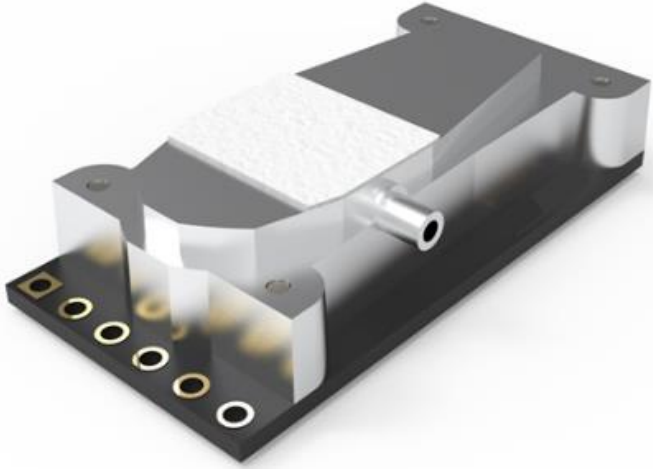




PRELIMINARY

SG112B Gas Sensor Dual Channel NDIR CO₂ Sensor Module

10% TO 30% CO₂ CONCENTRATION RANGE

Introduction

SG112B is a compact dual channel non-dispersive infrared (NDIR) sensor module with digital interfaces for measuring CO₂ at relatively high concentrations ranging from 10% to 30% (300,000 ppm) in otherwise ambient air.

The SG112B has multiple digital interfaces for customer use to seamlessly integrate SG112B with other hardware systems. SG112B offers high accuracy and dependability at an affordable price. The sensor module is individually pre-calibrated, does not require calibrations in the field.

Features

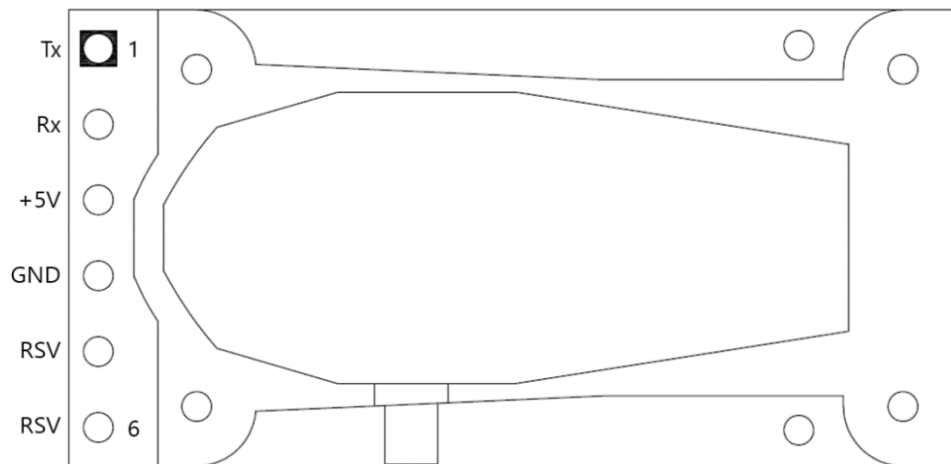
- Ultra-Small size
- Low power
- High accuracy and excellent stability
- Absolute measurement with dual-channel NDIR sensor
- Pre-calibrated and ready-to-use
- Digital interface using RS232

Applications

- Perishables goods monitoring
- Industrial processes
- Smart farms and agriculture

Pin Configuration*

Pin No.	Pin Name	Description
1	TX	TX: 3.3V(Typ) CMOS Level Signal
2	RX	RX: 3.3V(Typ) CMOS Level Signal
3	+5V	+5V Input
4	GND	Ground
5	RSV	No Connect
6	RSV	No Connect



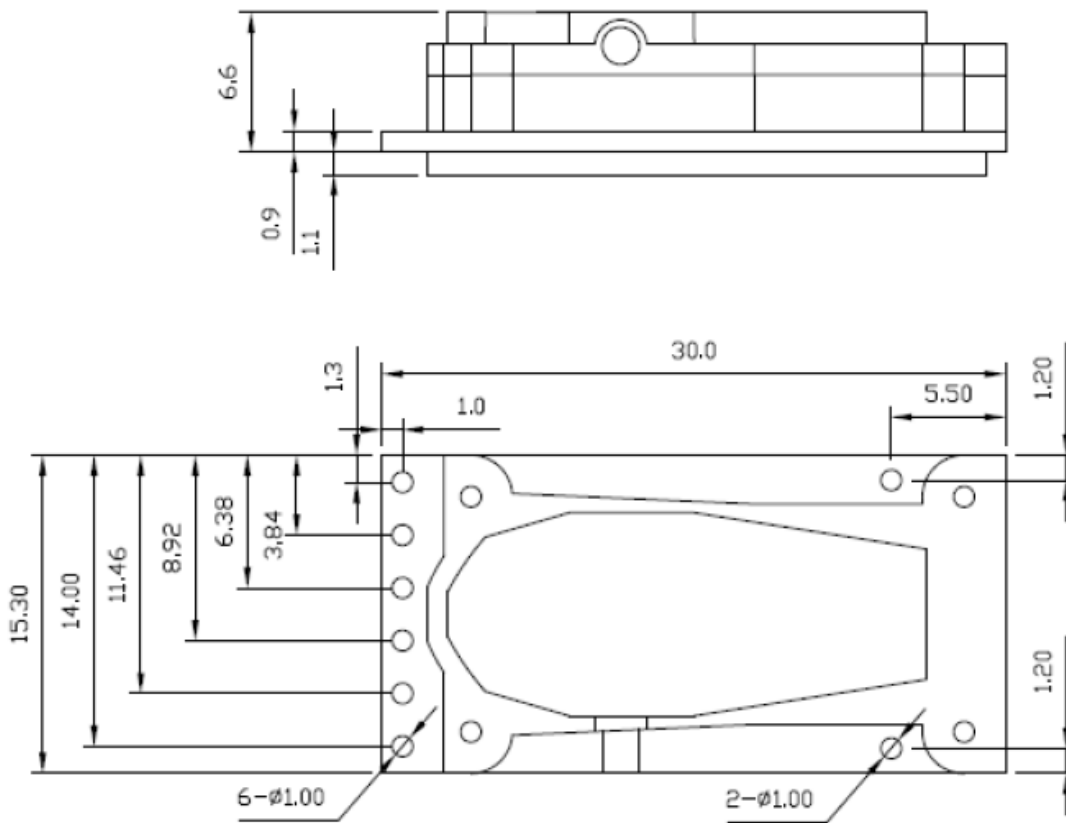
* Pin configuration is subject to change.

Specifications

Item		Specification
General	Product Name	Dual Channel NDIR CO2 sensor module
	Operation Technology	Non-dispersive Infrared (NDIR)
	Operating Temperature	-10°C ~ 50°C (Non-condensing)
	Operating Humidity	0 ~ 95% RH (Non-condensing)
	Operating Environment	Residential, Commercial spaces
	Storage Temperature	-20°C ~ 80°C (Non-condensing)
CO2 Measurement	Sensing Method	Dual Channel NDIR (Non-dispersive Infrared)
	Measurement Range	10 ~ 30%
	Accuracy	+3% of reading value of CO2)
	Warm-up Time	< 10 seconds
	Response Time	< 20 seconds (diffusion)
	Sampling Interval	2 seconds
Electrical Data	Power Input	5 VDC @5% (4.75Vdc ~ 5.25Vdc) Average current 25.0 mA@5V IR Lamp On 120 mA@5V IR Lamp Off 10 mA@5V Peak Current 520mA@5V
	Output connector	6 pins (Terminals not mounted)
Output Interface	Digital Input/Output	RS232 (UART) $V_{IL} \max = 0.475 \times 3.3 - 0.2 = 1.3675V$ $V_{IH} \min = 0.5 \times 3.3 + 0.2 = 1.85V$
Abs. Max Ratings	UART Max voltage	5.5V
	UART Min voltage	-0.3V
Weight	Module Weight	3.4g

** Specification is subject to change without notice

Dimensions



* Module Total Dimension: 30.0mm (W) x 15.3mm (L) x 7.7mm (H)

* Specification is subject to change without notice

* "2-Ø1.00" is for mounting only and not electrically connected

Digital Interfaces

The SG112B has RS232 digital interface. Users control the register map through digital interfaces by reading and writing register values. This section describes the digital interface. The command/response maps are introduced in the following section.

UART Interface

SG112B supports a RS232 Serial interface. Pin Rx is UART Rx (CMOS level input to sensor) and Pin Tx is UART Tx (CMOS level output from sensor). In detail, the UART specifications are:

- 9600 baud rate
- No parity bit
- 1 stop bit
- 8 data bits
- No flow control

The SG112B sends (push) CO2 information (ppm) to a Host via the UART interface every 2 seconds (other measurement intervals available upon request). A Host can also obtain additional information such as version details, serial number, and alarm setting via command/request data. The device message format is shown below.

UART Command Message Format

2 bytes		1 byte	1 byte	n byte	2 bytes
Sync		Command	Length	Data	Crc16
Type	Size	Description			
Sync	2 bytes	Sync Data, 0xAA55			
Command	1 byte	Command code. details in Command List			
Length	1 byte	Data Size Field without CRC16			
Data	n byte	Data to be transmitted			
CRC16	2 bytes	Error check code			

UART Response Message Format

2 bytes		1 byte	1 byte	n byte	2 bytes
Sync		Response	Length	Data	Crc16
Type	Size	Description			
Sync	2 bytes	Sync Data, 0xBB66			
Response	1 byte	Response code.			
Length	1 byte	Data Size Field without CRC16			
Data	n byte	Data to be reported			
CRC16	2 bytes	Error check code			

A Host must include the Cyclical Redundancy Check fields (CRC16) at the end of the message to ensure detecting any error.

Command/Response List

Name	Code	R/W	Data Type	Description
CMD_GET_VER	0x10	RO	-	Read Firmware Version Information
CMD_GET_SER	0x12	RO	-	Read Serial Number
CMD_GET_PPM	0x14	RO	-	Read PPM

Examples of Protocol

Read PPM

0xBB	Sync (MSB)
0x66	Sync (LSB)
0x15	Response
0x02	Size
xx	Gas Concentration (LSB)
xx	Gas Concentration (MSB)
xx	CRC (LSB)
xx	CRC (MSB)

PPM information is calculated by using the following equation:

$$\text{PPM} = (\text{MSB} \times 256 + \text{LSB}) \times 10$$

FIRMWARE VERSION (CMD_GET_VER)

This command will return the current Firmware Version number, for example v1.1.2

Example 1: Request / Response command for reading the Firmware Version.

Request (UART)

0xAA	Sync (MSB)
0x55	Sync (LSB)
0x10	Command
0x00	Size
xx	CRC (LSB)
xx	CRC (MSB)

Response (UART)

0xBB	Sync (MSB)
0x66	Sync (LSB)
0x11	Response
0x03	Size
xx	Major
xx	Minor
xx	Build
xx	CRC (LSB)
xx	CRC (MSB)

SERIAL NUMBER (CMD_GET_SER)

This command will return the Serial Number of the sensor. The length of the Serial Number is 8 bytes.

Example 2: Request / Response command for reading the Serial Number.

Request (UART)

0xAA	Sync (MSB)
0x55	Sync (LSB)
0x12	Command
0x00	Size
xx	CRC (LSB)
xx	CRC (MSB)

Response (UART)

0xBB	Sync (MSB)
0x66	Sync (LSB)
0x13	Response
0x08	Size
xx	S/N Byte 0 (LSB)
...	...
...	...
xx	S/N Byte 7 (MSB)
xx	CRC (LSB)
xx	CRC (MSB)

CRC API

```
uint16_t Calculate_CRC16 ( uint8_t *cmd , int cmd_length )
{
    uint16_t ret = 0xffff , polynomial = 0xa001 ;
    int shift = 0x0;
    for ( int i = cmd_length - 1 ; i >= 0 ; i-- ) {
        uint16_t code = ( uint16_t )( cmd [ cmd_length -1 - i ] & 0xff );
        ret = ret ^ code ;
        shift = 0x0;
        while ( shift <= 7 ) {
            if ( ret & 0x1 ) {
                ret = ret >> 1;
                ret = ret ^ polynomial ;
            } else {
                ret = ret >> 1;
            }
            shift++;
        }
    }
    return ret;
}
```

Stop ppm push

By default, the SG112B acquires and sends CO2 concentrations in ppm to the host every 2 seconds. The host, therefore, doesn't need to take any action to receive ppm values.

If the host doesn't need the ppm push information periodically, that is, if the host wants to read ppm values only on-demand, this can be done via the command `CMD_GET_PPM`, 0x14 or `CMD_GET_VER`, 0x10.

While the SG112B is sending ppm data periodically, if the host sends the `CMD_GET_PPM` or `CMD_GET_VER` command, periodic CO2 concentration measurement will be deactivated and ppm data will no longer be sent to the host.

Subsequently, the host can only read ppm data on-demand by sending the `CMD_GET_PPM` command. If the host wants to enable the periodic ppm measurement feature again, the SG112B module must be reset.

Example 3:

Request (UART)

0xAA	Sync (MSB)
0x55	Sync (LSB)
0x14	Command
0x00	Size
xx	CRC (LSB)
xx	CRC (MSB)

Response (UART)

0xBB	Sync (MSB)
0x66	Sync (LSB)
0x15	Response
0x02	Size
xx	Gas Concentration (LSB)
xx	Gas Concentration (MSB)
xx	CRC (LSB)
xx	CRC (MSB)



Do not touch or remove the particle filter!

About nanotron Technologies GmbH

Nanotron is a leading provider of electronic location awareness solutions. If knowing what, where and when is mission-critical to your business, rely on nanotron with Location Running. Nanotron's solutions deliver precise position data augmented by context information in real-time. Location Running means, reliably offering improved safety and increased productivity, 24 hours a day, 7 days per week: Location-Awareness for the Internet of Things (IoT).

An Inpixon Company

In 2020, nanotron was acquired by Inpixon (Nasdaq: INPX), a leader in Indoor Intelligence. Recognized as an industry leader in the ultra-wideband (UWB) market, nanotron's precision location awareness technology solutions enhance Inpixon's offering and homogenize the positioning of people and assets, both indoors and outdoors. Together, nanotron's solutions and Inpixon's indoor data technology, sensors, video surveillance solutions, and GPS offerings, combine to deliver actionable indoor location data and intelligence.

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