

Laser Dust Sensor

MMD202 Product Datasheet



1. Product Introduction

The MMD202 laser dust sensor is a digital particle sensor that can be used to measure the number and mass of suspended particles in the air per unit volume, that is, the particle concentration ($\mu\text{g}/\text{m}^3$), and output it in the an digital form. This sensor can be embedded in various instruments or environmental equipment provide accurate and instant particle measurement information.

This sensor uses the principle of laser scattering, that is, the laser is irradiated on the suspended particles in the air to produce scattering, and the scattered light is collected at a specific angle to obtain a curve of the scattered light intensity signal. Then the microprocessor uses an algorithm based on the Mie (MIE) theory to obtain the equivalent particle size of the particles and the number of particles of different sizes per unit volume.

2. Characteristics

- Full shielding design, stronger anti-interference ability, air inlet and outlet on the same side, customers do not need to design air duct
- Minimum resolution particle size 0.3 microns
- Ultra-thin, ultra-quiet
- Zero false alarm
- Real-time response
- Accurate data
- Long life time

3. Main Application

- Air quality monitoring equipment, portable instruments, air purifiers
- Fresh air ventilation system, air conditioning, smart home equipment

- Hospitals, hotels, schools and other public places

4. Product Description

4.1 Technical parameters

Table 1

Items	Parameters	Unit
particle size range	0.3~10	μm
Output results	Particle mass concentration	μg/m ³
Measuring range	PM1.0: 0 ~ 1,000 PM2.5: 0 ~ 1,000 PM100 ~ 1,000	μg/m ³
Resolution	1	μg/m ³
Maximum consistency error for PM1.0&PM2.5&PM10	0 ~ 100, ±10 101 ~ 1,000, ±10% of reading	μg/m ³
Response time	≤10	S
Working temperature	-10~50	°C
Working humidity	0~99%RH (no condensation)	%
Storage temperature	-30~60	°C
Power supply	DC 5V±0.1V, ripple <50mV	V
Working current	≤100	mA
Stand-by current	≤200	μA
Digital output 1 (default)	I ² C, UART_TTL (L<0.8V@3.3V;H>2.7V@3.3V)	
Digital output 2	DAC (can be customized)	
Digital output 3	PWM (can be customized)	
Output method	The default is passive output after power-on, and the sampling time interval requires more than 1000ms.	
Mean time between failures under normal temperature and pressure	> 40000 (continuous operation)	hr
Reference Size	48×37×12	mm

5. Output Results

The main output is the mass and number of particulate matter of each concentration in the unit volume, where the unit volume of the number of particulate matter is 0.1 liters.

5.1 Internal structure description

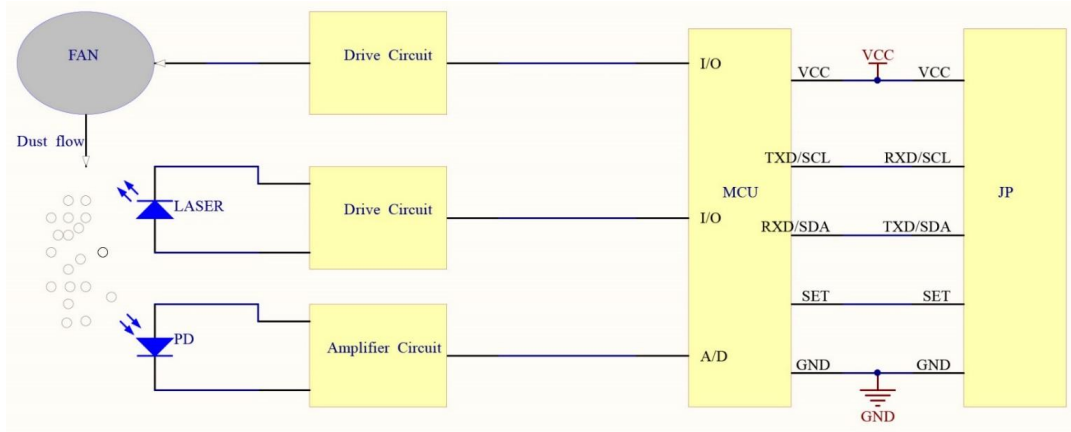


Figure 1. Internal configuration

According to the above block diagram, the particles can be such in chamber by the fan. Laser source from a diode emit the light, the light reflected and scattered on particles, a photo-electron diode and an amplifier consist photo signal detection circuit. The measurement data transfer and communicate with master device through a MCU.

5.2 Pin definition

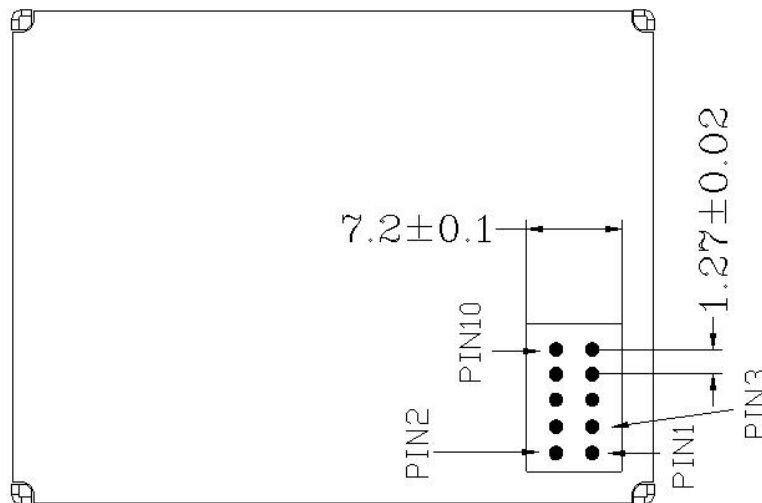


Figure 2 Pin definition of digital interface

Table 2

PIN1	VCC	Power input (+ 5V)
PIN2	VCC	Power input (+ 5V)
PIN3	GND	Power input (ground terminal)
PIN4	GND	Power input (ground terminal)
PIN5	RESET	Module reset (TTL level @3.3V, low level signal)
PIN6	DAC	Customizable
PIN7	RXD/SDA	UART-RX / I ² C SDA (TTL level @3.3V) compatible with 5V communication
PIN8	PWM	Customizable
PIN9	TXD/SCL	UART-TX/I ² C SCL (TTL level @3.3V) compatible with 5V communication
PIN10	SET	Setting (TTL level @3.3V/5V, high level or pause is normal working state, low level is sleep mode.)

Note: If SET=1, the module works in continuous sampling mode, the sampling response time is less than 500 milliseconds, and the data update time is less than 1 second. If SET=0, the module enters low-power standby mode.

Connector is box header type as shown in the figure below:

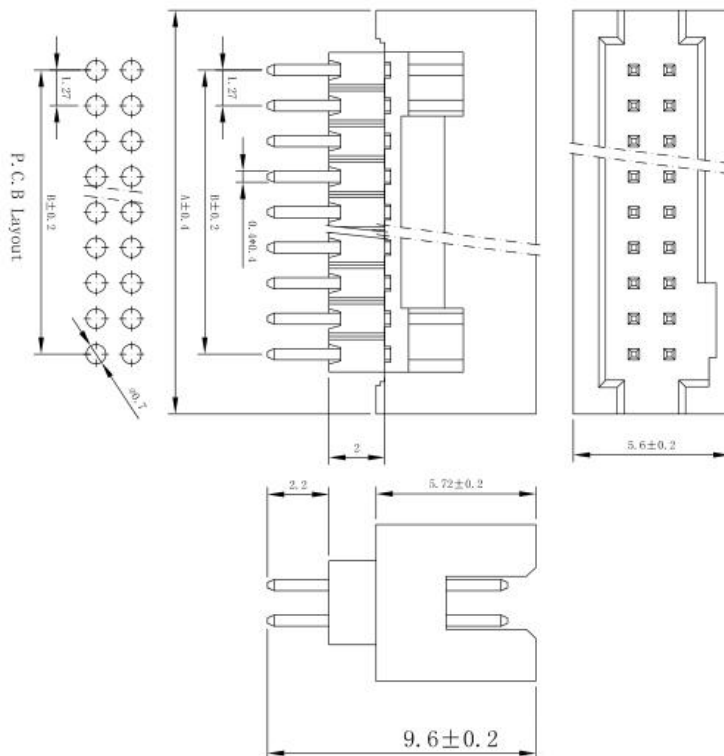


Figure 3 box header connector

The box receptacle corresponding to header can be through hole or SMT type, as shown in the figure below:

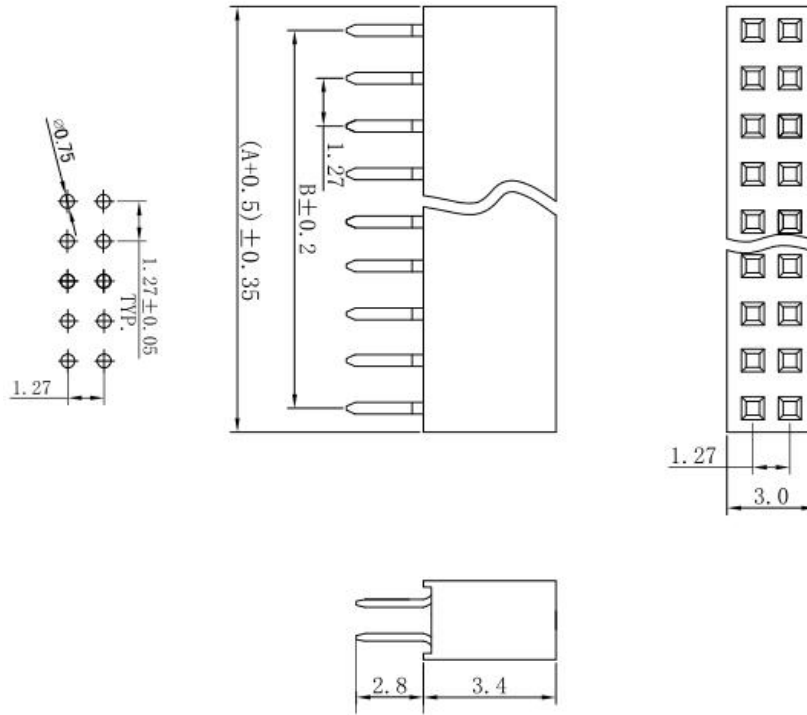


Figure 4 Schematic diagram of the receptacle (through hole type)

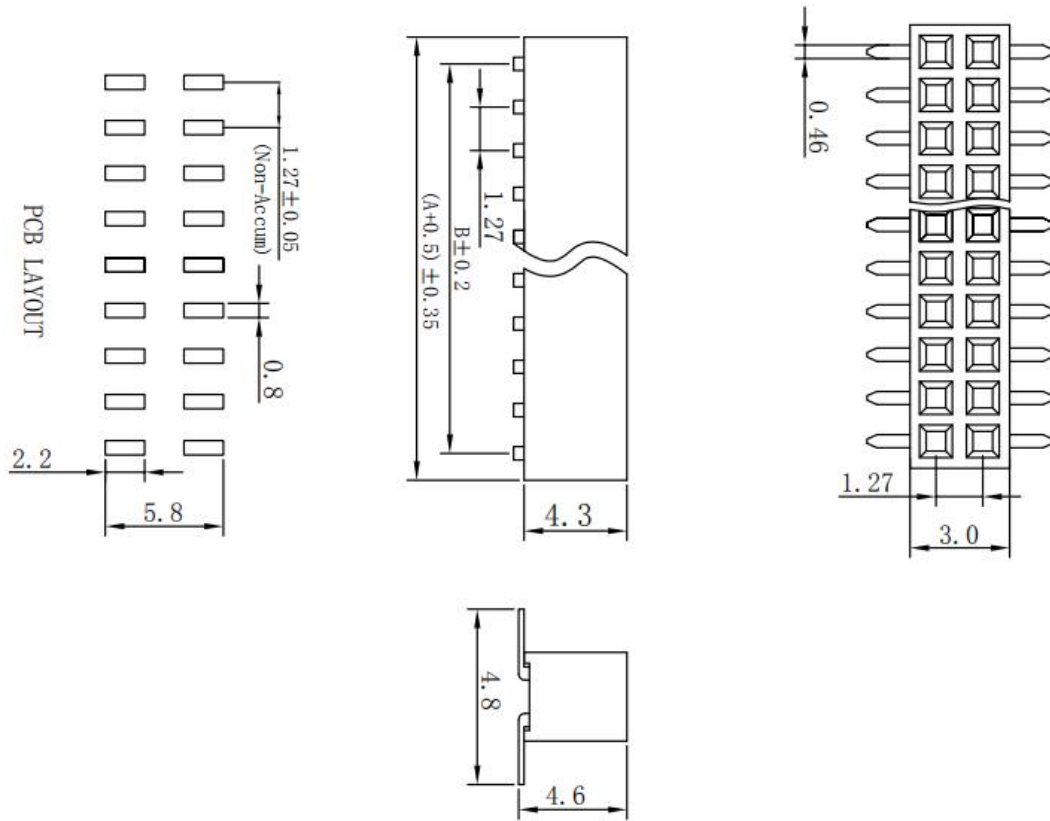


Figure 5 Schematic diagram of receptacle (SMT)

6. Typical Application Circuit

Case 1. UART application

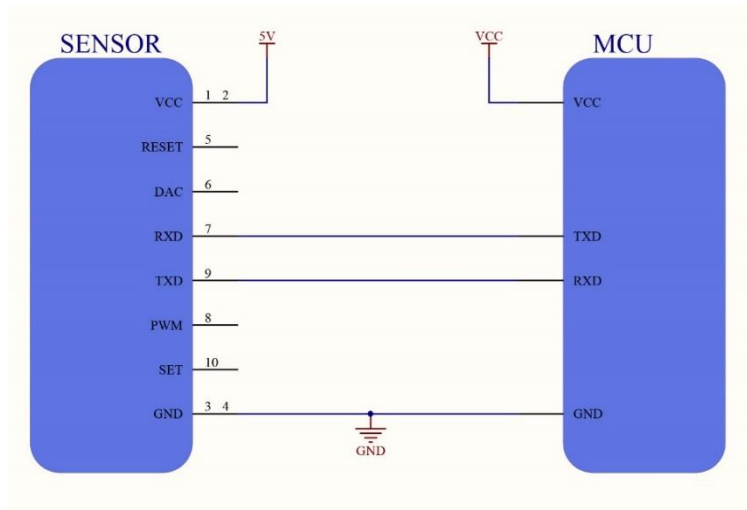


Figure 6 UART connection

Case 2. I²C application

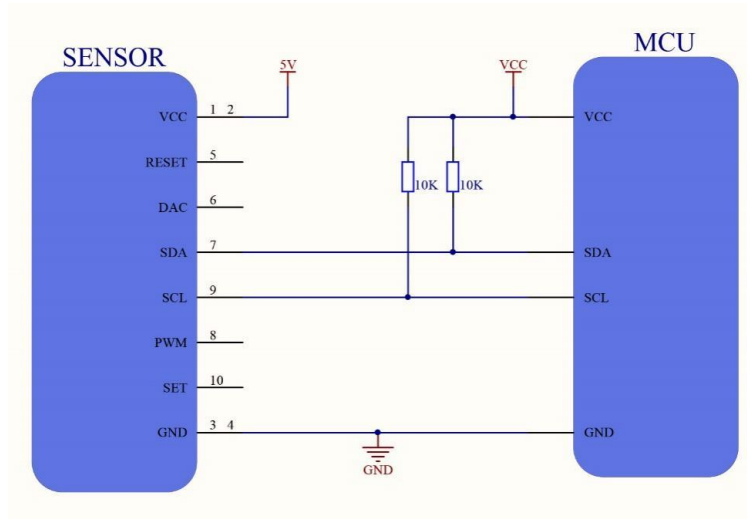


Figure 7 IIC connection

Case 3. PWM application

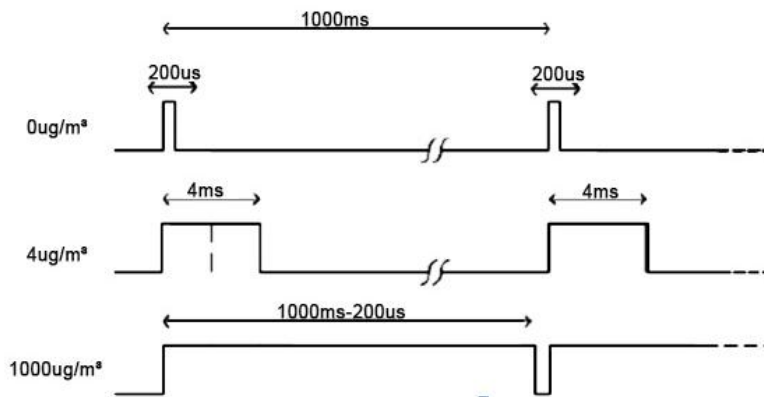


Figure 8

Circuit design considerations:

※ The power supply of MMD202 should be 5V, because the fan should be driven by a 5V power supply. But other data communication and control pins require 3.3V as a high level. Therefore, the mainboard MCU that communicates with the sensor should be a 3.3 communication level. If the mainboard MCU is a 5V communication level, an external 5V to 3.3V regulator should be add on circuit as following example:

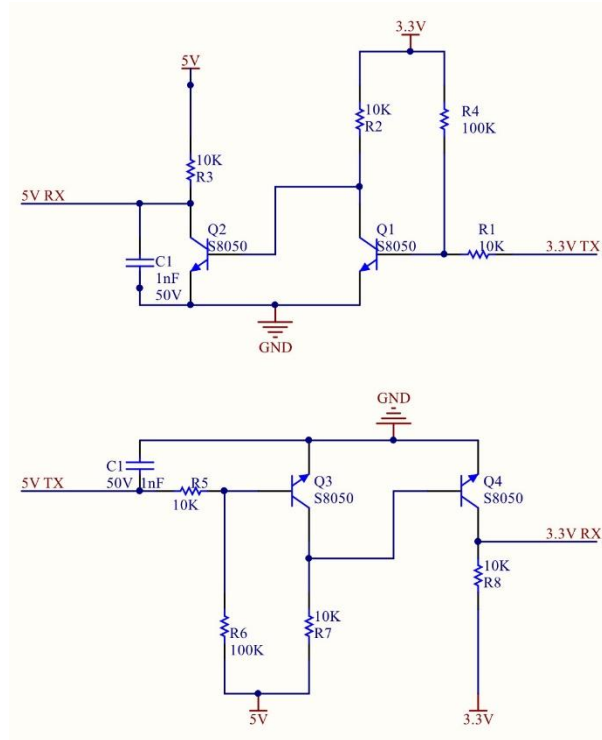


Fig. 9 Example of regulator

※ UART communication is compatible with 3.3V and 5V levels.

※ There are pull-up resistors inside SET and RESET pins. These two pins will work normally regardless of whether there is a signal input. If they are useless to you, just leave them floating.

6.2 Temperature influence curve

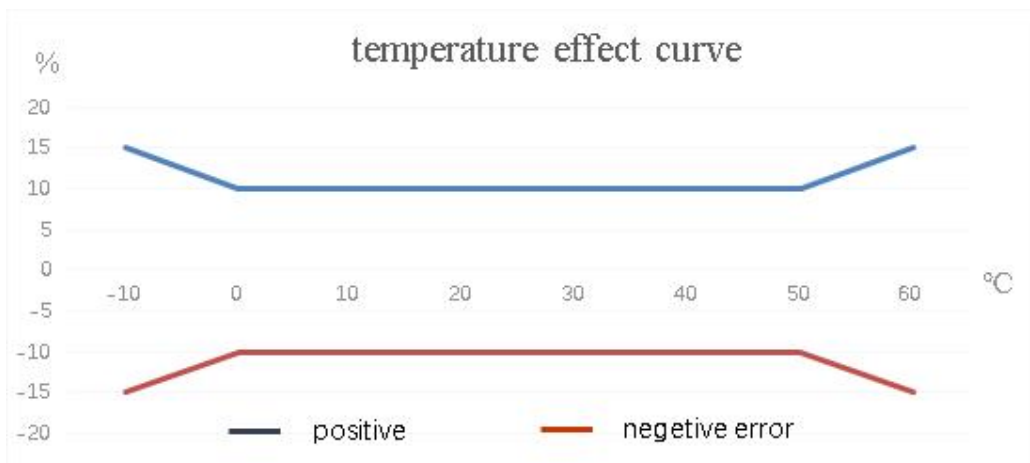


Fig.10

6.3 Sensor reliability test

Table 3

Test items	Test conditions	Standard	N=samples C=defects
Storage low temperature	The sensor power off in $-30\pm 2^{\circ}\text{C}$ for 72 hours and then place it in a room temperature to measure error.	After 2 hours of recovery in a normal temperature, the sensor should be able to work normally.	N=5 C=0
storage high temperature	The sensor power off in $60 \pm 2^{\circ}\text{C}$ for 72 hours and then place it in a room temperature to measure error.	After 2 hours of recovery in a normal temperature, the sensor should be able to work normally.	N=5 C=0
Work in low temperature	The sensor in temperature of $-10\pm 2^{\circ}\text{C}$, apply rated voltage, work for 72 hours, and then place it in a normal temperature to measure the error.	After 2 hours of recovery in normal temperature, the sensor should be able to work normally.	N=5 C=0
Work in high temperature	The sensor in temperature of $50\pm 2^{\circ}\text{C}$, apply rated voltage, work for 72 hours. Then, place it in a normal temperature to measure the error.	After 2 hours of recovery in normal temperature, the sensor should be able to work normally.	N=5 C=0
High and low temperature shock	Sensor in power off, keep it in -30°C for 60 minutes, the rise to 60°C within 10 seconds and keep for another 60 minutes, repeat this cycle 10 times.	After 2 hours of recovery in normal temperature, the sensor should be able to work normally.	N=5 C=0
High temperature + humidity	Place the sensor in $45\pm 2^{\circ}\text{C}$, $90\pm 5\%\text{RH}$, and operate at the maximum voltage (within the acceptable range) for 72 hours.	After 2 hours of recovery in a normal temperature, the sensor should be able to work normally.	N=5 C=0
Salt spray test	According to GB/T2423.17, place the sensor in a salt spray box at 35°C and spray with 5% sodium chloride salt water for 24 hours. After the	Under standard environment, recovery should be no less than 1 hour and no more than 2 hours	N=2 C=0
Vibration	in the X/Y/Z axis should be able to withstand the vibration test under the following conditions: Frequency range: $10\sim 55\sim 10\text{Hz}/\text{min}$;	After testing, there should be no defects in appearance. The sensor meets basic performance testing	N=4 C=0
Packaging dropped	Drop height: Set the height according to the weight height specified in GB/T4857.18. The test is carried out in accordance with the GB/T4857.5 packaging and transportation packaging drop test method. The order of drop test is one corner, three flutes and six sides.	After the packaging drop test, the sensor should have no bad appearance, no parts falling off, and the sensor should work normally.	N=1 box C=0

7. Dimensions

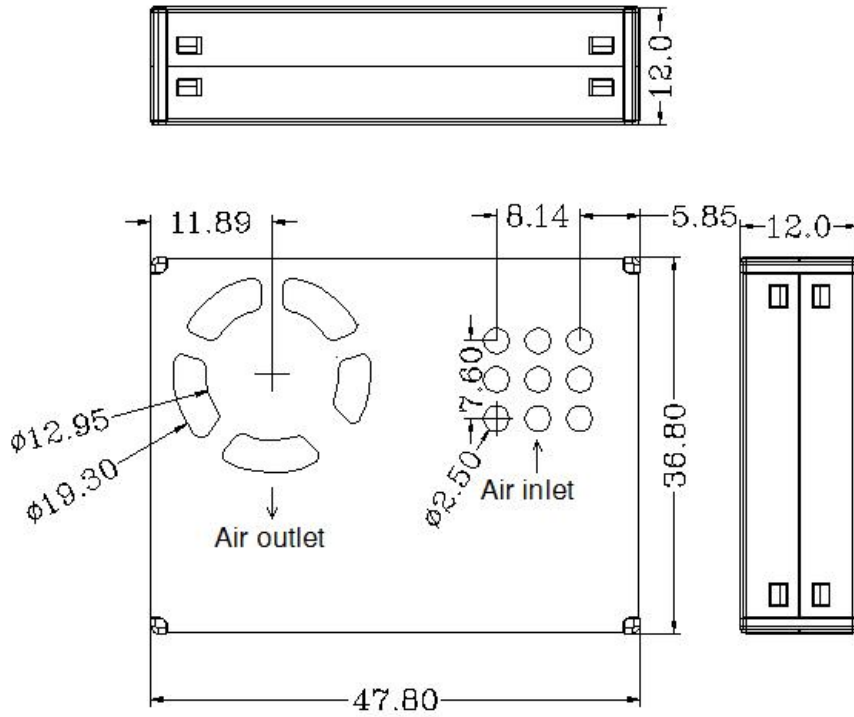


Figure 11: Overall dimensions (unit: mm, error ± 0.2 mm)

3D diagram

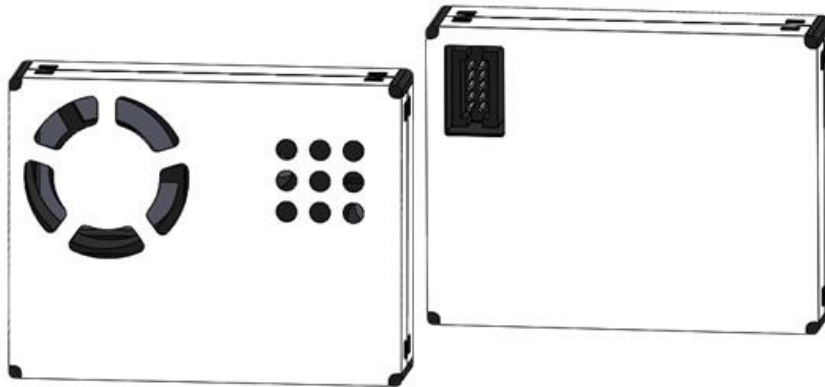


Figure 12

8. Packaging Solution

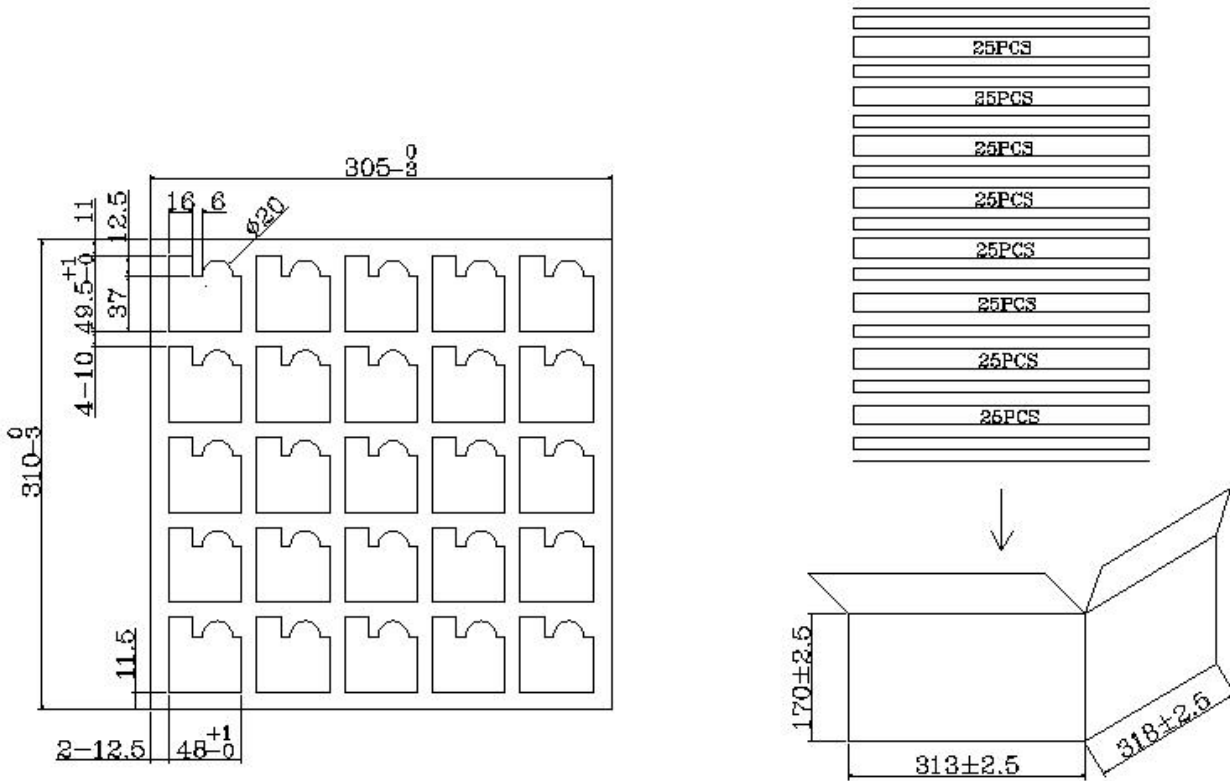


Figure 13

Table 4. Packaging description

Each layer	Layers	Full box	Carton size	Net weight per box	Gross weight per box	Packaging Materials
25pcs	8	200pcs	W318*L313*H170mm	5.17kg	7kg	Red pearl cotton (EPE)

9. Precautions

- The sensor must be mounted vertically, ensuring that the inlet and outlet are free from obstructions and strong air flow are avoided.
- Keep away from artificial flow such as fans. For example, when used in an air purifier, it should be installed on the side of the purifier case without blocking the air inlet.
- Avoid sticky particles such as oil entering the sensor during installation. Failures will occur when such particles adhere to optical components.

- Keep away from wet environment.
- Avoid operating outdoors or in dusty environments.
- The metal part of the product shell is connected to the DC ground of the internal circuit board. If a person directly touches the DC ground of the entire machine, there will be safety issue. Therefore, the sensor needs to be installed in a position that cannot be directly touched by the human body, and the sensor can only be touched after the power is turned off.
- The following installation positions are for reference:



Fig.14

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