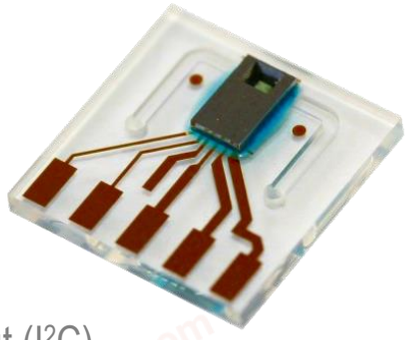
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SENSIRION
THE SENSOR COMPANY

LPG10-1000 Liquid Flow Sensor

Digital Planar Package Sensor



- Ultra small size
- Excellent repeatability
- Bio-compatible & inert materials
- Calibrated and temperature compensated digital output (I^2C)

Product Summary

Unique CMOSens® planar packaging technology enables non-invasive measurement of liquid flow inside a cost-effective planar form factor. The flow channel passes through the planar substrate and is connected to fluidic channels via a manifold. The fluid is only in contact with the glass channel. The digital microsensor chip provides the full signal processing functionality for a fully calibrated, temperature-compensated digital output.

Integration of the LPG10-1000 Liquid Flow Sensor

Due to the dramatically reduced size and downmount fluidic connections, the LPG10-1000 allows an outstandingly compact mechanical, fluidic, and electronic integration. To receive support and acceleration on initial testing, please contact Sensirion about existing integration solutions.

1 Sensor Performance

Table 1: Performance of LPG10-1000 (all data for medium H_2O, 23 °C, 1 bar_{abs} unless otherwise noted)

Parameter	LPG10-1000	Unit
Full scale flow rate	1000	µl/min
Sensor output limit[a]	1500	µl/min
Accuracy below full scale (whichever error is larger)	5 0.25	% of measured value % of full scale
Repeatability error from zero to full scale (whichever error is larger)	0.5 0.025	% of measured value % of full scale
Temperature coefficient (additional error / °C; whichever is larger)	0.1 0.005	% of measured value / °C % of full scale / °C
Flow detection response time τ_{63}	40	ms
Response time on power-up	120	ms
Operating temperature	+5 … +50 (+41 … +122)	°C (°F)
Operating humidity	0…95%, non-condensing	% RH
Storage temperature[b]	-40 … +60 (-40 … +140)	°C (°F)
Storage humidity	0…95%, non-condensing	% RH
Recommended maximum operating pressure[c]	3 (43)	bar (psi)
Burst pressure[c]	7 (101)	bar (psi)

[a]Flow rate at which the sensor output saturates, see section 2 for performance specifications between full scale and saturation point
[b]Flow path empty
[c]Pressures listed are mechanical limits of the glass substrate; Burst pressure of manifold assembly depends on actual manifold seal design.

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2 Specifications Chart

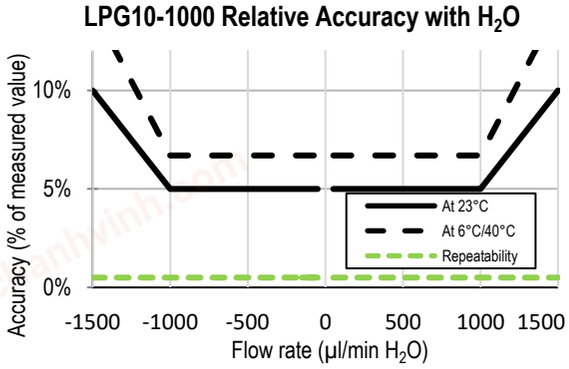


Figure 1: Sensor accuracy and repeatability (% of measured value) across the sensor's flow range

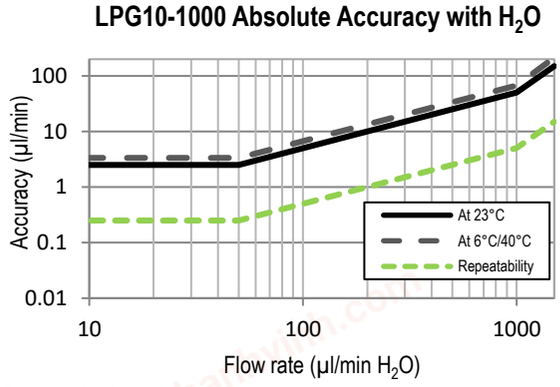


Figure 2: Sensor accuracy and repeatability (µl/min) across the sensor's flow range

3 Communication with the Sensor

The OEM flow sensor LPG10-1000 shows bi-directional, linear transfer characteristics. The product comes fully calibrated for water.

Digital sampling time, 16 bit	74 ms
Digital sampling time, 9 bit	1 ms

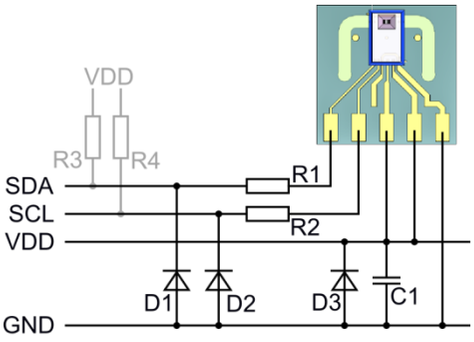
3.1 Electrical Specifications

Table 2: DC Characteristics

Parameter	LPG10-1000
Operating voltage	3.3– 3.6 V_{DC} (Recommended: 3.4-3.5 V_{DC})
Operating current	< 6 mA typical in operation

The electrical connection to the LPG10-1000 flow sensor is illustrated in the schematic drawing shown in section 3.2.

3.2 Sample Circuitry



D1, D2, D3: ESD5Z5.0T1G
R1, R2: 47R
C1: 1uF, 25V, X7R, place as close as possible to the sensor pads

Table 3: Pad assignment from left to right:

Pad	Assignment
1	SDA, data
2	SCL (bi-directional), clock
3	VDDA, analog supply voltage
4	VDDD, digital supply voltage
5	GND, ground

The electrical connection to the pads can be realized in different ways, e.g. using spring contacts.

3.3 Digital Communication via I²C-Bus

Digital communication between a master and the LPG10-1000 sensor runs via the standard I²C-interface. The physical interface consists of two bus lines, a data line (SDA) and a clock line (SCL) which need to be connected via pull-up resistors to the bus voltage of the system. By default, the I²C address is set to 64 (hexadecimal: 40, binary: 1000000).

These lines can be used on a 3.3 V level with a clock frequency of 100 kHz. For the detailed specifications of this I²C communication, please refer to specific I²C Application Notes from Sensirion.

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4 Fluidic Connection

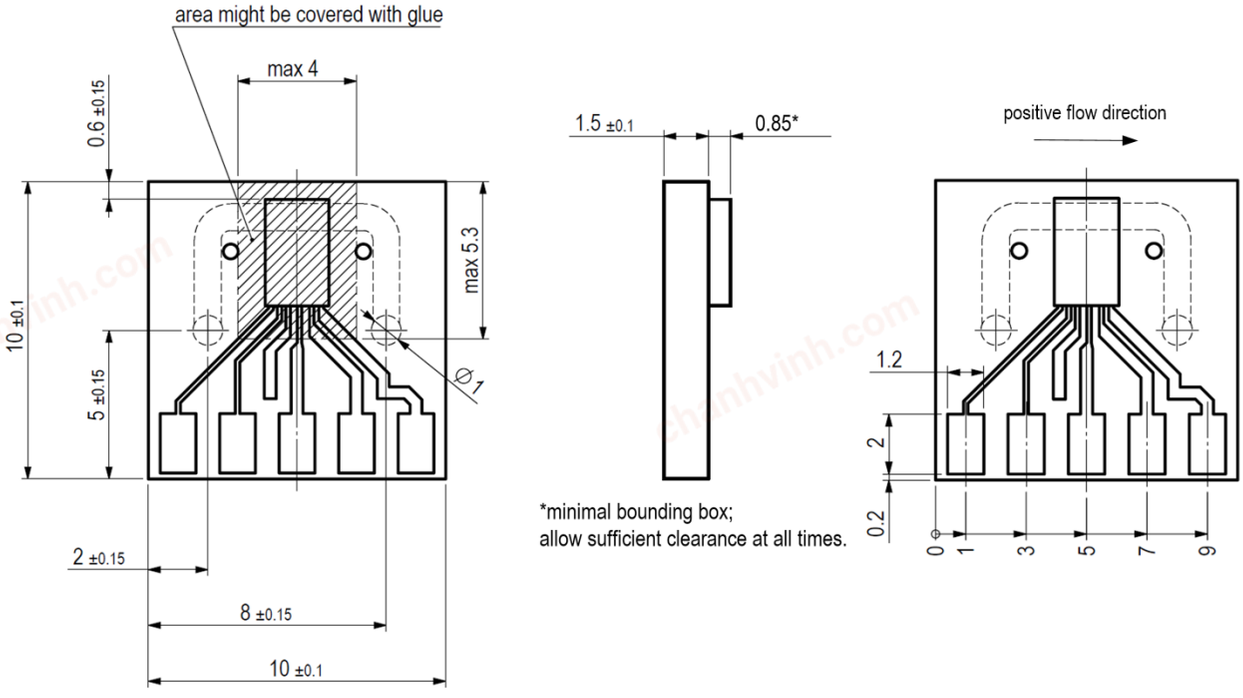
Table 4: Fluidic Specifications and Pressure Rating

Parameter	LPG10-1000
Wetted materials:	
• Internal substrate flow channel material	Borosilicate glass
Fluidic connection	Downmount
Pressure drop (at full scale flow rate, H_2O, 23°C)	0.1 mbar
Total internal volume	~11.7 µl

5 Mechanical Specifications

Table 5: Mechanical Specifications (for tolerances please see the drawings below)

Parameter	LPG10-1000
Largest dimensions	~10 x 10 x 2.35 mm
Total mass	~0.32 g
Cross section flow channel	~0.9 x 0.9 mm



All dimensions in mm

Attention fragile!	
Mechanical shocks and touching or probing of the glass surface may lead to stress on the chip and may damage the glass package. • The thin-walled top layer can easily break. Thus, do not touch the planar glass package on the top surface with your fingers or tools (e.g. tweezers). • Respect the burst pressure specification. Be aware that injecting fluid by hand with a syringe can lead to large pressure peaks. • Do not exert pressure on the sensor chip. Mechanical structures must not be in contact with the sensor chip (see bounding box above). • Do not operate the liquid flow sensor when the contact pads have been wetted. Dry first.	!

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6 Ordering Information

Standard shipment includes only the sensor, neither cables nor fluidic connection material.

For easy testing, an Evaluation Kit is available. The kit contains:
One LPG10-1000 sensor, preassembled in a fluidic manifold (PMMA), featuring ¼ -28 flat bottom fluidic fittings. The fluidic seal between sensor and manifold is ensured using two O-Rings (FKM). The included connector cap secures the sensor to the manifold and features a 4-pin Molex connector. The included Molex adapter cable, USB-cable and software allow for easy evaluation using a PC. When using the Evaluation Kit, the wetted materials include PMMA (manifold) and FKM (O-Rings), as well as borosilicate glass (LPG10 sensor).
For integration support, please see the Application Note “Engineering Guidelines for LPG10 Integration”.

The connector cap included in the Evaluation Kit can be purchased in combination with the LPG10-1000 sensor.

Contact Sensirion for more information on the Evaluation or the Connectivity Kit.

Product	Article No	MOQ	Packaging Unit
LPG10-1000	1-101126-01	100	20
Evaluation Kit LPG10-1000	1-101319-01	1	n/a
Connector Cap LPG10	3.000.151	100	20

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Important Notices

Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer shall purchase or use SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION shall be allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.
See application note “ESD, Latchup and EMC” for more information.

Warranty

SENSIRION warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in SENSIRION’s published specifications of the product. Within such period, if proven to be defective, SENSIRION shall repair and/or replace this product, in SENSIRION’s discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION’s reasonable satisfaction, to have arisen from SENSIRION’s faulty design, material, or workmanship;
- the defective product shall be returned to SENSIRION’s factory at the Buyer’s expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by SENSIRION for the intended and proper use of the equipment. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.
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SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer’s applications by customer’s technical experts. Recommended parameters can and do vary in different applications.
SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

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REACH, RoHS and WEEE Statement

The LPG10-1000 complies with requirements of the following directives:

- EU Directive 1907/2006/EC concerning Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
- EU Directive 2002/96/EC on waste electrical and electronic equipment (WEEE), OJ13.02.2003; esp. its Article 6 (1) with Annex II.
- EU Directive 2002/65/EC on the restriction of certain hazardous substances in electric and electronic equipment (RoHS), OJ01.01.2011

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Revision History of the LPG10-1000 Datasheet

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Revision	Date	Changes Chapter	Description
4	January 2019	5, 6	Updated dimensions and contact information. Updated ordering information