

PRODUCT	Particulate Matter Sensor	SHINYEI KAISHA ELECTRONICS DIVISION ENGINEERING DEPT.	Issued	May 2002
			Rev.1	
			Rev.2	
MODEL NO.	PPD3NS	APPROVED BY:	Rev.3	
		CHECKED BY:	Rev.4	
		DRAWN BY :	Rev.5	

### 1.Scope

This specification establishes the configuration, performance, test and acceptance requirement

for Particulate Matter Sensor Model PPD3

### 2.Configuration

The configuration and connector pin allocation are shown in the attached drawing Fig1.

### 3.Sensor Performance

This sensor is to create Digital (Lo Pulse) output to Particulate Matters(PM).

Lo Pulse Occupancy time (LPO time) is in proportion to PM concentration.

The output from "P1" is for PM whose size is around 1 micro meter or larger.

"P1" Output characteristics is shown in the attached drawing Fig2.,when tested in standard condition stipulated below.

"P2" Output is for bigger sized particles of which size is around 2.5 micro meter or larger ones.

### 4. Specification

- 4-1. Detectable particle size: approx. 1 $\mu$  m (minimum.)
- 4-2. Detectable range of concentration: 0 ~ 53,000 pcs/liter (0 ~ 15,000pcs/0.01 CF)
- 4-3. Supply Voltage: DC5V  $\pm$  10% ( CN1:Pin1=GND, Pin3=+5V )  
Ripple Voltage within 30mV
- 4-4. Power consumption: 90mA
- 4-5. Operating condition range  
Temperature: 10 ~ 45°C  
Humidity: under 95%RH max.(without dew condensation)
- 4-6. Recommended storage condition: - 30 ~ 60°C
- 4-7. Time for stabilization: 1 minute after power turned on
- 4-8. Dimensions: 59(W)  $\times$  45(H)  $\times$  22(D) [mm]
- 4-9. Weight: 30g(approx.)
- 4-10. Output Method: Negative Logic, Digital output,  
Hi :4.5V Lo : 0.7V (As Input impedance : 20k $\Omega$  )  
Op-Amp output, Pull-up resistor : 10k $\Omega$

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**5. Standard test Method**

Burn two pieces of cigarettes in an ambient of temperature  $23 \pm 7^{\circ}\text{C}$  to generate cigarette smoke in the room. Then extinguish them after fully burned out, use air purifier (with HEPA filter) to lessen the concentration of smokes. Check the sensor output variation in accordance with fluctuation of concentration.

Sensor output characteristics should be set in between standard "upper limit" sensor and standard "lower limit" sensor.

Particle counter is to be referred for the smoke concentration.

- Cigarette: 2 pcs. Cigarette (Japanese Brand :Mild seven)  
 Particle counter: RION Co., Ltd. Model No. KC-01B or KC-01C  
 (particle size level :  $1\mu\text{m}$  min.)  
 Smoke generator: Automatic smoke suction machine  
 (Japan Electric Industrial Organization JEM146)  
 Room capacity:  $20 \sim 30\text{m}^3$   
 Stirring: Stir by electric fan. During the test, collect dusts  
 by air purifier, and lessen the concentration rate of cigarette smoke.  
 Sensor setting location: Center of the room,  $40 \sim 80\text{cm}$  height from the floor level.  
 Rated input voltage:  $\text{DC}5\text{V} \pm 2\%$

**6. Mechanical Characteristics**

No.	Item	Test method	Characteristics
1	Drop test	Drop it unintentionally from 70 cm height down to the hard wooden board for 3 times at random.	No damage, No breakage No failure on electrical Characteristics

**7. Endurance Characteristics**

No.	Item	Test method	Characteristics
1	heat endurance	Leave it in the atmosphere of the $60^{\circ}\text{C}$ for 1,000 hours.	Within $\pm 0.5\text{V}$ at the original value.
2	cold endurance	Leave in the atmosphere of the $-30^{\circ}\text{C}$ for 500 hours.	Within $\pm 0.5\text{V}$ at the original value.
3	Heat cycle	Repeat 10 times in the following cycle. After leaving in the atmosphere of $-25^{\circ}\text{C}$ for 30 minutes, move it into the atmosphere of $+70^{\circ}\text{C}$ within 10 seconds. Further, return to the atmosphere of $-25^{\circ}\text{C}$ after 30 minutes.	Within $\pm 0.5\text{V}$ at the original value.

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SP-30-E-02003

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4	Heat shock	Repeat 10 times for following cycle. After soaking in the liquid of +5°C for 5 minutes, move to the liquid of +70°C within 10 seconds. Further, return to the liquid of +5°C after 5 minutes.	Within $\pm$ 0.5V at the original value.
5	High temperature and humidity	Leaving it in the atmosphere of 60°C, 90% ~ 95%RH for 1,000 hours.	Within $\pm$ 0.5V at the original value.
6	H <sub>2</sub> S endurance	Leaving it in the atmosphere of 25°C, over 95%RH, 10 ~ 15ppm for 10days.	Within $\pm$ 0.5V at the original value.
7	SO <sub>2</sub> endurance	Leaving it in the atmosphere of 25°C, over 95%RH, 25 $\pm$ 5ppm for 10 days.	Within $\pm$ 0.5V at the original value.

## 8. Endurance Characteristics

No.	Item	Testing method	Characteristics
1	High temperature and humidity	Leaving it in the atmosphere of 60°C, 90~95%RH for 1,000 hours.	Within $\pm$ 0.5V at the original value.
2	On-off cycle test	Apply the power on-off test for 500 hours in the atmosphere of 45°C, 90~ 95%RH. On time: 5 minutes / Off time : 5 minutes	Within $\pm$ 0.5V at the original value.
3	vibration	10 ~ 15 ~ 10Hz / 1 minute vibration amplitude : 1.5mm X,Y,Z-Way , Per 2 hours	

## 9. Open-Short Circuit Test

## 9-1. Test method :

Keep the mutual terminals of electronic parts in short circuit, or keep the terminals opened, and supply the electric current to it.

## 9-2. Characteristics :

Not to cause the smoking, firing, burning on the electric circuits, for which open-short

circuit test was taken. But the simple smoke or burn, which is not in danger of fire can be disregarded.

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**10. Tracking Endurance Test**

10-1. Test method :

Drops 5% saltwater 200 times on the printed board with 30 seconds interval.

10-2. Characteristics :

Not to cause the smoke or fire.

**11. Solder Crack Test**

11-1. Test method :

Repeat 200 times for following cycle. After soaking in the liquid of  $-40^{\circ}\text{C}$  for 1 hour, move to the liquid of  $+80^{\circ}\text{C}$  within 10 seconds. Further, return to the liquid of  $-40^{\circ}\text{C}$  after 1 hour.

11-2. Characteristics :

Not to crack or line

**12. Life expectancy**

The light emitter is continuously turned on for 7 years minimum.

**13. Maintenance of the Sensor**

Lens need to be cleaned depending on the condition. Cigarette tar on the lens should affect the sensitivity of the sensor. Wet a end of the swab with water and wipe the lens with it and then dry lens with the other end of swab.

**14. Standard Sensor**

We hold "upper limit" sensor and "lower limit" sensor as standard against which every unit of sensor to be set its characteristics in between upper and lower limit characteristics curve. Those standard "upper limit" sensor and "lower limit" sensor are to be tested, calibrated periodically.

**15. Instruction for operation / Caution**

15-1. Setting position : Use it at the Vertical position (within  $\pm 3^{\circ}$ )

15-2. Please have a kind of door to cover the front window to make sensing area completely dark condition

15-3. Don't use in an ambient of the organic gas and flammable gas.

15-4. Don't use the material such as alcohol to clean the lens. Use water only.

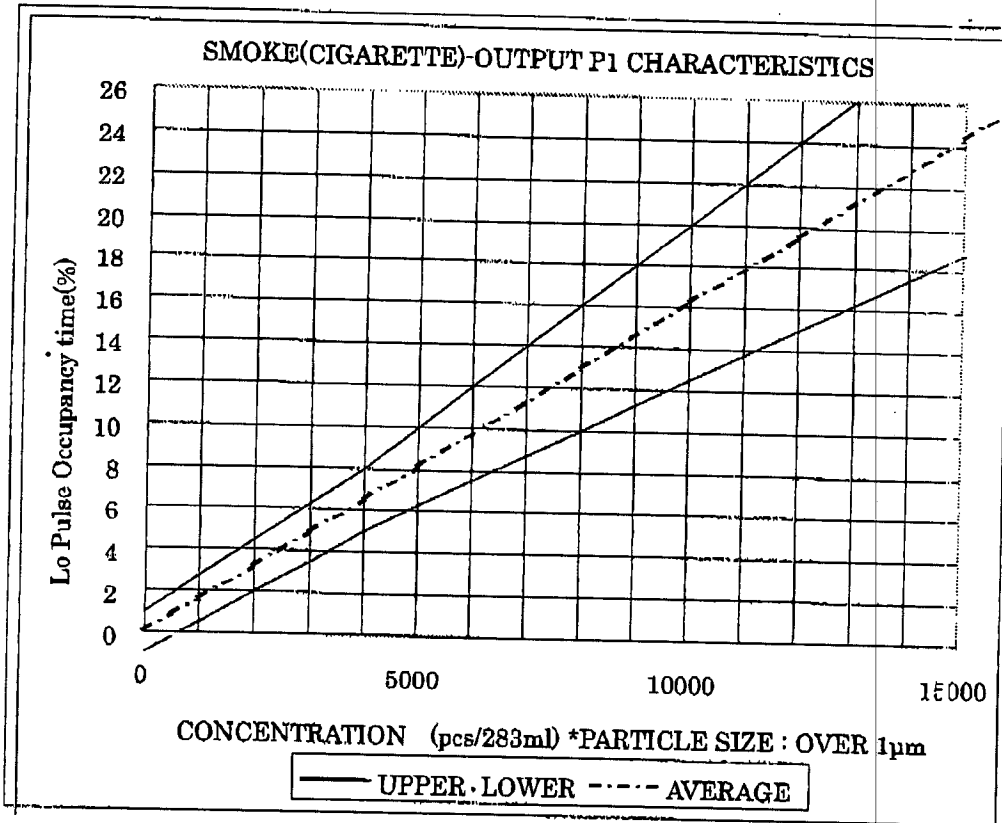
**16. Marking for Lot Number**

Indicate the model number, date of manufacture on PCB by silk screening.

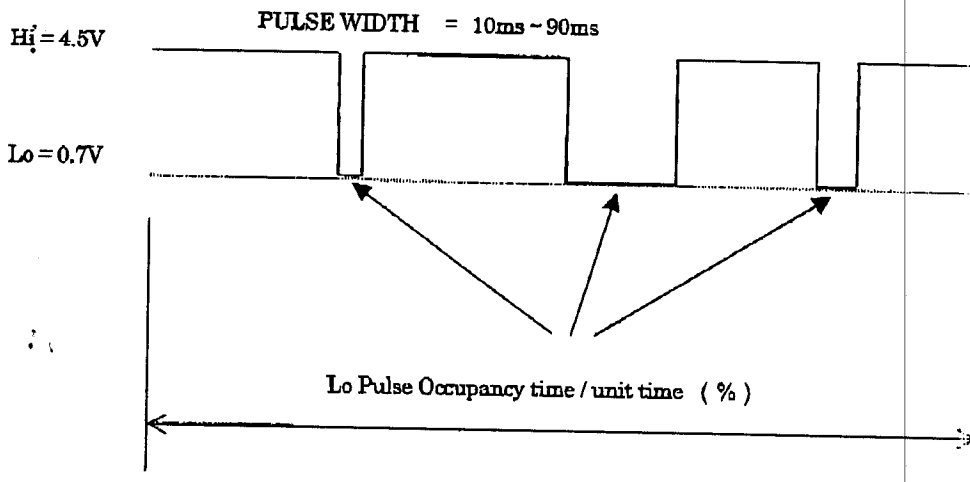
**17. Specification is subject to change for improvement, without prior notice.**



Fig 2



$$\text{AVERAGE} = 6.5 / 4,000 \times X \quad X / 283\text{ml (over } 1\mu\text{m)}$$



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