E160-RxFS1L User Manual

OOK/ASK Low-Power Superheterodyne 315/433.92MHz 4-Channel Output Receiver Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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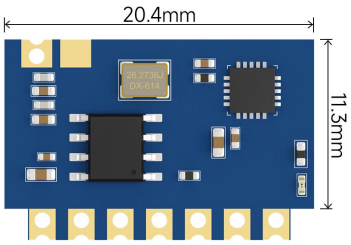
Chapter 1 Product Overview

1.1 Product Introduction

E160-RxFS1L is a low-cost OOK/ASK modulation 315MHz/433.92MHz low-power wireless receiver module with four outputs developed by Ebyte. It adopts a high-performance RF chip with excellent anti-interference capability. The module provides four output ports and supports momentary, self-locking, and interlocking output functions. It is compatible with the EV1527 standard encoding format and can store up to 15 groups of address codes,average power consumption is as low as 0.03mA.

The module features compact size, high performance, low power consumption, wide operating voltage range, and high stability. It can pass FCC and CE certifications and is suitable for simple control applications such as home appliance remote control, toy remote control, access control systems, electric bicycles, and similar applications.

**The module cannot communicate directly after factory delivery. It must be paired with the E160-TxFS1 transmitter module or another OOK/ASK modulation transmitter module compliant with the EV1527 encoding protocol.*



（E160-R4FS1L/E160-R3FS1L）

1.2 Features and Functions

- Compact size: 20.4 × 13.3 × 3.0 mm (L × W × H)
- Wide operating voltage: 1.8 ~ 3.6V
- Average power consumption: <0.03mA (at supply voltage from 1.8 to 3.6V)
- Compatible with EV1527 standard encoding format
- Can store up to 15 address codes (supports pairing with 15 different remote controls)
- Four independent level output pins (support momentary, self-locking, and interlocking modes)
- Communication distance: 210m

1.3 Application Scenarios

- Home appliance remote control (fans, lighting)
- Toy remote control
- Access control system remote control
- Electric bicycles

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Chapter 2 Specifications

2.1 RF Parameters

RF Parameter	Value	Notes
Operating Frequency (MHz)	315/433.92	E160-R3FS1L(315MHz)/E160-R4FS1L(443.92MHz)
Modulation Method	ASK/OOK	Amplitude Shift Keying / On-Off Keying
Blocking Power (dBm)	10	-
Maximum Transmit Power (dBm)	-	Not applicable for receiver module
Receive Sensitivity (dBm)	-109	@315MHz/433.92MHz
Receive Bandwidth (dBc)	±200	-
Transmission Rate (kbps)	9.6	RF unit supported rate, not the actual module transmission rate
Frequency Offset (MHz)	±0.05	-
Antenna Impedance (Ω)	50	-
Reference Communication Distance (m)	210	When used with E160-TxFS1 in open environment, antenna gain 1.5dBi, height 2m

2.2 Electrical Parameters

Electrical Parameter	Min	Typical	Max	Notes
Operating Voltage (V)	1.8	-	3.6	≥3.3V ensures optimal performance
Communication Level (V)	1.8	-	3.6	Determined by supply voltage
Transmit Current (mA)	-	-	-	Receiver module has no transmit current
Receive Current (mA)	5.0	-	7.0	Within rated voltage range
Sleep Current (μA)	-	28	-	Sleep current when module is inactive
Startup Time (ms)	-	3.0	-	Time from power-on to normal operation
ESD Protection	-4	-	+4	ESD HBM human body model
Operating Temperature (℃)	-40	-	+85	Industrial-grade design
Operating Humidity (%rh)	10	-	90	-
Storage Temperature (℃)	-55	-	+125	-

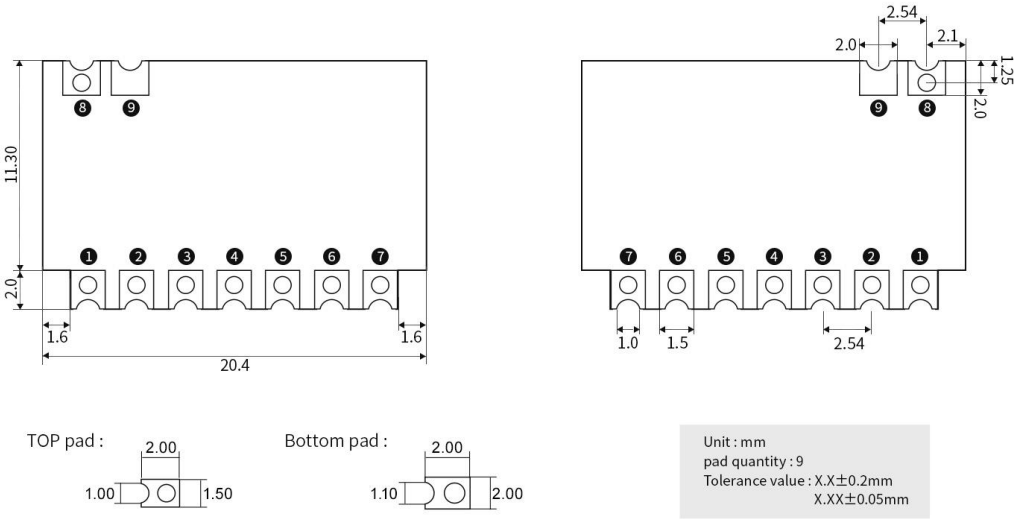
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2.3 Hardware Parameters

Hardware Parameter	Value	Notes
Crystal Frequency (MHz)	26.27	E160-R3FS1L(315MHz)
	27.14	E160-R4FS1L(443.92MHz)
Module Size (mm)	20.4*11.3*3.0	Length × Width × Height
Antenna Type	Stamp Hole	-
Communication Interface	GPIO	Determined by supply voltage
Packaging Method	SMD / Stamp Hole	Pin pitch 2.54mm
Weight (g)	3.65	-

Chapter 3 Mechanical Dimensions and Pin Definitions



Pin No.	Pin Name	Direction	Description
1	GND	-	Power ground
2	VCC	Power Input	DC 1.8~3.6V；
3	D0	Output	Push-pull output, sink current (low level) 30mA, source current (high level) 30mA; active high; default low after power-on reset
4	D1	Output	Push-pull output, sink current (low level) 30mA, source current (high level) 30mA; active high; default low after power-on reset
5	D2	Output	Push-pull output, sink current (low level) 30mA, source current (high level) 30mA; active high; default low after power-on reset
6	D3	Output	Push-pull output, sink current (low level) 30mA, source current (high level) 30mA; active high; default low after power-on reset
7	K/O	Input / Output	High level active when used as input (built-in pull-down resistor); drives onboard LED when used as output, active high
8	GND	-	Power ground
9	ANT	-	Antenna pin (receiver only, no transmission)

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Chapter 4 Development and Usage

E160-RxFS1L four-channel output receiver module can be directly used together with Ebyte's E160-TxFS1 transmitter module, or with other OOK/ASK modulation transmitter modules compliant with the EV1527 encoding protocol. The E160-RxFS1L provides four high/low level output ports to achieve low-power reception, supporting momentary, self-locking, and interlocking logic control, making it convenient for applications involving simple control logic in household appliances.

4.1 Operation and Usage

The following example uses the E160-RxFS1L (receiver module) and E160-TxFS1 (transmitter module) to explain the configuration and usage method of the E160-RxFS1L.

① **Enter Pairing Mode:**

Double-click the K/O pin of the E160-RxFS1L (the interval between presses must be less than 500ms). The LED will remain on for 4 seconds, during which the module enters pairing mode.

Press the remote control button within 4 seconds. If the remote control is recognized, the LED flashes twice (at 1.6Hz) and then turns off, indicating successful pairing.（Only one address can be paired at a time.)

② **Switch Output Mode:**

The default factory mode of the E160-RxFS1L is self-locking mode. Press the K/O pin four consecutive times (interval between presses must be less than 500ms), and the module enters output mode switching mode. The LED flashes at a rate of 1.6Hz:

- LED flashes 2 times: Mode 1 [Self-locking]
- LED flashes 3 times: Mode 2 [Momentary]
- LED flashes 4 times: Mode 3 [Interlocking]

Each four-click operation on the K/O pin cycles the output mode sequentially (saved after power-off). All output pins (D0~D3) default to low level output. After the LED flashing sequence finishes, the module exits output mode switching mode.

③ **Restore Factory Settings:**

Press and hold the K/O pin of the E160-RxFS1L (keep high level for at least 5000ms). The LED remains ON for 2 seconds and then turns OFF, while all stored pairing information (address codes) is cleared.

④ **Supported Pairing Quantity:**

The E160-RxFS1L can store up to 15 groups of address codes. When the limit is exceeded, the earliest stored address codes will be overwritten sequentially.

⑤ **Mode Description (under EV1527 encoding protocol, paired and with stable communication):**

Momentary Mode (supports multiple buttons): When any button on the transmitter is pressed, the corresponding key output pin on the receiver (E160-RxFS1L) outputs a high level. When the transmitter button is released, the corresponding receiver output pin returns to low level (default). In this mode, multiple key signals can be output simultaneously.

Self-locking Mode (supports multiple buttons): When any button on the transmitter is pressed, the corresponding key output pin state on the receiver (E160-RxFS1L) toggles. After the transmitter button is released, the receiver output state remains unchanged.

Interlocking Mode (single button only): When any button on the transmitter is pressed, the corresponding key output pin on the receiver (E160-RxFS1L) outputs high level, while all other output pins remain low level. Only one output pin can remain high at a time. When the transmitter button is released, the corresponding receiver output pin returns to low level (default).

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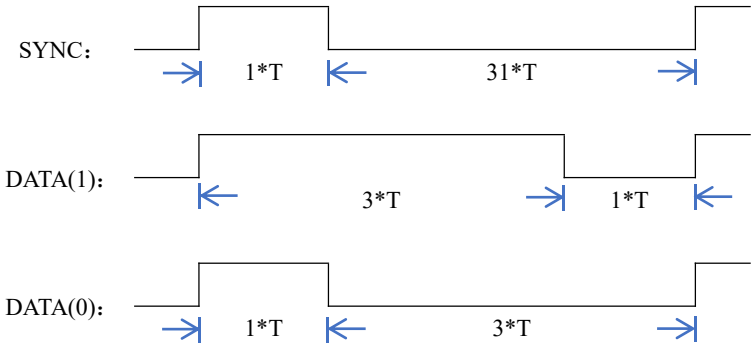
4.2 Software Development

If users intend to use their own transmitter with the E160-RxFS1L module, it is necessary to understand the data frame structure recognized by the E160-RxFS1L module.

The EV1527 encoding frame structure consists of a “SYNC code”, a 20-bit “Address Code”, and a 4-bit “Key Code”. The E160-RxFS1L only supports the EV1527 encoding protocol. The basic time unit is T(ms), where T = 0.35ms.

Each data bit consists of 4T:

- “DATA(1)” consists of 3*T high level* + *1*T low level
- “DATA(0)” consists of 1*T high level* + *3*T low level



The E160-RxFS1L module can store up to 15 groups of address codes and recognizes four key values: “0001”, “0010”, “0100”, and “1000”, corresponding respectively to pins “D0”, “D1”, “D2”, and “D3”.

EV1527 Encoding Protocol					
32*T	80*T （20 bits）	4*T （1 bit）	4*T （1 bit）	4*T （1 bit）	4*T （1 bit）
Sync Code	Address Code C0~C19 (1 million groups)	D0	D1	D2	D3

Chapter 5 Hardware Design

- It is recommended to use a DC regulated power supply for the module. The power ripple coefficient should be as low as possible (less than 100mV), and the module must be reliably grounded;
- Please pay attention to correct polarity connection of the power supply. Reverse connection may permanently damage the module;
- Please check the power supply to ensure it is within the recommended voltage range. Exceeding the maximum value may permanently damage the module;
- Please ensure power supply stability. Voltage fluctuations should not be excessive or frequent;
- When designing the module power supply circuit, it is recommended to reserve more than 30% margin to ensure long-term stable operation of the whole system;
- The module should be kept away from power supplies, transformers, high-frequency traces, and other sources of strong electromagnetic interference;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid routing underneath the module. If routing underneath is unavoidable and the module is mounted on the Top Layer, ground copper should be poured on the Top

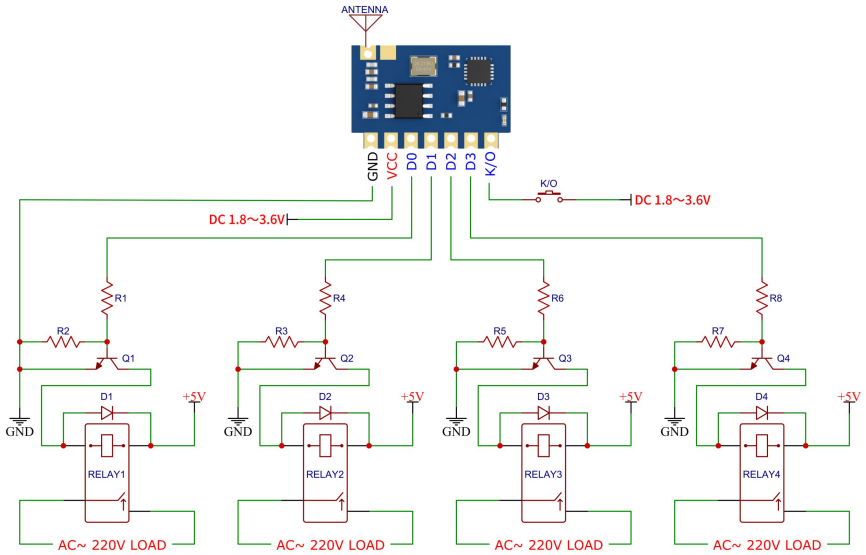
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Layer contact area (fully grounded), while routing should be placed close to the digital section and routed on the Bottom Layer;

- If the module is mounted or placed on the Top Layer, random routing on the Bottom Layer or other layers is also incorrect and may affect module spurious performance and receive sensitivity to varying degrees;
- If strong electromagnetic interference devices are present around the module, module performance may be greatly affected. Depending on interference intensity, appropriate spacing, shielding, or isolation is recommended;
- If strong electromagnetic interference traces (high-frequency digital, high-frequency analog, or power traces) are present around the module, module performance may also be significantly affected. Proper spacing and shielding are recommended where possible;
- Keep away from some TTL protocols operating at 2.4GHz physical layer frequencies, such as USB3.0;
- Antenna installation structure has a significant impact on module performance. Ensure the antenna is exposed and preferably oriented vertically upward. When the module is installed inside an enclosure, a high-quality antenna extension cable may be used to extend the antenna outside the enclosure;
- The antenna must not be installed inside a metal enclosure, otherwise the transmission distance will be greatly reduced.

Chapter 6 Reference Circuit



E160-RxFS1L Reference Circuit

Chapter 7 Frequently Asked Questions

7.1 Unsatisfactory Communication Distance

- Communication distance will decrease when obstacles exist in the direct communication path;
- Temperature, humidity, and same-frequency interference may increase packet loss rate;
- Ground absorption and reflection of radio waves may result in poor performance when testing close to the ground;

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- Seawater strongly absorbs radio waves, therefore communication performance near the seaside may be poor;
- Metal objects near the antenna or installation inside a metal enclosure will severely attenuate the signal;
- Incorrect power register settings or excessively high air data rate settings (higher air data rates result in shorter communication distance);
- Under room temperature conditions, if the supply voltage is lower than the recommended value, lower voltage results in lower transmit power;
- Poor antenna matching or poor antenna quality may also affect communication distance.

7.2 Module Easily Damaged

- Please check the power supply voltage to ensure it remains within the recommended range. Exceeding the maximum value may permanently damage the module;
- Please ensure power supply stability. Excessive or frequent voltage fluctuations may damage the module;
- Ensure anti-static protection during installation and operation. RF devices are sensitive to electrostatic discharge;
- Ensure humidity during installation and operation is not excessively high, as some components are humidity-sensitive;
- Unless required for special applications, operation under excessively high or low temperatures is not recommended.

7.3 Excessive Bit Error Rate

- Nearby same-frequency signal interference. Keep away from interference sources or change frequency/channel settings to avoid interference;
- Poor power supply quality may also cause garbled data. Ensure reliable power supply;
- Poor-quality or excessively long extension cables and feeder cables may increase the bit error rate.

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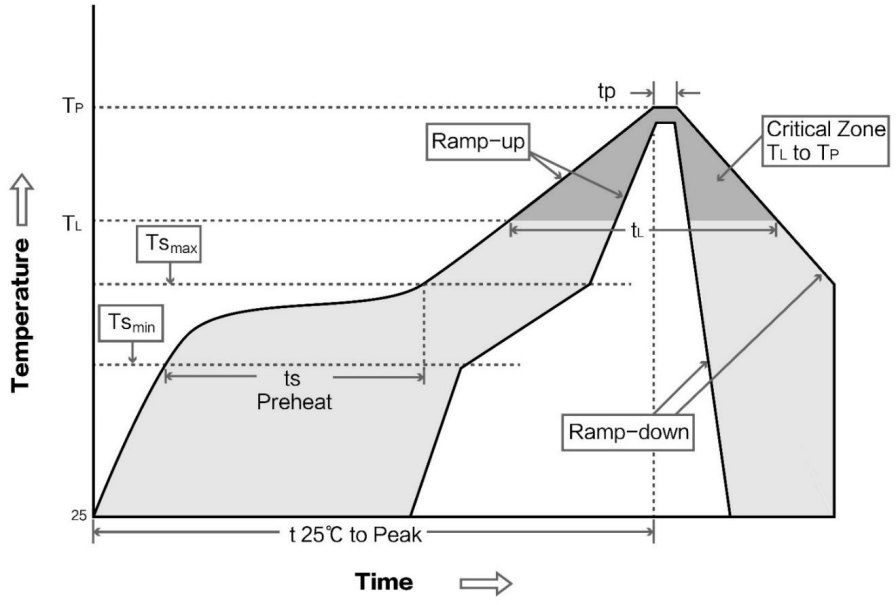
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Chapter 8 Soldering Guidelines

8.1 Reflow Soldering Temperature

Profile Feature	Curve Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Minimum Preheat Temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum Preheat Temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheat Time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average Ramp-up Rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquidous Temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time Above Liquidous	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak Temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average Ramp-down Rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25℃ to Peak Temperature	6 minutes max	8 minutes max

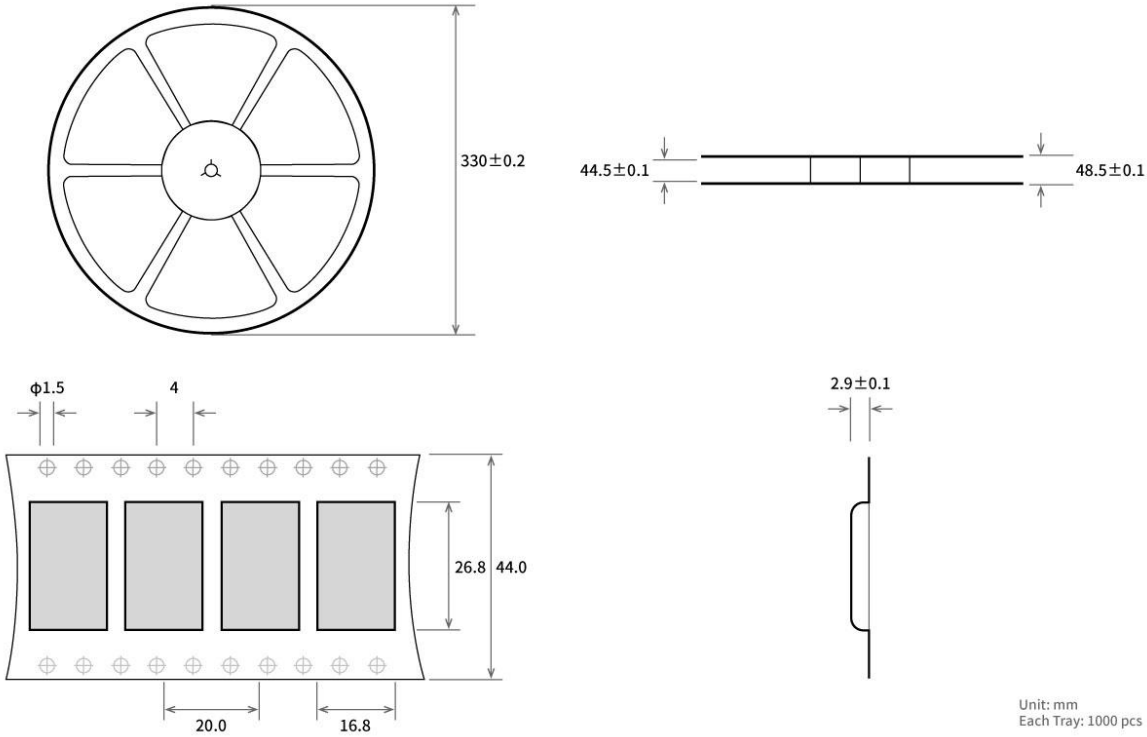
8.2 Reflow Soldering Curve



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Chapter 9 Bulk Packaging Method



Revision History

Version	Revision Date	Revision Description	Maintainer
1.0	2026-05-15	Initial Version	Lan

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