Product Specification

Senseair Sunlight R290

Sensor module for leakage detection of refrigerants

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General

Item	Senseair Sunlight R290 Article No. 009-4-0002
Operating principle	Non-dispersive infrared (NDIR)
Target gas	R290, propane (C_3H_8) [1]
Operating range *	-40–70 °C, 0–95% RH (non-condensing)
Measurement range	0–100% LFL
Accuracy (R290) *	Standard range: ±2.5% LFL [2,3,4] Extended range: ±5% LFL [2,3,4]
Resolution	1 ppm [5]
Pressure dependence	+1% reading per kPa deviation from normal pressure
Power supply	3.05–5.50 V [6]
Peak current	< 95 mA [7]
Steady state current during sampling	84 mA
Average current, typical	Table comparing continuous measurement mode and single measurement mode.[8,9]
Measurement setting	Default: Continuous measurement mode, 2 s, 8 samples [9,10] Adjustable by host
Dimensions (L x W x H)	34 x 21 x 12 max [mm]
Life expectancy	> 15 years in normal commercial environments
Storage temperature	-40–85 °C
Weight	5 g
Communication interface	UART / I²C

Table comparing continuous measurement mode and single measurement mode.[8,9]

Measurement period	2 sample		8 Samples		32 Samples	
	Continuous	Single	Continuous	Single	Continuous	Single
2 s	34 µA		94 µA			
16 s	18 µA		25 µA		56 µA	
1 min	16 µA	8 µA	18 µA	10 µA	26 µA	20 µA
2 min	16 µA	4 µA	17 µA	5 µA	21 µA	10 µA

Table 1 General specifications

Note 1:   Sensor measures molecules containing C-H bonds.
Note 2:   Standard measurement range 0–25% LFL, Extended measurement range 25–70% LFL. The accuracy over the complete measurement range is specified in Figure 3
Note 3:   -30–60 °C, 0–95% RH, after 3 ABC periods or 1 zero calibration and default measurements settings.
Note 4:   Specification is referenced to uncertainty of calibration gas mixtures (±1%).
Note 5:   Convert to %LFL: $C_3H_{8\,\%LFL} = \frac{Sensor_{reading}}{210}$
Note 6:   Unprotected against surges and reverse power supply polarity.
Note 7:   At sampling start/stop there is a fast transient current.
Note 8:   nRDY output pin disabled. See Figure 4 Average current.
Note 9:   See Measurement mode for detailed information.
Note 10:   ABC ON. ABC period 720 h (30 days).
              * Might be changed without notice

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Description

Senseair Sunlight is a low-cost miniature sensor module for leakage detection of refrigerants containing R290. Customer has full control over integration of sensor into a host system, flexibility in changing of measurement period and power consumption.

Installation and soldering

Refer to Senseair Sunlight Handling manual (ANO4947).

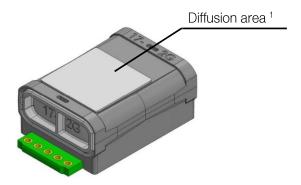## Sample gas diffusion area

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)

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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 / I²C bidirectional serial data; True Open-Drain when operating as output.
5	TxD/SCL	I/O	Sensor UART transmit output / I²C clock input; True Open-Drain when operating as output, 100 kΩ 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 = I²C (Connect to GND).
7	nRDY	Output	Measurement ready output; True Open-Drain, active LOW; 1M Ω 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 1.2 V to turn on the sensor. Drive this pin below 0.4 V to put the sensor into shutdown mode. Do not leave floating. Connect to VBB if not used.

Table 2 Pin functions

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Specifications

Absolute maximum ratings

Over operating temperature range (unless otherwise noted); all voltages are with respect to GND [1]

Symbol	Description		Min	Max	Unit
	Voltage				
VBB	Supply voltage		-0.3	6	V
EN	Enable				
VDDIO	I/O supply voltage		-0.3	6.5 [2]	V
RxD/SDA	UART / I²C				
TxD/SCL	UART / I²C				
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	
	Current				
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.

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Recommended operating conditions

Over operating temperature range (unless otherwise noted)

Symbol	Description	Min	Typ	Max	Unit	Test conditions
	Voltage					
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 / I²C	0		VDDIO	V	
TxD/SCL	UART / I²C	0		VDDIO	V	
	Current					
I_{COMSEL} [1]	DC injection current	-2		2	mA	(V_{IN} < GND, V_{IN} > DVCC)
I_{DVCC} [1, 2]	Internal supply voltage current	0		25	mA	

Table 4 Recommended operating conditions

Note 1:   Limited to the value specified.
Note 2:   Leave floating if unused.
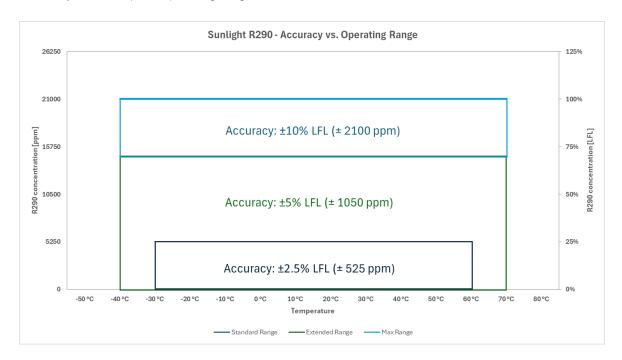
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Accuracy over complete operating range
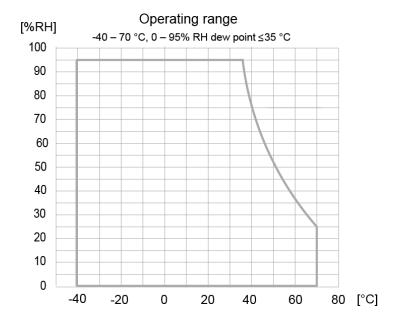

Figure 3 Accuracy over complete operating range

Figure 4 Operating range Temperature and Relative Humidity

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Electrical characteristics

Over operating temperature range, $V_{EN} = V_{BB} = 3.3$ V and default settings:
Continuous mode, 2 s measurement period, 8 samples, unless otherwise noted.

Symbol	Description		Min	Typ	Max	Unit
	Voltage					
V_{DVCC} [1]	Supply voltage output		2.70		2.91	V
V_{IH}	Input high voltage [2]	COMSEL RxD (UART)	2.32			V
		SDA (I²C) SCL (I²C)	2.0			
		ENABLE	1.2			
V_{IL}	Input low voltage [2]	COMSEL RxD (UART)			0.54	V
		SDA (I²C) SCL (I²C)			0.81	
		ENABLE			0.4	
V_{HYS}	Input hysteresis	COMSEL, RxD/SDA, TxD/SCL	270			mV
	Current					
I_{VBB}	Operating peak current Operating average current	$V_{EN} \geq 1.2$ V; $3.05 \leq V_{BB} \leq 5.5$ V		94	94	mA µA
I_{VBB}	Supply quiescent current	$V_{EN} \leq 0.3$ V; $3.05 \leq V_{BB} \leq 5.5$ V		0.2	1	µA
I_{EN}	Enable pin leakage current	$V_{EN} = V_{BB} = 5.5$ V		5.5		µA
I_{VDDIO}	I/O supply leakage current	$V_{DDIO} = 3.3$ V		0.2	1.1	µA
I_{IN}	Input leakage current	$V_{DDIO} = 3.3$ V; RxD/SDA, TxD/SCL		0.1	5	µA

Table 5 Electrical characteristics, Typical values at $T_A = 25$ °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 I²C is used.
Note 3:   nRDY output pin disabled.

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Average current

Average current estimation at room temperature, VBB=VDDIO=3.3V
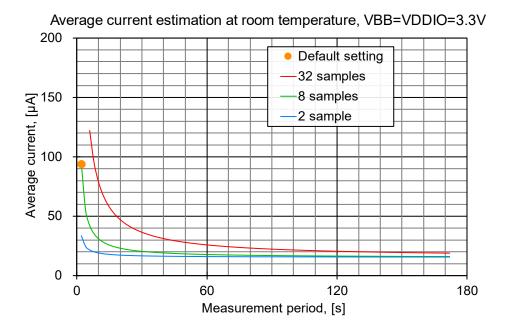

Figure 4 Average current

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Measurement mode

The Senseair Sunlight supports two modes of operation for measurement of R290 concentration: Continuous measurement mode and Single measurement mode. The default operation mode for Senseair Sunlight is Continuous measurement mode.

1) In Continuous measurement mode, the sensor measures at regular intervals (measurement period, default setting 2 s). 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.

Communication

Refer to "Modbus on Senseair Sunrise and Sunlight" (TDE5514) and "I2C on Senseair Sunrise and Sunlight" (TDE5531).

Dimensions

Refer to drawing 740-00600.

Maintenance

Senseair Sunlight has a built-in self-correcting ABC algorithm. ABC period is adjustable by host and comes default with ABC ON and an ABC period of 720 h.
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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