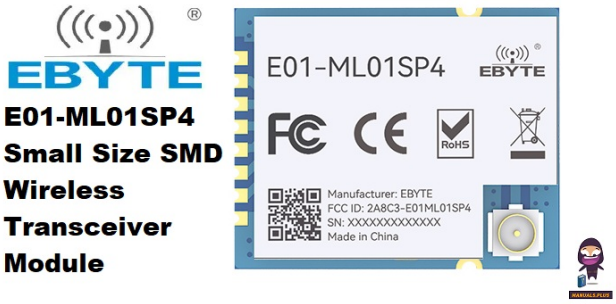

EBYTE E01-ML01SP4 Small Size SMD Wireless Transceiver Module Instruction Manual

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EBYTE E01-ML01SP4 Small Size SMD Wireless Transceiver Module

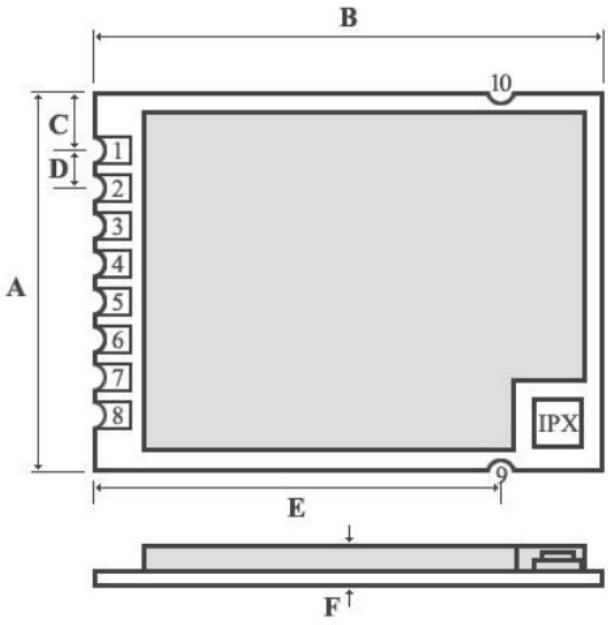
Introduction

E01-ML01SP4 is a small-size SMD wireless transceiver module, operates at 2.4 GHz, with high data rate (Max 2Mbps and SPI interface. The IPEX interface designed on the module is convenient to connect external antenna. Cost-effective and Batch production, which makes the module suitable for various applications. E01-ML01SP4 is based on original imported nRF24L01P form Nordic in Norway, and equipped with power amplifier chip imported from USA, which makes the transmitting power achieve 1.06dBm. at the same time, the receiving sensitivity is improved by 10dB, which makes the communication distance of the module is more than 10 times of the nRF24L01P itself. and the hardware design is provided with an anti-interference shielding cover, so that the anti-interference ability of the module is greatly improved.

Electrical parameter

No.	Parameter item	Parameter details	Description
1	RF IC	nRF24L01P	Nordic
2	Size	14.5 * 18.0 mm	–
3	PCB	SMT	Lead-free
4	Connector	1 * 8 * 1.27mm	SMD
5	Supply voltage	2.0 ~ 3.6V DC	Notes: the voltage is higher than 3.6V is forbidden
6	Frequency	2402 ~ 2480MHz	Adjustable
7	Communication level	0.7VCC ~ 3.6V	VCC refers to the supply voltage
8	Operation Range	10m	Clear and open area, 1.06dBm antenna gain: 4dBi height: 2m
9	Transmitting Power	Maximum 1.50dBm	1.413 mW
10	Air data rate	250kbps~2Mbps	250kbps, 1Mbps, 2Mbps
11	Sleep current	1.0uA	nRF24L01P sets as power-down, CE low level
12	Transmitting current	**80mA@1.5dBm**	100mA
13	Receiving current	26mA	CE=1
14	Communication interface	SPI	Data rate: up to 10Mbps
15	Transmitting length	3 level FIFO.	32 bytes (maximum) for one package
16	Receiving length	3 level FIFO.	32 bytes (maximum) for one package
17	Antenna type	PCB	50 ohm characteristic impedance
18	Sensitivity	-106dBm@250kbps	Please see more in IC datasheet
19	Operating temperature	-40 ~ +85℃	–
20	Operating humidity	10% ~ 90%	Relative humidity, no condensation
21	Storage temperature	-40 ~ +125℃	–

Pin definition



Units: mm

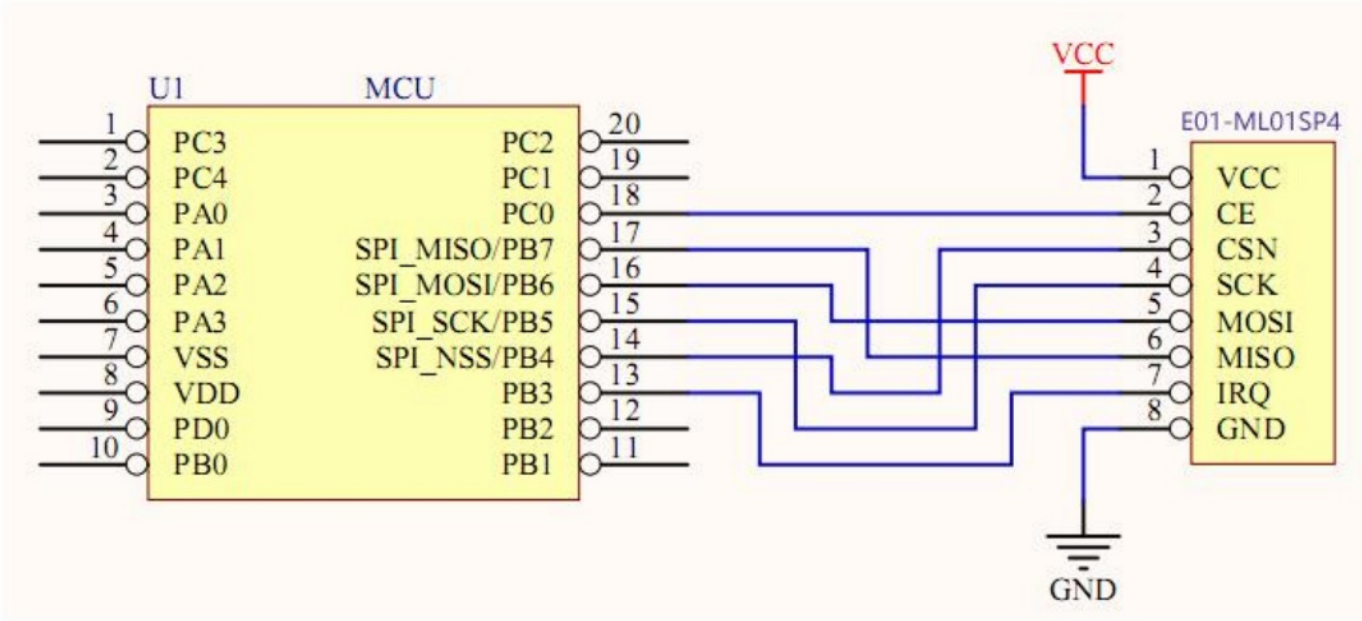
	MIN	MAX
A	14.4	14.6
B	17.9	18.1
C	2.75	2.85
D	1.27	1.27
E	12.9	13.1
F	0.75	0.85

Pin No.	Pin item	Pin direction	Pin application
1	VCC		Power supply 2.0V ~ 3.6V DC
2	CE	Input	Chip Enable
3	CSN	Input	SPI Chip select
4	SCK	Input	SPI clock
5	MOSI	Input	SPI master output slave input
6	MISO	Output	SPI master input slave output
7	IRQ	Output	Interrupt request.
8	GND		Ground
9	GND		Ground
10	GND		Ground

Note

No.	Item	Attention
1	Static electricity	Please try not to touch the electronic components with bare hands.
2	Welding	When welding, a soldering iron needs grounding. The producer needs to wear a cable electrostatic bracelet, which is grounding when mass-produced.
3	Power supply	Power quality has a great impact on the performance of the module, please make sure the power supply has small ripple and avoid frequent and large jitter. π filter is recommended (Ceramic capacitor/tantalum capacitor + inductance).
4	Ground	Single-point grounding is recommended. 0 ohm resistor or 10mH inductance are recommended.
5	Antenna	How to install the antenna has a great impact on the performance of the module, please make sure the antenna is exposed and vertical upward. It will lead to the transmitting distance greatly weakened if the antenna is installed in the interior of the housing. When the module is installed in the interior of the housing, a high-quality antenna extension line can be used to extend the antenna to the outside of the housing.
6	Interference	If there are different modules work in another frequency band in the same product, the user needs to plan rationally and take measures to shield, in case the harmonic interference and intermodulation interference exist.

USAGE



No.	Brief introduction of connection between module and MCU (STM8)
1	CE pin can be high level for long-term, but it needs to set as POWER DOWN mode when the module write registers, and it is recommended that CE is controlled by MCU pin.
2	As interrupt pin for IRQ, it can be used to wake-up MCU and achieve fast response; But the user can get the interrupt status through SPI (not recommended, it is not conducive to the overal l power consumption, and with low efficiency .

Drive mode

No.	Description
1	This module is nRF24L01+PA+LNA, the drive mode is exactly equivalent to nRF24L01P, the user can operate according to the nRF24L01P manual (Please see nRF24L01P manual for more details).
2	Make sure the CE pin connect to LNA enable pin , when CE equal to 1, LNA is turned on, when CE to 0, LNA is turned off. This operation is perfectly matched with the transceiver mode of nRF24L01; that i s to say, users do not have to care about the LNA operation
3	If the automatic response is needed, the CE pin must keep high level when transmitting, instead of keeping high level time just more than 10us like the datasheet mentioned. The operation we recommended is: when CE equal to 1, the module begin sending, after sending all, t hen make the CE equal to 0, instead of making the CE equal to 0 after 10 us. The reason is: the module turns into receiving mode immediately after sending L01P, If CE equal to 0,it means LNA closed, will not be beneficial to the receiving senility

E01 Series

Model	RF IC	Package	Conducted Out put Power	Range	Antenna Type
E01-ML01SP4	nRF24L01P	SMD	1.50dBm	10m	PCB

Important Notice to OEM integrators

(Reference KDB 996369 D03 OEM Manual v01, 996369 D04 Module Integration Guide v02)

1. Applicable FCC rules:
   This device complies with part 15.247 of the FCC Rules. This module is limited to OEM installation ONLY. .
2. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
3. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance

as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s). The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed. Important Note notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Chengdu Ebyte that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2A8C3-E01ML01SP4" The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

1. The transmitter module may not be co-located with any other transmitter or antenna.
2. Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	Peak Gain
PCB	4.0dBi

FCC Statement

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization

Information on test modes and additional testing requirements

1. 1) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to retest all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
2. The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is

especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

3. If the investigation indicates a compliance concern, the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected.
4. Additional testing, Part 15 Sub part B disclaimer: The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host/module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details. The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual. Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a

residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction. This module has been tested and found to comply with part 15.247 requirements for Modular Approval. The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuit), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions:

1. The authorized antenna must be used, and
2. The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

About us

Chengdu Ebyte Electronic Technology Co., Ltd. (Ebyte) is specialized in wireless solutions and products.

- We research and develop various products with diversified firmware;
- Our catalogue covers WiFi, Bluetooth, Zigbee, PKE, wireless data transceivers & etc.;
- With about one hundred staffs, we have won tens of thousands of customers and sold millions of products;
- Our products are being applied in over 30 countries and regions globally;
- We have obtained ISO9001 QMS and ISO14001 EMS certifications;
- We have obtained various of patents and software copyrights, and have acquired FCC, CE, RoHs & etc.

Address Building B2, Mould Industrial Park, 199# Xi-Qu Ave, West High-tech Zone, Chengdu, 611731, Sichuan, China Technical support **support@cdebyte.com**

Frequently Asked Questions

- **Q: Can the module be operated without an external antenna?**
  - A: The module is designed with an IPEX interface for connecting an external antenna, which is recommended for optimal performance. Operating without an external antenna may result in reduced range and signal quality.
- **Q: What is the recommended operating voltage range for the module?**
  - A: The module operates within a supply voltage range of 2.0V to 3.6V DC. Operating the module outside this range may lead to improper functionality and potential damage.
- **Q: How should the CE pin be configured for efficient power management?**
  - A: The CE pin should be set to POWER DOWN mode when not actively transmitting or receiving data to minimize power consumption and enhance overall efficiency.

Documents / Resources

	EBYTE E01-ML01SP4 Small Size SMD Wireless Transceiver Module [pdf] Instruction Manual E01ML01SP4, 2A8C3-E01ML01SP4, 2A8C3E01ML01SP4, E01-ML01SP4 Small Size SMD Wireless Transceiver Module, E01-ML01SP4, Small Size SMD Wireless Transceiver Module, SMD Wireless Transceiver Module, Wireless Transceiver Module, Transceiver Module, Module

References

- EBYTE-LoRa/WiFi/BLE/ZigBee wireless modules Manufacturers, industrial IoT terminals suppliers
- User Manual