Digital Type VOC Module

（Model：ZPS20）

User’s Manual

Version:1.2

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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.

Digital type ZPS20 Module

Profile

Digital type ZPS20 module is a general-purpose air quality sensor module. This module is to detect VOC gas concentration, ambient temperature and humidity, adopting advanced semiconductor VOC gas sensor and MEMS temperature humidity sensor. It has the features of high sensitivity and digital output, which is convenient to use.

Features

High sensitivity; Excellent long-term stability;

Low power consumption; Long lifespan; I2C output;

Application

Air cleaner, fresh-air system, intelligent integrated ceiling, air quality detector, ventilation fans, and air-condition etcs air pollution detection and air purification areas.

Technical Index **Table 1**

Model No.	ZPS20
Detection Gas	Benzene, toluene, formaldehyde, alcohol etcs organic volatile gases; cigarette smoke, carbon monoxide, ammonia, hydrogen etcs harmful and explosive gases
Output	I2C output
Working voltage	5.0±0.1V DC
Working Current	≤70mA
Warm-up Time	3 min
Response Time	≤30s
Recovery Time	≤60s
Detection Range	0~10mg/m3
VOC index output	0~500
Operating Temperature	0~50℃
Operating Humidity	15%RH- 95％RH(no condensation)
Temperature output range	-40~85℃
Humidity output range	0~100%RH
Storage temperature	-20~60℃
Size	32mm*24mm*11mm

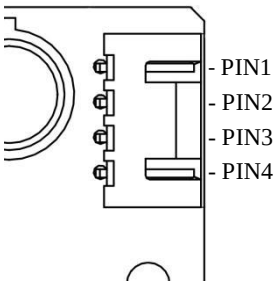
Note: 1. It will affect the sensor performance, if the working voltage is too high or too low.

2. VOC index output of 0~500 can correspond to ethanol gas 0~5ppm.

3. It is recommended that the device be used within the recommended operating temperature and humidity range of the module; otherwise, large errors may occur in the output data.

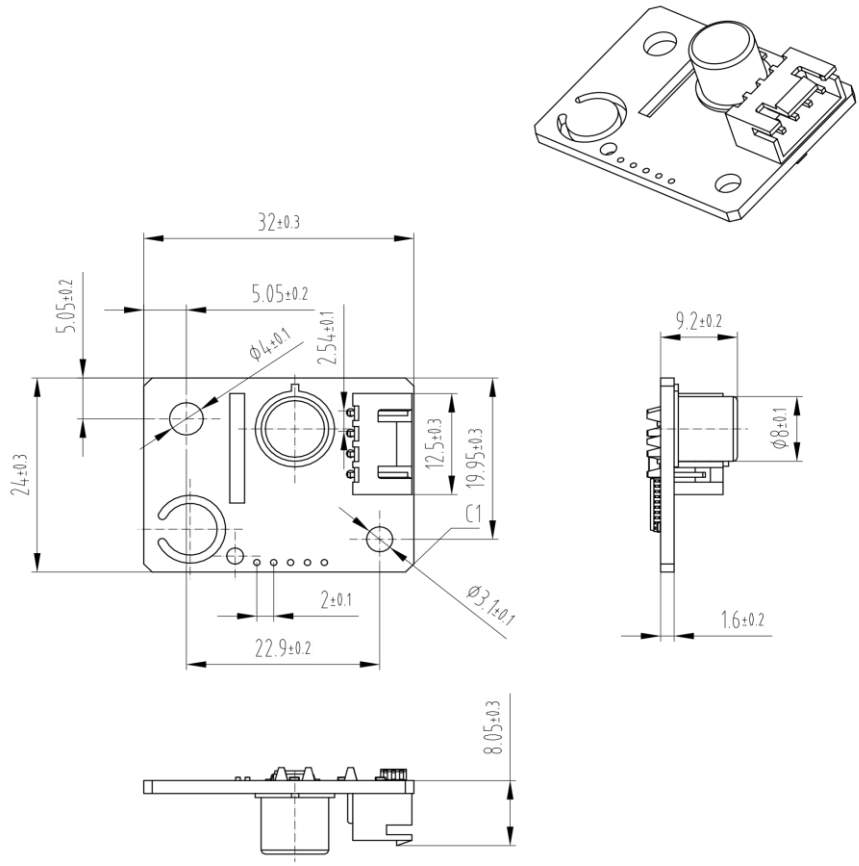
PIN Definition

PIN1	VIN (voltage input)
PIN2	SCL(Serial Clock)
PIN3	SDA(Serial Data)
PIN4	GND



Pin diagram (Terminal type：XHD2.54mm-4P)

Sensor Size



Sensor Communication

1. Communication Mode

The ZPS20 module adopts IIC communication mode, and the IIC address is 89(0x59). All module instructions consist of two bytes (16 bit), and there are no CRC bytes after the command; The data packet returned from the sensor is transmitted as a two-byte (16-bit) measurement and a one-byte (8-bit) CRC.

2. Typical IIC communication timing between the host and VOC modules

In the IIC bus, the sensor as a slave device supports communication rates up to 70kHz. When the host sends the start signal (low level), the sensor begins to communicate; and when the host sends the stop signal (high level), the communication ends. The start and end signals are only effective when the SCL is low, and the typical communication timing between the host and the VOC module is shown in Figure 4.

After the module is powered on, the host periodically sends commands and reads data in the following order:

(1) The host sends the measurement command.

(2) The maximum waiting time or expected duration of the host is about 50ms.

(3) The host reads the measurement result. If the communication fails, the host waits for 1s and sends the measurement command again.

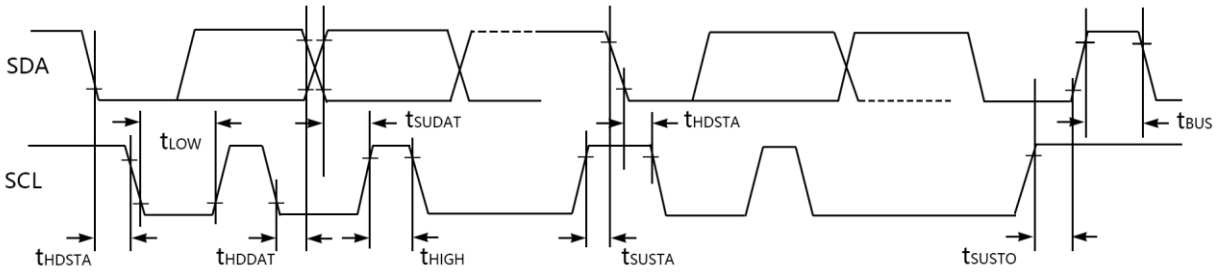


Fig 4 IIC communication timing

Table 3 IIC parameter

Parameter	Condition	MIN	TYP	MAX	Unit
IIC clock frequency	f_{SCL}	10	\	70	KHz
Initial signal time	t_{HDSTA}	14	\	\	μs
SCL clock high level width	t_{HIGH}	7	\	\	μs
SCL clock low level width	t_{LOW}	7	\	\	μs
time set relative to the SCL edge start condition	t_{SUSTA}	7	\	\	μs
Data retention time relative to SCL SDA edge	t_{HDDAT}	3	\	\	μs
data set time relative to the SCL SDA edge	t_{SUDAT}	4	\	\	μs
Set time on SCL stop condition	t_{SUSTO}	7	\	\	μs
The bus idle time between the stop condition and the start condition	t_{BUS}	14	\	\	μs

3. IIC communication command

(1) Read the VOC measurement

The host can periodically send this command to obtain the VOC value detected by the VOC module. It is recommended that the sending interval be longer than or equal to 1 second.

Table 4 IIC VOC measurement command

Command	Hexadecimal command code	Description
To measure VOC value	0x26 0x0F	This command starts/continues the VOC measurement mode

Table 5 The value returned by VOC measurement command

Byte	Description	Instructions
1, 2	High byte and low byte of VOC_index	VOC_index = byte1 * 256 + byte2
3	CRC	To verify bytes 1,2

(2) Read the module serial number

Within 3 minutes of power-on, the host can send this command to obtain the serial number of the VOC module as actual demand. Once communicated, the serial number can be obtained, and repeat sending is not required.

Table 6 IIC serial no. reading command

Command	Hexadecimal command code	Description
To obtain serial no.	0x36 0x82	This command provides the serial number of the VOC module by returning 3 x 3 bytes (2 + CRC bytes).

Table 7 The value returned by serial no. reading command

Byte	Description	Instructions
1, 2	Serial no.	The 1st (highest) and 2nd bytes of the serial number.
3	CRC	to verify bytes 1, 2
4, 5	Serial no.	The 4th and 5th bytes of the serial number
6	CRC	to verify bytes 4, 5
7, 8	Serial no.	The 7th and 8th bytes of the serial number (the lowest byte)
9	CRC	to verify bytes 7, 8

(3) Read the temperature and humidity measurement values

The host can send this command to obtain the temperature and humidity value periodically. It is recommended that the interval for sending this command be no less than 1 second.

Table 8 IIC temperature and humidity measurement command

Command	Hexadecimal command code	Description
To measure T/H value	0x46 0xFD	This command starts/continues the T/H measurement mode. The returned data contains the temperature value first and the humidity value after.

Table 9 The value returned by T&H measurement command

Byte	Description	Instructions
1, 2	Temperature value	T = ((byte1*256 + byte2) / 100)℃, if (byte1*256 + byte2 < 32767) T = (((byte1*256 + byte2) - 65536) / 100)℃, if (byte1*256 + byte2 > 32767)
3	CRC	to verify bytes 1, 2
4, 5	Humidity value	H = ((byte4 * 256 + byte5) / 100) %RH
6	CRC	to verify bytes 4, 5

Note: All returned data contains the high byte first and the low byte after.

4. Example of IIC reading data

Trigger measurement data

Start	IIC address + write								ACK	0x26								ACK	0x0F								ACK	Stop
S	1	0	1	1	0	0	1	0		0	0	1	0	0	1	1	0		0	0	0	0	1	1	1	1		P

Time delay: 50ms

Read VOC_index value

Start	IIC address + read								ACK	VOC_index high byte								ACK	VOC_index low byte								ACK	CRC								NAK	Stop
S	1	0	1	1	0	0	1	1		x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		P

5. Checksum calculation

The CRC algorithm generates an 8-bit CRC checksum for each digit transmitted from behind. The CRC is the result of the check of two bytes of data that were previously transmitted.

//CRC verification type: CRC8/MAXIM

// Polynomial: X8+X5+X4+1

//Poly: 0011 0001 0x31

// Data-high would be 1000 1100 0x8c after transferring.

//C implementation code:

```
U8 Calc_CRC8(U8 *message, U8 Num)
{
    U8 i;
    U8 byte;
    U8 crc = 0xFF;
    for(byte = 0; byte < Num; byte++)
    {
        crc ^= (message[ byte ] );
        for(i = 8; i > 0; --i)
        {
            if(crc & 0x80) crc = ( crc << 1 ) ^ 0x31;
            else crc = ( crc << 1 );
        }
    }
    return crc;
}
```

Recommendations for Installation

It is recommended to install the module in a place that can have good contact with the ambient air, preferably in a parallel direct air flow. The direction of the air flow follows the direction shown by the green arrow in the following figure, and the direct air flow in the opposite direction and perpendicular to the sensor is prohibited. If the PCB is not placed in the air flow, it is recommended that the PCB be placed vertically and the T/H sensor be placed under the gas sensor to prevent heat convection from affecting the T/H sensor.

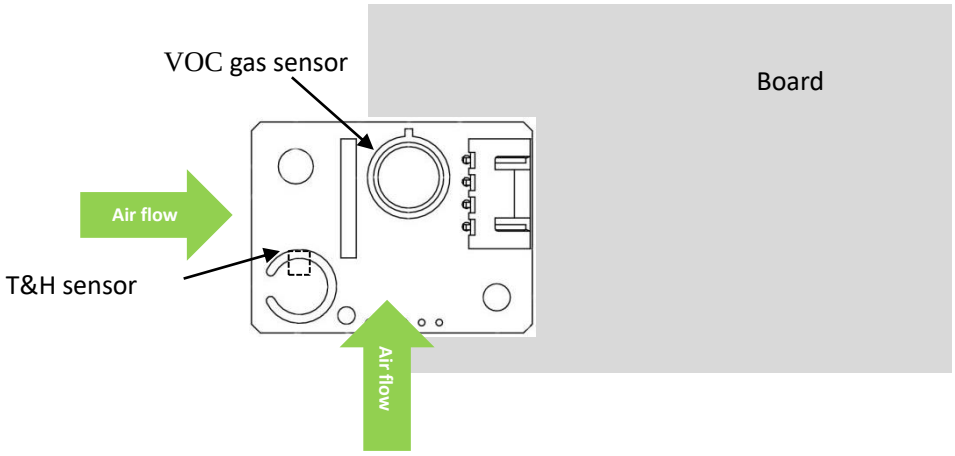


Fig 5 Module installation air flow direction diagram

Cautions

- Please do not put the module in organic solvent (include silica gel and other cementing compound), painting, medicament, oils and fuels, high concentration gas etc. Avoid alkali, alkali metal salt, and halogen pollution
- Please do not impact or vibrate the module seriously.
- Please warm up for 5~20 min before first using.
- Please do not use the module related with personal safety.
- Please do not install the module in the severe convection environment.
- Please do not put in the module in high concentration organic gas for long time.
- Power the module strictly according to the request in manual.

Zhengzhou Winsen Electronics Technology Co., Ltd
Add: No.299, Jinsuo Road, National Hi-Tech Zone.
Zhengzhou 450001 China
Tel: +86-371-67169097/67169670
Fax: +86-371-60932988
E-mail: sales@winsensor.com
Website: www.winsen-sensor.com