



AS01-ML01D User Manual

2.4G,1mw RF Transceiver Based on nRF24L01P With PCB Antenna and Shield Case

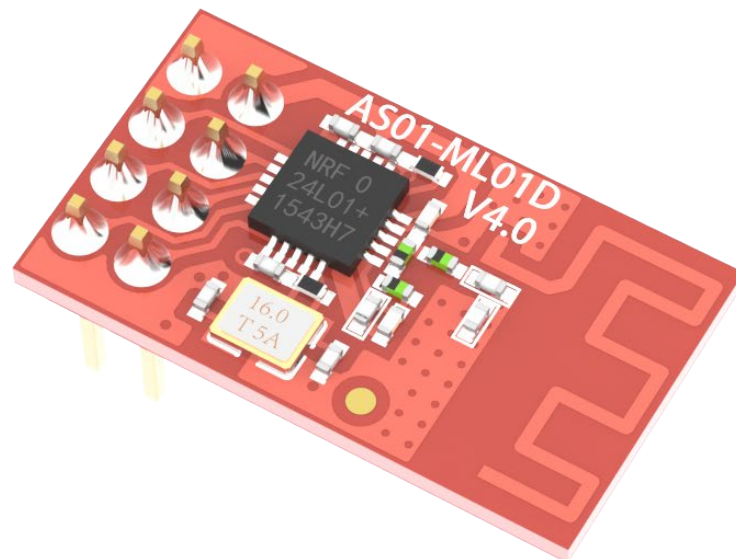


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1. Product Overview

AS01-ML01D is a 1mW industrial wireless data transceiver with high speed and high stability, operates at ISM band 2.4GHz~2.525GHz (default 2.4GHz). The module comes with PCB antenna and exact impedance matching, and uses original nRF24L01P from Nordic. It features enough power, good spectral properties, small harmonic wave, small cross talk and super small volume. Some of the devices meet military grade standard.

2. Product Features

- Comes with PCB antenna, transmission distance up to 0.12km^[1]
- Super low power consumption, the lowest power consumption is about 0.9uA
- Operation frequency 2.4-2.525GHz, a total of 126 channels
 - Frequency adjustable, 1MHz stepping
 - GFSK modulation
- 3 FIFO levels
 - Transmission length: 1-32 bytes each data packet
 - Receiving length: 1-32 bytes each data packet
 - Automatically resend mechanism
 - Support data transmission of 6 channels
- Communication interface
 - Hardware SPI interface of 4-Pin
 - 4Mbps data speed is recommended, Max speed is up to 10Mbps.
- Multiple levels of airspeed
 - 3 levels of air speed are optional:^[2] 250Kbps, 1Mbps, 2Mbps
- 4 power levels adjustable, the max power is about 0dBm^[3]
- 4 operation modes^[4]
 - Power down
 - Standby
 - Send
 - Receive
- supply voltage range
 - 1.8V-3.6VDC
- Transmitting current
 - When the transmitting power is 0dBm, the transmitting current is tested as 13mA
- Receiving sensibility
 - -82dBm (data speed 2Mbps)
 - -85dBm (data speed 1Mbps)
 - -94dBm (data speed 250Kbps)
- Ultra-small volume, in-line package
 - 12.5*22mm
 - Module weight is about 1.1g

Remarks:

- 1) Open, sunny, no obstacles; The max power, height 2m, data speed 250Kbps
- 2) The airspeed is higher, the distance is closer; The airspeed is lower, distance is longer
- 3) For transmitting power, please see chip manual of nRF24L01P
- 4) For four operation modes, please see chip manual nRF24L01P
- 5) Voltage higher than 3.6V will damage the module permanently

3. Series Products

Table 3-1 Brief Specification of AS01-ML01D

Model Number	Carrier Frequency (Hz)	IC	Package	Size (mm)	Max Transmit Power (dBm)	Range (km)	Antenna type
AS01-ML01S	2.4G~2.525G	nRF24L01P	SMD	12 * 19	0	0.12	PCB
AS01-ML01D	2.4G~2.525G	nRF24L01P	DIP	12.5 * 22	0	0.12	PCB
AS01-ML01DC	2.4G~2.525G	nRF24L01P	DIP	13.2 * 30	0	0.12	PCB
AS01-ML01IPX	2.4G~2.525G	nRF24L01P	SMD	12 * 19	0	0.2	IPEX
AS01-ML01DP2	2.4G~2.525G	nRF24L01P +PA	DIP	17 * 33.5	20	1.8	SMA-K
AS01-ML01DP3	2.4G~2.525G	nRF24L01P +PA	DIP	15 * 27	20	1.5	SMA-K
AS01-ML01DP5	2.4G~2.525G	nRF24L01P +PA	DIP	18 * 33.3	20	2.0	SMA-K
AS01-ML01DP6	2.4G~2.525G	nRF24L01P +PA	DIP	16.5 * 30	20	1.2	PCB
AS01-SPIPX	2.4G~2.525G	nRF24L01P +PA	SMD	13 * 19	20	2.0	IPEX
AS01-SP2	2.4G~2.525G	nRF24L01P +PA	SMD	13 * 25	20	1.2	PCB/IPEX
ASU1-SA	2.4G~2.525G	nRF24LU1P	DIP	14.4*47.5	0	0.1	PCB
★Above model numbers of the AS01 series can communicate★							

4. Electrical Parameters

Table 4-1 Electrical Parameters of AS01-ML01D

Test Condition: Tc=25°C, VCC=3.3V

Parameter	Parameter Name	Description	Min Value	Typical Value	Max Value	Unit
Voltage	Supply voltage ^[1]		1.8		3.6	VDC
	Communication level	The communication level is generally smaller than the supply voltage, and VCC in 0.7*VCC refers to the supply voltage.	0.3*VCC		0.7*VCC	V
Current	Transmitting current ^[2]			22		mA
	Receiving current	CE=1		19		mA
	Turn off current	nRF24L01P set as power down mode, CE is low level.		0.9		uA
	Operating frequency	adjustable, 1MHz stepping	2.4		2.525	GHz
	Transmitting power	4 chip powers are available, Max		0		dBm

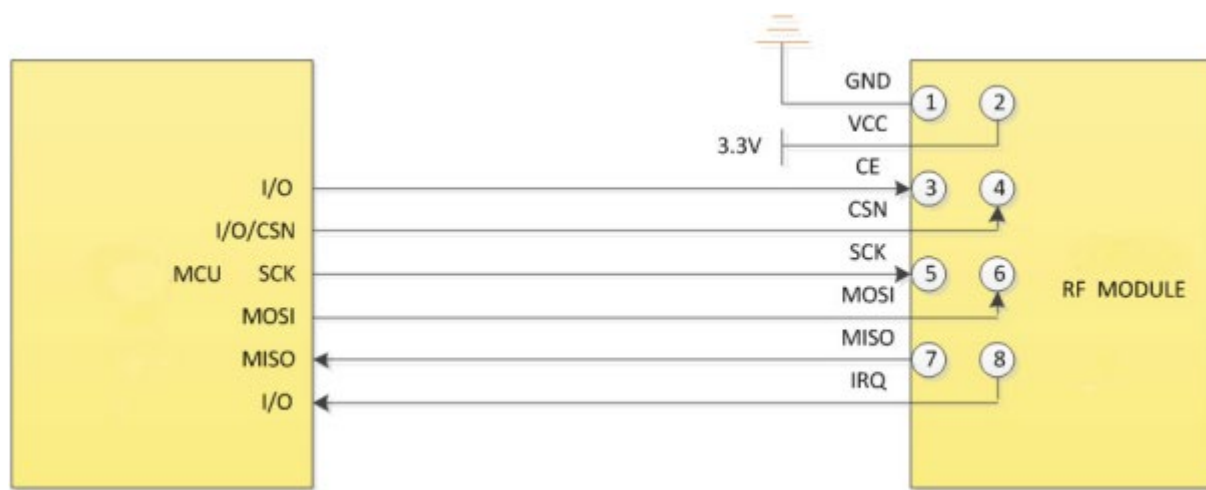
RF Parameters		0dBm, about 1mW				
	Receiving sensitivity	-94dBm@250kbps, receive sensitivity is detailed in the chip manual		-94		dBm
	Air speed	3 air speeds are available (250Kbps, 1Mbps, 2Mbps)	250K	250K	2M	bps
Operation Environment	Operating temperature	Industrial grade	-40		+85	°C
	Operating humidity	Relative humidity, no condensation	10%		90%	
	Storage temperature		-40		+125	°C

Remarks:

- 1) Voltage higher than 3.6V will damage the module. The lower the voltage, the lower the transmission power.
- 2) Power supply capability must be greater than 30mA.

5. Module Functions

5.1 Recommended Connection Diagram



0-1 Recommended Connection Diagram

Explanation:

1. high level CE is valid. When the module writes the register, it must first be set to power-down mode. It is recommended to connect CE to the IO port of the micro-controller.
2. IRQ is recommended to connect the external interrupt of the micro-controller. Alternatively, the SPI query mode can be used to obtain the interrupt status.
3. The nRF24L01P technical manual requires that the high-level time of the CE pin is greater than 10us to start data transmission. However, in order to make the same code compatible with our AS01 series modules with PA and LNA, it is recommended to change CE to high level after setting the SPI operation. After the completion of the transmission, continue to maintain a high level of 1ms, and then lower the CE.

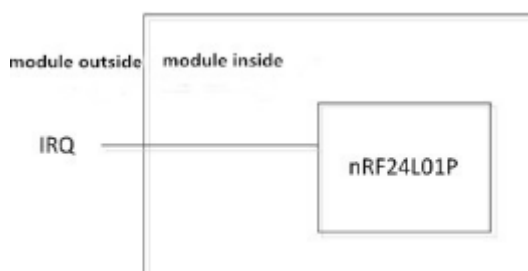
5.2 Pin Definition

Table 5-1 Pin Definition of AS01-ML01D

Pin No.	Pin Name	Pin Direction	Pin Description
1	GND		Ground, connect to power reference ground
2	VCC		Power supply, range 1.8~3.6V, recommend 3.3V, It is recommended to add ceramic filter capacitors externally.
3	CE	input	Module control pin, please see nRF24L01P data sheet for details
4	CSN	input	Module chip select pin, used to start an SPI communication
5	SCK	input	Module SPI bus clock
6	MOSI	input	Module SPI Data Input Pin
7	MISO	output	Module SPI Data Output Pin
8	IRQ	output	Module interrupt signal output, valid in low communication level
*See the nRF24L01P data sheet for pin definitions, software drivers, and communication protocols of the module. *			

5.3 Pin Function

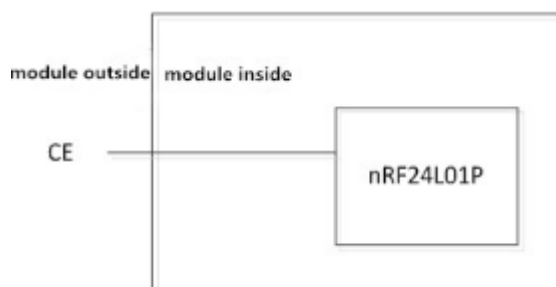
5.3.1 Function of IRQ Pin



Picture 0-2 IRQ Local Connection Diagram

IRQ is the interrupt mapping pin, low level is valid, and the specific interrupt signal represented is in the nRF24L01P chip manual

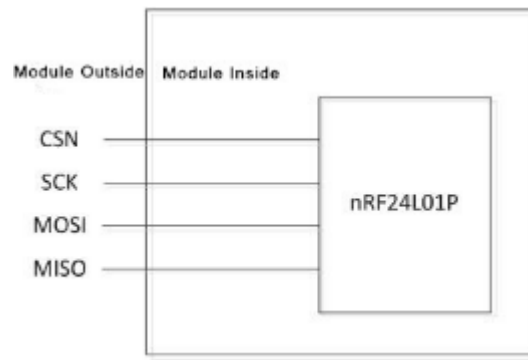
5.3.2 Function of CE Pin



Picture 0-3 CE Local Connection Diagram

The module control pin, the module's transmit mode (TXD) and receive mode (RXD) are determined by this pin. See the nRF24L01P chip manual for details.

5.3.3 Function of SPI pin

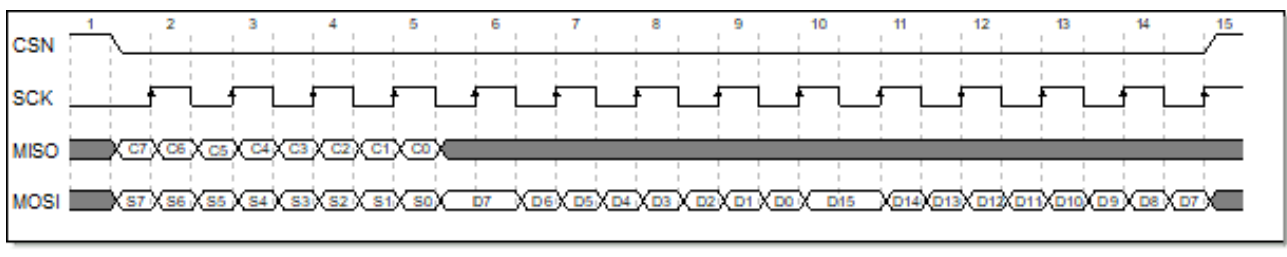


Picture 5-4 SPI Local Connection Diagram

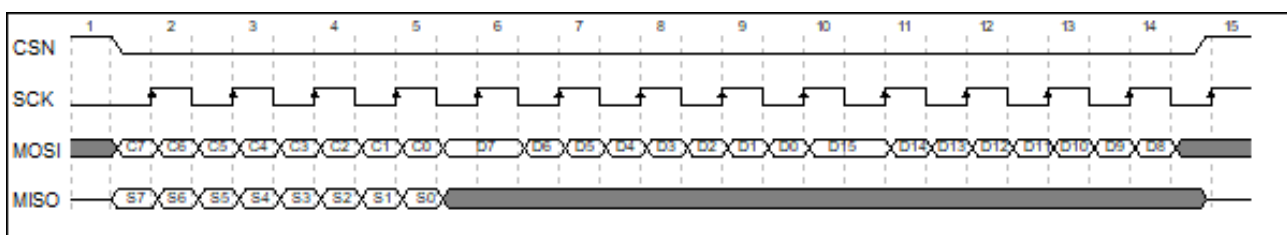
The SPI Sequence Diagram is as follows:

Table 5-2 Operation Mode Form

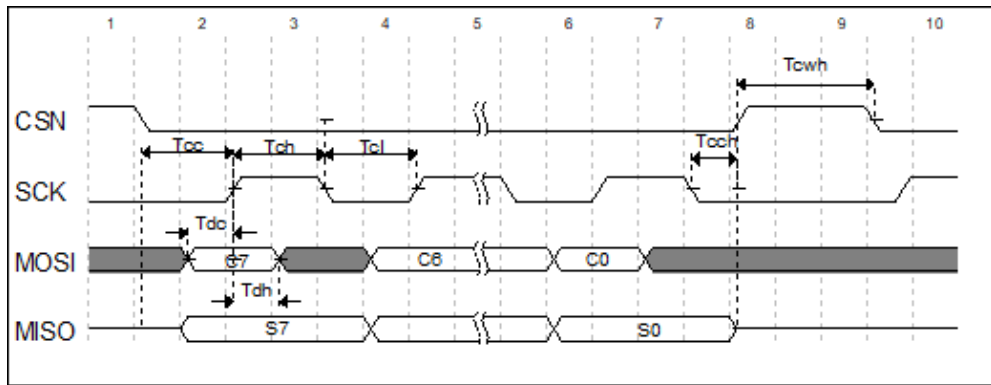
abbr	Description
Cn	SPI command bit
Sn	Status register bit
Dn	Data bit



Picture 5-5 Sequence Diagram of SPI Read Operation



Picture 5-6 Sequence Diagram of SPI Write Operation



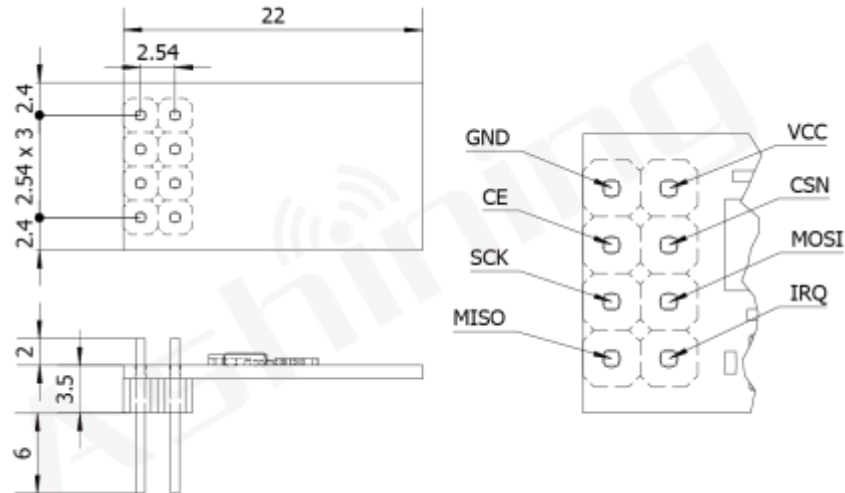
Picture 5-7 SPI Sequence Diagram of Parameters

Table 5-3

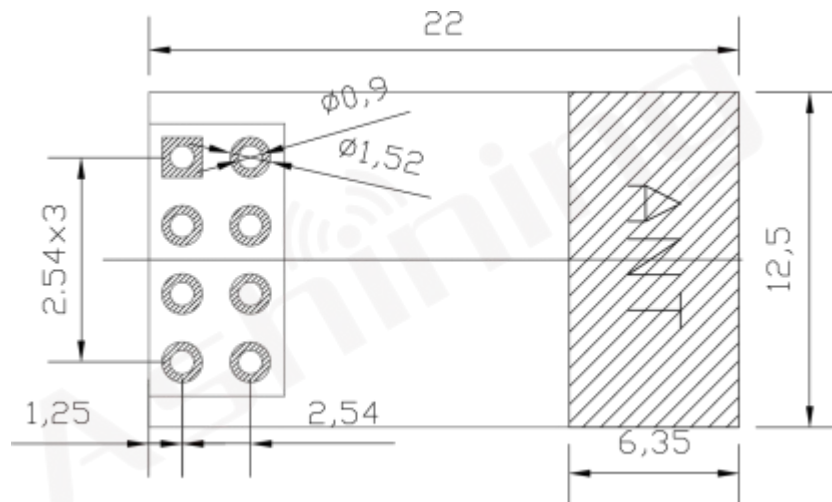
Parameters Symbols	Description	Min	Max	Unit
T_{cc}	Chip select clock setting	2		ns
T_{ch}	Clock high level time	40		ns
T_{cl}	Clock low level time	40		ns
T_{cch}	The selection time lasts	2		ns
T_{cwh}	Chip selection idle time	50		ns
T_{dc}	Data initialization clock	2		ns
T_{dh}	Data duration	2		ns

6. Package Information

6.1 Machine Size (unit: mm)



6.2 Reference Pad Design (unit: mm)

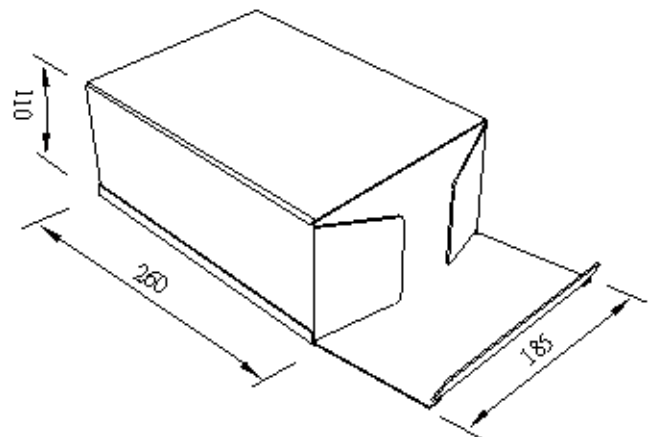
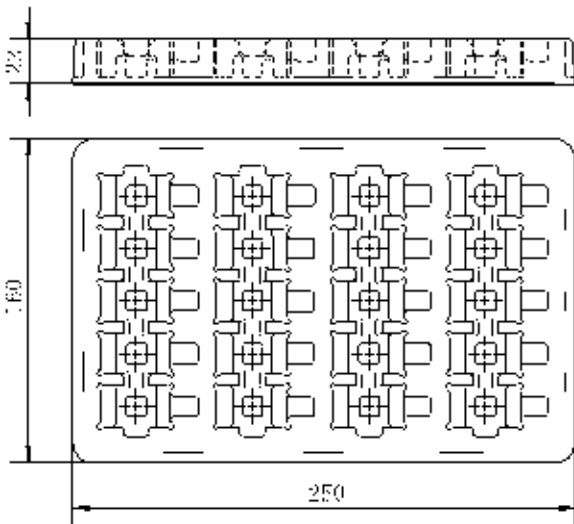


7. Package Manner

7.1 Electrostatic Bag Package



7.2 Pallet Package (unit: mm)



Important Remarks and Disclaimers

As the hardware and software of the product continue to improve, this manual may be subject to change, and the final version of the manual shall prevail.

Users of this product need to pay attention to the product dynamics on the official website, so that users can get the latest information of this product in time.

The pictures and diagrams used in this manual to explain the functions of this product are for reference only.

The measured data in this specification are all measured by our company at room temperature for reference only. Please refer to the actual measurement for details.

Chengdu Ashining Technology Co., Ltd. reserves the right of final interpretation and modification of all contents in this manual