E160-TxFS1 User Manual

OOK/ASK superheterodyne 315/433.92MHz with 4-way key transmitter module

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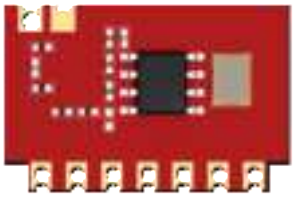
Chapter 1 Product Overview

1.1 Product Introduction

E160-TxFS1 is a low-cost OOK/ASK modulation 315MHz/433.92MHz wireless transmitter module with 4-way button input developed by Ebyte . It uses high-performance chips, internally integrated PLL and power amplifier to ensure signal power output; it has 4 independent buttons (values), supports EV1527 standard encoding, and comes with 20-bit address code (millions of groups) at the factory; it has the characteristics of small size, ultra-low power consumption, high performance, wide voltage, and high power . It can pass FCC and CE certification and is suitable for button battery power supply. It is suitable for simple control applications: small home appliance remote control, toy remote control, access control system remote control, electric bicycle and other application scenarios .

** The module has a unique address code (20 bits/million groups), so there is no need to worry about address code duplication (an extremely small probability of one in a million) .*



Front (E160-T4FS1)

Back (E160-T4FS1)

1.2 Features

- Small size: 20.3 × 13.3 × 3.0mm (L × W × H) ;
- Wide operating voltage: 1.8V ~ 5.5V;
- Ultra-low standby power consumption: 0.01uA (shutdown current) ;
- High power: +17dBm (5V power supply);
- High temperature resistance: can work normally at 120℃;
- ESD HBM electrostatic protection capability: 8KV (RFout pin 6KV) ;
- Compatible with EV1527 standard encoding format;
- Internally solidified 20-bit address code (millions of groups);
- It has 4 independent key input pins;
- Communication distance: 240m;

1.3 Application Scenario

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

Chapter 2 Specifications

2.1 RF parameters

RF parameters	Parameter Value	Remark
Operating frequency (MHz)	315/433.92	E160-T3FS1(315MHz)/E160-T4FS1(443.92MHz)
Modulation	ASK/OOK	Amplitude Keying/On-Off Keying
Blocking power (dBm)	-	The transmitter module does not have this parameter
Maximum transmit power (dBm)	14±1.0	When the supply voltage is 3V
	17±1.0	When the supply voltage is 5V
Harmonic suppression (dBc)	>45	@433MHz, 15dBm, second harmonic
Transfer rate (kbps)	2.86	Fixed value
Frequency deviation (MHz)	±0.05	-
Antenna impedance (Ω)	50	-
Reference communication distance (m)	240	When used with E160-RxFS1, in a clear and open environment , with an antenna gain of 1.5dBi and a height of 2m

2.2 Electrical parameters

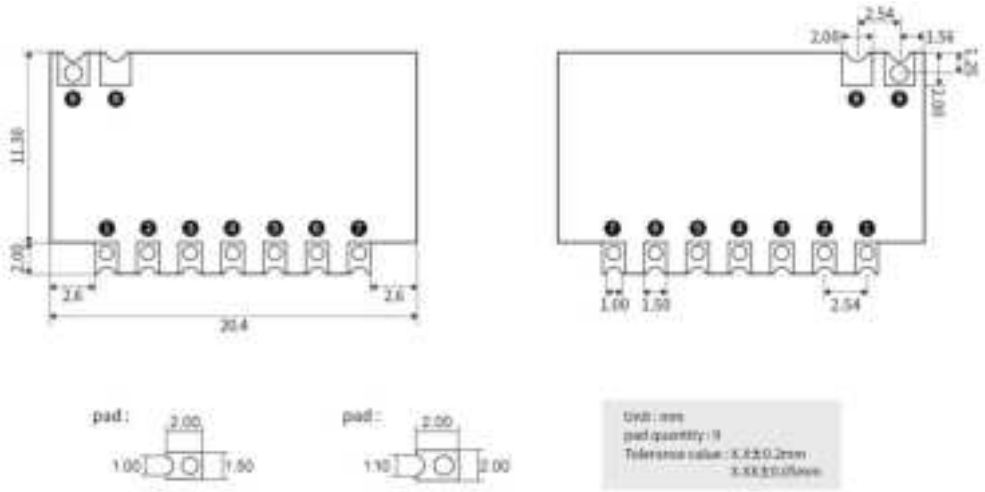
Electrical parameters	Minimum	Typical Value	Maximum	Remark
Operating voltage (V)	1. 8	3.0	5.5	≥ 5.0 V can guarantee the maximum output power , exceeding 5.5 V may cause burnout
Communication level (V)	1.8	3.0	5.5	Based on the supply voltage
Emission current (mA)	-	10.0	-	When the supply voltage is 5.0V, the frequency is 433.92MHz, and the output power is 17dBm, the instantaneous power consumption
Receive current (mA)	-	-	-	The transmitter module has no receiving current
Sleep current (μA)	-	0.01	-	When not transmitting data (transmitting state), it is dormant
Startup time (ms)	-	2.0	-	The time it takes for the module to enter normal working state after power-on
ESD Protection (KV)	-8		+8	HBM, special note: RF pin is ±6KV
Operating temperature (℃)	-40	-	+ 120	Industrial-grade design
Operating humidity (%rh)	10	-	90	-
Storage temperature (℃)	- 65	-	+150	-

2.3 Hardware Parameters

Hardware Parameters	Parameter Value	Remark
Crystal frequency (MHz)	9.84374	E160-T3FS1(315MHz)
	13.56	E160-T4FS1(443.92MHz)

Module size (mm)	20.3*13.3*3.0	Length*Width*Height
Antenna type	Stamp Holes	-
Communication interface	GPIO	Communication level 1.8 ~ 5.5V, 3.3V is recommended to ensure data reliability
Packaging	Patch/Stamp Hole	Pin spacing 2.54mm, please see Chapter 3 for detailed dimension information
Weight (g)	3.65	-

Chapter 3 Mechanical Dimensions and Pin Definition

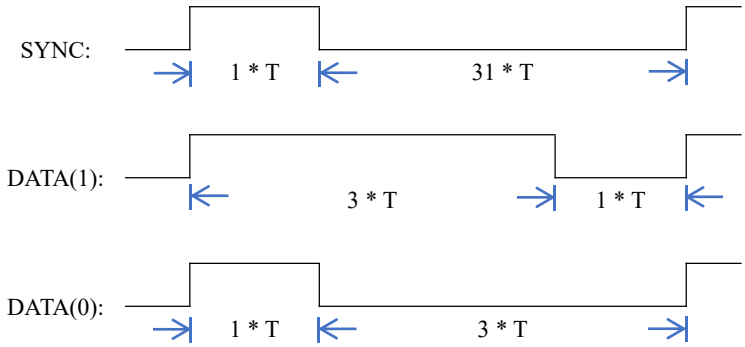


Pin number	Pin Name	Pin Direction	Pin Purpose
1	K0	Input	Key input pin, low level is effective, lasts at least 100ms, key value is "0001"
2	K1	Input	Key input pin, low level is effective, lasts at least 100ms, key value is "0010"
3	K2	Input	Key input pin, low level is effective, lasts at least 100ms, key value is "0100"
4	K3	Input	Key input pin, low level is effective, lasts at least 100ms, key value is "1000"
5	VDD	Power supply	DC 1.8 ~ 5.5V
6	GND	-	Power Ground
7	GND	-	Power Ground
8	GND	-	Power Ground
9	ANT	Output	Antenna pin (transmitter module, only transmit, no receive)

Chapter 4 Software development and use

The E160-TxFS1 can be used directly with our E160-RxFS1 receiver module. E160-TxFS1 can be connected to four external keys to send key values, or it can be connected to the MCU pin to simulate key actions to send key values.

If the user wants to parse the data sent by the E160-TxFS1 transmitter at the receiving end, they must understand the data frame structure sent by the E160-TxFS1. The square wave demodulated by the receiving end through the RF unit consists of a "synchronization code", a 20-bit "address code" and a 4-bit "key code" (1527 encoding rule). The basic unit time of the E160-TxFS1 signal is T (ms), T = 0.35ms. The data bit consists of 4 Ts, of which " DATA (1) " consists of 3 * T high level plus 1 * T low level; " DATA (0) " consists of 1 * T high level plus 3 * T low level.



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

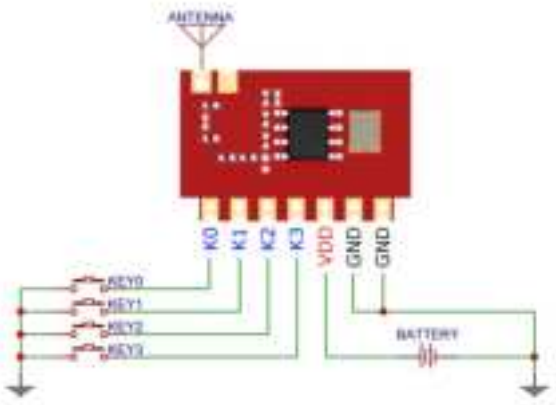
Chapter 5 Hardware Design

- 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 parts with large electromagnetic interference, such as power supplies, transformers, and high-frequency wiring;
- 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 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.

Chapter 6 Reference Circuit



E 160-TxFS1 Reference Circuit

Chapter 7 Frequently Asked Questions

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 at room temperature is lower than the recommended value. 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

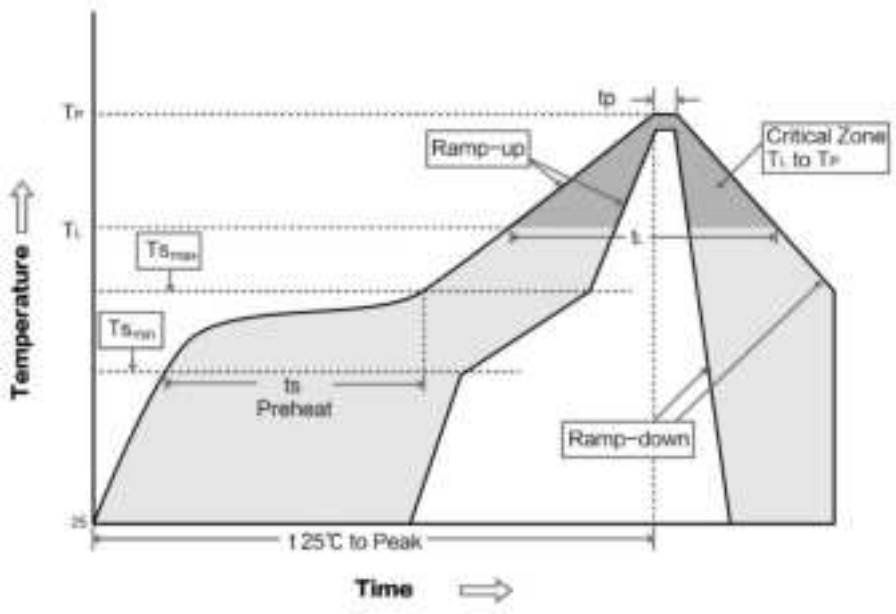
- There is interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Extension cables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

Chapter 8 Welding Operation Instructions

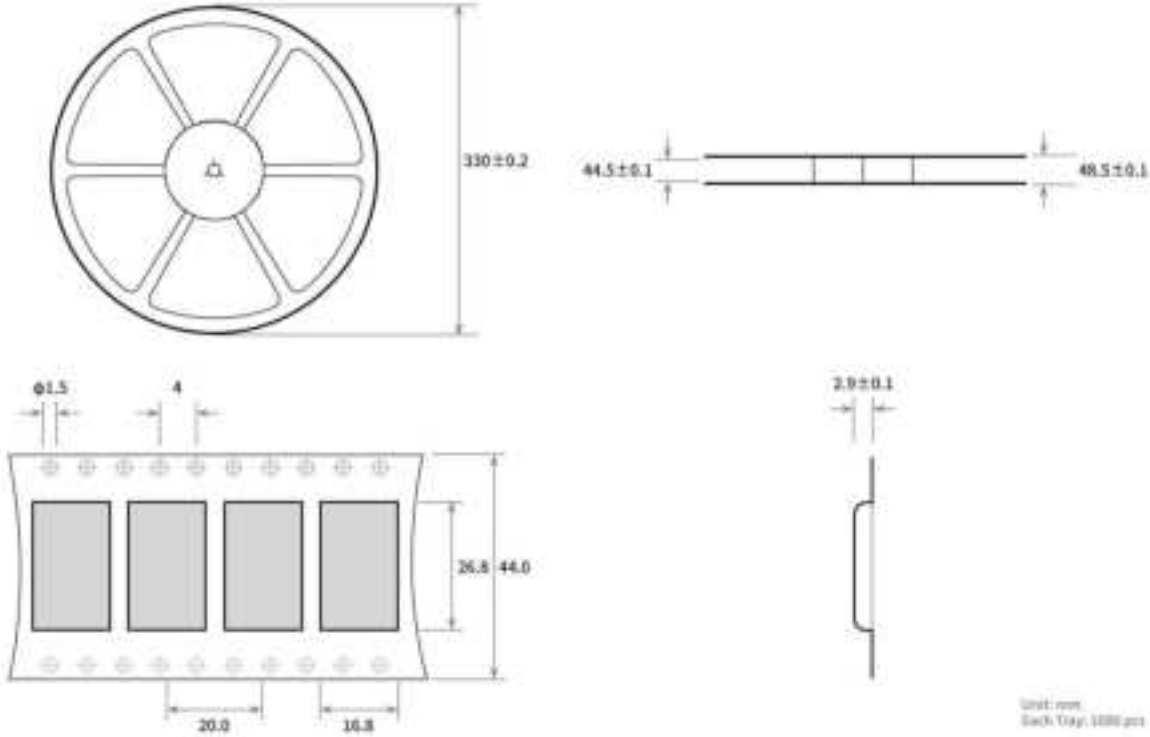
8.1 Reflow temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Minimum preheating temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ascent rate	3℃/second max	3℃/second max
Liquid Temperature (TL)	Liquidus temperature	183℃	217℃
Time(tL)Maintained Above(TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average descent 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 Oven Curve



Chapter 9 Bulk Packaging Method



Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2024-12-27	First edition	Ning

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