

## Datasheet Sensirion SCD30 Sensor Module

CO<sub>2</sub>, humidity, and temperature sensor

- NDIR CO<sub>2</sub> sensor technology
- Integrated temperature and humidity sensor
- Best performance-to-price ratio
- Dual-channel detection for superior stability
- Small form factor: 35 mm x 23 mm x 7 mm
- Measurement range: 400 ppm – 10.000 ppm
- Accuracy:  $\pm(30 \text{ ppm} + 3\%)$
- Current consumption: 19 mA @ 1 meas. per 2 s.
- Fully calibrated and linearized
- Digital interface UART or I<sup>2</sup>C



### Product Summary

CMOSens® Technology for IR detection enables carbon dioxide measurements of the highest accuracy at a competitive price.

Along with the NDIR measurement technology for detecting CO<sub>2</sub> comes a best-in-class Sensirion humidity and temperature sensor integrated on the very same sensor module. Ambient humidity and temperature can be measured by Sensirion's algorithm expertise through modelling and compensating of external heat sources without the need of any additional components. The very small module height allows easy integration into different applications.

Carbon Dioxide is a key indicator for indoor air quality. Thanks to new energy standards and better insulation, houses have become increasingly energy-efficient, but the air quality can deteriorate rapidly. Active ventilation is needed to maintain a comfortable and healthy indoor environment and improve the well-being and productivity of the inhabitants. Sensirion sensor solutions offer an accurate and stable monitoring of CO<sub>2</sub> in the air, as well as temperature and humidity. This enables our customers to develop new solutions that increase energy efficiency and simultaneously support the well-being of everyone.

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# 1 Sensor Specifications<sup>1</sup>

## CO<sub>2</sub> Sensor Specifications

Parameter	Conditions	Value
CO <sub>2</sub> measurement range	I2C, UART PWM	0 – 40'000 ppm 0 – 5'000 ppm
Accuracy <sup>2</sup>	400 ppm – 10'000 ppm	± (30 ppm + 3%MV)
Repeatability <sup>3</sup>	400 ppm – 10'000 ppm	± 10 ppm
Temperature stability <sup>4</sup>	T = 0 ... 50°C	± 2.5 ppm / °C
Response time <sup>5</sup>	$\tau_{63\%}$	20 s
Accuracy drift over lifetime <sup>6</sup>	400 ppm – 10'000 ppm ASC field-calibration algorithm activated and SCD30 in environment allowing for ASC, or FRC field-calibration algorithm applied.	± 50 ppm

**Table 1:** SCD30 CO<sub>2</sub> sensor specifications

## Humidity Sensor Specifications<sup>7</sup>

Parameter	Conditions	Value
Humidity measurement range	-	0 %RH – 100 %RH
Accuracy <sup>8</sup>	25°C, 0 – 100 %RH	± 3 %RH
Repeatability <sup>3</sup>	-	± 0.1 %RH
Response time <sup>5</sup>	$\tau_{63\%}$	8 s
Accuracy drift	-	< 0.25 %RH / year

**Table 2:** SCD30 humidity sensor specifications

## Temperature Sensor Specifications<sup>7</sup>

Parameter	Conditions	Value
Temperature measurement range <sup>9</sup>	-	- 40°C – 70°C
Accuracy <sup>8</sup>	0 – 50°C	± (0.4°C + 0.023 × (T [°C] – 25°C))
Repeatability <sup>3</sup>	-	± 0.1°C
Response time <sup>5</sup>	$\tau_{63\%}$	> 10 s
Accuracy drift	-	< 0.03 °C / year

**Table 3:** SCD30 temperature sensor specifications

<sup>1</sup> Default conditions of T = 25°C, humidity = 50 %RH, p = 1013 mbar, V<sub>DD</sub> = 3.3 V, continuous measurement mode with measurement rate = 2 s apply to values listed in the tables, unless otherwise stated.

<sup>2</sup> Deviation to a high-precision reference in the calibrated range (400 – 10'000 ppm) of the SCD30. Accuracy is fulfilled by > 90% of the sensors after calibration. Rough handling, shipping and soldering reduces the accuracy of the sensor. Full accuracy is restored with FRC or ASC recalibration features. Accuracy is based on tests with gas mixtures having a tolerance of ± 1.5%.

<sup>3</sup> RMS error of consecutive measurements at constant conditions. Repeatability is fulfilled by > 90% of the sensors.

<sup>4</sup> Average slope of CO<sub>2</sub> accuracy when changing temperature, valid at 400 ppm. Fulfilled by > 90% of the sensors after calibration.

<sup>5</sup> Time for achieving 63% of a respective step function. Response time depends on design-in, heat exchange and environment of the sensor in the final application.

<sup>6</sup> CO<sub>2</sub> concentrations < 400 ppm may result in sensor drifts when ASC is activated. For proper function of ASC field-calibration algorithm SCD30 has to be exposed to air with CO<sub>2</sub> concentration 400 ppm regularly.

<sup>7</sup> Design-in of the SCD30 in final application and the environment impacts the accuracy of the RH/T sensor. Heat sources have to be considered for optimal performance. Please use integrated on-board RH/T compensation algorithm to account for the actual design-in.

<sup>8</sup> Deviation to a high-precision reference. Accuracy is fulfilled by > 90% of the sensors after calibration.

<sup>9</sup> RH/T sensor component is capable of measuring up to T = 120°C. Measuring at T > 70°C might result in permanent damage of the sensor.

## Electrical Specifications

Parameter	Conditions	Value
Average current <sup>10</sup>	Update interval 2 s	19 mA
Max. current	During measurement	75 mA
DC supply voltage (V <sub>ddmin</sub> - V <sub>ddmax</sub> )	Min. and max. criteria to operate SCD30	3.3 V – 5.5 V
Interface	-	UART (Modbus Point to Point; TTL Logic), PWM and I <sup>2</sup> C
Input high level voltage (V <sub>IH</sub> ) I2C	Min. and max. criteria to operate SCD30	1.75 V - 3.0 V
Input high level voltage (V <sub>IH</sub> ) Modbus	Min. and max. criteria to operate SCD30	1.75 V – 5.5 V
Input low level voltage (V <sub>IL</sub> ) I2C/Modbus	Min. and max. criteria to operate SCD30	- 0.3 V – 0.9 V
Output low level voltage (V <sub>OL</sub> ) I2C/Modbus	I <sub>IO</sub> = +8 mA, Max. criteria	0.4 V
Output high level voltage (V <sub>OH</sub> ) I2C/Modbus	I <sub>IO</sub> = -6 mA, Min. criteria	2.4 V

**Table 4** SCD30 electrical specifications

## Operation Conditions, Lifetime and Maximum Ratings

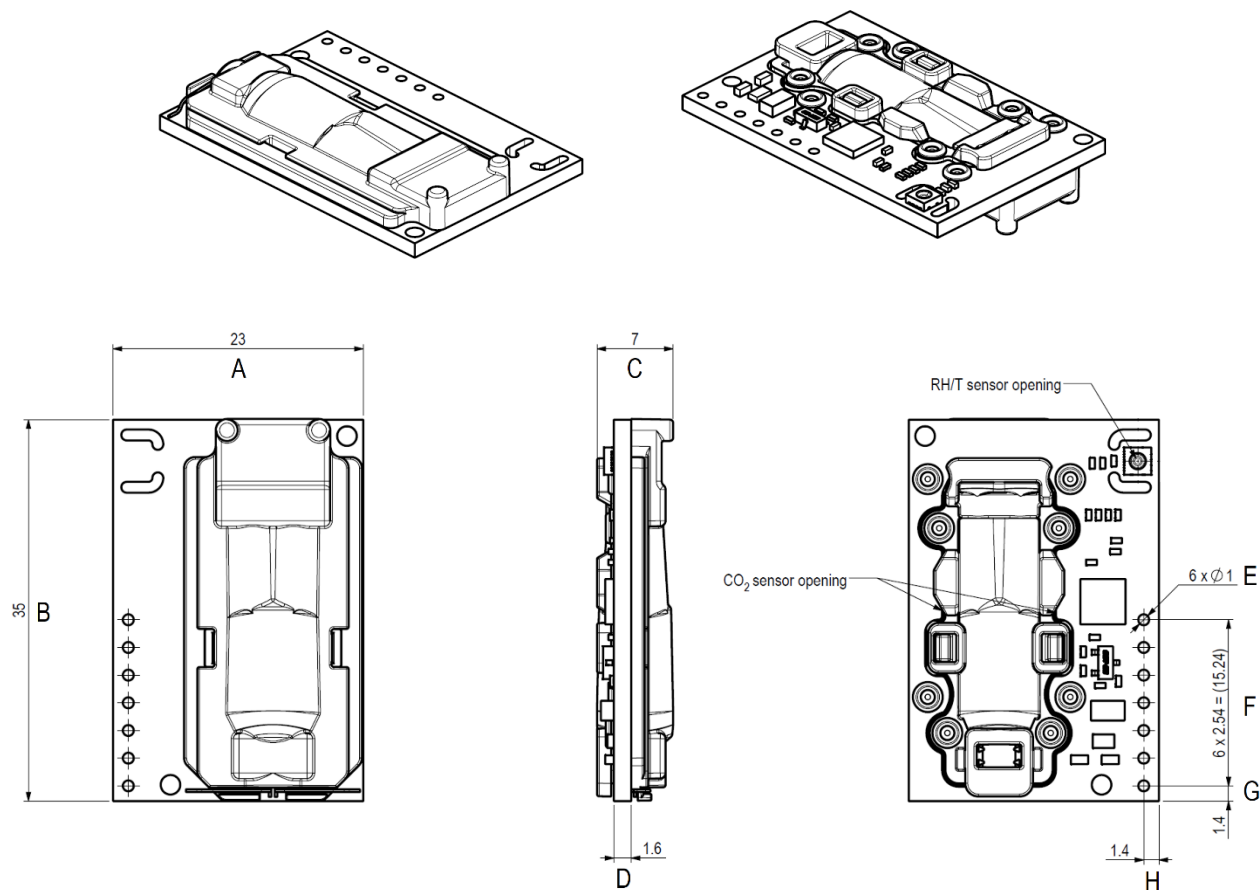
Parameter	Conditions	Value
Temperature operating conditions	Valid for CO <sub>2</sub> sensor.	0 – 50°C
Humidity operating conditions	Non-condensing. Valid for CO <sub>2</sub> sensor.	0 – 95 %RH
DC supply voltage	Exceeding specified range will result in damage of the sensor.	- 0.3 V – 6.0V
Voltage to pull up selector-pin	Max criteria	4.0 V
Voltage to pull up selector-pin	Min criteria	1.75 V
Storage temperature conditions	Exceeding specified range will result in damage of the sensor.	- 40°C – 70°C
Maintenance Interval	Maintenance free when ASC field-calibration algorithm <sup>11</sup> is used.	None
Sensor lifetime	-	15 years

**Table 5:** SCD30 operation conditions, lifetime and maximum ratings

<sup>10</sup> Average current including idle state and processing. Other update rates for small power budgets can be selected via the digital interface.

<sup>11</sup> CO<sub>2</sub> concentrations < 400 ppm may result in sensor drifts. For proper function of ASC field-calibration algorithm SCD30 has to be exposed to air with 400 ppm regularly.

## 2 Package Outline Drawing



**Figure 1** Product outline drawing of SCD30. Pictures on the left show top-view, pictures on the right bottom-view.

Sensor height is 7 mm at the thickest part of SCD30. The weight of one SCD30 sensor is 3.4 g.

**Table 6:** Nominal dimensions and tolerances SCD30

Dimension	A	B	C	D	E	F	G	H
Nominal [mm]	23.00	35.00	7.00	1.60	1.00	15.24	1.40	1.40
Tolerance [mm]	± 0.20	± 0.20	± 0.70	± 0.20	± 0.15	± 0.30	± 0.15	± 0.15

### 3 Pin-Out Diagram

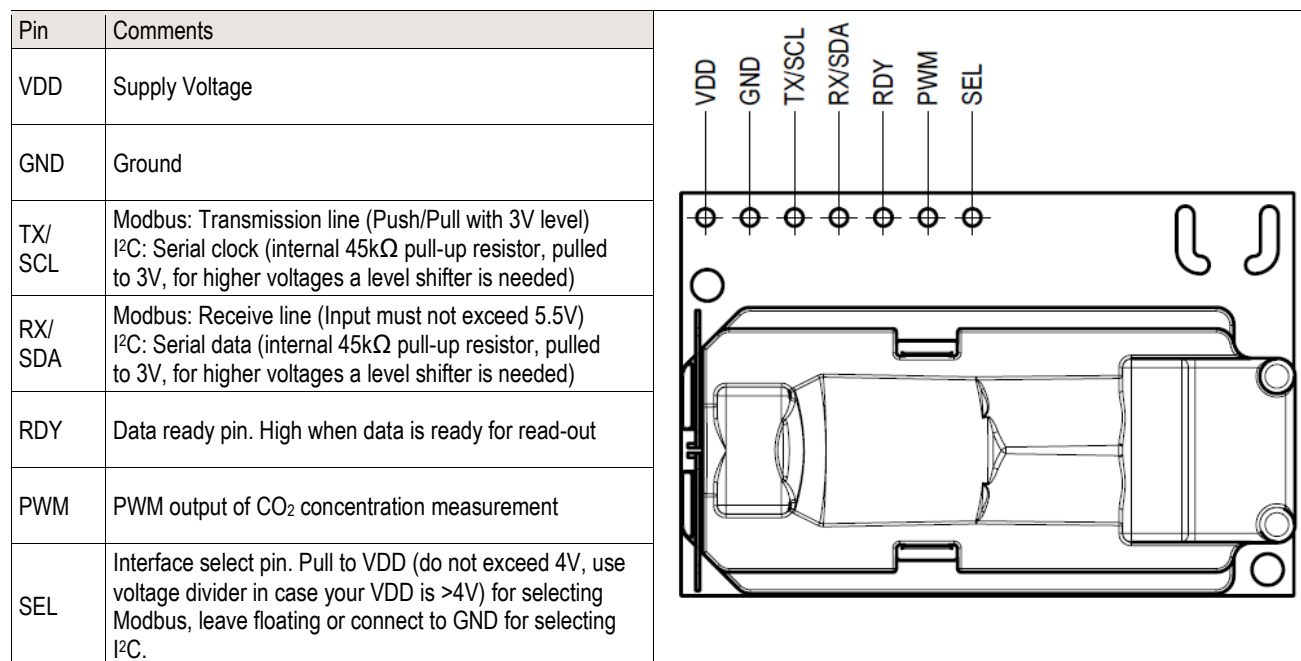


Figure 2: Pin-out of the SCD30.

### 4 Operation and Communication

Communication lines for I<sup>2</sup>C have an internal pull-up (45kΩ) to 3V, for higher voltages a level shifter is needed. Check VIH level of your I<sup>2</sup>C master to determine communication voltage. Please visit the download center of Sensirion webpage for the I<sup>2</sup>C, Modbus and PWM interface documentation <sup>12</sup>.

### 5 Shipping Package

SCD30 sensor is shipped in stackable trays with 40 pieces each. The tray dimension is 363 mm x 257 mm x 19 mm. Stacking of trays results in an effective tray height of 13 mm.

### 6 Ordering Information

SCD30 and accessory can be ordered via the following article numbers.

Product	Description	Article Number
SCD30 sensor	CO <sub>2</sub> , RH and T sensor module	1-101625-10
SEK-SCD30-Sensor	Standalone SCD30 sensor for EvalKit	3.000.061
SEK-SensorBridge	Sensor Bridge to connect SEK-SCD30-Sensor to computer	3.000.124