E160 - TxMS1 Product Data Sheet

OOK/ASK 315/433.92MHz Superheterodyne Transmitter Module

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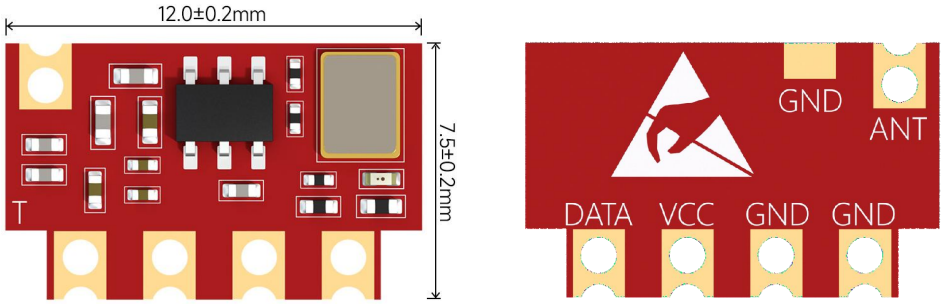
Chapter 1 Product Overview

1.1 Product Introduction

E160-TxMS1 is an extremely low-cost OOK/ASK modulation 315MHz/433.92MHz wireless transmitter module developed by Ebyte . It uses high-performance RF chips and narrowband matching networks to improve harmonic suppression capabilities and ensure signal power output; it has the characteristics of small size, 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 application scenarios such as small home appliance remote control, toy remote control, access control system remote control, tire pressure detection system, and wireless data transmission .

* Since this module is a pure hardware RF module, users need to encode its input signal before it can be used directly .



E160-TxMS1

1.2 Features

- Small size: 12.0 × 7.5 × 2.0mm (L × W × H) ;
- Low power consumption: 0.01uA (when not transmitting) ;
- High speed: supports up to 40kbps transmission rate;
- High power: +12dBm;
- High temperature resistance: can work normally at 120℃;
- Built-in narrowband matching network to improve harmonic suppression capability ;
- Communication distance: 210m;
- With emission indicator light ;

1.3 Application Scenario

- Remote control of small appliances (fans, lighting)
- Toy remote control
- Access control system remote control
- Tire pressure detection

- Wireless data transmission

Chapter 2 Specifications

2.1 RF parameters

RF Parameters	Parameter Value	Remark
Operating frequency (MHz)	315/433.92	-
Modulation	ASK/OOK	Amplitude Keying/On-Off Keying
Blocking power (dBm)	-	The transmitter module does not have this parameter
Maximum transmit power (dBm)	12.0±1.0	When the supply voltage is 3.3V
Harmonic suppression (dBc)	>40	@433MHz, 12dBm, second harmonic
Transfer rate (kbps)	0.5～40	Determined by software programmed pulse width timing
Frequency deviation (MHz)	±0.05	-
Antenna impedance (Ω)	50	-
Reference communication distance (m)	210	When used with E160-RxMS1, in a clear and open environment , with an antenna gain of 1.5dBi and a height of 2m

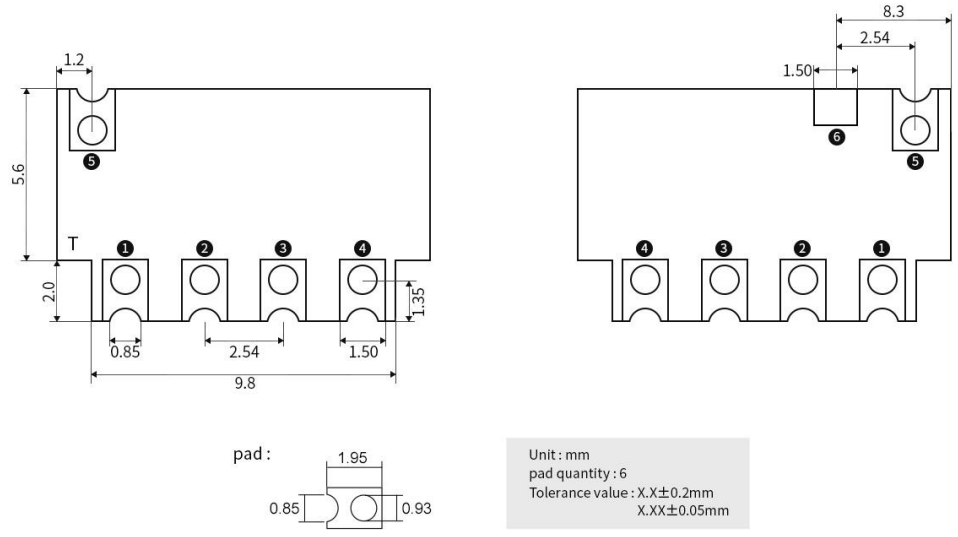
2.2 Electrical parameters

Electrical Parameters	Minimum	Typical Value	Maximum	Remark
Operating voltage (V)	1. 8	3. 3	3. 6	≥3.3 V can guarantee output power,exceeding 3.6 V may cause burnout
Communication level (V)	-	3.3	-	Using 5V TTL may cause burnout , please use the conversion circuit reasonably
Emission current (mA)	15.0	16.0	17.0	@3.3V, 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
Operating temperature (℃)	-40	-	+ 120	Industrial-grade design
Operating humidity (%rh)	10	-	90	-
Storage temperature (℃)	- 65	-	+150	-

2.3 Hardware Parameters

Hardware Parameters	Parameter Value	Preparation Note
Crystal frequency (MHz)	13.56	-
Module size (mm)	12.0*7.5*2.0	Length*Width*Height
Antenna type	Stamp Holes	-
Communication interface	GPIO	Communication level 1.8 ~ 3.6V, 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)	1.85	-

Chapter 3 Mechanical Dimensions and Pin Definition

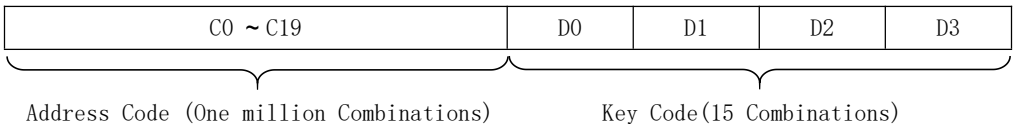


Pin Number	Pin Name	Pin Direction	Pin Purpose
1	GND	power supply	-
2	GND	power supply	-
3	VCC	power supply	DC 1.8 ~ 3.6V
4	DATA	Input	Data input pin
5	ANT	Output	Antenna pin (transmitter module, only
6	GND	power supply	-

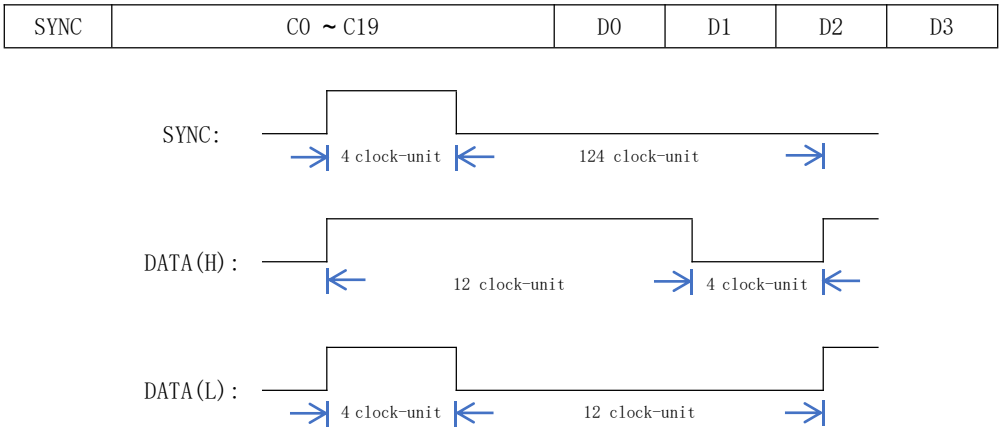
Chapter 4 Software development and use

In terms of the coding type of wireless remote control, it can be divided into two categories : one is fixed code, that is, the address of the coding chip is unchanged, and the chip models are represented by HS 1527, EV 1527, RT 1527, FP 1527, and PT226 2 ; the other is rolling code, the address code of the chip is changing, and the chip models are represented by HS300 and HS301.

We take the common 1527 encoding as an example to briefly introduce the data frame structure characteristics of wireless remote control. Each frame of 1527 data consists of 24 data bits, the first 20 bits are address codes, and the last 4 bits are key codes. Usually, the 1527 encoding IC will be pre-programmed with 20-bit address codes, with a total of 1048576 address code combinations, and the 4-bit key code is determined by the K0 ~ K3 input pins on the corresponding IC, with a maximum of 15 key code combinations.



There is a synchronization pulse before the data bit, that is, each frame of data starts with a synchronization pulse. The "1" and "0" of the data bit are determined by the ratio of the high and low level widths (pulse widths). If the high level width is three times the low level width, it means logic "1", and conversely, if the low level is three times the high level width, it means logic "0". The ratio of the high level and low level of the synchronization pulse is fixed at 4:124.



From this we can conclude that the pulse signal can be input to the module through the DATA pin of E160-TxMS1, and the module converts it into a wireless RF signal for transmission. On the contrary, the receiving end is converted into a pulse signal by the E160-RxMS1 module and output from the DATA pin. The minimum pulse period for communication is determined by the "transmission rate" of the module. For example: the maximum "transmission rate" of the transmitter module is 40kbps, and the maximum "transmission rate" of the receiver module is 4kbps, then the maximum "transmission rate" between the two is determined by the receiver module, which is 4kbps.

Above we briefly introduced a public encoding rule, which can also be considered as a communication protocol, from which we can also formulate a private encoding rule by ourselves: by changing the frame structure (packet length/number of bytes), pulse width, pulse period and 0/1 data judgment logic.

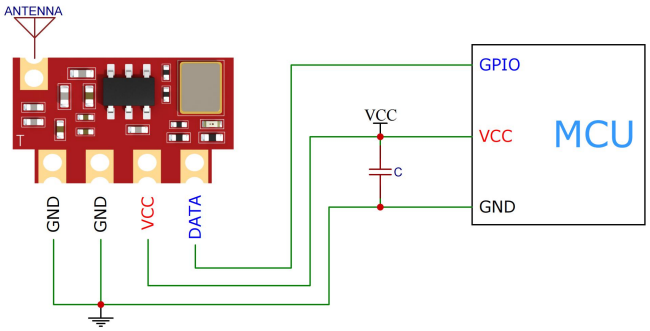
As for those public encoding rules, you can easily find encoding and decoding instructions and sample codes on the

Internet, so Xiaoyi will not give examples one by one.

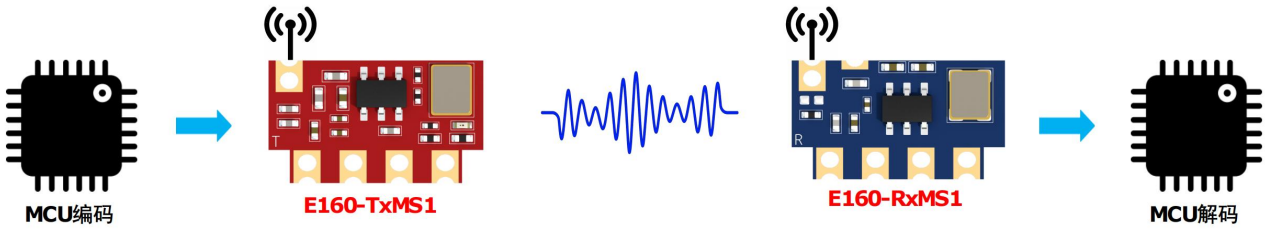
Charpter 5 Hardware Design

- 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 and the module should 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, so that the whole machine can work stably for a long time;
- 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 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, 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.

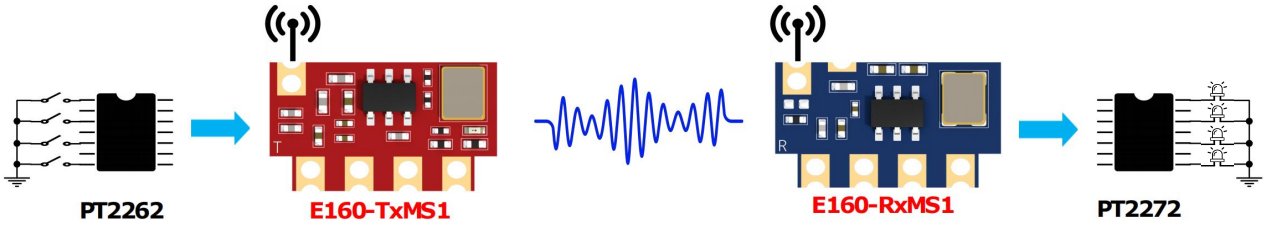
Chapter 6 Reference Circuit and Application Schematic



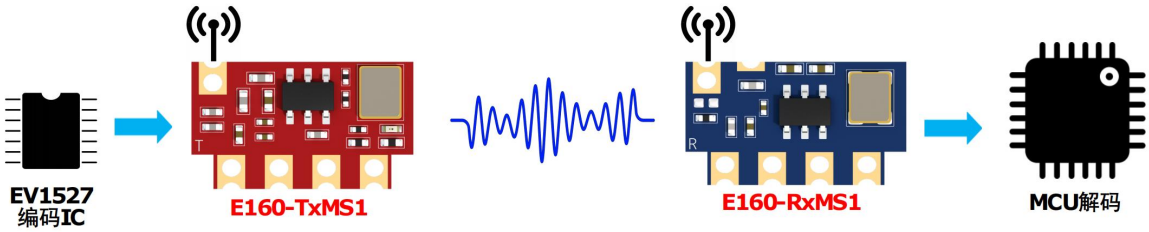
※ E160-TxMS1 and MCU application connection diagram ※



※ E160-TxMS1/E160-RxMS1 and MCU application connection diagram ※



※ E160-TxMS1/E160-RxMS1 and PT2262/PT2272 application connection diagram ※



※ E160-TxMS1/E160-RxMS1 and EV1527 encoder IC application connection diagram ※

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 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

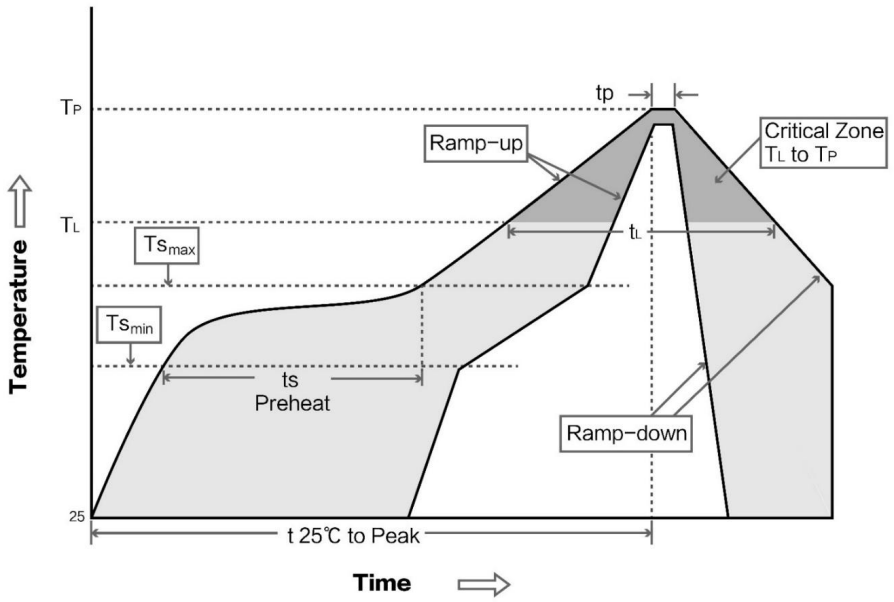
- There is interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Extension cables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

Chapter8 Welding Operation Instructions

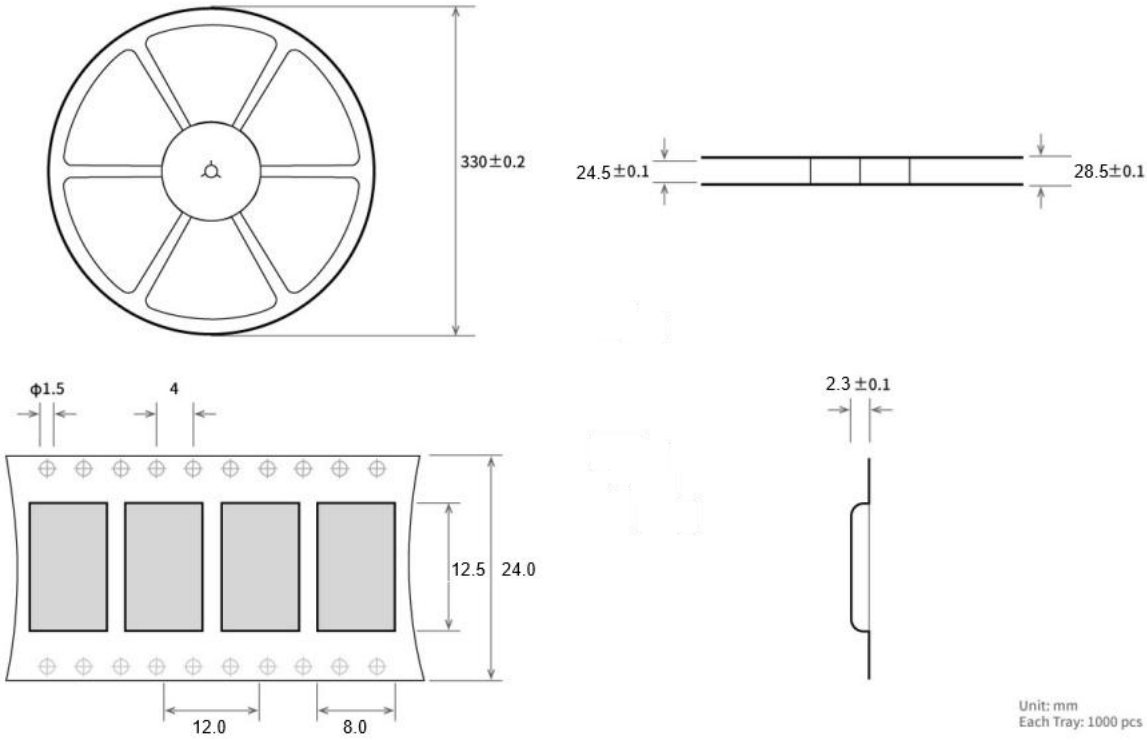
8.1 Reflow temperature

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



Charpter 9 Bulk Packaging Methods



Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2024-9-10	First edition	Ning

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