MDSM025B
Particle Sensor Module

Features

- **Detects PM2.5 dust**
- **Customized sensitivity for efficient control in application**
- **Excellent long term reliability and easy maintenance**
- **Compact size & MCU Control**
- **PWM Output (Low Logic Pulse Active)**
- **Optimization function**

Product Summary

MDSM025B detects fine particle such as house dust, pollen, germs, dust mites and cigarette smoke as small as 2.5μm and measures the concentration of floating particles in a room space up to maximum 30㎥.

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

MDSM025B's signal is converted to PWM output by internal circuit and MCU program. Also, the sensor's filter circuit and MCU program can remove a noise in order to operate more stably when a noise is in-flowed in the signal, and **by operating optimization**, the sensor's detecting

performance can maintain a similar condition with an initial state. The optimization function extends the life span of the sensor by recovering reduced detecting ability caused by long-term usage or pollution.

MDSM025B has advantages of both stable detecting ability and high manufacturing efficiency.

The sensor does not have an additional control point (VR Trimmer) on the device unlike its previous model (DSM). It prevents potential malfunction often occurred by user's arbitrary modification.

Applications

- **Air cleaners, Air conditioners**
- **Ventilation System, Fan Control**
- **IAQ Monitoring & Control**
- **IoT Device**

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Product Specification

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	5V ±10%	V
Supply Current (@ 5V)	I_{CC}	< 85	mA
Storage Temperature Range	T_{stg}	-20 ~ 80	℃
Operating Temperature Range	T_a	-10 ~ 65	℃
Operating Humidity Range (Without dew condensation)	RH	< 95	%RH
Particle Detection Range [*1]		Detectable Particle Size : > 0.85μm	
		Count : 8,000 pcs / 283㎖, Concentration : 300μg/m³	
Accuracy Tolerance [*2]		> ±30% @ < 1,000 pcs/283㎖ (Cigarette Smoke) < ±30% @ > 1,000 pcs/283㎖ (Cigarette Smoke)	
Output Signal		PWM (Pulse Width Modulation) - Low Logic Pulse Active Output	
Weight		25g	
Size		(W) 59 mm x (H) 45 mm x (D) 17 mm	

*1 : It refers to the range which accuracy tolerance is guaranteed.

*2 : Please refer to Particle Sensor Characteristics in Page 6.

Output Characteristics

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

*1 : Vout 2 at the highest state when particles are not detected. (=clean room)

*2 : Vout 2 at the lowest state when particles are detected.

*3 : It refers to the heating time to create stable air flow after power-on.
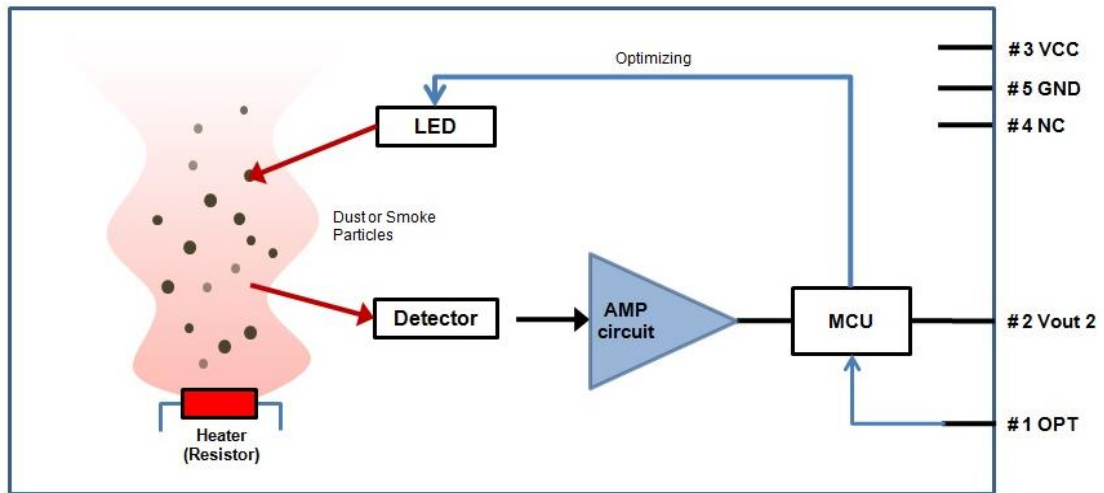
Internal Configuration

Figure 1 Internal Configuration

According to above Block Diagram, MDSM025B consists of infrared LED for particle detection, Photo TR for scattered infrared signal, OP-Amp for signal amplification and MCU for optimization function.

The principle of particle detection is that while in-flowed particle is passing by the measuring scope through upstream with self-heating of heater, the lights from LED is scattered by particle and is recognized as a signal at detector.

The signal from detector is filtered by circuit and MCU, and it is transformed into a PWM signals. The MCU has an optimization function to recover the sensor's detecting ability as similar as an initial state.

A User can operate optimization when the sensor's detecting performance decreases due to unidentified changes or pollution caused by long-term using.

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	NC	No connect
5	GND	Ground

PIN Description

Opt (Pin #1)

This Pin is used for operating optimization function. And it can work as Active High (5V) signal through external control system or equipment.

When optimization does not work due to internal pull down (10kΩ), it is always Low(0V). This operation takes max. 15sec.

After optimization, a user should operate the sensor after reset (Power off → on).
For the function description, please refer to 'Description of Optimization Function' in page 8.

Vout 2 (Pin #2)

This Pin is used to transform PM2.5 signals into PWM (Pulse Width Modulation) signal (Active Low). Refer to the attached additional 'Application Note'.

Vcc (Pin #3)

The Pin of DC 5V input Power.

For stable operation, the power supply range should be adjusted within ±10% and Ripple has to be below 30㎳.

NC (Pin #4)
No connect

GND (Pin #5)

Pin #5 is used for Ground.

Connector Description

Model name	Part No.		Description	Connector's maker
MDSM025B	Wafer	S5B-EH	2.5mm pitch	J.S.T.
	Housing	EHR-5		

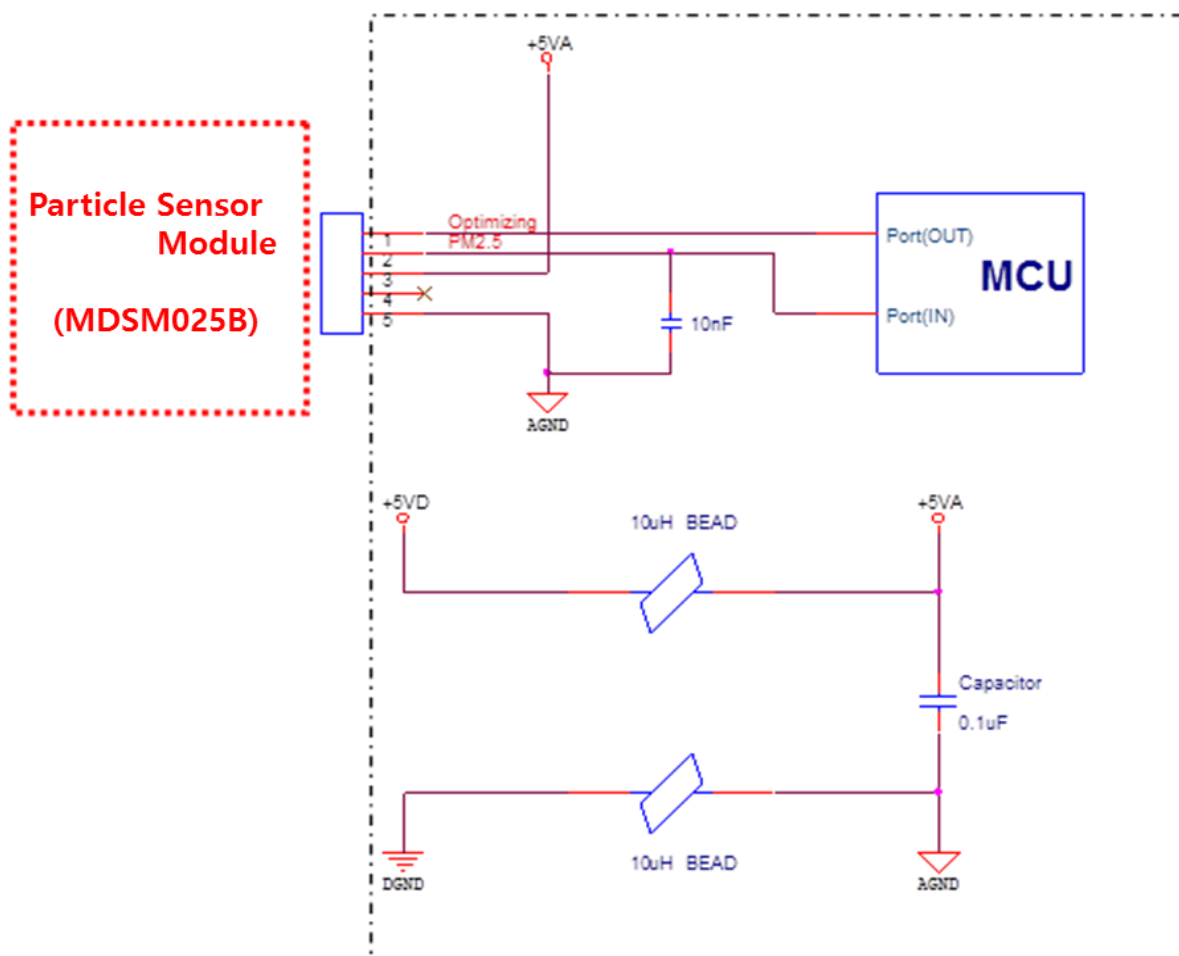** Please use AWG24 or thicker wire to connect MDSM025B.

Basic Circuit Diagram

Figure 2 Basic Schematic

** Please use an extra power regulator and/or a bypass capacitor(below 10nF) on the signal line in order to compensate noise if there is noise on the signal or power line and/or signal line are longer than 50cm.

Particle Sensor Characteristics

Low Pulse Ratio and Weight Concentration (㎍/㎥) Correlation
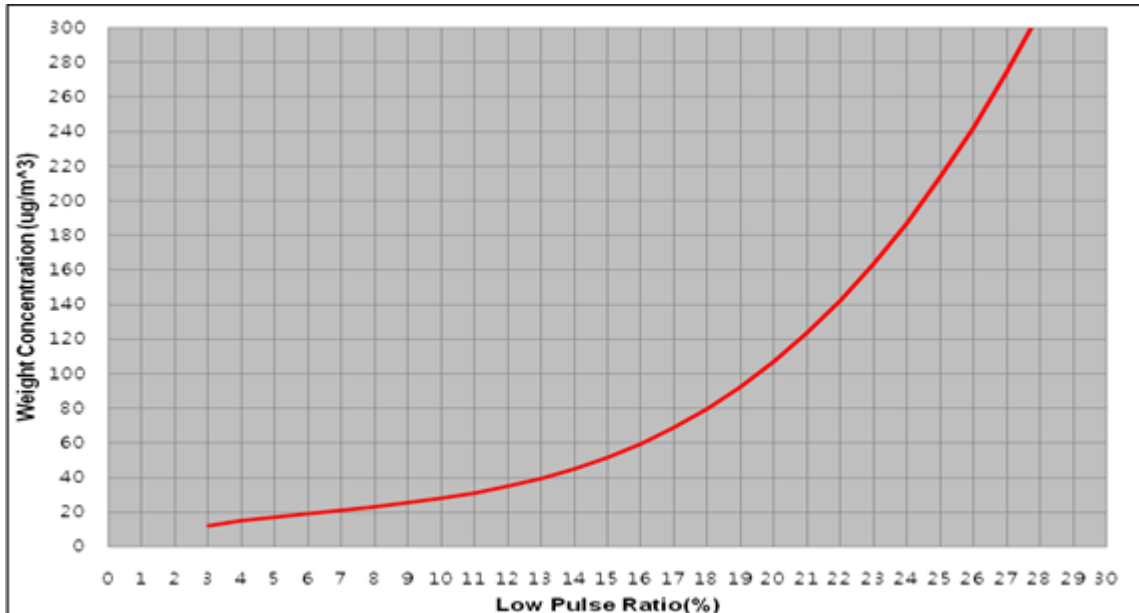
Figure 3 Low Pulse Ratio and Weight Concentration Correlation Graph

** Above weight concentration is a referential value and not absolute.

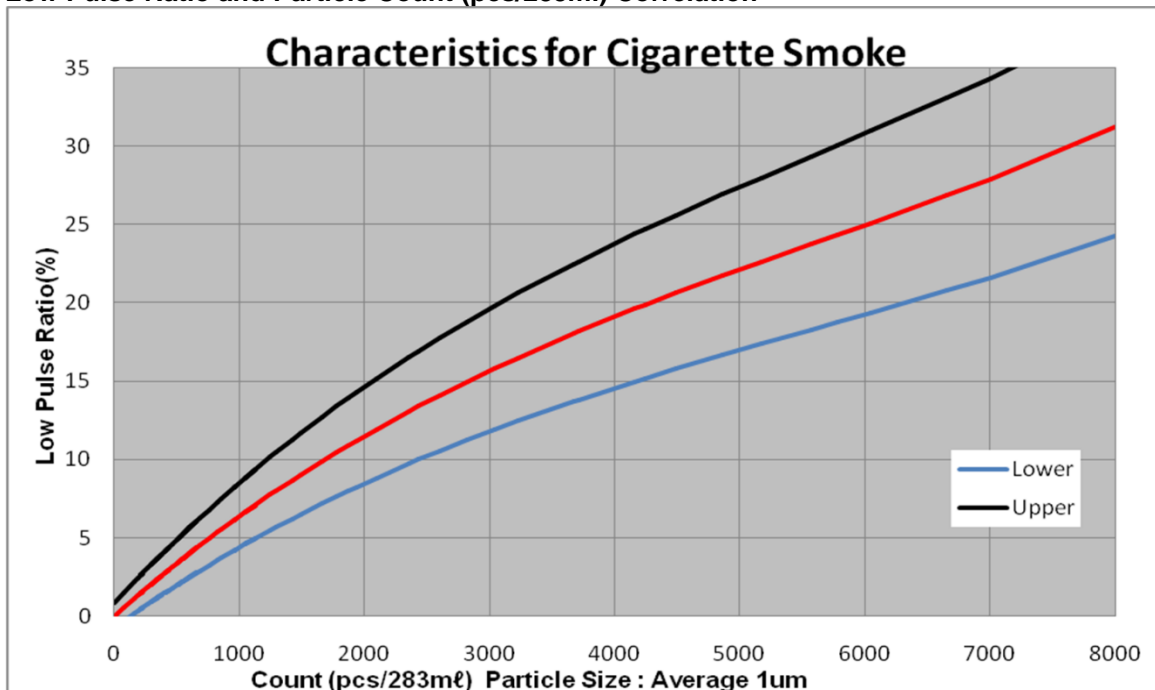**Low Pulse Ratio and Particle Count (pcs/283ml) Correlation**

Figure 4 Low Pulse Ratio and Particle Count Correlation Graph

** The sensor's characteristic is verified at the following condition :
  Ambient Temperature and humidity of 22±5℃ and 30~60%RH in 30m^3 room chamber.
  The reference is located at the center of the room chamber. For more details, please contact SAMYOUNG S&C.
** 283ml = 0.01 CF(Cubic Feet). Particle counters use CFM(cubic feet per minute) for Flow Rate in general and it is
  converted into Liter on the above graph.

** The particle weight concentration in this datasheet was measured on the basis of the reference and the accuracy of weight concentration solely depends on the reference. Please contact SAMYOUNG S&C for weight concentration conversion.
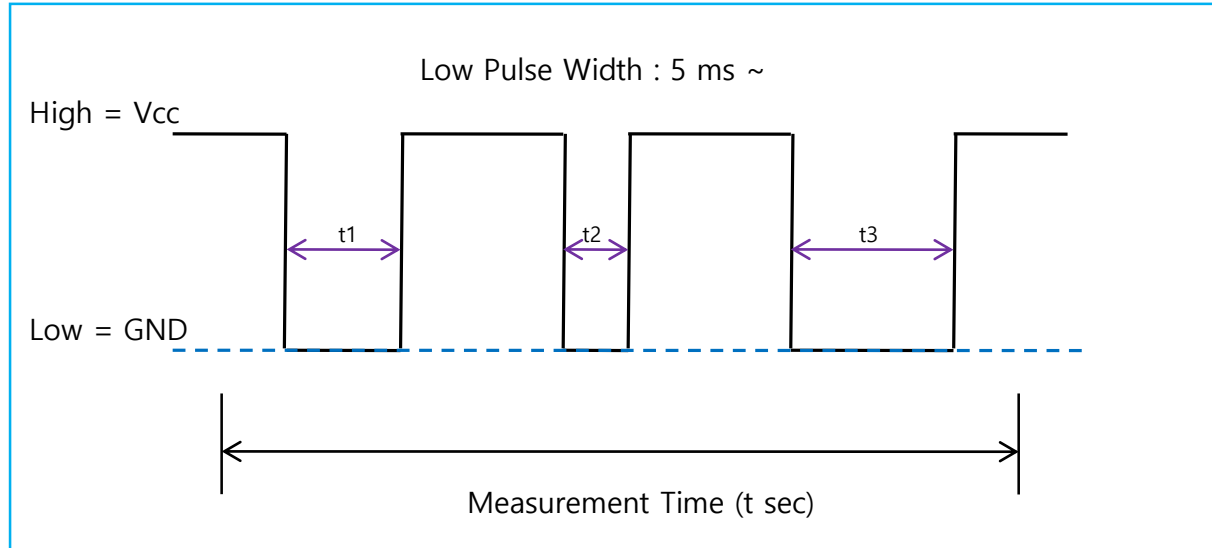
Low Ratio Calculation

Figure 5 Particle Sensor Low Ratio

Low Ratio (%) = (t1 + t2 + t3) / t x 100
(Measurement Time is calculated by a percentage of sum of Low signals occurred within t(Approx.60) seconds)

** 60sec for calculating Low Pulse Ratio is recommended.
If it is shorter than 60 sec, the signal detection becomes too sensitive that may lead to frequent fluctuation.
If it is longer than 60sec, the signal detection becomes insensitive.

** Checking the changes of Low Pulse Ratio(%) values should be done by 1~2 sec cycle. If to set other time cycles, please contact SAMYOUNG S&C for an advice.

Description of Optimization Function

The optimization function can recover the detecting ability as an initial status when the detecting ability decreases due to long-term usage or polluted lens. Users can operate an optimization function when the detecting ability notably decreases.

Input signal to Optimization Function Pin (Opt. Pin No. 1)

Connect active high (5V) signal to Opt (Pin.1) input signal pin.
After inputting signal to sensor, the optimization function starts operating.
At the moment, the active high (5V) signal can be kept min. $1ms$ or more.

Wait for Optimization

The optimization function takes approximately max. 15sec, and during the operation, keep the sensor away from any external impact, vibration or scattering lights.
Furthermore, do not turn the power off while optimizing. It may cause inputting new values on the EEPROM of MCU.

Reset after completing Optimization Function

After completing the optimization function, turn the power off and restart for a stable sensor operation.
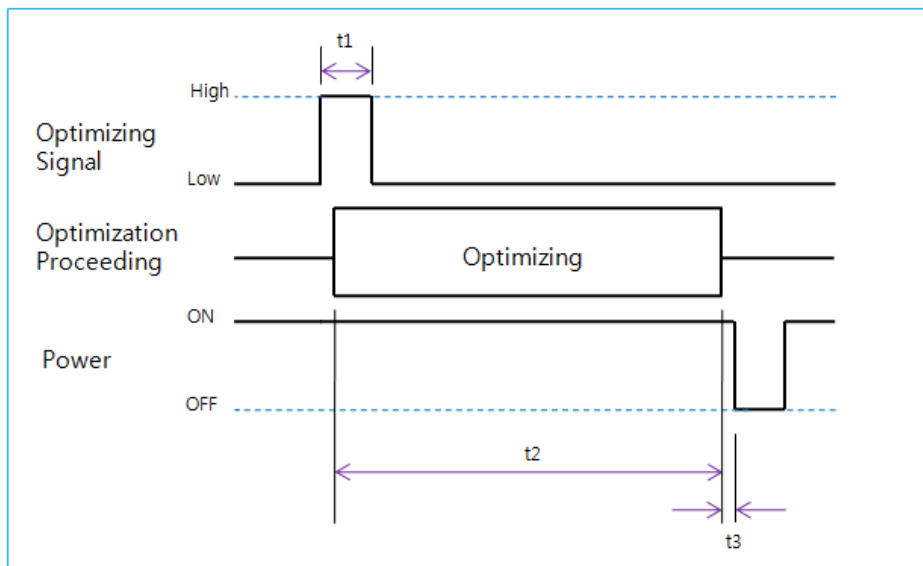
Parameter	Description	Min.	Max.	Unit
t1	Optimizing Signal Input Time	1		ms
t2	Optimization Proceeding Time		15	sec
t3	Switch Off after Optimization	0.1		ms

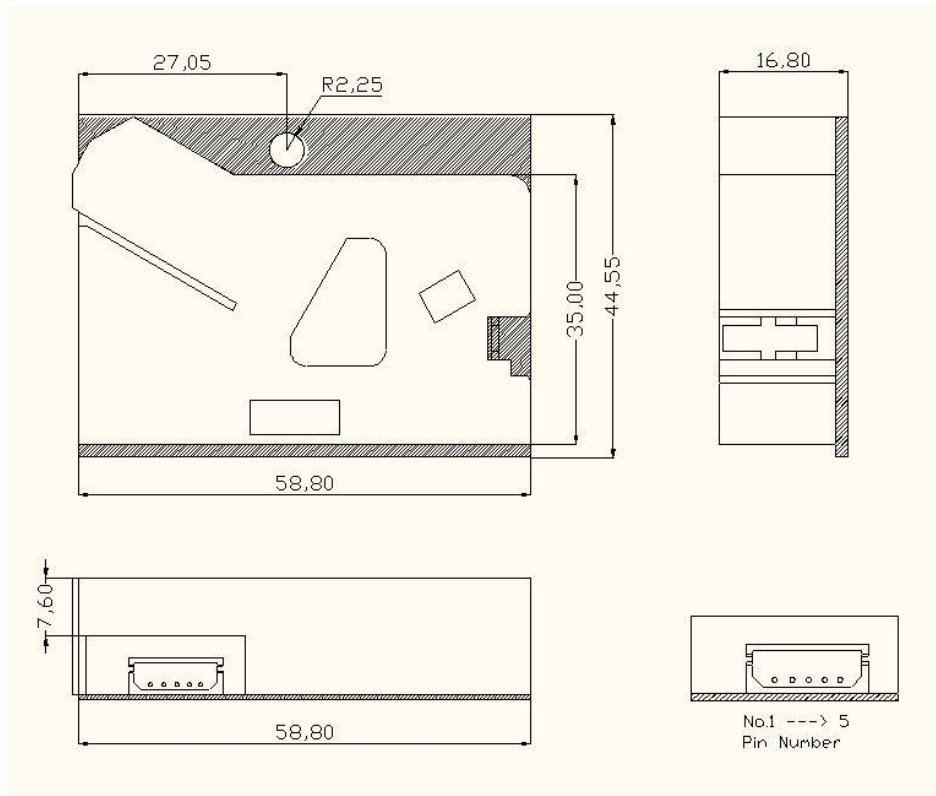Figure 6 Optimization Process

Dimension
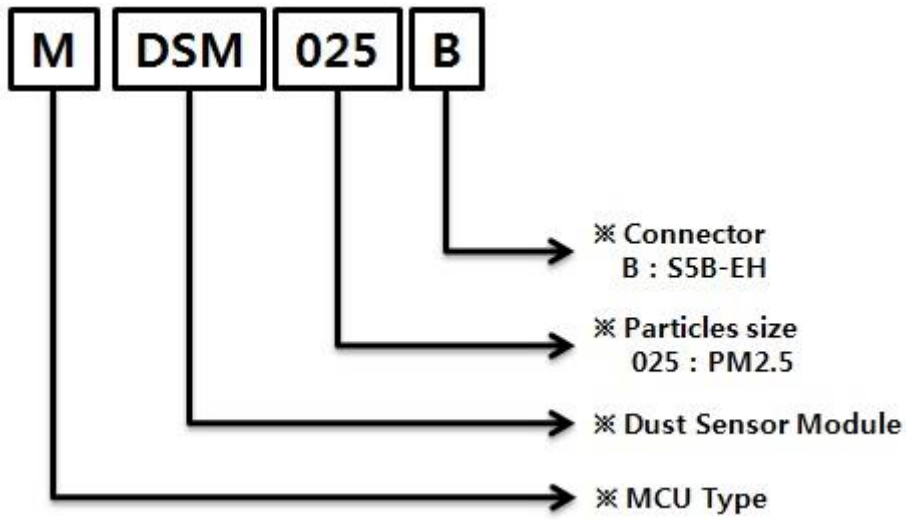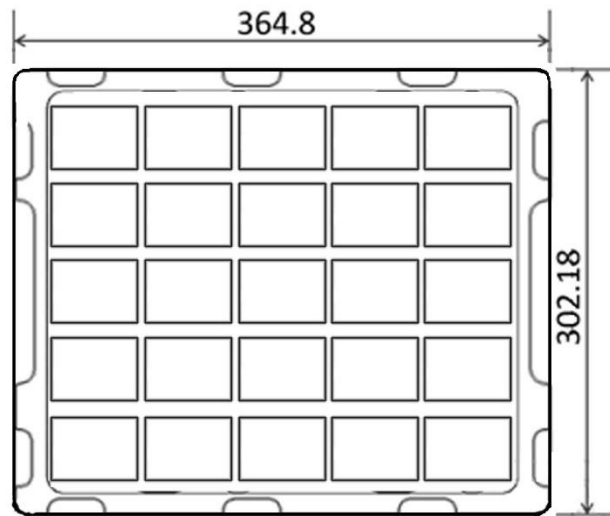
(Unit : mm)

Figure 7 Dimension
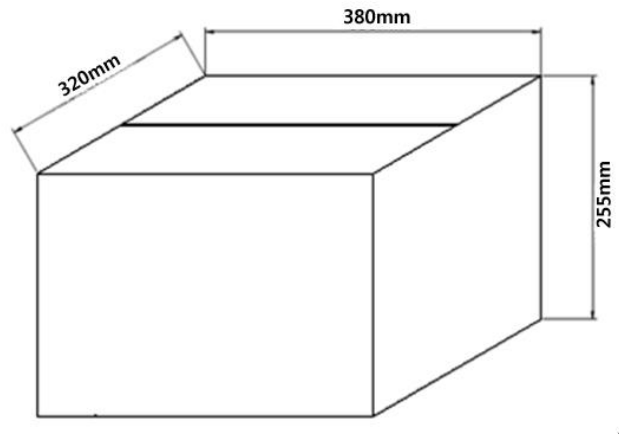
Ordering Information

Figure 8 Ordering Information

Packaging Information

Type	Quantity(pcs.)		Size (W × L × H ㎜)	
	Tray	Out box	Tray	Out box
MDSM025B	10	250	364.8×302.18×25	380×320×255

Tray : 25pcs / 1 Tray(Anti-static PS, 364.8×302.18×25 mm)

Out box (380×320×255 mm): 10 Trays (250pcs)

Revision History

Date	Version	Page	Change
2015-12-22	1.0		First Release
2016-03-28	1.1		Added extra description on each parts

Caution

Please do not adjust, disassemble or reassemble the sensor arbitrarily. It may cause malfunctions of the sensor.

To use the product properly, please refer to the attached additional 'Application Note'.

Please avoid using this sensor for Emergency or Fire alarm application.

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This Application Guide should be used only for intended and authorized application of **MDSM025B**.
Please consult with **SAMYOUNG S&C** for any specific application requirements and for detailed data sheet.