



Digital MEMS VOC+Temperature and Humidity Three in one Module

(Model No.: GMD-350B)

Manual

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Zhengzhou Winsen Electronics Technology CO., LTD

Digital MEMS VOC+Temperature and Humidity Three in one Module

Production Description:

MEMS digital VOC+temperature and humidity three in one is a low-power, miniaturized module. This module combines semiconductor gas sensors, humidity sensors, and high-performance microprocessors to detect gas concentration, temperature, and humidity in the environment. This module has high sensitivity, is compact and precise, compatible with UART and IIC digital signal output methods, convenient for users to use and debug, and greatly shortens the design and development cycle for users. This module can be widely used in various fields such as environmental safety, portable instruments, etc.



Characteristics:

High sensitivity
High resolution
Low power consumption
Long service life
UART & IIC output (with four working modes)

Applications:

Environmental monitoring
Portable device
Health care
Site control

Technical indicators

Table 1

Model No.	GMD-350B
Target gases	VOC
Output mode	UART/IIC output
Working voltage	3V-5V
Pre-heat time	≤3 minutes
Response time	≤60 seconds(Quick Mode)
Recovery time	≤60 seconds(Quick Mode)
Detection range	0-5ppm
Resolution	0.01ppm
Working temperature	-20℃-50℃
Working humidity	15%RH~90%RH) (non-condensing)

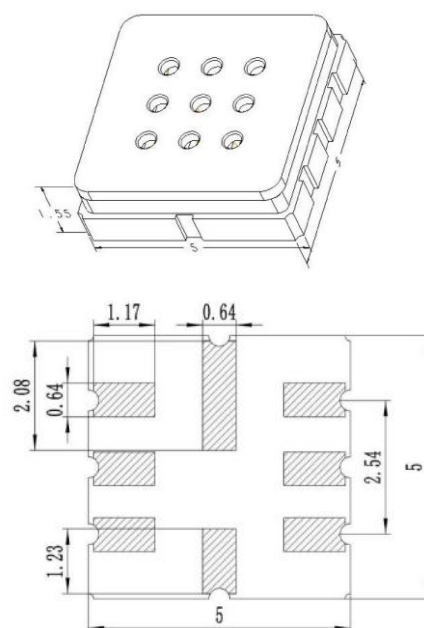


Figure 1: dimension figure

Pin definition

Table 2

Pin Number	Signal Name	Note
Pin 1	VCC	VCC
Pin 2	VCC	VCC
Pin3	Connecting Capacitor	1 μ F capacitor must be connected between the pin and GND
Pin4	GND	GND
Pin5	SDA/TXD	UART: TX IIC: SDA
Pin6	SCL/RXD	UART: RX IIC: SCL
Pin7	IO	Interface Selection: Floating or Pull-up: IIC int erface. Pull-down GND: UART inte rface.
Pin8	GND	GND

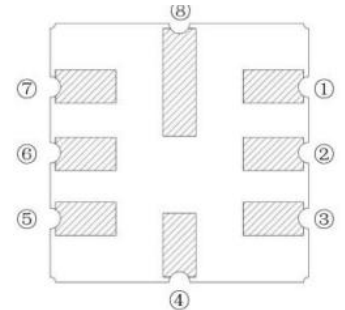


Figure 2: pin definition of module

Note: Both PIN1 and PIN2 require VCC, and a 1 μ F capacitor must be connected between PIN3 and GND.

Uart output

1. General stttings

Table 3

Baud rate	9600
Data bit	8-bit
Stop bit	1-bit
Check bit	None

2. Communication command

The communication supports two modes: active reporting and question-answer (polling) mode. The module defaults to active reporting mode from factory settings, transmitting concentration values at 1-second intervals.

When a user sends a question-answer command, the module will switch to question-answer mode. If no command is received within 10 seconds, it will automatically revert to active reporting mode.

The data format for active reporting is as follows:

Table 4

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Start bit	Mode	High byte of concentration	Low byte of concentration	High temperature	Low temperature	High humidity level	Low humidity level	Check Value
0xFF	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0xFF

The command format for reading concentration is as follows :

Table 5

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Start bit	Reserved	Command	Reserved	Reserved	Reserved	Reserved	Reserved	Check Value
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79

The format of the Returned Sensor Concentration Value is as follows:

Table 6

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Start bit	Reserved	Command	Reserved	High temperature	Low temperature	High humidity level	Low humidity level	Check Value
0xFF	0x86	0x00	0x00	0x00	0x00	0x00	0x00	0x7A

Gas Concentration Value = High Byte of Gas Concentration × 256 + Low Byte of Gas Concentration

Temperature (°C)=(high temperature * 256+low temperature)/10;

Humidity (% RH)=(high humidity level * 256+low humidity level)/10.

The command format for switching work modes is as follows:

Table 7

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start bit	Reserved	Command	Reserved	Model	Reserved	Reserved	Reserved	Check Value
0xFF	0x01	0x88	0x00	0x01	0x00	0x00	0x00	0x76

The display format returned is as follows:

Table 8

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start bit	Command	Reserved	Reserved	Reserved	Reserved	Reserved	Model	Check Value
0xFF	0x88	0x00	0x00	0x00	0x00	0x00	0x01	0x77

Four working modes;

0x01: Quick detection module (with large temperature and humidity deviation);

0x02: Normal detection mode (longer detection cycle);

0x03: Single VOC mode;

0x04: Single temperature and humidity mode.

3.Checksum and calculation

Checksum = (Inverse of (Byte1 + Byte2 + ... + Byte7)) + 1

Reference Example:

```
/******  
* Function Name: unsigned char FucChecksum(uchar *i, uchar ln)  
* Description: Checksum calculation (inverse of the sum of bytes 1\2\3\4\5\6\7 plus 1).  
* Function Details: Add the elements of the array from 1 to the second to last and take the inverse+1  
  (the number of elements must be greater than 2)  
*****/  
unsigned char FucChecksum(unsigned char *i,unsigned char ln)  
{  
  unsigned char j,tempq=0;  
  i+=1;  
  for(j=0;j<(ln-2);j++)  
  {  
    tempq+=*i;  
    i++;  
  }  
  tempq=(~tempq)+1;  
  return(tempq);  
}
```

IIC output

1.IIC Communication Interface Characteristics and Timing

The module supports a communication rate of up to 400kHz. When the host sends a start signal (low level), the sensor initiates communication. When the host sends a stop signal (high level), the current communication session ends. The start and stop signals are only valid when SCL is at a low level.

2. Communication Commands

When the host initiates a start signal and the operation of the SCL bus meets the timing parameter conditions described above, the sensor will begin communication. Commands or data are always transmitted on the rising edge of SCL, and communication continues until the sensor receives a stop signal from the host.

After the start signal is sent, the host sends an 8-bit read/write command. This command includes a 7-bit high-order address and a read (1)/write (0) bit as the 8th bit. The read/write command directly determines the data transmission direction.

Communication Protocol Description:

- **START:** Communication start signal, initiated by the host controller.
- **STOP:** Communication stop signal, initiated by the host controller.
- **ACK:** Acknowledgment signal. Bold text indicates the signal is sent by the module; otherwise, it is sent by the host controller.
- **NACK:** Non-acknowledgment signal. Bold text indicates the signal is sent by the

module; otherwise, it is sent by the host controller.

- **WRITE:** Sent by the host controller to perform a write command operation on the module.
- **READ:** Sent by the host controller to perform a read data operation on the module.
- **Command Code:** Command data sent by the host controller. For commands and their corresponding functions, refer to Table 5.
- **Dx:** Data output by the module. For detailed content, refer to Table 6,7,8.

Sending Control Command Data:

The host controller sends control commands, and the module receives the command codes. Upon receiving the command codes, the module caches and identifies the command type. When the host controller initiates a read command, the module returns the corresponding data or executes the corresponding instruction.

Communication Process:

START + WRITE + ACK + High Byte of Command Code + ACK + Low Byte of Command Code + ACK + STOP

Table 9

Data	Byte Content	Byte Content Description
Module Write	0x34	I2C slave address and write command
Command Code	0x01 86	Obtain module VOC, temperature and humidity data
	0x34 01	Switch to fast detection mode (with large temperature and humidity deviation)
	0x34 02	Switch to normal detection mode (longer detection cycle)
	0x34 03	Switch to single VOC mode
	0x34 04	Switch to single temperature and humidity mode

Read Data Command:

The host controller sends a read data command. Upon receiving the command, the module returns the corresponding data or executes the corresponding instruction based on the command code sent by the host controller. The read data command should be executed 20ms after sending the control command to ensure the module's data is properly refreshed.

Communication Process:

START + READ + ACK + D1 + ACK + D2 + ACK + ... + Dx + NACK + STOP

0x01 86 Command Communication:

Table 10

Data	Byte Content	Byte Content Description
Module Read	0x35	I2C slave address and read command.
D1	Gas Type	0x34 Gas type is VOC.
D2	Operating Mode: 0x03	1-4 working modes
D3	Data 1 High Byte	High byte of VOC concentration.
D4	Data 1 Low Byte	Low byte of VOC concentration.
D5	Data 2 High Byte	High temperature byte
D6	Data 2 Low Byte	Low temperature byte
D7	Data 3 High Byte	High humidity byte
D8	Data 3 Low Byte	Low humidity byte
D9	Checksum	D2~D8 accumulate and take the inverse+1 check value

Gas Concentration Value = High Byte of Gas Concentration × 256 + Low Byte of Gas Concentration

Temperature (°C)=(high temperature * 256+low temperature)/10;

Humidity (% RH)=(high humidity level * 256+low humidity level)/10.

0x34 01~04 Command Communication:

Table 11

Data	Byte Content	Byte Content Description
Module Read	0x35	I2C slave address and read command.
D1	Byte Content	0x34 Gas type is VOC.
D2	Byte Content	1-4 working modes
D3	Byte Content	High byte of VOC concentration.
D4	Byte Content	Low byte of VOC concentration.
D5	Byte Content	High temperature byte
D6	Byte Content	Low temperature byte
D7	Byte Content	High humidity byte
D8	Byte Content	Low humidity byte
D9	Byte Content	D2~D8 accumulate and take the inverse+1 check value

3. Verification and calculation

Checksum=(take the inverse (Byte1+Byte2+...+Byte7))+1

The reference routine is as follows:

```
/******  
*Function Name: unsigned char FucCheckSum(uchar *i,uchar ln)  
*Function description: Sum up verification (taking the sum of 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 of the  
sending and receiving protocols and taking the inverse+1)  
*Function description: Add the elements of an array from 1 to the second to last and take the  
inverse+1 (the number of elements must be greater than 2)  
*****/  
unsigned char FucCheckSum(unsigned char *i,unsigned char ln)  
{  
    unsigned char j,tempq=0;  
    i+=1;  
    for(j=0;j<(ln-2); j++)  
    {  
        tempq+=*i;  
        i++;  
    }  
    tempq=(~tempq)+1;  
    return(tempq);  
}
```

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 9

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, fixture, 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, SO₂, 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 splattered 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 $250 \pm 10^{\circ}\text{C}$;

Avoid flux vapor.

3.6.2 Recommended conditions for manual welding

rosin flux with the least chlorine;

Welding temperature $\leq 350^{\circ}\text{C}$;

Duration $\leq 5\text{s}$.

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

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