

MH-Z19B NDIR CO2 Module

1. Profile

MH-Z19B NDIR infrared gas module is a common type, small size sensor, using non-dispersive infrared (NDIR) principle to detect the existence of CO₂ in the air, with good selectivity, non-oxygen dependent and long life. Built-in temperature compensation; and it has UART output and PWM output. It is developed by the tight integration of mature infrared absorbing gas detection technology, precision optical circuit design and superior circuit design.

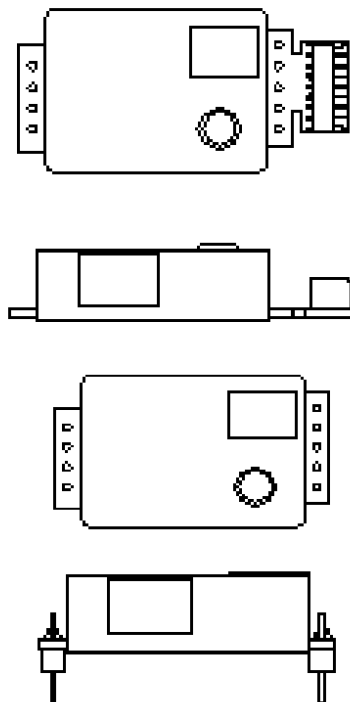
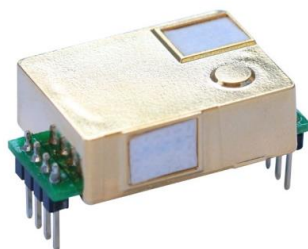
2. Applications

- | | | |
|---------------------|---------------------|--------------------------------|
| *HVAC refrigeration | *Air cleaner device | *Indoor air quality monitoring |
| *Smart home | *Ventilation system | *School |

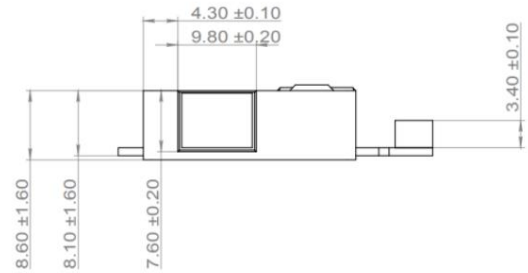
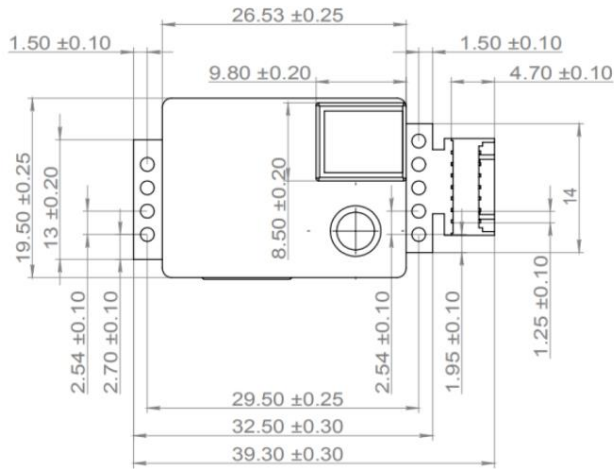
3. Main Features

Chamber is gold plated, water-proof and anti-corrosion
High sensitivity, low power consumption
Good stability
Temperature compensation, excellent linear output
Multiple output modes: UART, PWM
Long lifespan
Anti-water vapor interference, anti-poisoning

4. Structure

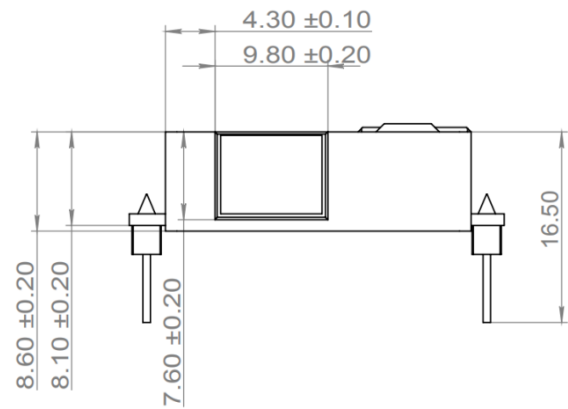
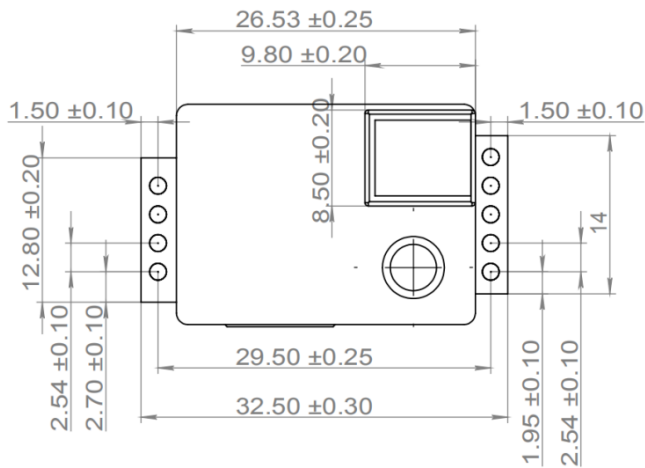


Terminal connection type:



Pins connection type:

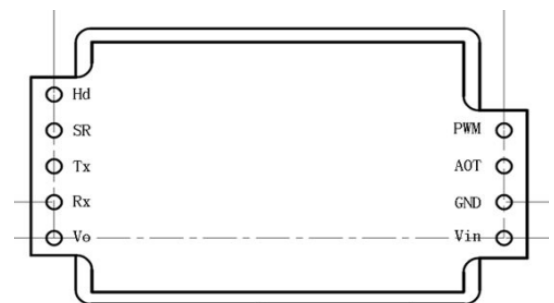
Unit: mm



Pin is the common standard type with square cross section.

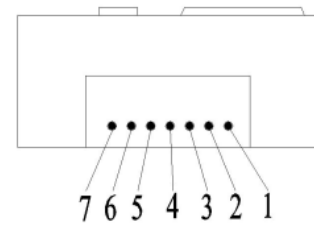
Pins connection type:

Pin	Pin Definition
Vin	Positive pole of power (Vin)
GND	Negative pole of power (GND)
PWM	PWM
Hd	HD(zero point calibration, low level lasting for over 7s is effective)
Rx	UART(RXD)TTL Level data input
Tx	UART(TXD)TTL Level data output
Vo	reserved
SR	reserved
AOT	reserved



Terminal connection type:

Pin	Terminal pin Definition
Pin 1	reserved
Pin 2	reserved
Pin 3	Negative Pole of power (GND)
Pin 4	Positive Pole of power(Vin)
Pin 5	UART(RXD)TTL Level data input
Pin 6	UART(TXD)TTL Level data output
Pin 7	reserved



Note: All the pins for reserved must be vacant while the sensor is working.

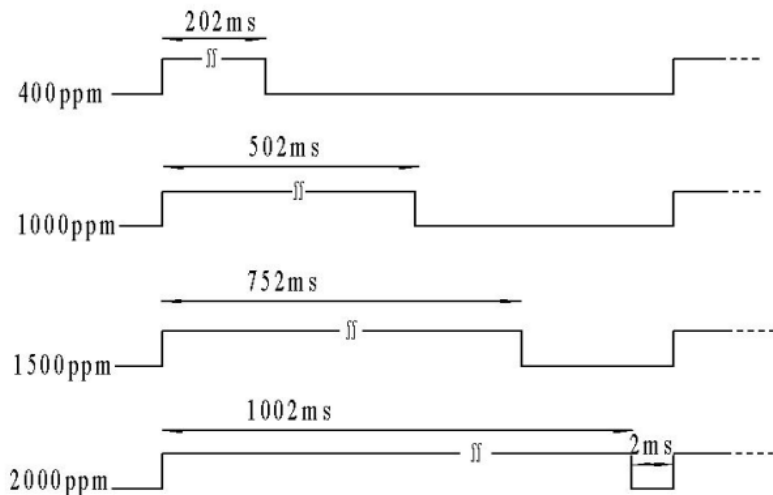
5. Detection range and accuracy

Detection Gas	Formula	Detection Range	Accuracy
Carbon Dioxide	CO ₂	0~2000ppm	± (50ppm+5% reading value)
		0~5000ppm	
		0~10000ppm	

6. Main parameters

Model No.	MH-Z19B
Detection Gas	CO ₂
Working voltage	4.5 ~ 5.5 V DC
Average current	< 20mA (@5V power supply)
Peak current	150mA (@5V power supply)
Interface level	3.3 V (Compatible with 5V)
Detection Range	0~2000/5000/10000ppm(optional)
Output signal	Serial Port (UART) (TTL level 3.3V)
	PWM
Preheat time	3 min
Response Time	T ₉₀ < 120 s
Working temperature	-10 ~ 50 °C
Working humidity	0 ~ 95% RH (No condensation)
Weight	5 g
Lifespan	> 5 years

7. Output

PWM output	
Take 0~2000ppm for example	
CO2 output range	0~2000ppm
Cycle	1004ms±5%
Cycle start high level output	2ms(theoretical value)
The middle cycle	1000ms±5%
cycle end low level output	2ms(theoretical value)
CO2 concentration: $C_{ppm}=2000\times (TH-2ms)/(TH+TL-4ms)$	
C _{ppm} : CO2 concentration could be calculated by PWM output	
TH high level output time during cycle	
TL low level output time during cycle	
	

Serial port output (UART)

Hardware connection

Connect module's Vin-GND-RXD-TXD to users' 5V-GND-TXD-RXD.

(Users must use TTL level. If RS232 level, it must be converted.)

Software setting

Set serial port baud rate be 9600, data bytes have 8 bytes, stop byte has 1 byte, parity byte is null.

Commands	
0x86	Read CO2 concentration
0x87	Calibrate Zero Point (ZERO)
0x88	Calibrate Span Point (SPAN)

0x86- Read CO2 concentration

Sending command

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	Command	-	-	-	-	-	Checksum
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79

Return value

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Command	Concentration (High 8 Byte)	Concentration (Low 8 Byte)	-	-	-	-	Checksum
0xFF	0x86	HIGH	LOW	-	-	-	-	Checksum

$$\text{CO}_2 \text{ concentration} = \text{HIGH} * 256 + \text{LOW}$$

For example: Send command FF 01 86 00 00 00 00 79, Return value FF 86 **01 F4** 00 00 00 85

How to calculate concentration: convert hexadecimal 01 into decimal 1, hexadecimal F4 into decimal 254, then $1 \times 256 + 254 = 500\text{ppm}$

1. Checksum calculation method

$$\text{Checksum} = (\text{Negative}(\text{Byte1} + \text{Byte2} + \text{Byte3} + \text{Byte4} + \text{Byte5} + \text{Byte6} + \text{Byte7})) + 1$$

For example:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	Command	-	-	-	-	-	Checksum
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	Checksum

Calculating Checksum:

1、Add Byte 1 to Byte 7: $0x01 + 0x86 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 = 0x87$

2、 Negative: $0xFF - 0x87 = 0x78$

3、 Then+1: $0x78 + 0x01 = 0x79$

C language

```
char getChecksum(char *packet)
{
    char i, checksum;
    for( i = 1; i < 8; i++)
    {
        checksum += packet[i];
    }
    checksum = 0xff - checksum;
    checksum += 1;
    return checksum;
}
```

8.Zero Point Calibration

About zero point calibration:

This module has three methods for zero point calibration: hand-operated method, sending command method and self-calibration. All the zero point is at 400ppm CO2 level.

A). Hand-operated method: Connect module's HD pin to low level(0V), lasting for 7 seconds at least. Before calibrating the zero point, please ensure that the sensor is stable for more than 20 minutes at 400ppm ambient environment.

B). To send command method:

Zero and Span point calibration can be achieved by sending a calibration command to the sensor via the serial port (URAT). Zero and SPAN point calibration commands are as follows:

0x87-To calibrate zero point								
Send command								
Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	reserved	Command	-	-	-	-	-	Checksum
0xFF	0x01	0x87	0x00	0x00	0x00	0x00	0x00	Checksum
No returned value								
Caution: zero-point means 400ppm, please ensure the module works in 400ppm CO2 gas stably for 20 min at least before send the command								

0x88- To calibrate span point								
Send command								
Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	No.	Command	Span (High 8 bits)	Span (low 8 bits)	-	-	-	Checksum
0xFF	0x01	0x88	HIGH	LOW	0x00	0x00	0x00	Checksum
No returned value. If SPAN value is 2000ppm, HIGH=2000/256; LOW=2000%256								
Caution:								
* Please do Zero calibration before SPAN calibration.								
*Before sending the SPAN calibration command, please ensure that the sensor is stable for more than 20 minutes at the corresponding concentration.								
Suggest to take 2000ppm as SPAN calibration point, if need lower concentration, it should be higher than 1000ppm.								

C).Self-calibration:

After the module works for some time, it can judge the zero point intelligently and do the zero calibration automatically. The calibration cycle is every 24 hours since the module is power on. The zero point is 400ppm. This method is suitable for office and home environment, not suitable for agriculture greenhouse, farm, refrigerator, etc.. If the module is used in latter environment, please turn off this function.

9. Notes

- 9.1 Please avoid the pressure of its gilded plastic chamber from any direction, during welding, installation, and use.
- 9.2 When placed in small space, the space should be well ventilated, especially for diffusion window.
- 9.3 The module should be away from heat, and avoid direct sunlight or other heat radiation.
- 9.4 The module should be calibrated termly, the suggested period is not longer than 6 months.
- 9.5 Do not use the sensor in the high dusty environment for long time.
- 9.6 To ensure the normal work, the power supply must be among 4.5V~5.5V DC rang, the power current must be not less than 150mA. Out of this range, it will result in the failure of the sensor. (The concentration output is low, or the sensor can not work normally.)
- 9.7 During the zero point calibration procedure by manual, the sensor must work in stable gas environment (400ppm) for over 20 minutes. Connect the HD pin to low level (0V) for over 7 seconds.
- 9.8 Forbid using wave soldering for the sensor.
- 9.9 When soldering with soldering iron, set the temperature to be $(350 \pm 5) ^\circ \text{C}$, and soldering time must be within 3 seconds.
- 9.0 As for pin version sensor, it is recommended to use soldering socket to directly insert or remove sensors for convenient maintenance.