

FS1023

Liquid Flow Sensor Module

The FS1023 liquid flow sensor module measures the flow rate using the thermo-transfer (calorimetric) principle.

The FS1023 offers key advantages over resistor-based flow solutions. The sensor utilizes thermopile sensing, which provides an excellent signal-to-noise ratio. The sensor comprises a “solid” thermal isolation technology with protective coating.

The non-linear flow output curve allows for sensitivity from low to full-scale flow rates. The FS1023 provides analog output.

Module Picture



Features

- Liquid flow: 0 to 3 liters/min (with water)
- Robust “solid” isolation technology
- Resistant to vibration and pressure shock
- Minimal flow resistance
- Analog voltage output
- Supply voltage: 5V

Applications

- Water dispensers
- Liquid metering or switch
- Process controls and monitoring



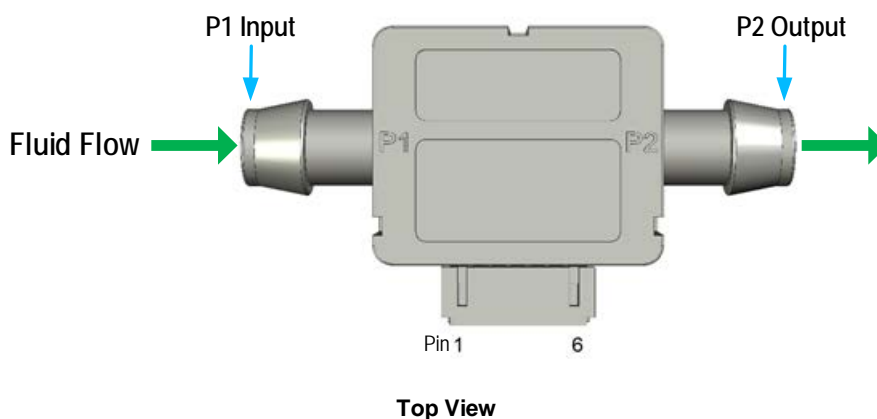
COMPONENT

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1. Pin Information

1.1 Pin Assignments



1.2 Pin Descriptions

| Pin Number | Pad Name | Type | Description |
|------------|----------|--------|--------------------------------|
| 1 | VDD | Input | Supply voltage. |
| 2 | GND | Input | Ground. |
| 3 | OUTPUT | Output | Flow analog output. |
| 4 | NC | - | Do not connect. |
| 5 | HE | Input | Heater enable, connect to +5V. |
| 6 | TEMP | Output | Thermistor analog output. |

1. "NC" stands for not connected / no connection required / not bonded.

2. Specifications

2.1 Absolute Maximum Ratings

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

| Symbol | Parameter | Conditions | Minimum | Maximum | Unit |
|------------|---------------------|------------|---------|---------|------|
| V_{IN} | Supply Voltage | - | 5 | 5.5 | V |
| T_{STOR} | Storage Temperature | - | 0 | 85 | °C |

2.2 Recommended Operating Conditions

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|------------|--|---------|---------|---------|------|
| V_{IN} | Supply Voltage | - | 5 | 5.5 | V |
| T_{AMB} | Ambient Operating Temperature (in air) | 0 | - | 70 | °C |
| P_{STAT} | Static Pressure | - | - | 30 | PSI |

2.3 Electrical Characteristics

| Symbol | Parameter | Conditions | Minimum | Typical | Maximum | Unit |
|------------|-----------------------------------|--------------------------------------|---------|---------|---------|-----------|
| I_{VIN} | Current Consumption | - | - | 18 | 20 | mA |
| F_{LQ} | Liquid Flow Range | Tested with water, room temperature. | 0 | - | 3 | Liter/min |
| V_{AOUT} | Analog Voltage Output | Non-linear curve. | 0 | - | 5 | V |
| V_{NULL} | Flow Null Voltage | No flow. | - | 0.005 | - | V |
| τ_H | Flow Response Time ^[1] | - | - | 5 | - | msec |
| V_{TEMP} | Temperature Output | At 5°C. | - | 4.25 | - | V |
| | | At 80°C. | - | 1.0 | - | |

- The flow response time includes a 10% to 90% rise time for the flow sensor to electrically respond to any flow change. Measurements may be affected by the pneumatic interface.

3. Typical Flow Graphs

Figure 1 show the typical analog output versus flow (with water). From a flow rate of 0.5 to 3 SLPM, the voltage output can be correlated by the following approximation:

$$\text{Flow rate (liters/min)} = 0.017 * (V_{\text{out}})^2 + 0.62 * (V_{\text{out}}) - 0.47$$

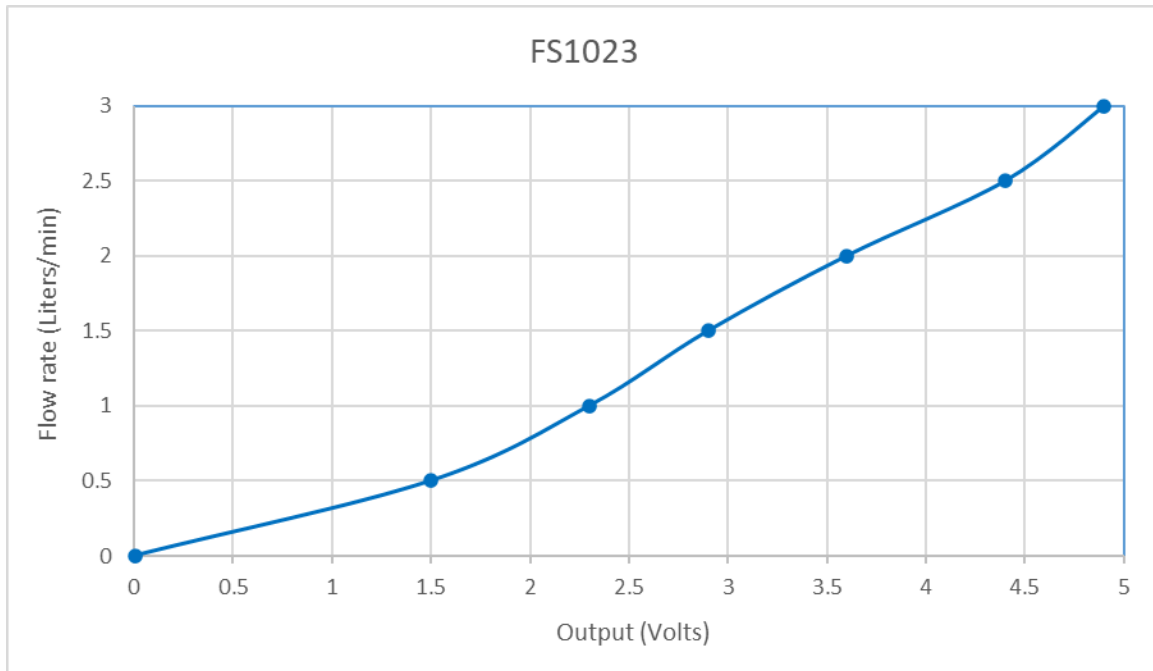


Figure 1. Analog Output Curve (in Water, Room Temperature)

3.1 Heater Enable

The FS1023 allows power savings through the operation of the Heater Enable (HE) pin. The flow sensor element includes a micro-heater. The HE pin powers the micro-heater. When a measurement is taken, the HE pin must be powered on and connected to +5VDC. To conserve power, the HE pin can be pulsed on when taking measurements or grounded (turned off) when no measurements are required. Alternatively, the HE pin can be constantly powered on.

3.2 Electrical Connector

A 6-position receptacle (not provided) is required to mate to the board crimp style connector. A part number example is PHR-6 (JST).

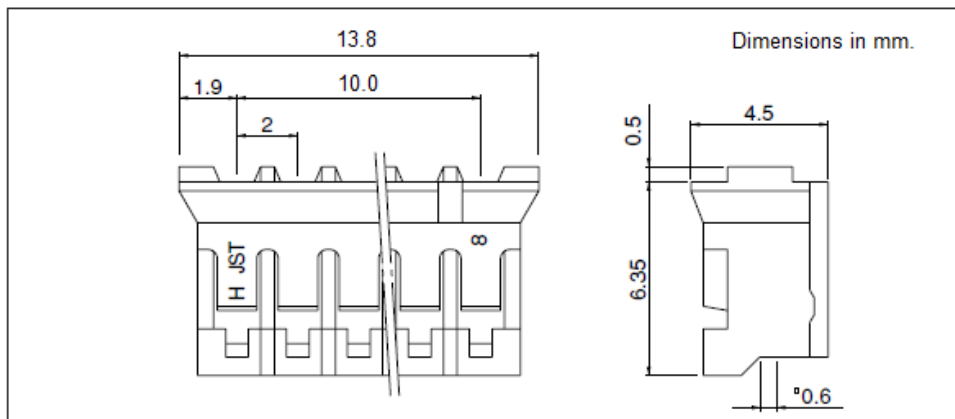


Figure 2. Receptacle Drawing

3.3 Module Material

The wetted contact surface of the FS1023 consists of the following:

- Housing – Polyphenylene Ether (PPE) + Polystyrene (PS) blend resin
- Flow Sensor – Silicon-carbide thin film
- Epoxy
- Gasket – Silicone
- Substrate – Gold plating

3.4 Tubing Guidance

The FS1023 module has barb tube endings. Soft tubing with a nominal 3/8-inch (9.5mm) internal diameter is recommended for use. A clamp may be necessary to secure the tubing over the barb.

4. Package Outline Drawings

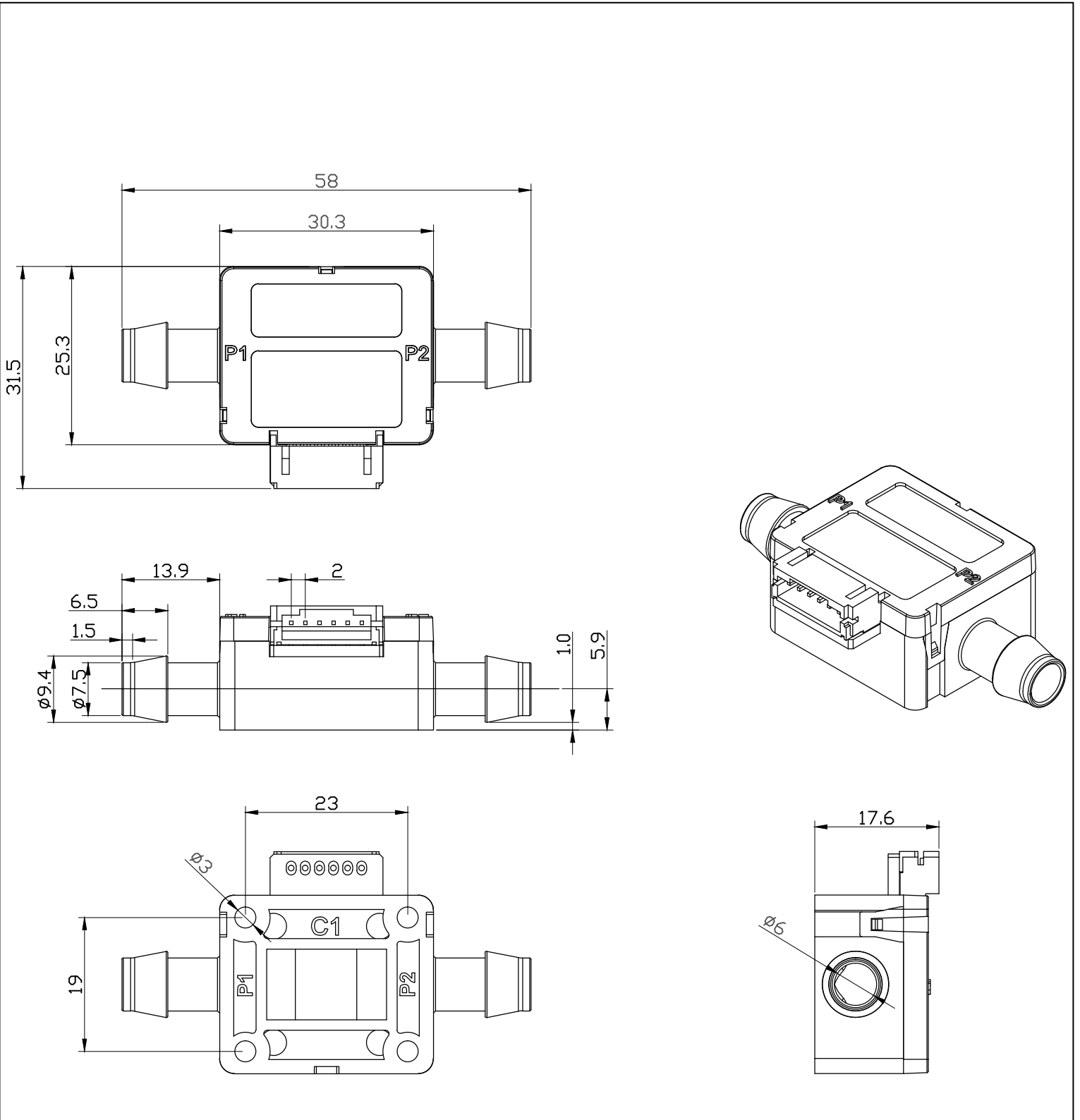
The package outline drawings are located at the end of this document and are accessible from the Renesas website. The package information is the most current data available and is subject to change without revision of this document.

5. Ordering Information

| Part Number | Package Description | Carrier Type | Temperature Range |
|-------------|---|--------------|-------------------|
| FS1023 | 0 to 3 liter/min liquid flow sensor module with analog voltage output (see MOD1) | Tray | 0° to +70°C |

6. Revision History

| Revision | Date | Description |
|----------|-------------|--------------------------------------|
| 1.01 | Sep 1, 2022 | Updated reference output with water. |
| 1.00 | Jul 2, 2021 | Initial release. |



| Package Revision History | | |
|--------------------------|---------|-----------------|
| Date Created | Rev No. | Description |
| Nov 28, 2017 | Rev 00 | Initial Release |

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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