SPECIFICATION

Product Name：Laser Particle Sensor Module

Item No.： PM2008

Version：V0.3

Date：2018-10-10

Writer	Audit	Approved
Mei Yang		

Revision

No.	Version	Content	Reviser	Date

Laser Particle Sensor Module

PM2008

Application

- ✧ Air purifier, air quality monitor
- ✧ Ventilation system, air conditioner with purifying function
- ✧ Auxiliary product of consumer electronic products
- ✧ Environmental Monitoring
- ✧ Handheld Air Quality Detector

Description

PM2008 laser particle sensor module use light scattering principle, to measure and calculate the suspending particle number which is within unit volume on the air exactly. Then output particle mass concentration by mathematical algorithm and scientific calibration.

Working principle

Sampling by the internal pressure which occurs by fan, when sampling particles pass through light beam (laser), there will be light scattering phenomenon. Scattered light will be converted into electrical signal (pulse) via photoelectric transformer. The bigger particles will obtain stronger pulse signal (peak value). Through peak value and pulse value quantity concentration of particles in each size can be calculate. Thus, real-time measured data is obtained through measuring quantity and strength of scattered light.

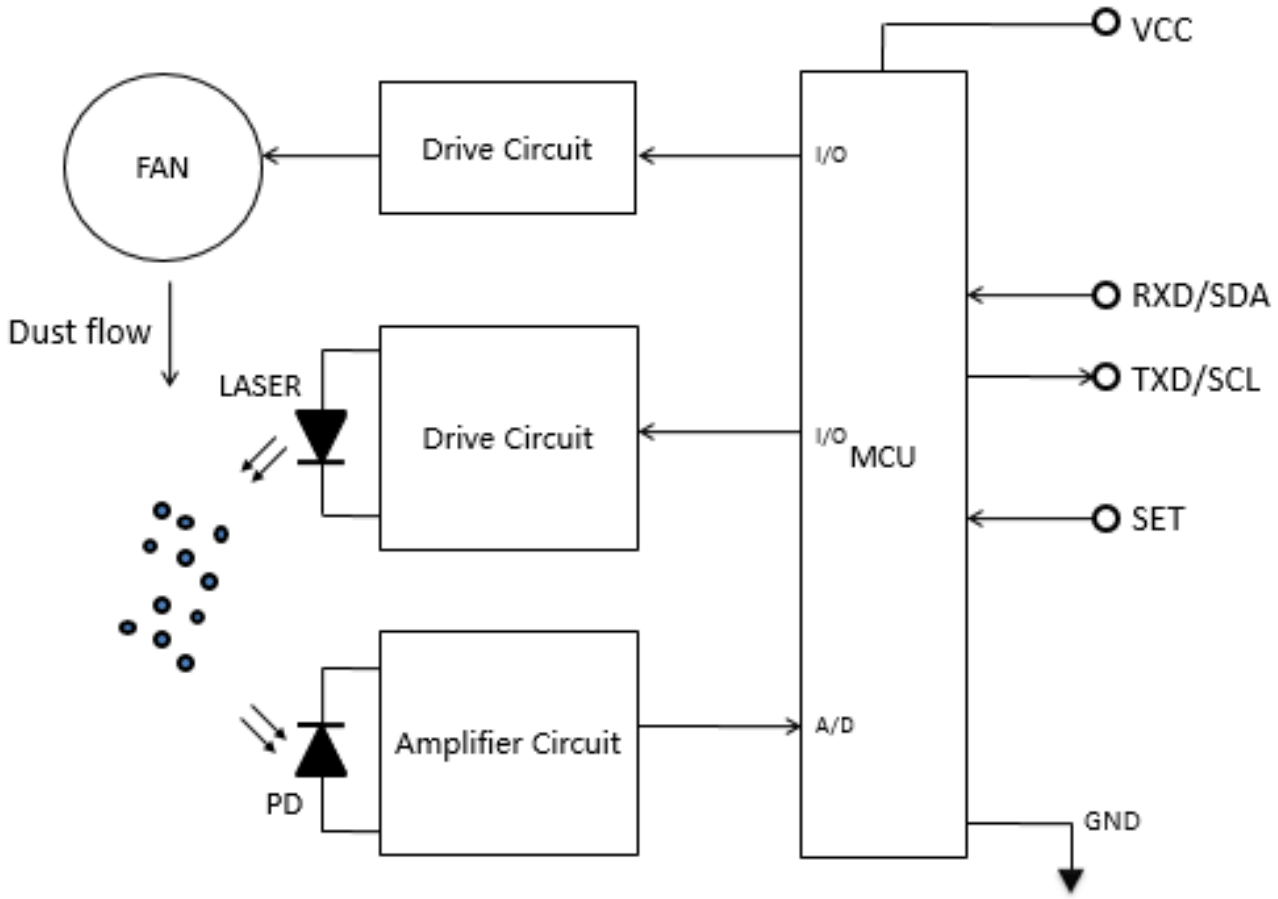
Main features

- ✧ The smallest size of available measurement: 0.3μm
- ✧ High accuracy，digital display prioritized
- ✧ Highly sensitive and quick response
- ✧ All metal shielding，good in antijamming capability
- ✧ Super Slim Design，height only 12mm
- ✧ Three types of optional signal output: UART_TTL, I2C, PWM

Table1 Cubic particle sensor module specification

Particle size range	0.3μm ~ 10μm
Output result	Particle mass concentration (μg/m³)
Measurement range	0 ~ 1,000μg/m³
Resolution	1μg/m³
Maximum Consistency Error for PM1.0&PM2.5	0 ~ 100μg/m³, ±10μg/m³ 101 ~ 1,000μg/m³, ±10% reading Condition: 25±2℃, 50±10%RH Reference instrument: GRIMM
Respond time	1sec
Time to first reading	≤ 8 seconds
Working condition	-10 ~ 60°C, 0 ~ 95%RH non-condensing
Storage condition	-30 ~ 70°C, 0 ~ 95%RH non-condensing
Power supply	DC 5V±0.1V， ripple wave＜50mV
Working current	≤100mA
Standby current	≤200μA
Digital output 1 （default）	I²C, UART_TTL(L<0.8V @3.3V/5V; H >2.7V@3.3V/5V ）
Digital output 2	PWM (customized)
Output method	Default by passive output after powering on, sampling time interval should be over 1,000ms.
MTTF	37,297hr (continuous turn on)

Internal architecture description

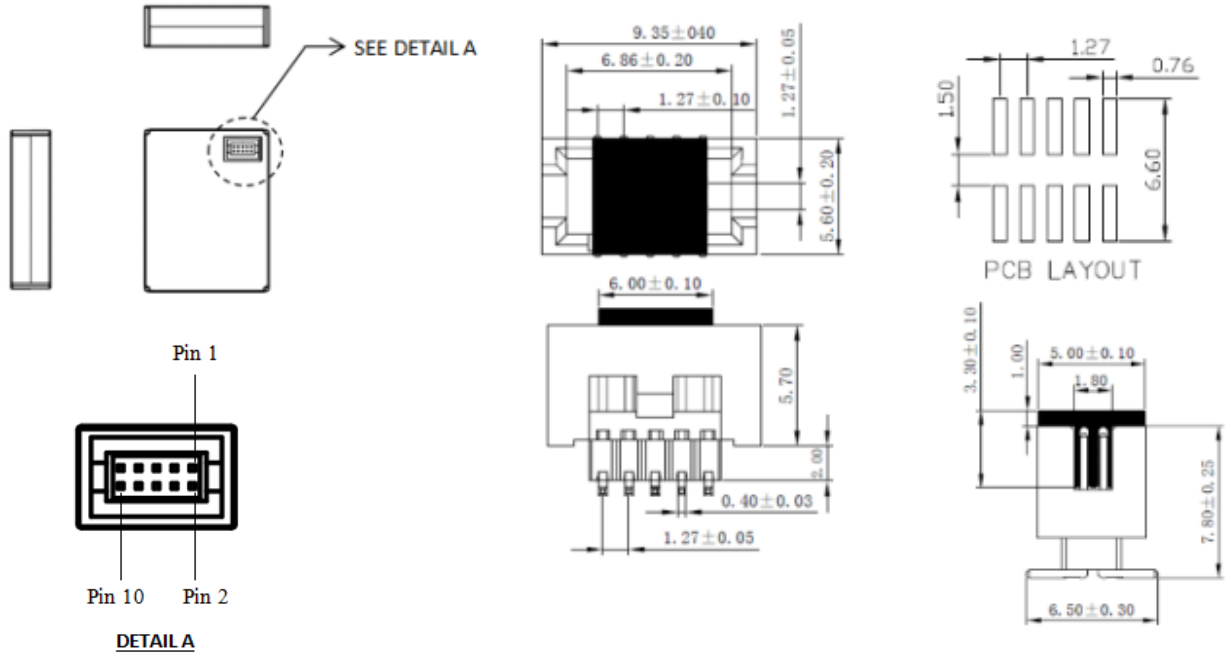


Picture 1. Internal configuration

According to above Block Diagram, the light source of PM2008 is consist of fan for particle sampling, laser diode for particle detection, photodiode for scattered laser signal, Amp for signal amplification the detecting part is consist of light sensitive part which receives reflected light and amplifying circuit. Value and communication output is finished by MPU.

When heating resistor heats, and after showing vertical draft, particles will pass the detecting chamber. The light from laser diode will be scattered by particles and will be tell out by light sensitive equipment, then convert into electronic signal. Electronic signal is disposed by filter circuit and MCU, it will convert into PWM signal output.

Configuration structure and I/O definitions



Picture 2：Configuration structure and I/O definitions

Table 2：I/O definitions

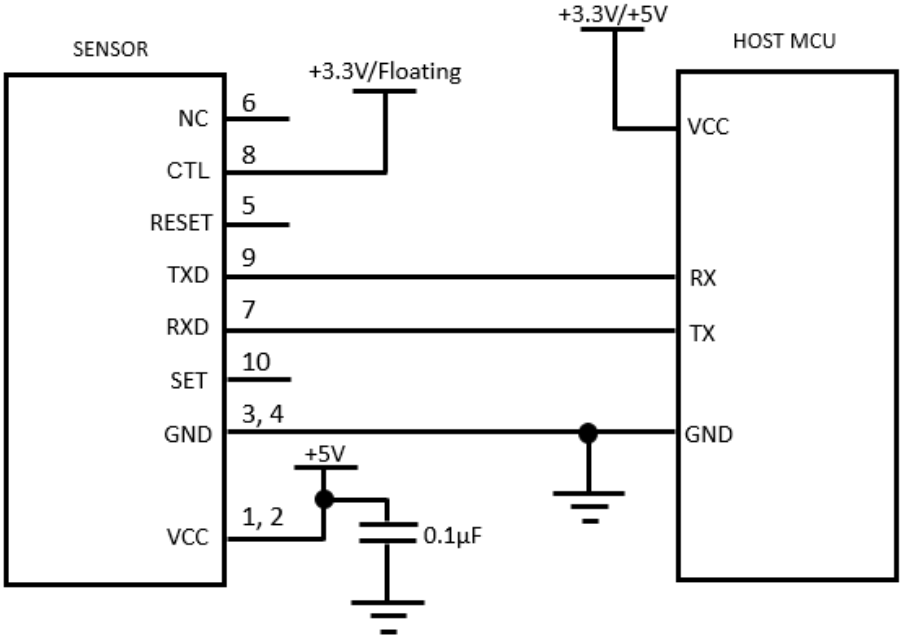
No.	Pin	Description
1	VCC	Power input（+5V）
2	VCC	Power input（+5V）
3	GND	Power input (ground terminal)
4	GND	Power input (ground terminal)
5	Reset	Module reset signal（TTL level @3.3V，Low level signal）
6	NC	NC
7	RXD/SDA	**UART-RX / I²C SDA**（TTL level @3.3V），compatible with 5V communication
8	CTL	Output mode exchange TTL level @3.3V High level or floating is UART communication mode, low level is I²C communication mode
9	TXD/SCL	**UART-TX / I²C SCL**（TTL level @3.3V）, compatible with 5V communication
10	SET	Set（TTL level @3.3V/5V，high level or floating is normal working status, while low level is sleeping mode.

Table 3. Connector description (Can be customized)

Item	Pin spacing	Brand
JSD-BH-312-002	1.27 mm pitch	FXK

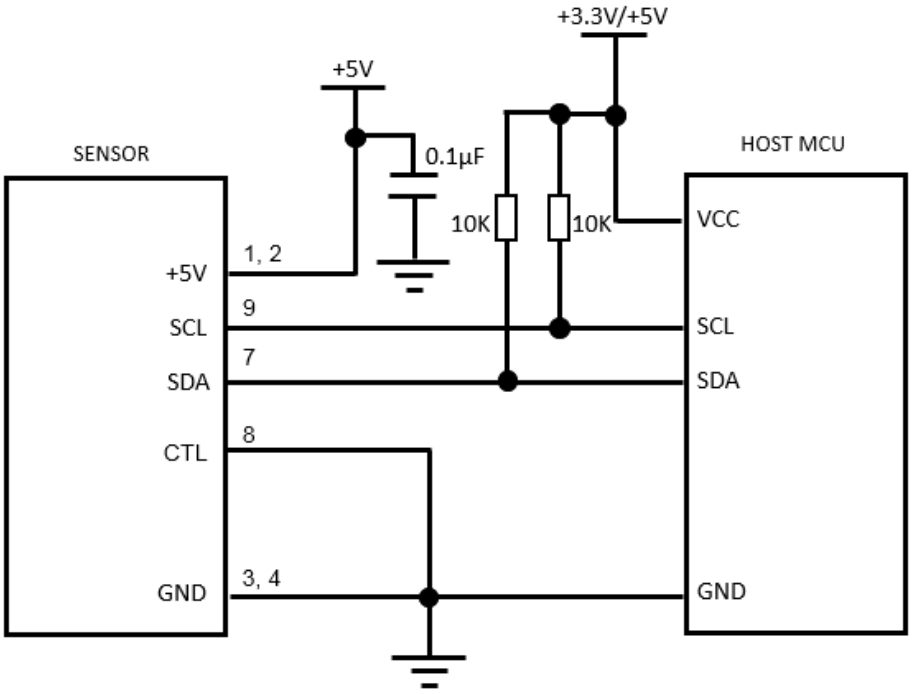
Typical application circuit

Case 1. UART application



Picture 3：UART application circuit

Case 2. I²C application



Picture 4：**I²C** application circuit

Note of circuit design：

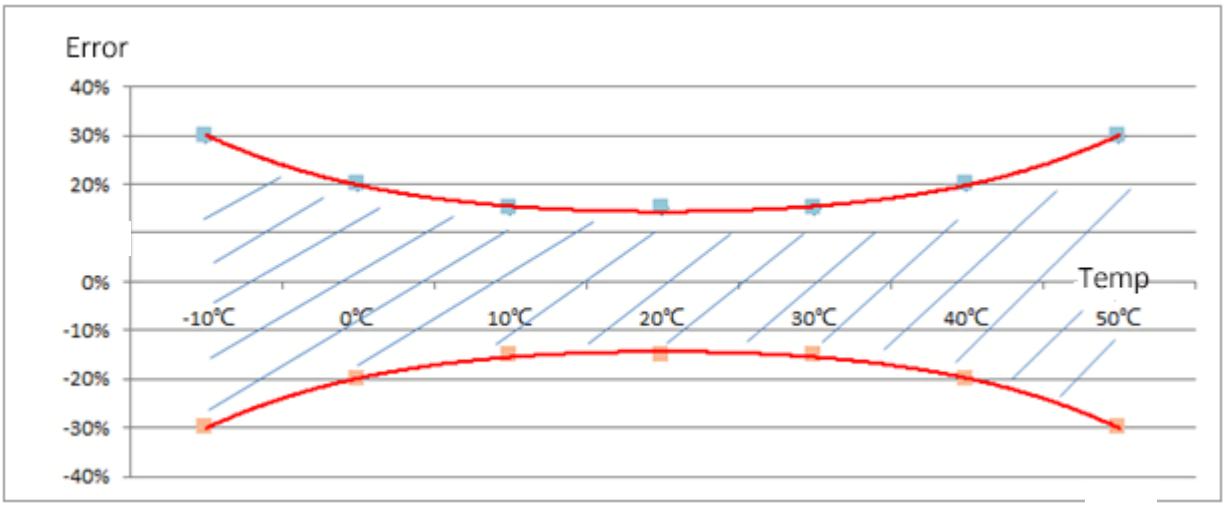
※ UART and I²C communication is compatibility with 3.3V and 5V level.

※ There is pull-up resistor inside the SET and RESET. No matter there is signal input or not, these two pins will work normally. If they are not useful for you, keep it floating.

※ PIN6 is the pin for manufacturer testing, you can keep it floating.

※ The power supply of sensor should be 5V and low noise, please refer to table 1 for details.

Temperature influence curve

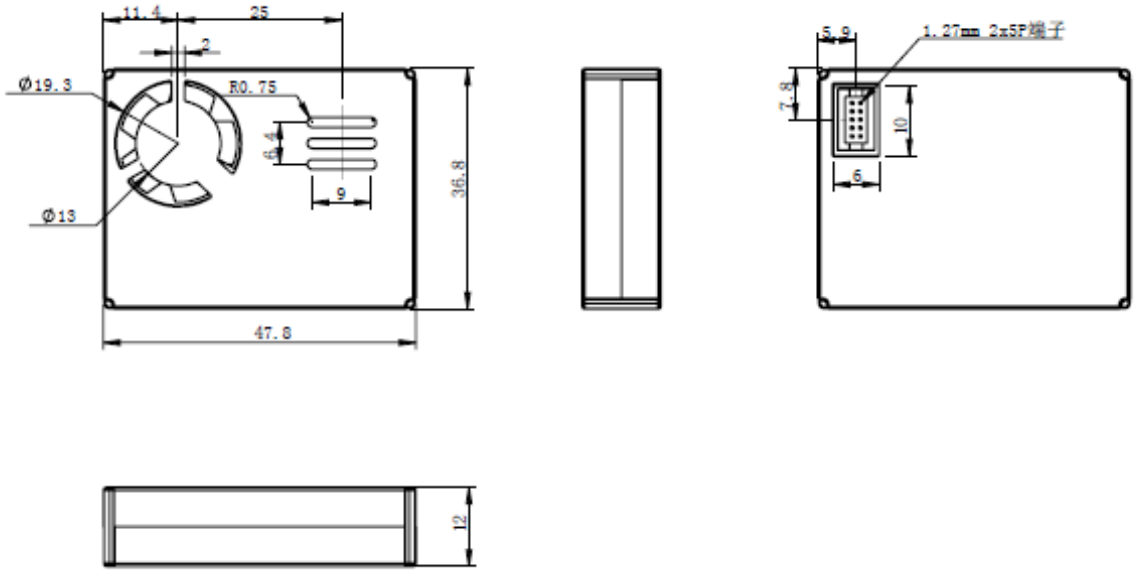


Picture 6. Temperature Influence Curve

Particle measured error: under 25±2℃, 0 ~ 1,000μg/m³, consistency and accuracy of PM2.5/PM1.0 is either ±10% reading or ±10μg/m³, use the biggest one.

Temperature influence coefficient: 0.5%/℃ ~ 1%/℃ or 0.5μg/m³/℃ ~ 1μg/m³/℃, use the biggest one.

Sensor appearance size and installing



Picture 5：Appearance size（Unit mm，Error ±0.2mm）

Note of sensor installing

※ Metal case conducts with internal power supply. Notice that cannot short connect with other external circuit or chassis shell.

※ The surface of inlet and outlet cling to wall of user receiver, this is the best installing method. If cannot do like this, there should be air isolation structure between inlet and outlet, to avoid the air back flow in the user receiver.

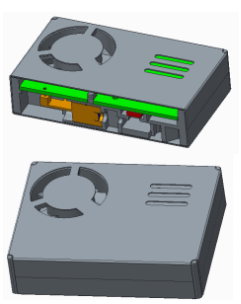
※ The size of inlet and outlet for wall of user receiver should be smaller than inlet and outlet size of sensor.

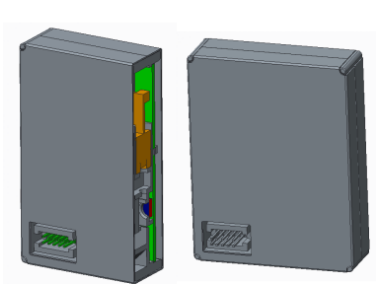
※ For purification products, sensor cannot be installed in the purify air flue, if cannot do like this, should design a separately structure for sensor, make it isolated for purify air flue and sensor.。
For purifier and detector device, the install place of sensor should be above 20cm higher than floor, to avoid approaching the particles and floccules twine fan.

※ Sensor does not be recommended to use for outdoor detect equipment.

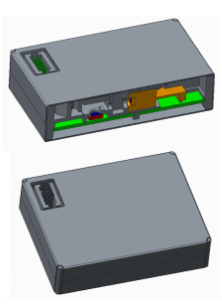
※ Sensor is an integral unit, in case of irreversible damage, sensor cannot be disassembling, including metal screening can.

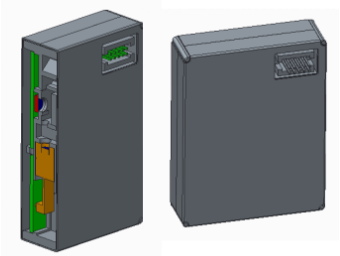
※ When installing to system, make sure the inlet and outlet is unobstructed, and cannot be touched against by large air stream. There are two sides cannot be put downwards (As below pictures), In case of dust deposition on the surface of sensitive device, dust deposition will affect accuracy of sensor.





Correct installation





Wrong installation

Reliability test

Test Item	Test Condition	Standard	Sample qty: N Defective qty: C
High temperature working	Leave the sensor in the ambient of 50±2℃, powered with nominal voltage for 72 hours.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
High temperature storage.	Leave the sensor in the ambient of 60±2℃, powered with nominal voltage for 72 hours.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
High temperature and high humidity operation	Operating the sensor in the ambient of 45±2℃, 90±5%RH, max voltage (within range of acceptable working voltage), for 72 hours.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
Low temperature storage	Leave the sensor in the ambient of -30±2℃, for 72 hours.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
Low temperature working	Leave the sensor in the ambient of -10±2℃, max voltage (within range of acceptable working voltage) for 72 hours.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
Thermal cycle	Leave the sensor in ambient of -10℃ for 1 hour then move it to ambient of +50℃ for 1 hour. Keep this cycle for 10 times. No control of humidity exert nominal voltage. No connection to inside power control, no connection to load, but adding voltage to direct current circuit.	The sensor works normally after 2 hours in the ambient.	N=5, C=0
Vibration test	10-55-10Hz/min, with amplitude of 1.5mm, vibrate in X, Y, Z direction, each direction for 2 hours.	The sensor works normally after 2 hours in the ambient.	N=2, C=0
Drop test	Drop the sensor from 70cm height down to the hard-wooden board randomly.	No damage, no breaking, no failure on electrical characteristics.	N=5, C=0
Salt spray test	According to GB/T2423.17-2008, leave the sensor in the 35℃ salt-fog cabinet, spray it with 5% sodium chloride saltwater for 24 hours. Clean the sensor after test.	No red rust on the sensor surface.	N=5, C=0

Packing

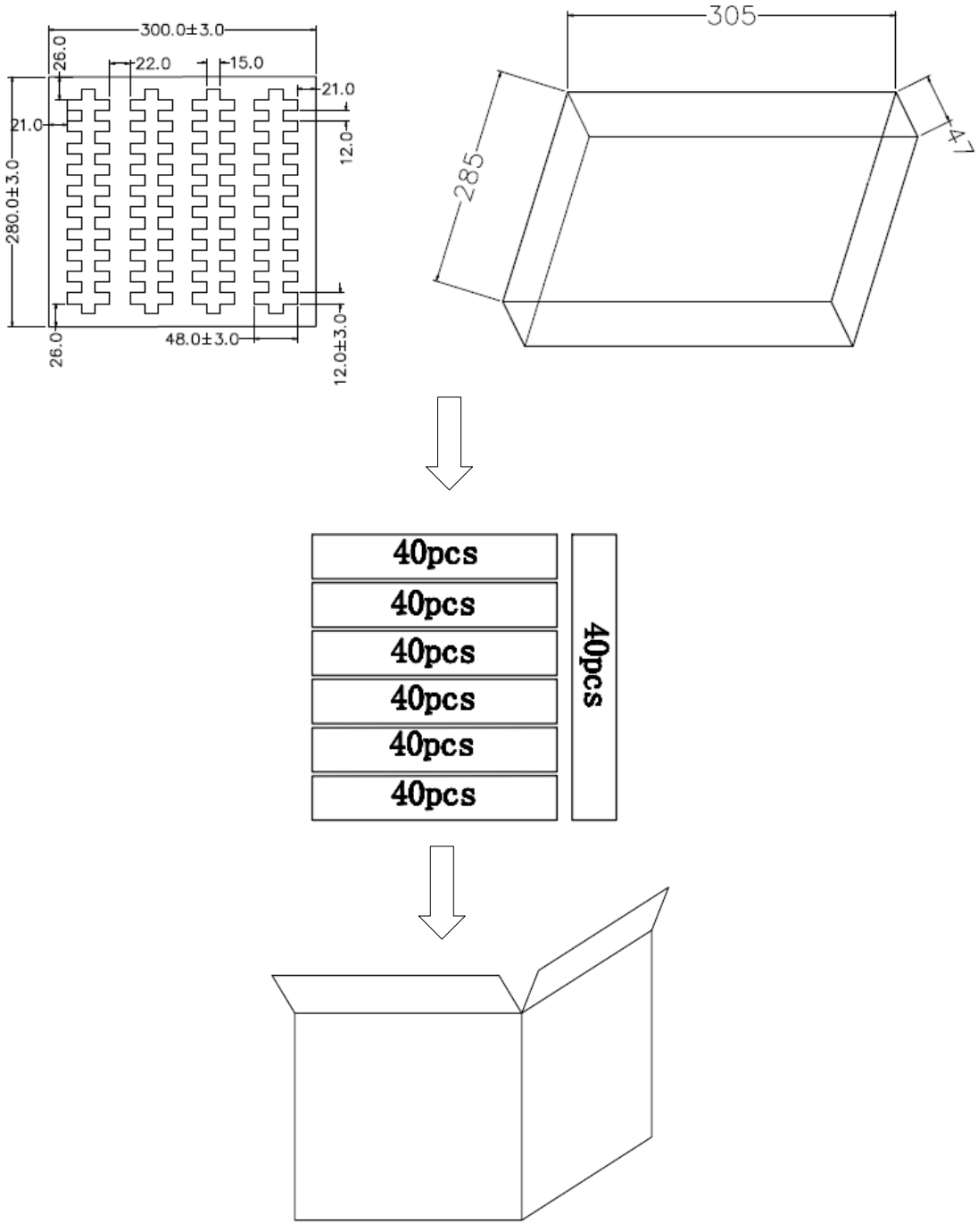
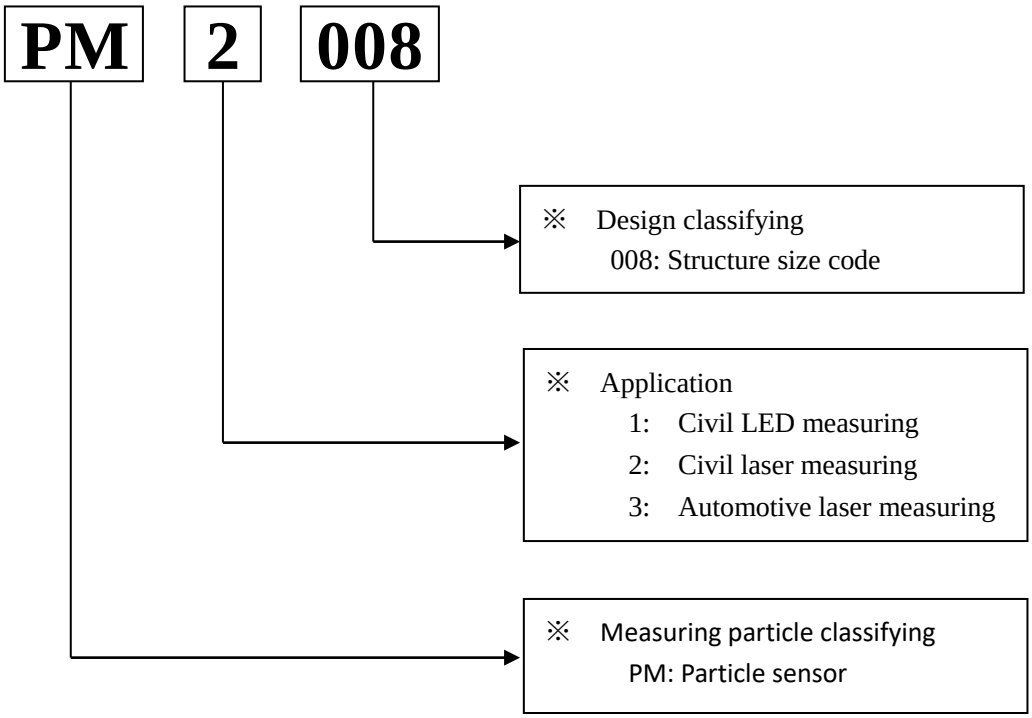


Table 4. Packing description

Qty per layer	Small Carton Qty	Carton	Carton dimensions	Packing material
40pcs	7pcs	280pcs	W400 * L300 * H320 mm	Red pearl cotton (ESD)

Ordering Information



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