Infrared Carbon Dioxide Sensor Module

CM1108-Dual Beam

Introduction

Dual beam (single light source, dual wavelength) CM1108 CO2 gas sensor module is mainly used to detect CO2 concentration by adopting non-dispersive infrared (NDIR) technology. It is widely used for ventilation system, agricultural greenhouse facilities, agricultural IoT, IAQ monitor, air conditioner with purifying function, air purifier, automotive and other consumer electronic products etc.

Main features

- ✧ Advanced non-dispersive infrared technology (NDIR) with independent intellectual property
- ✧ High accuracy: temperature and concentration calibration within whole measurement range
- ✧ High stability: advanced auto-calibration in background
- ✧ Small size and compact structure and easy to install
- ✧ One beam for detecting, the other beam for reference

Application

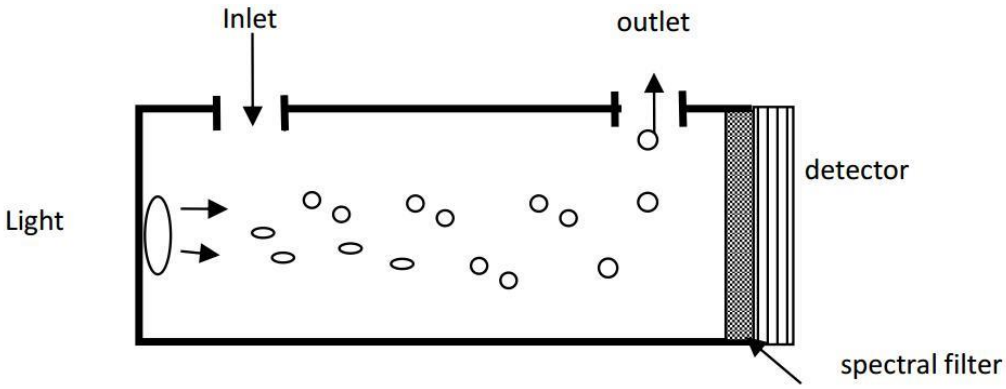
- ✧ Ventilation system
- ✧ Agricultural greenhouse facilities
- ✧ Agricultural IoT
- ✧ IAQ monitor
- ✧ Air conditioner with purifying function
- ✧ Air purifier
- ✧ Automotive

Wuhan Cubic CM1108 specification list

Technology	NDIR
Sampling method	diffusion
Measurement range	0 ~ 2,000ppm default, (0 ~ 5,000ppm, should be customized)
Accuracy	± (40ppm+2% of reading),
Max drift	±2%FS
Resolution	1 ppm
Repeatability	<2%
Preheating time	< 120sec
Temperature influence coefficient	＜0.5% FS per℃
Working temperature	-10℃ ~ +50℃
Working Humidity	0 ~ 95% RH non-condensing
Power supply	DC 5V±5%, ripple wave<50mV
Working current	Average 75mA, Peak 190mA
Signal output	PWM: linear output
	UART: TTL (3.3v electrical level)
	I²C: 3.3V/5V electrical level
Size	(L)42*(W)25*(H)10mm
Data bits	Data bits: 8; Stop bit: 1; Check bit: no check bit. Standard baud rate: 9,600bps
Lifespan	8 ~ 10 years

Principle of measurement

Molecule like CO2 and CO is composed of different types of atoms, it has absorption spectrum in infrared range. Absorption intensity abides by Lambert-Beer's Law. When light wave corresponded to certain gas with absorption spectrum passes through measured gas, the intensity of light wave will be significantly weakened. The intensity attenuation is related to concentration of measured gas. This relation follows Lambert-Beer's Law. Basic working principle of NDIR sensor is as below,



Basic mathematical model：A majority of both organic and inorganic polyatomic gas have specific absorptive wavelength in infrared region. When infrared light passed by, the light transmissivity of this gas molecule to certain wavelength can be expressed by Lambert-Beer Law:

I stands for light transmissivity, $I = I_0 e^{-kpl}$

i stands for light absorption intensity, $i = I_0 - I = I_0 (1 - e^{-kpl})$

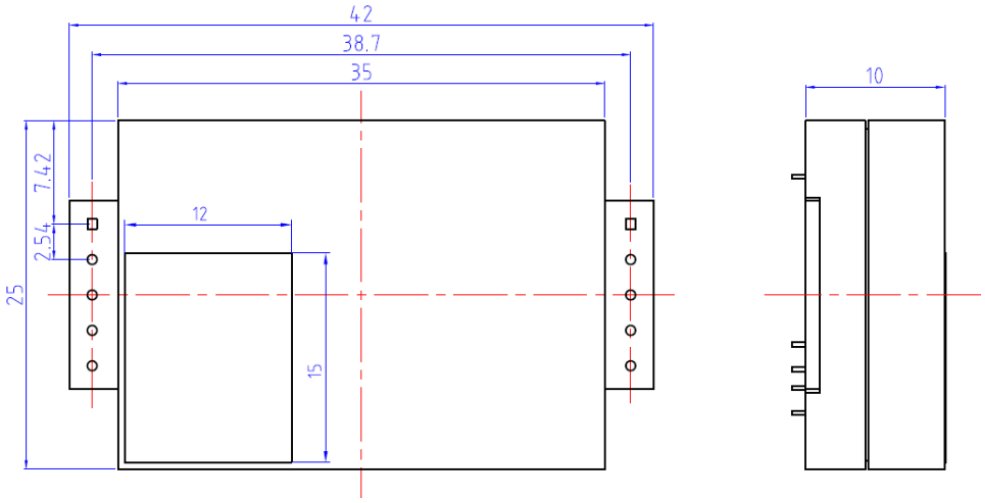
I_0**:** incident light intensity.
l: thickness of gaseous medium
p: gas concentration
k: absorption coefficient

Manual calibration

Short circuit CA and GND in CON5 for 2s and the sensor will activate the calibration after 6s. The calibration procedure is set to calibrate the zero point of sensor to be 400ppm. Before calibration, please make sure the current environment is stable. The sensor could also be calibrated through protocol command, please refer to more details in communication protocol.

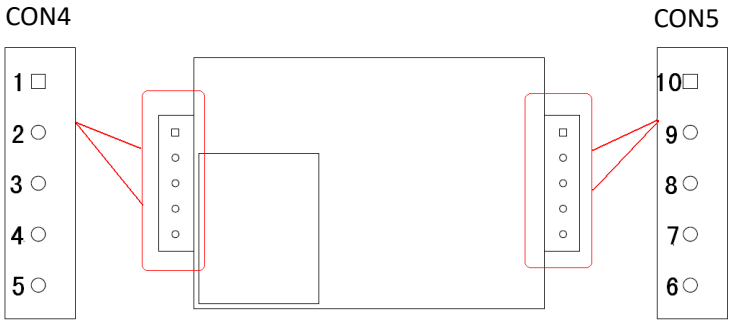
CM1108 is dual beam, there are two wavelengths, one is for measurement, the other one is for reference.
The sensor is performing real time compensation with these two wavelengths.
If value of the two wavelengths are the same, sensor will not do any compensation.
If value is different from the two wavelengths, it will do compensation to get balance output value.

Dimensions



Schematic diagram（tolerances: ±0.2mm）

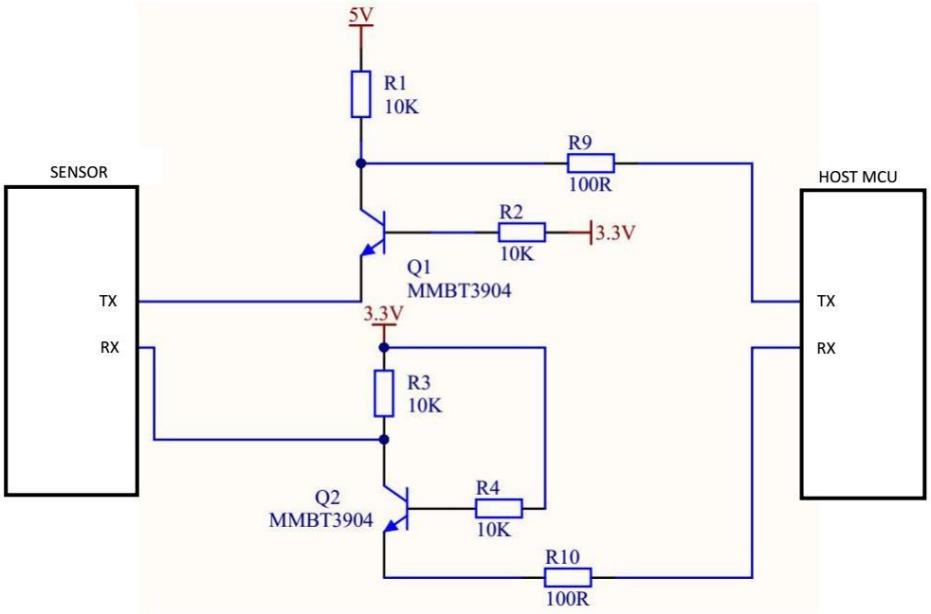
I/O Definition



CON4			CON5		
No	**Name**	**Description**	**No**	**Name**	**Description**
①	+3.3V	Power supply output +3.3V/20mA	⑩	+5V	Power supply input (+5V)
②	SDA	I²C data (Compatible with 3.3V and 5V communication)	⑨	GND	Common ground (GND)
③	SCL	I²C clock (Compatible with 3.3V and 5V communication)	⑧	PWM	PWM output
④	RXD	UART RX(receiving) TTL level @3.3V	⑦	CA	Manual calibration
⑤	TXD	UART TX(sending) TTL level @3.3V	⑥	B	Factory use

Typical application circuit

5V-3.3V Level Shift, RX, TX Level Shift



Reliability test

Test List	Test Condition	Standard	Sample qty: N Defective qty: C
Normal temperature	Operating the sensor with power on in the ambient of 25±2℃, 50+10%RH, detecting the measurement error of the sensor in different CO2 concentration.	CO2 accuracy： ±(40ppm+2% of reading)	n=10 c=0
Low humidity working	Operating the sensor powered in the ambient of 25±2℃, 30±5%RH, detecting the measurement error of the sensor in different CO2 concentration.	CO2 accuracy： ±(40ppm+2% of reading)	
High humidity working	Operating the sensor powered in the ambient of 25±2℃, 80±5%RH，detecting the measurement error of the sensor in different CO2 concentration.	CO2 accuracy： ±(40ppm+2% of reading)	
Temperature influence curve	Operating the sensor with power on in the ambient of -10±2℃, 0±2℃, 10±2℃, 20±2℃, 30±2℃, 40±2℃, 50±2℃ separately, detecting the measurement error of the sensor.	Preheating time 2min, responding time is 10sec after normal working.	
Low temperature storage.	Leave the sensor in the ambient of -20±2℃ without power on, keep for 96 hours, detecting the measurement error of the sensor under normal temperature.	The sensor works normally after 2 hours in the ambient of normal temperature	n=5 c=0
Low temperature working	Operating the sensor powered in the ambient of -10±2℃ for 96 hours, detecting the measurement error of the sensor in different CO2 concentration.	The sensor works normally after 2 hours in the ambient of normal temperature	
High temperature	Operating the sensor in the ambient of 60±2℃, 50±10%RH	The sensor works normally	

storage	without powering on, keep for 96 hours, detecting the measurement error of the sensor in different CO2 concentration.	after 2 hours in the ambient of normal temperature	
High temperature working	Operating the sensor with power on in the ambient of 50±2℃, after 96 hours, detecting the measurement error of the sensor in different CO2 concentration.	The sensor works normally after 2 hours in the ambient of normal temperature	
Impact test	Leave the sensor in ambient of -20℃ for 60mins then move it to ambient of +60℃ for 60mins. Keep this cycle for 10 times. Samples are powering off during the test.	The sensor works normally after 2 hours in the ambient of normal temperature	
High temperature, high humidity working (Endurance test)	Leave the sensor in the high temperature, high humidity ambient of 40±2℃, 90%～95%RH, add the highest voltage within voltage working range. Keep for 500 hours. (In the ambient of 25℃, 50%RH, make sure to work for 30,000hours continuously)	The sensor works normally after 2 hours in the ambient of normal temperature	
Salt spray test	According to GB/T2423.17-2008, leave the sensor in the 35℃ salt-fog cabinet, spray it with 5% sodium chloride saltwater for 24 hours. Clean the sensor after test.	No red rust on the sensor surface	n=2 c=0
Vibration test	10-55-10Hz/min, with amplitude of 1.5mm, vibrate in X, Y, Z direction, each direction for 2 hours.	No falling of terminal after test, sensor can match performance test standard.	n=4 c=0
Drop test	Drop the sensor from 70cm height down to the hard-wooden board randomly for three times.	No falling of terminal after test, sensor can match performance test standard.	

Note:

(1) The definition of normal temperature normal humidity: temperature range: 25±2℃, humidity range: 50±10%RH.

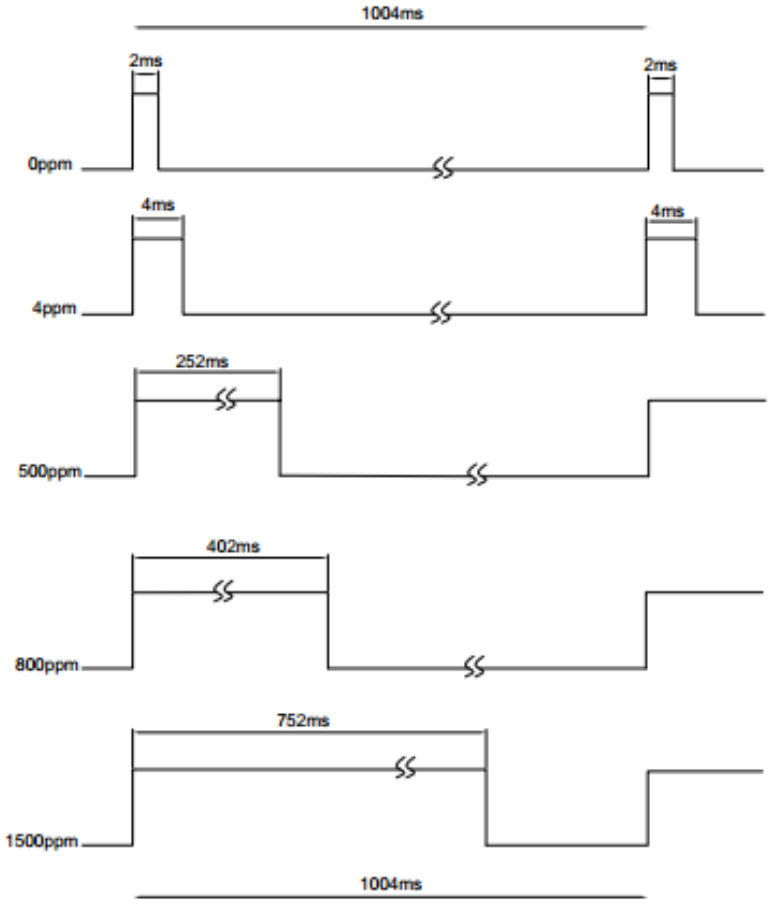
(2) The definition of sensor normal working: Sensor can measure normally and output value.

PWM output

PWM cycle：1,004ms

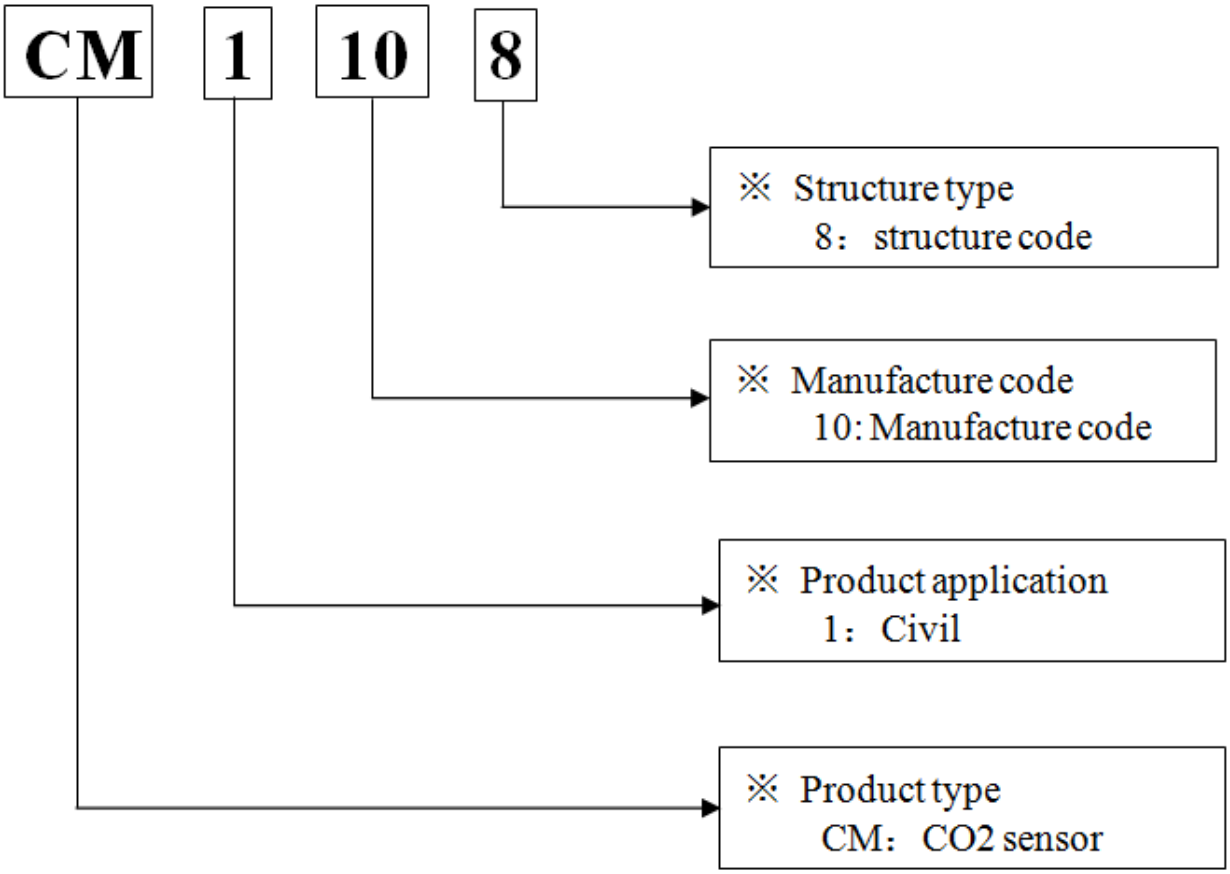
Positive pulse width： （PPM / 2）+ 2ms

PWM output schema：

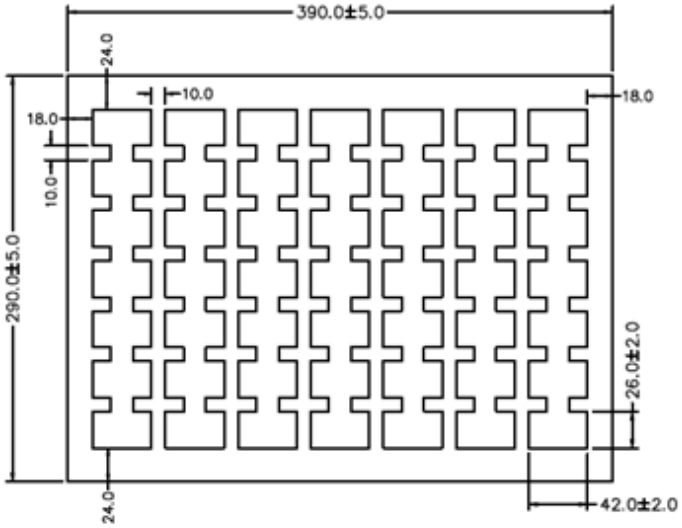


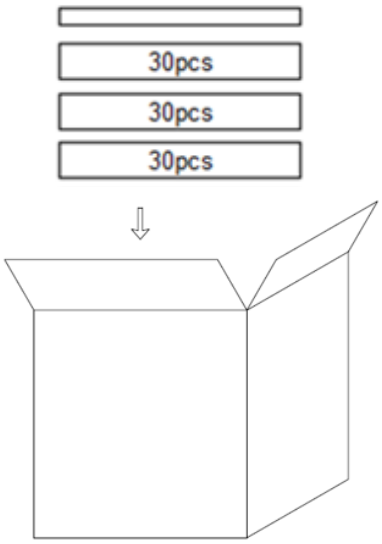
- **Connect the pin of PWM to the oscilloscope.**
- **Add a pull-up resistor around 5K between the pin of PWM and 5V.**

Ordering information



Packing





Packing description

Qty per layer	Layer	Carton	Carton dimensions	Packing material
30pcs	12 layers	360pcs	W400 * L300 * H320 mm	Red pearl cotton (ESD)

After-sales services and consultancy

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