

Particle Sensor Module

MDSM 501 Series

1. Features

- ♦ Detecting fine dust over $1\mu\text{m}$
- ♦ Customized sensitivity for efficient control depending on application
- ♦ Excellent long term reliability and easy maintenance
- ♦ Compact size / MCU Control
- ♦ PWM Output
- ♦ Optimizing function



2. Applications

- ♦ Air cleaners, Air conditioners
- ♦ Ventilation System, Fan Control
- ♦ IAQ Monitoring & Control
- ♦ Smoke Detectors

3. Description

MDSM501 detects fine particle, house dust, pollen, germs, dust mites and cigarette smoke as small as $1\mu\text{m}$ and measures quantity of floating particles in a room space up to maximum 30m^3 .

This sensor is ideal product for automatic room air monitoring system as an air purifier.

MDSM501's signal is converted to PWM output by internal circuit and MCU program.

Also, the sensor's filter circuit and MCU program could remove a noise for more stable sensing operation when the noise is inflowed in the signal, and **by operating optimization**, the sensor's detecting performance could maintain the similar condition with an initial state.

It has an effect on the recovery of the reduced detecting ability of sensor by long-term usage or pollution.

MDSM501 has advantage of both stable detecting ability and high production efficiency.

The sensor doesn't need additional control point for preventing malfunction from user's arbitrary modification.

4. Product Specification

Ta = 25°C

Parameter	Symbol	Min.	Typ	Max	Unit
Supply Voltage	V _{CC}	4.5	5.0	5.5	V
Current Consumption(@ 5V)	I _{CC}			85	mA
Storage Temperature Range	T _{stg}	-20		80	°C
Operating Temperature Range	T _a	-10		65	°C
Operating Humidity Range (Without dew condensation)	RH			95	%RH
Detectable Particle Size		1			μm
Detectable Range of Concentration		0		15,000	pcs/283mℓ
Output Signal	PWM (Pulse Width Modulation)				
Weight	25g				
Size	(W) 59 mm x (H) 45 mm x (D) 17 mm				

5. Output Characteristics

Vcc = 5V, Ta = 25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Vout 1, 2 at high ^{*1}	Voh	No particle	-	Vcc	-	V
Vout 1, 2 at low ^{*2}	Vol	Particle	-	-	0.8	V
Time for stabilization ^{*3}			1	-	-	minute

*1 : Vout 1 and Vout 2 are high state when particles are not detected. (=clean room)

*2 : Vout 1 and 2 go to low state when particles are detected.

*3 : After the power is turned on.

6. Block Diagram

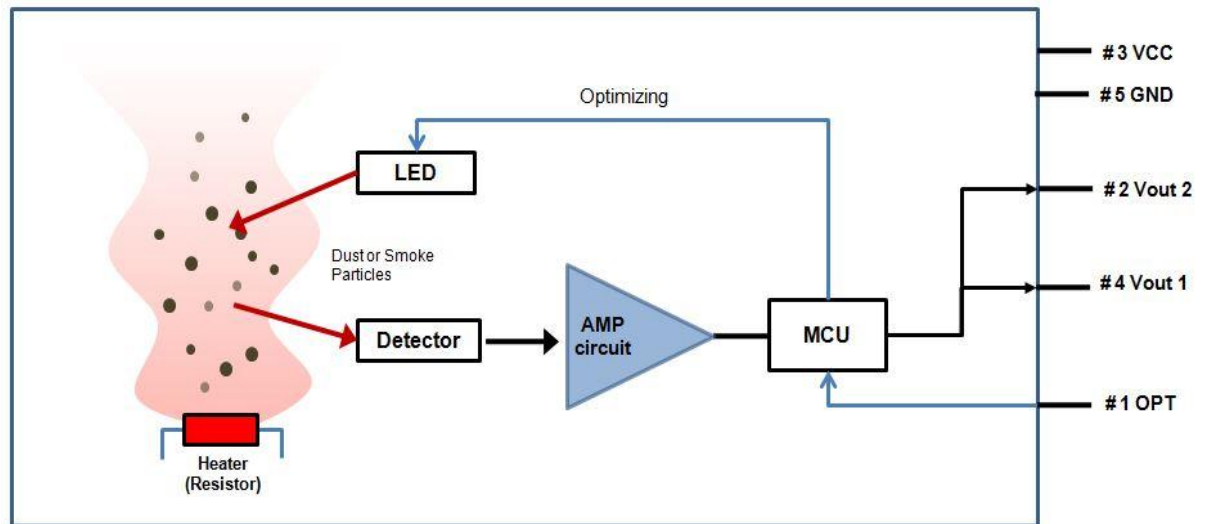


Fig.1 Block Diagram

According to the above Block Diagram, in the inside of sensor module, there are dust detection for infrared LED, Photo TR for scattered infrared signal by external dust, OP-Amp for signal amplification and MCU for optimizing function.

The principle of dust detection is that inflowed dust is passed by the measuring scope through upstream due to self-heating of heater, and lights from LED is spawned by dust and is realized as a signal at Detector.

The signal from detector is filtered by circuit and MCU and it is transferred as a PWM signals. The MCU has an optimizing function for making similar status about sensor's initial detecting ability. A User could use this operation when the sensor's detecting performance is slowdown through changes according to time or pollution by long-term using.

7. I / O Connector Specifications

Pin number	Pin name	Description
1	Opt	Optimizing input
2	Vout 2	Vout 2 output (PWM)
3	Vcc	DC 5 V Input
4	Vout 1	Vout 1 output (PWM)
5	GND	Ground

7-1. PIN Description

Opt (Pin #1)

This Pin is used for operating optimization function. And, it could be working as an active high(5V) signals through external control system or equipment.

When the optimizing function is stopped due to internal full down (10K Ω), this function's working time is Max. 15sec.

After completed an optimizing function, user should operate the sensor after reset (Power off → on).

For the function description, Please refer to '10. Description of Optimizing Function' in the 'Page.8'.

Vout 2 (Pin #2)

This Pin is used to transfer dust signals (over 1 μ m) to PWM (Pulse Width Modulation) signal (Active Low).

Refer to the 'Page.6~7' or attached additional 'Application Note'

Vcc (Pin #3)

The Pin of DC 5V input Power.

For the stable operation, the power supply range adjust within $\pm 10\%$, Ripple has to be 30mV.

Vout 1 (Pin #4)

This Pin is used to transferred dust signals (over 2.5 μ m) to PWM (Pulse Width Modulation) signal(Active Low).

Refer to the 'Page.6~7' or attached additional 'Application Note' about the method of signal conditioning.

GND (Pin #5)

Pin #5 is used for Ground.

7-2. Connector Description

Model name	Part No.		Description	Connector's maker
MDSM501A	Wafer	20010WR-05	2mm pitch	Yeonho Electronic
	Housing	20010HS-05		
MDSM501B	Wafer	S 5B-EH	2.5mm pitch	J.S.T.
	Housing	EHR-5		

7-3. Sample Schematics

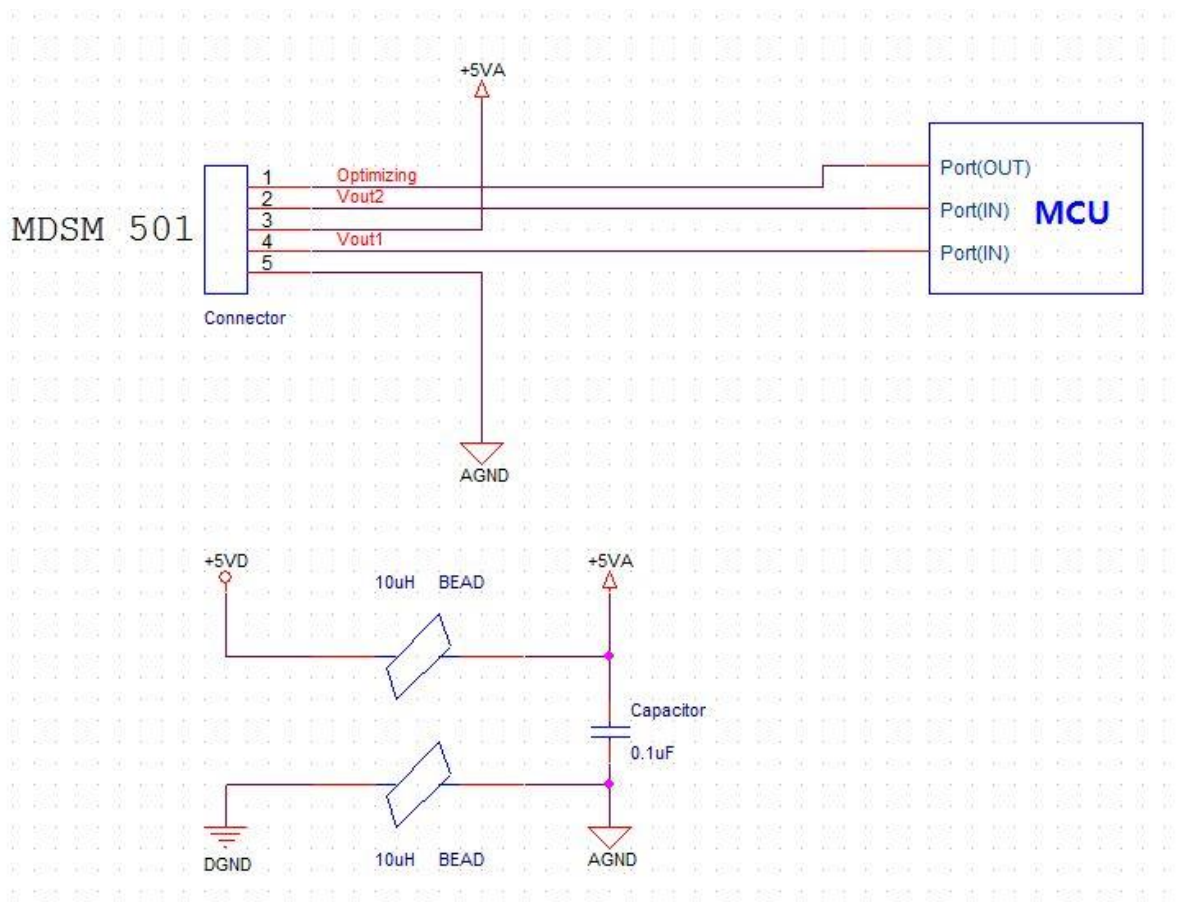


Fig.2 Sample Schematic

8. Detection Size Determination

Size of the signal from the sensor differs depending on the size of the particles detected; over 1 μ m (Vout2) and over 2.5 μ m (Vout1).

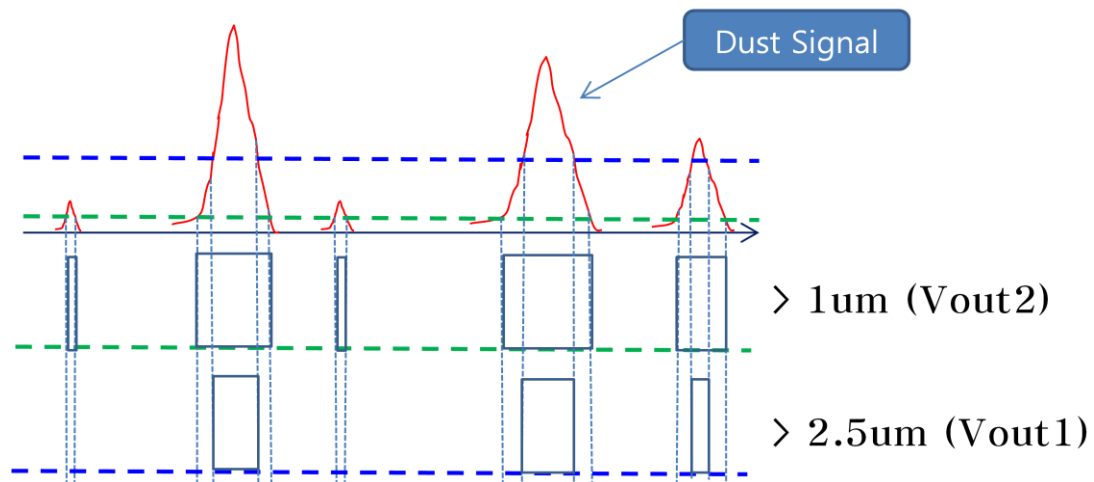


Fig.3 Detection Size Determination

9. Sensor Characteristics vs Low ratio

9-1. Dust sensor Characteristics

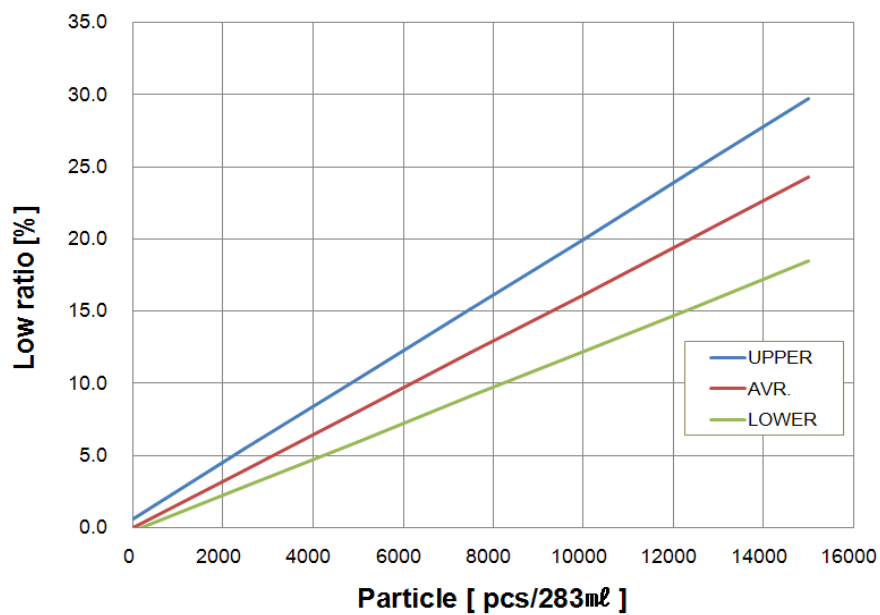


Fig.4 Sensitivity Characteristics of Dust sensor

9-2. Low Ratio Calculation

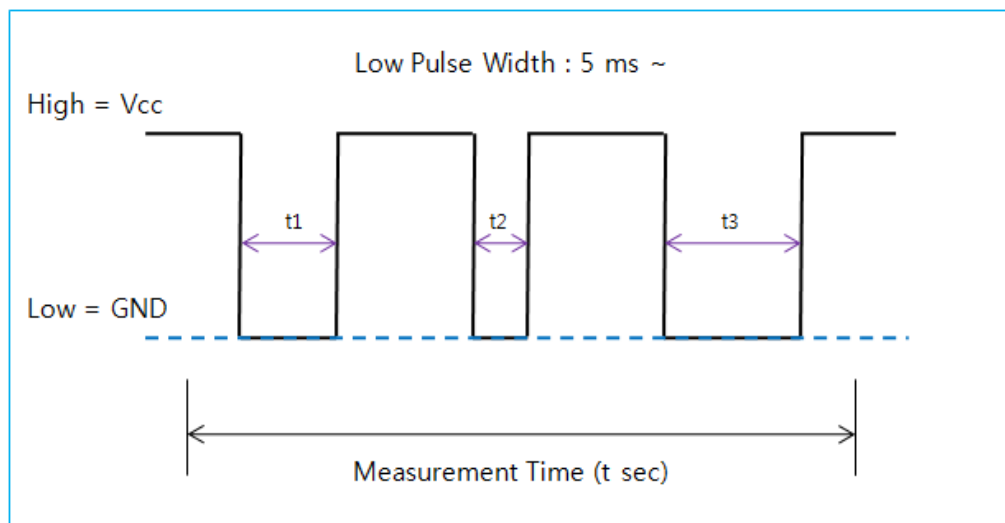


Fig.5 Dust sensor Low Ratio

$$\text{Low Ratio (\%)} = (t_1 + t_2 + t_3) / t \times 100$$

(Measurement Time is calculated by a percentage of sum of Low signals occurred within t(5~30) seconds)

10. Description of Optimizing Function

The optimizing function can recover the detecting ability as an initial status when it decreases due to long-term using and polluted lens. User can operate an optimizing function when the detecting ability is slowdown rapidly.

10-1. To inputting signal to Optimization Function Pin (Opt. Pin No. 1)

To connect active high (5V) signal to Opt (Pin.1) input signal pin.

After inputting signal to sensor, the optimizing function is operating.

On that time, the active high (5V) signal should be keep more than Min. 1ms.

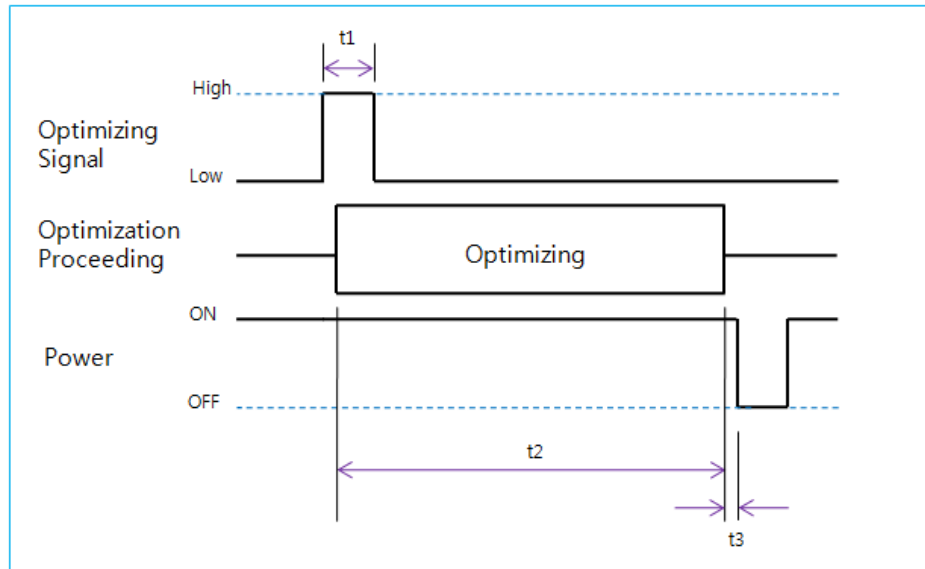
10-2. Waiting for Optimizing Function

The optimizing function time is taken approximately Max. 15sec, and during the operating, Please keep away the any external impact, vibration or scattering lights to the sensor.

Furthermore, Please do not turn off the power during operating optimization because new values are automatically inputted to the EEPROM of MCU.

10-3. Resetting after completed Optimizing function

After completed the optimizing function, Please turn off the power and restart for stable sensor operation.



Parameter	Description	Min	Max	Unit
t1	Optimizing Signal Input Time	1		ms
t2	Optimization Proceeding Time		15	sec
t3	Switch Off after Optimization	0.1		ms

Fig.6 Handling Optimization

11. Dimension

(Unit : mm)

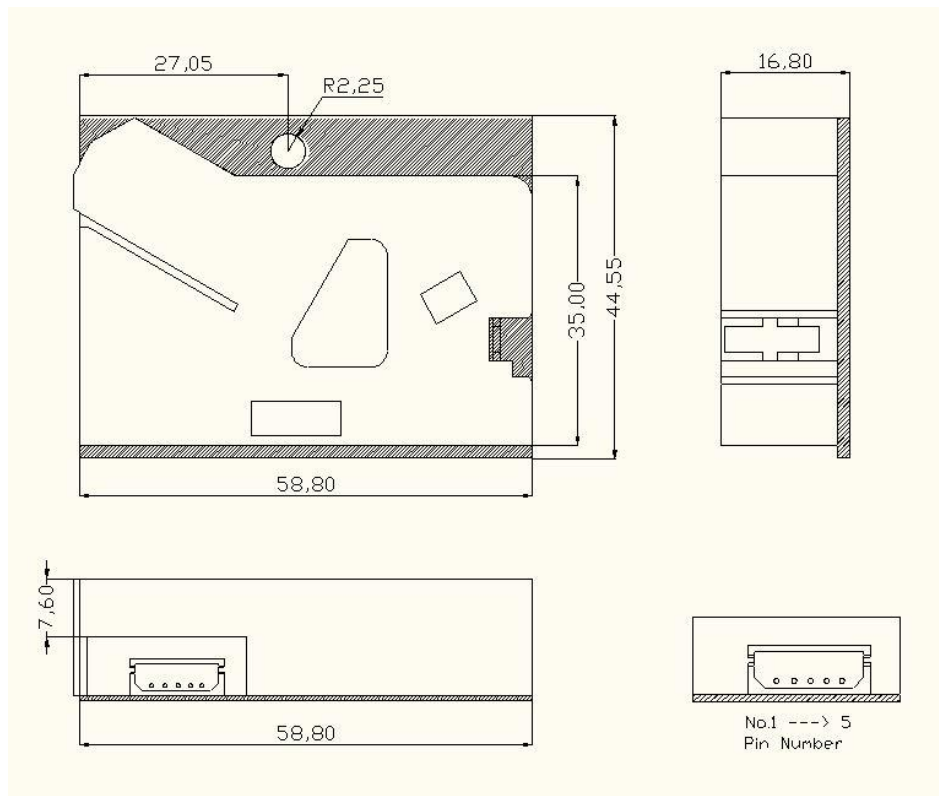


Fig.7 Dimension

12. Ordering Information

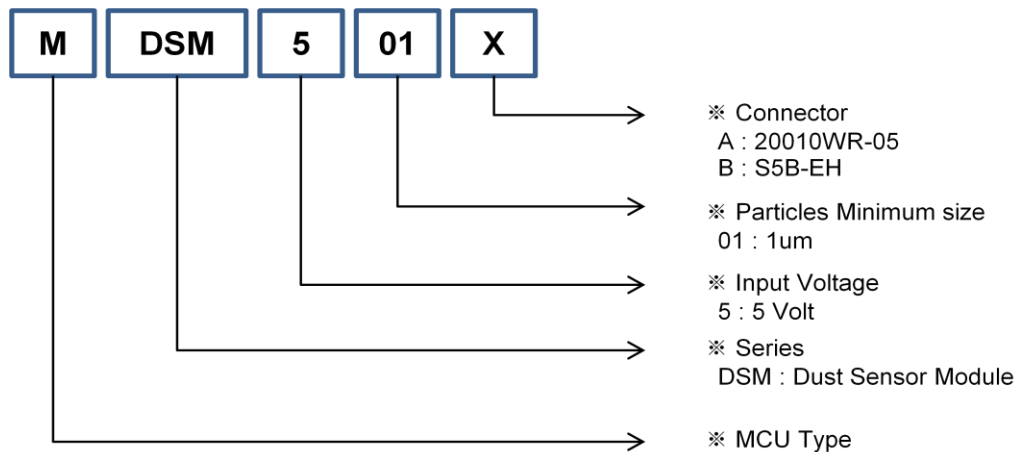


Fig.8 Ordering Information

13. Packaging Information

13-1. Marking

Model no.	MDSM501A or MDSM501B
Qt'y	00 pcs

13-2. Packaging Details

Module dimensions	: W59 x H45 x D17 mm
Weight	: Approx. 25g / ea
Tray	: modules of 25pcs.(5x5) per tray
Outer box	: 10 trays per box (module 250pcs)
Outer Box Dimensions	: W380 x H255 x D320mm
Weight	: Max. 7.5Kg per outer box

Caution for Use

Please do not disassemble the device. If the device is reassembled, it may not satisfy the specification.

For using the products normally and stably, please refer to additional 'Application Note'.

Please **never use** this device for **Emergency** or **Fire alarm** application.