

# Product Specification

## Senseair Sunrise

Sensor module for battery-powered applications



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## General

Item	Senseair Sunrise Article No. 006-0-0008						
Target gas	Carbon dioxide (CO <sub>2</sub> )						
Operating principle	Non-dispersive infrared (NDIR)						
Operating range	0 – 50°C, 0 – 85% RH (non-condensing), (see figure 3)						
Measurement range	400 – 5000 ppm; extended range up to 10000 ppm <sup>1</sup>						
Accuracy [CO <sub>2</sub> ]	±(30 ppm +3% of reading) <sup>2, 3</sup> (extended range ±10% of reading) <sup>2, 3, 4</sup>						
Pressure dependence	1.6% reading per kPa deviation from normal pressure						
RMS noise, Typ. [CO <sub>2</sub> ]	<u>Filtered:</u> 0.8 ppm @ 400 ppm, 25°C 2 ppm @ 3000 ppm, 25°C		<u>Unfiltered:</u> 9 ppm @ 400 ppm, 25°C 24 ppm @ 3000 ppm, 25°C				
Power supply	3.05 – 5.5 V <sup>5</sup>						
Peak current	<125 mA <sup>6</sup>						
Steady state current during sampling	90 mA						
Average current, typical	Table comparing continuous measurement mode and single measurement mode. <sup>7,8</sup>						
	Measurement period	2 samples		8 Samples		32 Samples	
		Continuous	Single	Continuous	Single	Continuous	Single
	16 s	22 µA		<b>34 µA</b>			
	1 min	18 µA	7 µA	21 µA	17 µA	35 µA	27 µA
5 min	16 µA	1 µA	17 µA	3 µA	20 µA	5 µA	
Measurement setting	Default: Continuous measurement mode, 16 s, 8 samples (adjustable by host) <sup>7</sup>						
Dimensions (L x W x H)	33.5 x 19.7 x 11.5 mm						
Life expectancy	>15 years						
Storage temperature	-40 – 70°C						
Weight	5 g						
Communication interface	UART / I <sup>2</sup> C						

Table 1 General Specifications

Note 1: Sensor is designed to measure in the range 400 – 5000ppm, extended range up to 10000ppm, which is specified in the table accuracy. Nevertheless, exposure to concentrations below 400ppm may result in incorrect operation of ABC algorithm and shall be avoided for model with ABC ON.

Note 2: 15 – 35°C, 0 – 80%RH, after 3 ABC periods and default measurements settings.

Note 3: Specification is referenced to uncertainty of calibration gas mixtures (±1%).

Note 4: Extended range accuracy is not calibrated or guaranteed, it is extrapolated from calibrated range.

Note 5: Unprotected against surges and reverse polarity.

Note 6: At sampling start/stop there is a fast transient current. See “Sunrise customer integration guidelines” (TDE7318) for details.

Note 7: See Measurement mode for detailed information

Note 8: nRDY output pin disabled. See Figure 4 Average current.



## Description

Senseair Sunrise is a miniature sensor module for battery-powered applications. It gives full control over integration of sensor into a host system, flexibility in changing of CO<sub>2</sub> measurement period and power consumption.

## Applications

Senseair Sunrise is designed for battery powered applications. Key Benefits

- Wide supply voltage range enables a variety of battery options
- Adjustable measurement period by host
- Adjustable ABC period by host
- Ultra-low power consumption

## Installation and Soldering

Refer to Senseair Sunrise Handling manual (ANO4947).

## Sample Gas Diffusion Area

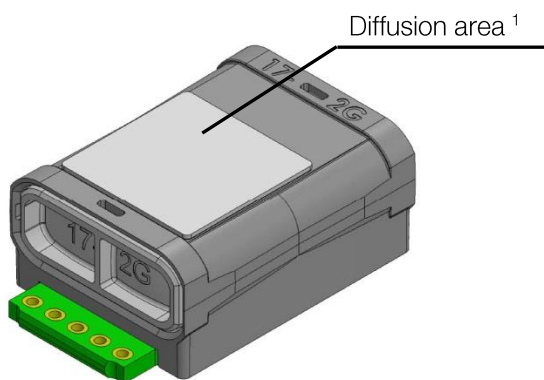


Figure 1 Sample Gas Diffusion Area

Note 1: Diffusion area must not be covered. Diminished sample gas circulation may affect response time.

## Pin Configuration and Functions

### Pin Configuration

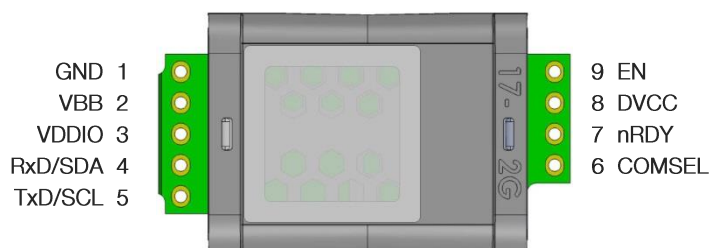


Figure 2 Pin Configuration (Top view)

## Pin Functions

Pin #	Symbol	I/O Type	Description
1	GND	Power	Ground
2	VBB	Power	Sensor supply voltage
3	VDDIO	Power	I/O supply voltage for TXD/SCL and nRDY.
4	RxD/SDA	I/O	Sensor UART receive input / I <sup>2</sup> C bidirectional serial data; True Open-Drain when operating as output.
5	TxD/SCL	I/O	Sensor UART transmit output / I <sup>2</sup> C clock input; True Open-Drain when operating as output, 100k $\Omega$ internal Pull-Up to VDDIO.
6	COMSEL	Input	Communication select, valid at power-up: HIGH = UART (Default, internal Pull-Up, can be left floating); LOW = I <sup>2</sup> C (Connect to GND).
7	nRDY	Output	Measurement ready output; True Open-Drain, active LOW; 1M $\Omega$ internal Pull-Up to VDDIO.
8	DVCC	Power	Internal supply voltage output. Not intended to supply external systems, leave floating if not used.
9	EN	Input	Enable (active high). Drive this pin over 1.2V to turn on the sensor. Drive this pin below 0.4V to put the sensor into shutdown mode. Do not leave floating. Connect to VBB if not used.

Table 2 Pin Functions

## Specifications

### Absolute Maximum Ratings

Over operating temperature range (unless otherwise noted); all voltages are with respect to GND <sup>1</sup>

Symbol	Description		Min	Max	Unit
<b>Voltage</b>					
VBB	Supply voltage		-0.3	6	V
EN	Enable				
VDDIO	I/O supply voltage				
RxD/SDA	UART / I <sup>2</sup> C		-0.3	6.5 <sup>2</sup>	V
TxD/SCL	UART / I <sup>2</sup> C				
nRDY	Ready output		-0.3	6.5	V
DVCC	Internal supply voltage output		-0.3	VBB + 0.3 or 4.3 whichever is less	V
COMSEL	Communication select	EN = HIGH	-0.3	DVCC + 0.3	V
		EN = LOW	-0.3	0.3	
<b>Current</b>					
DVCC	Maximum output current		Internally limited		A
COMSEL, RxD/SDA, TxD/SCL	Instantaneous maximum current limit		15		mA

Table 3 Absolute Maximum Ratings

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note 2: Do not input signals or an I/O pull-up power supply while the device is not powered (EN = LOW or VBB out of recommended operating condition). The current injection that results from input of such a signal or I/O pull-up might cause malfunction and the abnormal current that passes in the device at this time might cause degradation of internal elements.

## Recommended Operating Conditions

Over operating temperature range (unless otherwise noted)

Symbol	Description	Min	Typ	Max	Unit	Test conditions
<b>Voltage</b>						
VBB	Supply voltage	3.05	3.3	5.5	V	
VDDIO	I/O supply voltage for TXD/SCL and nRDY.	0		5.5	V	
COMSEL	Communication select	0		DVCC	V	
EN	Enable	0		VBB	V	
RxD/SDA	UART / I <sup>2</sup> C	0		VDDIO	V	
TxD/SCL	UART / I <sup>2</sup> C	0		VDDIO	V	
<b>Current</b>						
I <sub>COMSEL</sub> <sup>2</sup>	DC injection current	-2		2	mA	(V <sub>IN</sub> <GND, V <sub>IN</sub> >DVCC)
I <sub>DVCC</sub> <sup>1,2</sup>	Internal supply voltage current	0		25	mA	

Table 4 Recommended Operating Conditions

Note 1: Leave floating if unused.

Note 2: Limited to the value specified.

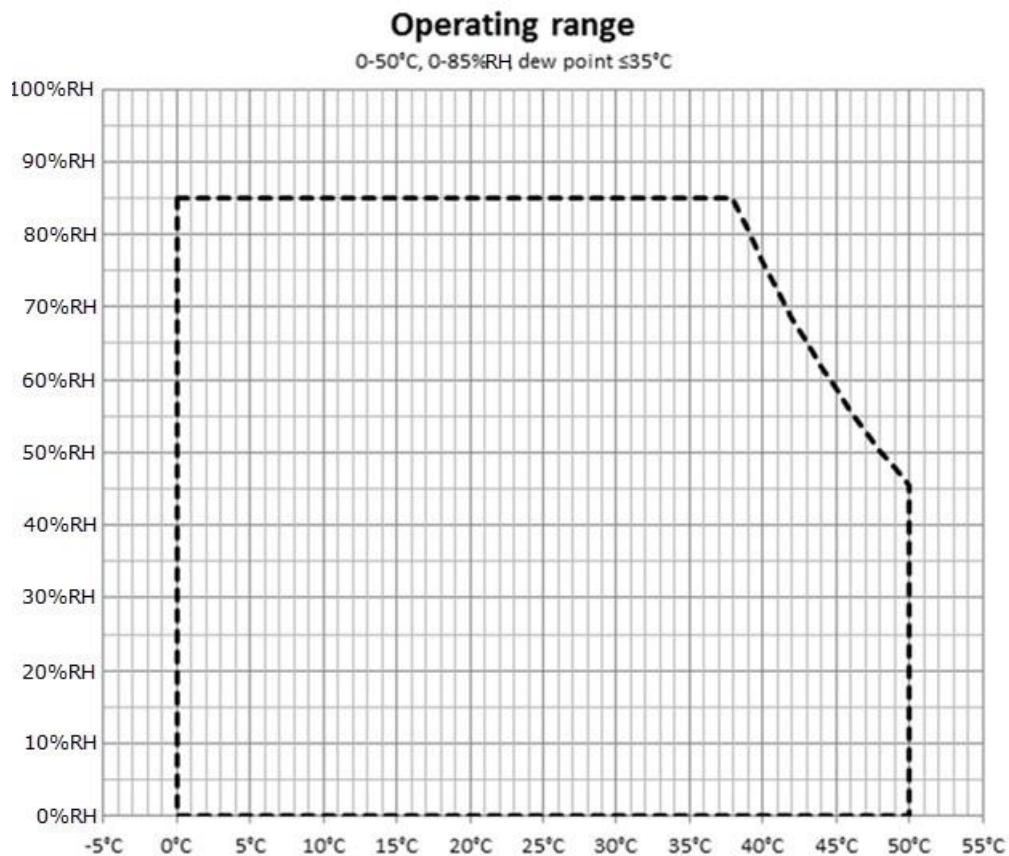


Figure 3 Operating range



## Electrical Characteristics

Over operating temperature range,  $V_{EN} = V_{BB} = 3.3V$  and default settings:  
Continuous mode, 16s measurement period, 8 samples, unless otherwise noted.

Symbol	Description	Min	Typ	Max	Unit
<b>Voltage</b>					
$V_{DVCC}^1$	Supply voltage output	2.70		2.91	V
$V_{IH}$	Input high voltage <sup>2</sup>	COMSEL RxD (UART)	2.32		V
		SDA (I <sup>2</sup> C) SCL (I <sup>2</sup> C)	2.0		
		ENABLE	1.2		
$V_{IL}$	Input low voltage <sup>2</sup>	COMSEL RxD (UART)		0.54	V
		SDA (I <sup>2</sup> C) SCL (I <sup>2</sup> C)		0.81	
		ENABLE		0.4	
$V_{HYS}$	Input hysteresis	COMSEL, RxD/SDA, TxD/SCL	270		mV
<b>Current</b>					
$I_{VBB}$	Operating peak current	$V_{EN} \geq 1.2V; 3.05 \leq V_{BB} \leq 5.5V$		125	mA
	Operating average current			34 <sup>3</sup>	$\mu A$
$I_{VBB}$	Supply quiescent current	$V_{EN} \leq 0.3V; 3.05 \leq V_{BB} \leq 5.5V$	0.2	1	$\mu A$
$I_{EN}$	Enable pin leakage current	$V_{EN} = V_{BB} = 5.5V$	5.5		$\mu A$
$I_{DDIO}$	I/O supply leakage current	$V_{DDIO} = 3.3V$	0.2	1.1	$\mu A$
$I_{IN}$	Input leakage current	$V_{DDIO} = 3.3V; RxD/SDA, TxD/SCL$	0.1	5	$\mu A$

Table 5 Electrical Characteristics, Typical values at  $T_A = 25^\circ C$ .

- Note 1: Output is not intended to supply external systems, leave floating if unused.  
 Note 2: Different voltage levels on pins RxD/SDA and TxD/SCL depending on if UART or I<sup>2</sup>C is used  
 Note 3: nRDY output pin disabled



## Average current

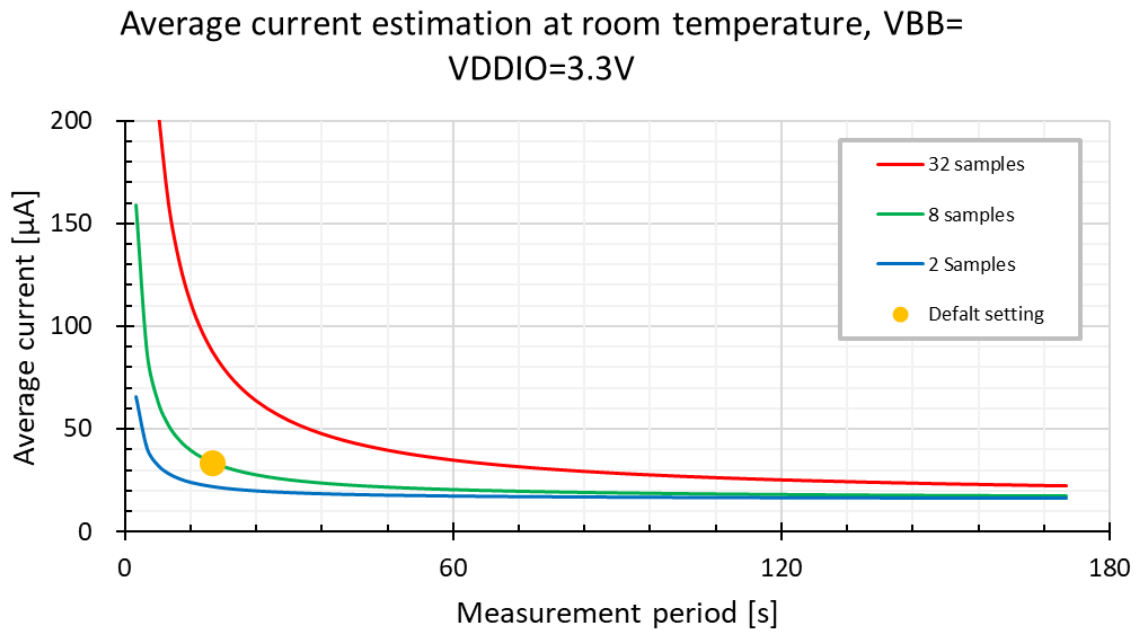


Figure 4 Average current

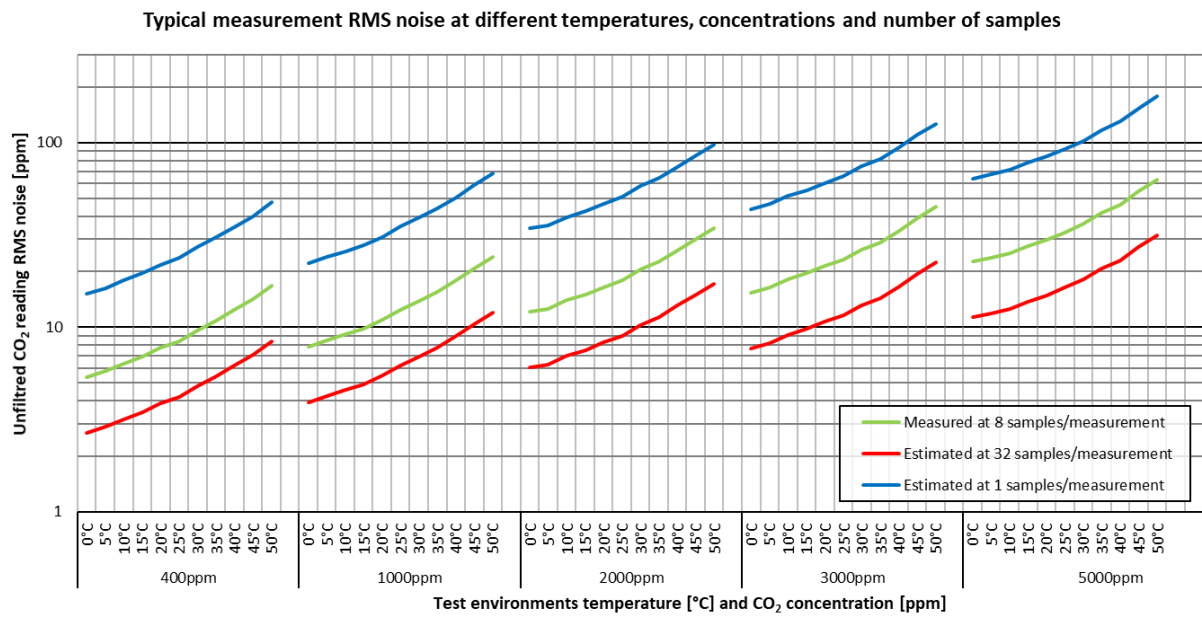


Figure 5 Measurement RMS noise

## Measurement Mode

The Senseair Sunrise supports two modes of operation for measurement of CO<sub>2</sub> concentration: Continuous measurement mode and Single measurement mode. The default operation mode for Senseair Sunrise is Continuous measurement mode.

- 1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 16s). The host can read measurement data after each measurement and does not need to send any command to trigger measurements.
- 2) In Single measurement mode, the sensor waits for the hosts command to measure. The host needs to send a command sequence to trigger each measurement.

See "Sunrise customer integration guidelines" (TDE7318) for details.

## Communication

Refer to "Modbus on Senseair Sunrise" (TDE5514) and "I2C on Senseair Sunrise" (TDE5531). See "Sunrise customer integration guidelines" (TDE7318) for details.

## Dimensions

Refer to drawing 740-00993.

## Maintenance

Senseair Sunrise has a built-in self-correcting ABC algorithm. ABC period is adjustable by host. Discuss your application with Senseair in order to get advice for a proper calibration strategy.

## Handling

Refer to Handling Manual (ANO4947)



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