E30-400M30S(4438)

SI4438 400MHz 1W SPI Wireless Module



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Contents

DISCLAIMER 3
1 OVERVIEW 3
1.1 BRIEF INTRODUCTION 4
1.2 FEATURES 4
1.3 APPLICATION 4
2 SPECIFICATION AND PARAMETER 5
2.1 LIMIT PARAMETER 5
2.2 OPERATING PARAMETER 5
3 SIZE AND PIN DEFINITION 6
4 RECOMMENDED CIRCUIT DIAGRAM 7
5 HARDWARE DESIGN 7
6 FAQ 8
6.1 COMMUNICATION RANGE IS TOO SHORT 8
6.2 MODULE IS EASY TO DAMAGE 9
6.3 BER(BIT ERROR RATE) IS HIGH 9
7 PRODUCTION GUIDANCE 9
8 E30 SERIES 9
9 ANTENNA RECOMMENDATION 10
10 PACKAGE METHOD FOR BULK ORDER 10
REVISION HISTORY 11
ABOUT US 11

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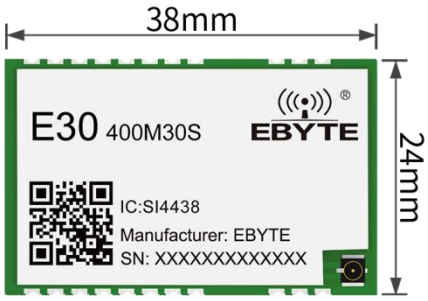
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1 OVERVIEW

1.1 Brief Introduction



E30-400M30S（4438） is a hardware module (SPI) based on the SI4438 RF chip imported from Silicon Labs. It is a half-duplex, SMD integrated transceiver with transparent transmission available. With working frequency band 425～525MHz, transmitting power 1w, it is suitable for a variety of environments. The original imported SI4438 RF chip from Silicon Labs(USA) features high receiving sensitivity and strong anti-interference, supporting the development of low power consumption as well. It has been widely used in various industries and has the characteristics of stable performance, long transmission distance, and strong ability of penetration and diffraction, etc.

1.2 Features

- The measured communication distance is up to 5.6km;
- Maximum transmission power: 1W;
- 425～525MHz ultra-wide frequency band;
- Air date rate：100bps～500kbps;
- With 3.3～5.5V power supply, over 5 V guarantees the best performance;
- Industrial grade standard design,support -40 ~ 85 °C for working over a long time;

1.3 Application

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors, etc.;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial-grade remote control;
- Intelligent agriculture and oilfield solutions;
- Health care products;
- Advanced Meter Reading Architecture(AMI);
- Automotive industry applications.

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2 Specification and Parameter

2.1 Limit Parameter

Main parameter	Performance		Remark
	Min	Max	
Power supply（V）	3.3	5.5	Voltage over 5.5V will cause permanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature（℃）	-40	+85	Industrial grade

2.2 Operating Parameter

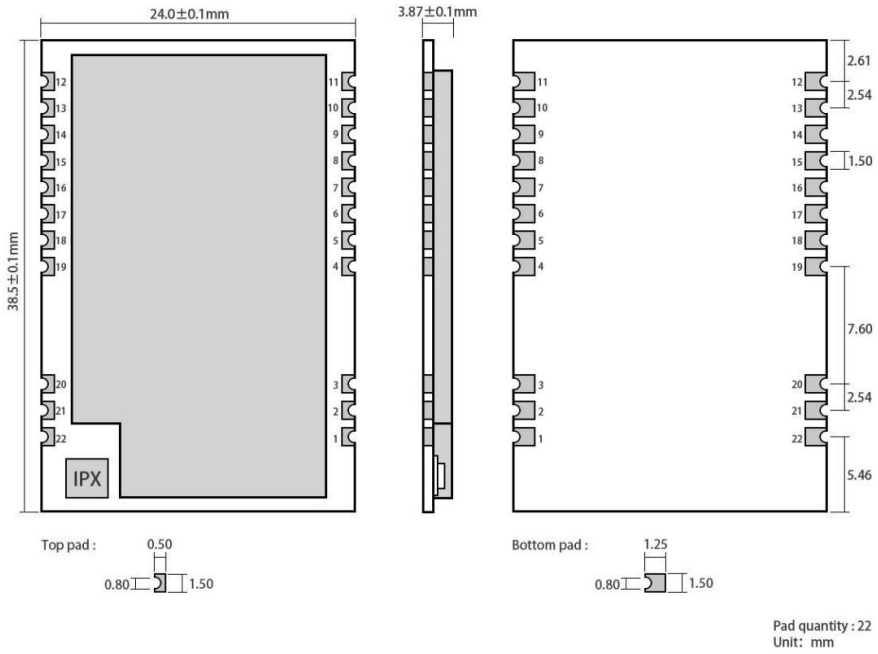
Main parameter		Performance			Remark
		Min	Typical	Max	
Operating voltage（V）		3.3	5.0	5.5	5 V ensures output power
Communication level（V）		-	3.3	-	For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	+85	Industrial grade
Operating frequency（MHz）		425	-	525	-
Power Consump - tion	TX current（mA）	550	650	700	Instant power consumption
	RX current（mA）	-	22	-	-
	Sleep current （μA）	-	2	-	-
Max TX power（dBm）		29	30	30.5	-
Receiving sensitivity（dBm）		-120	-121	-122	Air data rate is1kbps

Main parameter	Description	Remark
Reference distance	5.6Km	Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m，air data rate: 1kbps
Modulation	GFSK	-
Crystal frequency	26MHz	Built-in passive crystal
Communication Interface	SPI	Max. rate 10Mbps
Package	SMD	-
Interface method	Stamp Hole	-
Size	38.5*24mm	-
Antenna	IPEX/STAMP	50 ohm impedance

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3 Size and Pin definition



Pin No.	Item	Direction	Description
1	GND		Ground wire, connected to the power reference ground
2	GND		Ground wire, connected to the power reference ground
3	GND		Ground wire, connected to the power reference ground
4	GND		Ground wire, connected to the power reference ground
5	GND		Ground wire, connected to the power reference ground
6	IO_2	Output	Configurable universal GPIO2 ports (controlled via SI4438 internal register, see SI4438 manual), the RF transceiver control switch RX enabling terminal is connected inside the module, see Table 1 for control logic
7	IO_3	Output	The configurable universal GPIO3 port (controlled by SI4438 internal register, see SI4438 manual), the RF transceiver control switch TX enabling terminal is connected inside the module, see Table 1 for control logic
8	IO_0	Output	Configurable universal GPIO0 port (see SI4438manual for details)
9	VCC		Power supply, 3.3~5.5V, 5V is recommended (It is also recommended to add external ceramic filter capacitor)
10	VCC		Power supply, 3.3~5.5V, 5V is recommended (It is also recommended to add external ceramic filter capacitor)
11	GND		Ground wire, connected to the power reference ground
12	GND		Ground wire, connected to the power reference ground
13	IO_1	Output	Configurable universal GPIO1 port (see SI4438 manual for details)
14	IRQ	Output	SPI interrupt request
15	SDN		Shutdown Input Pin. It is low level when working (See SI4438 manual for more details)
16	MISO	Output	SPI master output slave input

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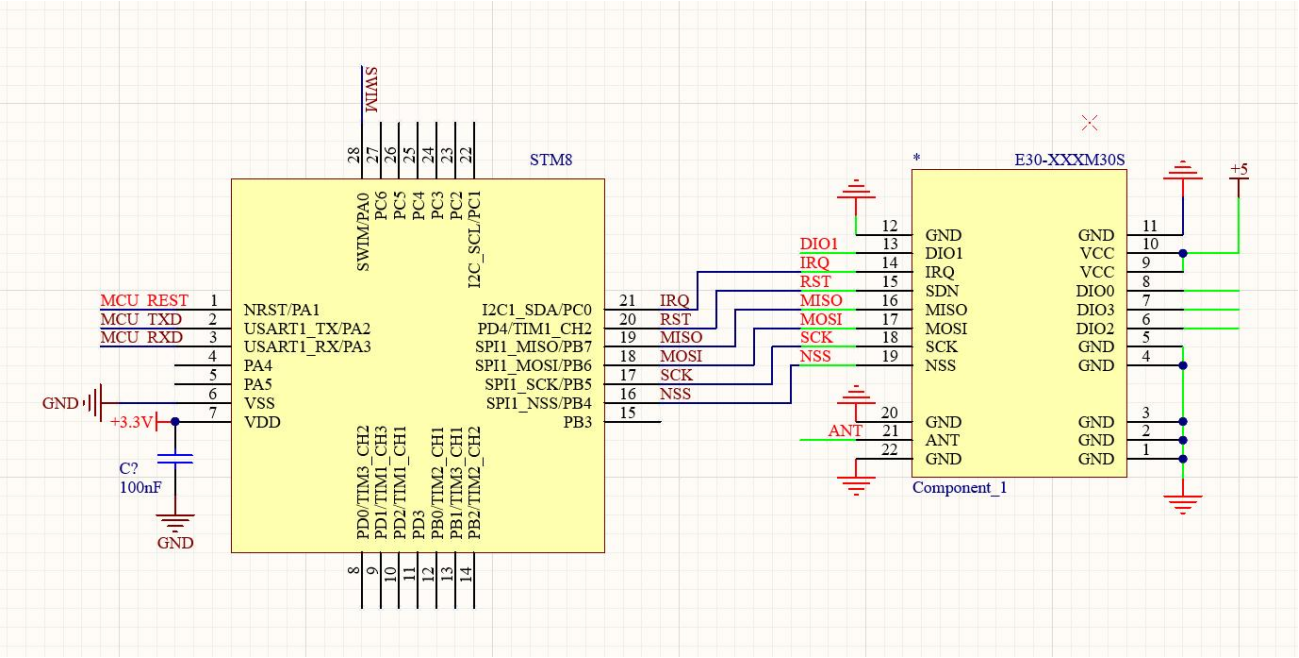
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17	MOSI	Input	SPI master input slave output
18	SCK	Input	Serial Clock Input
19	nSEL	Input	SPI Chip select for starting SPI communication
20	GND		Ground wire, connected to the power reference ground
21	ANT	Input/Output	Antena
22	GND		Ground wire, connected to the power reference ground

Table 1 [Transceiver state control truth table]

Pin / Radio State	GPIO2 （RXEN）	GPIO3 （TXEN）	Remark
Transmit	0	1	“0”：low level, “1”：high level * GPIO2,GPIO3 cannot be at the same time as “1”. * If at the far-distance, the received packet lacks the first few frames, then try to delay the data by 1ms after opening the transmit state on the transmitter.
Receive	1	0	
Low power consumption	0	0	

4 Recommended circuit diagram



5 Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible 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

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may cause permanent damage to the module;

- Please check the power supply to ensure that between the recommended supply voltage, if exceeding the maximum, the module will be permanently damaged;
- Please check the stability of the power supply. Voltage can not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- Bottom Layer High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference.If necessary, appropriate isolation and shielding can be done;
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some physical layers such as TTL protocol at 400MHz;
- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward.
- When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside; When the antenna is installed inside a metal case, it will cause the transmission distance to be greatly weakened.

6 FAQ

6.1 Communication range is too short

- The communication distance will be affected when obstacle exists;
- Data lose rate will be affected by temperature, humidity and co-channel interference;
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground;
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea;
- The signal will be seriously affected when the antenna is near metal object or put in a metal case;
- Power register was set incorrectly or air data rate is set as too high (the higher the air data rate, the shorter the distance);
- The power supply low voltage under room temperature is lower than our recommendation, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

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6.2Module is easy to damage

- Please check the power supply, ensure it works in correct voltage;
- Please check the stability of power source, the voltage cannot fluctuate too much;
- Please make sure anti-static operation when installing and using, high frequency devices have electrostatic susceptibility;
- Please ensure the humidity is within limited range, some parts are sensitive to humidity;
- Please avoid using modules under too high or too low temperature.

6.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high.

7 Production guidance

This product is a SMD module. When soldering the module, the soldering personnel must work in accordance with the anti-static operation specification;

This product is an electrostatic sensitive product. If the module is not welded according to the specification, the module may be permanently damaged.

8 E30 series

Model No.	IC	Frequency Hz	Tx power dBm	Distance km	Air data rate bps	Package	Size mm	Antenna
E30-170T20D	SI4463	170M	20	2.0	1k～25k	DIP	21 * 36	SMA-K
E30-170T27D	SI4463	170M	27	5.0	1k～25k	DIP	24 * 43	SMA-K
E30-433T20D	SI4463	433M	20	2.5	1k～25k	DIP	21 * 36	SMA-K
E30-433T20S3	SI4463	433M	20	2.5	1k～25k	SMD	16 * 26	IPEX/STAMP
E30-400M20S(4438)	SI4438	433/470M	20	2.5	100bps～500kbps	SMD	14 * 20	IPEX/STAMP
E30-400M20S(4463)	SI4463	433/470M	20	2.5	100bps～1Mbps	SMD	14 * 20	IPEX/STAMP
E30-900M20S	SI4463	868/915M	20	2.5	100bps～1Mbps	SMD	14 * 20	IPEX/STAMP
E30-400M30S(4438)	SI4438	433/470M	30	5.6	100bps～500kbps	SMD	24 * 38.5	IPEX/STAMP

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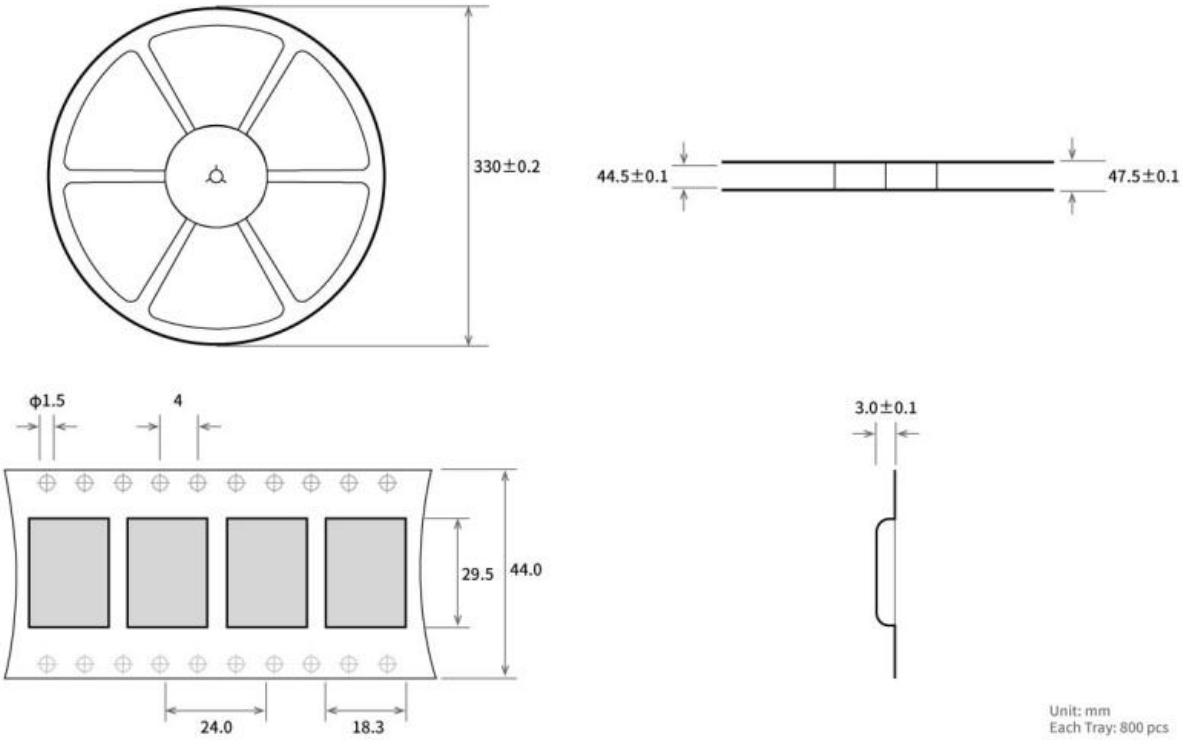
E30-400M30S(4463)	SI4463	433/470M	30	5.6	100bps～1Mbps	SMD	24 * 38.5	IPEX/STAMP
E30-900M30S	SI4463	868/915M	30	5.6	100bps～1Mbps	SMD	24 * 38.5	IPEX/STAMP

9 Antenna recommendation

The antenna plays an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequeny Hz	Interface	Gain dBi	Hight mm	Cable mm	Function feature
TX433-JZLW-15	Rubber	433M	IPEX 1	3.0	165	150	Rubber antenna for cabinet, omnidirectional
TX433-FPC-5711	FPC	433M	IPEX 1	2.5	57	68	Cost-effective
TX433-PCB-3207	PCB	433M	IPEX 1	2.0	32	90	PCB antenna,
TX433-FPC-4516	FPC	433M	IPEX 1	2.0	45	120	Cost-effective
TX433-FPC-3208	FPC	433M	IPEX 1	2.0	32	90	Cost-effective
TX470-JZLW-15	Rubber	470MHz	IPEX 1	3.0	155	150	Rubber antenna for cabinet, omnidirectional

10 Package method for bulk order



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Version	Date	Description	Issued by
1.0	2021-08-09	Content updated	Linson
1.1	2022-08-17	Revised content	Yan
1.2	2024-11-26	Add a description of the RF transceiver logic control	Ning
1.3	2025-1-13	Example Modify the description of the airspeed error	Hao

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