Digital MEMS VOC Gas Sensor Module

（Model No.:ZM01）

Manual

Version: 1.5

Valid from: 2023-06-25

Zhengzhou Winsen Electronics Technology Co., Ltd

Statement

Thanks for purchasing our product. In order to let customers use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes &etc, please in kind prevail.

We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users' comments on optimized using way are welcome.

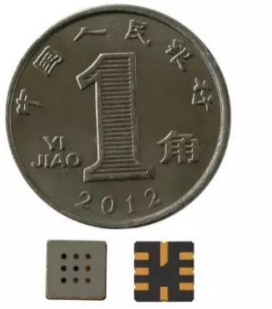
Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD

ZM01 MEMS VOC Gas Sensor Module

Production Description:

The Digital VOC module is a low-power, miniaturized module. The module uses a semiconductor Gas sensor and a high-performance micro-processor to detect gas concentrations in the environment. The module has high sensitivity, small size and adopts I2C digital signal output mode, which is convenient for using and debugging. It can shorten the user's design and development cycle. The module can be widely used in environmental safety, portable equipment and many other areas.



Characteristics:

MEMS technology
Stable and strong structure
Low power consumption
High sensitivity
Anti-electromagnetic interference

Applications:

Environmental monitoring
Portable device
Health care
Site control

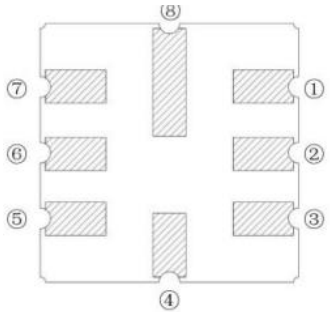
Parameters

Working voltage	2.5±0.1V	Working current	≤25mA
Max heating power	80mW	Detection range	5ppm（alcohol）
Output mode	I2C slave mode	Default address	0x55
I2C rate	10-100kbps	Pull-up resister	Need external pull-up resistor
Pre-heat time	≤3min	Response time	≤ 60s

Chip limit value

Parameter	Min	Type	Max	Unit
Storage temperature	-25	-	60	℃
Working temperature	-10	-	50	℃
Limit voltage (VCC & GND)	-0.3	-	VCC+0.3	V
Limit voltage (Other pins)	-0.3	-	VCC+0.3	V
Limit current	-	-	100	mA

Pin definition



1	/	5	NC
2	SCL	6	NC
3	SDA	7	VCC
4	/	8	GND

Figure 1： pin definition of sensor(bottom view)

Size

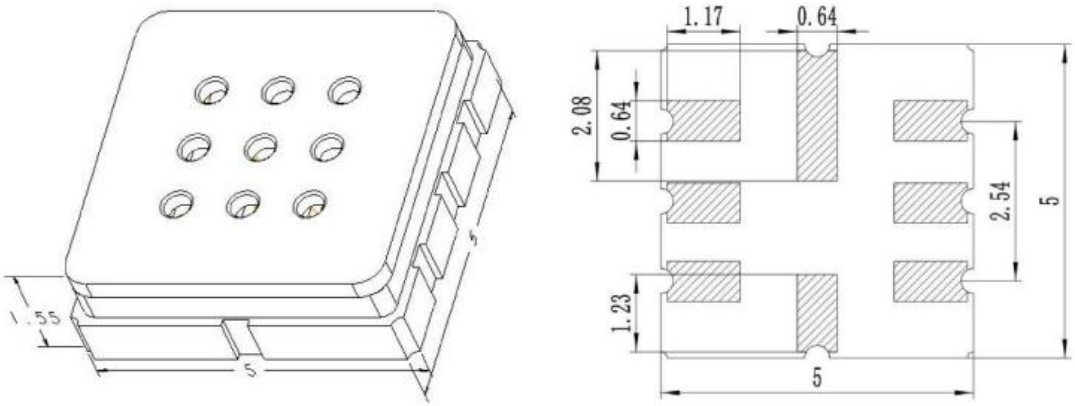


Figure 2: ZM01 dimension figure

Sensitivity curve

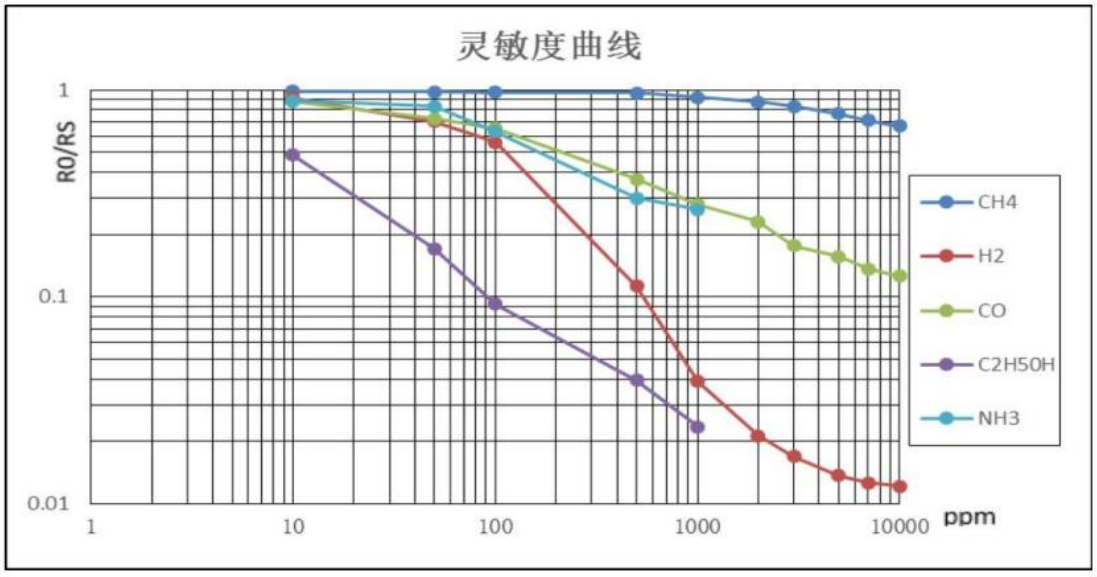


Figure 3: sensitivity curve

Temperature & Humidity Curve

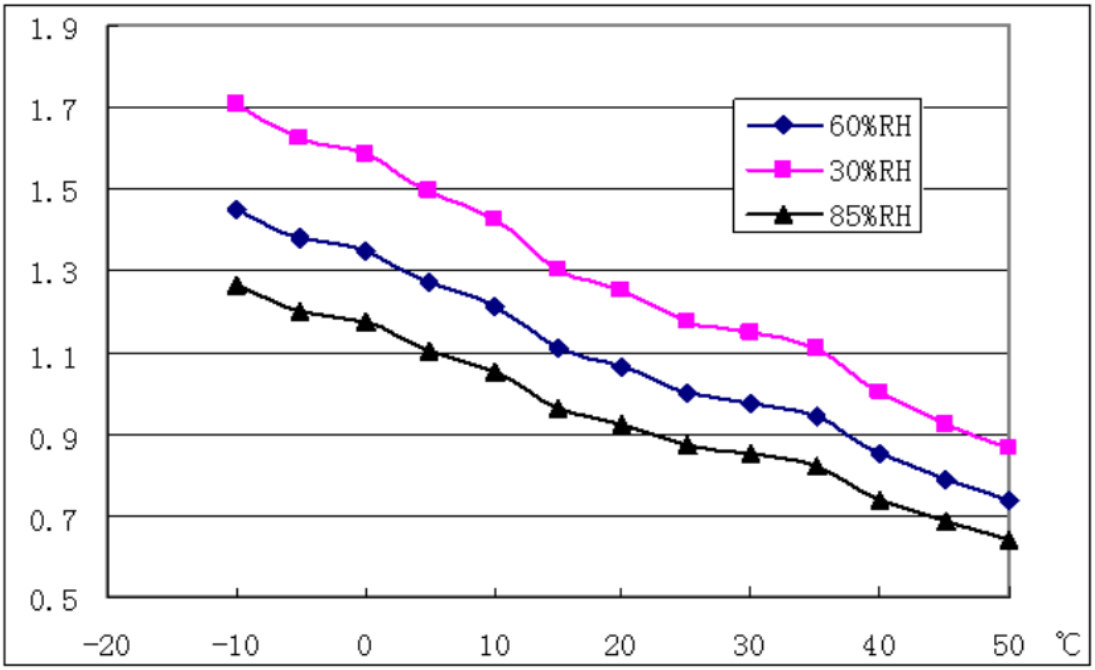
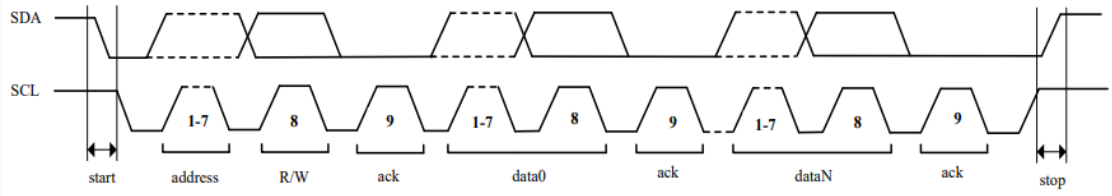


Figure 4: temperature and humidity characteristic curve

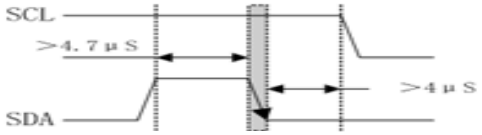
IIC communication protocol

Bus description

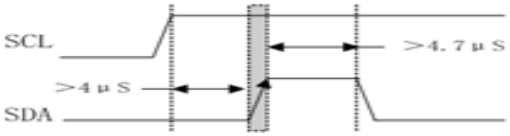
The IIC protocol is a special bus signal protocol. It is composed of three parts: start (start signal), stop (end signal), and binary data, as shown in the figure below. At the beginning, SCL is high and SDA is falling edge. After that, send the slave address. After the 7-bit address bit, it is the control read and write bit to select the read and write operation. When the slave recognizes its corresponding address information, it will send a response signal to the master, pulling down SDA in the 9th clock cycle. When stopped, SCL remains high and SDA rises.



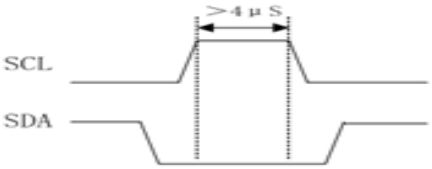
Typical signal simulation



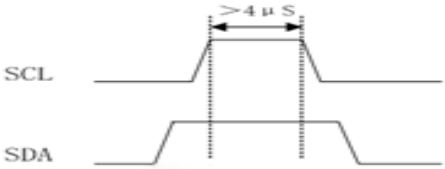
Start Signal S



End signal P



Response "0"



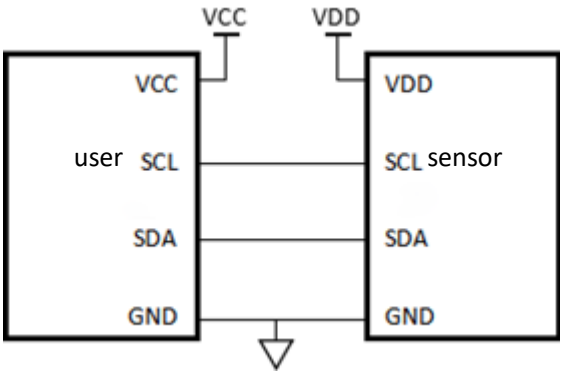
Non-response "1"

Slave address

Address format: the upper 7 bits are the module address of the sensor (0x55), the lowest bit is the read/write operation bit, 1 means read, 0 means write.

A7	A6	A5	A4	A3	A2	A1	R/W
0	1	0	1	0	1	0	1

Hardware connection



Note:

In the user's internal, IIC communication needs to use pull-up resistors on the SCL and SDA lines, with a resistance value of 1-10K. The recommended clock frequency is less than 50KHz.

Data interface

Power supply pin (VCC GND): The supply voltage range of ZM01 is 2.4V-2.6V.

Serial clock input (SCL): The SCL pin is the IIC communication clock line.

Serial Data (SDA): The SDA pin is an IIC data cable used for reading and writing data.

Data frame format

The data frame contains 4 bytes in total, and the data content is shown in the table below.

0	1	2	3
0x55	0xAA	0x55	DATA
Slave address(R/W address included)	Read command	Slave address(R/W address included)	VOC concentration level value

Note: The VOC concentration is divided into 200 levels, the minimum is 1, the maximum is 200.
VOC concentration = grade value*range/200

Application Method:

The sensor needs warm-up after power-on for about 100 seconds. After preheating is completed, the sensor enters into normal working condition.

Connect the module to the I2C bus, and the host sends a read command to enter the read state. The module will immediately return an 8-bit data value that represents the current VOC concentration value. The larger the value, the higher the VOC concentration. The minimum value is 1, and the maximum value is 200. If the range is 5ppm, the value read is 50, and the current concentration is 5 * 50/200=1.25ppm.

The following figure is a complete waveform of I2C communication process for reference. It starts with “start”, sends slave address 0x55, receives slave response signal ACK, sends read command 0xAA, receives slave response signal ACK; starts signal “start”, sends slave address 0x55, receives slave response signal ACK, reads the VOC concentration level value and end the signal stops;

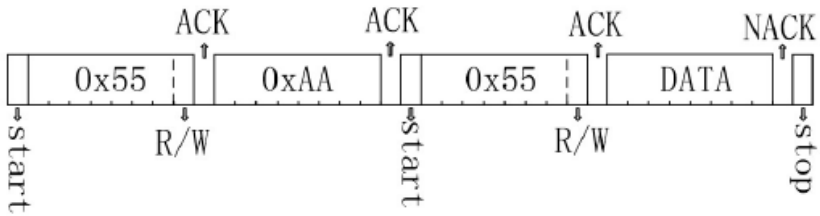


Figure 5: I2C communication waveform

Cautions

1. Preheating time

When the module is stored for a long time without power, its sensor resistance will produce reversible drift, and the module should be preheated to the chemical balance inside before using. The storage time and corresponding preheating time are recommended as follow.

Table 6

Storage time	Recommendation of preheating time
Less than one month	24hours
One month to six month s	48hours
Over six months	72hours

2. Following conditions must be prohibited

2.1 Exposed to organic silicon steam

Sensing material will lose sensitivity and never recover if the sensor absorbs organic silicon steam. Sensors must be avoid exposing to silicon bond, fixature, silicon latex, putty or plastic contain silicon environment.

2.2 High Corrosive gas

If the sensors are exposed to high concentration corrosive gas (such as H2S, SOX, Cl2, HCL etc.), it will not only result in corrosion of sensors structure, also it cause sincere sensitivity attenuation.

2.3 Alkali, Alkali metals salt, halogen pollution

The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorine.

2.4 Touch water

Sensitivity of the sensors will be reduced when spattered or dipped in water.

2.5 Freezing

Do avoid icing on sensor's surface, otherwise sensing material will be broken and lost sensitivity.

2.6 Applied voltage

The overload heating power caused by the overload voltage will cause irreversible damage to the module, and static electricity will also damage the module, so anti-static measures should be taken when touching the module.

3. Following situations should be avoided if possible

3.1 Water Condensation

Indoor conditions, slight water condensation will influence sensors' performance lightly. However, if water condensation on sensors surface and keep a certain period, sensors' sensitive will be decreased.

3.2 Used in high gas concentration

No matter the sensor is electrified or not, if it is placed in high gas concentration for long time, sensors characteristic will be affected. If lighter gas sprays the sensor, it will cause extremely damage.

3.3 Long time exposed to adverse environment

No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc., it will influence the sensors' performance badly.

3.4 Vibration

Continual vibration will result in sensors down-lead response then break. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

3.5 Concussion

If sensors meet strong concussion, it may lead its lead wire disconnected.

3.6 Soldering

3.6.1 Recommended Conditions for Reflow welding

Neutral atmosphere

Welding temperature 250±10℃;

Avoid flux vapor.

3.6.2 Recommended conditions for manual welding

rosin flux with the least chlorine;

Welding temperature ≤350℃;

Duration ≤5s.

Violation of the above conditions of using will degrade the characteristics of the module.

Packaging method

MEMS modules are coated with special protective film to prevent the influence of dust, water, gas and high temperature. The protective film can be removed after welding.

Using braid packaging, we can also provide other packaging methods according to customer requirements.

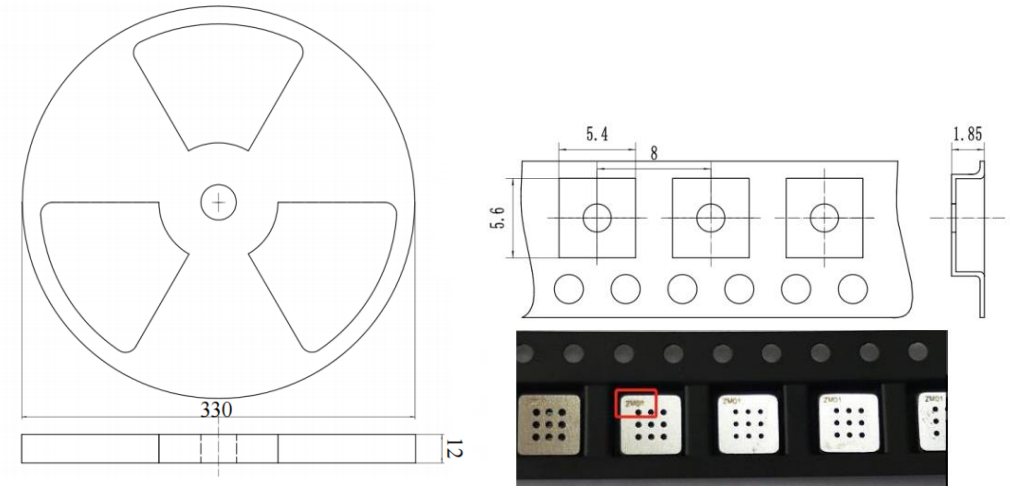


Figure 6: Packaging of ZM01 Module

Environmental protection clause

RoHS: This product complies with current RoHS.

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