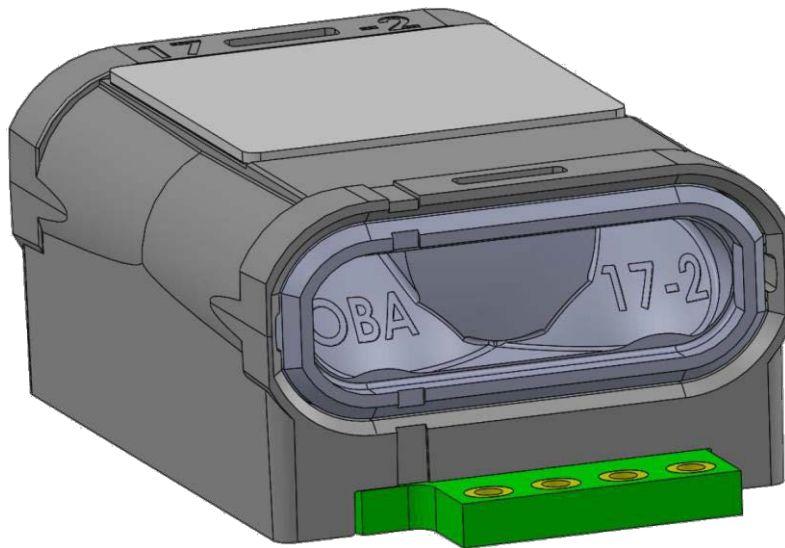


# Product Specification

## Sunrise 1% CO2 Sensor (SE-11)

Sensor module for battery-powered applications



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## General Specifications

Item	SE-11
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 – 5000ppm; extended range up to 10000ppm <sup>1</sup>
Accuracy [CO <sub>2</sub> ]	±(30ppm +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> 0.7ppm @ 400ppm, 25°C 1.4ppm @ 2000ppm, 25°C <u>Unfiltered:</u> 6ppm @ 400ppm, 25°C
Power supply	3.05 – 5.5V <sup>5</sup>
Peak current	<125mA
Average current	<150µA <sup>6</sup>
Measurement period	Default : 16s (adjustable by host) <sup>6</sup>
Dimensions (Max. L x W x H)	33.9 x 19.8 x 12.3mm
Life expectancy	>15 years
Storage temperature	-40 – 70°C
Weight	5.0 ±0.5g
Serial communication	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 three (3) ABC periods.

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 connection.

Note 6: See Measurement mode for detailed information

## Description

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

## Applications

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 Sunrise Handling manual (ANO4947).

### Gas Diffusion Area

#### Sample Gas Diffusion Area

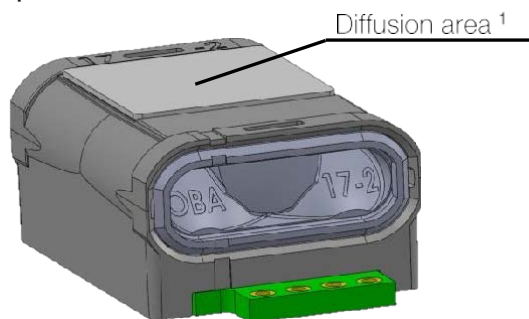


Figure 1 Sample Gas Diffusion Area

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

## Pin Configuration and Functions

### Pin Configuration

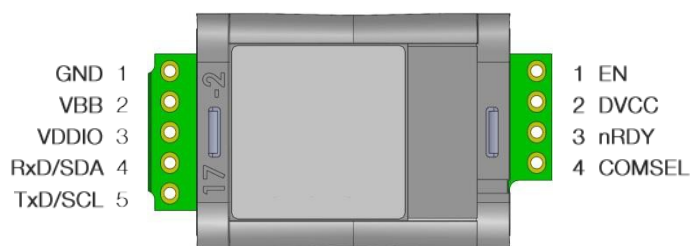


Figure 2 Pin Configuration (Top view)

## Pin Functions

Pin#	Symbol	I/O Type	Description
<b>JP1 (4-pin header)</b>			
1	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.
2	DVCC	Power	2.8V internal supply voltage output. Not intended to supply external systems, leave floating if not used.
3	nRDY	Output	Measurement ready output; True Open-Drain, active LOW; 100kΩ internal Pull-Up to VDDIO.
4	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).
<b>JP2 (5-pin header)</b>			
1	GND	Power	Ground
2	VBB	Power	Sensor supply voltage
3	VDDIO	Power	I/O supply voltage
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, 100kΩ internal Pull-Up to VDDIO.

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				
VDDIO	I/O supply voltage				
nRDY	Ready output		-0.3	6	V
RxD/SDA	UART / I <sup>2</sup> C				
TxD/SCL	UART / I <sup>2</sup> C				
EN	Enable		-0.3	< VBB + 0.3	V
DVCC	Internal supply voltage output				
COMSEL	Communication select	3.05 ≤ VBB, EN = HIGH	-0.3	DVCC + 0.3V	V
		VBB ≤ 3.05V, EN = HIGH	-0.3	DVCC + 0.3V	
		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			25	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.

## 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	3.3V	5.5	V	
VDDIO	I/O supply voltage	2.03		5.5	V	
COMSEL	Communication select	0		DVCC	V	
DVCC	Internal supply voltage output <sup>1</sup>	0		2.8	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: Output is not intended to supply external systems, leave floating if unused.

Note 2: Must be limited to the value specified.

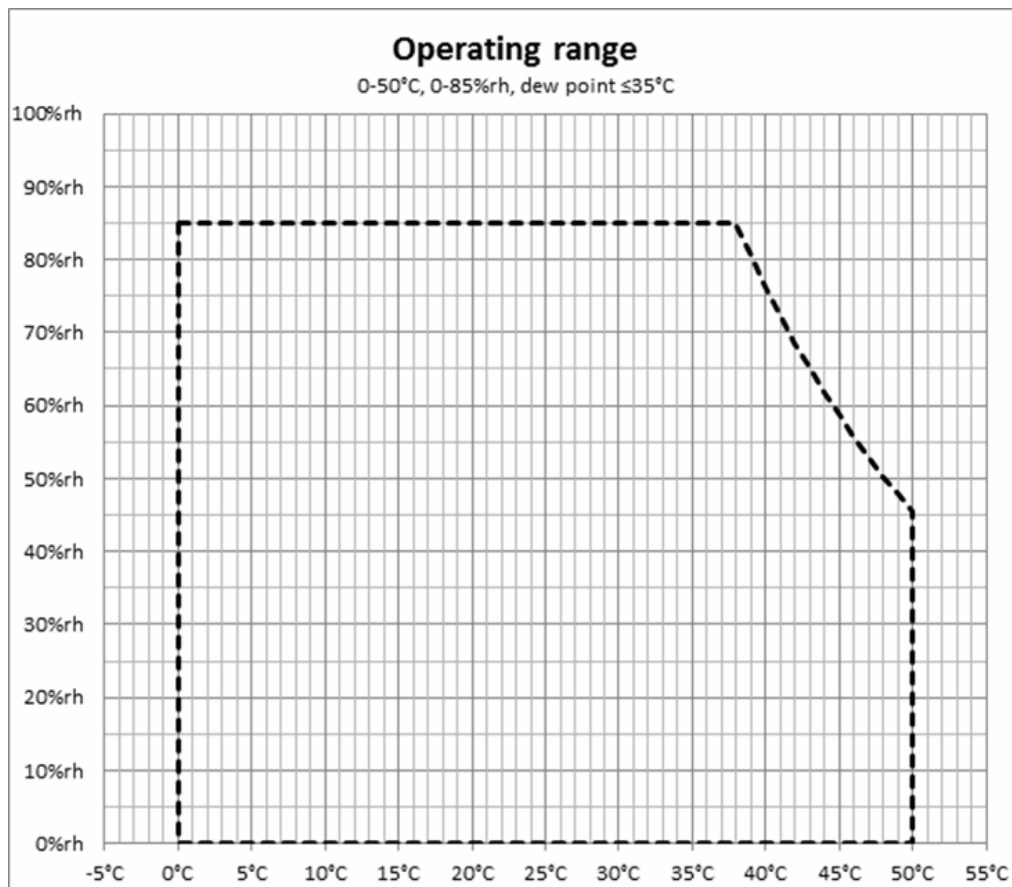


Figure 3 Operating range

## Electrical Characteristics

Over operating temperature range,  $V_{EN} = V_{BB} = 3.3V$ , 16s measurement period, unless otherwise noted.

Symbol	Description	Min	Typ	Max	Unit
	<b>Operating voltage</b>				
$V_{DVCC}$	Supply voltage output		2.8		V
$V_{IH}$	Input high voltage	COMSEL, RxD/SDA, TxD/SCL ENABLE	1.96 1.2		V V
$V_{IL}$	Input low voltage	COMSEL, RxD/SDA, TxD/SCL ENABLE		0.84 0.4	V V
$V_{HYS}$	Input hysteresis	COMSEL, RxD/SDA, TxD/SCL	168		mV
	<b>Operating current</b>				
$I_{VBB}$	Operating peak current Operating average current	$V_{EN} \geq 1.2V; 3.05 \leq V_{BB} \leq 5.5V$		125 150	mA $\mu A$
	<b>Shutdown current</b>				
$I_{VBB}$	Supply quiescent current	$V_{EN} \leq 0.3V; 3.05 \leq V_{BB} \leq 5.5V$	0.018	1	$\mu A$
$I_{EN}$	Enable pin leakage current	$V_{EN} = V_{BB} = 5.5V$		40	nA
$I_{VDDIO}$	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	1	$\mu A$

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

## Measurement mode

The Sunrise SE-11 supports two modes of operation for measurement of CO2 concentration: Continuous measurement mode and Single measurement mode.

*The default operation is Continuous mode.*

- 1) In continuous 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 the Single measurement mode, the sensor waits for the hosts command to measure. The host needs to send a command sequence (see Single measurement mode) to trigger each measurement.





Parameters	Min	Typical (ms)	Max (ms)	Timing Control	Comments
T_Start		35		Ready for communication after MCU start	Bootloader is skipped for single measurement mode
		450			Bootloader is enabled during start-up in multi-measurement mode
T_Ready		169	250	Measurement data ready after measuring command is issued	The time depends on if the calibration is also executed
T_Meas		1.81	TBD	Measurement time	The time for CO2 measurement

Table 6 Timing parameters for measurements

### Continuous measurement mode

In the Continuous measurement mode, the measurement is performed automatically according to the measurement period and number of sub-samples per measurement set by the user. The timing diagram is illustrated in Figure 5. Please refer to Table 6 for relevant timing and parameter values.

Measurement parameters:

- 1) Default measurement period: 16s (the minimum period is 2s)
- 2) Default number of sub-samples: 32 (range 1 - 32)

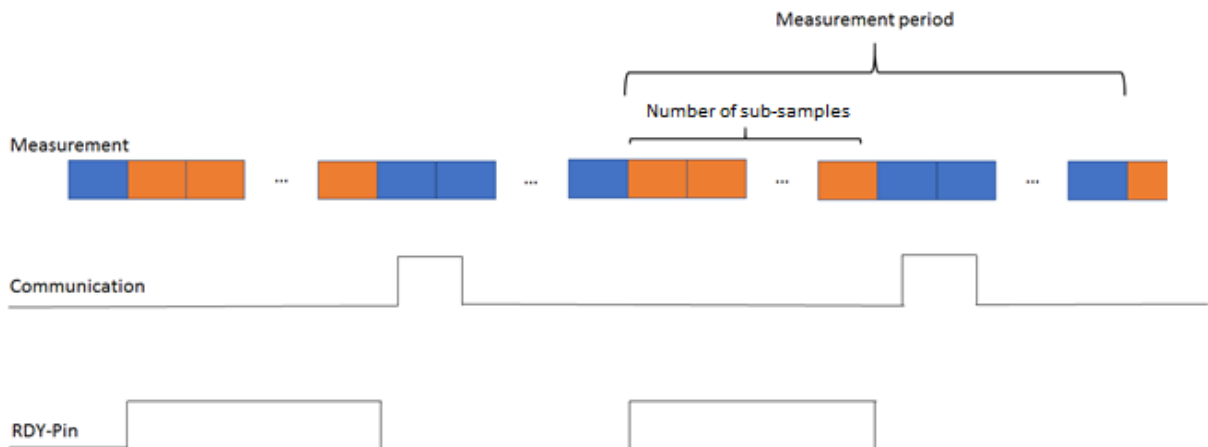


Figure 5 Timing diagram for the Continuous measurement mode

## Typical Applications

### UART Connection

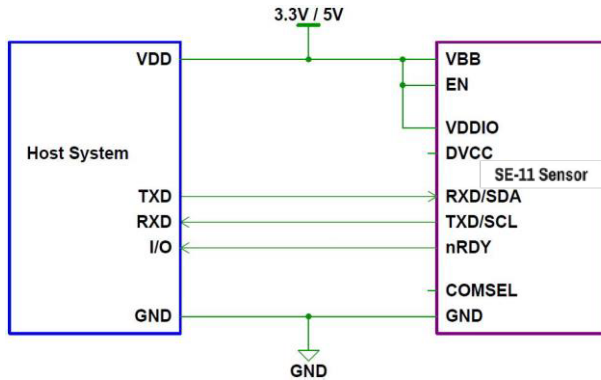


Figure 6 UART, Continuous measurement mode

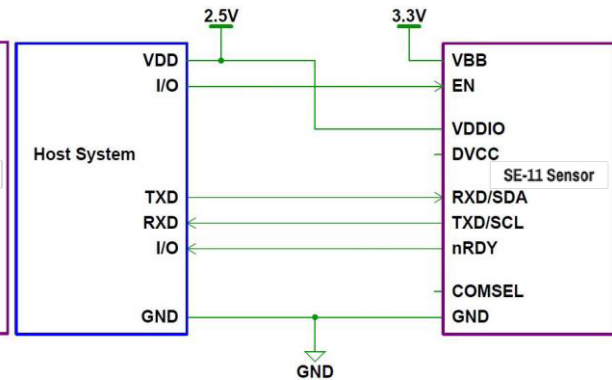


Figure 7 Low voltage UART, Single / Continuous measurement mode

### I<sup>2</sup>C Connection

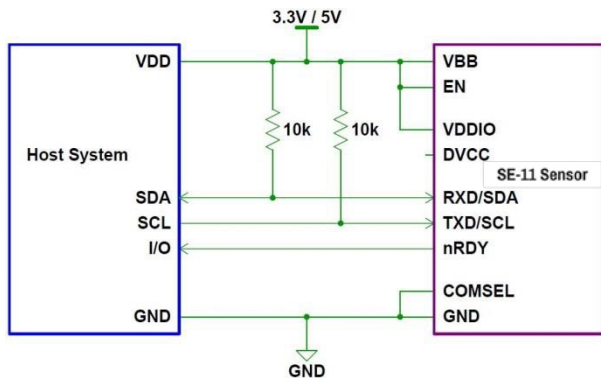


Figure 8 I<sup>2</sup>C, Continuous measurement mode

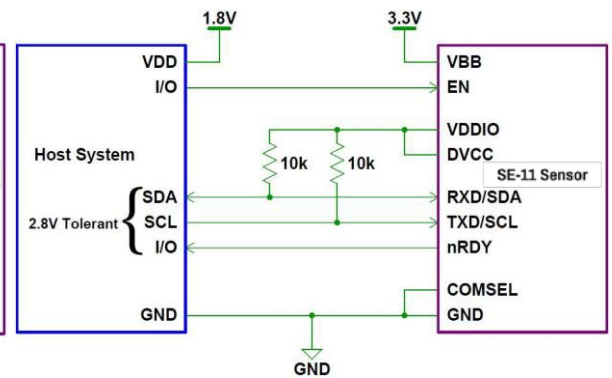


Figure 9 Low voltage I<sup>2</sup>C, Single / Continuous measurement mode

## Communication

Refer to "Modbus on **SE-11 Sensor** (TDE5514) and "I<sup>2</sup>C on **SE-11 Sensor** (TDE5531).

## Dimensions

Refer to drawing 832-00073

## Maintenance

The Sunrise has a built-in self-correcting ABC algorithm. ABC period is adjustable by host. Discuss your application with CO<sub>2</sub>Meter in order to get advice for a proper calibration strategy, [Support@CO<sub>2</sub>Meter.com](mailto:Support@CO2Meter.com)

**IMPORTANT**

**NOTICE Warranty**

- The sensor module comes with a **90** day warranty starting from the date the sensor was shipped to the buyer.
  - For more information, visit our website: [www.co2meter.com/pages/terms-conditions](http://www.co2meter.com/pages/terms-conditions)

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