



Infrared CO2 Sensor Module (Model: MH-Z19C-DZ)

User's Manual

(Version 1.21)

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Zhengzhou Winsen Electronics Technology Co., Ltd

ISO9001 Certificated Company

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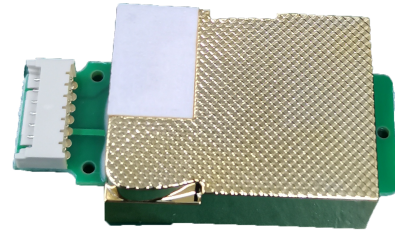
Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD.

MH-Z19C-DZ NDIR CO2 Module

Profile

MH-Z19C-DZ 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.



Main Features

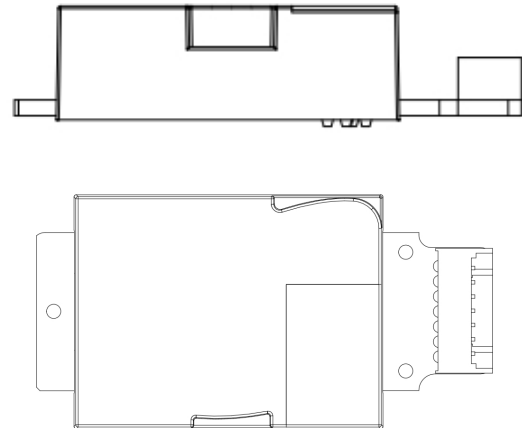
- Chamber is gold plated
- High sensitivity, low power consumption
- Good stability
- Temperature compensation, excellent linear output
- Multiple output modes: UART, DAC, PWM
- Long lifespan
- Anti-water vapor interference, anti-poisoning

Applications

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

Main parameters

Model No.	MH-Z19C-DZ
Detection Gas	CO ₂
Working voltage	DC(5.0±0.1)V
Average current	< 80mA (@5V power supply)
Peak current	125mA (@5V power supply)
Interface level	3.3 V (Compatible with 5V)
Detection Range	400~5000ppm(optional)(400~10000ppm range could be customized)
Output signal	Serial Port (UART) (TTL level 3.3V)
	PWM
	Analog output(DAC) (default 0.4~2V) (0~3V range could be customized)
Preheat time	2.5min
Response Time	T ₉₀ < 120s
Working temperature	-10℃ ~ 50℃
Storage temperature	-20℃ ~ 60℃
Working humidity	0 ~ 95% RH (No condensation)
Weight	5 g
Lifespan	> 5 years

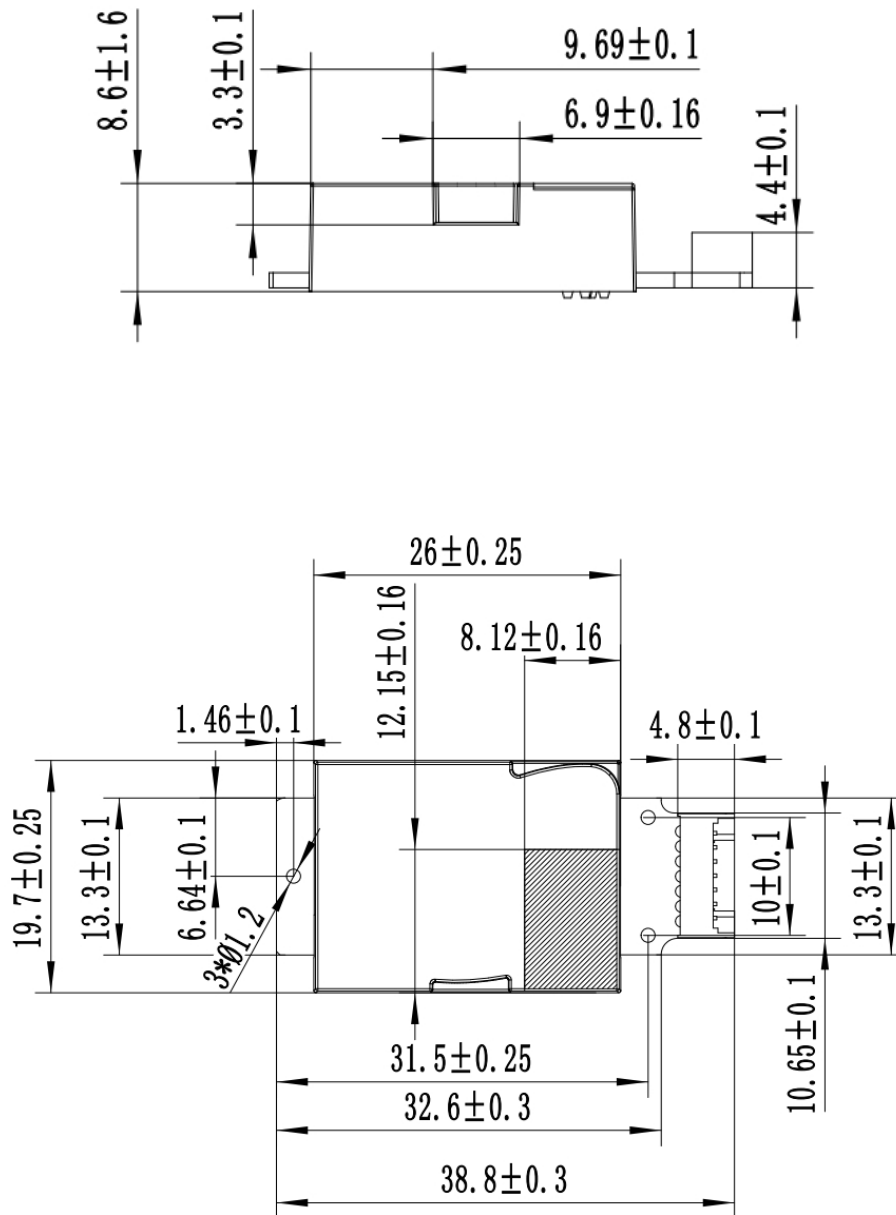


Structure

Detection range and accuracy

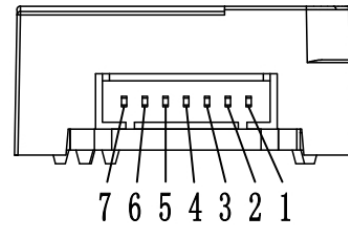
Detection Gas	Formula	Detection Range	Accuracy
Carbon Dioxide	CO ₂	400~2000 ppm	±(50ppm+5% reading value)
		400~5000 ppm	

Dimension



Pin Definition

Pin	Terminal pin Definition
Pin 1	HD
Pin 2	Analog Output Vo
Pin 3	Negative Pole(GND)
Pin 4	Positive Pole(Vin)
Pin 5	UART(RXD)TTL Level data input
Pin 6	UART(TXD)TTL Level data output
Pin 7	PWM



Terminal connection version

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: $C_{ppm} = 2000 \times (TH - 2ms) / (T - 4ms)$	
C_{ppm} : CO2 concentration could be calculated by PWM output TH high level output time during cycle T output time during cycle(1004ms±5%)	

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 bit 8 bytes, stop bit 1byte, parity bit null.														
<table border="1"> <thead> <tr> <th colspan="2">Commands</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0x86</td> <td style="text-align: center;">Read CO2 concentration</td> </tr> <tr> <td style="text-align: center;">0x87</td> <td style="text-align: center;">Calibrate Zero Point (ZERO)</td> </tr> </tbody> </table>									Commands		0x86	Read CO2 concentration	0x87	Calibrate Zero Point (ZERO)
Commands														
0x86	Read CO2 concentration													
0x87	Calibrate Zero Point (ZERO)													
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						
For example: CO2 concentration = HIGH * 256 + LOW														
How to calculate concentration: convert hexadecimal 01 into decimal 1, hexadecimal F4 into decimal 244, then 1*256+244=500ppm														

Analog Voltage Output (Vo)
Conversion between analog voltage output and concentration, take 0.4V~2V as an example: $Vo(V)=0.4V+(2.0V-0.4V)*C(\text{concentration ppm}) / \text{range}(\text{ppm})$

Checksum calculation method								
Checksum = (Negative (Byte1+Byte2+Byte3+Byte4+Byte5+Byte6+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	0x00	Check sum
<p>Calculating Checksum:</p> <p>1、 Add Byte 1 to Byte 7: 0x01 + 0x86 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 = 0x87</p> <p>2、 Negative: 0xFF - 0x87 = 0x78</p> <p>3、 Then+1: 0x78 + 0x01 = 0x79</p>									
C language									
<pre>char getChecksum(char *packet) { char i, checksum; for(i = 1; i < 8; i++) { checksum += packet[i]; } checksum = 0xff – checksum; checksum += 1; return checksum; }</pre>									

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.									
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.									
Sending 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-Zero Point Calibration									
Sending command									
Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	
Start Byte	Reserved	Command	-	-	-	-	-	-	Checksum
0xFF	0x01	0x87	0x00	0x00	0x00	0x00	0x00	0x00	Checksum
No return value									
For example: Zero Point means 400ppm, put the module in 400ppm standard CO2 gas for at least 30 minutes. When calibration is done, the sensor concentration value is about 400ppm									
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.

Notes

- Please avoid the pressure of its gilded plastic chamber from any direction, during welding, installation, and use.
- When placed in small space, the space should be well ventilated, especially for diffusion window.
- 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 cannot work normally.)
- The module should be away from heat, and avoid direct sunlight or other heat radiation.
- The module should be calibrated termly, the suggested period is no longer than 6 months.
- Do not use the sensor in the high dusty environment for long time.
- During the zero-point calibration procedure by manual or sending command, the sensor must work in stable gas environment (400ppm) for over 30 minutes.
- Forbid using wave soldering for the sensor.
- When soldering with soldering iron, set the temperature to be $(350 \pm 5) ^\circ \text{C}$, and soldering time must be within 3 seconds.

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