation
Decoupling Capacitor	Place a 0.1 uF ceramic capacitor between VCC/V and GND/G close to the module.
Bulk Capacitor	Add a 1-4.7 uF capacitor according to the complete-product supply conditions.
Sleep Control	Low-power products should explicitly control the sleep-pin state and verify reception stability after wake-up.
Power-Supply Noise	If the system has a DC-DC converter, motor, or relay, check for false data-output triggers and changes in receiving distance.

10 EMC and Interference-Immunity Recommendations

- Keep the module away from switching-power inductors, MOSFET switching nodes, relay contacts, motor wiring, and high-current loops.
- Do not make the data-output line unnecessarily long. If an inter-board connection is required, add necessary series resistance or filtering near the MCU.
- Avoid long parallel routing of the sleep-control line with high-noise harnesses. If needed, add filtering or a default-level constraint at the MCU.
- Where the complete product has surge, ESD, or EFT requirements, add protection at the power entry, external key lines, and long-wire interfaces.
- Receiver software should filter abnormally short pulses, excessively long pulses, and incomplete frames.
- Before mass production, verify reception stability with the final enclosure, wiring harness, power supply, and installation orientation.

11 PCB Layout Recommendations

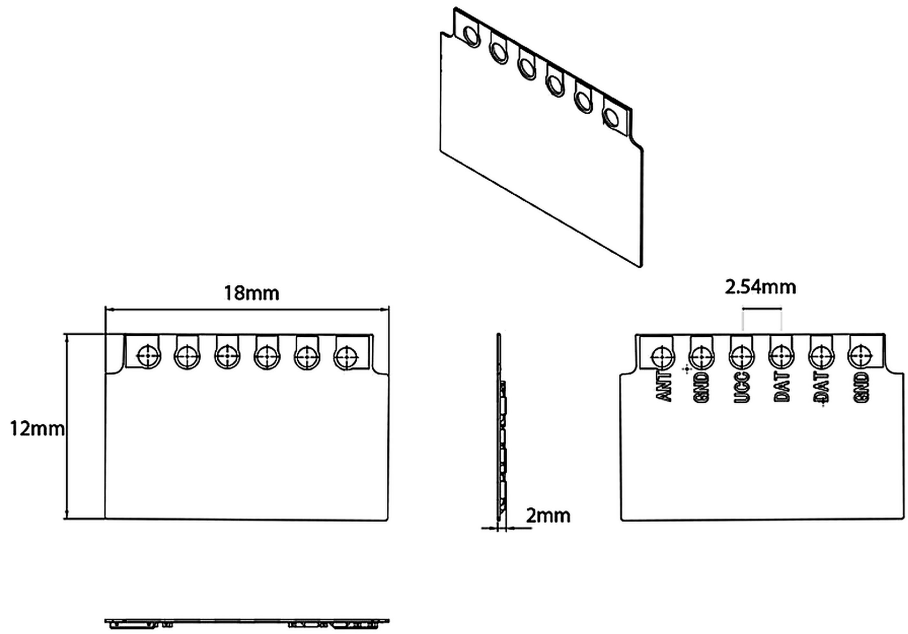
- Place the VCC/V-to-GND/G decoupling capacitor near the module power pins and keep the loop area as small as possible.
- Keep the data-output trace away from the antenna terminal, DC-DC switching nodes, crystal oscillator, high-speed clocks, and relay-drive traces.
- The sleep-control line may be driven directly by an MCU GPIO. Keep it short and clearly routed, away from high-voltage or high-current nodes.
- Keep the ANT/A trace short and straight; avoid long routed paths.
- Copper areas and metal structures near the module and antenna affect reception. Provide clearance according to the dimensional drawing and mechanical requirements.

12 Antenna and Mechanical Recommendations

The antenna has a significant effect on receiving distance and stability. No antenna or an unmatched antenna noticeably degrades reception; actual performance also depends on the PCB, enclosure, mechanical structure, installation position, and on-site interference.

Item	Recommendation
Frequency-Band Matching	315 MHz and 433 MHz antennas are not directly interchangeable.
Installation Position	Place the antenna area as close as practical to a non-metallic enclosure area.
Surrounding Structure	Keep away from metal parts, batteries, shields, wiring harnesses, and large copper areas.
Verification Method	Test with the actual transmitter at the target distance, orientation, and installation environment.

13 Dimensions



14 Documentation and Technical Support

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

WWW.FNRFLINK.COM

Appendix Antennas、Development Tools

Antennas are important. No antenna or an unmatched antenna can seriously affect performance. Actual performance also depends on the PCB, enclosure, and mechanical structure; purchase several types for practical testing.

TT02		433MHz	27.5mm*5.0mm

Development Tools:

Development Assistant	Signal Assistant
	
Difference: 1、Measures data values 2、Requires an encoding type (1527, etc.)	Difference: 1、Measures signal strength 2、No encoding restriction (ASK/OOK modulation)
Use: 1、Displays the address code and key value of a remote control/transmitter module 2、Displays remote-control frequency, pulse width, and encoding type 3、Volume testing of remote-control products	Use: 1. Displays signal strength of a remote control/transmitter module (relative value) 2. Compares antenna performance 3. Volume testing of remote-control products
Power Supply: TYPE-C	Power Supply: TYPE-C