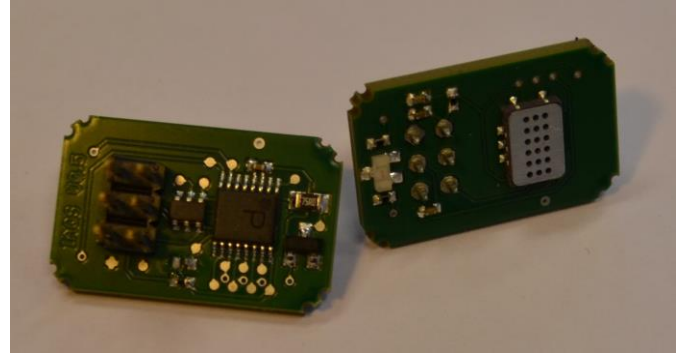




# The MiCS-VZ-87 is an integrated sensor board for Indoor Air Quality monitoring.

The MiCS-VZ-87 combines state-of-the-art MOS sensor technology with intelligent detection algorithms to monitor VOCs and CO<sub>2</sub> equivalent variations in confined spaces, e.g. meeting rooms or vehicle cabins. The signal output can be used to control ventilation on-demand, saving energy and reducing cost-of-ownership.

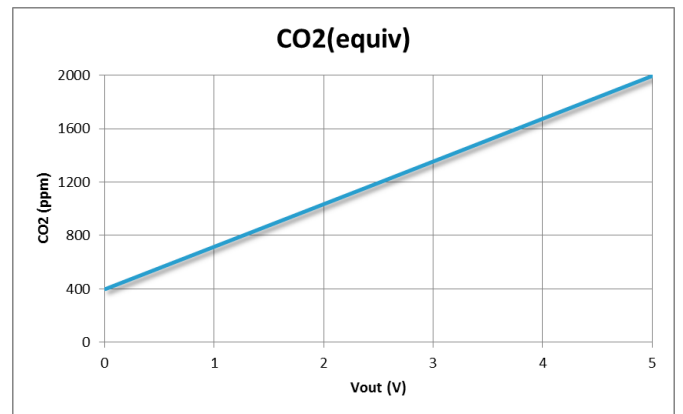


## Features

- Calibration-free
- Low power
- Wide VOCs detection range
- High sensitivity
- High resistance to shocks and vibrations

## Detectable gases

• Volatile Organic Compounds		VOCs
• equivalent Carbon Dioxide		CO <sub>2</sub> (equiv)
0V	→	400ppm CO <sub>2</sub> (equiv)
1V	→	720ppm CO <sub>2</sub> (equiv)
2V	→	1040ppm CO <sub>2</sub> (equiv)
3V	→	1360ppm CO <sub>2</sub> (equiv)
4V	→	1680ppm CO <sub>2</sub> (equiv)
5V	→	2000ppm CO <sub>2</sub> (equiv)



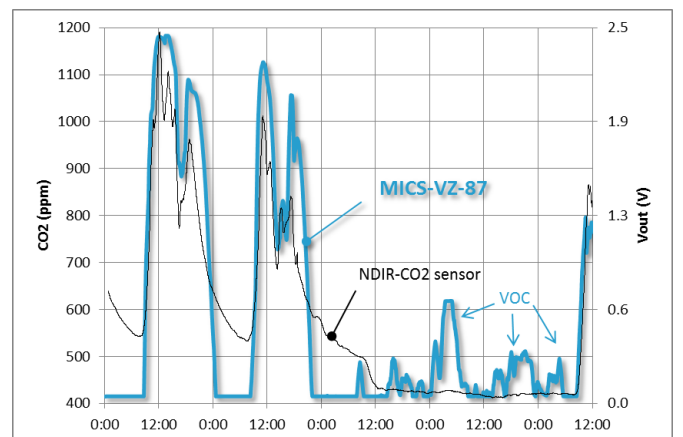
Conversion from analog output signal Vout of MiCS-VZ-87 to equivalent Carbon Dioxide concentration in ppm

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Comparison between MiCS-VZ-87 output signal and NDIR CO<sub>2</sub> sensor signal over a duration of 4 consecutive days (Thu – Sun)

## Performance

Detection Method	Semiconductor gas sensor, detecting a wide range of VOCs
Monitoring Range	400-2000 ppm equivalent CO <sub>2</sub>
Analog Output	Pin 2 – 3: 0...5V
Digital Output	Pin 5 – 6: I2C
PWM Output	Pin 2 – 4: TTL output 30Hz, Full Range 5...95%, duty cycle 5V
Response Time	Equivalent to conventional NDIR-CO <sub>2</sub> sensors
Refresh Output Frequency	1 Hz

## Operation

Supply Voltage	5V DC, regulated +/- 0.25V
Operating Power	250 mW
Warm-up Time	15 min
Operating Temperature	0°C to 50°C
Operating Humidity	0%RH to 95%RH (non condensing)
Storage Temperature	-40°C to 80°C
Storage Humidity	0%RH to 95%RH (non condensing)

## IMPORTANT PRECAUTIONS

Read the following instructions carefully before using the indoor air quality sensor described in this document to avoid erroneous readings and to prevent the device from permanent damage.

- The sensor must not be exposed to high concentrations of organic solvents, ammonia, silicone vapour or cigarette-smoke in order to avoid poisoning the sensitive layer.
- The sensor should be protected against water and dust projections.
- SGX strongly recommends using ESD protection equipment to handle the sensor.
- For any additional questions, contact SGX Sensortech

## Power-on Self-Test

Parameter	Criteria	Failed Diagnostic Indicator
Sensor Resistance Range	Range Check	Continuous Red LED at Power ON
Sensor Operating Power	Range Check	Continuous Red LED at Power ON

## LED Indicator

Operation Period	Operation Mode	Indicator
First minute after Power-on	Functional Test Mode	Blinking LED (0.5 Hz) Color according to pollution level (CO2 equ.)
Continuous mode after 60 sec.	Normal Operation	Green LED < 1027 ppm CO2 equ. 1027 ppm CO2 equ. < Yellow LED < 1654 ppm CO2 equ. 1654 ppm CO2 equ. < Red LED

## MiCS-VZ-87 Outputs

After Power-on self-test (2 seconds), the device is in "Functional Test Mode" for 60 seconds. This mode is made visible by LED indicator blinking. During this period the device can be exposed to a test gas in order to check the reactivity and sensitivity of gas sensor (exposure to alcohol bottleneck is an example of check method).

Out of this initial period, the device will have the three outputs (Analog, PWM and I2C) indicating CO2 equivalent Air Quality Level.

From Analog [V]:  $CO_2 \text{ equ} = (\text{Analog\_reading}) * (2000-400)/(5) + 400$

From PWM [%]:  $CO_2 \text{ equ} = (\text{PWM\_reading} - 5) * (2000-400)/(95-5) + 400$

From I2C [data byte value]:  $CO_2 \text{ equ} = (\text{I2C\_reading} - 13) * (2000-400)/(242-13) + 400$

CO2 equ [ppm]	Analog Output [V]	PWM Output [%]	LED Indicator
400	0	5	GREEN
1027	1.96	40.3	YELLOW (start)
1654	3.92	75.6	RED (start)
2000	5	95	RED

## I2C Communication

I2C is a simple two-wire chip-to-chip digital communication protocol. The protocol is master oriented but allows bidirectional communication on just two communication lines.

Mode	Standard Mode, Slave
I2C Addressing method	7-bit addressing + R/W
MiCS-VZ-87 Slave address	0b1110000
Get Data Command	0b00000100
Data Retrieval	Read MiCS-VZ-87 data on two bytes: 1st byte (8-bit): CO2 equ value 2 <sup>nd</sup> byte (8-bit): reserved (set at 0b00000000)
Clock Speed	Up to 100 kbit/s
Pull-up Resistor	Resistors between 2k and 10k work for most systems

### I2C Communication example:

#### MASTER to SLAVE

Address byte = 0b11100000 (*Write*)

Command = 0b00000100

Data byte 1 = 0bxxxxxxx (*not used*)

Data byte 2 = 0bxxxxxxx (*not used*)

Address byte = 0b11100001 (*Read*)

#### SLAVE to MASTER

Address byte = 0b11100000

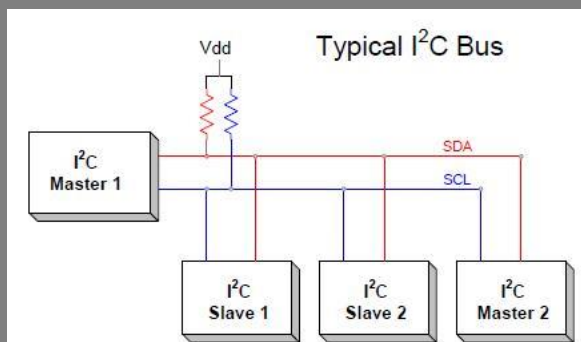
Command = 0b00000100

Data byte 1 = 0b00001101 (example of data)

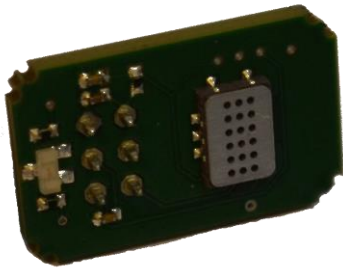
Data byte 2 = 0b00000000 (constant)

Data byte 1 = 13 =>  $13/255 = 5\%$

5% correspond to 400 ppm CO2 equ ("Clean air")



I2C bus allows communication between several masters and several slaves used in monitoring and control of peripherals like humidity and temperature sensors, actuators, etc...

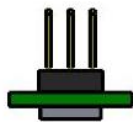
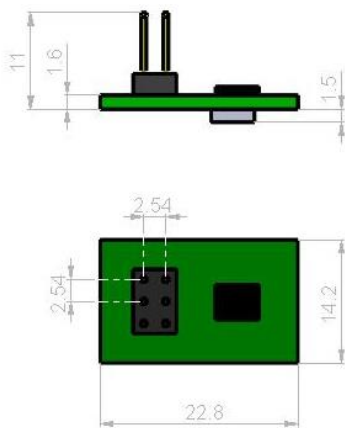


**VZ-87 PCB  
module**



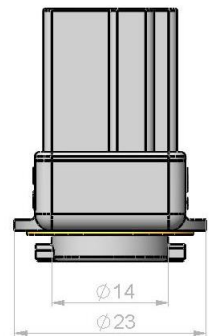
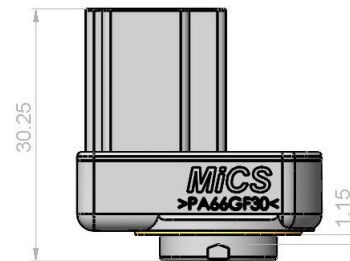
**VZ-87H packaged  
module**

The MiCS-VZ-87 is available as a PCB module (designated VZ-87) or as a packaged version for protection and simple mounting (designated VZ-87H)



← Pin Connection →

6: SDA	5: SCL
4: PWM	3: 0...5V
2: GND	1: +5V



Teflon Membrane +  
Bayonet Attachment

Electrical Connector  
mates with Tyco Electronics  
965413-1  
1355881-1

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