E160-RxFS1 Product User Manual

OOK/ASK Superheterodyne 315/433.92MHz Four-channel Output Receiver Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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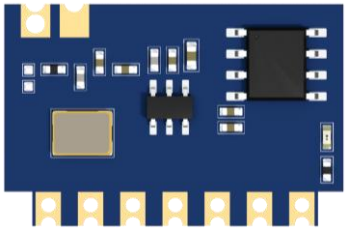
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1 Product Overview

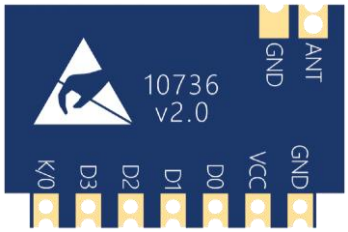
1.1 Product Introduction

E160-RxFS1 is a low-cost OOK/ASK modulation 315MHz/433.92MHz with 4-channel output wireless receiving module developed by Ebyte . It adopts high-performance chips and has good anti-interference performance ; it has 4 output ports, which can realize output functions such as inching, flipping, and interlocking, supports EV1527 standard encoding, and can save 15 groups of address codes; it has the characteristics of small size, high performance, wide voltage, and high stability . It can pass FCC and CE certification and is suitable for simple control applications: small home appliance remote control, toy remote control, access control system remote control, electric bicycles and other application scenarios .

** It cannot be used for direct communication after leaving the factory. It needs to be paired with our E160-TxFS1 or other OOK/ASK modulated transmitter modules that comply with 1527 coding rules .*



Front (E160-R4FS1)



Back (E160-R4FS1)

1.2 Features

- Small size: 20.3 × 13.3 × 3.0mm (L × W × H) ;
- Wide operating voltage: 2.0V ~ 5.5V;
- Low receiving current: <9.5A (when the supply voltage is 3.3 ~ 5.5V) ;
- ESD HBM electrostatic protection capability: ≥4KV ;
- Compatible with EV1527 standard encoding format;
- A maximum of 15 address codes can be saved (can be paired with 15 different remote controls);
- It has 4 independent level output pins (can realize inching, reversing and interlocking);
- Communication distance: 240m;

1.3 Application Scenario

- Remote control of small appliances (fans, lighting)
- Toy remote control
- Access control system remote control
- Electric bikes

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2 Specifications

2.1 RF parameters

RF parameters	Parameter Value	Remark
Operating frequency (MHz)	315/433.92	E160-R3FS1(315MHz)/E160-R4FS1(443.92MHz)
Modulation	ASK/OOK	Amplitude Keying/On-Off Keying
Blocking power (dBm)	10	-
Maximum transmit power (dBm)	-	The receiving module does not have this parameter
Receive sensitivity (dBm)	-109	@315MHz/433.92MHz
Receive bandwidth (dBc)	±200	-
Transfer rate (kbps)	4	Specifically refers to the rate that the radio unit can support, not the actual transmission rate of the module
Frequency deviation (MHz)	±0.05	-
Antenna impedance (Ω)	50	-
Reference communication distance (m)	240	When used with E160-TxFS1, in a clear and open environment , with an antenna gain of 1.5dBi and a height of 2m

2.2 Electrical parameters

Electrical parameters	Minimum	Typical Value	Maximum	Remark
Operating voltage (V)	2.0	-	5.5	≥ 5.0 V to ensure optimal performance
Communication level (V)	2.0	-	5.5	Based on the supply voltage
Emission current (mA)	-	-	-	The receiving module has no receiving current
Receive current (mA)	7.0	-	9.5	Within the rated power supply range
Sleep current (μA)	-	-	-	Normal receiving state, that is, equal to the receiving current
Startup time (ms)	-	2.0	-	The time it takes for the module to enter normal working state after power-on
ESD Protection (KV)	-4		+4	ESD HBM Electrostatic Discharge Human Body Model
Operating temperature (℃)	-40	-	+ 85	Industrial-grade design
Operating humidity (%rh)	10	-	90	-
Storage temperature (℃)	- 55	-	+125	-

2.3 Hardware Parameters

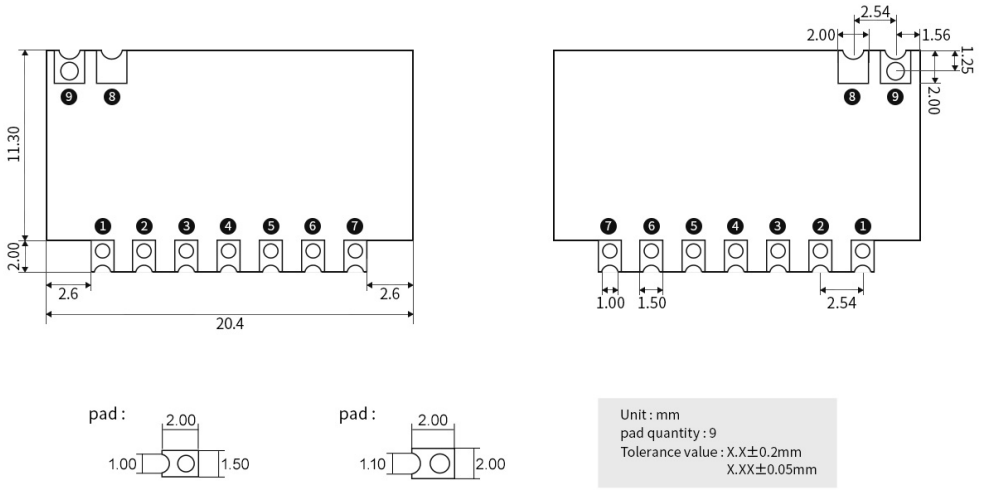
Hardware Parameters	Parameter Value	Preparation Note
Crystal frequency (MHz)	9.84374	E160-R3FS1(315MHz)
	13.56	E160-R4FS1(443.92MHz)
Module size (mm)	20.4*11.3*3.0	Length*Width*Height

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Antenna type	Stamp Holes	-
Communication interface	GPIO	The supplied voltage is based on
Package	Patch/Stamp Hole	Pin spacing 2.54mm, please see Chapter 3 for detailed dimension information
Weight (g)	3.65	-

3 Mechanical Dimensions and Pin Definition



Pin Number	Pin Name	Pin Direction	Pin Purpose
1	GND	-	Power Ground
2	VCC	Power	DC 2.0 ~ 5.5V
3	D0	Output	Push-pull output, sink current (low level) 35mA, source current (high level) 10mA; High level is effective, low level after power-on reset
4	D1	Output	Push-pull output, sink current (low level) 35mA, source current (high level) 10mA; High level is effective, low level after power-on reset
5	D2	Output	Push-pull output, sink current (low level) 35mA, source current (high level) 10mA; High level is effective, low level after power-on reset
6	D3	Output	Push-pull output, sink current (low level) 35mA, source current (high level) 10mA; High level is effective, low level after power-on reset
7	K/O	Input/Output	When input, high level is valid(Built-in pull-down resistor); When outputting, the LED on the driver module is high level effective
8	GND	-	Power Ground
9	ANT	-	Antenna pin (receiver module, only receive, no transmit)

4 Development and use

The E160-RxFS1 four-channel output receiving module can be used directly with our E160-TxFS1 transmitting module, or with other transmitting modules that use OOK/ASK modulation and comply with 1527 coding rules. The E160-RxFS1 has

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four high and low level output ports, which can realize logic control such as inching, flipping and interlocking, and is convenient for application in some small household appliance scenarios with simple control logic.

4.1 Operation and use

Below we use our company's E160-RxFS1 (receiver module) and E160-TxFS1 (transmitter module) as operation examples to explain how to configure and use E160-RxFS1:

① **Enter pairing (coding) mode** :

Short press (hold high for at least 100ms) the K/O pin of E160-RxFS1, and the LED will start to flash at a rate of 2Hz for 8 seconds, during which the module is in pairing mode. At this point, pressing any key on E160-TxFS1 will complete the pairing (the LED will stop flashing once, and only one address can be paired at a time). This means that E160-RxFS1 has saved the address code information of the transmitter, and the data is retained even if the power is lost. If the pairing is completed or if the timeout (8 seconds) is reached, E160-RxFS1 will exit the pairing mode. During the pairing mode, the K/O button is disabled (it cannot be operated).

② **Switch output mode** :

The E160-RxFS1 is preset to point mode at factory default. Double-click the K/O pin of the E160-RxFS1 (holding high for at least 50ms each time) to start the LED flashing at a rate of 2Hz: one flash indicates mode 1 [flip], two flashes indicate mode 2 [point], and three flashes indicate mode 3 [interlock]. Each double-click of the K/O pin to switch modes will sequentially change the output mode (power-off saved), with all output pins (D0~D3) defaulting to low level. Once the LED flashes complete, the output mode switching stops, and the K/O button becomes inactive during this period.

③ **Restore factory settings** :

Long press (at least 3000ms high level) the K/O pin of E160-RxFS1, the LED will be extinguished for 2s and the saved pairing information (address code) will be cleared.

④ **Number of pairs supported** :

The E160-RxFS1 can save up to 15 sets of address codes. After exceeding the maximum, the first address code will be overwritten in sequence.

⑤ **Mode description (1527 coding rules, and has been paired and well communicated):**

Dotted mode (supporting multiple keys): When the transmit end presses any key, the corresponding pin on the receive end (E160-RxFS1) outputs a high level; when the transmit end releases the key, the corresponding pin on the receive end (E160-RxFS1) outputs a low level (default). In this mode, the receive end (E160-RxFS1) can simultaneously output multiple key value signals.

Flipping mode (supporting multiple keys): When the key at the transmitting end is pressed, the level state of the corresponding key value pin at the receiving end (E160-RxFS1) is flipped; when the key at the transmitting end is released, the level state of the corresponding key value pin at the receiving end (E160-RxFS1) remains.

Interlock mode (only supports a single button): When the button on the transmitting end is pressed, the corresponding key value pin of the receiving end (E160-RxFS1) outputs a high level, while all other pins output a low level, with only one pin outputting a high level. After the button on the transmitting end is released, the corresponding pin of the receiving end (E160-RxFS1) outputs a low level (default).

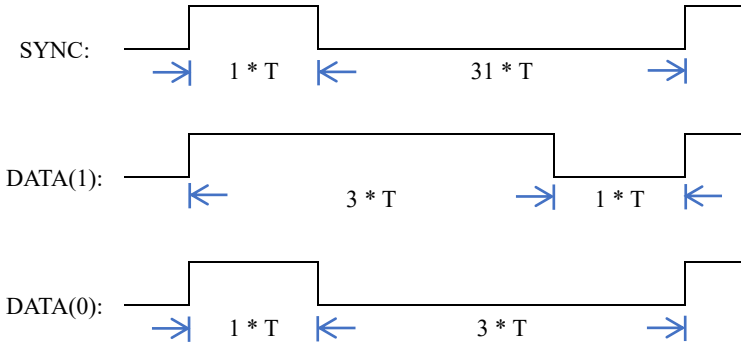
4.2 Software Development

If the user wants to use his own transmitter with our E160-RxFS1 module, then we must understand the data frame structure that the E160-RxFS1 module can recognize. The 1527 encoding rule data frame structure is composed of "synchronization code", 20-bit "address code" and 4-bit "key value code". The E160-RxFS1 module only supports the 1527 encoding rule, and the basic unit time is T

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(ms), T = 0.35ms timing data. The data bit is composed of 4 Ts, of which " DATA (1) " is composed of 3 * T high level plus 1 * T low level; " DATA (0) " is composed of 1 * T high level plus 3 * T low level.



The E160-RxFS1 module can save 15 groups of address codes and can identify four key values such as "0001", "0010", "0100", and "1000", which correspond to the "D0", "D1", "D2", and "D3" pins of the E160-RxFS1 module.

1527 Encoding Rules					
32 * T	80 * T (20 bits)	4 * T (1 bit)	4 * T (1 bit)	4 * T (1 bit)	4 * T (1 bit)
Synchronous code	Address code C0 ~ C19 (million groups)	D0	D1	D2	D3

5 Hardware Design

- It is recommended to use a DC regulated power supply to power the module. The power supply ripple coefficient should be as small as possible (less than 100mV) , and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged.
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from power supplies, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid the bottom of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, ground copper should be laid on the Top Layer of the module contact part (all copper should be laid and well grounded), and it must be close to the digital part of the module and routed on the Bottom Layer ;
- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the module's spurious signal and receiving sensitivity to varying degrees ;
- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power

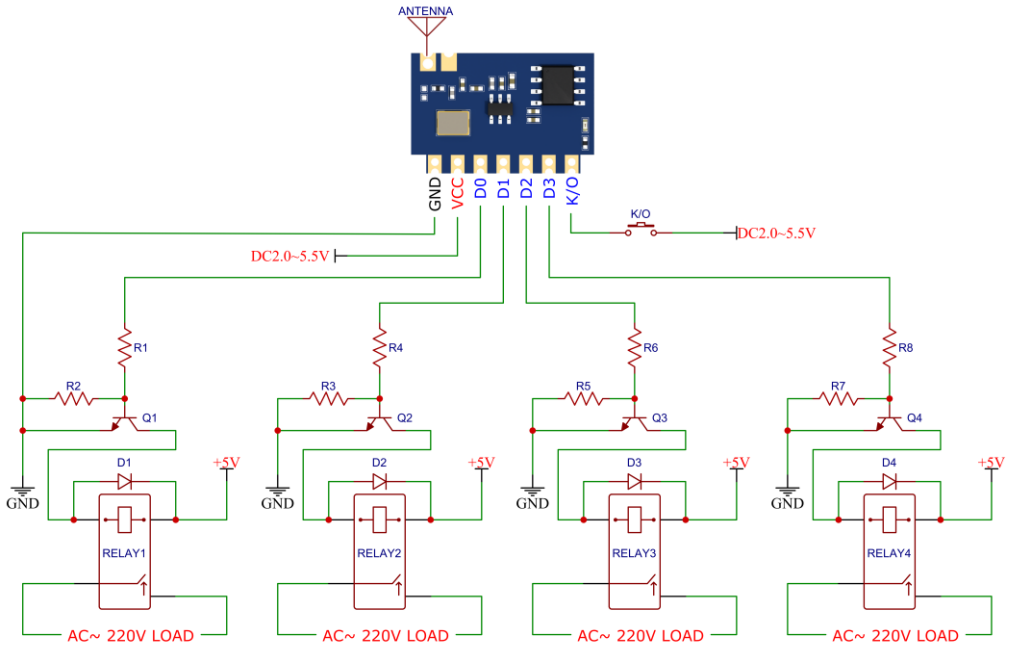
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traces), it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.

- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Make sure the antenna is exposed and preferably vertically upward. When the module is installed inside the housing, you can use a high-quality antenna extension cable to extend the antenna to the outside of the housing;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.

6 Reference Circuit



E 160-RxFS1 Reference Circuit

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7 FAQ

7.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance) ;
- The power supply voltage is lower than the recommended value at room temperature. The lower the voltage, the lower the power output .
- The antenna used does not match the module well or the antenna itself has quality issues.

7.2 Modules are vulnerable to damage

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity ;
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

7.3 The bit error rate is too high

- There is interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Extension cables or feeder cables that are of poor quality or are too long can also cause a high bit error rate.

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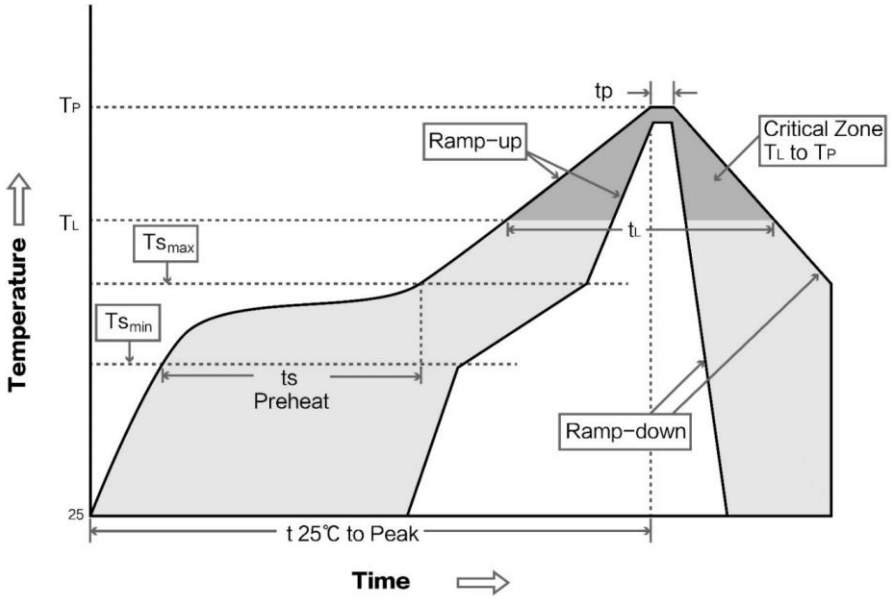
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8 Welding Operation Instructions

8.1 Reflow temperature

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

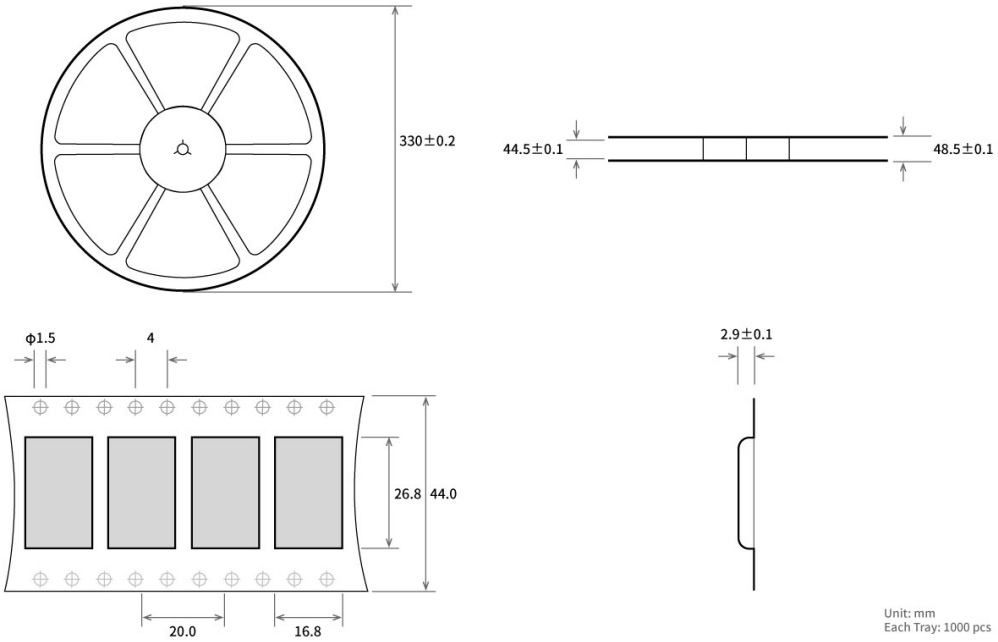
8.2 Reflow Oven Curve



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9 Bulk Packaging Methods



Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2024-12-27	First edition	Ning
1.1	2025-06-19	Modify the size description and modify the operation description	Ning

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