E04-400M16S User Manual

S2-LP 433M/470M Low Power Consumption SMD Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Contents

1. Overview 3
1.1 Brief introduction 3
1.2 Features 3
1.3 Application 3
2. Specification and parameter 4
2.1 Limit parameter 4
2.2 Operating parameter 4
3. Size and pin definition 6
4. Basic operation 8
4.1 Circuit diagram 8
4.2 Hardware design 8
5. FAQ 9
5.1 Communication range is too short 9
5.2 Module is easy to damage 10
5.3 BER (Bit Error Rate) is high 10
6. Soldering guidance 11
6.1 Reflow soldering temperature 11
6.2 Reflow soldering curve 11
7. Antenna guidance 12
7.1 Antenna recommendation 12
Revision history 13
About us 13

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

1. Overview

1.1 Brief introduction

The E04-400M16S is based on STMicroelectronics' S2-LPQTR chip as the core, it is an ultra-small size chip wireless transceiver RF module independently developed by Ebyte, working in the 433M/470M frequency band, with a maximum transmission power of 16dBm.

Since this module is a SPI pure hardware radio frequency transceiver module, it needs to be driven by MCU.



1.2 Features

- Ultra-small size, only 14x20mm;
- The communication distance can reach 1km under ideal conditions;
- The maximum transmit power is 16dBm;
- The receiving current (RX) is as low as 7mA, and the transmitting current (TX) is as low as 10mA @10dBm;
- Low power consumption, suitable for battery-powered applications;
- Support 433M/470M frequency band;
- Support multiple debugging modes of 2(G)FSK, 4(G)FSK, OOK, ASK;
- Support 2.5V～3.6V power supply, power supply greater than 3.3V can guarantee the best performance;
- Industrial-grade standard design, supporting long-term use at -40～85℃;
- IPEX interface and stamp hole are optional, which is convenient for users to develop and integrate.

1.3 Application

- Smart meeting
- Wireless alarm system
- Smart door lock
- Building automation
- Industrial acquisition and control
- Intelligent lighting system

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2. Specification and parameter

2.1 Limit parameter

Table 2-1 Limit parameter table

Main parameter	Performance		Remark
	Min.	Max.	
Power supply（V）	2.5	3.6	Exceeding the maximum value may burn permanently
Blocking power（dBm）	—	10	It is less likely to burn when used at close range
Operating temperature（℃）	-40	85	—

2.2 Operating parameter

Table 2-2 Working parameter table

Main parameter		Performance			Remark
		Min.	Typ.	Max.	
Operating voltage（V）		2.5	3.3	3.6	≥3.3V ensures output power
Communication level（V）		—	3.3	—	For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	—	85	Industrial design
Operating frequency（MHz）		413	433	479	Support ISM band
Power consumption	TX current（mA）	—	10	—	Instantaneous power consumption @10dBm
	RX current（mA）	—	7	—	—
	Sleep current（nA）	—	2.5	—	Software is shut down
Max TX power（dBm）		13	14	16	—
Receiving sensitivity（dBm）		-100	-120	-130	Air data rate is 0.3 kbps
Air data rate（kbps）		0.3	—	250	Controlled via user's programming @ 2 GFSK
		4.8	—	19.2	Controlled via user's programming @ 4-GFSK
		0.3	—	125	Controlled via user's programming @ OOK
Distance for reference		1000 m			Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m
Crystal frequency		26 MHz			—

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Modulation	SIGFOX	2(G)FSK、4(G)FSK、OOK、ASK
Package	SMD	—
Connector	1.27 mm	Stamp Hole
Communication interface	SPI	0～10Mbps
Size	20*14 mm	—
RF interface	Stamp Hole/IPEX	Equivalent impedance is about 50ohms

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3. Size and pin definition

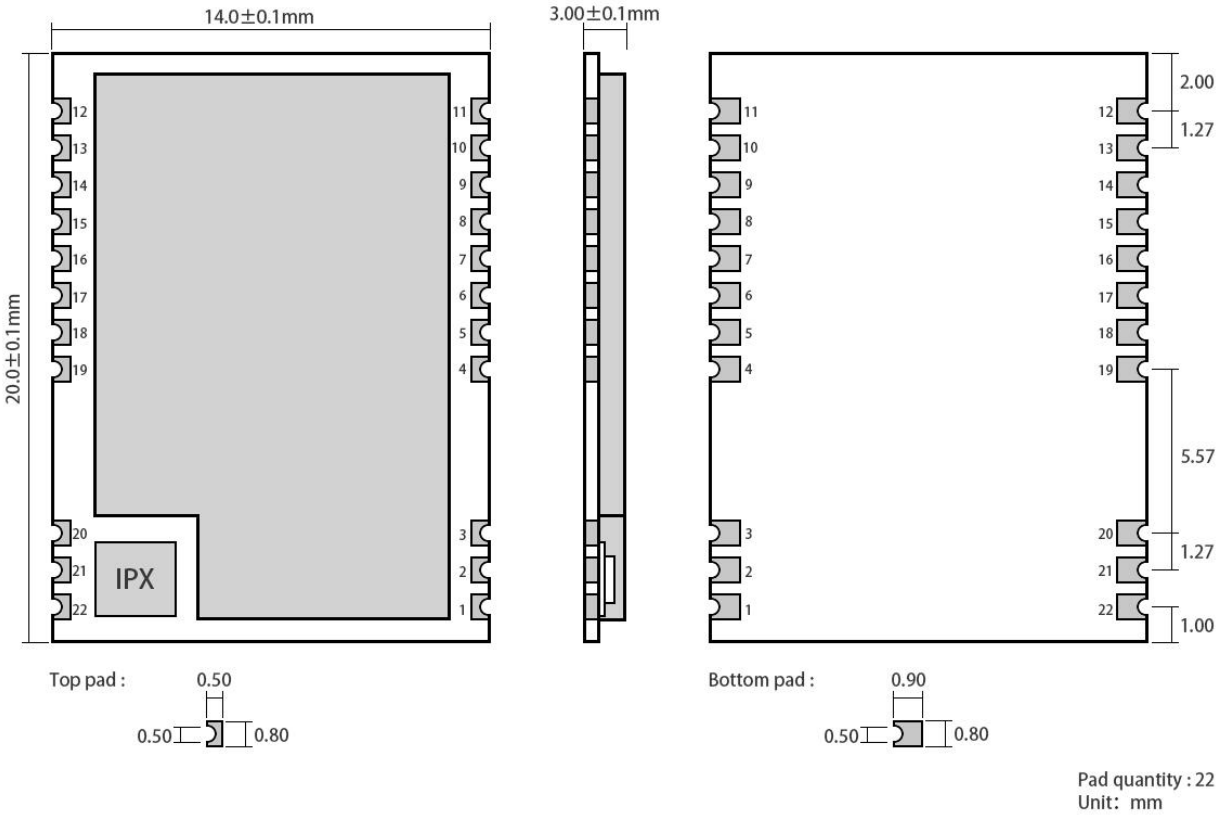


Figure 3-1 Mechanical size and pin definition

Table 3 Pin definition table

Pin No.	Pin item	Pin direction	Pin application
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	GPIO1	I/O	Configurable general IO port (see S2-LPQTR manual for details)
7	GPIO2	I/O	Configurable general IO port (see S2-LPQTR manual for details)
8	GPIO3	I/O	Configurable general IO port (see S2-LPQTR manual for details)
9	VCC	—	Power supply, range 2.5～3.6V (recommend to add ceramic filter capacitor)
10	GND	—	Ground wire, connected to the power reference ground
11	GND	—	Ground wire, connected to the power reference ground
12	GND	—	Ground wire, connected to the power reference ground
13	GPIO0	I/O	Configurable general IO port (see S2-LPQTR manual for details)
14	SDN	Input	Used to shut down the module (see S2-LPQTR manual for details)
15	NC	—	—

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

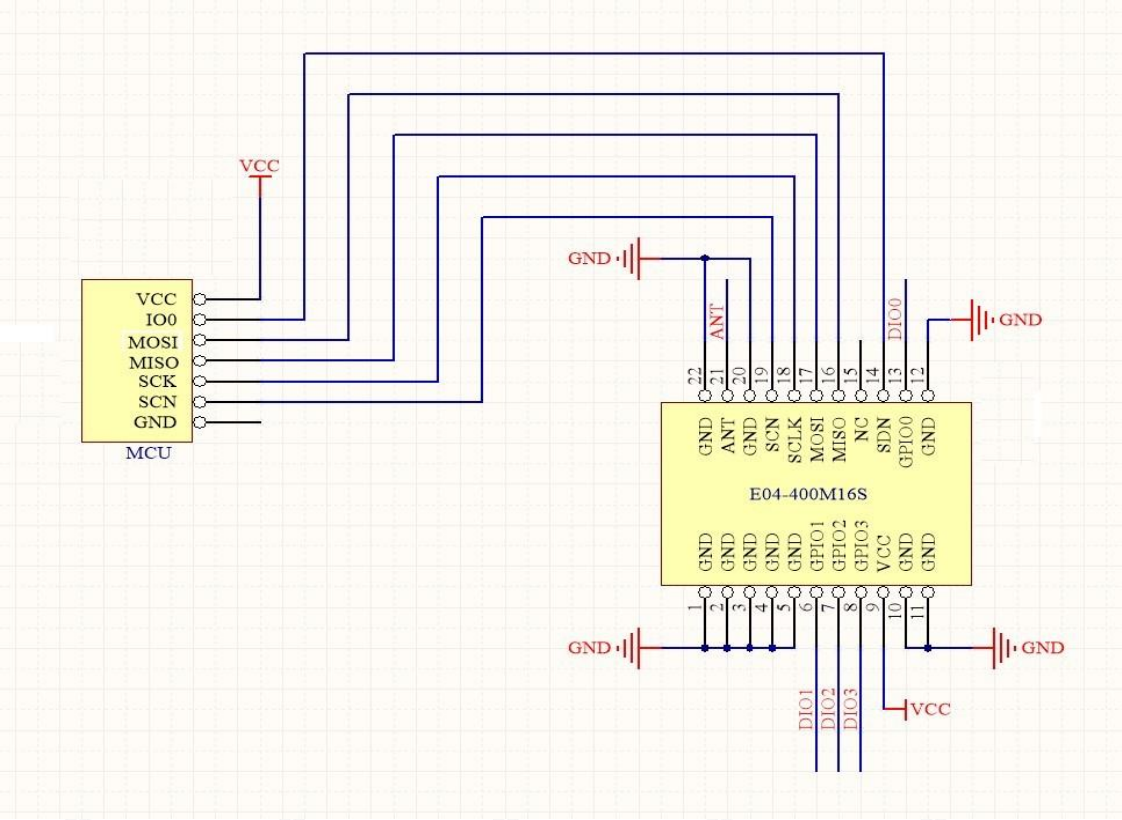
16	MISO	Input	SPI data input pin
17	MOSI	Output	SPI data output pin
18	SCLK	Input	SPI clock input pin
19	CSN	Input	Module chip select pin, used to start a SPI communication
20	GND	—	Ground wire, connected to the power reference ground
21	ANT	—	Antenna interface, stamp hole (50Ω characteristic impedance)
22	GND	—	Ground wire, connected to the power reference ground

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

4. Basic operation

4.1 Circuit diagram



4.2 Hardware design

- It is recommended to use a DC stabilized power supply to supply power to the module. The power ripple coefficient should be as small as possible, and the module should be grounded reliably;
- 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, it will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage should 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, and the whole machine is conducive to long-term stable operation;
- The module should be as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital wiring, high-frequency analog wiring, and power wiring must avoid the bottom of the module. If it is necessary to pass under the module, assume that the module is soldered to the Top Layer, and

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

the top layer of the contact part of the module is covered with copper (all copper And well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;

- Assuming that 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 stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. If the situation permits, proper isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power wiring), it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. Isolation and shielding;
- If the communication line uses 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 part of the physical layer that is also 2.4GHz TTL protocol, such as: USB3.0;
- The antenna installation structure has a greater impact on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the case, a high-quality antenna extension cable can be used to extend the antenna to the outside of the case;
- The antenna must not be installed inside the metal shell, which will greatly reduce the transmission distance.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

5. FAQ

5.1 Communication range is too short

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-frequency interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test results near the ground are poor;
- Sea water has a strong ability to absorb radio waves, so the seaside test results are poor.
- If there is a metal object near the antenna or placed in a metal shell, the signal attenuation will be very serious;
- The power register setting is wrong, the air speed setting is too high (the higher the air speed, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, the lower the voltage, the lower the power output;
- The matching degree of the antenna and the module is poor or the quality of the antenna itself is problematic.

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.2 Module is easy 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 and frequently.
- Please ensure anti-static operation during installation and use, and high-frequency components are electrostatically sensitive.
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity sensitive.
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

5.3 BER (Bit Error Rate) is high

- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- The clock waveform on SPI is not standard, check whether there is interference on the SPI line, and the SPI bus line should not be too long;
- Unsatisfactory power supply may also cause garbled codes. Ensure the reliability of the power supply;
- Poor or too long extension cables and feeders can also cause high bit error rates.

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

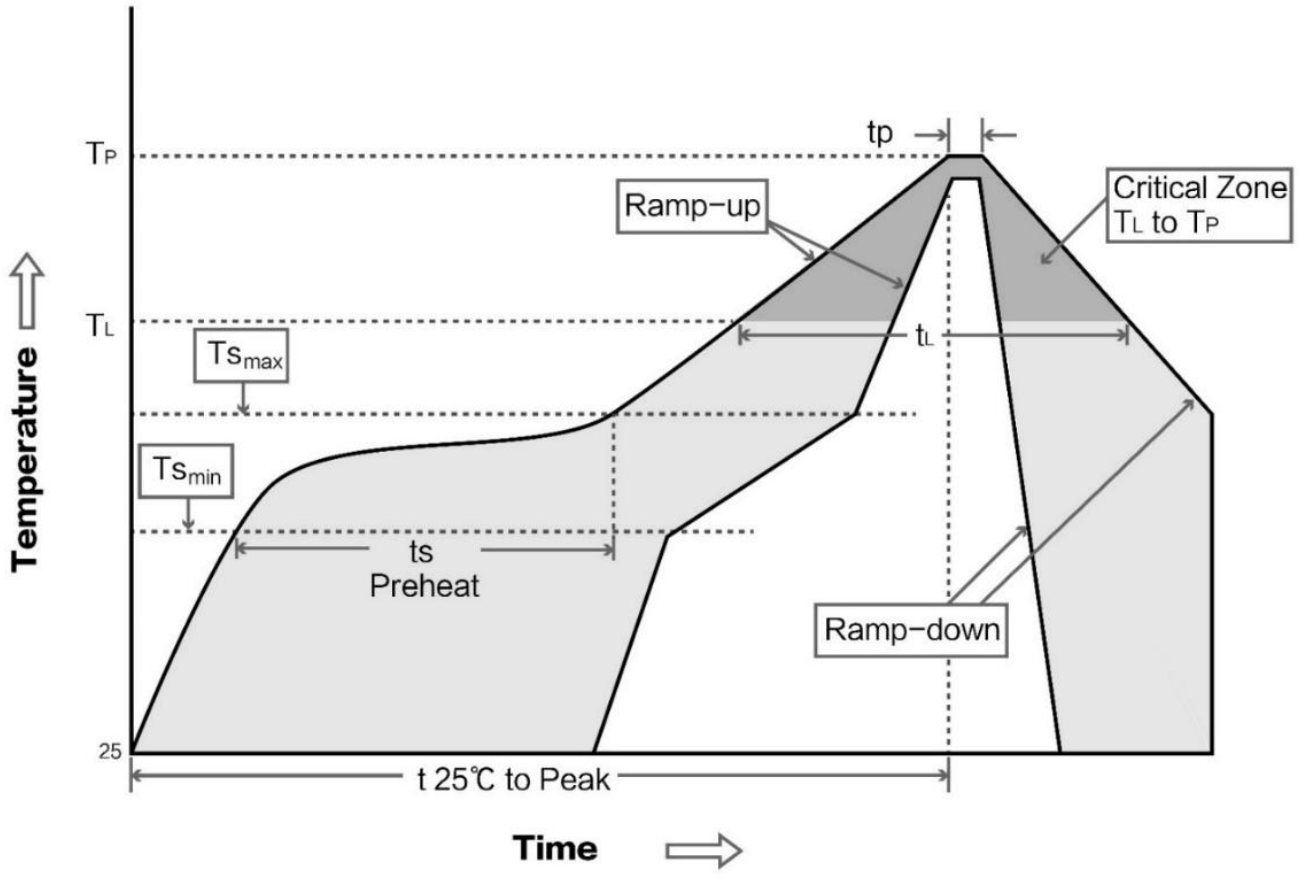
Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6. Soldering guidance

6.1 Reflow soldering 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
Liquidous 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

6.2 Reflow soldering curve



Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

7. Antenna guidance

7.1 Antenna recommendation

Antennas are an important role in the communication process, and often inferior antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as supporting our company's wireless modules with excellent performance and reasonable prices.

Model No.	Type	Frequency Band (Hz)	Interface	Gain dBi	Height	Feeder	Features
TX433-NP-4310	Flexible PCB antenna	433M	SMA-J	2	43.8*9.5mm	-	Built-in flexible, FPC soft antenna
TX433-JW-5	Rubber antenna	433M	SMA-J	2	50mm	-	Bendable rubber, omnidirectional antenna
TX433-JWG-7	Rubber antenna	433M	SMA-J	2.5	75mm	-	Bendable rubber, omnidirectional antenna
TX433-JK-20	Rubber antenna	433M	SMA-J	3	210mm	-	Bendable rubber, omnidirectional antenna
TX433-JK-11	Rubber antenna	433M	SMA-J	2.5	110mm	-	Bendable rubber, omnidirectional antenna
TX433-XP-200	Suction antenna	433M	SMA-J	4	19cm	200cm	Suction antenna, high gain
TX433-XP-100	Suction antenna	433M	SMA-J	3.5	18.5cm	100cm	Suction antenna, high gain
TX433-XPH-300	Suction antenna	433M	SMA-J	6	96.5cm	300cm	Car suction antenna, Ultra-high gain
TX433-JZG-6	Rubber antenna	433M	SMA-J	2.5	52mm	-	Ultra-short straight, omnidirectional antenna
TX433-JZ-5	Rubber antenna	433M	SMA-J	2	52mm	-	Ultra-short straight, omnidirectional antenna
TX490-XP-100	Suction antenna	490M	SMA-J	50	12cm	100cm	Suction antenna, high gain
TX490-JZ-5	Rubber antenna	490M	SMA-J	50	50mm	-	Ultra-short straight, omnidirectional antenna

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Revision history

Version	Date	Description	Issued by
1.0	2020-08-31	Original version	ken

About us

Technical support: support@cdebyte.com

Documents and RF Setting download link:：https://www.cdebyte.com

Thank you for using Ebyte products! Please contact us with any questions or suggestions: info@cdebyte.com

---

Web: https://www.cdebyte.com

Address: B5 Mould Park, 199# Xiqu Ave, High-tech District, Sichuan, China

Chengdu Ebyte Electronic Technology Co.,Ltd.

Copyright ©2012–2020，Chengdu Ebyte Electronic Technology Co., Ltd

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000