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SPECIFICATION

Product Name: Super Low Power CO_2 Sensor Module

Item No.: CM1106SL

Version: V0.1

Date: November 01, 2018

Writer	Audit	Approved
Mei Yang		

Revision

No.	Version	Content	Reviser	Date

Super Low Power NDIR CO_2 Sensor Module

CM1106SL

Applications

- HVAC industry
- Detecting units with battery operation
- Portable instruments

Description

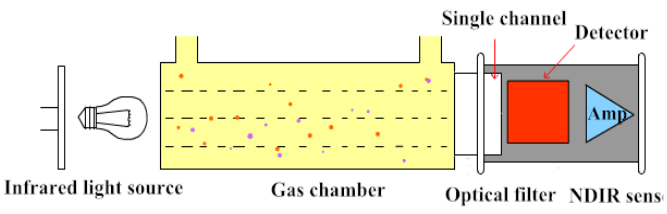
CM1106SL is super low power consumption, high performance NDIR CO_2 sensor, which can be used to detect CO_2 concentration of indoor air by adopting advanced non-dispersive infrared (NDIR) technology. It is ideally suited for HVAC industry, detecting units with battery operation, portable instruments, etc.

Features

- NDIR technology with independent intellectual property
- Super low power consumption
- High accuracy, long-term stability, long life (>10 years)
- Temperature calibration within whole measurement range
- Auto-calibration, no need of maintenance
- Small size and compact structure, easy to install

Working Principle

The main components of an NDIR CO_2 sensor are an infrared source, a sample chamber, a filter and an infrared detector. The infrared light is directed by the infrared source passing through the gas chamber towards the detector.



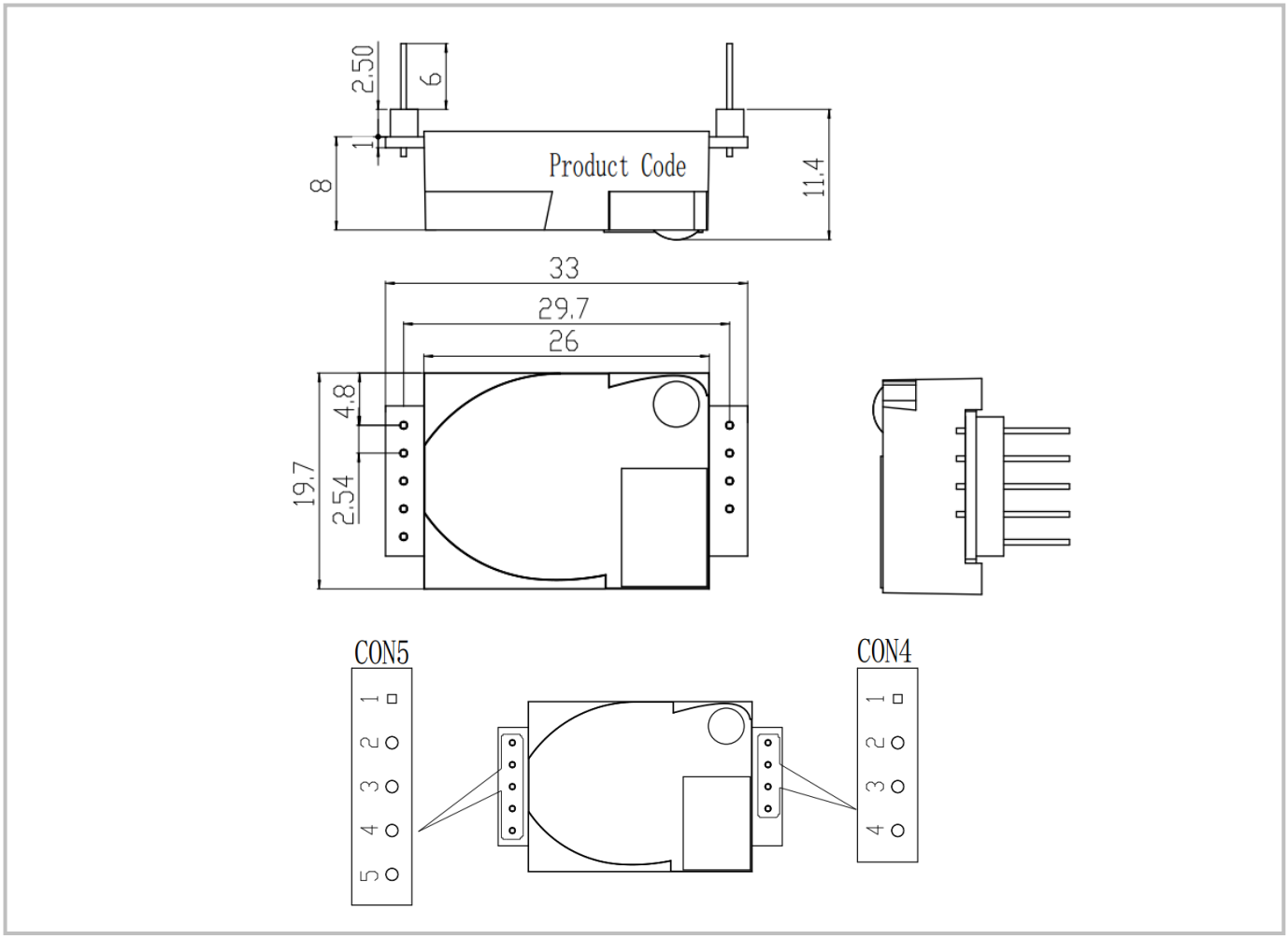
CO_2 molecules inside the gas chamber will only absorb a specific wavelength of the light. The filter allows only the specific wavelength corresponded to pass through it. The detector measures the intensity of infrared light that is related to the intensity of CO_2 and can be described through the Lambert-Beer's Law. The change in sensor signal reflects the change in gas concentration.

Specifications

Super Low Power NDIR CO_2 Sensor Specification	
Target gas	Carbon dioxide (CO_2)
Operating principle	Non-dispersive infrared (NDIR)
Measurement range	0 ~ 5,000pm
Working temperature	-10°C ~ 40°C
Working humidity	0 ~ 95%RH (non-condensing)
Storage temperature	-30°C ~ 70°C
Storage humidity	0 ~ 95%RH (non-condensing)
Accuracy	± (50ppm+5% of reading) @25±2℃, 50±10%RH
Sampling frequency	1sec
Power supply	DC 3.3V ~ 5.5V
Ripple wave	＜50mV
Working current	Average 29.8μA @ 2min measurement period
Dimensions	33 x 19.7 x 8.9mm (pin is not included)
Weight	5g
Signal output	UART: TTL
Life span	≥10 years

Dimensions and Connector

1. Dimensions (Unit mm, tolerance ±0.2 mm)

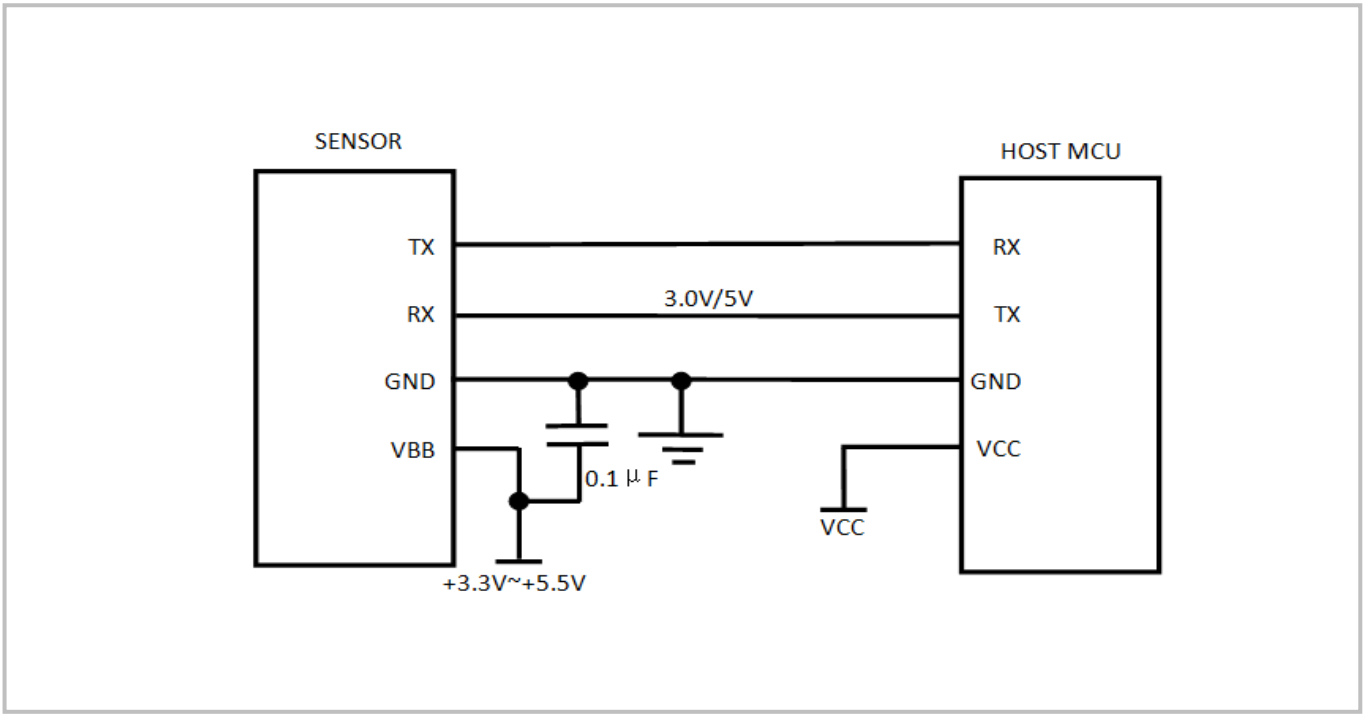


2. I/O Connector Pinout

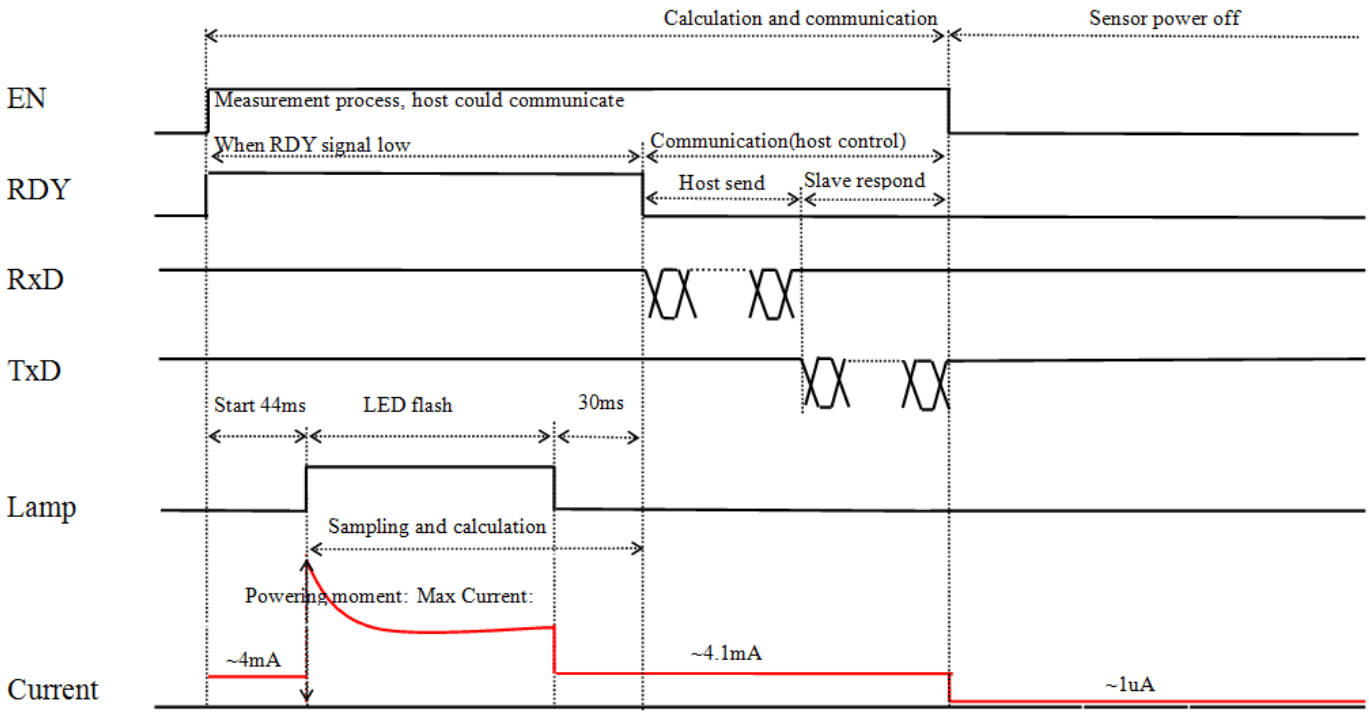
CON5			CON4		
Pin	Name	Description	Pin	Name	Description
1	VCAP	Light source power supply input	1	VBB	MCU power supply input
2	RX	UART-RX (Receiving) data, Compatible with 3.0V and 5V communication.	2	GND	Power supply input (GND)
3	TX	UART-TX (Sending), Compatible with 3.0V communication.	3	RDY	Used to indicate that the sensor data is ready, and the host could communicate.
4	EN	Power input enabled (+5V power supply is normal when in high level and disconnect	4	P	Reserved
5	CAL	Reserved			

Reference Circuit

Application scene: UART TTL serial port output



Working Sequential Chart



Explanation of Working Mode

The working mode of CM1106SL is host-slave mode: CM1106SL is a slave and it begins to work after getting EN_VBB pin high level and getting power from the host.

After powering on for 44ms, the sensor starts to work.

After 50ms working period (the light source flashing 50ms), CM1106SL starts a calculation on measured CO_2 concentration. Then the host could communicate with CM1106SL when the RDY pin goes low level.

After communication, the host will put EN_VBB pin to low level and the CM1106SL is powered off and stops working. CM1106SL stops working after getting EN_VBB pin low level.

If the host keeps the EN_VBB pin high to keep the sensor active all the time, the sensor will work in every 2 minutes cycle as default.

If CM1106SL works every 2 minutes (120 seconds) by getting power from host and then powered off after communication.

Then, the average power consumption in 44ms' period (first powering on) is 4mA.

The average power consumption in 50ms' period (the light source flashing 50ms) is 63.1mA. The average power consumption in 30ms communication period is 4.1mA.

The power consumption is about 1uA after the sensor is turned off by the EN_VBB pin.

Therefore, the average power consumption during 2 minutes' period is

I_{avg}= (44ms * 4mA + 50ms * 63.1mA + 30ms * 4.1mA) / 120sec + 1uA= 29.8 uA

Description of Calibration

CM1106SL support power-off memory and could do auto-calibration through following mode:

Auto-calibration under automatic data counting storage mode
The user could set auto-calibration period by command in protocol.

Auto-Calibration:

Auto-calibration under automatic data counting storage mode:
When user want to use automatic data counting storage mode, automatic data counting storage function needs to be open.
Under this mode, the user could set calibration period from 1 to 10, the default is 7. If the calibration period is set over 10, it will be set as 7 by default.
The sensor will store a data in each working period.
When the storing data reach calibration period * 96 times, the sensor will perform an auto-calibration.
The sensor will record data each 15 minutes as default.

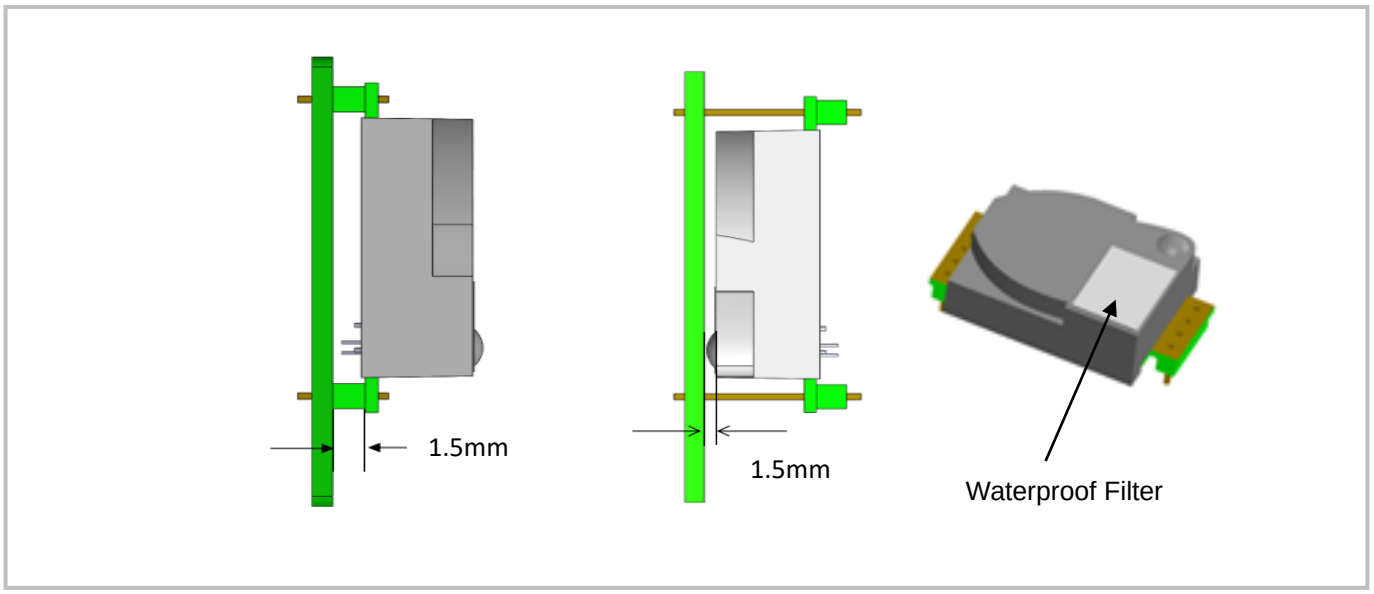
Example:
If the auto-calibration period is 7, then the auto-calibration will be after the sensor stores 672 (7 * 96= 672) data.
If the working period of CM1106SL record data every 15minutes, 672 storing data equals to 7-days calibration period [672 ÷ (24 ÷ 0.25)].

Note:
1. Please ensure the sensor is powered on during the complete 15 minutes, otherwise it cannot make the record.
2. CM1106SL support power-off memory, even it is powered off, the data already recorded will be kept, when the total data record times reached the requested times, the sensor will perform auto-calibration.

Product Installation

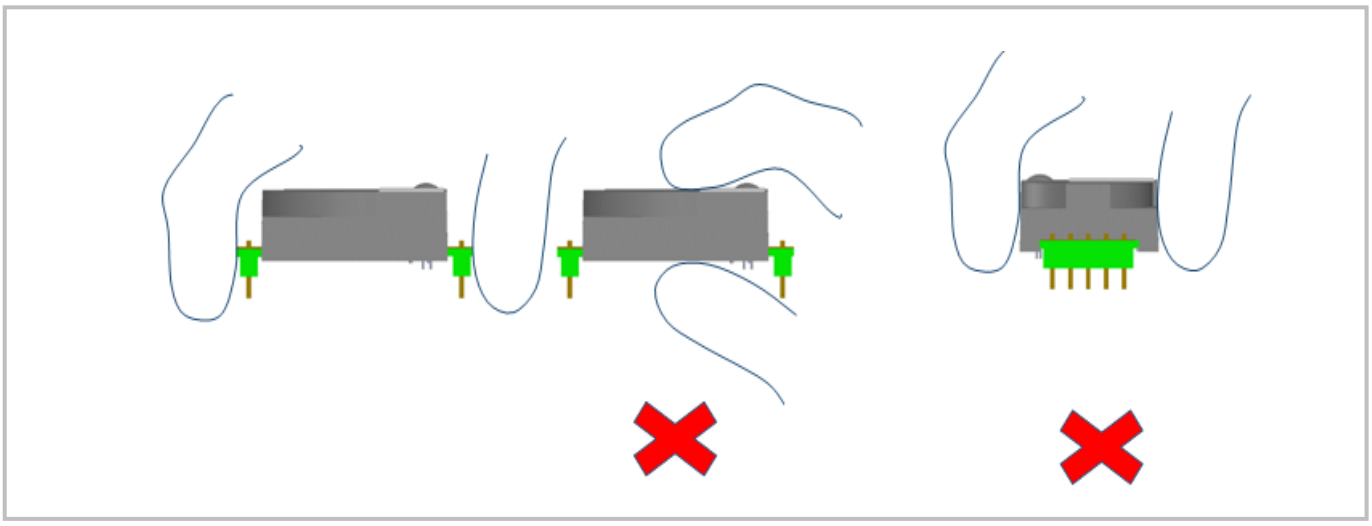
1. In order to ensure airflow diffusion into the sensor inner, make sure the minimum distance between the area of the waterproof filter and the other components is 1.5mm, otherwise, quick response time of the sensor will be affected.

Reference as below:



2. To avoid the influence of stress on sensor, please soldering by hand as much as possible when mounting the sensor to the PCB.

Reference as below:



UART Communication Protocol

1. General Statement

1).The data in this protocol is all hexadecimal data. For example, “46” for decimal [70].

2). Baud rate: 9600, Data Bits: 8, Stop Bits: 1, Parity: No, Flow Control: No.

3). [x x] is for single-byte data (unsigned, 0-255); for double data, high byte is in front of low byte.

2. Format of Serial Communication Protocol

Sending format of test software:

Start Symbol	Length	Command	Data1	…	Data n.	Check Sum
HEAD	LEN	CMD	DATA1	…	DATAn	CS
11H	XXH	XXH	XXH	…	XXH	XXH

Detail description on protocol format:

Protocol Format	Description
Start Symbol	Sending by test software is fixed as [11H], module response is fixed as [16H]
Length	Length of frame bytes= data length +1 (including CMD+DATA)
Command	Command
Data	Data of writing or reading, length is not fixed
Check Sum	Cumulative sum of data = 256-(HEAD+LEN+CMD+DATA)%256

3. Command Table of Serial Protocol

Item No.	Function Name	Command
1	Read measured result of CO_2	0x01
2	Set ABC parameter	0x10
3	Calibration of CO_2 Concentration	0x03
4	Set measurement period	0x50
5	Read the serial number of the sensor	0x1F
6	Read software version	0x1E

4. Detail Description of RS232 Protocol

4.1 Read Measured Result of CO_2

Send: 11 01 01 ED
Response: 16 05 01 DF1- DF4 [CS]
Function: Read measured result of CO_2 (Unit: ppm)

Note:
CO_2 measured result= DF1 * 256 + DF2
DF3, DF4 is reserved

Example:
Response: 16 05 01 02 58 00 00 8B

Explanation:
Hex is converted to decimal: 02 is 02; 58 is 88
CO_2 concentration= 02 * 256 + 88= 600ppm

4.2 Set ABC Parameter

Send: 11 07 10 DF1 DF2 DF3 DF4 DF5 DF6 CS
Response: 16 01 10 D9
Function: Set ABC parameter

Explanation:
DF1: reserved, default 100 (0x64)
DF2: open/close auto calibration (0: open; 2: close, the default is close)
DF3: calibration cycle (1-10 optional, 7days is default)
DF4 and DF5: The base line of calibration. (Default is 400, 400~1499 could be set)
DF6: reserved, default is 100 (0x64)

When setting parameters according to the above instructions, the ABC enabled switch state and auto-calibration cycles are set.

1. If the ABC enable switch is on, the calibration cycles must be limited to 1~10 days, and the sensor enters the automatic count storage mode, and the sensor automatically stores the data one time in every working cycle. After a total storage of 96 times of calibration cycles, the sensor starts calibrating. For example, if the calibration cycle is set to 7 days in this mode, after storing 7*96=672 times of data, the sensor starts the calibration. Assume that the sensor continuously works with 15 minutes working cycle, and the actual calibration cycle for 672 counts is 7 days.
2. After parameter is set each time, the counts of calibration and the saved raw data will return to the initial state and restart.

4.3 Calibration of CO_2 Concentration

Send: 11 03 03 DF1 DF2 CS
Response: 16 01 03 E6
Function: Calibration of CO_2 concentration

Note:

1. Calibration target value= DF1 * 256 + DF2 Unit: PPM, range (400 ~ 1,500ppm)
2. Before calibration, please make sure CO_2 concentration in current ambient is calibration target value. Keeping this CO_2 concentration for two 2 minutes, and then began calibration.

Example:

When you need to calibrate CO_2 concentration of the sensor to 600ppm, send command:

Send: 11 03 03 02 58 8F

Hex is converted to decimal: 02 is 02; 58 is 88

CO_2 concentration= 02 * 256 + 88= 600ppm

4.4 Set Measurement Period

Send: 11 03 50 DF1 DF2 CS

Response: 16 01 50 99

Function: Set measurement period

Note:

Measurement period = DF1 * 256 + DF2

The setting range for measurement period is for 15s to 300sec

4.5 Read the Serial Number of the Sensor

Send: 11 01 1F CF

Response: 16 0B 1F (SN1) (SN2) (SN3) (SN4) (SN5) [CS]

Function: Read the serial number of the sensor

Note: Read the serial number of the sensor. SNn: 0 ~ 9,999, 5integer form 20-digit number

4.6 Read Software Version

Send: 11 01 1E D0

Response: 16 0C 1E DF1…..DF11 CS

Function: Read software version

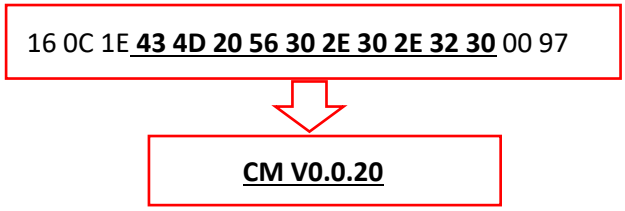
Note:

1. DF1-DF10: stand for ASCII code of software version, DF11 is reserved
2. The length of DATA is not fixed, DF1 - DFX, X stands for the length of DATA.

Example:

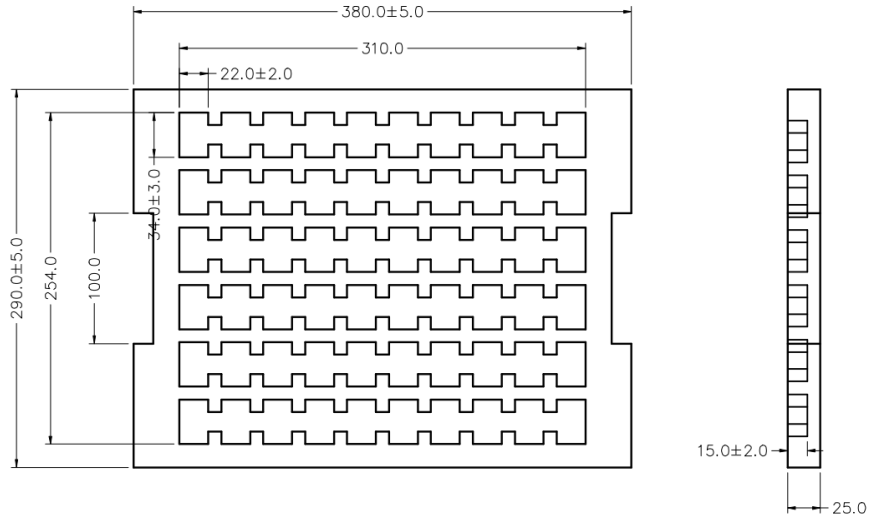
When the sensor version is CM V0.0.20, response data as follows:

Hexadecimal converted to ASCII code:

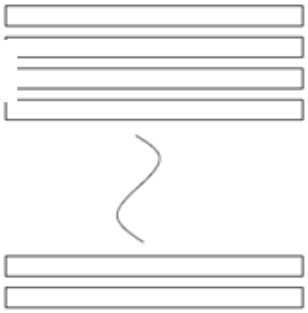


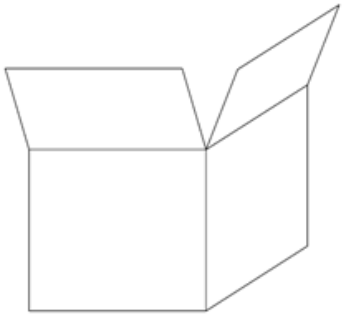
Packing Information

Tray Size



Tray Qty 18





Carton

Sensor per Tray	Tray Qty	Sensor per Carton	Carton Dimensions	Packing Material
60 pcs	18 layers	1080 pcs	395*310*480 mm	Red anti-static EPE

After-Sales Services and Consultancy

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